



AMERICAN ASSOCIATION
FOR THORACIC SURGERY
We Model Excellence

AATS ANNUAL MEETING 2016



SATURDAY AND SUNDAY SYMPOSIA

May 14 – 18, 2016

Baltimore Convention Center
Baltimore, MD, USA

www.aats.org

Welcome to the AATS 2016 Saturday Courses and Sunday Symposia

SATURDAY COURSES | MAY 14

Your Saturday all-access registration grants you admittance to all of the sessions taking place on Saturday from 8:00 AM to 3:30 PM in the Baltimore Convention Center (BCC).

Adult Cardiac Skills
Congenital Skills
General Thoracic Skills
Interprofessional Cardiothoracic Team Symposium
Optimal Therapies for End-Stage Thoracic Organ Failure
Surgical Ethics Course

Ballroom I, Level 400, BCC
Ballroom III, Level 400, BCC
Ballroom IV, Level 400, BCC
Room 337, Level 300, BCC
Room 340, Level 300, BCC
Room 343, Level 300, BCC

Hands-On Sessions | 4:00 PM – 6:00 PM

Hands-On sessions require a separate registration from the Saturday all-access registration. If you registered for one of the Hands-On courses you will see either an “AHO, GHO, CHO or THO” printed on the top right-hand corner of your badge. Those who do not have the code printed but would like to attend, should visit the registration area located on in the Pratt Street Lobby on Level 200 of the Baltimore Convention Center.

Adult Cardiac Hands-On
Congenital Hands-On
General Thoracic Hands-On
Optimal Therapies for End-Stage Thoracic Organ Failure Hands-On

Ballroom II, Level 400, BCC
Room 324, Level 300, BCC
Room 327, Level 300, BCC
Room 336, Level 300, BCC

SUNDAY AATS/STS POSTGRADUATE SYMPOSIA | MAY 15

Your Sunday all-access registration grants you admittance to all of the sessions taking place on Sunday from 8:00 AM to 5:00 PM in the Baltimore Convention Center (BCC).

AATS/STS Adult Cardiac Surgery Symposium
AATS/STS Congenital Heart Disease Symposium
AATS/STS General Thoracic Surgery Symposium
AATS/STS Cardiothoracic Critical Care Symposium
Survival Guide for the Cardiothoracic Surgical Team

Hall E, Level 100, BCC
Ballroom III, Level 400, BCC
Ballroom IV, Level 400, BCC
Room 337, Level 300, BCC
Room 340, Level 300, BCC

Welcome Reception | 5:00 PM – 7:00 PM in the AATS Exhibit Hall, Level 100, BCC

Join us as we officially celebrate the opening of this year's 96th Annual Meeting. Visit with our valued exhibitors and supporters in the AATS Exhibit Hall where you will learn cutting edge techniques and discover groundbreaking new products while networking with other attendees.

The AATS Exhibit Hall offers a number of exciting learning opportunities:

- AATS Learning Center features cutting edge Case Videos of novel procedures and surgical techniques, as well as highlights of the 2016 Aortic Symposium and 2015 Mitral Conclave
- AATS Resident Poster Competition
- AATS Perioperative & Team-Based Care Poster Competition

AATS Annual Meeting Didactic Committee

*Joseph S. Coselli, *Chair*
 *Charles D. Fraser, *Co-Chair*
 *David R. Jones, *Co-Chair*
 *Ottavio R. Alfieri
 *Duke E. Cameron
 *Andrew C. Chang
 *Edward P. Chen

*Haiquan S. Chen
 *R. Duane Davis
 *Gebrine El Khoury
 Katherine J. Hoercher
 +Viktor Hraska
 *John S. Ikonomidis
 *Krishna S. Iyer
 *Nevin M. Katz

*Shaf Keshavjee
 *M. Blair Marshall
 *E. Dean McKenzie
 *Marc R. Moon
 *Mark Onaitis
 *Gosta B. Pettersson
 *Todd K. Rosengart
 *George E. Sarris

*Ashish S. Shah
 Scott C. Silvestry
 *Thoralf M. Sundt, III
 *David P. Taggart
 *Dirk E. van Raemdonck
 *Paul E. van Schil
 *Luca A. Vricella
 *Thomas K. Waddell

SATURDAY, MAY 14

Adult Cardiac Skills:

Ballroom I, Level 300, BCC

Demystifying Complex Cardiac Surgery-Minimizing the Fear Factor

Saturday, May 14, 2016 | 8:00 AM - 3:30 PM

Course Chair: *Edward P. Chen, *Emory University*

Course Co-Chair: *Gebrine El Khoury, *Université Catholique de Louvain*

8:00 AM - 8:10 AM	Welcome and Introduction
8:10 AM - 8:20 AM	Repair of Anomalous RCA *Robert A. Guyton, <i>Emory University</i>
8:20 AM - 8:30 AM	Radial Artery Grafting in CABG: Harvesting Techniques and Options for Bypass *Jennifer S. Lawton, <i>Washington University</i>
8:30 AM - 8:40 AM	Total Arterial Left-Sided Revascularization with BIMA, Vein to the RCA *Clifford W. Barlow, <i>Southampton General Hospital</i>
8:40 AM - 8:50 AM	Total Arterial Revascularization: Left and Right *John D. Puskas, <i>Mount Sinai Medical Center</i>
8:50 AM - 9:00 AM	Surgical Repair of LV Aneurysm *Michael A. Acker, <i>University of Pennsylvania</i>
9:00 AM - 9:10 AM	Surgical Repair of a Posterior Post-Infarct VSD *Vivek Rao, <i>Toronto General Hospital</i>
9:10 AM - 9:20 AM	Alternative Surgical Approaches to Post-Infarct VSD Mani A. Daneshmand, <i>Duke University</i>
9:20 AM - 9:30 AM	Decision Tree Options for Acute Pulmonary Embolism: Live In Box Case William Brent Keeling, <i>Emory University</i>
9:30 AM - 9:40 AM	Surgical Options for Chronic Pulmonary Embolism: In Box Case Presentation *Michael M. Madani, <i>University of California</i>
9:40 AM - 10:10 AM	Panel Discussion
10:10 AM - 10:30 AM	Coffee Break
10:30 AM - 10:40 AM	Complex Mitral Valve Repair for Bileaflet Prolapse *David H. Adams, <i>Mount Sinai Medical Center</i>
10:40 AM - 10:50 AM	3D Echocardiographic Evaluation and Repair of Functional MR *Song Wan, <i>Prince of Wales Hospital</i>
10:50 AM - 11:00 AM	Radical Decalcification of Posterior MAC and Reconstruction *Thomislav Mihaljevic, <i>Cleveland Clinic</i>
11:00 AM - 11:10 AM	How to perform a MAZE Procedure in 2016 *Patrick M. McCarthy, <i>Northwestern University</i>
11:10 AM - 11:20 AM	Surgical Strategies for Reoperative MVR after Previous Aortic Valve or Root Intervention *Y. Joseph Woo, <i>Stanford University</i>
11:20 AM - 11:30 AM	Surgical Options for Avoiding PPM during Primary AVR with the Small Aortic Root *Neal D. Kon, <i>Wake Forest University</i>

11:30 AM - 11:40 AM	Redo-AVR after previous CABG with a Patent LIMA Graft *Edward P. Chen, <i>Emory University</i>	
11:40 AM - 12:00 PM	Panel Discussion	
12:00 PM - 1:00 PM	Combined Luncheon Video Interview *Denton A. Cooley, <i>Texas Heart Institute</i>	Hall E, Level 100, BCC
1:00 PM - 1:10 PM	Surgical Options for Prosthetic Valve Endocarditis Complicated by Root Abscess +/- Pseudoaneurysm *Gosta B. Pettersson, <i>Cleveland Clinic</i>	
1:10 PM - 1:20 PM	Correction of Double Native Valve Endocarditis with Destruction of the Central Fibrous Body *Gebrine El Khoury, <i>Université Catholique de Louvain</i>	
1:20 PM - 1:30 PM	TAVR Valve-in-valve for Aortic Bioprosthetic Degeneration *Vinod H. Thourani, <i>Emory University</i>	
1:30 PM - 1:40 PM	Transcatheter Valve-in-valve Therapy for Mitral Bioprosthetic Degeneration *Friedrich W. Mohr, <i>Herzzentrum Leipzig</i>	
1:40 PM - 1:50 PM	Surgical Techniques for Correcting Severe AI in Bicuspid Valve Anatomy +Laurent de Kerchove, <i>Cliniques Universitaires Saint-Luc</i>	
1:50 PM - 2:00 PM	Surgical Options for Addressing Aortopathy in Bicuspid Valve Disease *John S. Ikonomidis, <i>Medical University of South Carolina</i>	
2:00 PM - 2:20 PM	Panel Discussion	
2:20 PM - 2:30 PM	Valve-sparing Root Replacement for Severe AI of a Trileaflet Valve Requiring Cusp Repair *Joseph E. Bavaria, <i>University of Pennsylvania</i>	
2:30 PM - 2:37 PM	Repair of Acute Type A Dissection with Malperfusion using Frozen Elephant Trunk Technique Bradley G. Leshnower, <i>Emory University</i>	
2:37 PM - 2:44 PM	Repair of Acute Type A Dissection with Malperfusion with an Integrated TEVAR-First Approach *Eric E. Roselli, <i>Cleveland Clinic</i>	
2:44 PM - 2:54 PM	Circulation Management Options for Open DTAA/TAAA *Joseph S. Coselli, <i>Baylor College of Medicine</i>	
2:54 PM - 3:01 PM	Combined Open Proximal, Stent-Graft Distal Arch Repair for Aneurysm *Marc R. Moon, <i>Washington University</i>	
3:01 PM - 3:11 PM	Redo-Sternotomy for Transverse Arch Replacement after Previous Type A Repair *Thomas G. Gleason, <i>University of Pittsburgh</i>	
3:11 PM - 3:30 PM	Panel Discussion	
3:30 PM	Adjourn for Coffee Break followed by Hands-On Sessions from 4:00 PM - 6:00 PM Seperate Registration Required	

Congenital Heart Disease Skills: *Toward Technical Perfection*

Ballroom III, Level 300, BCC

Saturday, May 14, 2016 | 8:00 AM - 3:30 PM

Course Chair: *E. Dean McKenzie, *Texas Children's Hospital*

Course Co-Chair: *Krishna S. Iyer, *Fortis Escorts Heart Institute*

Mitral Valve

- 8:00 AM - 8:15 AM **Echocardiographic Evaluation of the Mitral Valve**
Gerald R. Marx, *Boston Children's Hospital*
- 8:15 AM - 8:30 AM **Mitral Valve Reparative Techniques in Small Children**
*Pedro J. Del Nido, *Boston Children's Hospital*
- 8:30 AM - 8:45 AM **Mitral Valve Replacement in Newborns and Infants**
*Yves d'Udekem, *Children's Hospital of Philadelphia*
- Anomalous Aortic Origin of a Coronary Artery**
- 8:45 AM - 9:00 AM **Imaging Evaluation of AAOCA**
Rajesh Krishnamurthy, *Texas Children's Hospital*
- 9:00 AM - 9:15 AM **Technique for Unroofing and Pulmonary Artery Translocation**
*Frank L. Hanley, *Stanford University*
- 9:15 AM - 9:30 AM **Technique for Ostial Translocation Neo-Ostial Creation**
Carlos M. Mery, *Texas Children's Hospital / Baylor College of Medicine*
- 9:30 AM - 10:15 AM **Coffee Break**

Perfusion Details

- 10:15 AM - 10:30 AM **How I Conduct Operations Using DHCA**
*Christian Pizarro, *Alfred Dupont Hospital for Children*
- 10:30 AM - 10:45 AM **How I Conduct Operations Using Selective Cerebral Perfusion**
*Frank A. Pigula, *Boston Children's Hospital*

Repair of IAA

- 10:45 AM - 11:00 AM **Yasui Method**
*Kirk R. Kanter, *Emory University*
- 11:00 AM - 11:15 AM **Subaortic resection/VSD Closure/Autologous Arch Repair**
*Charles D. Fraser, *Texas Children's Hospital*

Complete AVSD

- 11:15 AM - 11:30 AM **One Patch Method**
*Richard A. Jonas, *Children's National Medical Center*
- 11:30 AM - 11:45 AM **Two Patch Method**
*Krishna S. Iyer, *Fortis Escorts Heart Institute*
- 11:45 AM - 12:00 PM **"Australian" Method**
*Tom R. Karl, *Johns Hopkins All Children's Hospital*
- 12:00 PM - 1:00 PM **Combined Luncheon Video Interview**
*Denton A. Cooley, *Texas Heart Institute*

Hall E, Level 100, BCC

Ebstein's Anomaly

1:00 PM – 1:15 PM	Echocardiographic Evaluation for AVSD and Ebstein's Anomaly Girish S. Shirali, <i>Children's Mercy Hospital</i>
1:15 PM - 1:30 PM	Newborn Repair: How I Really Do This Operation *Christopher J. Knott-Craig, <i>Le Bonheur Children's Hospital</i>
1:30 PM - 1:45 PM	Newborn Tricuspid Exclusion – How I Really Do This Operation *Vaughn A. Starnes, <i>Keck Hospital of USC</i>
1:45 PM - 2:00 PM	Technical Tricks for Adult Ebstein's Repair *Joseph A. Dearani, <i>Mayo Clinic</i>

HLHS Technical Refinement

2:00 PM - 2:15 PM	MRI Assessment for Stage Single Ventricle Palliation Shi-Joon Yoo, <i>Hospital for Sick Children</i>
2:15 PM - 2:30PM	Avoiding Arch Obstruction *Thomas L. Spray, <i>Children's Hospital of Philadelphia</i>
2:30PM - 2:45 PM	Avoiding Conduit Obstruction and Pulmonary Artery Distortion *Shunji Sano, <i>Okayama University</i>
2:45 PM - 3:00 PM	Comprehensive Stage II Hakan Akintürk, <i>Universitätsklinikum Giessen und Marburg</i>
3:00 PM	Adjourn for Coffee Break followed by Hands-On Sessions from 4:00 PM - 6:00 PM <i>Seperate Registration Required</i>

General Thoracic Skills: Mastering Cutting-edge Technologies

Ballroom IV, Level 300, BCC

Saturday, May 14, 2016 | 8:00 AM - 3:30 PM

Course Chair: *Mark Onaitis, *Duke University*

Course Co-Chair: *Haiquan S. Chen, *Fudan University Shanghai Cancer Center*

8:00 AM - 8:10 AM **Welcome and Introduction**

Staging/Diagnosis of Lung and Esophageal Cancer

8:10 AM - 8:20 AM	EBUS *Mark F. Berry, <i>Stanford University</i>
8:20 AM - 8:30 AM	Electromagnetic Bronchoscopy *Jeffrey L. Port, <i>New York Presbyterian Hospital - Weill Cornell Medical College</i>
8:30 AM - 8:40 AM	EUS *Sudish C. Murthy, <i>Cleveland Clinic</i>
8:40 AM - 8:50 AM	EMR/RFA *Mark Onaitis, <i>Duke University</i>
8:50 AM - 9:00 AM	VAMLA *Todd L. Demmy, <i>Rutgers Cancer Institute of New Jersey</i>
9:00 AM - 9:15 AM	Panel Discussion
9:15 AM - 9:30 AM	Coffee Break

Lung Cancer

9:30 AM - 9:40 AM	Segmentectomy Michael Kent, <i>Beth Israel Deaconess Medical Center</i>
9:40 AM - 9:50 AM	VATS Extended Resections *Thomas A. D'Amico, <i>Duke University</i>
9:50 AM - 10:00 AM	Robotic Resection *Robert J. Cerfolio, <i>University of Alabama at Birmingham</i>
10:00 AM - 10:10 AM	VATS Mediastinal Lymphadenectomy *David R. Jones, <i>Memorial Sloan Kettering Cancer Center</i>
10:10 AM - 10:20 AM	VATS Sleeve Resection *M. Blair Marshall, <i>Georgetown University</i>
10:20 AM - 10:30 AM	Multiple GGO Lesions *Haiquan S. Chen, <i>Fudan University Shanghai Cancer Center</i>
10:30 AM - 10:40 AM	3D Modeling *Shanda H. Blackmon, <i>Mayo Clinic</i>
10:40 AM - 11:00 AM	Panel Discussion
11:00 AM - 11:10 AM	Coffee Break

Mediastinum

11:10 AM - 11:20 AM	Robotic Thymectomy Jens C. Rueckert, <i>University Medicine Berlin, Charite</i>	
11:20 AM - 11:30 AM	Open Thymectomy +James Huang, <i>Memorial Sloan Kettering Cancer Center</i>	
11:30 AM - 11:40 AM	VATS Sympathectomy *David H. Harpole, Jr., <i>Duke University</i>	
11:40 AM - 11:50 AM	Leiomyoma *Gail E. Darling, <i>Toronto General Hospital</i>	
11:50 AM - 12:00 PM	Panel Discussion	
12:00 PM - 1:00 PM	Combined Luncheon Video Interview *Denton A. Cooley, <i>Texas Heart Institute</i>	Hall E, Level 100, BCC

Benign/Malignant Esophagus

1:00 PM - 1:10 PM	Laparoscopic PEHR Katie S. Nason, <i>University of Pittsburgh</i>
1:10 PM - 1:20 PM	POEM Brian E. Louie, <i>Swedish Cancer Institute and Medical Center</i>
1:20 PM - 1:30 PM	Laparoscopic Diverticulum Matthew Hartwig, <i>Duke University</i>
1:30 PM - 1:58 PM	Panel Discussion
1:58 PM - 2:10 PM	Transhiatal Esophagectomy *Andrew C. Chang, <i>University of Michigan</i>

2:10 PM - 2:22 PM	Minimally-Invasive Ivor Lewis Yi Hua Sun, <i>Fudan University Shanghai Cancer Center</i>
2:22 PM - 2:34 PM	Open Ivor Lewis *Wayne L. Hofstetter, <i>MD Anderson Cancer Center</i>
2:34 PM - 2:46 PM	Minimally-Invasive 3-incision Lijie Tan, <i>Zhong Shan Hospital, Fudan University</i>
2:46 PM - 2:58 PM	3-incision Esophagogastrectomy for Lower Third Adenocarcinoma *Brendon M. Stiles, <i>New York Presbyterian Hospital</i>
2:58 PM - 3:10 PM	Robotic Esophagectomy *Inderpal S. Sarkaria, <i>University of Pittsburgh</i>
3:10 PM - 3:30 PM	Panel Discussion
3:30 PM	Adjourn for Coffee Break followed by Hands-On Sessions from 4:00 PM - 6:00 PM <i>Seperate Registration Required</i>

Interprofessional Cardiothoracic Team Symposium:

Room 337, Level 300, BCC

Advancing Excellence in Systems of Care and Outcomes

Saturday, May 14, 2016 | 8:00 AM - 3:30 PM

Course Chairs: *Gosta B. Pettersson, *Cleveland Clinic*
Katherine J. Hoercher, *Cleveland Clinic*



In collaboration with the American Society of ExtraCorporeal Technology (AmSECT) and the Association of Physician Assistants in Cardiovascular Surgery (APACVS).

8:00 AM - 8:15 AM **Welcome and Introduction**

Session I: Improving Systems of Care/Quality/ Safety

Moderators: *Gosta B. Pettersson, *Cleveland Clinic* and Katherine J. Hoercher, *Cleveland Clinic*

8:15 AM - 8:30 AM **Transforming Cardiovascular Care Delivery Incentive Structure: Value-based Bundled Payment, Redesign and Predesign of Care and Care Pathways**
Katherine J. Hoercher, *Cleveland Clinic*

8:30 AM - 8:45 AM **"I Have a Concern": Value and Limitations of Protocols and Check Lists and Strategies for Error Management in Cardiovascular and Thoracic Surgery**
*Thoralf M. Sundt, III, *Massachusetts General Hospital*

8:45 AM - 9:00 AM **Utilizing Registries to Predict Total Hospital Costs after Cardiac Surgery: An Opportunity for Process Improvement**
*Jeffrey B. Rich, *Sentara Heart Hospital*

9:00 AM - 9:15 AM **Electronic Medical Records and Discontinuity of Care: How to Ensure and Perfect Transitions of Care and Hand-Off Protocols in the OR and ICU**
Jeffrey Riley, *Mayo Clinic*

9:15 AM - 9:30 AM **Key Communication Strategies to Building Effective Multi Specialty Interprofessional Cardiothoracic Teams**
*Ross M. Ungerleider, *Wake Forest Baptist Health*

9:30 AM - 9:45 AM **Organizational Structure and Process Factors Associated With ICU Mortality**
*Glenn J. Whitman, *Johns Hopkins Hospital*

9:45 AM - 10:15 AM	Coffee Break	
10:15 AM - 10:30 AM	Penalty for Readmission - Risk Factors and Predictors: Discharge and Post Discharge Planning and Coherent Prevention Strategies Robert A. Lancey, <i>Bon Secours Heart and Vascular Institute</i>	
10:30 AM - 10:45 AM	The Evolution of Quality Measurement in CT Surgery *David M. Shahian, <i>Massachusetts General Hospital</i>	
10:45 AM - 11:00 AM	Is True Informed Consent for CV Surgery Achievable and What Should It Include? *Robert M. Sade, <i>Medical University of South Carolina</i>	
11:00 AM - 11:20 AM	Strategies to Improve End of Life and Palliative Care Discussions: When and with Whom? *Gosta B. Pettersson, <i>Cleveland Clinic</i>	
11:20 AM - 11:40 AM	What Is the Definition of Futility: When and How to Say No To the Patient, Family, and Referring Physician Marci Damiano, <i>Washington University</i>	
11:40 AM - 12:00 PM	Post ICU syndrome and Depression: Risk Factors, Outcomes, and Management *Kamal R. Khabbaz, <i>Beth Israel Deaconess Medical Center</i>	
12:00 PM - 1:00 PM	Combined Luncheon Video Interview *Denton A. Cooley, <i>Texas Heart Institute</i>	Hall E, Level 100, BCC
Session II: OR and ICU Issues		
Moderators: Jeffrey Riley, <i>Mayo Clinic</i> and David Lizotte, <i>University of Louisville</i>		
1:15 PM - 1:30 PM	Management of HIT and Anti-Coagulation for Patients with Heparin Allergy, Acute, Urgent and Elective Strategies: How has the Landscape Changed? Colleen Koch, <i>Johns Hopkins Hospital</i>	
1:30 PM - 1:55 PM	Prevention and Management of Bleeding in the OR: Maximizing Blood Conservation Surgeon Perspective: *Gosta B. Pettersson, <i>Cleveland Clinic</i> Anesthesia Perspective: Colleen Koch, <i>Johns Hopkins Hospital</i>	
1:55 PM - 2:10 PM	Recognition and Clinical Decision Making in Hypovolemia and Shock States in the ICU: Rhythm, Rate, Pacing, Volume, Colloid, Cells, Inotropes, Pressors, IABP, ECMO Michael Tong, <i>Cleveland Clinic</i>	
2:10 PM - 2:25 PM	What do Perfusionists Worry about in the OR?: Low Frequency Crisis Events and Their Management Jeffrey Riley, <i>Mayo Clinic</i>	
2:25 PM - 2:40 PM	Postoperative Surgical Bleeding: Management Strategies in ICU Damien J. LaPar, <i>University of Virginia</i>	
2:40 PM - 2:55 PM	Air, Blood and Water: Management of Pleural Complications: Effusions, Empyema, and Pneumothorax *Stephen C. Yang, <i>Johns Hopkins Hospital</i>	
2:55 PM - 3:10 PM	Sepsis Precautions, Infection Monitoring and Management *Vinod H. Thourani, <i>Emory University</i>	
3:10 PM - 3:25 PM	Arrhythmia and Pacemaker Management in the ICU David Lizotte, <i>University of Louisville</i>	
3:25 PM - 3:40 PM	New Technologies to Support Patients with Acute Respiratory Failure, Short Term and Long Term, to Recovery and Bridge to Transplant: What You Need to Know About and Respiratory Dialysis *Kenneth R. McCurry, <i>Cleveland Clinic</i>	

3:40 PM

Adjourn for Coffee Break followed by Hands-On Sessions from 4:00 PM - 6:00 PM
Seperate Registration Required

Optimal Therapies for End-Stage Thoracic Organ Failure:

Room 340, Level 300, BCC

The Critical Role of the Surgeon and the use of ECMO, MCS and Transplantation

Saturday, May 14, 2016 | 8:00 AM - 3:30 PM

Course Chair: *R. Duane Davis, Jr., *Florida Hospital*

Course Co-Chair: *Ashish S. Shah, *Vanderbilt University*

8:00 AM - 8:10 AM **Welcome and Introduction**

Moderators: *R. Duane Davis, Jr., *Florida Hospital* and *Ashish S. Shah, *Vanderbilt University*

8:10 AM - 8:25 AM **VV ECMO for ARDS: An Update from Clinical Trials**
*Matthew Bacchetta, *Columbia University Medical Center*

8:25 AM - 8:29 AM **Case Presentation: Prolonged VV ECMO with Recovery**
Stephan Ensminger, *Herz- und Diabeteszentrum NRW*

8:29 AM - 8:33 AM **Case Presentation: ECMO for ARDS Bridge to Transplant**
*Ashish S. Shah, *Vanderbilt University*

8:33 AM - 8:37 AM **Case Presentation: ECMO for ARDS to Palliation**
*Matthew Bacchetta, *Columbia University Medical Center*

8:37 AM - 8:50 AM **Panel Discussion**

ECMO Bridge to Transplant - How I Do It

8:50 AM - 8:58 AM **Avalon for VV and V-VA**
Charles Hoopes, *University of Alabama at Birmingham*

8:58 AM - 9:06 AM **Central Cannulation**
*Walter Klepetko, *Vienna Medical University*

9:06 AM - 9:15 AM **Nova Lung**
*Shaf Keshavjee, *Toronto General Hospital*

9:15 AM - 9:25 AM **Management to Optimize Outcomes, Recovery, Rehab and Timing**
Charles Hoopes, *University of Alabama at Birmingham*

9:25 AM - 9:40 AM **Outcomes with Bridge to Transplant: Times are Changing**
+Marcelo Cypel, *Toronto General Hospital*

9:40 AM - 9:50 AM **Panel Discussion**

9:50 AM - 10:15 AM **Coffee Break**

Moderators: +Marcelo Cypel, *Toronto General Hospital* and *Walter Klepetko, *Vienna Medical University*

10:15 AM - 10:30 AM **What is the Current Role of Ex Vivo Lung Perfusion In Standard Lung Transplantation?**
*Abbas Ardehali, *UCLA*

10:30 AM - 10:45 AM **What is the Role of EVLP in the Marginal Donor**
*Ed Cantu, *University of Pennsylvania*

10:45 AM - 11:00 AM **EVLP for the Unusable Lungs: What is on the Immediate Horizon**
+Marcelo Cypel, *Toronto General Hospital*

Video Session

11:00 AM - 11:06 AM	How to Perform Bilateral Lung Transplant through Sterntomy *John H. Dark, <i>The Freeman Hospital</i>	
11:06 AM - 11:12 AM	How to Perform Lung Transplant using ECMO *Walter Klepetko, <i>Vienna Medical University</i>	
11:12 AM - 11:20 AM	How to Perform Redo Lung Transplant *R. Duane Davis, Jr., <i>Florida Hospital</i>	
11:20 AM - 11:30 AM	Tough Cases: Things I Would Never Do Again *Shaf Keshavjee, <i>Toronto General Hospital</i> Mani Daneshmand, <i>Duke University</i>	
11:35 AM - 12:00 PM	Debate: Transplantation on ECMO Should Be the Standard for Lung Transplantation Pro: *Walter Klepetko, <i>Vienna Medical University</i> Con: *R. Duane Davis, Jr., <i>Florida Hospital</i>	
12:00 PM - 1:00 PM	Combined Luncheon Video Interview *Denton A. Cooley, <i>Texas Heart Institute</i>	Hall E, Level 100, BCC
Moderators: Scott C. Silvestry, <i>Florida Hospital Transplant Institute</i> and *Francis D. Pagani, <i>University of Michigan</i>		
1:00 PM - 1:15 PM	Temporary Circulatory Support in Cardiogenic Shock: Which Platforms to Maximize Recovery and for How Long? Aly El Banayosy, <i>INTEGRIS Baptist Medical Center</i>	
1:15 PM - 1:30 PM	Durable LVADs in Acute Cardiogenic Shock: Which Pump and When *Nader Moazami, <i>Cleveland Clinic</i>	
1:30 PM - 2:00 PM	Panel Discussion: Device Selection and Patient Management in Shock Scott C. Silvestry, <i>Florida Hospital Transplant Institute</i> *Francis D. Pagani, <i>University of Michigan</i> Aly El Banayosy, <i>INTEGRIS Baptist Medical Center</i> *Nader Moazami, <i>Cleveland Clinic</i>	
2:00 PM - 2:15 PM	New Mechanical Circulatory Support Devices: An Update from Europe - HM III and MVAD Jan D. Schmitto, <i>Hannover Medical School</i>	
2:15 PM - 2:30 PM	Lessons from ENDURANCE and ROADMAP Trials *Carmelo A. Milano, <i>Duke University</i>	
2:30 PM - 2:45 PM	Pulmonary Vascular-Right Ventricular Interactions: The Achilles Heel in Heart Transplantation and Mechanical Circulatory Support Navin K. Kapur, <i>Tufts University</i>	
2:45 PM - 3:15 PM	Video Session: How to Do it Temporary RVAD Support Chris Sciortino, <i>Johns Hopkins Hospital</i> Scott C. Silvestry, <i>Florida Hospital Transplant Institute</i> Charles Hoopes, <i>University of Alabama at Birmingham</i>	
3:00 PM - 3:10 PM	Longer-term Support: Biventricular LVAD *Carmelo Milano, <i>Duke University</i>	
3:10 PM - 3:15 PM	Longer-term Support: TAH *Francisco A. Arabia, <i>Cedars-Sinai Medical Center</i>	

3:15 PM - 3:25 PM	Difficult Cases in TCS and MCS *Ashish S. Shah, <i>Vanderbilt University</i> +Simon Maltais, <i>Mayo Clinic</i> *Francis D. Pagani, <i>University of Michigan</i> *Carmelo Milano, <i>Duke University</i> Stuart Russell, <i>Johns Hopkins Hospital</i>
3:25 PM - 3:40 PM	Why all the PGD: Lessons Learned from an In-depth Analysis within an Institution Hiroo Takayama, <i>Columbia University</i>
3:40 PM - 3:55 PM	Functional Capacity and Exercise with Continuous Flow Devices Stuart Russell, <i>Johns Hopkins Hospital</i>
4:00 PM	Adjourn for Coffee Break followed by Hands-On Sessions from 4:00 PM - 6:00 PM Seperate Registration Required

Surgical Ethics Course: *Surgeons Solving Ethical Problems in Surgery*

Room 343, Level 300, BCC

Saturday, May 14, 2016 | 8:00 AM - 3:30 PM

Course Chairs: *Martin F. McKneally, *University of Toronto* and *Robert M. Sade, *Medical University of South Carolina*

8:00 AM - 8:15 AM	Welcome and Introduction	
8:15 AM - 9:15 AM	Keynote Address: Working Virtues in Surgical Practice: How to Transmit Essential Character Traits Larry Churchill, <i>Vanderbilt University</i>	
9:15 AM - 9:30 AM	Ethical Issues of LVAD Management John W.C. Entwistle, III, <i>Thomas Jefferson University</i>	
9:30 AM - 9:45 AM	Transplantation: Confronting the Ethics of Scarcity J. Scott Millikan, <i>Billings Clinic</i>	
9:45 AM - 10:15 AM	Panel Discussion	
10:15 AM - 10:45 AM	Coffee Break	
10:45 AM - 11:00 AM	Public Reporting of Surgeons' Results: Does Shame and Blame Hurt Our Patients? *Susan D. Moffatt-Bruce, <i>Ohio State University</i>	
11:00 AM - 11:15 AM	Preoperative Disclosure: In all Honesty, My Results ... Sandra Starnes, <i>University of Cincinnati Cancer Institute</i>	
11:15 AM - 11:45 AM	Panel Discussion	
12:00 PM - 1:00 PM	Combined Luncheon Video Interview *Denton A. Cooley, <i>Texas Heart Institute</i>	Hall E, Level 100, BCC
1:00 PM - 1:15 PM	My Patient Wants to Die: How Can I Help? Kathleen Fenton, <i>William Novick Global Cardiac Alliance</i>	
1:15 PM - 1:30 PM	Unrealistic Hopes: When Family and Caregivers Don't Agree *Leslie J. Kohman, <i>State University of New York Upstate Medical University</i>	
1:30 PM - 2:00 PM	Panel Discussion	
2:00 PM - 2:15 PM	Doing the Wrong Thing in Research *Thomas A. D'Amico, <i>Duke University</i>	
2:15 PM - 2:30 PM	The Dark Side of Expert Witness Testimony *Richard I. Whyte, <i>Beth Israel Deaconess Medical Center</i>	

2:30 PM - 3:00 PM	Panel Discussion
3:00 PM - 3:15 PM	Flexible Decision Making About Life Support Jennifer Ellis, <i>Washington Hospital Center</i>
3:15 PM - 3:30 PM	Panel Discussion
3:30 PM	Adjourn for Coffee Break followed by Hands-On Sessions from 4:00 PM - 6:00 PM <i>Seperate Registration Required</i>

SUNDAY, MAY 15

AATS/STS Adult Cardiac Surgery Symposium:

Hall E, Level 100, BCC

21st Century Cardiac Surgery and the Sea Change We Face

Sunday, May 15, 2016 | 8:00 AM - 5:00 PM

Course Chair: *Todd K. Rosengart, *Baylor College of Medicine*

Course Co-Chair: *David P. Taggart, *University of Oxford*

8:00 AM - 8:05 AM **Welcome and Introduction**

Session I: CABG is Back

Moderators: *Todd K. Rosengart, *Baylor College of Medicine* and *David P. Taggart, *University of Oxford*

8:05 AM - 8:20 AM **Incontrovertible Evidence You Need to Know from SYNTAX, FREEDOM, Real World Registries and other Pivotal Trials**
*A. Pieter Kappetein, *Erasmus MC*

8:20 AM - 8:35 AM **It's Too Early to Throw in the Towel: Better Stents and Gadgets Means PCI is Coming Back**
Stephen Ellis, *Cleveland Clinic*

8:35 AM - 8:50 AM **Not so Fast: Better Drugs will Make Both PCI and CABG Irrelevant**
David Holmes, *Mayo Clinic*

8:50 AM - 9:00 AM **Panel Discussion**

9:00 AM - 9:20 AM **Gladiator Session I: Total Arterial Revascularization**
Moderator: *John D. Puskas, *Mount Sinai Health System*
Pro: *Craig R. Smith, *Columbia University*
Con: *Joseph F. Sabik, III, *Cleveland Clinic*

9:20 AM - 9:40 AM **Debate: Integrating Interventional and Surgical Approaches for Treating Coronary Disease**
Moderator: *David P. Taggart, *University of Oxford*

Pro: Integrated Training - The Key to Our Future
*Mathew Williams, *New York University*

Con: Heart Teams Are Good Enough: Lessons from the Left Main
*Ko Bando, *Jikei University*

9:40 AM - 9:50 AM **Coffee Break**

Session II: The End of a Valve Surgery Era – Trans-Vascular Valve Rising

Moderators: *Faisal G. Bakaeen, *Baylor College of Medicine* and *David P. Taggart, *University of Oxford*

9:50 AM - 10:05 AM **TAVR: Where We Are, Where We're Headed: The US Experience**
*Michael J. Mack, *Baylor Health Care System*

10:05 AM - 10:20 AM	Universal TAVR: We're Almost There David Holmes, <i>Mayo Clinic</i>
10:20 AM - 10:35 AM	Percutaneous Mitral Technologies Around the Corner and Other Game Changers *A. Marc Gillinov, <i>Cleveland Clinic</i>
10:35 AM - 10:45 AM	AATS Consensus Guideline: Endocarditis *Gosta Pettersson, <i>Cleveland Clinic</i>
10:45 AM - 10:55 AM	Panel Discussion
Session III: Aortic Surgery	
Moderators: *Faisal G. Bakaeen, <i>Baylor College of Medicine</i> and *Todd K. Rosengart, <i>Baylor College of Medicine</i>	
10:55 AM - 11:10 AM	Intervening on the BAV Aorta: When, Why and Wherefore? *Y. Joseph Woo, <i>Stanford University</i>
11:10 AM - 11:25 AM	Intervening on the Type B Descending Aorta: TEVAR or Open *Leonard N. Girardi, <i>New York Presbyterian Hospital - Weill Cornell Medical College</i>
11:25 AM - 11:40 AM	Tackling the Marfan's Root: Pitfalls and Solutions +Ourania Preventza, <i>Texas Heart Institute</i>
11:40 AM - 12:00 PM	Debate: Valve Sparing Root Replacement Moderator: *Lars G. Svensson, <i>Cleveland Clinic</i>
	Pro: Always Spare the Valve *Joseph E. Bavaria, <i>University of Pennsylvania</i>
	Con: A Good Replacement is Better than a Bad Repair! *Hans-Joachim Schaeffers, <i>Saarland University Medical Center</i>
12:00 PM - 1:00 PM	Legends Luncheon *John L. Ochsner, <i>Ochsner Clinic Foundation</i>
	<i>Remain in Hall E for Legends Luncheon</i>

Session IV: ECMO and Bridging VAD - A New Paradigm for Sustaining Life

Moderators: *Irving L. Kron, *University of Virginia* and *Todd K. Rosengart, *Baylor College of Medicine*

1:00 PM - 1:15 PM	Extracorporeal Support – The Sooner the Better *Mark S. Slaughter, <i>University of Louisville</i>
1:15 PM - 1:30 PM	ECMO in the Field – The New Logistics of Pump and Run *Matthew Bacchetta, <i>Columbia University Medical Center</i>
1:30 PM - 1:45 PM	Ventricular Salvage – When and How to Wean VAD Support Steve Singh, <i>Baylor College of Medicine</i>
1:45 PM - 2:00 PM	New Devices - We Can Make This Even Easier *William E. Cohn, <i>Texas Heart Institute</i>
2:00 PM - 2:15 PM	Devices Are So Old School – The New World of Myocardial Regeneration *Todd K. Rosengart, <i>Baylor College of Medicine</i>
2:15 PM - 2:30 PM	Panel Discussion
2:30 PM - 2:45 PM	Coffee Break

Session V: "Classic" Valve Surgery – Tough Decisions and Advancing the Art

Moderators: *Friedrich W. Mohr, *Herzzentrum Leipzig* and *Todd K. Rosengart, *Baylor College of Medicine*

2:45 PM - 3:00 PM	Degenerative Mitral Regurgitation: Are Artificial Chords State of the Art? *Friedrich W. Mohr, <i>Herzzentrum Leipzig</i>
3:00 PM - 3:15 PM	Aortic Root Enlargement to Avoid PPM: Is there Still a Need? *George T. Christakis, <i>Sunnybrook Hospital</i>
3:15 PM - 3:30 PM	Mitral Intervention in CABG Patients: Is Less Ever More? *Louis P. Perrault, <i>Montreal Heart Institute</i>
3:30 PM - 3:50 PM	Gladiator Session II: Bicuspid Aortic Valve Repair Moderator: *Tirone E. David, <i>Toronto General Hospital</i> Pro: *Gebrine El Khoury, <i>Université Catholique de Louvain</i> Con: *D. Craig Miller, <i>Stanford University</i>
3:50 PM - 4:05 PM	Functional Mitral Regurgitation: Back to Basics (Replace) or Stick with Repair? *Steven F. Bolling, <i>University of Michigan</i>
4:05 PM - 4:20 PM	Minimally Invasive Valve Surgery: State of the Art Joseph Lamelas, <i>Mount Sinai Medical Center</i>
4:20 PM - 4:40 PM	Panel Discussion
4:40 PM - 5:00 PM	Gladiator Session III: Concomitant Tricuspid Repair Moderator: *James S. Gammie, <i>University of Maryland</i> Pro: *David H. Adams, <i>Mount Sinai Medical Center</i> Con: *John V. Conte, <i>Johns Hopkins Hospital</i>
5:00 PM	Adjourn for Welcome Reception in the Exhibit Hall, Level 100, BCC

AATS/STS Congenital Heart Disease Symposium:

Ballroom III, Level 400, BCC

Respecting Our Past; Embracing Our Future

Sunday, May 15, 2016 | 8:00 AM - 5:00 PM

Course Chair: *Charles D. Fraser, *Texas Children's Hospital*

Course Co-Chair: *George E. Sarris, *Athens Heart Surgery Institute*

7:50 AM - 8:00 AM **Welcome and Introduction**

Session I

Moderators: *Marshall L. Jacobs, *Johns Hopkins Hospital* and *George E. Sarris, *Athens Heart Surgery Institute*

Pediatric VAD Update

8:00 AM - 8:11 AM **Overview of Current Pediatric and Adult Devices in Congenital Heart Disease**
Iki Adachi, *Texas Children's Hospital*

8:11 AM - 8:22 AM **The Pumpkin Trial: We Are Close**
Tim Baldwin, *NHLBI*

8:22 AM - 8:33 AM **Total Artificial Heart Trial**
*David L. Morales, *Cincinnati Children's Hospital*

8:33 AM - 8:44 AM **VAD's in Adults with Failing Single Ventricles**
Ronald K. Woods, *Medical College of Wisconsin*

Getting Increasingly Complex: Adult Congenital Cardiac Surgery

8:44 AM - 9:20 AM **Controversy #1: Evolution of Adult-Congenital Heart Surgery – Optimal Environment?**

The Emory System

*Brian E. Kogon, *Emory University*

The University of Pennsylvania System

*Michael A. Acker, *University of Pennsylvania*

9:20 AM - 9:35 AM

Rescuing the Late Failing Fontan: Focus on Dysrhythmias

*Carl L. Backer, *Lurie Children's Hospital of Chicago*

9:35 AM - 10:00 AM

Coffee Break**Session II**

Moderators: *Charles D. Fraser, *Texas Children's Hospital* and *James S. Tweddell, *Cincinnati Children's Hospital*

10:00 AM - 10:15 AM

The Complex Arterial Switch Operation: Techniques and Outcomes

*Charles D. Fraser, *Texas Children's Hospital*

10:15 AM - 11:00 AM

Controversy #2: Ready or Not, Here Comes Public Reporting**What Every Parent Must Know**

Annie Garcia, *OpHeart*

The STS CHS Public Reporting Initiative: It Is Here

*Jeffrey P. Jacobs, *All Children's Hospital*

A Word of Caution in Public Reporting

*Thomas Spray, *Children's Hospital of Philadelphia*

Complex Aortic Surgery in Children

11:00 AM - 11:15 AM

Genetics of Aortopathies in Childhood

Hal Dietz, *Johns Hopkins Hospital*

11:15 AM - 11:30 AM

Decisions and Operations in Childhood Marfan's/Loeys-Dietz/Ehler-Danlos

*Luca A. Vricella, *Johns Hopkins Hospital*

11:30 AM - 11:45 AM

Aortic Arch Advancement and Slide Aortoplasty

*E. Dean McKenzie, *Texas Children's Hospital*

12:00 PM - 1:00 PM

Legends Luncheon

Remain in Ballroom III for Legends Luncheon

*Leonard L. Bailey, *Loma Linda University*

Session III

Moderators: *Charles D. Fraser, *Texas Children's Hospital* and *George E. Sarris, *Athens Heart Surgery Institute*

1:00 PM - 2:00 PM

Controversy #3: The ABTS Congenital Fellowship: How is it Working?**ABTS Perspective**

*James S. Tweddell, *Cincinnati Children's Hospital*

Recent Graduate's Perspective

Carlos M. Mery, *Texas Children's Hospital / Baylor College of Medicine*

1:45 PM - 2:00 PM

Have We Lost Our International Heritage?

*Vaughn A. Starnes, *University of Southern California*

2:00 PM - 3:00 PM

Tough Case Scenarios: Cases I Struggled With

Expert Panelists:

*E. Dean McKenzie, *Texas Children's Hospital*

*George E. Sarris, *Athens Heart Surgery Institute*

*Christian Pizarro, *Alfred Dupont Hospital for Children*
 *Jonathan M. Chen, *Seattle Children's Hospital*

2:00 PM - 2:20 PM

Case I

*Charles D. Fraser, *Texas Children's Hospital*

2:20 PM - 2:40 PM

Case II

*Gosta Pettersson, *Cleveland Clinic*

2:40 PM – 3:00 PM

Case III

*Krishna S. Iyer, *Fortis Escorts Heart Institute*

3:00 PM - 3:20 PM

Case IV

*Sertac Cicek, *Anadolu Medical Center*

3:20 PM - 3:40 PM

AATS Consensus Guideline: Anomalous Coronary Artery Origin from Wrong Sinus

*James S. Tweddell, *Cincinnati Children's Hospital*

3:40 PM - 4:20 PM

Coffee Break

Tetralogy Surgery: Back To Baltimore 70 Years Later

4:20 PM - 4:35 PM

Balloon Valvotomy

*Emile A. Bacha, *Children's Hospital of New York*

4:35 PM - 4:50 PM

Melbourne Heritage and Group Tribute to Juan Comas

*George E. Sarris, *Athens Heart Surgery Institute*

5:00 PM

Adjourn for Welcome Reception in the Exhibit Hall, Level 100, BCC

AATS/STS General Thoracic Surgery Symposium:

Ballroom IV, Level 400, BCC

The Best Way to Predict the Future is to Invent It

Sunday, May 15, 2016 | 8:00 AM - 5:00 PM

Course Chair: *Thomas K. Waddell, *University of Toronto*

Course Co-Chair: *Paul E. van Schil, *University Hospital of Antwerp*

8:00 AM - 8:05 AM

Welcome and Introduction

Lung Cancer

Moderators: *Thomas K. Waddell, *University of Toronto* and *Paul E. van Schil, *University Hospital of Antwerp*

8:05 AM - 8:17 AM

Update on CALGB 140503: Lobar vs. Sublobar Resection for ≤ 2 cm NSCLC

*Nasser K. Altorki, *New York Presbyterian Hospital*

8:17 AM - 8:29 AM

Does Tumor Genomic Profiling Matter in the Management of Stage I/II NSCLC?

*Raphael Bueno, *Brigham and Women's Hospital*

8:29 AM - 8:41 AM

Management of the Solitary Pulmonary Nodule: Update on Fleischner Guidelines

Herb Macmahon, *University of Chicago*

8:41 AM - 8:53 AM

IASLC Classification Changes for Lung Adenocarcinoma: Impact on Surgical Procedure

*Prasad S. Adusumilli, *Memorial Sloan Kettering Cancer Center*

8:53 AM - 9:15 AM

Panel Discussion

9:15 AM - 9:40 AM

Gladiator Session I: Role of VATS Lobectomy for Locoregionally Advanced NSCLC

*Raja M. Flores, *Mount Sinai Health Systems*

+Daniel J. Boffa, *Yale University*

9:45 AM - 10:00 AM **Coffee Break**

Benign Lung Disease and Transplantation

Moderators: *G. Alexander Patterson, *Washington University* and *Thomas K. Waddell, *University of Toronto*

10:00 AM - 10:12 AM **Lung Biopsy for Interstitial Lung Disease: Risk vs. Reward**
Eric Grogan, *Vanderbilt University*

10:12 AM - 10:24 AM **Current Role of EVLP in Lung Transplantation**
Edward Cantu, *University of Pennsylvania*

10:24 AM - 10:36 AM **Management of Post-Intubation Tracheal Stenosis**
*Cameron D. Wright, *Massachusetts General Hospital*

10:36 AM - 10:48 AM **ECMO as a Bridge to Lung Transplantation**
*R. Duane Davis, *Florida Hospital*

10:48 AM - 11:00 AM **Pulmonary Thromboendarterectomy: Indications and Outcomes**
*Marc de Perrot, *Toronto General Hospital*

11:00 AM - 11:12 AM **When is Surgery Indicated for MAI?**
Alain D.L. Sihoe, *University of Hong Kong*

11:12 AM - 11:32 AM **Panel Discussion**

11:32 AM - 11:55 AM **Gladiator Session II: Optimal Surgical Treatment for End-Stage Emphysema**
David Waller, *University of Leicester*
*Michael S. Mulligan, *University of Washington*

12:00 PM - 1:00 PM **Legends Luncheon** *Remain in Ballroom IV for Legends Luncheon*
*Joel D. Cooper, *University of Pennsylvania*

Mediastinum, Pleura and Other

Moderators: *David J. Sugarbaker, *Baylor College of Medicine* and *Paul E. van Schil, *University Hospital of Antwerp*

1:10 PM - 1:22 PM **Multimodality Management of Stage III/IVa Thymic Tumors**
Pier Luigi Filosso, *University of Torino, Italy*

1:22 PM - 1:32 PM **Pulmonary Metastatectomy: Ablate or Resect – What is the Evidence?**
*Jay M. Lee, *University of California, Los Angeles*

1:32 PM - 1:42 PM **Induction vs. Adjuvant Therapy in Surgically Resectable Malignant Mesothelioma**
Isabelle Optiz, *University Hospital Zurich*

1:42 PM - 1:52 PM **Contemporary Management of Post Resection Empyema**
Thorsten Krueger, *University Hospital of Lausanne*

1:52 PM - 2:15 PM **Panel Discussion**

2:15 PM - 2:40 PM **Gladiator Session III: Management of a 2 cm Thymoma in an Elderly Patient**
*M. Blair Marshall, *Georgetown University*
*Michael J. Liptay, *Rush University*

2:40 PM - 3:00 PM **Coffee Break**

Esophagus

Moderators: *Wayne L. Hofstetter, *MD Anderson Cancer Center* and *Thomas K. Waddell, *University of Toronto*

3:00 PM - 3:12 PM **What is the Optimal Lymphadenectomy for Esophageal Cancer?**
*Mark Onaitis, *Duke University*

3:12 PM - 3:24 PM	Starting a Minimally-Invasive Esophagectomy Program Daniela Molena, <i>Johns Hopkins Hospital</i>
3:24 PM - 3:36 PM	Optimal Management of the Pylorus Following an Esophagectomy *Traves D. Crabtree, <i>Washington University</i>
3:36 PM - 3:48 PM	Robotic Esophagectomy: Outcomes and Complications *Robert J. Cerfolio, <i>University of Alabama at Birmingham</i>
3:48 PM - 4:00 PM	Re-operation for Failed Anti-Reflux Operations *Arjun Pennathur, <i>University of Pittsburgh</i>
4:00 PM - 4:15 PM	The Surgeon's Role in Clinical Trials for Esophageal Cancer: Going, Going, Gone? *Gail E. Darling, <i>Toronto General Hospital</i>
4:15 PM - 4:35 PM	Panel Discussion
4:35 PM - 5:00 PM	Ask the Experts: MIE is Superior to Open Esophagectomy for Esophageal Cancer *James D. Luketich, <i>University of Pittsburgh</i> *Manjit S. Bains, <i>Memorial Sloan Kettering Cancer Center</i> *Robert J. Cerfolio, <i>University of Alabama at Birmingham</i> *Mark B. Orringer, <i>University of Michigan</i> *Gail E. Darling, <i>Toronto General Hospital</i>
5:00 PM	Adjourn for Welcome Reception in the Exhibit Hall, Level 100, BCC

AATS/STS Cardiothoracic Critical Care Symposium:

Room 337, Level 300, BCC

Innovations and Complications in the ICU

Sunday, May 15, 2016 | 8:00 AM - 5:00 PM

Course Chairs: *Andrew C. Chang, *University of Michigan*

*Nevin M. Katz, *Johns Hopkins Hospital*

Aaron M. Cheng, *University of Washington*



In collaboration with the American Society of ExtraCorporeal Technology (AmSECT) and the Association of Physician Assistants in Cardiovascular Surgery (APACVS).

8:00 AM - 8:10 AM **Welcome and Introduction**

Infection and Inflammation in the ICU

Moderator: *Andrew C. Chang, *University of Michigan*

8:10 AM - 8:25 AM **Update on Management of Sepsis in the CTICU**

James Isbell, *University of Virginia*

8:25 AM - 8:40 AM **Management of Complex Mediastinal Issues**

*Jonathan W. Haft, *University of Michigan*

8:40 AM - 8:55 AM **Empyema - Operative & ICU Care**

Aaron M. Cheng, *University of Washington*

8:55 AM - 9:10 AM **Latest Management of Esophageal Leak**

*Richard K. Freeman, *St. Vincent Hospital*

9:10 AM - 9:25 AM **Panel Discussion**

9:25 AM - 9:40 AM **Coffee Break**

Mechanical Circulatory Support and ICU Care

Moderators: *Andrew C. Chang, *University of Michigan* and Aaron M. Cheng, *University of Washington*

9:40 AM - 9:55 AM	Single-provider ECMO – How We Do It *Jonathan W. Haft, <i>University of Michigan</i>
9:55 AM - 10:10 AM	Mechanical Circulatory Support: Undercoagulation is as Bad as Over Giles Peek, <i>Pediatric Heart Center at Montefiore and Einstein</i>
10:10 AM - 11:05 AM	ECMO Emergencies & Complications: ICU Management William Lynch, <i>University of Michigan</i>
11:05 AM - 11:20 AM	VAD Emergencies & Complications: ICU Management +John Stulak, <i>Mayo Clinic</i>
11:20 AM - 11:40 AM	Panel Discussion
12:00 PM - 1:00 PM	Legends Luncheons *Leonard L. Bailey <i>Taking place in Ballroom III, Level 400, BCC</i> *Joel D. Cooper <i>Taking place in Ballroom IV, Level 400, BCC</i> *John L. Ochsner <i>Taking place in Hall E, Level 100, BCC</i>

Innovative Technology in the ICU

Moderator: *Andrew C. Chang, *University of Michigan*

1:15 PM - 1:30 PM	Early Detection & Management of Neurologic Complications Vassyl Lonchya, <i>Chicago</i>
1:30 PM - 1:45 PM	Complications of Transcatheter Valve Procedures *Vinod H. Thourani, <i>Emory University</i>
1:45 PM - 2:05 PM	Latest Management of Coagulopathies Kenichi Tanaka, <i>University of Maryland</i>
2:05 PM - 2:30 PM	Panel Discussion
2:30 PM - 3:00 PM	Coffee Break

Quality of Care in the ICU

Moderators: *Andrew C. Chang, *University of Michigan* and Aaron M. Cheng, *University of Washington*

3:00 PM - 3:20 PM	Challenges of the Affordable Care Act: Systems for Quality Improvement in the ICU Daniel T. Engelman, <i>Baystate Medical Center</i>
3:20 PM - 3:40 PM	Palliative Care in the ICU Keki R. Balsara, <i>Washington University</i>
3:40 PM - 4:00 PM	Panel Discussion
4:00 PM - 5:00 PM	Difficult Cases in the CTICU Aaron M. Cheng, <i>University of Washington</i> James Isbell, <i>University of Virginia</i> Keki R. Balsara, <i>Washington University</i> Giles Peek, <i>Pediatric Heart Center at Montefiore and Einstein</i>
5:00 PM	Adjourn for Welcome Reception in the Exhibit Hall, Level 100, BCC

Survival Guide for the Cardiothoracic Surgical Team

Room 340, Level 300, BCC

Survival Guide for the Cardiothoracic Surgical Team Hands-On

Rooms 343, Level 300, BCC, *Not for Credit*

Sunday, May 15, 2016 | 1:00 PM - 5:00 PM | Pre-Registration Required

Course Chairs: *Abe DeAnda, Jr., *University of Texas Medical Branch, Galveston* and *Joseph C. Cleveland, Jr., *University of Colorado*

PART I: Groups A and B in Room 340 from 1:00 PM – 1:30 PM.

1:00 PM - 1:10 PM	Welcome and Introduction *Abe DeAnda, Jr., <i>University of Texas Medical Branch, Galveston</i> *Joseph C. Cleveland, Jr., <i>University of Colorado</i>
1:10 PM - 1:30 PM	Creating Resonant Teams through Attuned Communication *Ross M. Ungerleider, <i>Wake Forest Baptist Health</i>

PART 2: Group A remains in Didactic Session Room 340 / Group B goes to the Hands-On Session Room 343.

1:30 PM - 1:45 PM	Tamponade Jennifer D. Walker, <i>University of Massachusetts</i>
1:45 PM - 2:00 PM	Tension Pneumothorax Brandon Tieu, <i>Oregon Health & Science University</i>
2:00 PM - 2:15 PM	Airway Emergency *Stephen C. Yang, <i>Johns Hopkins Hospital</i>
2:15 PM - 2:30 PM	Post-op Bleeding *Howard K. Song, <i>Oregon Health & Science University</i>
2:30 PM - 2:45 PM	Low CO/CI Syndrome *Joseph C. Cleveland, Jr., <i>University of Colorado</i>
2:45 PM - 3:00 PM	Acute Aortic Syndromes Philip Hess, <i>University of Florida</i>

PART 3: Group A goes to the Hands-On Session Room 343 / Group B remains in Didactic Session Room 340.

3:00 PM - 3:15 PM	Tamponade Jennifer D. Walker, <i>University of Massachusetts</i>
3:15 PM - 3:30 PM	Tension Pneumothorax Brandon Tieu, <i>Oregon Health & Science University</i>
3:15 PM - 3:45 PM	Airway Emergency *Stephen C. Yang, <i>Johns Hopkins Hospital</i>
3:45 PM - 4:00 PM	Post-op Bleeding *Howard K. Song, <i>Oregon Health & Science University</i>
4:00 PM - 4:15 PM	Low CO/CI Syndrome *Joseph C. Cleveland, Jr., <i>University of Colorado</i>
4:15 PM - 4:30 PM	Acute Aortic Syndromes Philip Hess, <i>University of Florida</i>

Accreditation Information

Statement of Need

Cardiovascular disease and cancer are the leading causes of mortality and morbidity around the globe. Major advances in these conditions continue to be made at a rapid pace. Improvements in diagnostic techniques as well as interventional approaches to treatment, both surgical and percutaneous, challenge the clinical practitioner to remain current. Increasingly sophisticated technology to accomplish these aims is being developed and introduced into clinical practice. Exciting advances in basic and clinical science offer opportunities for participation in scientific studies and clinical trials. All of these elements create a significant educational need for the practicing cardiothoracic surgeon. The AATS Annual Meeting fills this need through a combination of lectures, original scientific presentations and discussion forums.

Educational Objectives

At the conclusion of the AATS Annual Meeting, through comprehensive lectures and discussions, participants will be able to:

1. Identify the latest techniques and current research specifically related to Adult Cardiac Surgery, Congenital Heart Disease, General Thoracic Surgery and Perioperative Care.
2. Select appropriate surgical procedures and other interventions for their own patients based upon results presented.
3. Incorporate the basic science developments and emerging technologies and techniques across the spectrum of cardiothoracic surgery.
4. Communicate current practice management necessary for the effective and safe delivery of patient care.
5. Translate expanded knowledge into practice for the improvement of patient outcomes and satisfaction.

Target Audience

The AATS Annual Meeting is specifically designed to meet the educational needs of:

- Cardiothoracic Surgeons
- Physicians in related specialties including Cardiothoracic Anesthesia, Critical Care, Cardiology, Pulmonology, Radiology, Gastroenterology, Thoracic Oncology and Vascular Surgery
- Fellows and Residents in Cardiothoracic and General Surgical training programs
- Health Care Professionals involved in the care of cardiothoracic surgical patients including Physician Assistants, Nurse Practitioners, Nurses, Surgical Assistants and Perfusionists
- Medical students with an interest in cardiothoracic surgery

AATS would like to thank the following companies for their marketing support:

Abbott Vascular	LivaNova
Atricure	Medela
CryoLife	Medtronic
Edwards Lifesciences	St. Jude Medical
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JOMDD	

AATS would like to thank the following companies for their educational support:

Abbott Vascular	Olympus America, Inc.
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As of April 20, 2016

Continuing Medical Education (CME) Accreditation

The American Association for Thoracic Surgery is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The American Association for Thoracic Surgery designates this live educational activity for a maximum of **34.75 AMA PRA Category 1 Credits™**. Physicians should only claim credit commensurate with the extent of their participation in the activity.



American Academy of Physician Assistants (AAPA) Accreditation

This program has been reviewed and is approved for a maximum of 67.25 hours of AAPA Category I CME credit by the Physician Assistant Review Panel. Physician assistants should claim only those hours actually spent participating in the CME activity. This program was planned in accordance with AAPA's CME Standards for Live Programs and for Commercial Support of Live Programs.

American Board of Cardiovascular Perfusion (ABCP) Accreditation

The American Board of Cardiovascular Perfusion designates this educational activity for a maximum of 40.1 Category 1 CEUs.

The American Association for Thoracic Surgery designates the following credit hours:

Saturday, May 14, 2016 – up to 6.5 hours (CME, AAPA, ABCP)

Adult Cardiac Skills, up to 6 hours
Congenital Skills, up to 5.25 hours
General Thoracic Skills, up to 6 hours
Interprofessional Cardiothoracic Team Symposium, up to 6 hours
Optimal Therapies for End-Stage Thoracic Organ Failure, up to 6.5 hours
Ethics Forum: Surgical Ethics Course, up to 5.75 hours

Sunday, May 15, 2016 – up to 7 hours (CME, AAPA, ABCP)

Adult Cardiac Surgery, up to 7 hours
Congenital Heart Disease, up to 7 hours
General Thoracic Surgery, up to 7 hours
Survival Guide for the Cardiothoracic Surgical Team, up to 3.75 hours

Monday, May 16, 2016 – up to 10.5 hours (CME, ABCP)

Plenary Scientific Session, Basic Science Lecture, Presidential Address, up to 3.5 hours
Ethics Forum Luncheon, up to 1.5 hours
Adult Cardiac Surgery Simultaneous Session, up to 2.5 hours
Congenital Heart Disease Simultaneous Session, up to 2.5 hours
General Thoracic Surgery Simultaneous Session, up to 2.5 hours
Perioperative Care Simultaneous Session, up to 2.5 hours
C. Walton Lillehei Resident Forum, up to 1.5 hours
Innovations in Transcatheter Therapies: What You Need to Know for Today and the Future, up to 1.5 hours

Tuesday, May 17, 2016 – up to 7 hours (CME, ABCP)

Cardiac Surgery Forum, up to 1.75 hours
General Thoracic Surgery Forum, up to 1.75 hours
Adult Cardiac Emerging Technologies and Techniques Forum, up to 1.75 hours
General Thoracic Emerging Technologies and Techniques Forum, up to 1.75 hours
Video Session, up to 1.75 hours
VAD/ECMO Session, up to 1.75 hours
Plenary Scientific Session, up to 2.25 hours
Honored Guest Lecture, not for credit
Cardiothoracic Surgical Trials Network: Implications for Clinical Practice, up to 1.25 hours
Adult Cardiac Surgery Simultaneous Session, up to 1.75 hours
Aortic/Endovascular Simultaneous Session, up to 1.75 hours
Congenital Heart Disease Simultaneous Session, up to 3 hours
General Thoracic Surgery Simultaneous Session, up to 3 hours

Wednesday, May 18, 2016 – up to 3.75 hours (CME, ABCP)

Adult Cardiac Surgery Simultaneous Session, up to 2 hours
Congenital Heart Disease Simultaneous Session, up to 2 hours
General Thoracic Surgery Simultaneous Session, up to 2 hours

Adult Cardiac Masters of Surgery Video Session, up to 1.75 hour
Congenital Masters of Surgery Video Session, up to 1.75 hours
General Thoracic Masters of Surgery Video Session, up to 1.75 hours

CME Certificates and Letters of Attendance

CME (Continuing Medical Education) and CE credits and Letters of Attendance may be obtained at the CME/CE Pavilion located in the Pratt Street Lobby, Level 300 of the Baltimore Convention Centre. The CME/CE Pavilion computers will allow attendees to manage all of their CME/CE credits and Letter of Attendance for the Annual Meeting. Access may also be obtained post-meeting by visiting <http://ceu.experient-inc.com/aat161>.

Attendees may email their CME/CE certificate and/or Letter of Attendance to themselves or they may print them out on site at the CME/CE Pavilion.

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It is the policy of the American Association for Thoracic Surgery (AATS) that any individual who is in a position to control or influence the content of an educational activity to disclose all relevant financial relationships or affiliations. All identified conflicts of interest must be resolved and the educational content thoroughly vetted by AATS for fair balance, scientific objectivity, and appropriateness of patient care recommendations. In addition, faculty members are asked to disclose when any discussion of unapproved use of pharmaceutical or medical device occurs.

For further information on the Accreditation Council for Continuing Medical Education (ACCME) standards of commercial support, please visit www.accme.org.

Disclosure List

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The following committee members have nothing to disclose with regard to commercial support. The following faculty members do not plan on discussing unlabeled/investigational uses of a commercial product.

*Ottavio R. Alfieri	Katherine J. Hoercher	*Nevin M. Katz	*Todd K. Rosengart
*Duke E. Cameron	*Viktor Hraska	*E. Dean McKenzie	*George E. Sarris
*Edward P. Chen	*John S. Ikonomidis	*Marc R. Moon	*Ashish S. Shah
*Haiquan S. Chen	*Krishna S. Iyer	*Mark Onaitis	*Dirk E. van Raemdonck
*Gebrine El Khoury	*David R. Jones	*Gosta B. Pettersson	*Paul E. van Schil

The following committee members have disclosures with regard to commercial support. The following faculty members do not plan on discussing unlabeled/investigational uses of a commercial product.

*Andrew C. Chang	Financial / Material Support from Ethicon Endo-Surgery, Covidien
*Joseph S. Coselli	Grants/Research Support from Edwards Lifesciences, Medtronic, WL Gore & Associates, GlaxoSmithKline; Consultant with St. Jude Medical Inc, Vascutek Terumo, Medtronic, WL Gore & Associates; Royalties from Vascutek Terumo
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*Charles D. Fraser	Consultant with Berlin Heart
*Shaf Keshavjee	Founder and Chief Scientific Officer of Perfusix Canada, Perfusix USA, XOR Laboratories; Research Support from XVIVO Perfusion, United Therapeutics, United Therapeutics
*M. Blair Marshall	Consultant with Ethicon; Financial / Material Support from ClinicalKey-Elsevier, Thoracic Surgery Clinic-Elsevier
Scott C. Silvestry	Consultant with Thoratec and Heartware

*Thoralf M. Sundt, III	Consultant with Thorasos, Inc.
*David P. Taggart	Grants/Research Support from Medistim, Vascular Graft Solutions; Consultant with Somahlution, Vascular Graft Solutions; Stock Shareholder with Vascular Graft Solutions; Financial / Material Support from Medistim, Vascular Graft Solutions
*Luca A. Vricella	Advisor with St. Jude Medical
*Thomas K. Waddell	Consultant with Perfusix US, Lunch Biotechnology Inc.; Stock Shareholder with XOR Labs Toronto, Inc.

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*Nasser K. Altorki	*Frank L. Hanley	*Thomislav Mihaljevic	Yihua Sun
*Francisco A. Arabia	*David H. Harpole	*Carmelo A. Milano	Hiroo Takayama
*Matthew Bacchetta	Matthew Hartwig	J. Scott Millikan	Lijie Tan
*Carl L. Backer	Philip Hess	Nader Moazami	Kneichi Tanaka
*Leonard L. Bailey	Katherine J. Hoercher	*Susan D. Moffatt-Bruce	Brandon Tieu
*Manjit S. Bains	*Wayne L. Hofstetter	*Friedrich W. Mohr	Michael Tong
Tim Baldwin	David Holmes	*Marc R. Moon	Hakin Akin Turk
Keki R. Balsara	Charles Hoopes	*Michael S. Mulligan	*James S. Tweddell
*Ko Bando	+James Huang	*Sudish C. Murthy	*Ross M. Ungerleider
*Clifford W. Barlow	*John S. Ikonmidis	Katie S. Nason	*Paul E. van Schil
*Joseph E. Bavaria	*Krishna S. Iyer	*John L. Ochsner	Jennifer D. Walker
*Mark F. Berry	*Jeffrey P. Jacobs	*Mark Onaitis	David Waller
*Shanda H. Blackmon	*Richard A. Jonas	Isabelle Optiz	*Glenn J. Whitman
+Daniel J. Boffa	*David R. Jones	*Mark B. Orringer	*Richard I. Whyte
*Haiquan S. Chen	*Kirk R. Kanter	*G. Alec Patterson	*Y. Joseph Woo
*Jonathan M. Chen	Navin K. Kapur	Giles Peek	*Cameron D. Wright
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*George T. Christakis	*Nevin M. Katz	*Frank A. Pigula	
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*Tirone E. David	*Leslie J. Kohman	*Robert M. Sade	
*Joseph A. Dearani	*Neal D. Kon	*Shunji Sano	
*Todd L. Demmy	Rajesh Krishnamurthy	*Inderpal S. Sarkaria	
*Gebrine El Khoury	*Irving L. Kron	*George E. Sarris	
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Kathleen Fenton	*Jay M. Lee	*Craig R. Smith	
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*Raja M. Flores	+Simon Maltais	*Thomas L. Spray	
*Richard K. Freeman	Gerald Ross Marx	*Vaughn A. Starnes	
Annie Garcia	*Kenneth R. McCurry	Sandra Starnes	
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*Abbas Ardehali	<i>Off-label/unapproved use discussion</i> – OCS-Lung, XVIVO Platform
+Laurent de Kerchove	<i>Off-label/unapproved use discussion</i> – use of the Simplici-T band as an external circumferential ring annuloplasty in aortic valve repair
Kathleen Fenton	<i>Off-label/unapproved use discussion</i> – The topic assigned is euthanasia and physician assisted suicide. This represents off label drug use in most places.
William Lynch	<i>Off-label/unapproved use discussion</i> – ECMO technologies are used in "off label" when used for ECMO
Chris Sciortino	<i>Off-label/unapproved use discussion</i> – Temporary RV support

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*Emile A. Bacha	Consultant with Cormatrix
*Faisal G. Bakaeen	Consultant with JACE Medical
*Steven F. Bolling	Consultant with Sorin, Abbott, Medtronic; Financial / Material Support from Edwards.
*Raphael Bueno	Grants/Research Support from Castle Biosciences, Myriad, Novartis, Verastem, Genentech, Siemens
*Edward Cantu	Financial / Material Support from XVIVO, Inc
*Robert J. Cerfolio	Consultant with Community Health Systems; Honorarium from Intuitive Surgical, Ethicon
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*Edward P. Chen	Honorarium from Cryolife
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*Traves D. Crabtree	Consultant with Ethicon Endosurgery.
+Marcelo Cypel	Grants/Research Support from Vivo Perfusion; Consultant with Lung Bioengineering/United Therapeutics; Stock Shareholder with XOR Labs Toronto and Perfusix Canada.
*Thomas A. D'Amico	Consultant with Scanlan

*R. Duane Davis	Grants/Research Support from ExVivo Perfusion, Perfusix, AtriCure; Consultant with Allmed, Transplant Analytics, Transplant Management Group
*Marc de Perrot	Honorarium from Bayer
*Pedro J. del Nido	Stock Shareholder with Nido Surgical LLC.
Jennifer Ellis	Consultant with KCI
*Charles D. Fraser	Consultant with Berlin Heart
*James S. Gammie	Stock Shareholder with Harpoon Medical, Inc.
*A. Marc Gillinov	Grants/Research Support from St. Jude; Consultant with On-X, Medtronic, Abbott, Clearflow, Tendy; Stock Shareholder with Clearflow; Financial / Material Support from AtriCure, Edwards Lifesciences, Medtronic, St. Jude
Eric Grogan	Grants/Research Support from VA Career Development Award
*Robert A. Guyton	Consultant with Medtronic, Inc.
James Isbell	Stock Shareholder with LumaCyte, LLC
*Marhsall L. Jacobs	Consultant with Berlin Heart
*A. Pieter Kappetein	Grants/Research Support from Medtronic (Steering committee SURTAVI trial)
*Shaf Keshavjee	Founder and Chief Scientific Officer of Perfusix Canada, Perfusix USA, XOR Laboratories; Research Support from XVIVO Perfusion, United Therapeutics, United Therapeutics
*Kamal R. Khabbaz	Consultant with On-X Life Technologies
Joseph Lamelas	Stock Shareholder with Miami Instruments; Honorarium from Medtronic, St. Jude, On-Q
*Michael J. Liptay	Honorarium from Covidien
Vassyl Lonchya	Stock Shareholder with Abbott, Abbvie and Hospira
Brian E. Louie	Grants/Research Support from Torax Medical Incorporated, Olympus Medical, Boston Scientific; Consultant with Torax Medical Incorporated
*James D. Luketich	Stock Shareholder with Abbott, Abbvie and Hospira
*Michael J. Mack	Manufacturer of Product with Edwards Lifesciences, Abbott Vascular
Herb Macmahon	Grants/Research Support from Philips Healthcare; Consultant with Riverain Technologies
*Michael M. Madani	Consultant with Bayer, Actelion, Wexler Surgical
*M. Blair Marshall	Consultant with Ethicon; Financial / Material Support from ClinicalKey-Elsevier, Thoracic Surgery Clinic-Elsevier
*Patrick M. McCarthy	Consultant with Abbott Vascular, Edwards Lifesciences, MiCardia; Financial / Material Support from Edwards Lifesciences

*D. Craig Miller	Grants/Research Support from Abbott Vascular -COAPT MitralClip Trial, PARTNER I & II Trials, Edwards Lifesciences, LLC, Medtronic Core Valve SURTAVI Trial, Edwards Lifesciences, COMMENCE Trial, PARTNER Executive Committee Member -Percutaneous AVR, Edwards Life
Daniela Molena	Honorarium from Novadaq Inc.
*Francis D. Pagani	Grants/Research Support from Thoratec, HeartWare
*Arjun Pennathur	Grants/Research Support from Accuray
*Louis P. Perrault	Consultant with Somahlution, Clearflow.
*Vivek Rao	Consultant with Medtronic, Thoratec, CorMatrix Cardiovascular
Stuart Russell	Consultant with Thoratec
*Joseph F. Sabik	Grants/Research Support from Edwards, Abbott; Consultant with Sorin, Medtronic; Honorarium from Medtronic
Jan D. Schmitto	Consultant with Thoratec Corp. Consultant, Heartware Inc.
Girish S. Shirali	Grants/Research Support from Edwards LifeSciences
Alain D.L. Sihoe	Financial / Material Support from Medela AG (Baar, Switzerland)
Scott C. Silvestry	Consultant with Thoratec and Heartware
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*Thoralf M. Sundt, III	Consultant with Thorasos, Inc.
*Lars G. Svensson	Manufacturer of Product with Royalties with Posthorax, Cardiosolutions Inc.
*David P. Taggart	Grants/Research Support from Medistim, Vascular Graft Solutions; Consultant with Somahlution, Vascular Graft Solutions; Stock Shareholder with Vascular Graft Solutions; Financial/Material Support from Medistim, Vascular Graft Solutions
*Vinod H. Thourani	Grants/Research Support from Abbott Medical, Edwards Lifesciences, Medtronic, St. Jude, Claret, Boston Scientific; Advisor with Abbott Medical, Edwards Lifesciences, Medtronic
*Ross M. Ungerleider	Consultant with Medtronic, Inc.
*Luca A. Vricella	Advisor with St. Jude Medical
*Thomas K. Waddell	Consultant with Perfusix US, Lunch Biotechnology Inc.; Stock Shareholder with XOR Labs Toronto, Inc.
*Song Wan	Consultant with St Jude; Honorarium from Sorin
*Mathew Williams	Consultant and Research Support from Medtronic, Edwards Lifesciences

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Iki Adachi	Grants/Research Support from Baylor College of Medicine; Consultant with New England Research Institutes, Sony-Olympus Medical Solutions; <i>Off-label/unapproved use discussion</i> – HeartWare HVAD, Thoratec HeartMate II, Abiomed Impella
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Mani A. Daneshmand	Honorarium from Maquet; <i>Off-label/unapproved use discussion</i> – ECMO is only FDA approved for 6 hours. I will be discussing supporting patients longer than 6 hours.
Hal Dietz	Grants/Research Support from NIH, HHMI, Scleroderma Research Foundation, Marfan Foundation, Leducq Foundation; Consultant with Blade Therapeutics, GSK; Stock Shareholder with Blade Therapeutics; <i>Off-label/unapproved use discussion</i> – Losartan
*Yves d'Udekem	Consultant with MSD, Actelion; <i>Off-label/unapproved use discussion</i> – Contegra valve in a mitral position
Aly El Banayosy	Consultant with Thoratec; <i>Off-label/unapproved use discussion</i> – Use of the CentriMag Pump in ECMO Circuits
Bradley G. Leshnowar	Consultant with Cryolife, Inc.; <i>Off-label/unapproved use discussion</i> – deployment of a thoracic aortic stent graft in an antegrade fashion for the treatment of Type A aortic dissection
*David L. Morales	Grants/Research Support from CorMatrix; Consultant with CorMatrix, Syncardia, Berlin Heart Inc.; Financial/Material Support from CorMatrix Options; <i>Off-label/unapproved use discussion</i> – Syncardia TAH 50/50cc
*Eric E. Roselli	Consultant with Bolton, Gore, Medtronic, LivaNova; Financial / Material Support from Direct Flow; Honorarium from St. Jude , Vascutek, Cook, Edwards; <i>Off-label/unapproved use discussion</i> – thoracic stentgrafts
Ronald K. Woods	Grants/Research Support from HeartWare, Syncardia; <i>Off-label/unapproved use discussion</i> – MCS in single ventricle patients
Shi-Joon Yoo	Manufacturer of Product with 3D HOPE Medical; <i>Off-label/unapproved use discussion</i> – MRI contrast agents in children

AATS Staff

AATS Staff have nothing to disclose with regard to commercial support.

**THE AMERICAN ASSOCIATION FOR THORACIC SURGERY
BALTIMORE STATE CONVENTION CENTER | BALTIMORE, MARYLAND
SATURDAY, MAY 14 – WEDNESDAY, MAY 18, 2016**

MONDAY, MAY 16, 2016

6:30 a.m.	Maintenance of Certification Information Breakfast This will have the faculty and a short description, similar to last year.	Room 340, BCC Not for Credit
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7:20 a.m.	Business Session, AATS Members Only	Hall E, BCC
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7:30 a.m.	Plenary Scientific Session 8 minute presentation, 12 minute discussion <i>Moderators: *Joseph S. Coselli and *Marc R. Moon</i>	Hall E, BCC
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1. Tricuspid Regurgitation Is Uncommon after Mitral Valve Repair for Degenerative Disease

***Tirone E. David**, Carolyn M David, Cedric Manlhiot
Toronto General Hospital, Toronto, ON, Canada

Invited Discussant: *Gilles D. Dreyfus

2. Comparison of del Nido and St. Thomas Cardioplegia Solutions for Myocardial Protection in Pediatric Patients Undergoing Open Heart Surgery: A Prospective Randomized Clinical Trial

Sachin Talwar, Amolkumar Bhoje, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan
All India Institute of Medical Sciences, New Delhi, India

Invited Discussant: *Pedro J. del Nido

3. A Population-based Analysis of Surgical Resection Versus Stereotactic Body Radiation Therapy for Stage I Non-small Cell Lung Cancer

Babatunde A. Yerokun¹, Chi-Fu Jeffrey Yang¹, Brian C Gulack¹, Michael S. Mulvihill¹, Lin Gu¹, Xuechan Li¹, Xiaofei Wang¹, *Mark F. Berry², *David H. Harpole¹, Thomas A. D'Amico¹, Matthew G. Hartwig¹

¹*Duke University, Durham, NC;* ²*Stanford University, Stanford, CA*

Invited Discussant: *Walter Weder

4. Causes of Death From the Randomized Comparison of Self-Expanding Transcatheter or Surgical Aortic Valve Replacement in Patients at High Surgical Risk

Vincent A. Gaudiani¹, Jeffrey J. Popma², *David H. Adams³, James Joye⁴, G. Michael Deeb⁵, Steven J. Yakubov⁶, *Michael J. Reardon⁷

¹*Pacific Coast Cardiac and Vascular Surgeons, Redwood City, CA;* ²*Beth Israel Deaconess Medical Center, Boston, MA;* ³*Mount Sinai Medical Center, New York, NY;* ⁴*El Camino Hospital, Mountain View, CA;* ⁵*University of Michigan Medical Center, Ann Arbor, MI;* ⁶*Riverside Methodist Hospital/Ohio Health Research Institute, Columbus, OH;* ⁷*Houston-Methodist-Debakey Heart and Vascular Center, Houston, TX*

Invited Discussant: *Craig R. Smith

8:50 a.m.	Award Presentations	Hall E, BCC
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9:05 a.m.	Coffee Break in the Exhibit Hall
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*AATS Member

+AATS New Member

9:45 a.m. Basic Science Lecture Hall E, BCC
Stopping Incurable Cancers through Eliminating their Anti-Oxidative Defenses
 James D. Watson, *Watson School of Biological Science*

10:25 a.m. Plenary Scientific Session Hall E, BCC
*Moderators: *Thoralf M. Sundt, III and *Marc R. Moon*

5. Surgical Quality Measures in Stage IIIA Non-small Cell Lung Cancer are Associated with Improved Survival

Pamela Samson¹, *Traves Crabtree¹, Daniel Morgensztern¹, Clifford Robinson¹, Stephen Broderick², G. Alexander Patterson¹, Bryan Meyers¹, +Varun Puri¹

¹Washington University, St. Louis, MO; ²St. Luke's Hospital, Chesterfield, MO

Invited Discussant: *Mark S. Allen

Late-Breaking Clinical Trial

Invited Discussant:

11:05 New Member Induction Hall E, BCC

11:25 a.m. Presidential Address Hall E, BCC
Competition: Perspiration to Inspiration
"Aut viam inveniam aut faciam"
 *Joseph S. Coselli, *Baylor College of Medicine*

12:15 p.m. Adjourn for Lunch in the Exhibit Hall

12:30 p.m. Ethics Forum Luncheon Room 343, BCC
 Separate Registration Required
Should a Surgeon Comply with Hospital Administration's Demand to Change Valve Preference?
Moderator: *Robert M. Sade, *Medical University of South Carolina*
Pro: J. Scott Millikan, *Billings Clinic*
Con: Robert J. Cusimano, *Toronto General Hospital*

12:30 p.m. Cardiothoracic Residents Luncheon: Room 343, BCC
Preparing Yourself for an Academic Career Luncheon
 Residents, Fellows and Medical Students Only
Not for Credit

MONDAY AFTERNOON, MAY 16, 2016

2:00 p.m. Adult Cardiac Surgery Simultaneous Scientific Session Hall E, BCC
 8 minute presentation, 12 minute discussion
*Moderators: *Scott A. LeMaire *Vinod H. Thourani*

6. Is Concomitant Tricuspid Valve Surgery Beneficial during Left Ventricular Assist Device Implantation: A Multi-Institutional Analysis

+John M. Stulak¹, Vakhtang Tchantchaleishvili¹, Nicholas A. Haglund², Shannon Dunlay¹, Keith Aaronson³, Jennifer Cowger⁴, Palak Shah⁵, *Francis D. Pagani³, +Simon Maltais¹

¹Mayo Clinic, Rochester, MN; ²Vanderbilt Heart, Nashville, TN; ³University of Michigan Health System, Ann Arbor, MI; ⁴St. Vincent Heart Center, Indianapolis, IN; ⁵Inova Heart and Vascular Institute, Falls Church, VA

Invited Discussant: *Nader Moazami

7. Comparison of Surgical Aortic Valve Replacement, Minimally Invasive Valve Replacement, and Transcatheter Aortic Valve Replacement In 2571 Patients

Tom C. Nguyen¹, *Vinod Thourani², Yelin Zhao¹, Matthew D. Terwelp¹, Prakash Balan¹, Daniel Ocazonez¹, *Anthony Estrera¹, Richard Smalling¹, Vasilis C. Babaliaros², Joseph Lamelas³

¹University of Texas, Houston, TX; ²Emory University, Atlanta, GA; ³Mount Sinai Medical Center, Miami Beach, FL

Invited Discussant: *Mathew R. Williams

8. A Long-Term Comparison Between Artificial Chordae And Double Orifice Repair In Degenerative Mitral Regurgitation Due To Anterior And Bileaflet Prolapse

Andrea Giacomini, Elisabetta Lapenna, Michele De Bonis, Giovanni La Canna, Alessandro Castiglioni, Teodora Nisi, *Ottavio Alfieri

San Raffaele University Hospital, Milan, Italy

Invited Discussant: *Mark Ruel

3:00 p.m. – 3:35 p.m. Coffee Break in the Exhibit Hall

9. Aortic Root Surgery with Circulatory Arrest: Predictors of Prolonged Hospital Stay and Implications for Lowering Hospital Cost and Expediting Recovery

+Ourania Preventza¹, Andrea Garcia¹, Shahab Akvan¹, Sarang Kashyap¹, Kiki Simpson², *Denton Cooley³, *Scott A. LeMaire¹, Kim de la Cruz¹, Konstantinos Spiliotopoulos¹, Matt D. Price¹, *Faisal G. Bakaeen², Shuab Omer², Lorraine Corwell², *Joseph Coselli¹

¹Baylor College of Medicine, Houston, TX; ²Michael E. DeBakey Veterans Affairs Medical Center, Houston, TX; ³Texas Heart Institute, Houston, TX

Invited Discussant: *Nicholas T. Kouchoukos

10. Why do a Ross? Equivalent 15-Year Survival But Improved Freedom from Thrombohemorrhagic Complications Compared to Mechanical Aortic Valve Replacement: A Propensity-Matched Cohort Study

Amine Mazine, Cedric Manlhiot, *Vivek Rao, Edward J Hickey, Shakira Christie, *Tirone E. David, Maral Ouzounian
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Duke E. Cameron

11. Predictors for Stable Late Rhythm in Surgical Ablation for Atrial Fibrillation Patients

*Niv Ad, Sari Diana Holmes, Deborah J. Shuman, Graciela Pritchard, Deborah Lamont
Inova Heart and Vascular Institute, Falls Church, VA

Invited Discussant: *Ralph J. Damiano, Jr.

12. What is the Risk of Adding Aortic Replacement to Cardiac Surgery?

Jay J. Idrees, *Eric E. Roselli¹, Ashley Lowery, *Eugene H. Blackstone, +Douglas R. Johnston, +Edward G. Soltesz, Gosta B. Pettersson, *Joseph F. Sabik, III, *Lars G. Svensson
Cleveland Clinic Foundation, Cleveland, OH

Invited Discussant: *Joseph E. Bavaria

5:00 p.m. Adjourn

MONDAY AFTERNOON, MAY 16, 2016

2:00 p.m. Congenital Heart Disease Simultaneous Scientific Session
8 minute presentation, 12 minute discussion
*Moderators: *Duke E. Cameron and *Jennifer C. Hirsch-Romano*

Ballroom III, BCC

13. Five-Year Experience With Arterial Switch Operation In the First Hours of Life using Autologous Umbilical Cord Blood
Kyrylo Chasovskyi, Yaroslav Mykychak, Nadiya Rudenko, Ganna Vorobyova, Illya Yemets
Ukrainian Children's Cardiac Center, Kyiv, Ukraine

Invited Discussant: *Christopher A. Caldarone

14. Five-Year Experience with Immediate Extubation after Arterial Switch Operation for Transposition of Great Arteries
Joby Varghese, Shelby Kutty, Sandy Hall, Mary Craft, Ibrahim Abdullah, James M. Hammel
Children's Hospital and Medical Center Omaha, Omaha, NE

Invited Discussant: Emile Bacha

15. Should All Patients with Congenitally Corrected Transposition of Great Arteries (ccTGA) Undergo Anatomic Repair?
Maryam Alomair, Mohammed Al-Jughiman, Andrew Redington, *Christopher Caldarone, Luc Mertens, *Glen Van Arsdell
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Bahaaldin AlSoufi

16. Pediatric Cardiac Surgical Outcomes following Implementation of a Novel Acuity Adaptable Care Model
John M. Costello, Elizabeth Preze, Nguyenvu Nguyen, Mary E. McBride, James W. Collins, Jr., Osama Eltayeb, Michael C. Monge, Barbara J. Deal, Michelle M. Stephenson, *Carl L. Backer
Ann and Robert H Lurie Children's Hospital of Chicago, Chicago, IL

Invited Discussant: *Sertac Cicek

3:20 p.m. - 3:55 p.m. Coffee Break in the Exhibit Hall

17. Preoperative Hemodynamic Parameters Predict Adverse Outcomes in Patients undergoing Biventricular Conversion with Damus-Kaye-Stansel Takedown
Melissa A. Herrin, Breanna L. Piekarsk, David Zurakowski, Christopher W. Baird, Wayne Tworetzky, Puja Banka, Gerald R. Marx, Roger E. Breitbart, Audrey C. Marshall, *Pedro J. del Nido, Sitaram M. Emani
Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *E. Dean McKenzie

18. Effect of Preoperative Administration of Allopurinol on Postoperative Outcomes in Patients Undergoing Repair of Tetralogy of Fallot
Sachin Talwar, Murugan Selvam Sathiya, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan
All India Institute of Medical Sciences, New Delhi, India

Invited Discussant: *J. William Gaynor

Late-Breaking Clinical Trial

Invited Discussant:

5:00 p.m. Adjourn

MONDAY AFTERNOON, MAY 16, 2016

2:00 p.m. General Thoracic Surgery Simultaneous Scientific Session

Ballroom IV, BCC

8 minute presentation, 12 minute discussion

*Moderators: *Sudish C. Murthy and *Thomas K. Waddell*

19. Late-Breaking Clinical Trial

Invited Discussant:

20. Achieving a 3-Star Lobectomy Ranking by using Continuing Process Improvement, Lean Methodology and Root Cause Analysis

**Robert Cerfolio¹, Benjamin Wei¹, Caroline Watson¹, Douglas Minnich¹, *Malcolm DeCamp²*

¹University of Alabama, Birmingham, AL; ²Northwestern University, Chicago, IL

Invited Discussant: *Stephen D. Cassivi

21. Is There a Hospital Volume Threshold for Operative Mortality for Lung Resections?

Anna Bendzsak, Nancy N. Baxter, Gail E. Baxter, Peter C. Austin, David R. Urbach

University of Toronto, Toronto, ON, Canada

Invited Discussant: *Benjamin D. Kozower

22. Unplanned Readmission following Esophagectomy: Complete follow up in a One Year Cohort With Identification of Risk Factors

*Karen J. Dickinson, James Taswell, *Mark S. Allen, *Shanda H. Blackmon, *Francis C. Nichols, III, *K. Robert Shen, *Dennis A. Wigle, *Stephen D. Cassivi*

Mayo Clinic, Rochester, MN

Invited Discussant: *Pascal A. Thomas

3:20 p.m. - 3:55 p.m. Coffee Break in the Exhibit Hall

23. Predicting Readmission after Resection for Non-Small Cell Lung Cancer (NSCLC): A Progression Toward Prevention

*Trevor A. Davis, Craig M. Hooker, Alicia Hulbert, Chen Chen, *Richard Battaifarano, *Malcolm V. Brock, Daniela Molena,*

**Stephen C. Yang*

The Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: *Tomasz Grodzki

24. Pulmonary Metastasectomy with Curative Intent for Soft Tissue Sarcoma

*Neel P. Chudgar, Murray F. Brennan, Rodrigo R. Munhoz, Peter R. Bucciarelli, Kay See Tan, Sandra P. D'Angelo, *Manjit S. Bains, Matthew Bott, +James Huang, *Bernard J. Park, *Valerie W. Rusch, *Prasad S. Adusumilli¹ *David R. Jones*

Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *Garrett L. Walsh

25. A Propensity Matched Comparison of Robotic, Thoracoscopic and Transsternal Thymectomy for Non-Thymomatous Myasthenia Gravis.

**Richard K. Freeman, Anthony J Ascoti, Megan Dake, Raja S Mahidhara*

St. Vincent's Health and Hospital System, Indianapolis, IN

Invited Discussant: *Kemp H. Kerstine

5:00 p.m. Adjourn

MONDAY AFTERNOON, MAY 16, 2016
SIMULTANEOUS SCIENTIFIC SESSIONS

2:00 p.m. **Perioperative Care Simultaneous Scientific Session** Room 337, BCC

8 minute presentation, 7 minute discussion

Moderators: *Gosta B. Pettersson and *Glenn J. Whitman

26. Pre-operative Hyperglycemia - A Risk Factor for Adverse Outcomes in Patients Undergoing Coronary Artery Surgery

Pradeep Narayan, Sarang Naresh Kshirsagar, Chandan Kumar Mandal, Emmanuel Rupert, Saibal Roy Chowdhury, Debasis Das, Mrinalendu Das

Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata, India

Invited Discussant: *Harold L. Lazar

27. Goal-Directed Resuscitation Following Cardiac Surgery Reduces Acute Kidney Injury: A Quality Initiative Pre-Post Analysis

Lily E. Johnston, Robert H. Thiele, Emily A. Downs, James M. Jaeger, Ravi K. Ghanta, *Irving L. Kron, James M. Isbell

University of Virginia, Charlottesville, VA

Invited Discussant: *John V. Conte

28. Phase of Care Mortality Analysis: A Unique Method for Comparing Mortality Differences Among TAVR and Surgical AVR Patients

Todd C. Crawford, J. Trent Magruder, Joshua C. Grimm, Kaushik Mandal, Joel Price, Jon R. Resar, Matthew Chacko, Rani K.

Hasan, *Glenn J. Whitman, *John V. Conte

Johns Hopkins University, Baltimore, MD

Invited Discussant:

29. Preoperative MRSA Screening and Targeted Decolonization in Cardiac Surgery

Manoj Kumar Saraswat, J. Trent Magruder, Julia Michele Gardner, Avinash Gadala, Damon Duquaine, Marc Steven Sussman,

Lisa Lockerd Maragakis, *Glenn Joseph Robert Whitman

Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: *Richard J. Shemin

30. Does Timing of Delayed Sternal Closure Affect Short- and Long-Term Outcomes in Patients with Open Chest Management Following Cardiac Surgery?

Joshua K. Wong, Devang J. Joshi, Amber L. Melvin, William J. Archibald, Alcina Lidder, *George L. Hicks, Peter A. Knight

University of Rochester, Rochester, NY

Invited Discussant:

3:15 p.m. – 3:45 p.m. Coffee Break in the Exhibit Hall

31. Early Extubation After Cardiac Surgery: Should Six Hours Be the Standard

Todd C. Crawford, J. Trent Magruder, Joshua C. Grimm, Christopher M. Sciortino, *John V. Conte, Bo S. Kim, *Robert S. Higgins,

*Duke E. Cameron, Marc Sussman, *Glenn J Whitman

Johns Hopkins University School of Medicine, Baltimore, MD

Invited Discussant:

32. Outcomes of Octogenarians Discharged Home after Prolonged ICU Length of Stay after Cardiac Surgery

Rizwan A. Manji, Rohit K. Singal, Brett Hiebert, *Alan H. Menkis, *Rakesh C. Arora

University of Manitoba, Winnipeg, MB, Canada

Invited Discussant:

33. The Effects of Steroids on Coagulation Dysfunction Induced by Cardiopulmonary Bypass: A Steroids in Cardiac Surgery (SIRS) Trial Sub-study

Domenico Paparella¹, *Alessandro Parolari², Crescenza Rotunno¹, Jessica Vincent³, Veronica Myasoedova⁴, Francesco Alamanni⁵, Piero Guida¹, Micaela de Palo¹, Vito Margari¹, Philip Devereaux⁶, Andre Lamy⁶, Salim Yusuf⁶, Richard Whitlock⁶

¹University of Bari, Bari, Italy; ²Policlinico San Donato, University of Milan, San Donato Milanese (MI), Italy; ³Hamilton Health Science and McMaster University, Hamilton, ON, Canada; ⁴Centro Cardiologico Monzino, Milan, Italy; ⁵Centro Cardiologico Monzino, Milano, Italy; ⁶Population Health Research Institute Mc Master University, Hamilton, ON, Canada

Invited Discussant: *Hersh Maniar

34. Unilateral Antegrade Cerebral Perfusion During Moderate Hypothermic Circulatory Arrest: Using Intraoperative EEG and Cerebral Oximetry to Improve Outcomes

Arminster S. Jassar, Steven R. Messe, *Joseph E. Bavaria, Prashanth Vallabhajosyula, +Nimesh D. Desai, Rita K. Milewski, Jacob Gutsche, William J. Vernick, *W Clark Hargrove, III, *Wilson Y. Szeto

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Eric E. Roselli

35. Optimal Blood Pressure during Cardiopulmonary Bypass Defined by Cerebral Autoregulation Monitoring and its Association with Severe Coronary Artery Disease

Daijiro Hori, Yohei Nomura, Masahiro Ono, Brijen Joshi, Kaushik Mandal, *Duke Cameron, Charles Hogue

The Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: Kenneth Shann

5:00 p.m. Adjourn

MONDAY EVENING, MAY 16, 2016

5:00 p.m. 19th Annual C. Walton Lillehei Resident Forum
7 minute presentation, 5 minute discussion
Chairs: *Juan A. Crestanello and *Pirooz Eghtesady

Room 340, BCC

L1. Thoracic-radiation Induced Tumor Immunomodulation: Mechanistic Insights and Translational Rationale for Combining with Chimeric Antigen Receptor (CAR) T-Cell Therapy for Thoracic Cancers

Jonathan Villena-Vargas, Marissa Mayor, Andreas de Biasi, *David R. Jones, Michel Sadelain, *Prasad S. Adusumilli

Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *Dao M. Nguyen

L2. Utilization of Lungs for Transplantation Following Donor Cardiac Death in the Field Is Successful with Targeted Drug Delivery During Ex Vivo Lung Perfusion

Eric J. Charles, J. Hunter Mehaffey, Ashish K. Sharma, James M. Isbell, *Christine L. Lau, *Curtis G. Tribble, Victor E. Laubach,

*Irving L. Kron

University of Virginia Health System, Charlottesville, VA

Invited Discussant: *Thomas K. Waddell

L3. Pathogenesis of De Novo Lung-Restricted Autoimmunity Following Lung Transplantation

Stephen Chiu¹, Vijay Subramanian², *Daniel Kreisel², GR Scott Budinger¹, Harris Perlman¹, *Malcolm McAvoy DeCamp, Jr.¹, Thalachallour Mohanakumar², Ankit Bharat¹

¹*Northwestern University, Chicago, IL*; ²*Washington University, St. Louis, MO*

Invited Discussant: +Jonathan D'Cunha

L4. Overexpression of the RNA-binding Protein CUG-BP1 Promotes Esophageal Cancer Cell Proliferation by Enhancing Mtor Expression

Daniel Mansour¹, Kimberly Byrnes¹, Pornima Phatak¹, Douglas Turner², *Richard Battafarano³, James Donahue¹

¹*University of Maryland Baltimore, MD*; ²*Baltimore Veteran Affairs Medical Center, Baltimore, MD*; ³*John Hopkins Hospital, Baltimore, MD*

Invited Discussant: *Jessica S. Donington

L5. Mechanistic Insights into the Pathophysiology of Pulmonary Vein Stenosis

Rachel D. Vanderlaan¹, Yaquin Yana Fu², Jingyi Pan², Anouk Martine-Teichert Martine-Teichert², Jiaquan Zhu², Mauro Lo Rito², Jason Maynes², *John Coles², Jaques Belik², *Christopher A. Caldarone²

¹*University of Toronto, Toronto, ON, Canada*; ²*Hospital for Sick Children, Toronto, ON, Canada*

Invited Discussant: +Massimo Caputo

L6. Obtaining the Biomechanical Behavior of Ascending Aortic Aneurysm by using Novel Speckle Tracking Echocardiography

Mohammed S. Alreshidan, Kevin Lachapelle, Sr., Richard Leask, Sr.

McGill University, Montreal, QC, Canada

Invited Discussant: *Abe DeAnda Jr.

L7. Calpain Inhibition Modulates GSK-3 β Pathways in A Swine Model of Chronic Myocardial Ischemia in the Setting of Metabolic Syndrome: A Proteomic and Mechanistic Analysis

Brittany A. Potz, Ashraf A. Sabe, Nassrene Y. Elmadhun, Jun Feng, Richard A. Clements, Ruhul M. Abid, *Frank W. Sellke

Brown University, Providence, RI

Invited Discussant: *Gorav Ailawadi

L8. Aortic Valve Repair using Autologous Pericardium: To Fix or Not to Fix?

Janet Mee Chin Ngu, Hadi Daood Toeg, Reza Jafar, Benjamin Sohmer, Vincent Chan, Michel Labrosse, *Munir Boodhwani

University of Ottawa Heart Institute, Ottawa, ON, Canada

Invited Discussant: *Frederick Y. Chen

6:40 p.m. Adjourn

**5:00 p.m. – 6:30 p.m. Innovations in Transcatheter Therapies:
What You Need To Know For Today and the Future
Course Chair: *Vinod H. Thourani, Emory University**

Room 327, BCC

TUESDAY MORNING, MAY 17, 2016

7:00 a.m. Cardiac Surgery Forum

Room 340, BCC

5 minute presentation, 5 minute discussion

*Moderators: *Jennifer S. Lawton and *Craig H. Selzman*

F1. Oxygenation of the Cerebrospinal Fluid with Nanobubbles Can Ameliorate a Spinal Cord Ischemic Injury in a Rabbit Model

Keisuke Kanda, Osamu Adachi, Satoshi Kawatsu, Ko Sakatsume, Kiichiro Kumagai, Shunsuke Kawamoto, Yoshikatsu Saiki
Tohoku University, Sendai, Japan

Invited Discussant: *T. Brett Reece

F2. Lower Body Perfusion for Spinal Protection in a Frozen Elephant Trunk Simulation Model

Peter Lukas Haldenwang¹, Lorine Häuser¹, Daniel Zieburg¹, Nora Prochnow¹, Andeas Baumann¹, Markus Schlömmicher¹,
Hildegard Christ², Justus Thomas Strauch¹

¹*BG University Hospital Bergmannsheil Bochum, Bochum, Germany*; ²*University of Cologne, Cologne, Germany*

Invited Discussant: +Ourania Preventza

F3. MRI Assessment of Cardiac Function in a Swine Model of Hibernating Myocardium Three Months Following Bypass Surgery

Laura Hocom Stone¹, Cory Swingen¹, Christopher T. Holley¹, Christin A. Wright¹, Melanie Crampton¹, *Herbert B. Ward¹,
Edward O. McFalls², *Rosemary F. Kelly¹

¹*University of Minnesota, Minneapolis, MN*; ²*Minneapolis VA Medical Center, Minneapolis, MN*

Invited Discussant: +Pavan Atluri

F4. Myocardial Rescue with Autologous Mitochondrial Transplantation in a Porcine Model of Ischemia/Reperfusion

Aditya K. Kaza¹, Isaac Wamala¹, Ingeborg Friehs¹, Joseph Kuebler¹, Rahul H. Rathod¹, Ignacio Berra¹, *Sidney Levitsky², *Pedro J.
del Nido¹, Douglas B. Cowan¹, James D. McCully¹

¹*Boston Children's Hospital, Boston, MA*; ²*Beth Israel Deaconess Medical Center, Boston, MA*

Invited Discussant: *Juan A. Crestanello

F5. Layered Smooth Muscle Cell-Endothelial Progenitor Cell Sheets Augment Post-Infarction Ventricular Function; Implications for Translating Multi-Lineage Cellular Tissue Engineering

Yasuhiro Shudo¹, Andrew B. Goldstone¹, Jeffrey E. Cohen¹, Masashi Kawamura¹, Jay Patel¹, Michael S. Hopkins¹, Bryan B.
Edwards¹, Shigeru Miyagawa², Yoshiki Sawa², *Joseph Woo¹

¹*Stanford University, Stanford, CA*; ²*Osaka University Graduate School of Medicine, Osaka, Japan*

Invited Discussant: *Joseph T. McGinn

F6. Evaluating a Bioprosthetic Anterior Mitral Valve Leaflet Made from Autologous Jugular Vein and Expanded Polytetrafluoroethylene (ePTFE) Chordae in a Sheep Model

Jacques Janson¹, Andre Coetzee¹, Gawie Rossouw¹, Izak Loftus², Riaan Murray¹, Pieter Rossouw¹, Philip Herbst¹

¹*Stellenbosch University, Tygerberg, South Africa*; ²*Pathcare, Somerset West, South Africa*

Invited Discussant: *Clifford W. Barlow

F7. Topographical Mapping of Left Ventricular Regional Contractile Injury in Ischemic Mitral Regurgitation

Timothy S. Lancaster, Julia Kar, Brian P. Cupps, Matthew C. Henn, Kevin Kulshrestha, Danielle J. Koerner, *Michael K. Pasque
Washington University, St. Louis, MO

Invited Discussant: Tomasz A. Timek

F8. Epicardial Erythropoietin Hydrogel Improves Post-ischemic Cardiac Performance and Accelerates Proliferation and Tissue Transformation in the Intramyocardial Mesenchyme

Christian Klopsch¹, Heiko Lemke¹, Marion Ludwig¹, Anna Skorska¹, Ralf Gaebel¹, Robert Jaster¹, Stefan Jockenhoevel², Robert David¹, Gustav Steinhoff¹

¹Rostock University Medical Center, Rostock, Germany; ²RWTH Aachen University, Aachen, Germany

Invited Discussant: *Sunjay Kaushal

F9. Hypoxia Modulates Cell Migration and Proliferation by Activating Akt and ERK through the SDF-1 α /CXCR4 Axis in Placenta-Derived Mesenchymal Stem Cells for Cardiac Repair

Li Li, Prashant Kumar Jaiswal, Rishi Jurakhan, Kaviyanka Selvasandran, Khalid Ridwan, Georges Makhoul, Minh Ngoc Duong, Renzo Cecere

McGill University, Montreal, QC, Canada

Invited Discussant: *Todd K. Rosengart

F10. Endothelial Primary Cilia Regulate Cardiac Fibrosis by Guiding Mesenchymal Fate Decisions

Krishna K. Singh, Yi Pan, Adrian Quan, Jonathan W. Yau, Jean-François Desjardins, Thomas G. Parker, Mohammed Al-Omran, *Subodh Verma

St. Michael's Hospital, Toronto, ON, Canada

Invited Discussant: *Pirooz Eghtesady

8:40 p.m. Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 a.m. General Thoracic Surgery Forum

Room 343, BCC

5 minute presentation, 5 minute discussion

Moderators: *Benjamin D. Kozower and *Dao M. Nguyen

F11. Immunogenic Effect of Local Radiation Therapy in a Mouse Model of Mesothelioma

Luis De la Maza-Borja, Matthew Wu, Licun Wu, *Marc De Perrot

University of Toronto, Toronto, ON, Canada

Invited Discussant: *Prasad S. Andusumilli

F12. A Prospective Study Comparing Targeted DNA Sequencing of Tumor Tissue with Noninvasive Liquid Biopsy of Circulating Tumor DNA in Surgical Non-small Cell Lung Cancer Patients

Kezhong Chen¹, Fan Yang¹, Jingbo Zhang², Tian Guan¹, Feng Lou², Jun Wang¹

¹Peking University People's Hospital, Bei Jing, China; ²San Valley Biotechnology Incorporated, Beijing, China

Invited Discussant: *David S. Schrupp

F13. Highly Effective Heparanase-Based Therapy for Mesothelioma

Moshe Lapidot¹, Uri Barash², Yaniv Zohar³, Neta Ilan², Israel Vlodavsky²

¹Brigham and Women's Hospital, Boston, MA; ²Cancer and Vascular Biology Research Center, Technion, Haifa, Israel; ³Rambam Health Care Center, Haifa, Israel

Invited Discussant: *Jay M. Lee

F14. In Silico Immune Response is the Most Predictive Factor of Overall Survival in Surgically Resected Pleural Mesothelioma

Hyun-Sung Lee¹, Rohan Shah¹, David Yoon¹, Shawn Groth¹, *Raphael Bueno², *David Sugarbaker¹, Bryan Burt¹

¹Baylor College of Medicine, Houston, TX; ²Brigham and Women's Hospital, Boston, MA

Invited Discussant: +Varun Puri

F15. Novel Bio-engineered Tracheal Patch Demonstrates Potential for Remodeling in a Growing Ovine Model

Farhan Zafar, Richard Scott Baker, Namheon Lee, Shiva Kumar Shanmukhappa, Michael D. Taylor, *David L Morales

Cincinnati Childrens Hospital, Cincinnati, OH

Invited Discussant: *Shanda H. Blackmon

F16. Role of Interleukin-17A in Early Graft Rejection after Orthotopic Lung Transplantation in Mice

Qi-rui Chen, Hui Li, Yao-zhong Ding

Beijing Chaoyang Hospital, Capital Medical University, Beijing

Invited Discussant:

F17. Cigarette Smoke Enhances Growth and Metastatic Potential of Lung Cancer Cells in-Vivo

Elvin Hekimoglu, Eden Payabyab, Mary Zhang, Julie A. Hong, Emily S. Reardon, Paul L. Feingold, R. Taylor Ripley, Choung D.

Hoang, Sichuan Xi, *David S. Schrupp

National Cancer Institute, Bethesda, MD

Invited Discussant: +Sunil Singhal

F18. Optimization of Image Capture Properties for Intraoperative Molecular Imaging of Lung Adenocarcinoma

Jarrod D. Predina, Olugbenga Okusanya, Jane Keating, +Sunil Singhal

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Andrew C. Chang

F19. Progression of EGFR Mutant Lung Adenocarcinoma is Driven by Alveolar Macrophages

Bryan M. Burt¹, Don-Hong Wang², Hyun-Sung Lee¹, David Yoon¹, Gerald Berry², Thomas M. Wheeler¹, Farrah Kheradmand¹,

*David J. Sugarbaker¹, Edgar Engleman²

¹Baylor College of Medicine, Houston, TX; ²Stanford University School of Medicine, Stanford, CA

Invited Discussant:

F20. Inherited Immunologic Factors Affecting Lung Cancer Susceptibility

Saeed Arefanian, Ryuji Higashikubo, *Daniel Kreisel, Andrew E Gelman, *Alexander Sasha Krupnick

Washington University, St. Louis, MO

Invited Discussant:

8:40 p.m. ADJOURN

TUESDAY MORNING, MAY 17, 2016

7:00 a.m. Adult Cardiac Emerging Technologies and Techniques Forum **Ballroom III, BCC**
5 minute presentation, 5 minute discussion
Moderators: *Gorav Ailawadi and *Himanshu J. Patel

T1. Multi-center Assessment of Grafts in Coronaries: Long Term Evaluation of the C-Port Anastomotic Device (The MAGIC Study)

Husam H. Balkhy¹, Mahesh Ramshandani², Nirav Patel³, *Valavunar Subramanian³, Nicholas Augelli⁴, Gareth Tobler⁵, Tung Cai⁶
¹University of Chicago Medicine, Chicago, IL; ²Methodist Hospital, Houston, TX; ³Lenox Hill Hospital, New York, NY; ⁴Regional Medical Center, Appleton, WI; ⁵University of Arkansas for Medical Sciences, Little Rock, AR; ⁶The Heart Hospital Baylor Plano, Plano, TX

T2. Hybrid Repair of Extensive Aortic Arch Disease with Supra-aortic Debranching and Endovascular Stent Graft Repair: Early and Long-term Outcomes

Qian Chang, Yan Li, Xiangyang Qian, Xiaogang Sun, Cuntao Yu, Haitao Zhang
National Heart Center and Fuwai Hospital, Beijing, China

TEVAR 2016

*Wilson Y. Szeto, University of Pennsylvania, Philadelphia, PA

T3. Early Clinical Outcomes of a Novel Self-expanding Transapical Transcatheter Aortic Valve Bioprosthesis in Patients at Higher Risk for Coronary Obstruction: First North American Experience

Michael W. A. Chu, Katie L. Losenno, Pantelis Diamantouros, Rodrigo Bagur, Patrick Teefy, Jill J. Gelinis, *Bob Kiaii
University of Western Ontario, London, ON, Canada

T4. Radiation Exposure during Transcatheter Aortic Valve Replacement: What Cardiac Surgeons Need to Know

Alex Aquino, Alan Zajarias, Spencer Melby, Nishath Quader, Brian Lindman, John Lasala, *Hersh Maniar
Washington University, St. Louis, MO

So You Want to Start a TMVR or TAVR Program: Necessary Tools and Approaches for Clinical and Fiscal Success

*Vinod H. Thourani, Emory University, Atlanta, GA

T5. Feasibility of Transcatheter Mitral Valve Replacement Using a Beating Heart Transapical Delivery System in Human Beings

Robert S. Farivar, Wesley Pedersen, Paul Sorajja, Richard Bae, *Benjamin Sun
Abbott Northwestern Hospital, Minneapolis, MN

T6. Up to One Year Follow Up Results of Transfemoral System for Mitral valve Reconstruction Multicentre Trial

Paolo Denti¹, Alec Vahanian², Francesco Maisano³, Karl-Heinz Kuck⁴, *Ottavio Alfieri¹, Antonio Colombo¹, Stephan Baldus⁵, Georg Nickenig⁶

¹San Raffaele University Hospital, Milan, Italy; ²Bichat Hospital, Paris, France; ³University Hospital Zurich, Switzerland, Zurich, Switzerland; ⁴St. George Hospital Hamburg, Germany, Hamburg, Germany; ⁵University Hospital Köln, Germany, Köln, Germany;

⁶University Hospital Bonn, Germany, Bonn, Germany

8:40 p.m. Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 a.m. General Thoracic Emerging Technologies and Techniques Forum **Ballroom IV, BCC**

5 minute presentation, 5 minute discussion

Moderators: *Steven R. DeMeester and *Henning A. Gaissert

T7. Preliminary Experience with Per-oral Endoscopic Myotomy (POEMS) by a Thoracic Surgical Service

Lara W. Schaheen¹, David D. Odell², Ernest G. Chan¹, +Jonathan D'Cunha¹, Ryan Levy¹, Omar Awais¹, Katie Nason¹, Inderpal Sarkaria¹, *James D Luketich¹

¹University of Pittsburgh, Pittsburgh, PA; ²Northwestern University, Chicago, IL

Complex Airway Reconstruction In the Era of Biologics Stem Cells and 3D Printers

*Henning A. Gaissert, Massachusetts General Hospital, Boston, MA

T8. A Novel System for Identifying Pulmonary Air Leaks with an Inhaled Marker

*Joseph Friedberg

University of Maryland, Baltimore, MD

T9. Management of Complex Airway Defects with Bioprosthetic Materials

Brooks Van Udelsman¹, Jessica Eaton², Ashok Muniappan¹, Christopher R. Morse¹, *Cameron Dorrans Wright¹, *Douglas James Mathisen¹

¹Massachusetts General Hospital, Boston, MA; ²University of Louisville, Louisville, KY

T10. Using 3D BioPrinting As A Tool For Tracheal Segment Tissue Engineering

Todd A. Goldstein, Daniel Grande, Benjamin Smith, Lee P. Smith, David Zeltsman

North Shore - LIJ Health System, Manhasset, NY

Image Guidance in Thoracic Surgery: Ready for Prime Time?

Daniela Molena, Memorial Sloan Kettering Cancer Center, New York, NY

T11. The Use of Electromagnetic Navigational Bronchoscopic Guidance for Intraoperative Localization of Nonpalpable Small Lung Nodules

+Abbas E. Abbas, Sagar Kadakia, Vishu Ambur *Larry R. Kaiser

Temple University, Philadelphia, PA

T12. Thoracoscopic Anatomic Lung Sub-segmentectomy using Three-dimensional Computed Tomography Simulation without Tumor Markings for Non-palpable, Small-Size Lung Nodules

Hirohisa Kato, Hiroyuki Oizumi, Makoto Endoh, Jun Suzuki, Hikaru Watarai, Akira Hamada, Katsuyuki Suzuki, Mitsuaki Sadahiro, Yamagata University, Yamagata-shi, Japan

T13. A Novel Minimally Invasive Near-infrared Thoracoscopic Localization Technique of Small Pulmonary Nodules: A Phase I Feasibility Trial

Hideki Ujiie, Tatsuya Kato, Hsin-pei Hu, Priya Patel, Hironobu Wada, Daiyoon Lee, Kosuke Fujino, Robert Weersink, Elsie Nguyen, +Marcelo Cypel, Andrew Pierre, *Marc de Perrot, *Gail Darling, *Thomas K. Waddell, *Shaf Keshavjee, *Kazuhiro Yasufuku

University of Toronto, Toronto, ON, Canada

Late-Breaking Clinical Trial (10 minutes)

Invited Discussant:

8:40 p.m. Adjourn

TUESDAY MORNING, may 17, 2016

VIDEO SESSION

7:00 a.m.

Video Session

Room 337, BCC

10 minute presentation

*Moderators: *Mark S. Bleiweis, *Subroto Paul and *Vivek Rao*

V1. Posterior Airway Stabilization Using Polypropylene Mesh for Tracheobronchomalacia

Tovy Haber Kamine, Jennifer L. Wilson, *Sidhu P. Gangadharan

Beth Israel Deaconess Medical Center, Boston, MA

V2. Robotic-Assisted Resection of Superior Sulcus Ganglioneuroma

Khalid Alshehri, Adil Ayub, Ahmad Altaweel, Chyun-Yin Huang, Norberto Santana-Rodriguez, Sadiq Rehmani, Adnan M Al-Ayoubi, Wissam Raad, Faiz Bhora

Mount Sinai Health System, New York, NY

V3. Trans-Cervical Mediastinal Cyst Resection With A Video Mediastinoscope

Eric Goudie, +Moishe Liberman

University of Montreal, Montreal, QC, Canada

V4. Robotic Morgagni Hernia Repair

*Jennifer L. Philip, *Ryan Macke

University of Wisconsin, Madison, WI

V5. Right Ventricular Free Wall Teratoma Requiring Surgical Intervention Secondary to Refractory Ventricular Tachycardia

*Awais Ashfaq, Tabitha Moe, Justin Ryan, *Paul Dickman, *Steve Taylor⁵, Daniel Velez, *Robert Puntel, *Andrew Papez, *John Nigro

Mayo Clinic, Phoenix, AZ

V6. Simplifying the Repair of Barlow's Disease: A Solution to Excess Leaflet Tissue without Resection

*Sabet W. Hashim, *Rajesh B. Sekar, *Peter W. Hashim, Roland Assi, Irena Vaitkeviciute

Yale University, New Haven, CT

V7. Total Endovascular Repair of Aortic Arch Using Inner Branched Arch Endograft

Muhammad Aftab, *Eric Roselli, +Douglas Johnston, *Matthew Eagleton

Cleveland Clinic, Cleveland, OH

V8. Approaches to Reconstruction of Severe Primary Tricuspid Valve Defects

Domenico Mazzitelli¹, Yacine Elhmidi¹, *J. Scott Rankin², Jelena Kasnar-Samprec¹, Julie Cleuziou¹, *Ruediger Lange¹

¹German Heart Center, Munich, Germany; ²Cardiothoracic Surgery Associates, Nashville, TN

V9. Modified Nikaidoh Procedure with Double-Root-Translocation

Yiqun Ding

Shenzhen Children's Hospital, Shenzhen, China

V10. One-stage Definitive Repair for Patient with Complete Atrioventricular Septal Defect and Pulmonary Atresia with Major Aortopulmonary Collateral Arteries

Yujiro Ide, Masaya Murata, Kisaburo Sakamoto

Mt. Fuji Shizuoka Children's Hospital, Shizuoka City, Japan

8:40 p.m.

Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 a.m.

VAD/ECMO Session

Room 327, BCC

5 minute presentation, 7 minute discussion

36. The Hospital Volume-Outcome Relationship for Left Ventricular Assist Device Implantation in Medicare Patients in the United States

+Nimesh D. Desai, Danielle Savino, Fenton H. McCarthy, Peter W. Groeneveld, Katherine McDermott, Danielle Spragan, Pavan Alturi, Dale Kobrin, Christian A. Bermudez, Eduardo Rame, *Michael A. Acker
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Nicholas G. Smedira

37. Novel Perspectives on Postcardiotomy Shock; New Insight to Improve Outcomes

Hiroo Takayama, Shinichi Fukuhara, Koji Takeda, Jiho Han, Scott DeRoo, Boyangi Li, Sowmyashree Sreekanth, Veli Topkara, Arthur Garan, Paolo Colombo, Melana Yuzefpolskaya, *Paul Kurlansky, *Yoshifumi Naka
Columbia University, New York, NY

Invited Discussant: +Edward G. Soltesz

38. Central Cannulation as a Viable Alternative to Peripheral Cannulation in Extracorporeal Membrane Oxygenation

David Ranney, Ehsan Benrashid, James Meza, Jeffrey Keenan, Mani Daneshmand
Duke University, Durham, NC

Invited Discussant: *Michael S. Firstenberg

39. Bridge to Durable Left Ventricular Assist Device using Various Short-term Mechanical Circulatory Support Devices for Patients with an INTERMACS I Profile

Koji Takeda, Hiroo Takayama, A. Reshad Garan, Veli K. Topkara, Jiho Han, Paul Kurlansky, Melana Yuzefpolskaya, Paulo C Colombo, *Yoshifumi Naka
Columbia University, New York, NY

Invited Discussant: *Ashish S. Shah

Mechanical Circulatory Support in High Risk Cardiac Surgery – Back-up, Adjunct, Bailout and Alternative

*Lyle D. Joyce, *Mayo Clinic*

40. Emergency Implantation of Durable Left Ventricular Assist Devices as Primary Therapy for Refractory Cardiogenic Shock

Amit Pawale, Yosef Schwartz, Sean Pinney, *David H. Adams, *Anelechi C Anyanwu
Mount Sinai Medical Center, New York, NY

Invited Discussant: Scott C. Silvestry

41. Left Ventricular Failure after Surgery to Correct Right Ventricular Pressure Overload in Pulmonary Hypertension Patients

Tom Verbelen, Alexander Van De Bruaene, Bjorn Cools, *Dirk Van Raemdonck, Marion Delcroix, Filip Rega, Bart Meyns
University Hospitals Leuven, Leuven, Belgium

Invited Discussant: *Michael M. Madani

42. Continuous Flow LVAD Minimally Invasive Implantation in INTERMACS Class Score I-II Patients: The Evolution of Surgical Technique in a Single Centre Experience

Alvise Guariento, Lorenzo Bagozzi, Jonida Bejko, Massimiliano Carrozzini, Marina Comisso, Giacomo Bortolussi, Michele Gallo, Vincenzo Tarzia, Tomaso Bottio, *Gino Gerosa
University of Padua, Padova, Italy

Invited Discussant: *Walter P. Dembitsky

8:40 a.m. Adjourn

TUESDAY, MAY 17, 2016

8:45 a.m. Plenary Scientific Session **Hall E, BCC**
8 minute presentation, 12 minute discussion
*Moderators: *Joseph S. Coselli and *Marc R. Moon*

43. External Stenting: A Reliable Technique to Relieve Airway Obstruction in Small Children

Makoto Ando¹, Yuuzou Nagase², Hisaya Hasegawa³, Yukihiro Takahashi¹

¹Sakakibara Heart Institute, Tokyo, Japan; ²Ginza Heart Clinic, Tokyo, Japan; ³Tokyo Women's Medical University Medical Center East, Tokyo, Japan

Invited Discussant:

44. 10-year Endpoint of RAPCO is Reached: Clinical and Angiographic Results of a Randomised Trial of Radial Artery Versus Right Internal Thoracic Artery or Saphenous Vein for the Second Graft

*Brian F. Buxton¹, Philip A. Hayward², George Matalanis², Simon C. Moten², Mark Horrigan², Alexander Rosalion³, Jai Raman⁴, David L. Hare¹

¹University of Melbourne, Melbourne Australia; ²Ausitn Hospital, Melbourne, Australia; ³Vincent's Hospital, Melbourne, Australia; ⁴Rush University Medical Center, Chicago, IL

Invited Discussant: *Stephen E. Fremes

45. Cost-Effectiveness of Invasive Mediastinal Staging in Non-Small Cell Lung Cancer

Kasia Czarnecka-Kujawa¹, Ursula Rochau², Uwe Siebert³, Eshetu Atenafu¹, *Gail Darling¹, *Thomas Kenneth Waddell¹, Andrew Pierre¹, *Marc De Perrot¹, +Marcelo Cypel¹, *Shaf Keshavjee¹, *Kazuhiro Yasufuku¹

¹University of Toronto, Toronto, ON, Canada; ²Institute of Public Health, Hall, Austria; ³UMIT - University for Health Sciences, Medical Informatics and Technology, Hall, Austria

Invited Discussant: *Douglas E. Wood

46. Impact of Protected Cardiothoracic Surgical Research Time during Residency on Careers in Academic Surgery

J. Trent Magruder¹, Joshua C. Grimm¹, Todd C. Crawford¹, *Ashish S Shah¹, *Timothy J. Gardner², *Bruce A Reitz¹, J. Alexander Haller¹, *Vincent C. Gott¹, *Duke E. Cameron¹, *William A. Baumgartner¹

¹Johns Hopkins, Baltimore, MD; ²Christiana Care Health Services, Newark, DE

Invited Discussant: Richard Lee

10:05 a.m. Coffee Break in The Exhibit Hall

10:30 a.m. Award Presentations **Hall E, BCC**

10:40 a.m. Plenary Scientific Session **Hall E, BCC**
8 minute presentation, 12 minute discussion
*Moderators: *Thoralf M. Sundt, III and *Marc R. Moon*

47. Mitral Valve Surgery in the US Veterans Administration Health System: 10-Year Outcomes and Trends

*Faisal G. Bakaeen¹, A. Laurie Shroyer², *Marco A Zenati³, *Vinay Badhwar⁴, *Vinod H Thourani⁵, *James S Gammie⁶, *Rakesh M. Suri⁷, *A. Marc Gillinov⁷, *Joseph F Sabik, III⁷, Danny Chu⁴, Laura A. Graham⁸, Mary T. Hawn⁹, *G. Hossein Almassi¹⁰, Lorraine D. Cornwell¹, *Frederick L. Grover¹¹, *Todd K. Rosengart¹, Shuab Omer¹

¹Baylor College of Medicine and Texas Heart Institute, Houston, TX; ²Northport VA Medical Center and Stony Brook School of Medicine, Stony Brook, NY; ³The West Roxbury VAMC and Harvard Medical School, Boston, MA; ⁴University of Pittsburgh, Pittsburgh, PA; ⁵Emory University, Atlanta, GA; ⁶University of Maryland, Baltimore, MD; ⁷Cleveland Clinic Foundation, Cleveland, OH; ⁸University of Alabama at Birmingham, Birmingham, AL; ⁹Stanford University, Stanford, CA; ¹⁰Medical College of Wisconsin and VA Medical Center, Milwaukee, WI; ¹¹University of Colorado Denver, Aurora, CO

Invited Discussant: *David H. Adams

48. Towards Making Lung Transplantation a Semi-Elective Procedure: Outcomes Following Clinical Lung Transplantation with Over Twelve Hours of Preservation Time

Jonathan C. Yeung, *Kazuhiro Yasufuku, *Marc de Perrot, Andrew F. Pierre, *Thomas K. Waddell, *Shaf Keshavjee, +Marcelo Cypel
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Bartley P. Griffith

49. Providing Cardiothoracic Services in 2035: Signs of Trouble Ahead

*Susan Moffatt-Bruce, *Juan Crestanello, David Way, *Thomas Williams
The Ohio State University, Columbus, OH

Invited Discussant: *John S. Ikonomidis

11:40 a.m.	Honored Guest Lecture Brian Kelly, Notre Dame Corbett Family Head Football Coach	Hall E, BCC
12:30 p.m.	Adjourn For Lunch in the Exhibit Hall	
12:45 p.m.	Moderated Poster Competitions 5 minute presentation	Exhibit Hall, BCC Not for Credit

Adult Cardiac Moderated Poster Competition

Moderator: *Richard Lee

P1. The IMPACT-CABG trial: A Multicenter Randomized Clinical Trial of CD133+ Stem Cell Therapy During CABG for Ischemic Cardiomyopathy

*Terrence M. Yau¹, Samer Mansour², *Richard Weisel¹, Louis-Mathieu Stevens², Katherine Tsang¹, Eric Larose², Shu-Hong Li¹, Neil Spiller¹, Minh Quan Vu², Andrew Crean¹, Denis-Claude Roy², Ignacio Prieto², Ren-Ke Li¹, Nicolas Noiseux²
¹Toronto General Hospital, Toronto, ON, Canada; ²Hospital Hotel-Dieu, Montreal, QC, Canada

P2. Sternal Closure Using Rigid Plate Fixation Versus Conventional Wire Cerclage: Results From A Prospective, Randomized Multi-Center Study

*Keith B. Allen¹, *Vinod H. Thourani², *Yoshifumi Naka³, Kendra J. Grubb⁴, John Grehan⁵, Nirav Patel⁶, *T. Sloane Guy⁷, *Kevin Landolfo⁸, Marc Gerdisch⁹, Mark Bonnell¹⁰, *David J. Cohen¹
¹St. Luke's Mid America Heart Institute, Kansas City, MO; ²Emory University, Atlanta, GA; ³Columbia University Medical Center, New York, NY; ⁴University of Louisville, Louisville, KY; ⁵United Heart and Vascular Clinic, AllinaHealth, Saint Paul, MN; ⁶Lenox Hill Hospital, New York, NY; ⁷Temple University, Philadelphia, PA; ⁸Mayo Clinic, Jacksonville, FL; ⁹Franciscan St. Francis Health, Indianapolis, IN; ¹⁰University of Toledo, Toledo, OH

P3. Trends in Multi-Arterial CABG Surgery 2004-2014: A Tale of Two Continents

*Thomas A. Schwann¹, *James Tatoulis², *John D. Puskas³, *David Taggart⁴, *Paul Kurlansky⁵, *Jeffrey Jacobs⁶, *Vinod H. Thourani⁷, Sean O'Brien⁸, Amelia Wallace⁸, Milo Engoren⁹, Robert F. Tranbaugh¹⁰, Mark R. Bonnell¹, Robert H. Habib¹¹
¹University of Toledo, Toledo, OH; ²Royal Melbourne Hospital, Parkville, Australia; ³Mount Sinai Beth Israel, New York, NY; ⁴University of Oxford, Oxford, United Kingdom; ⁵Columbia University, New York, NY; ⁶Johns Hopkins University, Baltimore, MD; ⁷Emory University, Atlanta, GA; ⁸Duke University, Durham, NC; ⁹University of Michigan, Ann Arbor, MI; ¹⁰Cornell University, New York, NY; ¹¹American University of Beirut, Beirut, Lebanon

P4. The Risk of Reoperative Cardiac Surgery in Radiation Induced Valvular Disease

Julius I. Eijofor, Anju Nohria, Yamine Maroun, Siobhan McGurk, Anthony V. Norman, *Sary F. Aranki, Prem Shekar, *Lawrence H Cohn, Tsuyoshi Kaneko
Brigham and Women's Hospital, Boston, MA

P5. Prosthesis Selection in Patients Undergoing Mitral Valve Repair for Type II Dysfunction

Naonori Kawamoto, Tomoyuki Fujita, Hiroki Hata, Yusuke Shimahara, Yuta Kume, *Junjiro Kobayashi
National Cerebral and Cardiovascular Center, Suita, Japan

P6. Long-term Outcomes of Surgery for Infective Endocarditis: A single-center Experience of 801 Patients

Sameh M. Said, Zaid M. Abdelsattar, *Hartzell V. Schaff, +Kevin L. Greason, *Richard C. Daly, *Alberto Pochettino, *Lyle D. Joyce, *Joseph A. Dearani
Mayo Clinic, Rochester, MN

P7. Mid-term Results of Mitral Valve Repair using Flexible Bands vs Complete Rings in Patients with Degenerative Mitral Valve Disease: A Prospective Randomized Study

Alexander V. Afanasyev, Alexander V. Bogachev-Prokophiev, Sergei I. Zheleznev, Vladimir M. Nazarov, Ravil M. Sharifullin, Alexander M. Karas'kov
Novosibirsk State Research Institute of Circulation Pathology, Novosibirsk, Russian Federation

P8. A Predictive Model for Early Outcome of Surgical Treatment of Heart Valve Infective Endocarditis: The Italian EndoSCORE

Michele Di Mauro, Guglielmo M Actis Dato, Pasquale Santè, Fabio Barili, Sandro Gelsomino, Alessandro Della Corte, Antonio Carrozza, Ester Della Ratta, Carlo Fino, Diego Cugola, Roger Devotini, Riccardo Casabona, *Francesco Santini, Roberto Scrofani, Carlo De Vincentiis, Andrea Biondi, Cesare Beghi, Alberto Pozzoli, Francesco Nicolini, *Davide Pacini, Giacomo Ravenni, Roberto Lorusso, Gabriele Di Giammarco, Daniele Marinelli, Emmanuel Villa, Giovanni Troise, Domenico Paparella, Vito Margari, Francesco Tritto, Giuseppe Scarscia, Salvatore Zaccaria, Attilio Renzulli, Giuseppe Serraino, Giovanni Mariscalco, *Alessandro Parolari, Giannantonio Nappi
Italian Group of Research for Outcome in Cardiac Surgery (GIROC), Rome, Italy

P9. A Single Center's Experience with Pacemaker Implantation after the Cox Maze Procedure for Atrial Fibrillation

*Niv Ad, Sari Diana Holmes, Deborah J. Shuman, Deborah Lamont
Inova Heart and Vascular Institute, Falls Church, VA

P10. Permanent Pacemaker After Surgical and Catheter Atrial Fibrillation Ablation: Incidence, Indications and Outcomes

Stephane Leung¹, Wai Sang¹, *Patrick M. McCarthy¹, Jane Kruse², Adin-Cristian Andrei², Adam Iddriss¹, *Richard Lee³, *S. Chris Malaisrie¹, Rachel Kaplan¹, Rod S. Passman¹
¹Northwestern University, Chicago, IL; ²Bluhm Cardiovascular Institute, Northwestern Medicine, Chicago, IL; ³St. Louis University School of Medicine, St. Louis, MO

P11. Cardiometabolic Syndrome in TAVR and SAVR

Lillian L. Tsai, Hanna A. Jensen, Jose . Condado, Yi Lasanajak, Omar M. Lattouf, Vasilis Babaliaros, Eric Sarin, Chandan Devireddy, Bradley Leshnower, James Stewart, *Edward Chen, Kreton Mavromatis, *Michael Halkos, Peter C. Block,

*Robert A. Guyton, Patricia Keegan, Amy Simone, Jessica Forcillo, *Vinod H. Thourani
Emory University, Atlanta, GA

P12. Predicting Long-Term Outcomes after Complex Mitral Valve Repair: A Single Center 15-Year Experience

James M. Tatum, Michael E. Bowdish, Wendy J. Mack, Adrienne Quinn, Dawn Hui, Mark L Barr, Fernando Fleischman, Amy Hackmann, *Craig Baker, *Robbin G. Cohen, Mark J. Cunningham, *Vaughn A. Starnes
University of Southern California, Los Angeles, CA

Congenital Heart Disease Moderated Poster Competition

*Moderator: *Carl L. Backer*

P14. Outcomes of Multistage Palliation of Patients With Single Ventricle and Atrioventricular Septal Defect

*Bahaaldin AlSoufi, Courtney McCracken, Subhadra Shashidharan, *Kirk Kanter, *Brian Kogon
Emory University, Atlanta, GA

P15. Cognitive, Neuropsychological and Social Status Is Impaired Two Decades After Neonatal Arterial Switch Operation

David Kalfa¹, Leila Kasmi², Michele Montreuil², Nikoletta Geronikola², Virginie Lambert³, Eleonora Murzi², *Emre Belli⁴, Damien Bonnet⁵

¹Columbia University, New York, NY; ²Université Paris, Saint Denis, France; ³Université Paris Sud, Le Plessis Robinson, France; ⁴Institut Jacques Cartier, Massy, France; ⁵Université Paris Descartes, Sorbonne Paris Cité, Paris, France

P16. Univentricular Pathway for Severe Neonatal Ebstein Anomaly and Tricuspid Dysplasia is Superior to Total Biventricular Approach at Late Follow-up

Jack Luxford¹, Nitin Arora², Julian Ayer², Charlotte Verrall², *Yves D'Udekem³, Gary Sholler², David Winlaw²

¹University of Sydney, Sydney, Australia; ²Children's Hospital at Westmead, Sydney, Australia; ³The Royal Children's Hospital, Parkville, Australia

P17. Detrimental Effects of High Flow Mechanical Assistance of Systemic Ventricle in a Fontan Circulation- Insights from a Unique Ex-Vivo Model

Pranava Sinha¹, Nina Deutsch¹, Dingchao He¹, Mark Nuszowski¹, Erin Montague¹, Gerald Mikesell¹, Karthik Ramakrishnan¹, Edem Ziadinov¹, David Zurakowski², *Richard Jonas¹

¹Children's National Medical Center, Washington, DC; ²Harvard Catalyst, Boston, MA

P18. Long-term Results of Anatomical Correction for Congenitally Corrected Transposition of the Great Arteries: A 19-year Experience

Christian P. Brizard, Alice Lee, Tyson A. Fricke, *Yves d'Udekem, *Igor E. Konstantinov, Johann Brink, Michael M.H. Cheung

Royal Children's Hospital, Parkville, Australia

P19. Re-intervention Type and Rates Following Neonatal Tetralogy of Fallot (TOF) Repair Vary by Operative Intervention on the Right Ventricular Outflow Tract (RVOT)

Shyamasundar Balasubramanya, Michele J. Borisuk, Aditya K. Kaza, *Frank Pigula, Hua Liu, Sitaram Emani, *Pedro J. del Nido, Christopher W. Baird

Boston Children's Hospital, Boston, MA

P20. Twenty-Five Year Outcomes of the Lateral Tunnel Fontan Procedure

Thomas G. Wilson¹, William Y. Shi¹, Ajay J. Iyengar¹, David S. Winlaw², Rachael L. Cordina³, Gavin R. Wheaton⁴, Andrew Bullock⁵, Thomas L. Gentles⁶, Robert G. Weintraub¹, Robert N. Justo⁷, Leeanne E. Grigg⁸, Dorothy J. Radford⁹, *Yves d'Udekem¹

¹Royal Children's Hospital, Parkville, Australia; ²The Children's Hospital at Westmead, Sydney, Australia; ³Royal Prince Alfred Hospital, Sydney, Australia; ⁴Women's and Children's Hospital, Adelaide, Australia; ⁵Princess Margaret Hospital for Children, Perth, Australia; ⁶Starship Children's Hospital, Auckland, New Zealand; ⁷Mater Children's Hospital, Brisbane, Australia; ⁸Royal Melbourne Hospital, Parkville, Australia; ⁹The Prince Charles Hospital, Brisbane, Australia

P21. Predictors of Successful Biventricular Repair after Hybrid Treatment for Borderline Hypoplastic Left Heart

Can Yerebakan¹, Uygur Yörüker¹, Klaus Valeske¹, Hatem Elmontaser¹, Josephine Murray¹, Anita Windhorst², Josef Thul¹, Matthias Müller¹, Dietmar Schranz¹, Hakan Akintürk¹

¹Pediatric Heart Center, Giessen, Germany; ²Justus-Liebig-University, Giessen, Germany

P22. Outcomes of Univentricular Repair in Children with Unbalanced Atrio-Ventricular Septal Defect

Edward Buratto, Xin Tao Ye, Robert G. Weintraub, *Yves d'Udekem, Christian P. Brizard, *Igor E. Konstantinov
The Royal Children's Hospital, Parkville, Australia

P23. Exercise Restriction is Not Associated with Increasing Body Mass Index Over Time in Patients with Coronary Arteries of Anomalous Aortic Origin

James M. Meza¹, Matthew Elias², Travis Wilder³, James E. O'Brien⁴, Richard W. Kim⁵, *Constantine Mavroudis⁶, *William G. Williams¹, Julie Brothers², Meryl Cohen², Brian W. McCrindle¹

¹The Hospital for Sick Children, Toronto, ON, Canada; ²The Children's Hospital of Philadelphia, Philadelphia, PA;

³University of California San Diego, La Jolla, CA; ⁴Children's Mercy Hospital, Kansas City, MO; ⁵Children's Hospital of Los Angeles, Los Angeles, CA; ⁶Florida Hospital for Children, Orlando, FL

P24. Oral Thyroxin Supplementation in Infants Undergoing Cardiac Surgery: A Double Blind Randomized Clinical Trial

Sachin Talwar, Amolkumar Bhoje, Rajesh Khadgawat, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan
All India Institute of Medical Sciences, New Delhi, India

GENERAL THORACIC MODERATED POSTER COMPETITION

*Moderator: *Jay M. Lee*

P25. Risk Factors for Progression of Ground Glass Opacities in Patients with Resected Pulmonary Adenocarcinoma

Rebecca W. Gao, *Mark F. Berry, Amanda Khuong, Joel W. Neal, Leah M. Backhus, *Joseph B. Shrager
Stanford University, Stanford, CA

P26. Prognostic Impact of the Findings on Thin-Section Computed Tomography in Patients with Subcentimeter Non-Small Cell Lung Cancer

Aritoshi Hattori, Kenji Suzuki, Takeshi Matsunaga, *Kazuya Takamochi, Shiaki Oh
Juntendo University, Tokyo, Japan

P27. A Clinical Prediction Model for Prolonged Air Leak after Pulmonary Resection

Adam Attaar, Daniel G. Winger, *James D. Luketich, Inderpal S. Sarkaria, *Neil A. Christie, Katie S. Nason
University of Pittsburgh, Pittsburgh, PA

P28. Prediction of Lepidic Predominant Clinical-stage IA Lung Adenocarcinoma with Radiological Pure-Solid Appearance for Possible Indications of Sublobar Resection

Aritoshi Hattori, Kenji Suzuki, Takeshi Matsunaga, *Kazuya Takamochi, Shiaki Oh
Juntendo University, Tokyo, Japan

P29. Evaluation of Acute and Chronic Pain Outcomes After Robotic, VATS, or Open Lobectomy

Sebastian Thomas Kwon, Lili Zhao, Rishindra Reddy, William Lynch, *Andrew Chang, Philip Carrott, *Mark Orringer, Chad Brummett, +Jules Lin
University of Michigan, Ann Arbor, MI

P30. Analytic Morphomics Predict Outcomes After Lung Volume Reduction Surgery

+Jules Lin, William B. Weir, Tyler Grenda, Peng Zhang, John Donkersloot, Binu Enchakalody, Brian Derstine, Joshua Underhill, Steven H. Sun, Rishindra M. Reddy, *Andrew C. Chang, Stewart C. Wang
University of Michigan, Ann Arbor, MI

P31. Surgeon Error in Predicting Stage I Non-Small Cell Lung Cancer (NSCLC) is a Major Factor Precluding Randomization in CALGB 140503 (Alliance)

*Leslie Kohman¹, Lin Gu², *Nasser Altorki³, Linda Veit¹, Xiaofei Wang²
¹SUNY, Syracuse, NY; ²Duke University, Durham, NC; ³Cornell University, New York, NY

P32. Treatment of Stage I Non-Small Cell Lung Cancer: What's Trending?

Puja M. Shah¹, Timothy L. Mcmurry¹, Pamela Samson², Clifford G. Robinson², James M. Isbell¹, *Benjamin D. Kozower¹
¹University of Virginia, Charlottesville, VA; ²Washington University, St. Louis, MO

P33. CT-Guided Fine Needle Aspiration (CT-FNA) Biopsy Performed by Thoracic Surgeons: A Paradigm Shift in Image-Guided Thoracic Procedures

Seth L. Welborn, Katie S. Nason, *Arjun Pennathur, Omar Awais, *Neil A. Christie, *James D. Luketich, *Matthew J. Schuchert
University of Pittsburgh, Pittsburgh, PA

P34. Outcome of Various Transplant Procedures (Single, Sparing, Inverted) in Living-Donor Lobar Lung Transplantation

*Hiroshi Date, Akihiro Aoyama, Kyoko Hijiya, Hideki Motoyama, Tomohiro Handa, Hideyuki Kinoshita, Shiro Baba, Toshiyuki Mizota, Kenji Minakata, Toyofumi F. Chen-Yoshikawa
Kyoto University, Kyoto, Japan

P35. Intraoperative use of Taurolidine In Cystic Fibrosis Patients Undergoing Lung Transplantation and Impact on Bacterial Colonization: A Propensity Score Matched Analysis

Mohamed Zeriuoh¹, Nikhil P. Patil¹, Anton Sabashnikov², Prashant N. Mohite¹, Bartlomeij Zych¹, Diana Garcia¹, Achim Koch¹, Simona Sores¹, Alexander Weymann³, Ashham Mansur⁴, Jens Wippermann², *Thorsten Wahlers², Fabio De Robertis¹, Andre R. Simon¹, Aron-Frederik Popov¹
¹Royal Brompton and Harefield Hospital, Middlesex, Harefield, London, United Kingdom; ²University Hospital of Cologne, Cologne, Germany; ³University of Heidelberg, Heidelberg, Germany; ⁴Georg August University, Goettingen, Germany

TUESDAY AFTERNOON, MAY 17, 2016

2:00 p.m. – 3:20 p.m. CT Surgical Trials Network: Implications for Clinical Practice
Faculty, description and program to come.

Hall E, BCC

3:20 p.m. – 3:55 p.m. Coffee Break in the Exhibit Hall

TUESDAY AFTERNOON, MAY 17, 2016

3:55 p.m. Adult Cardiac Surgery Simultaneous Scientific Session

Hall E, BCC

5 minute presentation, 7 minute discussion

Moderators: *Niv Ad and *Song Wan

50. The Role of Deliberate Practice in Achieving Technical Proficiency in Coronary Anastomosis Simulation: A Randomized Study of Surgical Novices

Dawn S. Hui, *Hendrick Barner, Mark Kohn, Erica R Holbrook, Christopher Odehnal, Aravindh Karunanandaa, *Richard Lee
St. Louis University, St. Louis, MO

Invited Discussant:

51. Longitudinal Outcomes After Surgical Repair of PostInfarction Ventricular Septal Defect

George J Arnaoutakis¹, Sunghee KIM², J. Matthew Brennan², Brian C Gulack², Jane M Han³, *Fred H Edwards⁴, *Jeffrey P Jacobs⁵, *John V Conte⁵

¹University of Pennsylvania, Philadelphia, PA; ²Duke University, Durham, NC; ³Society of Thoracic Surgeons, Chicago, IL;

⁴University of Florida, Jacksonville, FL; ⁵Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: *Hossein Almassi

52. Long-term Outcome Comparison of Mechanical versus Pericardial Aortic Valve Replacement in 50-60 Year-old Patients: Is it Time to Reassess The Guidelines?

*Anthony P. Furnary¹, Mansen Wang², Gary L. Grunkemeier², *Albert Starr³

¹Providence St. Vincent Hospital, Portland, OR; ²Providence Health and Services, Portland, OR; ³Oregon Health and Science University, Portland, OR

Invited Discussant:

53. Infective Endocarditis in Dialysis Patients: Is it Worth Operating?

Sajjad Raza, Asif Ansari, Jeevanantham Rajeswaran, Amr Arafat, Matteo Trezzi, Syed T Hussain, Haris Riaz, Sunil Panwar, Sevag Demirjian, Thomas Fraser, *Joseph F. Sabik, *Eugene H. Blackstone, *Gosta B. Pettersson
Cleveland Clinic, Cleveland, OH

Invited Discussant:

54. Long-term Outcome of Total Arterial Myocardial Revascularization versus Conventional Coronary Artery By-pass in Diabetic and Non Diabetic Patients: A Propensity-match Analysis

*Claudio Muneretto, Lorenzo Di Bacco, Gianluigi Bisleri, Laura Giroletti, Alberto Repossini

University of Brescia, Brescia, Italy

Invited Discussant: *John D. Puskas

55. Trends in 30 Day Readmission after CABG in the Medicare Population: Longitudinal Analysis Over 13 Years

Kathleen Kwedar, Christian McNeely, Stephen Markwell, Christina Vassileva

Southern Illinois University, Springfield, IL

Invited Discussant: *Jennifer S. Lawton

56. The Cox-Maze IV Procedure for Atrial Fibrillation has Similar Efficacy for Rheumatic and Degenerative Mitral Valve Disease

Jonathan E. Labin, Nowrin Haque, Laurie A. Sinn, Richard B. Schuessler, *Marc R. Moon, *Hersh S. Maniar, Spencer J. Melby, *Ralph J. Damiano, Jr.

Washington University, St. Louis, MO

Invited Discussant: *Vinay Badhwar

Late-Breaking Clinical Trial

Invited Discussant:

5:35 p.m. Executive Session, AATS Members Only

Hall E, BCC

3:55 p.m. Aortic/Endovascular Surgery Simultaneous Scientific Session

Ballroom I, BCC

5 minute presentation, 7 minute discussion

Moderators: *Anthony L. Estrera and *Steven L. Lansman

57. Deep Circumferential Annuloplasty as a Repair Adjunct in Regurgitant Bicuspid Aortic Valves with a Dilated Annulus: The Need to Address the Septum

Omar Nawaydou¹, *Munir Boodhwani², +Laurent de Kerchove¹, *Gebrine El Khoury¹

¹*Cliniques Universitaires Saint-Luc, Brussels, Belgium;* ²*University of Ottawa Heart Institute, Ottawa, ON, Canada*

Invited Discussant:

58. Cardiovascular Operations for Loeys-Dietz Syndrome: Intermediate Results

Nishant D. Patel, Todd Crawford, Jonathan T. Magruder, Diane E. Alejo, Narutoshi Hibino, Harry C. Dietz, James Black,

*Luca A. Vricella, *Duke E. Cameron

Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: Michael P. Fischbein

59. Are Outcomes of Thoracoabdominal Aortic Aneurysm Repair Different in Men vs. Women?

Konstantinos Spiliotopoulos, +Ourania Preventza, Matt Price, Qianzi Zhang, *Joseph Coselli, *Scott LeMaire

Baylor College of Medicine, Houston, TX

Invited Discussant:

60. Natural History and Management of DeBakey Type II Aortic Dissection

Harleen K. Sandhu, Kristofer M. Charlton-Ouw, Robert D. Rice, Charles C. Miller, III, Rana O. Afifi, *Hazim J. Safi,

*Anthony L. Estrera

University of Texas Health Science Center, Houston, TX

Invited Discussant: *S. Chris Malaisrie

61. Isolated Aortic Valve Repair in Bicuspid and Tricuspid Valve Morphology

Diana Aicher, Lena Winter, Ulrich Schneider, Christopher Hofmann, Janine Scheibel, Hans-Joachim Schäfers

University Hospital Homburg/Saar, Homburg, Germany

Invited Discussant: *Himanshu J. Patel

62. Reoperative Aortic Root Replacement: Clinical Outcomes in a Contemporary Complex Series Following Previous Aortic and/or Cardiac Surgery

Jiro Esaki¹, Bradley G. Leshnower², Jose N. Binongo², Yi Lasanajak², LaRonica McPherson², *Michael E. Halkos², *Vinod H. Thourani², *Robert A. Guyton², *Edward P. Chen²

¹*Otsu Red Cross Hospital, Otsu, Japan;* ²*Emory University, Atlanta, GA*

Invited Discussant: *Anthony L. Estrera

63. Does the Status of the False Lumen Impact Long-Term Outcomes and the Fate of the Residual Dissected Aorta following Repair of DeBakey 1 Aortic Dissection?

Jolian Dahl¹, *Edward P. Chen¹, *Vinod H. Thourani¹, *Michael E. Halkos¹, W. Brent Keeling¹, Eric L. Sarin¹, Yi Lasanajak², Jose N. Binongo², *Robert A. Guyton¹, Bradley G. Leshnower¹

¹*Emory University, Atlanta, GA;* ²*Rollins School of Public Health, Atlanta, GA*

Invited Discussant: *Scott A. LeMaire

64. Computational Fluid Dynamics Simulation of the Right Subclavian Artery Cannulation

Satoshi Numata, Keiichi Itatani, Sachiko Yamazaki, Kiyoshi Doi, Keiichi Kanda, Hitoshi Yaku
Kyoto Prefectural University of Medicine, Kyoto, Japan

Invited Discussant: *Subodh Verma

5:35 p.m. **Executive Session, AATS Members Only**

Hall E, BCC

TUESDAY AFTERNOON, MAY 17, 2016

2:00 p.m. **Congenital Heart Disease Simultaneous Scientific Session**

Ballroom III, BCC

8 minute presentation, 12 minute discussion

*Moderators: *J. William Gaynor and *Pirooz Eghtesady*

Congenital Late Breaking Clinical Trial

65. Concept of an Expandable Cardiac Valve for Surgical Implantation in Infants and Children

Sitaram M. Emani, Breanna L. Piekarski, David Zurakowski, Christopher A. Baird, Gerald Marx, Wayne Tworetzky, Audrey C Marshall, James E. Lock, *Pedro J. del Nido
Boston Children's Hospital, Boston, MA

Invited Discussant: *Thomas L. Spray

66. 10-Year Outcomes after Implant of Decellularized Pulmonary Allografts for RVOT Reconstruction

*John W. Brown², John D. Oswalt², Jennifer Christel Romano³, *James S. Tweddell⁴, *Pirooz Eghtesday⁵, Kent E. Ward⁶, Michael Felix Teodori⁷, John Paul Kupferschmid⁸, Donna Johnson²

¹Indiana University, Indianapolis, IN; ²Cardiothoracic and Vascular Surgeons, P.A., Austin, TX; ³University of Michigan, Ann Arbor, MI; ⁴Cincinnati Children's Hospital, Cincinnati, OH; ⁵Washington University, St. Louis, MO; ⁶University of Oklahoma, Oklahoma City, OK; ⁷Phoenix Children's Hospital, Phoenix, AZ; ⁸Methodist Children's Hospital, San Antonio, TX

Invited Discussant: *Richard A. Hopkins

67. Small Sized Conduits in the Right Ventricular Outflow Tract in Young Children: Bicuspidalized Homografts Perform Better than Xenografts

Katrien François, Katya De Groote, Kristof Vandekerckhove, Joseph Panzer, Hans De Wilde, Daniel De Wolf, Julie De Backer, Laurent Demulier, Thierry Bové
University Hospital Gent, Gent, Belgium

Invited Discussant: *John W. Brown

3:20 p.m. - 4:00 p.m. **Coffee Break in the Exhibit Hall**

3:30 p.m. - 4:00 p.m. **Deep Dive Session**

Exhibit Hall

AATS Consensus Guideline: Anomalous Coronary

Not for Credit

Artery Origin from Wrong Sinus

**James S. Tweddell, Cincinnati Children's Hospital*

68. Pulmonary Root Translocation is an Effective Approach for Left Coronary Artery Arising Anomalously from the Aorta with an Intramuscular Course in the Right Ventricle

Timothy Martens, S. Ram Kumar, Subhadra Shashidharan, *Vaughn A Starnes
Children's Hospital Los Angeles, Los Angeles, CA

Invited Discussant: James Tweddell

69. Comparison of Thoracotomy versus Thoracoscopic Vascular Ring Division in Children and Young Adults

Melissa A. Herrin, David Zurakowski, Francis Fynn-Thompson, Christopher W. Baird, *Pedro J. del Nido¹, Sitaram M. Emani
Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Carl L. Backer

70. A Common Polymorphism in the Mannose-binding Lectin Gene MBL2 is Associated with Poor Neurodevelopmental Outcomes Following Infant Cardiac Surgery

Ryan Robert Davies, Julia S. Barthold, Erica Sood, Yanping Wang, Edward Woodford, *Christian Pizarro
Nemours/A.I. duPont Hospital for Children, Wilmington, DE

Invited Discussant: *Jorge D. Salazar

71. Interrupted Arch repair with Direct Anastomosis and Homograft Augmentation Patch: Outcome at 25 years with a Standardised Technique

Mohammed Mohsin Uzzaman¹, Ben Davies², John Stickley¹, Natasha Khan¹, Timothy Jones¹, William Brawn¹, David Barron¹

¹Birmingham Children's Hospital, Birmingham, United Kingdom; ²Great Ormond Street Hospital, London, United Kingdom

Invited Discussant:

5:35 p.m. Executive Session, AATS Members Only)

Hall E, BCC

TUESDAY AFTERNOON, MAY 17, 2016

2:00 p.m. General Thoracic Surgery Simultaneous Scientific Session

Ballroom IV, BCC

8 minute presentation, 12 minute discussion

*Moderators: *Gail Darling and *David R. Jones*

72. Thorascopic Sympathectomy for Medically Refractory Recurrent Ventricular Arrhythmias

*Justin Van Meeteren, Dennis Wigel, *Shanda Blackmon, *Stephen Cassivi, *K. Robert Shen, *Mark Allen
Mayo Clinic, Rochester, MN

Invited Discussant: *Mark J. Krasna

73. Prospective Trial of Giant Paraesophageal Hernia Repair with 1-Year Follow-Up

John R. Stringham¹, Jennifer V. Phillips¹, Timothy L. McMurry¹, Drew L. Lambert¹, *David R. Jones², James M. Isbell¹, *Christine L. Lau¹, *Benjamin D. Kozower¹

¹University of Virginia, Charlottesville, VA; ²Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *James D. Luketich

74. A Randomized Controlled Trial of Continuous Subpleural Bupivacaine after Thoracoscopic Surgery

Daniel L. Fortes, Charles D. Ghee, Sandeep J. Khandhar, Heather A. Prentice

Invited Discussant: +Daniel J. Boffa

75. Near-Infrared Optical Imaging During Resection of Mediastinal Thymomas Improves Assessment of Surgical Margins

Jane J. Keating, Jarrod D. Predina, Sarah Nims, Ollin Venegas, Charuhas Deshpande, John Kucharczuk, +Sunil Singhal
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Yolonda L. Colson

3:20 p.m. - 4:00 p.m. Coffee Break in the Exhibit Hall

3:30 p.m. - 4:00 p.m. Deep Dive Session	Exhibit Hall
	<i>Not for Credit</i>

P25. Risk Factors for Progression of Ground Glass Opacities in Patients with Resected Pulmonary Adenocarcinoma

Rebecca W. Gao, *Stanford University, Stanford, CA*

P26. Prognostic Impact of the Findings on Thin-Section Computed Tomography in Patients with Subcentimeter Non-Small Cell Lung Cancer

Aritoshi Hattori, *Juntendo University, Tokyo, Japan*

P28. Prediction of Lepidic Predominant Clinical-stage IA Lung Adenocarcinoma with Radiological Pure-Solid Appearance for Possible Indications of Sublobar Resection

Aritoshi Hattori, *Juntendo University, Tokyo, Japan*

76. A Risk Score To Predict the Incidence of Prolonged Air Leak after Videoassisted Thoracoscopic Lobectomy: A European Multicenter Analysis

Cecilia Pompili¹, Pierre Emmanuel Falcoz², Michele Salati³, Zalan Szanto⁴, *Alessandro Brunelli¹

¹St. James University Hospital, Leeds, United Kingdom; ²University Hospital Strasbourg, Strasbourg, France; ³Ospedali Riuniti, Ancona, Italy; ⁴University of Pecs, Pecs, Hungary

Invited Discussant:

77. Salvage Pulmonary Resection Following SBRT: A Feasible and Safe Option For Local Failure

Mara B. Antonoff, Arlene Correa, Boris Sepesi, Quynh-Nhu Nguyen, *Garrett Walsh, *Stephen Swisher, *Ara Vaporciyan, *Reza Mehran¹, *Wayne Hofstetter, *David Rice
UT MD Anderson Cancer Center, Houston, TX

Invited Discussant: *Stephen R. Hazelrigg

78. A Modified Technique of Laryngotracheal Reconstruction without the Need for Prolonged Postoperative Stenting

Konrad Hoetzenecker, Thomas Schweiger, Imme Roesner, Matthias Leonhard, Gabriel Marta, Doris-Maria Denk-Linnert, Berit Schneider-Stickler, Wolfgang Bigenzahn, *Walter Klepetko
Medical University of Vienna, Vienna, Austria

Invited Discussant: *Joel D. Cooper

Late-Breaking Clinical Trial

Invited Discussant:

WEDNESDAY MORNING, MAY 18, 2016**7:30 a.m. Adult Cardiac Surgery Simultaneous Scientific Session****Ballroom I, BCC**

5 minute presentation, 6 minute discussion

*Moderators: *Faisal G. Bakaeen and *Clifford W. Barlow***79. Haemodynamic Performance and Early Outcome of Freedom Solo Stentless Valve vs TAVR for Aortic Valve Replacement in Patients with Intermediate Risk Profile : A European, Multicenter Experience**

Alberto Repossini¹, Laura Giroletti¹, Lorenzo Di Bacco¹, Bruno Passaretti², Gianluigi Bisleri¹, Christina Schafer³, Benjamin Claus³, Herko Grubitzsch³, Thierry Folliguet⁴, Roberto Di Bartolomeo⁷, Juan Pablo Maureira⁴, Francois Laborde⁶, *Claudio Muneretto¹

¹University of Brescia, Brescia, Italy; ²Humanitas Gavazzeni Hospital, Bergamo, Italy; ³Charité Universitätsmedizin Berlin, Berlin, Germany; ⁴CHU de Nancy, Vandoeuvre les Nancy, France; ⁵University of Bologna, Bologna, Italy; ⁶Institut Mutualiste Montsouris, Paris, France

Invited Discussant:**80. Safety and Effectiveness of Robotically-Assisted Mitral Valve Surgery: Analysis of 1,000 Consecutive Cases**

*A. Marc Gillinov, *Tomislav Mihaljevic, Hoda Javadikasgari, *Rakesh Suri, Stephanie Mick, *Jose Navia, Milind Desai, Johannes Bonatti, Mitra Khosravi, Jay Idrees, Ashley Lowry, *Eugene Blackstone, *Lars Svensson
Cleveland Clinic Foundation, Cleveland, OH

Invited Discussant:**81. Aortic Valve Repair with Geometric Ring Annuloplasty for Aortic Insufficiency Associated with Ascending Aortic/Root Aneurysms**

Domenico Mazzitelli¹, Theodor J.M. Fischlein², *J. Scott Rankin³, Yeong-Hoon Choi⁴, Christof Stamm¹, Jan Pirk⁵, Steffen Pfeiffer², Christian Noebauer¹, *Christian Schreiber¹, *Thorsten Wahlers⁴, *Friedhelm Beyersdorf⁶, Ruediger Lange¹

¹German Heart Center Munich, Munich, Germany; ²Klinikum Nürnberg, Paracelsus Medical University, Nuremberg, Germany; ³Cardiothoracic Surgery Associates, Nashville, TN; ⁴University of Cologne, Cologne, Germany; ⁵Institute for Clinical and Experimental Medicine, Prague, Czech Republic; ⁶Heart Center Freiburg University, Freiburg, Germany

Invited Discussant: *Gebrine El Khoury

82. Mid-Term Multi-Center Clinical and Hemodynamic Results of a High Performance Pericardial Surgical Valve

*Scott Goldman¹, Anson Cheung², *Joseph E. Bavaria³, Michael R. Petracek⁴, Mark A. Groh⁵, *Hartzell V. Schaff⁶

¹Lankenau Heart Institute, Wynnewood, PA; ²University of British Columbia, Vancouver, BC, Canada; ³University of Pennsylvania, Philadelphia, PA; ⁴Vanderbilt University, Nashville, TN; ⁵Mission Health and Hospitals, Asheville, NC; ⁶Mayo Clinic, Rochester, MN

Invited Discussant: *Y. Joseph Woo

Innovation in Cardiac Surgery

*Ralph J. Damiano, Jr., Washington University, St. Louis, MO

83. Frozen Elephant Trunk for Type A Aortic Dissection in Marfan Syndrome: Long-Term Single-Center Experience in 106 Patients

Long-Fei Wang¹, Wei-Guo Ma², Jun Zheng¹, Tian-Hua Rong¹, Bulat A Ziganshin², Sven Peterss², Wei Zhang¹, Yong-Min Liu¹, Jun-Ming Zhu¹, Qian Chang³, *John A Elefteriades³, *Li-Zhong Sun¹

¹Capital Medical University, Beijing, China; ²Yale-New Haven Hospital, New Haven, CT; ³Fu Wai Hospital and Cardiovascular Institute, Beijing, China

Invited Discussant: *Wilson Y. Szeto

84. Alternative Approaches in Transcatheter Aortic Valve Replacement and Costs in the U.S. Medicare Population

Fenton H. McCarthy, Danielle D. Spragan, Katherine M. McDermott, Peter W. Groeneveld, Ashley C. Hoedt, Howard C. Herrmann, Saif Anwaruddin, Jay Giri, *Joseph E. Bavaria, *Wilson Y. Szeto, +Nimesh D. Desai
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Vinod H. Thourani

85. Clinical Outcomes in Low and Intermediate-High Risk Groups with a Sutureless Heart Valve

*Axel Haverich¹, Theodor Fischlein², Kavous Hakim-Meibodi³, Martin Misfeld⁴, *Thierry Carrel⁵, *Marian Zembala⁶, Francesco Madonna⁷, François Laborde⁸

¹Hannover Medical School, Hannover, Germany; ²Paracelsus Medical University, Nuremberg, Germany; ³Ruhr-Universität Bochum, Bad Oeynhausen, Germany; ⁴Herzzentrum Universitaet Leipzig, Leipzig, Germany; ⁵Universitätsklinik für Herz- und Gefäßschirurgie Inselspital, Bern, Switzerland; ⁶Silesian University Zabrze, Poland; ⁷Hopital Cardiologique Du Haut-Leveque, Pessac, France; ⁸Institute Mutualiste Montsouris, Paris, France

Invited Discussant: *Niv Ad

86. Long-term Results of Transapical Off-pump Echo Guided Mitral Valve Repair with Neochord Implantation

Colli Andrea, Laura Besola, Erica Manzan, Eleonora Bizzotto, Fabio Zucchetta, Roberto Bellu, Demetrio Pittarello, Cristiano Sarais, *Gino Gerosa
University of Padua, Padua, Italy

Invited Discussant: *Anelechi C. Anyanwu

87. Thirty-Day and 1-Year Readmission Rate Following Transcatheter Aortic Valve Replacement in a High Volume Centre

Jessica Forcillo, Jose F. Condado, Vasilis Babaliaros, Jose Binongo, Yi-An Lasanajak, Eric Sarin, Chandan M. Devireddy, Bradley G. Leshnower, James P. Stewart, *Robert A. Guyton, Kreton Mavromatis, Peter C Block, Patricia Keegan, Amy Simone, *Vinod H Thourani
Emory University, Atlanta, GA

Invited Discussant: *Michael J. Reardon

9:35 AM – 9:50 AM Coffee Break

WEDNESDAY MORNING, MAY 17, 2016

7:30 a.m. Congenital Heart Disease Simultaneous Scientific Session

Ballroom III, BCC

5 minute presentation, 6 minute discussion

*Moderators: *Jonathan M. Chen and *Pedro J. del Nido*

88. Left Ventricular Assist Device As Destination Therapy in Cardiac End Stage Distrophinopathies: Midterm Results

Gianluigi Perri¹, Sergio Filippelli², Rachele Adoriso², Roberta Iacobelli², Francesca Iodice², Giuseppina Testa², Fabrizio Gandolfo², Domenico D'Amario¹, Massimo Massetti¹, Antonio Amodeo²

¹A. Gemelli Hospital, Rome, Italy; ²Bambino Gesù Children Hospital, Rome, Italy

Invited Discussant: *Kristine J. Guleserian

89. A Transapical to Aorta Double Lumen Cannula-based Neonate LVAD Efficiently Unloads the LV in Neonate Lambs

Cheng Zhou, Dongfang Wang, Cherry Croft, Francesca Condemi, Hassan K. Reda, *Joseph B. Zwischenberger
University of Kentucky, Lexington, KY

Invited Discussant: *David L. Morales

90. Preservation of Umbilical Vein Segments for Use as an Autologous Shunt Conduit in Neonates

David M. Hoganson¹, Dane A. Cooper¹, Kimberly N. Rich¹, Breanna L. Piekarski¹, Joseph P. Gaut², *John E. Mayer¹, Elena Aikawa³, Sitaram M. Emani¹

¹Boston Children's Hospital, Boston, MA; ²Washington University in St. Louis, St. Louis, MO; ³Brigham and Womens Hospital, Boston, MA

Invited Discussant:

91. Routine Preoperative Laboratory Testing in Elective Pediatric Cardiothoracic Surgery is Largely Unnecessary

R. Michael Nieto, Luis E. De León, Kimberly A. Krauklis, *Charles D. Fraser, Jr.
Texas Children's Hospital, Houston, TX

Invited Discussant: *Andrew J. Lodge

MCS for Failing Fontan

*Mark D. Rodefeld, *Indiana University School of Medicine, Indianapolis, IN*

92. Another Look at the Appropriateness of Technical Performance Scores: A Single Center Exploratory Analysis of Surgical Factors Associated with Complications, Reoperation, and Length of Stay Following Tetralogy of Fallot Repair

Daud Lodin¹, Orestes Mavrothalassitis², Naveen Swami³, Tara Karamlou³

¹San Juan Bautista, Caguas, PR; ²University of Maryland, Baltimore, MD; ³University of California, San Francisco, CA

Invited Discussant:

93. Proactive Platelet and Cryoprecipitate Transfusion during Neonatal Cardiopulmonary Bypass Rapidly Normalizes Platelet Count, Fibrinogen and Functional Rotational Thromboelastometry Parameters

John P. Scott¹, Robert A. Niebler¹, Eckehard A.E. Stuth¹, D. Woodrow Benson¹, Ronald K. Woods¹, *James S. Tweddell¹, Regina Cole¹, *Michael E. Mitchell¹, Rachel S. Bercovitz¹, Pippa Simpson¹, Robert Montgomery¹, Alan Mast², Susan Maroney², Ke Yan¹, Rowena Punzalan¹, Debra K. Newman²

¹Medical College of Wisconsin, Milwaukee, WI; ²Blood Research Institute, Milwaukee, WI

Invited Discussant: *Mark S. Bleiweis

94. Shape Does Matter: 3-D Statistical Shape Analysis of the Aortic Arch after Coarctation Repair Reveals Shape Correlation with Left Ventricular Function

Jan L. Bruse¹, Kristin McLeod², Giovanni Biglino¹, Maxime Sermesant³, Xavier Pennec³, Tain-Yen Hsia¹, Andrew M. Taylor¹, Silvia Schievano¹

¹Great Ormond Street Hospital for Children, London, United Kingdom; ²Simula Research Laboratory, Lysaker, Norway;

³INRIA Sophia Antipolis-Méditerranée, Sophia Antipolis, France

Invited Discussant:

95. Surgical Strategy for Aortic Arch Reconstruction after Norwood Procedure based on a Virtual Operation with Numerical Flow Analysis

Shohei Miyazaki¹, Keiichi Itatani², Norihiko Oka¹, Shinji Goto³, Masanori Nakamura³, Tadashi Kitamura¹, Tetsuya Horai¹, Yuki Nakamura¹, +Kagami Miyaji¹

¹*Kitasato University, Sagamihara, Japan;* ²*Kyoto Prefectural University of Medicine, Kyoto City, Japan;* ³*Saitama University, Saitama-Shi, Japan*

Invited Discussant: *Charles D. Fraser

9:35 AM – 9:50 AM Coffee Break

WEDNESDAY MORNING, MAY 18, 2016

7:30 a.m. General Thoracic Surgery Simultaneous Scientific Session

Ballroom IV, BCC

5 minute presentation, 6 minute discussion

*Moderators: *Shaf Keshavjee and *Gaetano Rocco*

96. Prognostic Factors of Tumor Recurrence in Stage I Adenocarcinoma of Lung: Influence of Preoperative biopsy

Chien-Sheng Huang, Po-Kuei Hsu, Chun-Ku Chen, Yi-Chen Yeh, Mei-Han Wu, Chih-Cheng Hsieh, Han-Shui Hsu, Teh-Ying Chou, Wen-Hu Wu, Biing-Shiun Huang

Taipei Veterans General Hospital, Taipei, Taiwan

Invited Discussant:

97. Characteristics and Outcomes of Pathologic Node Positive Esophageal Cancer Patients Receiving Adjuvant Chemotherapy Following Induction Chemotherapy and Esophagectomy

Pamela Samson¹, +Varun Puri¹, A. Craig Lockhart¹, Clifford Robinson¹, Stephen Broderick², G. Alexander Patterson¹, Bryan Meyers¹, *Traves Crabtree¹

¹*Washington University in St. Louis, St. Louis, MO;* ²*St. Luke's Hospital, Chesterfield, MO*

Invited Discussant: *Antoon E. Lerut

98. Well Differentiated Neuroendocrine Carcinoma (Typical Carcinoid) with Mediastinal Lymph Node Metastases: Surgical Outcomes and Whole Exome Sequencing (WES)

Eric Sceusi, Leiva-Juarez Miguel, *Reza Mehran, Neda Kalhor, Kenna Shaw, Andy Futreal, Arlene Correa, Cesar Moran, Ignacio Wistuba, Fujimoto Junya⁷, Xiayu Rao, *Stephen Swisher, *Ara Vaporciyan, Jing Wang, Mara Antonoff, *Wayne Hofstetter, *David Rice, Boris Sepesi, *Garrett Walsh, *Jack Roth

MD Anderson Cancer Center, Houston, TX

Invited Discussant: *David R. Jones

99. Survival Results and Gene Phenotype of Patients With Different Categories of Multiple Primary Lung Cancers

Kezhong Chen, Xun Wang, Fan Yang, Jingbo Zhang, Tian Guan, Jianhong Zhang, Jun Wang

Peking University People's Hospital, Beijing, China

Invited Discussant:

Invited Speaker

100. Partial Thymectomy Results In Similar Outcomes To Total Thymectomy In Masaoko-Koga Stages I And II Thymoma

Brian E Louie¹, *Xiaopan Yao², Eric Vallières¹, Zhitao Gu³, *Yue Shang⁴, Ralph W. Aye¹, +Alexander S. Farivar¹, Wentao Fang³

¹Swedish Cancer Institute, Seattle, WA; ²Yale University, New Haven, CT; ³Shanghai Chest Hospital, Shanghai, China; ⁴The MathWorks, Inc., Natick, MA

Invited Discussant: *Joshua R. Sonett

101. Role of Pulmonary Resection in Patients with Pleural Metastasis Encountered at the Time of Surgery

Samina Park, Yoohwa Hwang, Hyun Joo Lee, In Kyu Park, Chang Hyun Kang, *Young T. Kim
Seoul National University Hospital, Seoul, Republic of Korea

Invited Discussant:

102. miRNA Profiling of Lung Squamous Cell Carcinoma in the Head and Neck Cancer Patient: Metastasis or Primary Tumor

Juan A. Muñoz, Praveen Sridhar, Adam C. Gower, Anita Deshpande, Yuriy O. Alekseyev, Carl J. O'Hara, *Hiran C. Fernando, *Virginia R. Litle
Boston University, Boston, MA

Invited Discussant:

103. Lung Transplantation is Associated with a Survival Benefit in Patients with Chronic Obstructive Pulmonary Disease

Charles F. Evans, Zachary N. Kon, Min Zhan, June Kim, Irina Timofte, Aldo T Iacono, *James S. Gammie, *Si M. Pham, *Bartley P. Griffith, Pablo G. Sanchez
University of Maryland, Baltimore, MD

Invited Discussant: +Marcelo Cypel

9:35 AM – 9:50 AM Coffee Break

WEDNESDAY MORNING, MAY 18, 2016

9:50 AM	Adult Cardiac Masters of Surgery Video Session Moderator: *Thoralf M. Sundt, III, <i>Massachusetts General Hospital</i> Panelists: *David H. Adams, <i>Mount Sinai Medical Center</i> *Joseph S. Coselli, <i>Baylor College of Medicine</i> *Ralph J. Damiano, Jr., <i>Washington University</i>	Ballroom I, BCC
9:55 AM – 10:10 AM	Aortic Root Replacement with Valve Repair *Lars. G. Svensson, <i>Cleveland Clinic</i>	
10:10 AM – 10:25 AM	Maze Procedure *Vinay Badhwar, <i>University of Pittsburgh</i>	
10:25 AM – 10:40 AM	Aortic Arch Replacement *Malakh L. Shrestha, <i>Hannover Medical School</i>	

10:40 AM – 10:55 AM **TAVR without General Anesthesia**
*Vinod H. Thourani, *Emory University*

10:55 AM – 11:10 AM **Complex Mitral Valve Repair**
*Gebrine El Khoury, *Université Catholique de Louvain*

11:10 AM – 11:30 AM **Discussion**

9:50 AM **Congenital Masters of Surgery Video Session** **Ballroom III, BCC**
Moderators: *Charles D. Fraser, *Texas Children's Hospital*
*Luca A. Vricella, *Johns Hopkins Hospital*

9:55 AM – 10:15 AM **Slide Aortoplasty**
*E. Dean McKenzie, *Texas Children's Hospital*

10:15 AM – 10:35 AM **Modified Senning Procedure**
*Krishna S. Iyer, *Fortis Escorts Heart Institute*

10:35 AM – 10:55 AM **Arterial Switch Operation – Open Technique**
*Charles D. Fraser, *Texas Children's Hospital*

10:55 AM – 11:15 AM **Tetralogy of Fallot: Transatrial-Transpulmonary Repair**
*George E. Sarris, *Athens Heart Surgery Institute*

11:15 AM – 11:30 AM **Discussion**

9:50 AM **General Thoracic Masters of Surgery Video Session** **Ballroom IV, BCC**
Moderator: *Bernard J. Park, *Memorial Sloan-Kettering Cancer Center*
Panelists: *Todd L. Demmy, *Rutgers Cancer Institute of New Jersey*
*Robert J. Cerfolio, *University of Alabama at Birmingham*
*M. Blair Marshall, *Georgetown University*

9:55 AM – 10:15 AM **Robotic Bi-lobectomy**
*Bernard J. Park, *Memorial Sloan-Kettering Cancer Center*

10:15 AM – 10:35 AM **VATS Lobectomy with En Bloc Chest Wall Resection**
*Mark Onaitis, *Duke University*

10:35 AM – 10:55 AM **VATS Tracheal Sleeve Resection with ECMO Support**
*Scott J. Swanson, *Brigham & Women's Hospital*

10:55 AM – 11:15 AM **Robotic LUL Double Sleeve Resection**
*Haiquan S. Chen, *Fudan University Shanghai Cancer Center*

11:15 AM – 11:30 AM **Discussion**

11:30 AM **Annual Meeting Adjourns**

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Founded in 1917, the American Association for Thoracic Surgery (AATS) is an international organization consisting of over 1,300 of the world's foremost cardiothoracic surgeons representing 41 countries. Surgeons must have a proven record of distinction within the cardiothoracic surgical field and have made meritorious contributions to the extant knowledge base about cardiothoracic disease and its surgical treatment to be considered for membership. The Annual Meeting, research grants and awards, educational symposia and courses, and the AATS official journal, *The Journal of Thoracic and Cardiovascular Surgery*, all strengthen its commitment to science, education and research.

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*Steven S. Lansman

*Subroto Paul

*Vivek Rao

*Jorge D. Salazar

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Murata, Masaya	V10	O'Hara, Carl J	102
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Oswalt, John D	66	Pompili, Cecilia	76
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Renzulli, Attilio	P8	Santini, Francesco*	P8
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Key

- F = Laboratory Research Forum
- L = C. Walton Lillehei Resident Forum
- LB = Late Breaking Clinical Trial
- P = Moderated Poster Competition
- T = Emerging Technologies and Techniques Forum
- V = Video Session

MONDAY, MAY 16, 2016

MONDAY, MAY 16

6:30 AM **Update on Maintenance of Certification for the American Board of Thoracic Surgery** Room 340, BCC
Not for Credit
Faculty: *Yolanda L. Colson, *Brigham and Women's Hospital*
 *Cameron D. Wright, *Massachusetts General Hospital*

This session will feature presentations and discussion focusing on Maintenance of Certification (MOC) for the ABTS. Importantly MOC Part 3 and Part 4 have changed for this year and will be extensively discussed. MOC Part 3 used to be a secure exam administered at a Pearson Testing Center. This is no longer the case. The current method is taking a SESATS type exam, which is tailored to the cardiothoracic surgeon's specific practice profile and is now administered at your home or office over a secure web connection. This process will be thoroughly discussed. MOC Part 4 used to involve participation in a national database, but has now involved into a Quality Improvement Project of the surgeon's choice. All cardiothoracic surgeons are welcome in these sessions, but those approaching their 5th or 10th year of the ABTS MOC cycle will find this session particularly valuable. Adequate time will be allowed for discussion as there are often multiple areas cardiothoracic surgeons want to explore with regards to the MOC process with Board Directors.

7:20 AM **Business Session, AATS Members Only** Hall E, BCC

7:30 AM **Plenary Scientific Session** Hall E, BCC
8 minute presentation, 12 minute discussion
Moderators: *Joseph S. Coselli and *Marc R. Moon

1. Tricuspid Regurgitation Is Uncommon After Mitral Valve Repair for Degenerative Disease

*Tirone E. David, Carolyn M. David, Cedric Manlhiot
Toronto General Hospital, Toronto, ON, Canada

Invited Discussant: *Gilles D. Dreyfus

2. Comparison of del Nido and St. Thomas Cardioplegia Solutions for Myocardial Protection in Pediatric Patients Undergoing Open Heart Surgery: A Prospective Randomized Clinical Trial

Sachin Talwar, Amolkumar Bhoje, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan

All India Institute of Medical Sciences, New Delhi, India

Invited Discussant: *Pedro J. del Nido

*AATS Member *AATS New Member

3. A Population-Based Analysis of Surgical Resection Versus Stereotactic Body Radiation Therapy for Stage I Non-small Cell Lung Cancer

Babatunde A. Yerokun¹, Chi-Fu Jeffrey Yang¹, Brian C. Gulack¹, Michael S. Mulvihill¹, Lin Gu¹, Xuechan Li¹, Xiaofei Wang¹, *Mark F. Berry², *David H. Harpole¹, *Thomas A. D'Amico¹, Matthew G. Hartwig¹

¹Duke University, Durham, NC; ²Stanford University, Stanford, CA

Invited Discussant: *Walter Weder

4. Causes of Death from the Randomized Comparison of Self-Expanding Transcatheter or Surgical Aortic Valve Replacement in Patients at High Surgical Risk

Vincent A. Gaudiani¹, Jeffrey J. Popma², *David H. Adams³, James Joye⁴, G. Michael Deeb⁵, Steven J. Yakubov⁶, *Michael J. Reardon⁷

¹Pacific Coast Cardiac and Vascular Surgeons, Redwood City, CA; ²Beth Israel Deaconess Medical Center, Boston, MA; ³Mount Sinai Medical Center, New York, NY;

⁴El Camino Hospital, Mountain View, CA; ⁵University of Michigan Medical Center, Ann Arbor, MI; ⁶Riverside Methodist Hospital/Ohio Health Research Institute, Columbus, OH; ⁷Houston-Methodist-DeBakey Heart and Vascular Center, Houston, TX

Invited Discussant: *Craig R. Smith

8:50 AM AATS Award Presentations Hall E, BCC

9:05 AM Coffee Break in the Exhibit Hall

9:15 AM – 9:45 AM

AATS Consensus Guideline: Surgical Treatment of Atrial Fibrillation (inc. Maze PVI) Exhibit Hall, AATS CT Theater I, Booth #103
Not for Credit

*Niv Ad, Inova Heart and Vascular Institute

*Ralph J. Daminao, Jr., Washington University

Panelists: *Vinay Badhwar, West Virginia University

*Hersh Maniar, Washington University

9:45 AM Basic Science Lecture Hall E, BCC

**Charting Our Future Together:
Translating Discovery Science into Health Impact**

Gary M. Gibbons, National Heart, Lung, and Blood Institute

10:25 AM Plenary Scientific Session Hall E, BCC

Moderators: *Thoralf M. Sundt, III and *Marc R. Moon

5. Surgical Quality Measures in Stage IIIA Non-Small Cell Lung Cancer Are Associated with Improved Survival

Pamela Samson¹, *Traves Crabtree¹, Daniel Morgensztern¹, Clifford Robinson¹, Stephen Broderick², *G. Alexander Patterson¹, Bryan Meyers¹, ♦Varun Puri¹

¹Washington University, St. Louis, MO; ²St. Luke's Hospital, Chesterfield, MO

Invited Discussant: *Mark S. Allen

Late-Breaking Clinical Trial

LB1. TRANSFORM US Clinical Trial: Safety and Performance of a Rapid Deployment Aortic Valve

*Walter Randolph Chitwood, Jr.¹, Glenn R.R. Barnhart², *Kevin D. Accola³, *Joseph Y. Woo⁴, *Eugene A. Grossi⁵, Mubashir A. Mumtaz⁶, *Joseph F. Sabik, III⁷, Frank N. Slachman⁸, *Himanshu J. Patel⁹, *Michael A. Borger¹⁰, *Harvey Edward Garrett, Jr.¹¹, *Evelio Rodriguez¹², *Patrick M. McCarthy¹³, William H. Ryan, III¹⁴, Francis G. Duhay¹⁵, *Michael J. Mack¹⁶

¹East Carolina University, Greenville, NC; ²Swedish Heart and Vascular Institute, Seattle, WA; ³Florida Heart Institute, Orlando, FL; ⁴Stanford University, Stanford, CA; ⁵New York University, New York, NY; ⁶Pinnacle Health, Harrisburg, PA; ⁷Cleveland Clinic Foundation, Cleveland, OH; ⁸Mercy General Hospital, Sacramento, CA; ⁹University of Michigan, Ann Arbor, MI; ¹⁰Columbia University, New York, NY; ¹¹Baptist Memorial Hospital, Memphis, TN; ¹²Saint Thomas Heart Hospital, Nashville, TN; ¹³Northwestern University, Chicago, IL, Chicago, IL; ¹⁴Baylor Heart Hospital, Plano, TX; ¹⁵Edwards Lifesciences LLC, Irvine, CA, Irvine, CA; ¹⁶Heart Hospital Baylor Scott & Whyte, Plano, TX

Invited Discussant: *A. Pieter Kappetein

11:05 AM AATS New Member Induction Hall E, BCC

11:25 AM	Presidential Address <i>Competition: Perspiration to Inspiration</i> <i>"Aut viam inveniam aut faciam"</i> *Joseph S. Coselli, <i>Baylor College of Medicine</i>	Hall E, BCC
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12:15 PM Lunch in the Exhibit Hall

12:30 PM Ethics Forum Luncheon Room 343, BCC
Separate Registration Required
Should a Surgeon Comply with Hospital Administration's Demand to Change Valve Preference?
Moderator: *Robert M. Sade, *Medical University of South Carolina*
Pro: J. Scott Millikan, *Billings Clinic*
Con: Robert J. Cusimano, *Toronto General Hospital*

12:30 PM AATS/TSRA Preparing Yourself for an Academic Career Luncheon Room 340, BCC
Residents, Fellows and Medical Students Only
Pre-Registration Required
Not for Credit

MONDAY, MAY 16

* AATS Member ♦ AATS New Member

MONDAY AFTERNOON, MAY 16, 2016

2:00 PM **Adult Cardiac Surgery** Hall E, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion

Moderators: *Scott A. LeMaire and *Vinod H. Thourani

6. Is Concomitant Tricuspid Valve Surgery Beneficial During Left Ventricular Assist Device Implantation: A Multi-Institutional Analysis

♦John M. Stulak¹, Vakhtang Tchantchaleishvili¹, Nicholas A. Haglund², Shannon Dunlay¹, Keith Aaronson³, Jennifer Cowger⁴, Palak Shah⁵, *Francis D. Pagani³, ♦Simon Maltais¹
¹Mayo Clinic, Rochester, MN; ²Vanderbilt Heart, Nashville, TN; ³University of Michigan Health System, Ann Arbor, MI; ⁴St. Vincent Heart Center, Indianapolis, IN; ⁵Inova Heart and Vascular Institute, Falls Church, VA

Invited Discussant: *Nader Moazami

7. Comparison of Surgical Aortic Valve Replacement, Minimally Invasive Valve Replacement, and Transcatheter Aortic Valve Replacement In 2571 Patients

Tom C. Nguyen¹, *Vinod Thourani², Yelin Zhao¹, Matthew D. Terwelp¹, Prakash Balan¹, Daniel Ocazonez¹, *Anthony Estrera¹, Richard Smalling¹, Vasilis C. Babaliaros², Joseph Lamelas³

¹University of Texas, Houston, TX; ²Emory University, Atlanta, GA; ³Mount Sinai Medical Center, Miami Beach, FL

Invited Discussant: *Mathew R. Williams

8. A Long-Term Comparison Between Artificial Chordae and Double Orifice Repair in Degenerative Mitral Regurgitation Due to Anterior and Bileaflet Prolapse

Andrea Giacomini, Elisabetta Lapenna, Michele De Bonis, Giovanni La Canna, Alessandro Castiglioni, Teodora Nisi, *Ottavio Alfieri
San Raffaele University Hospital, Milan, Italy

Invited Discussant: *Mark Ruel

3:00 PM – 3:35 PM **Coffee Break in the Exhibit Hall**

3:15 PM – 3:35 PM

AATS Consensus Guideline: TAVR Exhibit Hall, AATS CT Theater I, Booth #103

*Wilson Y. Szeto, *University of Pennsylvania*

Not for Credit

Panelists: *Gorav Ailawadi, *University of Virginia Health System*

♦Kevin L. Greason, *Mayo Clinic*

*Rakesh M. Suri, *Cleveland Clinic*

9. Aortic Root Surgery with Circulatory Arrest: Predictors of Prolonged Hospital Stay and Implications for Lowering Hospital Cost and Expediting Recovery

♦Ourania Preventza¹, Andrea Garcia¹, Shahab Akvan¹, Sarang Kashyap¹, Kiki Simpson²,
*Denton Cooley³, *Scott A. LeMaire¹, Kim de la Cruz¹, Konstantinos Spiliotopoulos¹,
Matt D. Price¹, *Faisal G. Bakaeen², Shuab Omer², Lorraine Corwell², *Joseph Coselli¹
¹Baylor College of Medicine, Houston, TX; ²Michael E. DeBakey Veterans Affairs
Medical Center, Houston, TX; ³Texas Heart Institute, Houston, TX

Invited Discussant: *Nicholas T. Kouchoukos

10. Why Do a Ross? Equivalent 15-Year Survival But Improved Freedom from Thrombohemorrhagic Complications Compared to Mechanical Aortic Valve Replacement: A Propensity-Matched Cohort Study

Amine Mazine, Cedric Manlhiot, *Vivek Rao, Edward J. Hickey, Shakira Christie,
*Tirone E. David, Maral Ouzounian
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Duke E. Cameron

11. Predictors for Stable Late Rhythm in Surgical Ablation for Atrial Fibrillation Patients

*Niv Ad, Sari Diana Holmes, Deborah J. Shuman, Graciela Pritchard, Deborah Lamont
Inova Heart and Vascular Institute, Falls Church, VA

Invited Discussant: *Ralph J. Damiano, Jr.

12. What Is the Risk of Adding Aortic Replacement to Cardiac Surgery?

Jay J. Idrees, *Eric E. Roselli¹, Ashley Lowery, *Eugene H. Blackstone, ♦Douglas R. Johnston,
♦Edward G. Soltesz, Gosta B. Pettersson, *Joseph F. Sabik, III, *Lars G. Svensson
Cleveland Clinic Foundation, Cleveland, OH

Invited Discussant: *Joseph E. Bavaria

5:00 PM Adjourn

MONDAY AFTERNOON, MAY 16, 2016

2:00 PM **Congenital Heart Disease** Ballroom III, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion

Moderators: *Duke E. Cameron and *Jennifer C. Hirsch-Romano

13. Five-Year Experience with Arterial Switch Operation in the First Hours of Life Using Autologous Umbilical Cord Blood

Kyrylo Chasovskyi, Yaroslav Mykychak, Nadiya Rudenko, Ganna Vorobyova,
Illya Yemets

Ukrainian Children's Cardiac Center, Kyiv, Ukraine

Invited Discussant: *Christopher A. Caldarone

*AATS Member ♦AATS New Member

14. Five-Year Experience with Immediate Extubation After Arterial Switch Operation for Transposition of Great Arteries

Joby Varghese, Shelby Kutty, Sandy Hall, Mary Craft, Ibrahim Abdullah, James M. Hammel
Children's Hospital and Medical Center Omaha, Omaha, NE

Invited Discussant: *Emile A. Bacha

15. Should All Patients with Congenitally Corrected Transposition of Great Arteries (ccTGA) Undergo Anatomic Repair?

Maryam Alomair, Mohammed Al-Jughiman, Andrew Redington, *Christopher Caldarone, Luc Mertens, *Glen Van Arsdell
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Bahaaldin AlSoufi

16. Pediatric Cardiac Surgical Outcomes Following Implementation of a Novel Acuity Adaptable Care Model

John M. Costello, Elizabeth Preze, Nguyenvu Nguyen, Mary E. McBride, James W. Collins, Jr., Osama Eltayeb, Michael C. Monge, Barbara J. Deal, Michelle M. Stephenson, *Carl L. Backer
Ann and Robert H. Lurie Children's Hospital of Chicago, Chicago, IL

Invited Discussant: *Sertac Cicek

3:20 PM – 3:55 PM Coffee Break in the Exhibit Hall

17. Preoperative Hemodynamic Parameters Predict Adverse Outcomes in Patients Undergoing Biventricular Conversion with Damus-Kaye-Stansel Takedown

Melissa A. Herrin, Breanna L. Piekarsk, David Zurakowski, Christopher W. Baird, Wayne Tworetzky, Puja Banka, Gerald R. Marx, Roger E. Breitbart, Audrey C. Marshall, *Pedro J. del Nido, Sitaram M. Emani
Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *E. Dean McKenzie

18. Effect of Preoperative Administration of Allopurinol on Postoperative Outcomes in Patients Undergoing Repair of Tetralogy of Fallot

Sachin Talwar, Murugan Selvam Sathiya, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan
All India Institute of Medical Sciences, New Delhi, India

Invited Discussant: *J. William Gaynor

Late-Breaking Clinical Trial

LB2. The Miniaturized Pediatric Continuous Flow Device: Pre-Clinical Assessment in the Chronic Sheep Model

Iki Adachi¹, Sarah Burki¹, David Horne¹, Gil G. Costas², Robert Jarvik³, John Teal³, J. Timothy Baldwin⁴, Kurt Dasse⁵, Jeff Conger², *William E. Cohn², *Charles D. Fraser, Jr.¹
¹Texas Children's Hospital, Houston, TX; ²Texas Heart Institute, Houston, TX; ³Jarvik Heart, Inc., New York, NY; ⁴National Heart, Lung and Blood Institute, Bethesda, MD; ⁵Geno, LLC, Cocoa, FL

Invited Discussant:

5:00 PM Adjourn

MONDAY AFTERNOON, MAY 16, 2016

2:00 PM **General Thoracic Surgery** Ballroom IV, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion
Moderators: *Sudish C. Murthy and *Thomas K. Waddell

MONDAY, MAY 16

Late-Breaking Clinical Trial

LB3. Early Oral Feeding Following McKeown Minimally Invasive Esophagectomy: A Randomized Controlled Study

Yin Li, Hai-Bo Sun, Xian-Ben Liu, Rui-Xiang Zhang, Zong-Fei Wang, Yan Zheng, Shi-Lei Liu, Jian-Jun Qin, Xian-Kai Chen, Zhao Wu
Henan Cancer Hospital, The Affiliated Cancer Hospital of Zhengzhou University, Zhengzhou, China

Invited Discussant:

20. Achieving a 3-Star Lobectomy Ranking by Using Continuing Process Improvement, Lean Methodology and Root Cause Analysis

*Robert Cerfolio¹, Benjamin Wei¹, Caroline Watson¹, Douglas Minnich¹,
*Malcolm DeCamp²

¹University of Alabama, Birmingham, AL; ²Northwestern University, Chicago, IL

Invited Discussant: *Stephen D. Cassivi

21. Is There a Hospital Volume Threshold for Operative Mortality for Lung Resections?

Anna Bendzsak, Nancy N. Baxter, Gail E. Baxter, Peter C. Austin, David R. Urbach
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Benjamin D. Kozower

22. Unplanned Readmission Following Esophagectomy: Complete Follow Up in a One Year Cohort with Identification of Risk Factors

Karen J. Dickinson, James Taswell, *Mark S. Allen, *Shanda H. Blackmon,
*Francis C. Nichols, III, *K. Robert Shen, *Dennis A. Wigle, *Stephen D. Cassivi
Mayo Clinic, Rochester, MN

Invited Discussant: *Antoon E. Lerut

3:20 PM – 3:55 PM **Coffee Break in the Exhibit Hall**

23. Predicting Readmission After Resection for Non-Small Cell Lung Cancer: A Progression Toward Prevention

Trevor A. Davis, Craig M. Hooker, Alicia Hulbert, Chen Chen, *Richard Battafarano,
*Malcolm V. Brock, Daniela Molena, *Stephen C. Yang
The Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: *Tomasz Grodzki

*AATS Member ♦ AATS New Member

24. Pulmonary Metastasectomy with Curative Intent for Soft Tissue Sarcoma

Neel P. Chudgar, Murray F. Brennan, Rodrigo R. Munhoz, Peter R. Bucciarelli,
Kay See Tan, Sandra P. D'Angelo, *Manjit S. Bains, Matthew Bott, ♦James Huang,
*Bernard J. Park, *Valerie W. Rusch, *Prasad S. Adusumilli *David R. Jones
Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *Garrett L. Walsh

**25. A Propensity Matched Comparison of Robotic, Thoracoscopic and Transsternal
Thymectomy for Non-Thymomatous Myasthenia Gravis**

*Richard K. Freeman, Anthony J. Ascoti, Megan Dake, Raja S. Mahidhara
St. Vincent's Health and Hospital System, Indianapolis, IN

Invited Discussant: *Kemp H. Kerstine

5:00 PM Adjourn

MONDAY AFTERNOON, MAY 16, 2016

2:00 PM **Perioperative Care** Room 337, BCC
Simultaneous Scientific Session
8 minute presentation, 7 minute discussion

Moderators: *Gosta B. Pettersson and *Glenn J. Whitman

**26. Pre-Operative Hyperglycemia – A Risk Factor for Adverse Outcomes in Patients
Undergoing Coronary Artery Surgery**

Pradeep Narayan, Sarang Naresh Kshirsagar, Chandan Kumar Mandal,
Emmanuel Rupert, Saibal Roy Chowdhury, Debasis Das, Mrinalendu Das
Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata, India

Invited Discussant: *Harold L. Lazar

**27. Goal-Directed Resuscitation Following Cardiac Surgery Reduces Acute Kidney
Injury: A Quality Initiative Pre-Post Analysis**

Lily E. Johnston, Robert H. Thiele, Emily A. Downs, James M. Jaeger, Ravi K. Ghanta,
*Irving L. Kron, James M. Isbell
University of Virginia, Charlottesville, VA

Invited Discussant: *John V. Conte

**28. Phase of Care Mortality Analysis: A Unique Method for Comparing Mortality
Differences Among TAVR and Surgical AVR Patients**

Todd C. Crawford, J. Trent Magruder, Joshua C. Grimm, Kaushik Mandal, Joel Price,
Jon R. Resar, Matthew Chacko, Rani K. Hasan, *Glenn J. Whitman, *John V. Conte
Johns Hopkins University, Baltimore, MD

Invited Discussant: *Rakesh M. Suri

29. Preoperative MRSA Screening and Targeted Decolonization in Cardiac Surgery

Manoj Kumar Saraswat, J. Trent Magruder, Julia Michele Gardner, Avinash Gadala, Damon Duquaine, Marc Steven Sussman, Lisa Lockerd Maragakis, *Glenn Joseph Robert Whitman

Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: *Richard J. Shemin

30. Does Timing of Delayed Sternal Closure Affect Short- and Long-Term Outcomes in Patients with Open Chest Management Following Cardiac Surgery?

Joshua K. Wong, Devang J. Joshi, Amber L. Melvin, William J. Archibald, Alcina Lidder, *George L. Hicks, Peter A. Knight

University of Rochester, Rochester, NY

Invited Discussant: *Bruce J. Leavitt

3:15 PM – 3:45 PM Coffee Break in the Exhibit Hall

31. Early Extubation After Cardiac Surgery: Should Six Hours Be the Standard

Todd C. Crawford, J. Trent Magruder, Joshua C. Grimm, Christopher M. Sciortino, *John V. Conte, Bo S. Kim, *Robert S. Higgins, *Duke E. Cameron, Marc Sussman, *Glenn J. Whitman

Johns Hopkins University School of Medicine, Baltimore, MD

Invited Discussant: *J. Michael DiMaio

32. Outcomes of Octogenarians Discharged Home After Prolonged ICU Length of Stay After Cardiac Surgery

Rizwan A. Manji, Rohit K. Singal, Brett Hiebert, *Alan H. Menkis, *Rakesh C. Arora
University of Manitoba, Winnipeg, MB, Canada

Invited Discussant: *Ko Bando

33. The Effects of Steroids on Coagulation Dysfunction Induced by Cardiopulmonary Bypass: A Steroids in Cardiac Surgery Trial Sub-Study

Domenico Paparella¹, *Alessandro Parolari², Crescenza Rotunno¹, Jessica Vincent³, Veronica Myasoedova⁴, Francesco Alamanni⁵, Piero Guida¹, Micaela de Palo¹, Vito Margari¹, Philip Devereaux⁶, Andre Lamy⁶, Salim Yusuf⁶, Richard Whitlock⁶

¹University of Bari, Bari, Italy; ²Policlinico San Donato, University of Milan, San Donato Milanese (MI), Italy; ³Hamilton Health Science and McMaster University, Hamilton, ON, Canada; ⁴Centro Cardiologico Monzino, Milan, Italy; ⁵Centro Cardiologico Monzino, Milano, Italy; ⁶Population Health Research Institute Mc Master University, Hamilton, ON, Canada

Invited Discussant: *Hersh Maniar

34. Unilateral Antegrade Cerebral Perfusion During Moderate Hypothermic Circulatory Arrest: Using Intraoperative EEG and Cerebral Oximetry to Improve Outcomes

Arminder S. Jassar, Steven R. Messe, *Joseph E. Bavaria, Prashanth Vallabhajosyula, ♦Nimesh D. Desai, Rita K. Milewski, Jacob Gutsche, William J. Vernick, *W. Clark Hargrove, III, *Wilson Y. Szeto

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Eric E. Roselli

MONDAY, MAY 16

*AATS Member ♦AATS New Member

35. Optimal Blood Pressure During Cardiopulmonary Bypass Defined by Cerebral Autoregulation Monitoring and Its Association with Severe Coronary Artery Disease

Daijiro Hori, Yohei Nomura, Masahiro Ono, Brijen Joshi, Kaushik Mandal,

*Duke Cameron, Charles Hogue

The Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: Kenneth Shann

5:00 PM Adjourn

MONDAY EVENING, MAY 16, 2016

5:00 PM **19th Annual C. Walton Lillehei Resident Forum** Room 340, BCC

Supported by an educational grant from St. Jude Medical

7 minute presentation, 5 minute discussion

Chairs: *Juan A. Crestanello and *Benjamin D. Kozower

L1. Thoracic-Radiation Induced Tumor Immunomodulation: Mechanistic Insights and Translational Rationale for Combining with Chimeric Antigen Receptor T-Cell Therapy for Thoracic Cancers

Jonathan Villena-Vargas, Marissa Mayor, Andreas de Biasi, *David R. Jones,

Michel Sadelain, *Prasad S. Adusumilli

Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *Dao M. Nguyen

L2. Utilization of Lungs for Transplantation Following Donor Cardiac Death in the Field Is Successful with Targeted Drug Delivery During Ex Vivo Lung Perfusion

Eric J. Charles, J. Hunter Mehaffey, Ashish K. Sharma, James M. Isbell, *Christine L. Lau,

*Curtis G. Tribble, Victor E. Laubach, *Irving L. Kron

University of Virginia Health System, Charlottesville, VA

Invited Discussant: *Thomas K. Waddell

L3. Pathogenesis of De Novo Lung-Restricted Autoimmunity Following Lung Transplantation

Stephen Chiu¹, Vijay Subramanian², *Daniel Kreisel², G.R. Scott Budinger¹,

Harris Perlman¹, *Malcolm McAvoy DeCamp, Jr.¹, Thalachallour Mohanakumar²,

Ankit Bharat¹

¹Northwestern University, Chicago, IL; ²Washington University, St. Louis, MO

Invited Discussant: ♦Jonathan D'Cunha

L4. Overexpression of the RNA-Binding Protein CUG-BP1 Promotes Esophageal Cancer Cell Proliferation by Enhancing Mtor Expression

Daniel Mansour¹, Kimberly Byrnes¹, Pornima Phatak¹, Douglas Turner²,

*Richard Battafarano³, James Donahue¹

¹University of Maryland Baltimore, MD; ²Baltimore Veteran Affairs Medical Center,

Baltimore, MD; ³John Hopkins Hospital, Baltimore, MD

Invited Discussant: *Jessica S. Donington

L5. Mechanistic Insights Into the Pathophysiology of Pulmonary Vein Stenosis

Rachel D. Vanderlaan¹, Yaquin Yana Fu², Jingyi Pan², Anouk Martine-Teichert Martine-Teichert², Jiaquan Zhu², Mauro Lo Rito², Jason Maynes², *John Coles², Jaques Belik², *Christopher A. Caldarone²

¹University of Toronto, Toronto, ON, Canada; ²Hospital for Sick Children, Toronto, ON, Canada

Invited Discussant: ♦Massimo Caputo

L6. Obtaining the Biomechanical Behavior of Ascending Aortic Aneurysm by Using Novel Speckle Tracking Echocardiography

Mohammed S. Alreshidan, Kevin Lachapelle, Sr., Richard Leask, Sr.
McGill University, Montreal, QC, Canada

Invited Discussant: *Abe DeAnda Jr.

L7. Calpain Inhibition Modulates GSK-3 β Pathways in a Swine Model of Chronic Myocardial Ischemia in the Setting of Metabolic Syndrome: A Proteomic and Mechanistic Analysis

Brittany A. Potz, Ashraf A. Sabe, Nassrene Y. Elmadhun, Jun Feng, Richard A. Clements, Ruhul M. Abid, *Frank W. Sellke
Brown University, Providence, RI

Invited Discussant: *Juan A. Crestanello

L8. Aortic Valve Repair Using Autologous Pericardium: To Fix or Not to Fix?

Janet Mee Chin Ngu, Hadi Daood Toeg, Reza Jafar, Benjamin Sohmer, Vincent Chan, Michel Labrosse, ♦Munir Boodhwani
University of Ottawa Heart Institute, Ottawa, ON, Canada

Invited Discussant: *Frederick Y. Chen

6:40 PM Adjourn

MONDAY EVENING, MAY 16, 2016

5:00 PM Innovations in Transcatheter Valve Therapies: Room 327, BCC
What You Need to Know for Today and the Future

Course Chair: *Vinod H. Thourani, Emory University

Course Directors: *A. Marc Gillinov, Cleveland Clinic Foundation
*Vinod H. Thourani, Emory University
*Mathew R. Williams, New York University

5:00 PM – 5:05 PM

Introduction

*Vinod H. Thourani, Emory University

5:05 PM – 5:14 PM

How I Perform a Self-Expanding Valve-in-valve

*Michael Deeb, University of Michigan

*AATS Member ♦AATS New Member

5:15 PM – 5:24 PM

TAVR in Intermediate Risk Patients: Update on the Outcomes

*Vinod H. Thourani, *Emory University*

5:25 PM – 5:34 PM

Update on the New Valve Platforms

*Thomas G. Gleason, *University of Pittsburgh*

5:35 PM – 5:44 PM

Discussion

5:45 PM – 5:54 PM

How I Perform a Transcatheter Mitral Valve Repair

*Gorav Ailawadi, *University of Virginia Health System*

5:55 PM – 6:04 PM

How I Perform a Transcatheter Mitral Valve in Mitral Annular Calcification

*Mathew R. Williams, *New York University*

6:05 PM – 6:15 PM

Update on Transcatheter MV Repair and Replacement

*A. Marc Gillinov, *Cleveland Clinic Foundation*

6:16 PM – 6:29 PM

Discussion

6:29 PM – 6:30 PM

Closing

*Mathew R. Williams, *New York University*

6:30 PM

Adjourn

MONDAY EVENING, MAY 16, 2016

5:00 PM

**Emerging Interfaces in Advanced Imaging
and Interventions in Structural CV Disease**

Room 343, BCC

Supported by an educational grant from Siemens

Course Co-Chairs: *Juan B. Grau, *The Valley Hospital/Cleveland Clinic
Foundation*
Mani Vannan, *Ohio State University*

5:00 PM – 5:30 PM

Advent of New Developments in Pre-Op and Intra-Op Technologies for Valvular Disease

Thilo Noack, *Leipzig Heart Center*

5:30 PM – 6:00 PM

Use of Imaging Techniques to Properly Plan Mitral Valve Interventions

*Volkmar Falk, *German Heart Institute*

6:00 PM – 6:30 PM

Use of Preoperative Imaging to Guide Intraoperative Navigation of Complex Aortic Aneurysms

*Eric E. Roselli, *Cleveland Clinic Foundation*

6:30 PM Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 AM Cardiac Surgery Forum

Ballroom IV, BCC

5 minute presentation, 5 minute discussion

Moderators: *Jennifer S. Lawton and *Craig H. Selzman

F1. Oxygenation of the Cerebrospinal Fluid with Nanobubbles Can Ameliorate a Spinal Cord Ischemic Injury in a Rabbit Model

Keisuke Kanda, Osamu Adachi, Satoshi Kawatsu, Ko Sakatsume, Kiichiro Kumagai, Shunsuke Kawamoto, Yoshikatsu Saiki
Tohoku University, Sendai, Japan

Invited Discussant: *T. Brett Reece

F2. Lower Body Perfusion for Spinal Protection in a Frozen Elephant Trunk Simulation Model

Peter Lukas Haldenwang¹, Lorine Häuser¹, Daniel Ziebur¹, Nora Prochnow¹, Andreas Baumann¹, Markus Schlömacher¹, Hildegrad Christ², Justus Thomas Strauch¹
¹*BG University Hospital Bergmannsheil Bochum, Bochum, Germany*; ²*University of Cologne, Cologne, Germany*

Invited Discussant: ♦Ourania Preventza

F3. MRI Assessment of Cardiac Function in a Swine Model of Hibernating Myocardium Three Months Following Bypass Surgery

Laura Hocum Stone¹, Cory Swingen¹, Christopher T. Holley¹, Christin A. Wright¹, Melanie Crampton¹, *Herbert B. Ward¹, Edward O. McFalls², *Rosemary F. Kelly¹
¹*University of Minnesota, Minneapolis, MN*; ²*Minneapolis VA Medical Center, Minneapolis, MN*

Invited Discussant: *Michael K. Pasque

F4. Myocardial Rescue with Autologous Mitochondrial Transplantation in a Porcine Model of Ischemia/Reperfusion

Aditya K. Kaza¹, Isaac Wamala¹, Ingeborg Friehs¹, Joseph Kuebler¹, Rahul H. Rathod¹, Ignacio Berra¹, *Sidney Levitsky², *Pedro J. del Nido¹, Douglas B. Cowan¹, James D. McCully¹

¹*Boston Children's Hospital, Boston, MA*; ²*Beth Israel Deaconess Medical Center, Boston, MA*

Invited Discussant: *Juan A. Crestanello

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

F5. Layered Smooth Muscle Cell-Endothelial Progenitor Cell Sheets Augment Post-Infarction Ventricular Function; Implications for Translating Multi-Lineage Cellular Tissue Engineering

Yasuhiro Shudo¹, Andrew B. Goldstone¹, Jeffrey E. Cohen¹, Masashi Kawamura¹, Jay Patel¹, Michael S. Hopkins¹, Bryan B. Edwards¹, Shigeru Miyagawa², Yoshiki Sawa², *Joseph Woo¹

¹Stanford University, Stanford, CA; ²Osaka University Graduate School of Medicine, Osaka, Japan

Invited Discussant: *Joseph T. McGinn

F6. Evaluating a Bioprosthetic Anterior Mitral Valve Leaflet Made from Autologous Jugular Vein and Expanded Polytetrafluoroethylene Chordae in a Sheep Model

Jacques Janson¹, Andre Coetzee¹, Gawie Rossouw¹, Izak Loftus², Riaan Murray¹, Pieter Rossouw¹, Philip Herbst¹

¹Stellenbosch University, Tygerberg, South Africa; ²Pathcare, Somerset West, South Africa

Invited Discussant: *Clifford W. Barlow

F7. Topographical Mapping of Left Ventricular Regional Contractile Injury in Ischemic Mitral Regurgitation

Timothy S. Lancaster, Julia Kar, Brian P. Cupps, Matthew C. Henn, Kevin Kulshrestha, Danielle J. Koerner, *Michael K. Pasque
Washington University, St. Louis, MO

Invited Discussant: Tomasz A. Timek

F8. Epicardial Erythropoietin Hydrogel Improves Post-Ischemic Cardiac Performance and Accelerates Proliferation and Tissue Transformation in the Intramyocardial Mesenchyme

Christian Klopsch¹, Heiko Lemke¹, Marion Ludwig¹, Anna Skorska¹, Ralf Gaebel¹, Robert Jaster¹, Stefan Jockenhoevel², Robert David¹, Gustav Steinhoff¹

¹Rostock University Medical Center, Rostock, Germany; ²RWTH Aachen University, Aachen, Germany

Invited Discussant: *Sunjay Kaushal

F9. Hypoxia Modulates Cell Migration and Proliferation by Activating Akt and ERK Through the SDF-1 α /CXCR4 Axis in Placenta-Derived Mesenchymal Stem Cells for Cardiac Repair

Li Li, Prashant Kumar Jaiswal, Rishi Jurakhan, Kaviyanka Selvasandran, Khalid Ridwan, Georges Makhoul, Minh Ngoc Duong, Renzo Cecere

McGill University, Montreal, QC, Canada

Invited Discussant: *Todd K. Rosengart

F10. Endothelial Primary Cilia Regulate Cardiac Fibrosis by Guiding Mesenchymal Fate Decisions

Krishna K. Singh, Yi Pan, Adrian Quan, Jonathan W. Yau, Jean-François Desjardins, Thomas G. Parker, Mohammed Al-Omran, *Subodh Verma

St. Michael's Hospital, Toronto, ON, Canada

Invited Discussant: ♦Thorsten Doenst

8:40 PM

Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 AM **General Thoracic Surgery Forum** Room 343, BCC
5 minute presentation, 5 minute discussion

Moderators: *Benjamin D. Kozower and *Dao M. Nguyen

F11. Immunogenic Effect of Local Radiation Therapy in a Mouse Model of Mesothelioma

Luis De la Maza-Borja, Matthew Wu, Licun Wu, *Marc De Perrot
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Prasad S. Andusumilli

F12. A Prospective Study Comparing Targeted DNA Sequencing of Tumor Tissue with Noninvasive Liquid Biopsy of Circulating Tumor DNA in Surgical Non-Small Cell Lung Cancer Patients

Kezhong Chen¹, Fan Yang¹, Jingbo Zhang², Tian Guan¹, Feng Lou², Jun Wang¹
¹*Peking University People's Hospital, Bei Jing, China*; ²*San Valley Biotechnology Incorporated, Beijing, China*

Invited Discussant: *David S. Schrupp

F13. Highly Effective Heparanase-Based Therapy for Mesothelioma

Moshe Lapidot¹, Uri Barash², Yaniv Zohar³, Neta Ilan², Israel Vlodavsky²
¹*Brigham and Women's Hospital, Boston, MA*; ²*Cancer and Vascular Biology Research Center, Technion, Haifa, Israel*; ³*Rambam Health Care Center, Haifa, Israel*

Invited Discussant: *Jay M. Lee

F14. In Silico Immune Response Is the Most Predictive Factor of Overall Survival in Surgically Resected Pleural Mesothelioma

Hyun-Sung Lee¹, Rohan Shah¹, David Yoon¹, Shawn Groth¹, *Raphael Bueno²,
*David Sugarbaker¹, Bryan Burt¹
¹*Baylor College of Medicine, Houston, TX*; ²*Brigham and Women's Hospital, Boston, MA*

Invited Discussant: ♦Varun Puri

F15. Novel Bio-Engineered Tracheal Patch Demonstrates Potential for Remodeling in a Growing Ovine Model

Farhan Zafar, Richard Scott Baker, Namheon Lee, Shiva Kumar Shanmukhappa,
Michael D. Taylor, *David L. Morales
Cincinnati Childrens Hospital, Cincinnati, OH

Invited Discussant:

F16. Role of Interleukin-17A in Early Graft Rejection After Orthotopic Lung Transplantation in Mice

Qi-rui Chen, Hui Li, Yao-zhong Ding
Beijing Chaoyang Hospital, Capital Medical University, Beijing

Invited Discussant: *Daniel Kreisel

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

F17. Cigarette Smoke Enhances Growth and Metastatic Potential of Lung Cancer Cells in-Vivo

Elvin Hekimoglu, Eden Payabyab, Mary Zhang, Julie A. Hong, Emily S. Reardon, Paul L. Feingold, R. Taylor Ripley, Choung D. Hoang, Sichuan Xi, *David S. Schrupp
National Cancer Institute, Bethesda, MD

Invited Discussant: ♦Sunil Singhal

F18. Optimization of Image Capture Properties for Intraoperative Molecular Imaging of Lung Adenocarcinoma

Jarrold D. Predina, Olugbenga Okusanya, Jane Keating, ♦Sunil Singhal
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Andrew C. Chang

F19. Progression of EGFR Mutant Lung Adenocarcinoma Is Driven by Alveolar Macrophages

Bryan M. Burt¹, Don-Hong Wang², Hyun-Sung Lee¹, David Yoon¹, Gerald Berry², Thomas M. Wheeler¹, Farrah Kheradmand¹, *David J. Sugarbaker¹, Edgar Engleman²
¹Baylor College of Medicine, Houston, TX; ²Stanford University School of Medicine, Stanford, CA

Invited Discussant: ♦James Huang

F20. Inherited Immunologic Factors Affecting Lung Cancer Susceptibility

Saeed Arefanian, Ryuji Higashikubo, *Daniel Kreisel, Andrew E. Gelman, *Alexander Sasha Krupnick
Washington University, St. Louis, MO

Invited Discussant: *Christine L. Lau

8:40 PM Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 AM Adult Cardiac Emerging Technologies and Ballroom III, BCC
Techniques Forum

5 minute presentation, 5 minute discussion

Moderators: *Gorav Ailawadi and *Himanshu J. Patel

T1. Multi-Center Assessment of Grafts in Coronaries: Long Term Evaluation of the C-Port Anastomotic Device (The MAGIC Study)

Husam H. Balkhy¹, Mahesh Ramshandani², Nirav Patel³, *Valavunar Subramanian³, Nicholas Augelli⁴, Gareth Tobler⁵, Tung Cai⁶
¹University of Chicago Medicine, Chicago, IL; ²Methodist Hospital, Houston, TX; ³Lenox Hill Hospital, New York, NY; ⁴Regional Medical Center, Appleton, WI; ⁵University of Arkansas for Medical Sciences, Little Rock, AR; ⁶The Heart Hospital Baylor Plano, Plano, TX

T2. Hybrid Repair of Extensive Aortic Arch Disease with Supra-Aortic Debranching and Endovascular Stent Graft Repair: Early and Long-Term Outcomes

Qian Chang, Yan Li, Xiangyang Qian, Xiaogang Sun, Cuntao Yu, Haitao Zhang
National Heart Center and Fuwai Hospital, Beijing, China

TEVAR 2016

*Wilson Y. Szeto, *University of Pennsylvania, Philadelphia, PA*

T3. Early Clinical Outcomes of a Novel Self-Expanding Transapical Transcatheter Aortic Valve Bioprosthesis in Patients at Higher Risk for Coronary Obstruction: First North American Experience

Michael W. A. Chu, Katie L. Losenno, Pantelis Diamantouros, Rodrigo Bagur, Patrick Teefy, Jill J. Gelinas, *Bob Kiaii
University of Western Ontario, London, ON, Canada

T4. Radiation Exposure During Transcatheter Aortic Valve Replacement: What Cardiac Surgeons Need to Know

Alex Aquino, Alan Zajarias, Spencer Melby, Nishath Quader, Brian Lindman, John Lasala, *Hersh Maniar
Washington University, St. Louis, MO

So You Want to Start a TMVR or TAVR Program: Necessary Tools and Approaches for Clinical and Fiscal Success

*Vinod H. Thourani, *Emory University, Atlanta, GA*

T5. Feasibility of Transcatheter Mitral Valve Replacement Using a Beating Heart Transapical Delivery System in Human Beings

Robert S. Farivar, Wesley Pedersen, Paul Sorajja, Richard Bae, *Benjamin Sun
Abbott Northwestern Hospital, Minneapolis, MN

T6. Up to One Year Follow Up Results of Transfemoral System for Mitral Valve Reconstruction Multicentre Trial

Paolo Denti¹, Alec Vahanian², Francesco Maisano³, Karl-Heinz Kuck⁴, *Ottavio Alfieri¹, Antonio Colombo¹, Stephan Baldus⁵, Georg Nickenig⁶

¹*San Raffaele University Hospital, Milan, Italy*; ²*Bichat Hospital, Paris, France*;

³*University Hospital Zurich, Switzerland, Zurich, Switzerland*; ⁴*St. George Hospital Hamburg, Germany, Hamburg, Germany*; ⁵*University Hospital Köln, Germany, Köln, Germany*; ⁶*University Hospital Bonn, Germany, Bonn, Germany*

8:40 PM Adjourn

TUESDAY, MAY 17

* AATS Member ♦ AATS New Member

TUESDAY MORNING, MAY 17, 2016

7:00 AM **General Thoracic Emerging Technologies and Techniques Forum** Room 337, BCC
5 minute presentation, 5 minute discussion

Moderators: *Steven R. DeMeester and *Henning A. Gaissert

T7. Preliminary Experience with Per-Oral Endoscopic Myotomy by a Thoracic Surgical Service

Lara W. Schaheen¹, David D. Odell², Ernest G. Chan¹, ♦Jonathan D'Cunha¹, Ryan Levy¹, Omar Awais¹, Katie Nason¹, Inderpal Sarkaria¹, *James D. Luketich¹

¹University of Pittsburgh, Pittsburgh, PA; ²Northwestern University, Chicago, IL

Complex Airway Reconstruction In the Era of Biologics Stem Cells and 3D Printers

*Henning A. Gaissert, Massachusetts General Hospital, Boston, MA

T8. A Novel System for Identifying Pulmonary Air Leaks with an Inhaled Marker

*Joseph Friedberg

University of Maryland, Baltimore, MD

T9. Management of Complex Airway Defects with Bioprosthetic Materials

Brooks Van Udelman¹, Jessica Eaton², Ashok Muniappan¹, Christopher R. Morse¹,

*Cameron Dorrans Wright¹, *Douglas James Mathisen¹

¹Massachusetts General Hospital, Boston, MA; ²University of Louisville, Louisville, KY

T10. Using 3D BioPrinting As a Tool for Tracheal Segment Tissue Engineering

Todd A. Goldstein, Daniel Grande, Benjamin Smith, Lee P. Smith, David Zeltsman

North Shore – LIJ Health System, Manhasset, NY

Image Guidance in Thoracic Surgery: Ready for Prime Time?

Daniela Molena, Memorial Sloan Kettering Cancer Center, New York, NY

T11. The Use of Electromagnetic Navigational Bronchoscopic Guidance for Intraoperative Localization of Nonpalpable Small Lung Nodules

♦Abbas E. Abbas, Sagar Kadakia, Vishu Ambur *Larry R. Kaiser

Temple University, Philadelphia, PA

T12. Thoracoscopic Anatomic Lung Sub-Segmentectomy Using Three-Dimensional Computed Tomography Simulation Without Tumor Markings for Non-Palpable, Small-Size Lung Nodules

Hirohisa Kato, Hiroyuki Oizumi, Makoto Endoh, Jun Suzuki, Hikaru Watarai,

Akira Hamada, Katsuyuki Suzuki, Mitsuaki Sadahiro

Yamagata University, Yamagata-shi, Japan

T13. A Novel Minimally Invasive Near-Infrared Thoracoscopic Localization Technique of Small Pulmonary Nodules: A Phase I Feasibility Trial

Hideki Ujiie, Tatsuya Kato, Hsin-Pei Hu, Priya Patel, Hironobu Wada, Daiyoon Lee, Kosuke Fujino, Robert Weersink, Elsie Nguyen, ♦Marcelo Cypel, Andrew Pierre, *Marc de Perrot, *Gail Darling, *Thomas K. Waddell, *Shaf Keshavjee, *Kazuhiro Yasufuku

University of Toronto, Toronto, ON, Canada

Late-Breaking Clinical Trial

LB4. Phase 1 Clinical Trial Evaluating the Safety of Pulmonary Artery Branch Sealing Using an Ultrasonic Energy Vessel-Sealing Device in Open Pulmonary Lobectomy

Eric Goudie, Vicky Thiffault, Adeline Jouquan, Edwin Lafontaine, *Pasquale Ferraro, ♦Moishe Liberman

Centre Hospitalier de l'Universite de Montreal, Montreal, QC, Canada

Invited Discussant:

8:40 PM Adjourn

TUESDAY, MAY 17

TUESDAY MORNING, MAY 17, 2016

7:00 AM Video Session
10 minute presentation

Room 340, BCC

Moderators: *Mark S. Bleiweis, *Subroto Paul and *Vivek Rao

V1. Posterior Airway Stabilization Using Polypropylene Mesh for Tracheobronchomalacia

Tovy Haber Kamine, Jennifer L. Wilson, *Sidhu P. Gangadharan

Beth Israel Deaconess Medical Center, Boston, MA

V2. Robotic-Assisted Resection of Superior Sulcus Ganglioneuroma

Khalid Alshehri, Adil Ayub, Ahmad Altaweel, Chyun-Yin Huang, Norberto Santana-Rodriguez, Sadiq Rehmani, Adnan M. Al-Ayoubi, Wissam Raad, Faiz Bhora

Mount Sinai Health System, New York, NY

V3. Trans-Cervical Mediastinal Cyst Resection with a Video Mediastinoscope

Eric Goudie, ♦Moishe Liberman

University of Montreal, Montreal, QC, Canada

V4. Robotic Morgagni Hernia Repair

Jennifer L. Philip, Ryan Macke

University of Wisconsin, Madison, WI

V5. Right Ventricular Free Wall Teratoma Requiring Surgical Intervention Secondary to Refractory Ventricular Tachycardia

Awais Ashfaq, Tabitha Moe, Justin Ryan, Paul Dickman, Steve Taylor, Daniel Velez, Robert Puntel, Andrew Papez, John Nigro

Mayo Clinic, Phoenix, AZ

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V6. Simplifying the Repair of Barlow's Disease: A Solution to Excess Leaflet Tissue Without Resection

Sabet W. Hashim, Rajesh B. Sekar, Peter W. Hashim, Roland Assi, Irena Vaitkeviciute
Yale University, New Haven, CT

V7. Total Endovascular Repair of Aortic Arch Using Inner Branched Arch Endograft

Muhammad Aftab, *Eric Roselli, ♦Douglas R. Johnston, *Matthew Eagleton
Cleveland Clinic, Cleveland, OH

V8. Approaches to Reconstruction of Severe Primary Tricuspid Valve Defects

Domenico Mazzitelli¹, Yacine Elhmidi¹, *J. Scott Rankin², Jelena Kasnar-Samprec¹, Julie Cleuziou¹, *Ruediger Lange¹

¹German Heart Center, Munich, Germany; ²Cardiothoracic Surgery Associates, Nashville, TN

V9. Modified Nikaidoh Procedure with Double-Root-Translocation

Yiqun Ding

Shenzhen Children's Hospital, Shenzhen, China

V10. One-Stage Definitive Repair for Patient with Complete Atrioventricular Septal Defect and Pulmonary Atresia with Major Aortopulmonary Collateral Arteries

Yujiro Ide, Masaya Murata, Kisaburo Sakamoto

Mt. Fuji Shizuoka Children's Hospital, Shizuoka City, Japan

8:40 PM

Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 AM

VAD/ECMO Session

Ballroom I, BCC

5 minute presentation, 7 minute discussion

Moderators: *Anelechi C. Anyanwu and *Nader Moazami

36. The Hospital Volume-Outcome Relationship for Left Ventricular Assist Device Implantation in Medicare Patients in the United States

♦Nimesh D. Desai, Danielle Savino, Fenton H. McCarthy, Peter W. Groeneveld, Katherine McDermott, Danielle Spragan, Pavan Alturi, Dale Kobrin, Christian A. Bermudez, Eduardo Rame, *Michael A. Acker

University of Pennsylvania, Philadelphia, PA

Invited Discussant: Keki Balsara

37. Novel Perspectives on Postcardiotomy Shock; New Insight to Improve Outcomes

Hiroo Takayama, Shinichi Fukuhara, Koji Takeda, Jiho Han, Scott DeRoo, Boyangi Li, Sowmyashree Sreekanth, Veli Topkara, Arthur Garan, Paolo Colombo, Melana Yuzefpolskaya, *Paul Kurlansky, *Yoshifumi Naka

Columbia University, New York, NY

Invited Discussant: ♦Edward G. Soltesz

38. Central Cannulation As a Viable Alternative to Peripheral Cannulation in Extracorporeal Membrane Oxygenation

David Ranney, Ehsan Benrashid, James Meza, Jeffrey Keenan, Mani Daneshmand
Duke University, Durham, NC

Invited Discussant: *Michael S. Firstenberg

39. Bridge to Durable Left Ventricular Assist Device Using Various Short-Term Mechanical Circulatory Support Devices for Patients with an INTERMACS I Profile

Koji Takeda, Hiroo Takayama, A. Reshad Garan, Veli K. Topkara, Jiho Han,
*Paul Kurlansky, Melana Yuzefpolskaya, Paulo C. Colombo, *Yoshifumi Naka
Columbia University, New York, NY

Invited Discussant: *Ashish S. Shah

Mechanical Circulatory Support in High Risk Cardiac Surgery – Back-Up, Adjunct, Bailout and Alternative

*Lyle D. Joyce, Mayo Clinic, *Rochester, MN*

40. Emergency Implantation of Durable Left Ventricular Assist Devices As Primary Therapy for Refractory Cardiogenic Shock

Amit Pawale, Yosef Schwartz, Sean Pinney, *David H. Adams, *Anelechi C. Anyanwu
Mount Sinai Medical Center, New York, NY

Invited Discussant: Scott C. Silvestry

41. Left Ventricular Failure After Surgery to Correct Right Ventricular Pressure Overload in Pulmonary Hypertension Patients

Tom Verbelen, Alexander Van De Bruaene, Bjorn Cools, *Dirk Van Raemdonck,
Marion Delcroix, Filip Rega, Bart Meyns
University Hospitals Leuven, Leuven, Belgium

Invited Discussant: *Michael M. Madani

42. Continuous Flow LVAD Minimally Invasive Implantation in INTERMACS Class Score I-II Patients: The Evolution of Surgical Technique in a Single Centre Experience

Alvise Guariento, Lorenzo Bagozzi, Jonida Bejko, Massimiliano Carrozzini,
Marina Comisso, Giacomo Bortolussi, Michele Gallo, Vincenzo Tarzia, Tomaso Bottio,
*Gino Gerosa

University of Padua, Padova, Italy

Invited Discussant: *Walter P. Dembitsky

8:40 AM Adjourn

TUESDAY, MAY 17

* AATS Member ♦ AATS New Member

TUESDAY, MAY 17, 2016

8:45 AM **Plenary Scientific Session** Hall E, BCC
8 minute presentation, 12 minute discussion

Moderators: *Joseph S. Coselli and *Marc R. Moon

43. External Stenting: A Reliable Technique to Relieve Airway Obstruction in Small Children

Makoto Ando¹, Yuuzou Nagase², Hisaya Hasegawa³, Yukihiro Takahashi¹

¹Sakakibara Heart Institute, Tokyo, Japan; ²Ginza Heart Clinic, Tokyo, Japan;

³Tokyo Women's Medical University Medical Center East, Tokyo, Japan

Invited Discussant:

44. 10-Year Endpoint of RAPCO Is Reached: Clinical and Angiographic Results of a Randomised Trial of Radial Artery Versus Right Internal Thoracic Artery or Saphenous Vein for the Second Graft

*Brian F. Buxton¹, Philip A. Hayward², George Matalanis², Simon C. Moten², Mark Horrigan², Alexander Rosalion³, Jai Raman⁴, David L. Hare¹

¹University of Melbourne, Melbourne Australia; ²Ausitn Hospital, Melbourne, Australia;

³Vincent's Hospital, Melbourne, Australia; ⁴Rush University Medical Center, Chicago, IL

Invited Discussant: *Stephen E. Fremes

45. Cost-Effectiveness of Invasive Mediastinal Staging in Non-Small Cell Lung Cancer

Kasia Czarnecka-Kujawa¹, Ursula Rochau², Uwe Siebert³, Eshetu Atenafu¹,

*Gail Darling¹, *Thomas Kenneth Waddell¹, Andrew Pierre¹, *Marc De Perrot¹,

*Marcelo Cypel¹, *Shaf Keshavjee¹, *Kazuhiro Yasufuku¹

¹University of Toronto, Toronto, ON, Canada; ²Institute of Public Health, Hall, Austria;

³UMIT – University for Health Sciences, Medical Informatics and Technology, Hall, Austria

Invited Discussant: *Felix G. Fernandez

46. Impact of Protected Cardiothoracic Surgical Research Time During Residency on Careers in Academic Surgery

J. Trent Magruder¹, Joshua C. Grimm¹, Todd C. Crawford¹, *Ashish S. Shah¹,

*Timothy J. Gardner², *Bruce A. Reitz¹, J. Alexander Haller¹, *Vincent C. Gott¹,

*Duke E. Cameron¹, *William A. Baumgartner¹

¹Johns Hopkins, Baltimore, MD; ²Christiana Care Health Services, Newark, DE

Invited Discussant: *Richard Lee

10:05 AM **Coffee Break in The Exhibit Hall**

10:10 AM – 10:30 AM

AATS/ISHLT Guidelines for Cardiac Transplantation and Mechanical Circulatory Support Exhibit Hall, AATS CT Theater I, Booth #103
Not for Credit

*Ranjit John, University of Minnesota

*James K. Kirklin, Children's Hospital of Alabama

Panelists: *John V. Conte, Johns Hopkins Hospital

*Scott C. Silvestry, Florida Hospital Transplant Institute

10:30 AM **Award Presentations** Hall E, BCC

10:40 AM **Plenary Scientific Session** Hall E, BCC
8 minute presentation, 12 minute discussion

Moderators: *Thoralf M. Sundt, III and *Marc R. Moon

47. Mitral Valve Surgery in the US Veterans Administration Health System: 10-Year Outcomes and Trends

*Faisal G. Bakaeen¹, A. Laurie Shroyer², *Marco A. Zenati³, *Vinay Badhwar¹²,
*Vinod H. Thourani⁵, *James S. Gammie⁶, *Rakesh M. Suri⁷, *A. Marc Gillinov⁷,
*Joseph F Sabik, III⁷, Danny Chu⁴, Laura A. Graham⁸, Mary T. Hawn⁹, *G. Hossein
Almassi¹⁰, Lorraine D. Cornwell¹, *Frederick L. Grover¹¹, *Todd K. Rosengart¹,
Shuab Omer¹

¹Baylor College of Medicine and Texas Heart Institute, Houston, TX; ²Northport VA Medical Center and Stony Brook School of Medicine, Stony Brook, NY; ³The West Roxbury VAMC and Harvard Medical School, Boston, MA; ⁴University of Pittsburgh, Pittsburgh, PA; ⁵Emory University, Atlanta, GA; ⁶University of Maryland, Baltimore, MD; ⁷Cleveland Clinic Foundation, Cleveland, OH; ⁸University of Alabama at Birmingham, Birmingham, AL; ⁹Stanford University, Stanford, CA; ¹⁰Medical College of Wisconsin and VA Medical Center, Milwaukee, WI; ¹¹University of Colorado Denver, Aurora, CO; ¹²West Virginia University, Morgantown, WV

Invited Discussant: *David H. Adams

48. Towards Making Lung Transplantation a Semi-Elective Procedure: Outcomes Following Clinical Lung Transplantation with Over Twelve Hours of Preservation Time

Jonathan C. Yeung, *Kazuhiro Yasufuku, *Marc de Perrot, Andrew F. Pierre,
*Thomas K. Waddell, *Shaf Keshavjee, ♦Marcelo Cypel
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Bartley P. Griffith

49. Providing Cardiothoracic Services in 2035: Signs of Trouble Ahead

*Susan Moffatt-Bruce, *Juan Crestanello, David Way, *Thomas Williams
The Ohio State University, Columbus, OH

Invited Discussant: *John S. Ikonmidis

11:40 AM	Honored Guest Lecture	Hall E, BCC <i>Not for Credit</i>
Brian Kelly, Notre Dame Head Football Coach		

12:30 PM **Adjourn for Lunch in the Exhibit Hall**

TUESDAY, MAY 17

* AATS Member ♦ AATS New Member

12:45 PM – 1:35 PM

Cardiac Studies in Progress

Exhibit Hall, AATS CT Theater II, Booth #181

5 minute presentation, 7 minute discussion

Not for Credit

Chair: *Thomas G. Gleason

Panelists: *John S. Ikonmidis and *J. Michael DiMaio

LB5. The COMMENCE FDA Clinical Trial: A Benchmark for Isolated Aortic Valve Replacement in Low Risk Patients

*John D. Puskas¹, *Joseph E. Bavaria², *Lars G. Svensson³, *Eugene H Blackstone³, *Bartley P. Griffith⁴, *James S. Gammie⁴, David A. Heimansohn⁵, Jerzy Sadowski⁶, Jacek Rozanski⁷, *Douglas R. Johnston³, *Leonard N. Girardi⁸, *Charles T. Klodell⁹, Mubashir M. Mumtaz¹⁰, Francis G. Duhay¹¹, *Craig R. Smith¹²

¹Mount Sinai Beth Israel, New York, NY; ²University of Pennsylvania, Philadelphia, PA; ³Cleveland Clinic Foundation, Cleveland, OH; ⁴University of Maryland, Baltimore, MD; ⁵St. Vincent Heart Center, Indianapolis, IN; ⁶Jagiellonian University, Krakow, Poland; ⁷Instytut Kardiologii Warsaw, Poland; ⁸New York Weill Cornell Medical Center, New York, NY; ⁹University of Florida, Gainesville, FL; ¹⁰Pinnacle Health, Harrisburg, PA; ¹¹Edwards Lifesciences, Irvine, CA; ¹²Columbis Presbyterian Medical Center, New York, NY

LB6. One Year Clinical Outcomes After Rapid Deployment Aortic Valve Replacement – FOUNDATION REGISTRY: A Real World Series of 518 Patients

*Mattia Glauber¹, Günther Laufer², Alfred Kocher², Mauro Cassese³, Marco Solinas⁴, Francesco Alamanni⁵, Gianluca Polvani⁵, Bruno Podesser⁶, Jose Ignacio Aramendi⁷, Jose Arribas⁸, Olivier Bouchot⁹, Ugo Livi¹⁰, Rainald Seitelberger¹¹, Kim Terp¹², Christophe Giot¹³, Christopher Young¹⁴

¹Hospital San Raffaele, Milano, Italy; ²Allgemeines Krankenhaus Wien, Wien, Austria; ³Casa di Cura Santa Maria, Bari, Italy; ⁴Ospedale Del Cuore, Massa, Italy; ⁵Centro Cardiologico Monzino, University of Milan, Milano, Italy; ⁶Landeskrankenhaus St. Pölten, St. Pölten, Austria; ⁷Hospital Universitario de Cruces, Barakaldo, Spain; ⁸Hospital Universitario Virgen de La Arrixaca, Murcia, Spain; ⁹CHU du Bocage, Dijon, France; ¹⁰University Hospital Santa Maria della Misericordia, Udine, Italy; ¹¹Salzburger Universitätsklinikum, Salzburg, Austria; ¹²Aarhus University Hospital Skejby, Aarhus, Denmark; ¹³Edwards Lifesciences, Nyon, Switzerland; ¹⁴St. Thomas' Hospital, London, United Kingdom

LB7. Operative Strategies to Reduce Cerebral Embolic Events During Coronary Artery Bypass Surgery: A Prospective Randomized Trial

*Michael E. Halkos¹, Aaron Anderson¹, Jose Binongo¹, Anthony Stringer¹, *Vinod H. Thourani¹, Omar M. Lattouf¹, *Robert A. Guyton¹, Kim T. Baio¹, Eric Sarin¹, William B. Keeling¹, N. Renee Cook¹, Katherine Carssow¹, Alexis Neill¹, *John D. Puskas²

¹Emory University, Atlanta, GA; ²Mount Sinai Beth Israel Hospital, New York, NY

LB8. A Prospective Study of External Stenting of Saphenous Vein Grafts to the Right Coronary Artery: The VEST II Study

*David P. Taggart¹, Jasmina Djordjevic, Sanaz Amin, E.K. Oikonomou, Sheena Thomas, A.M. Kampoli, Nik Sabharwal, Andrew Kelion, Keith Channon, Charis Antonaides, George Krasopoulos

University of Oxford, Oxford, United Kingdom

12:45 PM – 2:00 PM

Moderated Poster Competitions

5 minute presentation

Exhibit Hall, Aisle 600, BCC

Not for Credit

Adult Cardiac Moderated Poster Competition

Moderator: *Richard Lee, *St. Louis University*

P1. The IMPACT-CABG Trial: A Multicenter Randomized Clinical Trial of CD133+ Stem Cell Therapy During CABG for Ischemic Cardiomyopathy

*Terrence M. Yau¹, Samer Mansour², *Richard Weisel¹, Louis-Mathieu Stevens², Katherine Tsang¹, Eric Larose², Shu-Hong Li¹, Neil Spiller¹, Minh Quan Vu², Andrew Crean¹, Denis-Claude Roy², Ignacio Prieto², Ren-Ke Li¹, Nicolas Noiseux²

¹Toronto General Hospital, Toronto, ON, Canada; ²Hospital Hotel-Dieu, Montreal, QC, Canada

P2. Sternal Closure Using Rigid Plate Fixation Versus Conventional Wire Cerclage: Results from a Prospective, Randomized Multi-Center Study

*Keith B. Allen¹, *Vinod H. Thourani², *Yoshifumi Naka³, Kendra J. Grubb⁴, John Grehan⁵, Nirav Patel⁶, *T. Sloane Guy⁷, *Kevin Landolfo⁸, Marc Gerdisch⁹, Mark Bonnell¹⁰, *David J. Cohen¹

¹St. Luke's Mid America Heart Institute, Kansas City, MO; ²Emory University, Atlanta, GA; ³Columbia University Medical Center, New York, NY; ⁴University of Louisville, Louisville, KY; ⁵United Heart and Vascular Clinic, AllinaHealth, Saint Paul, MN; ⁶Lenox Hill Hospital, New York, NY; ⁷Temple University, Philadelphia, PA; ⁸Mayo Clinic, Jacksonville, FL; ⁹Franciscan St. Francis Health, Indianapolis, IN; ¹⁰University of Toledo, Toledo, OH

P3. Trends in Multi-Arterial CABG Surgery 2004–2014: A Tale of Two Continents

*Thomas A. Schwann¹, *James Tatoulis², *John D. Puskas³, *David Taggart⁴, *Paul Kurlansky⁵, *Jeffrey Jacobs⁶, *Vinod H. Thourani⁷, Sean O'Brien⁸, Amelia Wallace⁸, Milo Engoren⁹, Robert F. Tranbaugh¹⁰, Mark R. Bonnell¹, Robert H. Habib¹¹

¹University of Toledo, Toledo, OH; ²Royal Melbourne Hospital, Parkville, Australia; ³Mount Sinai Beth Israel, New York, NY; ⁴University of Oxford, Oxford, United Kingdom; ⁵Columbia University, New York, NY; ⁶Johns Hopkins University, Baltimore, MD; ⁷Emory University, Atlanta, GA; ⁸Duke University, Durham, NC; ⁹University of Michigan, Ann Arbor, MI; ¹⁰Cornell University, New York, NY; ¹¹American University of Beirut, Beirut, Lebanon

P4. The Risk of Reoperative Cardiac Surgery in Radiation Induced Valvular Disease

Julius I. Ejiogor, Anju Nohria, Yamine Maroun, Siobhan McGurk, Anthony V. Norman, *Sary F. Aranki, Prem Shekar, *Lawrence H. Cohn, Tsuyoshi Kaneko
Brigham and Women's Hospital, Boston, MA

P5. Prosthesis Selection in Patients Undergoing Mitral Valve Repair for Type II Dysfunction

Naonori Kawamoto, Tomoyuki Fujita, Hiroki Hata, Yusuke Shimahara, Yuta Kume, *Junjiro Kobayashi
National Cerebral and Cardiovascular Center, Suita, Japan

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

P6. Long-Term Outcomes of Surgery for Infective Endocarditis: A Single-Center Experience of 801 Patients

Sameh M. Said, Zaid M. Abdelsattar, *Hartzell V. Schaff, ♦Kevin L. Greason,
*Richard C. Daly, *Alberto Pochettino, *Lyle D. Joyce, *Joseph A. Dearani
Mayo Clinic, Rochester, MN

P7. Mid-Term Results of Mitral Valve Repair Using Flexible Bands Versus Complete Rings in Patients with Degenerative Mitral Valve Disease: A Prospective Randomized Study

Alexander V. Afanasyev, Alexander V. Bogachev-Prokophiev, Sergei I. Zheleznev,
Vladimir M. Nazarov, Ravil M. Sharifullin, Alexander M. Karas'kov
Novosibirsk State Research Institute of Circulation Pathology, Novosibirsk, Russian Federation

P8. A Predictive Model for Early Outcome of Surgical Treatment of Heart Valve Infective Endocarditis: The Italian EndoSCORE

Michele Di Mauro, Guglielmo M. Actis Dato, Pasquale Santè, Fabio Barili,
Sandro Gelsomino, Alessandro Della Corte, Antonio Carrozza, Ester Della Ratta,
Carlo Fino, Diego Cugola, Roger Devotini, Riccardo Casabona, *Francesco Santini,
Roberto Scrofani, Carlo De Vincentiis, Andrea Biondi, Cesare Beghi, Alberto Pozzoli,
Francesco Nicolini, *Davide Pacini, Giacomo Ravenni, Roberto Lorusso, Gabriele Di
Giammarco, Daniele Marinelli, Emmanuel Villa, Giovanni Troise, Domenico Paparella,
Vito Margari, Francesco Tritto, Giuseppe Scarscia, Salvatore Zaccaria, Attilio Renzulli,
Giuseppe Serraino, Giovanni Mariscalco, *Alessandro Parolari, Giannantonio Nappi
Italian Group of Research for Outcome in Cardiac Surgery (GIROC), Rome, Italy

P9. A Single Center's Experience with Pacemaker Implantation After the Cox Maze Procedure for Atrial Fibrillation

*Niv Ad, Sari Diana Holmes, Deborah J. Shuman, Deborah Lamont
Inova Heart and Vascular Institute, Falls Church, VA

P10. Permanent Pacemaker After Surgical and Catheter Atrial Fibrillation Ablation: Incidence, Indications and Outcomes

Stephane Leung¹, Wai Sang¹, *Patrick M. McCarthy¹, Jane Kruse², Adin-Cristian Andrei²,
Adam Iddriss¹, *Richard Lee³, *S. Chris Malaisrie¹, Rachel Kaplan¹, Rod S. Passman¹
¹Northwestern University, Chicago, IL; ²Bluhm Cardiovascular Institute, Northwestern
Medicine, Chicago, IL; ³St. Louis University School of Medicine, St. Louis, MO

P11. Cardiometabolic Syndrome in TAVR and SAVR

Lillian L. Tsai, Hanna A. Jensen, Jose . Condado, Yi Lasanajak, Omar M. Lattouf,
Vasilis Babaliaros, Eric Sarin, Chandan Devireddy, Bradley Leshnower, James Stewart,
*Edward Chen, Kreton Mavromatis, *Michael Halkos, Peter C. Block, *Robert A. Guyton,
Patricia Keegan, Amy Simone, Jessica Forcillo, *Vinod H. Thourani
Emory University, Atlanta, GA

P12. Predicting Long-Term Outcomes After Complex Mitral Valve Repair: A Single Center 15-Year Experience

James M. Tatum, Michael E. Bowdish, Wendy J. Mack, Adrienne Quinn, Dawn Hui, Mark L. Barr, Fernando Fleischman, Amy Hackmann, *Craig Baker, *Robbin G. Cohen, Mark J. Cunningham, *Vaughn A. Starnes
University of Southern California, Los Angeles, CA

Congenital Heart Disease Moderated Poster Competition

Moderator: *Carl L. Backer, *Lurie Children's Hospital*

P14. Outcomes of Multistage Palliation of Patients with Single Ventricle and Atrioventricular Septal Defect

*Bahaaldin AlSoufi, Courtney McCracken, Subhadra Shashidharan, *Kirk Kanter, *Brian Kogon
Emory University, Atlanta, GA

P15. Cognitive, Neuropsychological and Social Status Is Impaired Two Decades After Neonatal Arterial Switch Operation

David Kalfa¹, Leila Kasmi², Michele Montreuil², Nikoleta Geronikola², Virginie Lambert³, Eleonora Murzi², *Emre Belli⁴, Damien Bonnet⁵
¹*Columbia University, New York, NY*; ²*Université Paris, Saint Denis, France*; ³*Université Paris Sud, Le Plessis Robinson, France*; ⁴*Institut Jacques Cartier, Massy, France*; ⁵*Université Paris Descartes, Sorbonne Paris Cité, Paris, France*

P16. Univentricular Pathway for Severe Neonatal Ebstein Anomaly and Tricuspid Dysplasia Is Superior to Total Biventricular Approach at Late Follow-Up

Jack Luxford¹, Nitin Arora², Julian Ayer², Charlotte Verrall², *Yves D'Udekem³, Gary Sholler², David Winlaw²
¹*University of Sydney, Sydney, Australia*; ²*Children's Hospital at Westmead, Sydney, Australia*; ³*The Royal Children's Hospital, Parkville, Australia*

P17. Detrimental Effects of High Flow Mechanical Assistance of Systemic Ventricle in a Fontan Circulation-Insights from a Unique Ex-Vivo Model

Pranava Sinha¹, Nina Deutsch¹, Dingchao He¹, Mark Nuszkowski¹, Erin Montague¹, Gerald Mikesell¹, Karthik Ramakrishnan¹, Edem Ziadinov¹, David Zurakowski², *Richard Jonas¹
¹*Children's National Medical Center, Washington, DC*; ²*Harvard Catalyst, Boston, MA*

P18. Long-Term Results of Anatomical Correction for Congenitally Corrected Transposition of the Great Arteries: A 19-Year Experience

Christian P. Brizard, Alice Lee, Tyson A. Fricke, *Yves d'Udekem, *Igor E. Konstantinov, Johann Brink, Michael M.H. Cheung
Royal Children's Hospital, Parkville, Australia

P19. Re-Intervention Type and Rates Following Neonatal Tetralogy of Fallot (TOF) Repair Vary by Operative Intervention on the Right Ventricular Outflow Tract (RVOT)

Shyamasundar Balasubramanya, Michele J. Borisuk, Aditya K. Kaza, *Frank Pigula, Hua Liu, Sitaram Emani, *Pedro J. del Nido, Christopher W. Baird
Boston Children's Hospital, Boston, MA

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

P20. Twenty-Five Year Outcomes of the Lateral Tunnel Fontan Procedure

Thomas G. Wilson¹, William Y. Shi¹, Ajay J. Iyengar¹, David S. Winlaw², Rachael L. Cordina³, Gavin R. Wheaton⁴, Andrew Bullock⁵, Thomas L. Gentles⁶, Robert G. Weintraub¹, Robert N. Justo⁷, Leeanne E. Grigg⁸, Dorothy J. Radford⁹, *Yves d'Udekem¹

¹Royal Children's Hospital, Parkville, Australia; ²The Children's Hospital at Westmead, Sydney, Australia; ³Royal Prince Alfred Hospital, Sydney, Australia; ⁴Women's and Children's Hospital, Adelaide, Australia; ⁵Princess Margaret Hospital for Children, Perth, Australia; ⁶Starship Children's Hospital, Auckland, New Zealand; ⁷Mater Children's Hospital, Brisbane, Australia; ⁸Royal Melbourne Hospital, Parkville, Australia; ⁹The Prince Charles Hospital, Brisbane, Australia

P21. Predictors of Successful Biventricular Repair After Hybrid Treatment for Borderline Hypoplastic Left Heart

Can Yerebakan¹, Uygar Yörüker¹, Klaus Valeske¹, Hatem Elmontaser¹, Josephine Murray¹, Anita Windhorst², Josef Thul¹, Matthias Müller¹, Dietmar Schranz¹, Hakan Akintürk¹

¹Pediatric Heart Center, Giessen, Germany; ²Justus-Liebig-University, Giessen, Germany

P22. Outcomes of Univentricular Repair in Children with Unbalanced Atrio-Ventricular Septal Defect

Edward Buratto, Xin Tao Ye, Robert G. Weintraub, *Yves d'Udekem, Christian P. Brizard, *Igor E. Konstantinov

The Royal Children's Hospital, Parkville, Australia

P23. Exercise Restriction Is Not Associated with Increasing Body Mass Index Over Time in Patients with Coronary Arteries of Anomalous Aortic Origin

James M. Meza¹, Matthew Elias², Travis Wilder³, James E. O'Brien⁴, Richard W. Kim⁵, *Constantine Mavroudis⁶, *William G. Williams¹, Julie Brothers², Meryl Cohen², Brian W. McCrindle¹

¹The Hospital for Sick Children, Toronto, ON, Canada; ²The Children's Hospital of Philadelphia, Philadelphia, PA; ³University of California San Diego, La Jolla, CA; ⁴Children's Mercy Hospital, Kansas City, MO; ⁵Children's Hospital of Los Angeles, Los Angeles, CA; ⁶Florida Hospital for Children, Orlando, FL

P24. Oral Thyroxin Supplementation in Infants Undergoing Cardiac Surgery: A Double Blind Randomized Clinical Trial

Sachin Talwar, Amolkumar Bhoje, Rajesh Khadgawat, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan

All India Institute of Medical Sciences, New Delhi, India

General Thoracic Moderated Poster Competition

Moderator: *Jay M. Lee, University of California, Los Angeles

P25. Risk Factors for Progression of Ground Glass Opacities in Patients with Resected Pulmonary Adenocarcinoma

Rebecca W. Gao, *Mark F. Berry, Amanda Khuong, Joel W. Neal, Leah M. Backhus, *Joseph B. Shrager

Stanford University, Stanford, CA

P26. Prognostic Impact of the Findings on Thin-Section Computed Tomography in Patients with Subcentimeter Non-Small Cell Lung Cancer

Aritoshi Hattori, Kenji Suzuki, Takeshi Matsunaga, *Kazuya Takamochi, Shiaki Oh
Juntendo University, Tokyo, Japan

P27. A Clinical Prediction Model for Prolonged Air Leak After Pulmonary Resection

Adam Attar, Daniel G. Winger, *James D. Luketich, Inderpal S. Sarkaria, *Neil A. Christie, Katie S. Nason
University of Pittsburgh, Pittsburgh, PA

P28. Prediction of Lepidic Predominant Clinical-Stage IA Lung Adenocarcinoma with Radiological Pure-Solid Appearance for Possible Indications of Sublobar Resection

Aritoshi Hattori, Kenji Suzuki, Takeshi Matsunaga, *Kazuya Takamochi, Shiaki Oh
Juntendo University, Tokyo, Japan

P29. Evaluation of Acute and Chronic Pain Outcomes After Robotic, VATS, or Open Lobectomy

Sebastian Thomas Kwon, Lili Zhao, Rishindra Reddy, William Lynch, *Andrew Chang, Philip Carrott, *Mark Orringer, Chad Brummett, ♦Jules Lin
University of Michigan, Ann Arbor, MI

P30. Analytic Morphomics Predict Outcomes After Lung Volume Reduction Surgery

♦Jules Lin, William B. Weir, Tyler Grenda, Peng Zhang, John Donkersloot, Binu Enchakalody, Brian Derstine, Joshua Underhill, Steven H. Sun, Rishindra M. Reddy, *Andrew C. Chang, Stewart C. Wang
University of Michigan, Ann Arbor, MI

P31. Accuracy in Predicting Stage I Non-Small Cell Lung Cancer in CALGB 140503 (Alliance)

*Leslie Kohman¹, Lin Gu², *Nasser Altorki³, Linda Veit¹, Xiaofei Wang²
¹SUNY, Syracuse, NY; ²Duke University, Durham, NC; ³Cornell University, New York, NY

P32. Treatment of Stage I Non-Small Cell Lung Cancer: What's Trending?

Puja M. Shah¹, Timothy L. Mcmurry¹, Pamela Samson², Clifford G. Robinson², James M. Isbell¹, *Benjamin D. Kozower¹
¹University of Virginia, Charlottesville, VA; ²Washington University, St. Louis, MO

P33. CT-Guided Fine Needle Aspiration Biopsy Performed by Thoracic Surgeons: A Paradigm Shift in Image-Guided Thoracic Procedures

Seth L. Welborn, Katie S. Nason, *Arjun Pennathur, Omar Awais, *Neil A. Christie, *James D. Luketich, *Matthew J. Schuchert
University of Pittsburgh, Pittsburgh, PA

P34. Outcome of Various Transplant Procedures (Single, Sparing, Inverted) in Living-Donor Lobar Lung Transplantation

*Hiroshi Date, Akihiro Aoyama, Kyoko Hijiya, Hideki Motoyama, Tomohiro Handa, Hideyuki Kinoshita, Shiro Baba, Toshiyuki Mizota, Kenji Minakata, Toyofumi F. Chen-Yoshikawa
Kyoto University, Kyoto, Japan

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

P35. Intraoperative Use of Taurolidine In Cystic Fibrosis Patients Undergoing Lung Transplantation and Impact on Bacterial Colonization: A Propensity Score Matched Analysis

Mohamed Zeriouh¹, Nikhil P. Patil¹, Anton Sabashnikov², Prashant N. Mohite¹, Bartlomeij Zych¹, Diana Garcia¹, Achim Koch¹, Simona Soresi¹, Alexander Weymann³, Ashham Mansur⁴, Jens Wippermann², *Thorsten Wahlers², Fabio De Robertis¹, Andre R. Simon¹, Aron-Frederik Popov¹

¹Royal Brompton and Harefield Hospital, Middlesex, Harefield, London, United Kingdom; ²University Hospital of Cologne, Cologne, Germany; ³University of Heidelberg, Heidelberg, Germany; ⁴Georg August University, Goettingen, Germany

TUESDAY AFTERNOON, MAY 17, 2016

2:00 PM Cardiothoracic Surgical Trials Network: Implications for Clinical Practice Hall E, BCC

Introduction to CTSN and Its Trials

Annetine C. Gelijns, *Icahn School of Medicine at Mount Sinai*

Power and Pitfalls of Randomized Studies in Surgery

*Thoralf M. Sundt, III, *Massachusetts General Hospital*

Severe Ischemic MR: Replace or Repair?

*Michael A. Acker, *University of Pennsylvania*

Invited Discussant: *Tirone E. David, *University of Toronto*

Surgical Repair of Ischemic MMR in CABG Patients: Implications for Practice?

*Robert E. Michler, *Montefiore-Einstein Heart Center*

Invited Discussant: *Michael A. Borger, *Columbia University*

Panel Discussion of IMR Trials

Moderator: Patrick T. O'Gara, *Brigham & Women's Hospital*

Panelists: *Gorav Ailawadi, *University of Virginia Health System*

*Vinod H. Thourani, *Emory University*

*Richard D. Weisel, *Toronto General Hospital*

Surgical Ablation for AF in MV Surgery Patients: Risks Versus Benefits

*A. Marc Gillinov, *Cleveland Clinic Foundation*

Invited Discussant: *Ralph J. Damiano, Jr., *Washington University*

Rate Versus Rhythm Control for Post-Op AF

*Michael J. Mack, *Baylor Health Care System*

Invited Discussant: *Richard Lee, *St. Louis University*

Panel Discussion of Atrial Fibrillation Trials

Moderator: Patrick T. O’Gara, *Brigham & Women’s Hospital*

Panelists: *Gorav Ailawadi, *University of Virginia*
*Vinod H. Thourani, *Emory University*
*Richard D. Weisel, *Toronto General Hospital*

Future of the Network

*Eric A. Rose, *Icahn School of Medicine at Mount Sinai*

The Network and AATS

Introduction: *Timothy J. Gardner, *Christiana Care Health System*
Marissa Miller, *National Heart, Lung, and Blood Institute*

3:20 PM – 3:55 PM Coffee Break in the Exhibit Hall

TUESDAY AFTERNOON, MAY 17, 2016

3:55 PM **Adult Cardiac Surgery** Hall E, BCC
Simultaneous Scientific Session
5 minute presentation, 7 minute discussion
Moderators: *Niv Ad and *Song Wan

50. The Role of Deliberate Practice in Achieving Technical Proficiency in Coronary Anastomosis Simulation: A Randomized Study of Surgical Novices

Dawn S. Hui, *Hendrick Barner, Mark Kohn, Erica R. Holbrook, Christopher Odehnal, Aravinth Karunanandaa, *Richard Lee
St. Louis University, St. Louis, MO

Invited Discussant:

51. Longitudinal Outcomes After Surgical Repair of PostInfarction Ventricular Septal Defect

George J. Arnaoutakis¹, Sunghee KIM², J. Matthew Brennan², Brian C. Gulack², Jane M. Han³, *Fred H. Edwards⁴, *Jeffrey P. Jacobs⁵, *John V. Conte⁵
¹*University of Pennsylvania, Philadelphia, PA*; ²*Duke University, Durham, NC*; ³*Society of Thoracic Surgeons, Chicago, IL*; ⁴*University of Florida, Jacksonville, FL*; ⁵*Johns Hopkins Hospital, Baltimore, MD*

Invited Discussant: *Hossein Almassi

Late-Breaking Clinical Trial

52. Is Subvalvular Repair Worthwhile in Severe Ischemic Mitral Regurgitation? Results from a Randomized Clinical Study

Francesco Nappi¹, Cristiano Spadaccio², Antonio Nenna³, Mario Lusini³, Massimo Chello³, Christophe Acar⁴

¹*Centre Cardiologique du Nord, Paris, France*; ²*Golden Jubilee National Hospital, Glasgow, United Kingdom*; ³*University Campus Bio-Medico, Rome, Italy*; ⁴*Hopital La Pitie Salpetriere, Paris, France*

Invited Discussant: *Manuel J. Antunes

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

53. Infective Endocarditis in Dialysis Patients: Is It Worth Operating?

Sajjad Raza, Asif Ansari, Jeevanantham Rajeswaran, Amr Arafat, Matteo Trezzi,
Syed T. Hussain, Haris Riaz, Sunil Panwar, Sevag Demirjian, Thomas Fraser,
*Joseph F. Sabik, *Eugene H. Blackstone, *Gosta B. Pettersson
Cleveland Clinic, Cleveland, OH

Invited Discussant: *Frank W. Sellke

54. Long-Term Outcome of Total Arterial Myocardial Revascularization Versus Conventional Coronary Artery By-Pass in Diabetic and Non Diabetic Patients: A Propensity-Match Analysis

*Claudio Muneretto, Lorenzo Di Bacco, Gianluigi Bisleri, Laura Giroletti,
Alberto Repossini
University of Brescia, Brescia, Italy

Invited Discussant: *John D. Puskas

55. Trends in 30 Day Readmission After CABG in the Medicare Population: Longitudinal Analysis Over 13 Years

Kathleen Kwedar, Christian McNeely, Stephen Markwell, Christina Vassileva
Southern Illinois University, Springfield, IL

Invited Discussant: *Jennifer S. Lawton

56. The Cox-Maze IV Procedure for Atrial Fibrillation Has Similar Efficacy for Rheumatic and Degenerative Mitral Valve Disease

Jonathan E. Labin, Nowrin Haque, Laurie A. Sinn, Richard B. Schuessler, *Marc R. Moon,
*Hersh S. Maniar, Spencer J. Melby, *Ralph J. Damiano, Jr.
Washington University, St. Louis, MO

Invited Discussant: *Vinay Badhwar

Late-Breaking Clinical Trial

LB9. Long-Term Follow-Up at 8 Years of the Clopidogrel After Surgery for Coronary Artery Disease Double-Blind, Randomized, Placebo-Controlled Trial

Ali Hage¹, Pierre Voisine¹, Fernanda Erthal², David Glineur², Benjamin Chow²,
Hugo Tremblay¹, Jacqueline Fortier², Gifford Ko², Dai Une², Michael Farkouh³,
Thierry G. Mesana², Michel LeMay², ♦Alexander Kulik⁴, *Marc Ruel²

¹Quebec Heart and Lung Institute, Quebec, QC, Canada; ²University of Ottawa Heart Institute, Ottawa, ON, Canada; ³University Health Network, Toronto, ON, Canada;

⁴Lynn Heart & Vascular Institute, Boca Raton, FL

Invited Discussant: *Sary F. Aranki

5:35 PM Executive Session, AATS Members Only

Hall E, BCC

TUESDAY AFTERNOON, MAY 17, 2016

3:55 PM **Aortic/Endovascular Surgery** Ballroom I, BCC
Simultaneous Scientific Session
5 minute presentation, 7 minute discussion

Moderators: *Anthony L. Estrera and *Steven L. Lansman

57. Deep Circumferential Annuloplasty As a Repair Adjunct in Regurgitant Bicuspid Aortic Valves with a Dilated Annulus: The Need to Address the Septum

Omar Nawaydou¹, ♦Munir Boodhwani², ♦Laurent de Kerchove¹, *Gebrine El Khoury¹

¹*Cliniques Universitaires Saint-Luc, Brussels, Belgium*; ²*University of Ottawa Heart Institute, Ottawa, ON, Canada*

Invited Discussant: *Malakh L. Shrestha

58. Cardiovascular Operations for Loeys-Dietz Syndrome: Intermediate Results

Nishant D. Patel, Todd Crawford, Jonathan T. Magruder, Diane E. Alejo, Narutoshi Hibino, Harry C. Dietz, James Black, *Luca A. Vricella, *Duke E. Cameron

Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: Michael P. Fischbein

59. Are Outcomes of Thoracoabdominal Aortic Aneurysm Repair Different in Men Versus Women?

Konstantinos Spiliotopoulos, ♦Ourania Preventza, Matt Price, Qianzi Zhang,

*Joseph Coselli, *Scott LeMaire

Baylor College of Medicine, Houston, TX

Invited Discussant: *Li-Zhong Sun

60. Natural History and Management of DeBakey Type II Aortic Dissection

Harleen K. Sandhu, Kristofer M. Charlton-Ouw, Robert D. Rice, Charles C. Miller, III,

Rana O. Afifi, *Hazim J. Safi, *Anthony L. Estrera

University of Texas Health Science Center, Houston, TX

Invited Discussant: *S. Chris Malaisrie

61. Isolated Aortic Valve Repair in Bicuspid and Tricuspid Valve Morphology

Diana Aicher, Lena Winter, Ulrich Schneider, Christopher Hofmann, Janine Scheibel, Hans-Joachim Schäfers

University Hospital Homburg/Saar, Homburg, Germany

Invited Discussant: *Himanshu J. Patel

62. Reoperative Aortic Root Replacement: Clinical Outcomes in a Contemporary Complex Series Following Previous Aortic and/or Cardiac Surgery

Jiro Esaki¹, Bradley G. Leshnower², Jose N. Binongo², Yi Lasanajak², LaRonica McPherson²,

*Michael E. Halkos², *Vinod H. Thourani², *Robert A. Guyton², *Edward P. Chen²

¹*Otsu Red Cross Hospital, Otsu, Japan*; ²*Emory University, Atlanta, GA*

Invited Discussant: *Anthony L. Estrera

TUESDAY, MAY 17

*AATS Member ♦AATS New Member

63. Does the Status of the False Lumen Impact Long-Term Outcomes and the Fate of the Residual Dissected Aorta Following Repair of DeBakey 1 Aortic Dissection?

Jolian Dahl¹, *Edward P. Chen¹, *Vinod H. Thourani¹, *Michael E. Halkos¹, W. Brent Keeling¹, Eric L. Sarin¹, Yi Lasanajak², Jose N. Binongo², *Robert A. Guyton¹, Bradley G. Leshnower¹

¹Emory University, Atlanta, GA; ²Rollins School of Public Health, Atlanta, GA

Invited Discussant: *Scott A. LeMaire

64. Computational Fluid Dynamics Simulation of the Right Subclavian Artery Cannulation

Satoshi Numata, Keiichi Itatani, Sachiko Yamazaki, Kiyoshi Doi, Keiichi Kanda, Hitoshi Yaku

Kyoto Prefectural University of Medicine, Kyoto, Japan

Invited Discussant: *Subodh Verma

5:35 PM

Executive Session, AATS Members Only

Hall E, BCC

TUESDAY AFTERNOON, MAY 17, 2016

2:00 PM

Congenital Heart Disease

Ballroom III, BCC

Simultaneous Scientific Session

8 minute presentation, 12 minute discussion

Moderators: *J. William Gaynor and *Jorge D. Salazar

Late-Breaking Clinical Trial

LB10. A Novel Bioabsorbable Vascular Graft in a Modified Fontan Procedure – the First Clinical Experience

*Leo Bockeria¹, Oleg Svanidze², Alex Kim¹, Konstantin Shatalov¹, Vladimir Makarenko¹

¹Bakoulev Center for Cardiovascular Surgery, Moscow, Russian Federation; ²Xeltis AG, Zurich, Switzerland

Invited Discussant:

65. Concept of an Expandable Cardiac Valve for Surgical Implantation in Infants and Children

Sitaram M. Emani, Breanna L. Piekarski, David Zurakowski, Christopher A. Baird, Gerald Marx, Wayne Tworetzky, Audrey C. Marshall, James E. Lock, *Pedro J. del Nido
Boston Children's Hospital, Boston, MA

Invited Discussant: *Thomas L. Spray

66. 10-Year Outcomes After Implant of Decellularized Pulmonary Allografts for RVOT Reconstruction

*John W. Brown², John D. Oswalt², Jennifer Christel Romano³, *James S. Tweddell⁴, *Pirooz Eghtesday⁵, Kent E. Ward⁶, Michael Felix Teodori⁷, John Paul Kupferschmid⁸, Donna Johnson²

¹Indiana University, Indianapolis, IN; ²Cardiothoracic and Vascular Surgeons, P.A., Austin, TX; ³University of Michigan, Ann Arbor, MI; ⁴Cincinnati Children's Hospital, Cincinnati, OH; ⁵Washington University, St. Louis, MO; ⁶University of Oklahoma, Oklahoma City, OK; ⁷Phoenix Children's Hospital, Phoenix, AZ; ⁸Methodist Children's Hospital, San Antonio, TX

Invited Discussant: *Richard A. Hopkins

67. Small Sized Conduits in the Right Ventricular Outflow Tract in Young Children: Bicuspidalized Homografts Perform Better than Xenografts

Katrien François, Katya De Groote, Kristof Vandekerckhove, Joseph Panzer, Hans De Wilde, Daniel De Wolf, Julie De Backer, Laurent Demulier, Thierry Bové
University Hospital Gent, Gent, Belgium

Invited Discussant: *John W. Brown

3:20 PM – 4:10 PM Coffee Break in the Exhibit Hall

3:30 PM – 4:00 PM

Deep Dive Session

Exhibit Hall, AATS CT Theater I, Booth #103

Moderator: *Charles D. Fraser

Not for Credit

AATS Consensus Guideline: Anomalous Coronary

Artery Origin from Wrong Sinus

*James S. Tweddell, Cincinnati Children's Hospital

68. Pulmonary Root Translocation Is an Effective Approach for Left Coronary Artery Arising Anomally from the Aorta with an Intramuscular Course in the Right Ventricle

Timothy Martens, S. Ram Kumar, Subhadra Shashidharan, *Vaughn A. Starnes
Children's Hospital Los Angeles, Los Angeles, CA

Invited Discussant: *James S. Tweddell

69. Comparison of Thoracotomy Versus Thoracoscopic Vascular Ring Division in Children and Young Adults

Melissa A. Herrin¹, David Zurakowski², Francis Fynn-Thompson¹, Christopher W. Baird¹, *Pedro J. del Nido¹, Sitaram M. Emani¹

¹Boston Children's Hospital, Harvard Medical School, Boston, MA; ²Harvard Catalyst, Boston, MA

Invited Discussant: *Carl L. Backer

70. A Common Polymorphism in the Mannose-Binding Lectin Gene MBL2 Is Associated with Poor Neurodevelopmental Outcomes Following Infant Cardiac Surgery

Ryan Robert Davies, Julia S. Barthold, Erica Sood, Yanping Wang, Edward Woodford, *Christian Pizarro

Nemours/A.I. duPont Hospital for Children, Wilmington, DE

Invited Discussant: *Jorge D. Salazar

TUESDAY, MAY 17

*AATS Member ♦ AATS New Member



71. Interrupted Arch Repair with Direct Anastomosis and Homograft Augmentation Patch: Outcome at 25 Years with a Standardised Technique

Mohammed Mohsin Uzzaman¹, Ben Davies², John Stickley¹, Natasha Khan¹, Timothy Jones¹, William Brawn¹, David Barron¹

¹Birmingham Children's Hospital, Birmingham, United Kingdom; ²Great Ormond Street Hospital, London, United Kingdom

Invited Discussant: *Jeffrey M. Pearl

5:35 PM

Executive Session, AATS Members Only

Hall E, BCC

TUESDAY AFTERNOON, MAY 17, 2016

2:00 PM

**General Thoracic Surgery
Simultaneous Scientific Session**

Ballroom IV, BCC

8 minute presentation, 12 minute discussion

Moderators: ♦Abbas E. Abbas and *David R. Jones

72. Thoroscopic Sympathectomy for Medically Refractory Recurrent Ventricular Arrhythmias

*Justin Van Meeteren, Dennis Wigle, *Shanda Blackmon, *Stephen Cassivi, *K. Robert Shen, *Mark Allen

Mayo Clinic, Rochester, MN

Invited Discussant: *Mark J. Krasna

73. A Modified Technique of Laryngotracheal Reconstruction Without the Need for Prolonged Postoperative Stenting

Konrad Hoetzenecker, Thomas Schweiger, Imme Roesner, Matthias Leonhard, Gabriel Marta, Doris-Maria Denk-Linnert, Berit Schneider-Stickler, Wolfgang Bigenzahn, *Walter Klepetko

Medical University of Vienna, Vienna, Austria

Invited Discussant: *Joel D. Cooper

74. A Randomized Controlled Trial of Continuous Subpleural Bupivacaine After Thoracoscopic Surgery

Daniel L. Fortes, Charles D. Ghee, Sandeep J. Khandhar, Heather A. Prentice
Inova Fairfax Hospital, Falls Church, VA

Invited Discussant: ♦Daniel J. Boffa

75. Near-Infrared Optical Imaging During Resection of Mediastinal Thymomas Improves Assessment of Surgical Margins

Jane J. Keating, Jarrod D. Predina, Sarah Nims, Ollin Venegas, Charuhas Deshpande, John Kucharczuk, ♦Sunil Singhal

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Yolonda L. Colson

3:20 PM – 4:10 PM

Coffee Break in the Exhibit Hall



3:30 PM – 4:00 PM

Deep Dive Session

Exhibit Hall, AATS CT Theater II, Booth #181

Moderator: ♦Jonathan D'Cunha

Not for Credit

P25. Risk Factors for Progression of Ground Glass Opacities in Patients with Resected Pulmonary Adenocarcinoma

Rebecca W. Gao, *Stanford University, Stanford, CA*

P26. Prognostic Impact of the Findings on Thin-Section Computed Tomography in Patients with Subcentimeter Non-Small Cell Lung Cancer

Aritoshi Hattori, *Juntendo University, Tokyo, Japan*

P28. Prediction of Lepidic Predominant Clinical-Stage IA Lung Adenocarcinoma with Radiological Pure-Solid Appearance for Possible Indications of Sublobar Resection

Aritoshi Hattori, *Juntendo University, Tokyo, Japan*

TUESDAY, MAY 17

76. A Risk Score to Predict the Incidence of Prolonged Air Leak After Video-Assisted Thoracoscopic Lobectomy: A European Multicenter Analysis

Cecilia Pompili¹, Pierre Emmanuel Falcoz², Michele Salati³, Zalan Szanto⁴,

*Alessandro Brunelli¹

¹St. James University Hospital, Leeds, United Kingdom; ²University Hospital Strasbourg, Strasbourg, France; ³Ospedali Riuniti, Ancona, Italy; ⁴University of Pecs, Pecs, Hungary

Invited Discussant: *Robert J. Cerfolio

77. Salvage Pulmonary Resection Following SBRT: A Feasible and Safe Option for Local Failure

Mara B. Antonoff, Arlene Correa, Boris Sepesi, Quynh-Nhu Nguyen, *Garrett Walsh, *Stephen Swisher, *Ara Vaporciyan, *Reza Mehran, *Wayne Hofstetter, *David Rice
UT MD Anderson Cancer Center, Houston, TX

Invited Discussant: *Stephen R. Hazelrigg

78. Prospective Trial of Giant Paraesophageal Hernia Repair with 1-Year Follow-Up

John R. Stringham¹, Jennifer V. Phillips¹, Timothy L. McMurry¹, Drew L. Lambert¹,

*David R. Jones², James M. Isbell¹, *Christine L. Lau¹, *Benjamin D. Kozower¹

¹University of Virginia, Charlottesville, VA; ²Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *James D. Luketich

Late-Breaking Clinical Trial

LB11. A Prospective Clinical Trial of Intra-Operative Tissue Oxygenation Measurement and Its Association with Anastomotic Leak Rate After Ivor Lewis Esophagectomy

*Prasad S. Adusumilli¹, Marom Bikson², Nabil Rizk¹, *Valerie W. Rusch¹, Boris Hristov¹, Rachel Grosser¹, Kay See Tan¹, Inderpal Sarkaria¹, ♦James Huang¹, Daniela Molena¹, *David R. Jones¹, *Manjit S. Bains¹

¹Memorial Sloan Kettering Cancer Center, New York, NY; ²City College of New York, New York, NY

Invited Discussant:

5:35 PM

Executive Session, AATS Members Only

Hall E, BCC

*AATS Member ♦AATS New Member

WEDNESDAY MORNING, MAY 18, 2016

7:30 AM Adult Cardiac Surgery Ballroom I, BCC

Simultaneous Scientific Session

5 minute presentation, 6 minute discussion

Moderators: *Faisal G. Bakaeen and *Clifford W. Barlow

79. Haemodynamic Performance and Early Outcome of Freedom Solo Stentless Valve Versus TAVR for Aortic Valve Replacement in Patients with Intermediate Risk Profile: A European, Multicenter Experience

Alberto Repossi¹, Laura Giroletti¹, Lorenzo Di Bacco¹, Bruno Passaretti², Gianluigi Bisleri¹, Christina Schafer³, Benjamin Claus³, Herko Grubitzsch³, Thierry Folliguet⁴, Roberto Di Bartolomeo⁷, Juan Pablo Maureira⁴, Francois Laborde⁶, *Claudio Muneretto¹

¹University of Brescia, Brescia, Italy; ²Humanitas Gavazzeni Hospital, Bergamo, Italy; ³Charité Universitätsmedizin Berlin, Berlin, Germany; ⁴CHU de Nancy, Vandoeuvre les Nancy, France; ⁵University of Bologna, Bologna, Italy; ⁶Institut Mutualiste Montsouris, Paris, France

Invited Discussant: *Jay K. Bhamra

80. Safety and Effectiveness of Robotically-Assisted Mitral Valve Surgery: Analysis of 1,000 Consecutive Cases

*A. Marc Gillinov, *Tomislav Mihaljevic, Hoda Javadikasgari, *Rakesh Suri, Stephanie Mick, *Jose Navia, Milind Desai, Johannes Bonatti, Mitra Khosravi, Jay Idrees, Ashley Lowry, *Eugene Blackstone, *Lars Svensson
Cleveland Clinic Foundation, Cleveland, OH

Invited Discussant: *T. Sloane Guy

81. Aortic Valve Repair with Geometric Ring Annuloplasty for Aortic Insufficiency Associated with Ascending Aortic/Root Aneurysms

Domenico Mazzitelli¹, Theodor J.M. Fischlein², *J. Scott Rankin³, Yeong-Hoon Choi⁴, Christof Stamm¹, Jan Pirk⁵, Steffen Pfeiffer², Christian Noebauer¹, *Christian Schreiber¹, *Thorsten Wahlers⁴, *Friedhelm Beyersdorf⁶, *Ruediger Lange¹

¹German Heart Center Munich, Munich, Germany; ²Klinikum Nürnberg, Paracelsus Medical University, Nuremberg, Germany; ³Cardiothoracic Surgery Associates, Nashville, TN; ⁴University of Cologne, Cologne, Germany; ⁵Institute for Clinical and Experimental Medicine, Prague, Czech Republic; ⁶Heart Center Freiburg University, Freiburg, Germany

Invited Discussant: *Gebrine El Khoury

82. Mid-Term Multi-Center Clinical and Hemodynamic Results of a High Performance Pericardial Surgical Valve

*Scott Goldman¹, Anson Cheung², *Joseph E. Bavaria³, Michael R. Petracek⁴, Mark A. Groh⁵, *Hartzell V. Schaff⁶

¹Lankenau Heart Institute, Wynnewood, PA; ²University of British Columbia, Vancouver, BC, Canada; ³University of Pennsylvania, Philadelphia, PA; ⁴Vanderbilt University, Nashville, TN; ⁵Mission Health and Hospitals, Asheville, NC; ⁶Mayo Clinic, Rochester, MN

Invited Discussant: *Y. Joseph Woo

Innovation in Cardiac Surgery

*Ralph J. Damiano, Jr., Washington University, St. Louis, MO

83. Frozen Elephant Trunk for Type A Aortic Dissection in Marfan Syndrome: Long-Term Single-Center Experience in 106 Patients

Long-Fei Wang¹, Wei-Guo Ma², Jun Zheng¹, Tian-Hua Rong¹, Bulat A. Ziganshin², Sven Peterss², Wei Zhang¹, Yong-Min Liu¹, Jun-Ming Zhu¹, Qian Chang³, *John A. Elefteriades³, *Li-Zhong Sun¹

¹Capital Medical University, Beijing, China; ²Yale-New Haven Hospital, New Haven, CT; ³Fu Wai Hospital and Cardiovascular Institute, Beijing, China

Invited Discussant: *Wilson Y. Szeto

84. Alternative Approaches in Transcatheter Aortic Valve Replacement and Costs in the U.S. Medicare Population

Fenton H. McCarthy, Danielle D. Spragan, Katherine M. McDermott, Peter W. Groeneveld, Ashley C. Hoedt, Howard C. Herrmann, Saif Anwaruddin, Jay Giri, *Joseph E. Bavaria, *Wilson Y. Szeto, ♦Nimesh D. Desai

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Vinod H. Thourani

85. Clinical Outcomes in Low and Intermediate-High Risk Groups with a Sutureless Heart Valve

*Axel Haverich¹, Theodor Fischlein², Kavous Hakim-Meibodi³, Martin Misfeld⁴, *Thierry Carrel⁵, *Marian Zembala⁶, Francesco Madonna⁷, François Laborde⁸

¹Hannover Medical School, Hannover, Germany; ²Paracelsus Medical University, Nuremberg, Germany; ³Ruhr-Universität Bochum, Bad Oeynhausen, Germany; ⁴Herzzentrum Universität Leipzig, Leipzig, Germany; ⁵Universitätsklinik für Herz- und Gefäßchirurgie Inselspital, Bern, Switzerland; ⁶Silesian University Zabrze, Poland; ⁷Hopital Cardiologique Du Haut-Leveque, Pessac, France; ⁸Institute Mutualiste Montsouris, Paris, France

Invited Discussant: *Niv Ad

WEDNESDAY, MAY 18

*AATS Member ♦AATS New Member

86. Long-Term Results of Transapical Off-Pump Echo Guided Mitral Valve Repair with Neochord Implantation

Andrea Colli, Laura Besola, Erica Manzan, Eleonora Bizzotto, Fabio Zucchetta, Roberto Bellu, Demetrio Pittarello, Cristiano Sarais, *Gino Gerosa
University of Padua, Padua, Italy

Invited Discussant: *Anelechi C. Anyanwu

87. Thirty-Day and 1-Year Readmission Rate Following Transcatheter Aortic Valve Replacement in a High Volume Centre

Jessica Forcillo, Jose F. Condado, Vasilis Babaliaros, Jose Binongo, Yi-An Lasanajak, Eric Sarin, Chandan M. Devireddy, Bradley G. Leshnower, James P. Stewart, *Robert A. Guyton, Kretan Mavromatis, Peter C. Block, Patricia Keegan, Amy Simone, *Vinod H. Thourani
Emory University, Atlanta, GA

Invited Discussant: *Michael J. Reardon

9:35 AM – 9:50 AM Coffee Break

WEDNESDAY MORNING, MAY 17, 2016

7:30 AM **Congenital Heart Disease** Ballroom III, BCC
Simultaneous Scientific Session
5 minute presentation, 6 minute discussion
Moderators: *Jonathan M. Chen and *Pedro J. del Nido

88. Left Ventricular Assist Device As Destination Therapy in Cardiac End Stage Distrophinopathies: Midterm Results

Gianluigi Perri¹, Sergio Filippelli², Rachele Adorisio², Roberta Iacobelli², Francesca Iodice², Giuseppina Testa², Fabrizio Gandolfo², Domenico D'Amario¹, Massimo Massetti¹, Antonio Amodeo²
¹A. Gemelli Hospital, Rome, Italy; ²Bambino Gesù Children Hospital, Rome, Italy

Invited Discussant: *Kristine J. Guleserian

89. A Transapical to Aorta Double Lumen Cannula-Based Neonate LVAD Efficiently Unloads the LV in Neonate Lambs

Cheng Zhou, Dongfang Wang, Cherry Croft, Francesca Condemi, Hassan K. Reda, *Joseph B. Zwischenberger
University of Kentucky, Lexington, KY

Invited Discussant: *David L. Morales

90. Preservation of Umbilical Vein Segments for Use As an Autologous Shunt Conduit in Neonates

David M. Hoganson¹, Dane A. Cooper¹, Kimberly N. Rich¹, Breanna L. Piekarski¹, Joseph P. Gaut², *John E. Mayer¹, Elena Aikawa³, Sitaram M. Emani¹
¹Boston Children's Hospital, Boston, MA; ²Washington University in St. Louis, St. Louis, MO; ³Brigham and Womens Hospital, Boston, MA

Invited Discussant: *Minoo Kavarana

91. Routine Preoperative Laboratory Testing in Elective Pediatric Cardiothoracic Surgery Is Largely Unnecessary

R. Michael Nieto, Luis E. De León, Kimberly A. Krauklis, *Charles D. Fraser, Jr.
Texas Children's Hospital, Houston, TX

Invited Discussant: *Andrew J. Lodge

MCS for Failing Fontan

*Mark D. Rodefeld, *Indiana University School of Medicine, Indianapolis, IN*

92. Another Look at the Appropriateness of Technical Performance Scores: A Single Center Exploratory Analysis of Surgical Factors Associated with Complications, Reoperation, and Length of Stay Following Tetralogy of Fallot Repair

Daud Lodin¹, Orestes Mavrothalassitis², Naveen Swami³, Tara Karamlou³

¹*San Juan Bautista, Caguas, PR*; ²*University of Maryland, Baltimore, MD*; ³*University of California, San Francisco, CA*

Invited Discussant: *Christian Pizarro

93. Proactive Platelet and Cryoprecipitate Transfusion During Neonatal Cardiopulmonary Bypass Rapidly Normalizes Platelet Count, Fibrinogen and Functional Rotational Thromboelastometry Parameters

John P. Scott¹, Robert A. Niebler¹, Eckehard A.E. Stuth¹, D. Woodrow Benson¹, Ronald K. Woods¹, *James S. Tweddell¹, Regina Cole¹, *Michael E. Mitchell¹, Rachel S. Bercovitz¹, Pippa Simpson¹, Robert Montgomery¹, Alan Mast², Susan Maroney², Ke Yan¹, Rowena Punzalan¹, Debra K. Newman²

¹*Medical College of Wisconsin, Milwaukee, WI*; ²*Blood Research Institute, Milwaukee, WI*

Invited Discussant: *Mark S. Bleiweis

94. Shape Does Matter: 3-D Statistical Shape Analysis of the Aortic Arch After Coarctation Repair Reveals Shape Correlation with Left Ventricular Function

Jan L. Bruse¹, Kristin McLeod², Giovanni Biglino¹, Maxime Sermesant³, Xavier Pennec³, Tain-Yen Hsia¹, Andrew M. Taylor¹, Silvia Schievano¹

¹*Great Ormond Street Hospital for Children, London, United Kingdom*; ²*Simula Research Laboratory, Lysaker, Norway*; ³*INRIA Sophia Antipolis-Méditerranée, Sophia Antipolis, France*

Invited Discussant: *Luca A. Vricella

95. Surgical Strategy for Aortic Arch Reconstruction After Norwood Procedure Based on a Virtual Operation with Numerical Flow Analysis

Shohei Miyazaki¹, Keiichi Itatani², Norihiko Oka¹, Shinji Goto³, Masanori Nakamura³, Tadashi Kitamura¹, Tetsuya Horai¹, Yuki Nakamura¹, ♦Kagami Miyaji¹

¹*Kitasato University, Sagami-hara, Japan*; ²*Kyoto Prefectural University of Medicine, Kyoto City, Japan*; ³*Saitama University, Saitama-Shi, Japan*

Invited Discussant: *Charles D. Fraser

9:35 AM – 9:50 AM

Coffee Break

WEDNESDAY, MAY 18

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WEDNESDAY MORNING, MAY 18, 2016

7:30 AM **General Thoracic Surgery** Ballroom IV, BCC
Simultaneous Scientific Session
5 minute presentation, 6 minute discussion

Moderators: *Shaf Keshavjee and *Gaetano Rocco

96. Prognostic Factors of Tumor Recurrence in Stage I Adenocarcinoma of Lung: Influence of Preoperative Biopsy

Chien-Sheng Huang, Po-Kuei Hsu, Chun-Ku Chen, Yi-Chen Yeh, Mei-Han Wu, Chih-Cheng Hsieh, Han-Shui Hsu, Teh-Ying Chou, Wen-Hu Wu, Biing-Shiun Huang
Taipei Veterans General Hospital, Taipei, Taiwan

Invited Discussant: *Haiquan Chen

97. Characteristics and Outcomes of Pathologic Node Positive Esophageal Cancer Patients Receiving Adjuvant Chemotherapy Following Induction Chemotherapy and Esophagectomy

Pamela Samson¹, ♦Varun Puri¹, A. Craig Lockhart¹, Clifford Robinson¹, Stephen Broderick², *G. Alexander Patterson¹, *Bryan Meyers¹, *Traves Crabtree¹
¹Washington University in St. Louis, St. Louis, MO; ²St. Luke's Hospital, Chesterfield, MO

Invited Discussant: *Antoon E. Lerut

98. Well Differentiated Neuroendocrine Carcinoma (Typical Carcinoid) with Mediastinal Lymph Node Metastases: Surgical Outcomes and Whole Exome Sequencing

Eric Sceusi, Leiva-Juarez Miguel, *Reza Mehran, Neda Kalhor, Kenna Shaw, Andy Futreal, Arlene Correa, Cesar Moran, Ignacio Wistuba, Fujimoto Junya, Xiayu Rao, *Stephen Swisher, *Ara Vaporciyan, Jing Wang, Mara Antonoff, *Wayne Hofstetter, *David Rice, Boris Sepesi, *Garrett Walsh, *Jack Roth
MD Anderson Cancer Center, Houston, TX

Invited Discussant: *David R. Jones

99. Survival Results and Gene Phenotype of Patients with Different Categories of Multiple Primary Lung Cancers

Kezhong Chen, Xun Wang, Fan Yang, Jingbo Zhang, Tian Guan, Jianhong Zhang, Jun Wang
Peking University People's Hospital, Beijing, China

Invited Discussant:

Surgical Management of IIIB NSCLC

*Elie Fadel, *Marie Lannelongue Hospital*

100. Partial Thymectomy Results In Similar Outcomes to Total Thymectomy in Masaoko-Koga Stages I And II Thymoma

Brian E. Louie¹, Xiaopan Yao², Eric Vallières¹, Zhitao Gu³, Yue Shang⁴, Ralph W. Aye¹,
♦Alexander S. Farivar¹, Wentao Fang³

¹Swedish Cancer Institute, Seattle, WA; ²Yale University, New Haven, CT; ³Shanghai Chest Hospital, Shanghai, China; ⁴The MathWorks, Inc., Natick, MA

Invited Discussant: ♦Joshua R. Sonett

101. Role of Pulmonary Resection in Patients with Pleural Metastasis Encountered at the Time of Surgery

Samina Park, Yoohwa Hwang, Hyun Joo Lee, In Kyu Park, Chang Hyun Kang,
Young T. Kim

Seoul National University Hospital, Seoul, Republic of Korea

Invited Discussant: ♦Abbas E. Abbas

102. miRNA Profiling of Lung Squamous Cell Carcinoma in the Head and Neck Cancer Patient: Metastasis or Primary Tumor

Juan A. Muñoz, Praveen Sridhar, Adam C. Gower, Anita Deshpande, Yuriy O. Alekseyev,
Carl J. O'Hara, *Hiran C. Fernando, *Virginia R. Little

Boston University, Boston, MA

Invited Discussant: ♦Mark Onaitis

103. Lung Transplantation Is Associated with a Survival Benefit in Patients with Chronic Obstructive Pulmonary Disease

Charles F. Evans, Zachary N. Kon, Min Zhan, June Kim, Irina Timofte, Aldo T. Iacono,
*James S. Gammie, *Si M. Pham, *Bartley P. Griffith, Pablo G. Sanchez

University of Maryland, Baltimore, MD

Invited Discussant: ♦Marcelo Cypel

Late-Breaking Clinical Trial

LB12. Systematic Short-Term Pulmonary Rehabilitation Before Lung Cancer Lobectomy: A Single-Blind Randomized Trial

Yutian Lai, Mingming Wang, Guowei Che

West China Hospital, Sichuan University, Chengdu, China

Invited Discussant:

9:35 AM – 9:50 AM

Coffee Break

WEDNESDAY, MAY 18

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WEDNESDAY MORNING, MAY 18, 2016

9:50 AM **Adult Cardiac Masters of Surgery** Ballroom I, BCC
Video Session

Moderator: *Thoralf M. Sundt, III, *Massachusetts General Hospital*

Panelists: *David H. Adams, *Mount Sinai Medical Center*

*Joseph S. Coselli, *Baylor College of Medicine*

*Ralph J. Damiano, Jr., *Washington University*

9:50 AM **Aortic Root Replacement with Valve Repair**
*Lars. G. Svensson, *Cleveland Clinic*

10:10 AM **Maze Procedure**
*Vinay Badhwar, *West Virginia University*

10:30 AM **Aortic Arch Replacement**
*Malakh L. Shrestha, *Hannover Medical School*

10:50 AM **TAVR Without General Anesthesia**
*Vinod H. Thourani, *Emory University*

11:10 AM **Complex Mitral Valve Repair**
*Gebrine El Khoury, *Université Catholique de Louvain*

9:50 AM **Congenital Masters of Surgery** Ballroom III, BCC
Video Session

Moderators: *Charles D. Fraser, *Texas Children's Hospital*

*Luca A. Vricella, *Johns Hopkins Hospital*

9:55 AM **Slide Aortoplasty**
*E. Dean McKenzie, *Texas Children's Hospital*

- 10:15 AM** **Modified Senning Procedure**
**Krishna S. Iyer, Fortis Escorts Heart Institute*
- 10:35 AM** **Arterial Switch Operation – Open Technique**
**Charles D. Fraser, Texas Children’s Hospital*
- 10:55 AM** **Tetralogy of Fallot: Transatrial-Transpulmonary Repair**
**George E. Sarris, Athens Heart Surgery Institute*
- 11:15 AM** **Discussion**

- 9:50 AM** **General Thoracic Masters of Surgery** Ballroom IV, BCC
Video Session
Moderator: **Bernard J. Park, Memorial Sloan-Kettering Cancer Center*
Panelists: **Todd L. Demmy, Rutgers Cancer Institute of New Jersey*
 **Robert J. Cerfolio, University of Alabama at Birmingham*
 **M. Blair Marshall, Georgetown University*

- 9:55 AM** **Robotic Bi-Lobectomy**
**Bernard J. Park, Memorial Sloan-Kettering Cancer Center*

- 10:15 AM** **VATS Lobectomy with En Bloc Chest Wall Resection**
**Mark Onaitis, Duke University*

- 10:35 AM** **VATS Tracheal Sleeve Resection with ECMO Support**
**Scott J. Swanson, Brigham & Women’s Hospital*

- 10:55 AM** **Robotic LUL Double Sleeve Resection**
**Haiquan S. Chen, Fudan University Shanghai Cancer Center*

- 11:15 AM** **Discussion**

11:30 AM **96th Annual Meeting Adjourns**

WEDNESDAY, MAY 18

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MONDAY, MAY 16, 2016

6:30 AM **Update on Maintenance of Certification for the American Board of Thoracic Surgery** Room 340, BCC
Not for Credit

See page 17 for description.

7:20 AM **Business Session, AATS Members Only** Hall E, BCC

7:30 AM **Plenary Scientific Session** Hall E, BCC
8 minute presentation, 12 minute discussion
Moderators: *Joseph S. Coselli and *Marc R. Moon

1. Tricuspid Regurgitation Is Uncommon After Mitral Valve Repair for Degenerative Disease

*Tirone E. David, Carolyn M. David, Cedric Manlhiot
Toronto General Hospital, Toronto, ON, Canada

Invited Discussant: *Gilles D. Dreyfus

Objective: To determine the incidence of tricuspid regurgitation (TR) after isolated mitral valve repair (MVR) for mitral regurgitation (MR) due to degenerative disease.

Patients and Methods: We examined 1,184 patients who had MVR and were followed prospectively with periodical clinical and echocardiographic assessments during a mean of 8.9 ± 5.3 years. Patients' mean age was 58.3 ± 12.7 years and 60% were men. Preoperatively, 44% were in functional classes III and IV, 20.2% had atrial fibrillation and 34% had ejection fraction $<60\%$. In addition to MVR, 17.1% had coronary artery bypass, 11.2% had the maze procedure, and 4.7% had tricuspid annuloplasty (TA).

Results: Moderate to severe and severe TR occurred in 40 patients (4 had TA). Table 1 shows Kaplan-Meier estimates on freedom from death, reoperation, MR and TR over time. By multivariable analysis only age by 5 year increments ($HR = 1.76$; 95% CL 1.45–2.13; $p < 0.001$) and preoperative atrial fibrillation ($HR = 3.09$; 95% CL 1.67–5.73; $p < 0.001$) were predictive of TR. All patients who developed TR had tricuspid annulus diameter <40 mm and less than moderate TR by echocardiography at the time of MVR. The development of TR had no effect on patients' survival.

Table: Kaplan-Meier Estimates of Adverse Events

Variable/Time	5 Years	10 Years	15 Years	20 Years
Survival	94.8 ± 0.6	86.5 ± 1.2	72.7 ± 2.1	57.6 ± 3.3
Freedom from reoperation	98.2 ± 0.3	96.4 ± 0.6	95.6 ± 0.8	92.6 ± 1.9
Freedom from MR $\geq 3+$	98.8 ± 0.3	96.4 ± 0.6	92.4 ± 1.4	90.4 ± 1.9
Freedom from TR $\geq 3+$	99.5 ± 0.4	96.4 ± 0.6	92.3 ± 1.4	90.4 ± 1.9

Conclusions: The development of significant TR after MVR for MR is uncommon. Older patients in atrial fibrillation are more likely to develop TR. Patients who developed TR had tricuspid annulus <40 mm at the time of the initial MVR. The addition of TA to the maze procedure in this sub-group merits evaluation.

2. Comparison of del Nido and St. Thomas Cardioplegia Solutions for Myocardial Protection in Pediatric Patients Undergoing Open Heart Surgery: A Prospective Randomized Clinical Trial

Sachin Talwar, Amolkumar Bhoje, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan

All India Institute of Medical Sciences, New Delhi, India

Invited Discussant: *Pedro J. del Nido

Objectives: We conducted a prospective randomized trial to compare Del nido cardioplegia with conventional cold blood cardioplegia solution in pediatric patients.

Methods: We randomized 100 pediatric patients <12 years to Del nido (DN) and cold blood cardioplegia (STH) groups. In DN group, a 20 ml/kg single dose was administered through aortic root. For STH group, a 30 mL/kg dose of cardioplegic solution was initially administered, followed by repeated dose (15 mL/kg) at 25- to 30-minute intervals. Intraoperative parameters and post-operative events were recorded. Cardiac index was calculated at 4 different time points. Troponin-I, interleukin-6 (IL-6) and tissue necrosis factor-alpha (TNF- α) were estimated. Myocardial biopsy was obtained from right ventricle to see the ultra-structural changes by electron microscopy.

Results: Mean cardiopulmonary bypass time was 66.6 ± 15.46 min and 77.7 ± 20.15 min ($p = 0.002$) and mean aortic cross clamp time was 39.98 ± 12.76 and 48.1 ± 16.31 min ($p = 0.007$) in DN and STH group respectively. Total amount of cardioplegia given was higher in STH group 673 ± 469.9 ml compared to DN group 371.8 ± 239.4 ml ($p = 0.0001$). Duration of mechanical ventilation was 6.982 ± 4.166 hours and 9.35 ± 5.16 hours ($p = 0.010$), ICU intensive care unit stay was 40.46 ± 14.59 hours and 57.36 ± 43.12 hours ($p = 0.0101$) and hospital stay was 6 ± 0.9 days and 6.82 ± 1.38 days ($p = 0.0007$) in DN and STH group respectively. Post bypass recovery in the cardiac index was faster in DN group compared to STH group. Mean troponin-I released after cardiopulmonary bypass was 6.92 ± 5.244 ng/ml and 10.42 ± 9.194 ng/ml ($p = 0.021$) in DN and STH group respectively. Ultra structural study of myocardium showed no statistically significant difference in the mean scores obtained for nuclear changes, mitochondrial changes, sarcoplasmic reticulum and glycogen depletion. Myofibrillar disarray was more in STH group ($p = 0.02$). However, Cellular edema was more in DN group compared to STH group ($p = 0.007$).

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Conclusion: Using long acting Del nido cardioplegic solution reduces CPB time and Aortic cross clamp time. Attainment of arrest with complete cessation of electrical activity is faster. Cardiac performance is satisfactory in post-operative period with better cardiac index profile, lesser troponin-I release and decreased morbidity. Ultra-structural changes are similar to conventional cardioplegia with an advantage of better myofibrillar alignment. Overall, Del nido cardioplegic solution is a simple and safe cardio protective strategy.



Table: Comparison Between Del Nido (DN) and St. Thomas (STH) Cardioplegia Groups

Variable		DN	STH	p-Value	Variable		DN	STH	p-Value
Peri-operative variables	CPB time	66.6 ± 15.46	77.7 ± 20.15	0.002	Time of hypothermia	Time of hypothermia	32.42 ± 12.348	41.7 ± 16.29	0.002
	Aortic clamp time	39.98 ± 12.76	48.1 ± 16.31	0.007			27.08 ± 8.759	32.24 ± 12.75	0.020
	Amount of cardioplegia	371.8 ± 239.4	673.4 ± 469.9	<0.001			1	7	0.006
	Duration of ventilation	6.982 ± 4.166	9.35 ± 5.16	0.010			1	11	0.004
	Hospital stay (days)	6 ± 0.9	6.82±1.38	0.007			40.46 ± 14.59	57.36 ± 43.12	0.0101
Biochemical markers	Prebypass Trop I	<1	<1	0.999	Prebypass Interleukin-6	Prebypass Interleukin-6	6.02 ± 3.873	5.04 ± 4.611	0.253
	Postbypass Trop I	6.92 ± 5.244	10.42 ± 9.194	0.021			165.74 ± 47.178	176.78 ± 54.731	0.283
	24 hours Trop I	4.22 ± 2.838	8.66 ± 6.239	<0.001			52.72 ± 19.313	72.32 ± 40.645	0.003
Electron Microscopy	Myofibrils	1.33 ± 0 .840	2.00 ± 0.730	0.02	Cellular edema	Cellular edema	2.44 ± 0.705	1.75 ± 0 .683	0.007

3. A Population-Based Analysis of Surgical Resection Versus Stereotactic Body Radiation Therapy for Stage I Non-small Cell Lung Cancer

Babatunde A. Yerokun¹, Chi-Fu Jeffrey Yang¹, Brian C. Gulack¹, Michael S. Mulvihill¹, Lin Gu¹, Xuechan Li¹, Xiaofei Wang¹, *Mark F. Berry², *David H. Harpole¹, *Thomas A. D'Amico¹, Matthew G. Hartwig¹

¹Duke University, Durham, NC; ²Stanford University, Stanford, CA

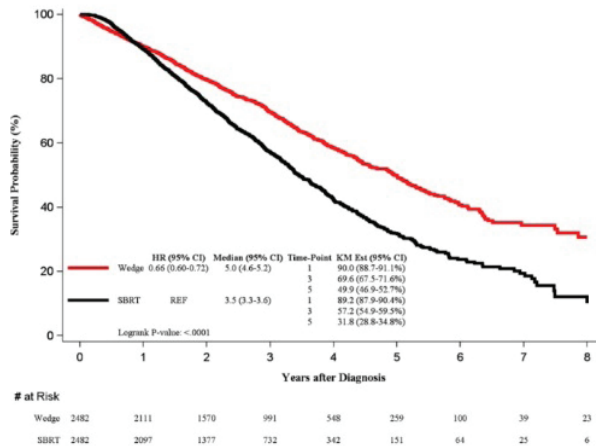
Invited Discussant: *Walter Weder

Objective: While surgical resection has been the standard of care for early-stage non-small cell lung cancer (NSCLC), an increasing number of patients with potentially operable early stage NSCLC are now being treated with stereotactic body radiation therapy (SBRT). We hypothesize that for operative candidates with Stage IA NSCLC, a wedge resection will afford a superior survival advantage compared to SBRT.

Methods: Overall survival (OS) of patients with cT1N0 who underwent SBRT or wedge resection in the National Cancer Data Base (NCDB) from 2003–2011 was assessed using Kaplan-Meier and propensity-score-matched analysis. Groups were matched for common prognostic covariates (age, sex, race, education, insurance status, facility type, distance from facility, Charlson-Deyo co-morbidity score, tumor histology, tumor size, and tumor location).

Results: Of the patients who were identified as having cT1N0 NSCLC in the NCDB, 2773 underwent SBRT and 9227 underwent wedge resection. Compared to the wedge resection cohort, the SBRT patients were older (74.2 vs 69.3 years, $p < 0.0001$) and more likely to be treated at an academic comprehensive cancer program (46.1% vs 34.9%, $p < 0.0001$). The median Charlson-Deyo score was lower in the SBRT patients (0 vs 1), and SBRT patients were less likely to have a T1a tumor (55.1% vs 75.6%, $p < 0.0001$). In unmatched analysis, SBRT was associated with significantly lower survival than wedge resection (5-year OS: 30.5% vs 52.6%, $p < 0.0001$). After propensity matching, all baseline covariates, including co-morbidity

Figure 1. Kaplan Meier Survival Curve for Matched Patients Underwent Wedge Resection vs SBRT.



scores, facility type and tumor size, were well balanced between the SBRT (n = 2482) and wedge (n = 2482) groups. However, even in the matched groups, SBRT was associated with significantly lower survival than wedge (5-year OS: 31.8% vs 49.9%, $p < 0.0001$). Additional sensitivity analyses in matched patients demonstrated that SBRT was associated with worse survival when compared with wedge even for younger patients (age <60) who had Charlson-Deyo score of 0 (5-year OS: 54.1% vs 75.2%, $p < 0.0007$).

Conclusions: In a nationally representative cancer database, wedge resection was associated with improved survival when compared with SBRT in patients with operable clinical Stage IA NSCLC. Thoracic surgeons should be included in the evaluation of these patients, and operative candidates with Stage IA NSCLC should continue to receive a wedge resection versus SBRT when technically feasible.

MONDAY, MAY 16

4. Causes of Death from the Randomized Comparison of Self-Expanding Transcatheter or Surgical Aortic Valve Replacement in Patients at High Surgical Risk

Vincent A. Gaudiani¹, Jeffrey J. Popma², *David H. Adams³, James Joye⁴, G. Michael Deeb⁵, Steven J. Yakubov⁶, *Michael J. Reardon⁷

¹Pacific Coast Cardiac and Vascular Surgeons, Redwood City, CA; ²Beth Israel Deaconess Medical Center, Boston, MA; ³Mount Sinai Medical Center, New York, NY; ⁴El Camino Hospital, Mountain View, CA; ⁵University of Michigan Medical Center, Ann Arbor, MI; ⁶Riverside Methodist Hospital/Ohio Health Research Institute, Columbus, OH; ⁷Houston-Methodist-DeBakey Heart and Vascular Center, Houston, TX

Invited Discussant: *Craig R. Smith

Objective: Transcatheter aortic valve replacement (TAVR) with a self-expanding TAV has been shown to be superior to surgical aortic valve replacement (SAVR) in high-risk patients with severe, symptomatic aortic stenosis (AS). We explored the causes and timing of death to further understand the differences in mortality reported from the CoreValve US High-Risk Pivotal Trial.

Methods: Patients were randomized (1:1) to TAVR or SAVR and 750 (391 TAVR; 359 SAVR) underwent implantation. Cause of death was adjudicated by an independent Clinical Event Committee. To determine if these causes varied based on time since procedure, we evaluated baseline characteristics, serious adverse event rates and causes of death for patients who died during 3 time periods: post-procedure (0–30 days); mid-term (31–90 days); and long-term (91–365 days).

Results: Mortality rates were similar for the post-procedural and late-term time periods between TAVR and SAVR groups (both $P = NS$). In the mid-term period (31–90 days), significantly fewer TAVR patients died v. SAVR patients (9 [2.4%] v. 18 [5.3%], $P = 0.04$). Death due to cardiovascular causes occurred in 8 (2.1%) TAVR patients and in 10 (2.9%) SAVR patients ($P = 0.49$); with only 1 (0.3%) TAVR death due to non-cardiovascular causes compared with 8 (2.3%) SAVR deaths. SAVR patients who died day 31–90 had significantly more anemia requiring transfusion, albumin <3.3 g/dL, unplanned weight loss, KATZ ADL deficits, chronic kidney disease (Stage 4/5), and Grade II-IV LV diastolic dysfunction at baseline than survivors. There were no statistically significant baseline anatomical or procedural differences between SAVR patients who died v. survived. For TAVR patients who

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Conclusions: Few trials have evaluated deaths in seriously ill patients in a TAVR v. SAVR randomized trial. Death rates were similar at 0–30 and 91–365 days, but more SAVR patients died from day 31–90 related to bleeding, frailty, and comorbid diseases, reflecting the impact of the added strain of surgery over intravascular intervention for AVR. Additional analyses are ongoing.

9:05 AM **Coffee Break in the Exhibit Hall**

*Hersh Maniar, *Washington University*

Gary M. Gibbons, *National Heart, Lung, and Blood Institute*

Moderators: *Thoralf M. Sundt, III and *Marc R. Moon

5. Surgical Quality Measures in Stage IIIA Non-Small Cell Lung Cancer Are Associated with Improved Survival

Pamela Samson¹, *Traves Crabtree¹, Daniel Morgensztern¹, Clifford Robinson¹, Stephen Broderick², *G. Alexander Patterson¹, Bryan Meyers¹, ♦Varun Puri¹

¹Washington University, St. Louis, MO; ²St. Luke's Hospital, Chesterfield, MO

Invited Discussant: *Mark S. Allen

Objective: In select patients with clinical Stage IIIA non-small cell lung cancer (NSCLC) induction therapy followed by surgery is a well-accepted strategy with favorable overall survival. However, the adherence and outcomes of quality recommendations in the surgical care of Stage IIIA non-small cell lung cancer patients is unknown.

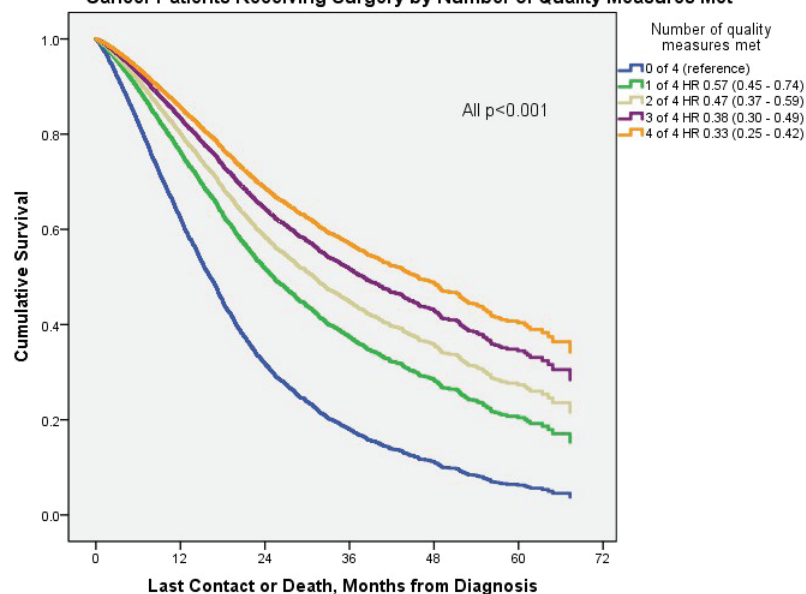
Methods: Patients receiving surgery for Stage IIIA NSCLC were identified in the National Cancer Data Base (NCDB). Upon reviewing national guidelines the following quality measures were chosen: delivery of neoadjuvant multiagent chemotherapy (with or without radiation therapy), performing a lobectomy or greater resection, obtaining ≥ 10 lymph nodes, and achieving an R0 resection. Multivariate logistic regression was performed to identify factors associated with meeting all 4 quality measures. Kaplan-Meier analysis and Cox proportional hazards modeling was performed to evaluate overall survival.

Results: From 2006 to 2010, 10,323 clinical Stage IIIA NSCLC patients received surgical resection, of which 7,936/10,323 (76.9%) had complete data on quality measures for analysis. 8,292/10,272 (80.7%) patients had clinical N2 disease. 2,842/9,600 (29.6%) received neoadjuvant multiagent chemotherapy, 8,427/10,044 (83.9%) received a lobectomy or greater resection, 4,003/9,110 (43.9%) had ≥ 10 lymph nodes examined, and 8,441/9,661 (87.4%) obtained negative surgical margins. Only 1,019/7,936 patients (12.8%) met all four quality measures. Variables independently associated with increasing likelihood of receiving all four quality measures included private insurance status (OR 1.28, 1.09–1.52, $p = 0.003$), higher education (OR 1.54, 1.31–1.80, $p < 0.001$), and receiving care at an academic cancer center (OR 1.44, 1.22–1.70, $p < 0.001$) or a center with ≥ 6 Stage IIIA NSCLC cases per year (based on upper quartile of case volume, OR 1.74, 1.46–2.07, $p < 0.001$). A decreasing likelihood of receiving all four measures was associated with increasing age (per year, 0.98, 0.97–0.98, $p < 0.001$), non-Caucasian race (OR 0.67, 0.53–0.87, $p = 0.002$), and increasing Charlson/Deyo score (CDS 1: OR 0.67, 0.56–0.79, CDS 2: OR 0.58, 0.44–0.76, reference CDS 0, $p < 0.001$). Kaplan-Meier analysis demonstrated improved overall median survival by number of quality measures obtained: 0 quality measures 12.7 months, 1 quality measure 25.0 months, 2 quality measures 31.4 months, 3 quality measures, 36.6 months, and 4 quality measures 43.5 months (log-rank $p < 0.001$). Cox modeling also demonstrated a decreased mortality hazard with increasing number of quality measures met (Figure 1).

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Cox Proportional Hazards Model, Survival for Clinical Stage IIIA Non-small Cell Lung Cancer Patients Receiving Surgery by Number of Quality Measures Met



Conclusions: While it is known that surgical resection is appropriate for select clinical Stage IIIA NSCLC patients, compliance with national recommendations regarding induction therapy and approach to surgical resection are crucial to optimizing long-term survival outcomes.

Late-Breaking Clinical Trial

LB1. TRANSFORM US Clinical Trial: Safety and Performance of a Rapid Deployment Aortic Valve

*Walter Randolph Chitwood, Jr.¹, Glenn R.R. Barnhart², *Kevin D. Accola³, *Joseph Y. Woo⁴, *Eugene A. Grossi⁵, Mubashir A. Mumtaz⁶, *Joseph F. Sabik, III⁷, Frank N. Slachman⁸, *Himanshu J. Patel⁹, *Michael A. Borger¹⁰, *Harvey Edward Garrett, Jr.¹¹, *Evelio Rodriguez¹², *Patrick M. McCarthy¹³, William H. Ryan, III¹⁴, Francis G. Duhay¹⁵, *Michael J. Mack¹⁶

¹East Carolina University, Greenville, NC; ²Swedish Heart and Vascular Institute, Seattle, WA; ³Florida Heart Institute, Orlando, FL; ⁴Stanford University, Stanford, CA; ⁵New York University, New York, NY; ⁶Pinnacle Health, Harrisburg, PA; ⁷Cleveland Clinic Foundation, Cleveland, OH; ⁸Mercy General Hospital, Sacramento, CA; ⁹University of Michigan, Ann Arbor, MI; ¹⁰Columbia University, New York, NY; ¹¹Baptist Memorial Hospital, Memphis, TN; ¹²Saint Thomas Heart Hospital, Nashville, TN; ¹³Northwestern University, Chicago, IL, Chicago, IL; ¹⁴Baylor Heart Hospital, Plano, TX; ¹⁵Edwards Lifesciences LLC, Irvine, CA, Irvine, CA; ¹⁶Heart Hospital Baylor Scott & Whyte, Plano, TX

Invited Discussant: *A. Pieter Kappetein

11:05 AM AATS New Member Induction Hall E, BCC

11:25 AM Presidential Address Hall E, BCC
Competition: Perspiration to Inspiration
"Aut viam inveniam aut faciam"
*Joseph S. Coselli, Baylor College of Medicine

MONDAY, MAY 16

12:15 PM Lunch in the Exhibit Hall

12:30 PM Ethics Forum Luncheon Room 343, BCC
Separate Registration Required
Should a Surgeon Comply with Hospital Administration's Demand to Change Valve Preference?
Moderator: *Robert M. Sade, Medical University of South Carolina
Pro: J. Scott Millikan, Billings Clinic
Con: Robert J. Cusimano, Toronto General Hospital

12:30 PM AATS/TSRA Preparing Yourself for an Academic Career Luncheon Room 340, BCC
Residents, Fellows and Medical Students Only
Pre-Registration Required
Not for Credit

MONDAY AFTERNOON, MAY 16, 2016

2:00 PM Adult Cardiac Surgery Hall E, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion
Moderators: *Scott A. LeMaire and *Vinod H. Thourani

6. Is Concomitant Tricuspid Valve Surgery Beneficial During Left Ventricular Assist Device Implantation: A Multi-Institutional Analysis

♦John M. Stulak¹, Vakhtang Tchantchaleishvili¹, Nicholas A. Haglund², Shannon Dunlay¹, Keith Aaronson³, Jennifer Cowger⁴, Palak Shah⁵, *Francis D. Pagani³, ♦Simon Maltais¹
¹Mayo Clinic, Rochester, MN; ²Vanderbilt Heart, Nashville, TN; ³University of Michigan Health System, Ann Arbor, MI; ⁴St. Vincent Heart Center, Indianapolis, IN; ⁵Inova Heart and Vascular Institute, Falls Church, VA

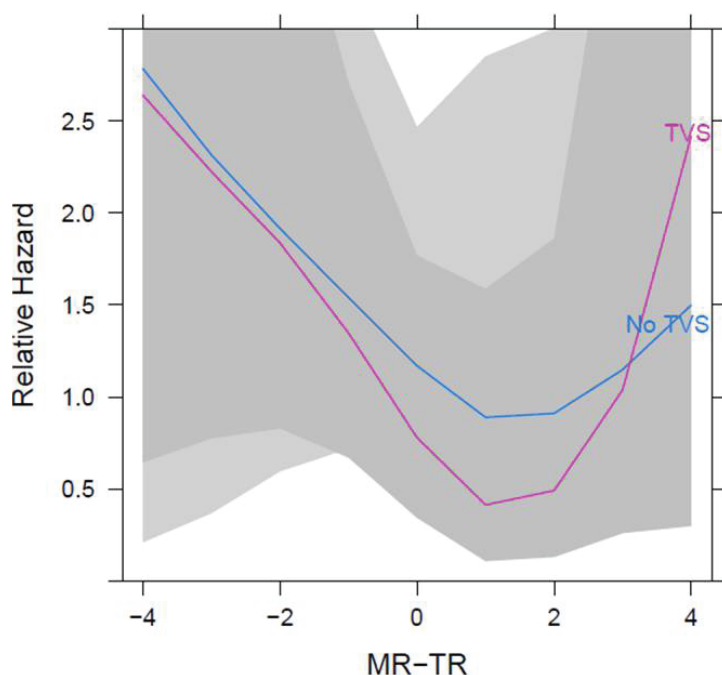
Invited Discussant: *Nader Moazami

Objectives: To date, the effect of tricuspid valve surgery (TVS) on long-term survival in CF-LVAD patients has not been sufficiently analyzed in a robust statistical manner nor has it accounted for the association with other hemodynamic variables. We retrospectively analyzed the prospectively-collected Mechanical Circulatory Support Research Network registry.

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Methods: In this population, the difference between semiquantitatively graded preoperative MR and TR (from 0 to 4) produces a variable ranging from -4 to 4 and was tested as it relates to overall mortality. Propensity-matched samples according to hemodynamics, pulmonary vascular resistance and right ventricular dysfunction were created and the effect of TV surgery was further evaluated on the relationship between valvular regurgitation and overall survival in a continuous nonlinear manner using restricted cubic splines. Predictors on remaining patients were subjected to multivariable Cox regression analysis to determine an overall effect of TV surgery on survival.

Results: Between May 2004 and May 2015, 1,150 consecutive patients underwent CF-LVAD placement at five institutions. Out of 1076 patients free of concomitant aortic valve interventions, information on TV surgery was available on 1068 patients; 225 patients (21%) underwent concomitant TV surgery. Restricted cubic spline regression showed a nonlinear but significant relationship between valvular regurgitation and mortality ($p = 0.01$). (Figure 1) In the multivariable model, the protective effect of TV surgery on overall survival was close to significant (H.R.:0.59, [0.34, 1.02], $p = 0.06$).



Conclusions: The relationship between TVS and survival is complex and concomitant TVS may positively affect overall survival in CF-LVAD patients. However, the relationship is non-linear and this assumption may only apply to patients with more TR and less MR, whereas in a situation of more MR and less TR, the effect of TV surgery is inverted and may add risk as a concomitant procedure with less survival benefit (i.e., prophylactic TV annuloplasty for enlarged annulus).

7. Comparison of Surgical Aortic Valve Replacement, Minimally Invasive Valve Replacement, and Transcatheter Aortic Valve Replacement In 2571 Patients

Tom C. Nguyen¹, *Vinod Thourani², Yelin Zhao¹, Matthew D. Terwelp¹, Prakash Balan¹, Daniel Ocazionez¹, *Anthony Estrera¹, Richard Smalling¹, Vasilis C. Babaliaros², Joseph Lamelas³

¹University of Texas, Houston, TX; ²Emory University, Atlanta, GA; ³Mount Sinai Medical Center, Miami Beach, FL

Invited Discussant: *Mathew R. Williams

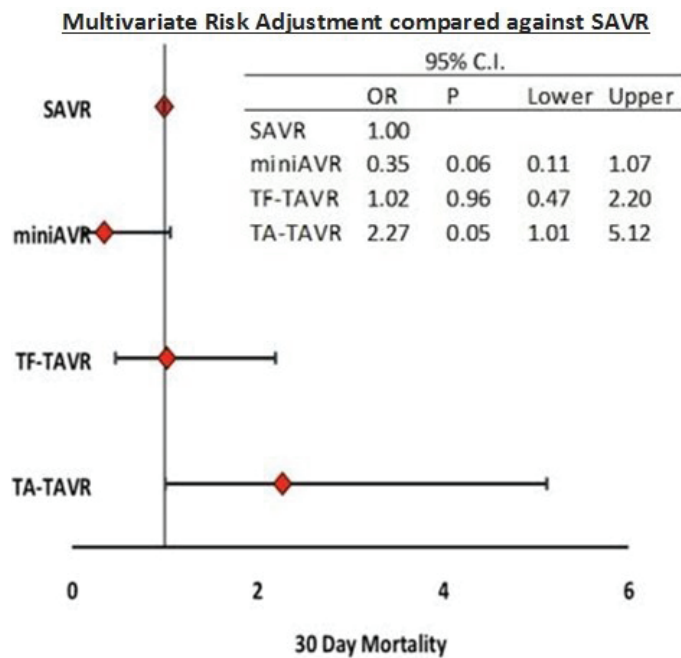
Objective: An increasing number of options exist for the treatment of severe symptomatic aortic stenosis. The objective of this study was to compare short-term outcomes in patients undergoing surgical aortic valve replacement (SAVR), minimally invasive aortic valve replacement (MIAVR), and transcatheter aortic valve replacement (TAVR).

Methods: A multi-institutional retrospective review of 2571 patients undergoing SAVR (n = 842), MIAVR via right anterior thoracotomy (n = 699), and TAVR (n = 1030) from 2011–2014 was performed. TAVR patients were broken down as either transfemoral (TF) or transapical (TA). Multivariate logistic and linear regression models were developed to adjust the risk factors for endpoints among treatment groups. Odds ratios (OR) and 95% confidence intervals were calculated. Propensity score matching was performed between TF-TAVR and MIAVR (247 matched pairs) as well as between TA-TAVR and MIAVR (115 matched pairs).

Results: Multivariate risk adjusted comparisons revealed that bleeding was less common in patients undergoing MIAVR (OR: 0.17, CI: 0.07–0.45) and TF-TAVR (OR: 0.07, CI: 0.02–0.25) when compared to SAVR patients. When compared to SAVR, 30-day mortality was highest in TA-TAVR (OR: 2.27, CI: 1.01–5.12, p = 0.5) and lowest in MIAVR (OR: 0.35, CI: 0.11–1.07, p = 0.06). Propensity matched comparisons of TF-TAVR and TA-TAVR versus MIAVR revealed no difference in 30-day mortality. Propensity matched comparison of TF-TAVR versus MIAVR revealed that MIAVR had decreased rate of stroke (0.4% vs. 3.6%, p = 0.02) and increased rate of atrial fibrillation (19.4% vs. 4%, p < 0.01). MIAVR was associated with longer length of stay compared to TF-TAVR (7.5d vs. 4.1d, p < 0.01). Propensity matched comparisons of TA-TAVR versus MIAVR revealed that MIAVR exhibited decreased ventilation hours (8.3 h vs. 13.4 h, p = 0.03) and ICU hours (63.7 h vs. 92.7 h, p = 0.02).

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Conclusions: Propensity matched analysis showed no difference in 30-day mortality between TF-TAVR and MIAVR. In patients with severe aortic stenosis, MIAVR represents an important quality alternative.

8. A Long-Term Comparison Between Artificial Chordae and Double Orifice Repair in Degenerative Mitral Regurgitation Due to Anterior and Bileaflet Prolapse

Andrea Giacomini, Elisabetta Lapenna, Michele De Bonis, Giovanni La Canna, Alessandro Castiglioni, Teodora Nisi, *Ottavio Alfieri
San Raffaele University Hospital, Milan, Italy

Invited Discussant: *Mark Ruel

Objective: Degenerative mitral regurgitation due to anterior or bileaflet prolapse can be treated with a variety of surgical techniques. In our Institution we have been using mainly the double orifice edge-to-edge repair (DO) or the implantation of artificial chordae (AC) (with or without concomitant posterior leaflet resection in case of bileaflet prolapse) to treat those lesions. To the best of our knowledge a long-term comparison between those two approaches has not been reported and represents the objective of this study.

Methods: The study population includes 356 pts submitted to MV repair for degenerative MR due to bileaflet (BLP) (204 patients, 57,3%) or anterior leaflet prolapse (ALP) (152 patients, 43,7%). The DO repair was used in 215 patients (215/356, 60,4%) and the AC in the remaining 141 (141/256, 39,6%). The baseline clinical and echocardiographic characteristics of the patients were not significantly different in

the two groups. Mean age was 53 ± 13 years, NYHA class I or II was present in 71% of the cases, atrial fibrillation in 17.2% and preoperative LVEF was $59.5 \pm 7.5\%$. The preoperative, intra e postoperative data were prospectively entered into a computerized database and retrospectively reviewed. Clinical and echocardiographic follow-up was performed in a dedicated outpatient clinic in most of the cases.

Results: There were no hospital deaths. Aortic cross-clamp and cardiopulmonary bypass times were significantly shorter in DO group (51.8 ± 13.3 vs 67 ± 17.9 min and 71.4 ± 20.1 vs 83.9 ± 19.6 , both $p = 0.0001$). The degree of residual MR at hospital discharge was similar in the two groups ($p = 0.9$). At 7 years overall survival (93.5 ± 1.7 vs 90.8 ± 5.1 , $p = 0.3$) and freedom from cardiac death (96 ± 1.3 vs 97 ± 2.5 , $p = 0.1$) were not significantly different in the DO vs AC groups. However freedom from recurrent MR3+ or 4+ was higher in the DO group (93 ± 1.7 vs 88 ± 2.9 $p = 0.02$). At multivariate analysis, the use of artificial chordae (HR 2.9, 95% CI 1.3–6.2, $p = 0.005$), anterior leaflet prolapse (HR 1.9, 95% CI 1–3.5, $p = 0.04$) and residual MR > 1+ ad hospital discharge (HR 13, 95% CI 6.2–29, $p = 0.0001$) were identified as independent predictors of recurrent MR $\geq 3+$ at follow-up. Indeed in patients with bileaflet prolapse, the 7-year freedom from recurrent MR $\geq 3+$ was comparable in the DO ($96 \pm 1.7\%$) and in the AC ($94 \pm 2.9\%$) groups ($p = 0.3$). On the other hand, in patients with anterior leaflet prolapse, freedom from MR $\geq 3+$ was significantly lower in the AC ($81 \pm 5.5\%$) vs the DO group ($92 \pm 2.9\%$) ($p = 0.05$).

Conclusions: In degenerative MR due to anterior or bi-leaflet prolapse both the DO and AC techniques combined with ring annuloplasty provide excellent results. In BLP no differences were found between the two methods of repair whereas in isolated ALP, the DO repair appeared to be more effective.

MONDAY, MAY 16

3:00 PM – 3:35 PM Coffee Break in the Exhibit Hall

3:15 PM – 3:35 PM

AATS Consensus Guideline: TAVR

Exhibit Hall, AATS CT Theater I, Booth #103

*Wilson Y. Szeto, *University of Pennsylvania*

Not for Credit

Panelists: *Gorav Ailawadi, *University of Virginia Health System*

◆Kevin L. Greason, *Mayo Clinic*

*Rakesh M. Suri, *Cleveland Clinic*

* AATS Member ◆ ATS New Member

9. Aortic Root Surgery with Circulatory Arrest: Predictors of Prolonged Hospital Stay and Implications for Lowering Hospital Cost and Expediting Recovery

♦*Ourania Preventza*¹, *Andrea Garcia*¹, *Shahab Akvan*¹, *Sarang Kashyap*¹, *Kiki Simpson*²,
**Denton Cooley*³, **Scott A. LeMaire*¹, *Kim de la Cruz*¹, *Konstantinos Spiliotopoulos*¹,
*Matt D. Price*¹, **Faisal G. Bakaeen*², *Shuab Omer*², *Lorraine Corwell*², **Joseph Coselli*¹
¹*Baylor College of Medicine, Houston, TX*; ²*Michael E. DeBakey Veterans Affairs*
Medical Center, Houston, TX; ³*Texas Heart Institute, Houston, TX*

Invited Discussant: **Nicholas T. Kouchoukos*

Objective: Whereas the outcomes of conventional aortic root surgery are well documented, much less is known about those of aortic root operations in patients with proximal aortopathy that necessitates hypothermic circulatory arrest (HCA). The purpose of this study was to identify predictors of hospital length of stay (LOS) and factors that affect recovery after such procedures.

Methods: During a recent 8-year period, 265 patients with proximal aortopathy underwent aortic root surgery with HCA under moderate hypothermia. For the 247 patients who survived (206 elective, 41 urgent/emergent), multivariate regression analysis using 23 variables was performed to identify predictors of LOS (as a continuous variable) and prolonged LOS (defined as LOS > 10 d, the median LOS for the cohort). By this definition, 107 patients (43.3%) had prolonged LOS (Group A), and 140 (56.7%) did not (Group B). Of the 247 patients, 105 had a mechanical root, 92 had a bioprosthetic root, and 50 had aortic valve-sparing root replacement (AVSRR). Concomitant procedures were 221 proximal arch repairs, 26 total arch procedures, and 35 CABG operations. Median cardiopulmonary bypass, cardiac ischemia, and circulatory arrest times were 168.0, 123.0, and 23.0 minutes, respectively, in Group A, and 150.5, 107.5, and 18.0 minutes, respectively, in Group B. Sixty-five patients (26.3%) had prior sternotomy.

Results: The preoperative and intraoperative factors that independently predicted prolonged LOS were emergent status ($P = 0.024$), redo sternotomy ($P = 0.0001$), concomitant CABG ($P = 0.0033$), and intraoperative RBC transfusion ($P = 0.039$). The postoperative complications that had the most impact on LOS were ventilator support >48 hours ($P < 0.0001$) and renal injury ($P = 0.0041$). Further analysis showed that intraoperative RBC transfusion ($P = 0.0021$), congestive heart failure ($P = 0.0070$), concomitant total arch replacement ($P = 0.0001$), and emergent status ($P = 0.0065$) predicted ventilation >48 hours, and that intraoperative RBC ($P = 0.0074$) and preoperative renal disease ($P = 0.027$) predicted postoperative renal injury. When LOS was analyzed as a continuous variable, age, redo sternotomy, preoperative pulmonary disease, postoperative ventilator support >48 hours, postoperative renal injury, reoperation for bleeding, and tracheostomy were associated with greater LOS. In a subgroup analysis of elective cases only, AVSRR predicted a shorter LOS (by a median of 2 d) than non-AVSRR repair ($P = 0.044$).

Conclusion: This study, which focused on predictors of prolonged LOS in patients undergoing aortic root surgery with HCA for proximal aortopathy, suggests that reducing intraoperative RBC transfusion; optimizing preoperative renal, cardiac, and pulmonary status; and minimizing reoperations for bleeding may reduce LOS, lower hospital cost, and expedite recovery. AVSRR, when feasible, may reduce LOS in elective cases.

10. Why Do a Ross? Equivalent 15-Year Survival But Improved Freedom from Thrombohemorrhagic Complications Compared to Mechanical Aortic Valve Replacement: A Propensity-Matched Cohort Study

Amine Mazine, Cedric Manlhiot, *Vivek Rao, Edward J. Hickey, Shakira Christie, *Tirone E. David, Maral Ouzounian

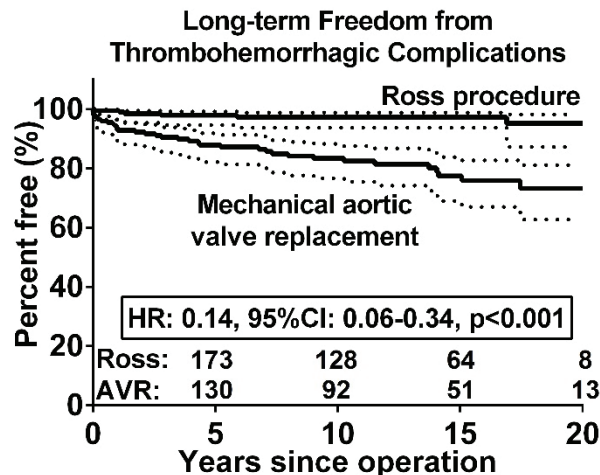
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Duke E. Cameron

Objective: We sought to compare the early and long-term outcomes of patients undergoing the Ross procedure vs. mechanical aortic valve replacement (AVR).

Methods: From February 1990 to August 2014, 258 patients underwent a Ross procedure and 1,444 a mechanical AVR at a single institution. Patients with acute aortic dissection, active endocarditis, or requiring emergency surgery were excluded. Patients were matched into 208 pairs using a propensity score. Mean age was 37.2 ± 10.2 years and 63% were male. Mean follow-up duration was 11.2 ± 6.4 years and was similar in both groups.

Results: Propensity-matched patients were well balanced with regards to preoperative baseline characteristics including age and comorbidities. Rates of 30-day mortality were similar between the two matched groups with one early death in each group (Ross: 0.5%; AVR: 0.5%, $p = 1.0$). There were no differences in rates of other early complications including stroke, myocardial infarction, atrial fibrillation, renal failure, and reoperations ($p = \text{NS}$). Overall survival at 5, 10, and 15 years was equivalent (Ross: 99.0 ± 1.0 , 97.5 ± 2.5 , 92.6 ± 7.4 respectively; AVR: 96.5 ± 3.5 , 95.0 ± 5.0 , 91.8 ± 8.2 ; $p = 0.39$). Similarly, rates of endocarditis (Ross: 3.9%; AVR: 2.9%, $p = 0.60$) and structural or non-structural valve deterioration (Ross: 7.2%; AVR: 4.8%, $p = 0.41$) were not different between the two groups. Freedom from reoperation at 15 years was excellent following both procedures (Ross: 91.9 ± 8.1 ; AVR: 91.5 ± 8.5 ; $p = 0.46$). Patients undergoing Ross procedures had improved freedom from cerebral thromboembolism (Ross: 98.4 ± 1.6 ; AVR: 87.3 ± 12.7 , $p < 0.001$) as well as improved freedom from anticoagulant-related hemorrhage (Ross: 99.0 ± 0.7 ; AVR:



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87.4 ± 3.0, $p < 0.001$) at 15 years. As shown in Figure 1, long-term freedom from thrombohemorrhagic complications was superior after the Ross procedure (Ross vs. AVR: Hazard Ratio 0.14, 95% CI; 0.06–0.34, $p < 0.001$).

Conclusions: In the longest comparative longitudinal study performed to date, early outcomes and overall survival were comparable between the Ross procedure and mechanical AVR. However, patients undergoing the Ross procedure had improved long-term freedom from thrombohemorrhagic events. The Ross procedure should be considered for young and middle-aged adults undergoing aortic valve replacement.

11. Predictors for Stable Late Rhythm in Surgical Ablation for Atrial Fibrillation

Patients

*Niv Ad, Sari Diana Holmes, Deborah J. Shuman, Graciela Pritchard, Deborah Lamont
Inova Heart and Vascular Institute, Falls Church, VA

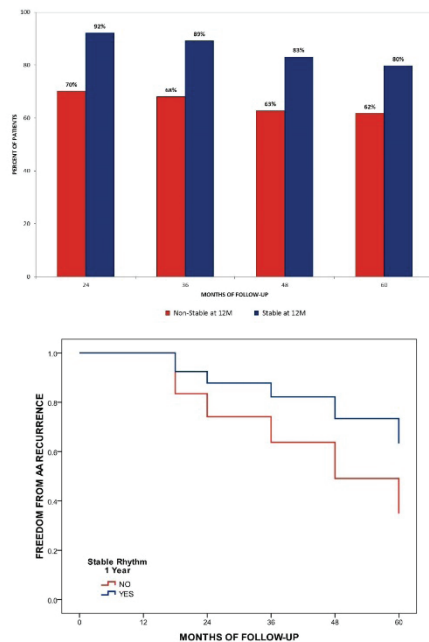
Invited Discussant: *Ralph J. Damiano, Jr.

Objective: An important clinical challenge in surgical ablation for atrial fibrillation (AF) is the scarcity of information on credible predictors of long-term success in patients whose procedures were performed with ablation tools that produce consistently reliable transmural lesions. We examined factors that predict stable rhythm at more than 1 year after surgery in patients who were in sinus rhythm and not taking antiarrhythmic drugs (AAD) at 12 months after surgical ablation for AF.

Methods: Patients who had undergone surgical ablation and were in sinus rhythm without AAD at 12 months after surgery were included and followed prospectively ($N = 622$). Multivariate Cox regression was conducted to examine the predictors of stable sinus rhythm in the absence of AAD at >1 year and up to 5 years after surgery. Stable sinus rhythm was defined as no recurrence of atrial arrhythmia, no follow-up cardioversions, and no follow-up ablations at all time points available for each patient, up to 5 years. Not all patients in this sample had reached 5 years after surgery, but Cox regression allowed the inclusion of all available follow-up data for patients after 1 year.

Results: The mean age of patients was 64.5 years, 32% were female, 86% had full Cox maze procedures, 21% had stand-alone procedures, 37% had persistent AF, and 48% had long-standing persistent AF. The mean follow-up period was 64.3 months. Of the patients with follow-up data available beyond 12 months, 69% ($n = 385$) did not experience a recurrence and remained off AAD. Patients in stable sinus rhythm during the first 12 months were more likely to maintain stable sinus rhythm between 1 and 5 years (74% vs. 46%, $P < 0.001$). Patients in stable sinus rhythm during the first 12 months after surgery were also more likely to be in sinus rhythm without the use of AAD at each individual time point up to 5 years ($P < 0.05$; Figure). Surgical ablation performed with cryothermia energy alone was more likely to result in stable sinus rhythm between 1 and 5 years (74% vs. 61%, $P = 0.002$).

Multivariate Cox regression incorporating time to first event revealed that a greater risk for atrial arrhythmia recurrence was associated with older age (HR = 1.03, 95% CI: 1.01–1.04, $P = 0.002$), longer preoperative duration of AF (HR = 1.003, 95% CI: 1.0002–1.01, $P = 0.028$), and unstable rhythm during the first 12 months (HR = 2.63, 95% CI: 1.86–3.71, $P < 0.001$; Figure). Other factors adjusted for in the model were gender, left atrium size, AF type, energy source, lesion set, surgeon experience, and number of concomitant procedures.



Conclusions: Most patients who experienced stable sinus rhythm during the first 12 months after surgical ablation continued to be without atrial arrhythmia recurrences after 12 months. In addition to younger patient age and shorter duration of AF, use of cryothermia as the sole energy source for ablation may be associated with more permanent surgical correction of AF.

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12. What Is the Risk of Adding Aortic Replacement to Cardiac Surgery?

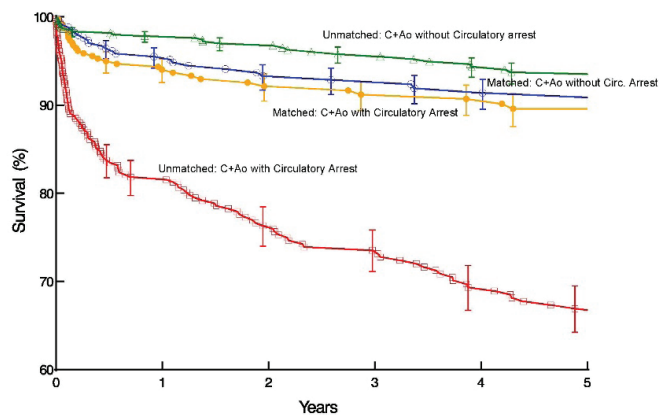
Jay J. Idrees, *Eric E. Roselli¹, Ashley Lowery, *Eugene H. Blackstone, ♦Douglas R. Johnston, ♦Edward G. Soltesz, Gosta B. Pettersson, *Joseph F. Sabik, III, *Lars G. Svensson
Cleveland Clinic Foundation, Cleveland, OH

Invited Discussant: *Joseph E. Bavaria

Objective: To determine whether performing ascending aorta replacement increases risk during an elective cardiac operation.

Methods: From 6/2006 to 1/2011, 14,294 patients underwent elective cardiac procedures with (C+Ao; 1677,12%) or without (C; 12617,88%) aortic replacement. Circulatory arrest was used in 728 (43%) of the C+Ao group. Propensity matching was performed using 79 pre-operative variables. Three matched comparisons were performed: I) C+Ao vs Cardiac (1284 pairs from the group of 1677), II) C+Ao with vs C+Ao without circulatory arrest (342 pairs from 728 eligible), and III) C+Ao group from II (i.e., adjusted for decision to use circulatory arrest) vs Cardiac from the greater population (647 pairs).

Results: From the first matched comparison between the larger cohorts, there was no difference in mortality (2.4% C+Ao vs 1.8% C, $n = 1284$ pairs, $p = 0.27$), but stroke was significantly higher in the C+Ao group (2.4% vs. 0.7%, $P = 0.0005$). Circulatory arrest was associated with stroke (3.9% vs. 0.6%, $P < .0001$) and mortality (4.1% vs. 1.8%, $P = .0032$) in that first comparison. After adjusting for the use of circulatory arrest in the second comparison, we found no difference in outcomes for stroke (1.5% vs 1.5%, $p = 1$) or mortality (1.2% vs 0.58%, $p = 0.41$) in patients undergoing C+Ao operations. These matched C+Ao patients were again compared to the larger C cohort confirming that the addition of aortic replacement did not contribute to the risk of mortality (0.92% C+Ao vs 0.46% C, $n = 647$ pairs, $p = 0.38$) or stroke (0.78% C+Ao vs 1.1 C, $n = 647$ pairs, $p = 0.82$). Finally, the risk of death and stroke in patients undergoing C+Ao operations who were unmatched was higher than in all other cohorts, especially for those requiring circulatory arrest (unmatched group: mortality 3.3%, 7% with circulatory arrest; stroke 3.0%, 6.5% with circulatory arrest; Figure).



Conclusions: In patients undergoing cardiac surgery, ascending aortic replacement not requiring circulatory arrest can be performed without penalty. Circulatory arrest itself does not contribute risk, but is a marker of more advanced aortic disease. For patients in whom cardiac and aortic surgery requires circulatory arrest, morbidity and mortality is still low but the added risk of aortic replacement should be weighed against the severity of aortic disease.

5:00 PM Adjourn

MONDAY AFTERNOON, MAY 16, 2016

MONDAY, MAY 16

2:00 PM **Congenital Heart Disease** Ballroom III, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion

Moderators: *Duke E. Cameron and *Jennifer C. Hirsch-Romano

13. Five-Year Experience with Arterial Switch Operation in the First Hours of Life Using Autologous Umbilical Cord Blood

Kyrylo Chasovskyi, Yaroslav Mykychak, Nadiya Rudenko, Ganna Vorobyova,
[Illya Yemets](#)

Ukrainian Children's Cardiac Center, Kyiv, Ukraine

Invited Discussant: *Christopher A. Caldarone

Objective: We compared postoperative outcomes of two management strategies for arterial switch operation (ASO) in the single institution: first hours of life surgery using autologous umbilical cord blood (UCB) and conventional approach.

Methods: From September 2009 to September 2014, 346 consecutive patients who underwent ASO were enrolled. Study group included 92 patients who underwent ASO in the first 24 hours after birth (Group I). Control group consisted of 254 patients who underwent ASO after 24 h of life in conventional way (Group II). Analyzed variables are listed in Table.

Results: Overall 30-day survival was 98% (2 (2%) Group I vs. 5 (2%) Group II, $p = 1.000$). Fifty (13.3%) major complications were observed: 14 (15%) in Group I and 36 (15%) in Group II ($p = 0.635$). Although post-extubation hospital length of stay and morbidity index did not differ significantly between groups, ventilation time and total hospital stay were significantly longer in Group II (Table). Group II patients experienced significantly higher preoperative length of ICU stay, rate of preoperative ventilation (62 (24%) Group II vs. 1 (1%) Group I, $p < 0.001$) and rate of balloon atrial septostomy (BAS) (201 (73%) Group II vs. 1 (1%) Group I, $p < 0.001$). A median volume of 80 ml (60–100 ml) of AUCB was collected (80 ml Group I vs. 60 ml Group II, $p = 0.090$). Homologous blood cell transfusion was avoided in 70 (78%) Group I patients and 13 (6%) Group II patients ($p < 0.001$).

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Table: Patient Characteristics

Variables	Group Ia (n = 92)	Group IIb (n = 254)	p-Value
Age at surgery (hr), median (IQR)	4 (3,5)	144 (96, 192)	<0.001
CPB time (min), mean (SD)	154 (29)	155 (32)	0.703
Cross-clamp (min), mean (SD)	85 (21)	85 (14)	0.952
Ventilation time (hr), median (IQR)	27 (22, 47)	42 (24, 67)	0.008
Preop ICU LOS (d), median (IQR)	0	3 (2, 4)	N/A
Postextubation hospital LOS (d), median (IQR)	13 (10, 15)	13 (10, 19)	0.744
Total Hospital LOS (d), median (IQR)	14 (12, 18)	18 (14, 24)	<0.001
Morbidity index*, median (IQR)	1 (1, 1,4)	1,1 (0.8, 1.9)	0.471

a-patients underwent ASO in the first hours of life using autologous umbilical cord blood transfusions;

b-patients underwent ASO in the first days of life using homologous blood transfusions;

* index, defined as ventilation time + post-extubation hospital length of stay + occurrence of selected major complications;

CPB = cardiopulmonary bypass; IQR = interquartile range; N/A = not applicable; Preop = preoperative;

SD = standard deviation; ICU = intensive care unit; LOS = length of stay

Conclusions: Compared to the conventional approach ASO during the initial 24 hours of life has similar outcomes in view of morbidity and mortality. Significantly reduced length of preoperative and total hospital stay, reduced the need for BAS and homologous blood exposure were observed in patients who underwent ASO in the first hours of life.

14. Five-Year Experience with Immediate Extubation After Arterial Switch Operation for Transposition of Great Arteries

Joby Varghese, Shelby Kutty, Sandy Hall, Mary Craft, Ibrahim Abdullah, James M. Hammel
Children's Hospital and Medical Center Omaha, Omaha, NE

Invited Discussant: *Emile A. Bacha

Objective: Impact of immediate extubation (IE) after arterial switch operation (ASO) for transposition of great arteries (TGA) is unknown. We sought to identify pre-operative, intra-operative and anatomical factors associated with immediate extubation after arterial switch operation.

Methods: This is a retrospective study performed at a tertiary care children's hospital on consecutive arterial switch operation performed from 01/01/2010 to 06/30/2015. IE was defined as successful extubation before termination of anesthetic care. Univariate/bivariate screening of pre-operative, intraoperative and anatomical variables was used to determine associations with IE. Data were analyzed by Fisher exact test and Wilcoxon rank sum tests.

Results: Of 33 patients in the TGA spectrum (age at operation 7.3 ± 4.7 , range 2–23 days), 18 (55%) underwent IE. 17 (52%) patients had intact ventricular septum, 16 (48%) had VSD, 3 (9%) had double outlet right ventricle (DORV) and 1 (3%) had

aortic arch obstruction. Twelve (71%) out of 17 patients with IVS and 6 (38%) out of 16 patients with VSD had IE, whereas none of the patients with DORV or aortic arch obstruction were able to be extubated in the OR (n = 4). There was no mortality. Variables and associations are shown in the Table. Patients who had cardiopulmonary bypass time >171 mins (p = 0.01), minimum temperature on CPB (T min) ≤30.4°C (p = 0.03) and aortic cross clamp time >74 mins (p = 0.04) were more likely to be left intubated at the end of the procedure. Patient's chronological age, gestational age, post conceptual age, weight, coronary anatomy or absence of VSD was not associated with IE in the cohort. Anesthesiologist emerged as a significant factor affecting IE (p = 0.02) while surgeon (p = 0.28) and perfusionist (p = 0.6) did not.

Patients who underwent IE had shorter intensive care unit stay (p = 0.018). There was no myocardial dysfunction evident on pre-dismissal echocardiography in the IE or non-IE group. Two patients (11%) who had IE were re-intubated in the first 24 hours after extubation; one had increased work of breathing due to upper airway congestion and the second had diffuse atelectasis. Two patients (12%) who didn't undergo IE were re-intubated in the first 24 hours after extubation; both had pulmonary dysfunction secondary to atelectasis.

Parameter		Cohort	Non-IE	IE	p-Value
VSD	Absent	17 (51.5%)	5 (29.4%)	12 (70.6%)	0.08
	Present	16 (48.5%)	10 (62.5%)	6 (37.5%)	
Coronary anatomy	1AD, CX;2R	21 (63.6)	8 (38.1)	13 (61.9)	0.26
	Non 1AD, CX;2R	12 (36.4)	7 (58.3)	5 (41.7)	
CPB	≤171 min	25 (75.76%)	8 (53.33%)	17 (94.44%)	0.01¶
	>171 min	8 (24.24%)	7 (46.67%)	1 (5.56%)	
XC	≤74 min	18 (54.5%)	5 (33.3%)	13 (72.2%)	0.04¶
	>74 min	15 (65.5%)	10 (66.6%)	5 (27.8%)	
T min	≤30.4OC	13 (39.4%)	9 (69.2%)	4 (30.8%)	0.03¶
	>30.4OC	20 (60.6%)	6 (30%)	14 (70%)	
pO ₂ / FiO ₂ *		368 [245, 433]	253 [68, 429]	405 [368, 437]	0.02¶
Last lactate in operating room*		2.1 [1.7, 2.5]	2.2 [1.5, 2.7]	2.1 [1.7, 2.3]	0.61
Total ICU stay*		4 [3, 4]	4 [3, 6]	3 [3, 4]	0.02¶

*Expressed as median (1st, 3rd quartiles); ¶ Statistical significance.

Conclusions: In this cohort of infants post ASO, 55% were extubated immediately in the operating room with no additional morbidity. This data attests to the safety of IE after ASO. Intraoperative factors appeared to influence the ability for IE more than preoperative factors; greater bypass and cross clamp times and T min ≤30.4°C were associated with lesser likelihood of IE. Length of intensive care unit stay was shorter in those who had IE, which may translate to cost benefits.

15. Should All Patients with Congenitally Corrected Transposition of Great Arteries (ccTGA) Undergo Anatomic Repair?

Maryam Alomair, Mohammed Al-Jughiman, Andrew Redington, *Christopher Caldarone, Luc Mertens, *Glen Van Arsdell

University of Toronto, Toronto, ON, Canada

Invited Discussant: *Bahaaldin AlSoufi

Background: Late failure of the systemic ventricle (the morphologic RV) with physiologic repair, and in those not having associated surgical lesions, has led to the question: Should all patients with ccTGA undergo anatomic repair?

Objective: We hypothesized that patients undergoing anatomic repair for ccTGA would have superior systemic ventricular function and survival.

Method: From 1982 to 2014, 261 patients with ccTGA were managed. Groups were: Anatomic repair (AnatR, n = 36), Physiologic repair (PhysR, n = 103), Single-ventricle repair (SV n = 35), No associated lesions (NoL, n = 47), Primary heart transplant (n = 2), and Palliated patients (n = 38).

1A. Freedom from mortality and transplant, last era (since 2000)

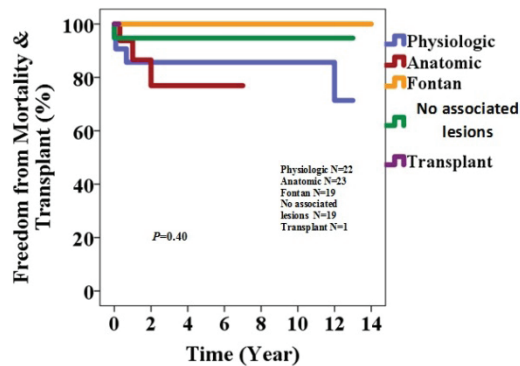
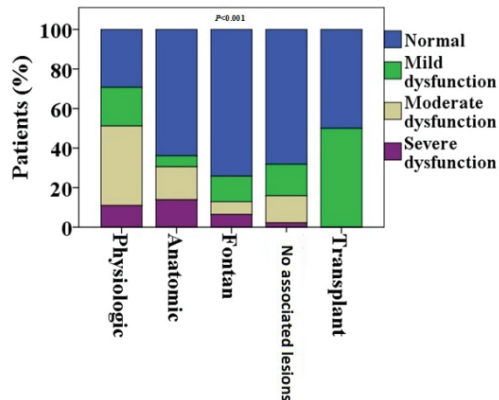


Figure 1B. Systemic ventricular function at last follow up



Result: At 18 years, survival was AnatR 38.1%, PhysR 70%, SV 82.7%, NoL 95.7%, and TX 100% $p = 0.006$. Since 2000, survival was AnatR (74% $n = 24$), PhysR (86.3% $n = 23$), SV (100%, $n = 19$), and NoL (94.7% $n = 19$) at 7 years ($p = 0.40$) (Figure 1A). Transplant free survival did not significantly improve over time ($p = 0.47$).

Moderate or greater systemic ventricular dysfunction was seen in 30.6% of AnatR, 51.2% of PhysR, 11.4% SV and 14.9% of NoL at last follow up ($p < 0.001$) (Figure 1B).

In multivariate analysis, severe dysfunction of the systemic ventricle was a predictor of late mortality ($p = 0.001$, OR = 13.94, 95% CI 3.06–63.54) and was a specific predictor of mortality in anatomic repair. AnatR, SV, and NoL had superior systemic ventricular function to PhysR at last f/u though the f/u time is shorter for AnatR.

Conclusion: Anatomic repair of ccTGA did not yield superior survival as compared to physiologic repair. The long term impact on systemic ventricular function is not certain. Survival was best in those having no associated lesions requiring operation indicating (at this length of f/u) that performing an anatomic repair for those not having associated lesions could be counter productive.

MONDAY, MAY 16

16. Pediatric Cardiac Surgical Outcomes Following Implementation of a Novel Acuity Adaptable Care Model

John M. Costello, Elizabeth Preze, Nguyenvu Nguyen, Mary E. McBride, James W. Collins, Jr., Osama Eltayeb, Michael C. Monge, Barbara J. Deal, Michelle M. Stephenson, *Carl L. Backer

Ann and Robert H. Lurie Children's Hospital of Chicago, Chicago, IL

Invited Discussant: *Sertac Cicek

Objective: We developed and implemented a novel acuity adaptable care model in which patients undergoing pediatric cardiac surgery are admitted to and remain in the Cardiac Care Unit and receive care from the same clinical team throughout their hospitalization. We hypothesized that patients undergoing pediatric cardiac surgery following implementation of the acuity adaptable care model would have improved outcomes when compared to those managed in a conventional model, in which patients were moved between units and care teams based on age, severity of illness, and operative status.

Methods: This study included consecutive patients undergoing an index pediatric cardiac operation assignable to a Society of Thoracic Surgeons-European Association for Cardio-Thoracic Surgery (STAT) mortality category between 7/2007 and 6/2015. From 7/2007 to 6/2010, patients were cared for with the conventional model. From 7/2010 to 6/8/2012, a transition period existed during which both models were used. The acuity adaptable care model was fully implemented on 6/9/2012. Outcomes between the conventional (7/07–6/10), transitional (6/10–6/8/12), and acuity adaptable (6/9/12–6/15) groups were compared, including operative mortality, hospital length of stay (LOS), incidence of surgical site infections, and failure to rescue rate (deaths in patients with any complication divided by number of total patients with any complication). Multivariable logistic regression modeling was used to adjust mortality estimates among groups for age, prematurity, non-cardiac structural anomalies, genetic syndromes, STAT mortality category, presence of any STS preoperative risk factor, surgeon, and CPB time.

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Results: There were 993 patients who received perioperative care in the conventional model, 556 in the transitional model, and 971 in the novel model. Unadjusted operative mortality decreased from 2.3% (23/993) to 2.2% (12/566) to 1.2% (12/971) ($p = 0.07$). When compared to the conventional group, the adjusted odds of mortality in the acuity adaptable group was 0.56 (95% CI, 0.26–1.20, $p = 0.14$). Postoperative length of stay tended to be shorter for patients receiving care in the acuity adaptable model (median 6 days [IQR, 4–14] vs. 6 days [IQR, 4–11], $p = 0.14$). Surgical site infections decreased from 1.8 and 1.9 to 0.6 per 100 cases ($p = 0.02$). The failure to rescue rate was significantly lower with the acuity adaptable model (8.6% [22/256] vs. 6.8% [12/176] vs. 4.2% [12/284]; $p = 0.04$).

Conclusions: When compared to outcomes achieved with a conventional model, the implementation of a novel acuity adaptable care model in our pediatric cardiac surgery program was associated with a favorable reduction in operative mortality, significantly fewer surgical site infections, and a lower failure to rescue rate.

3:20 PM – 3:55 PM Coffee Break in the Exhibit Hall

17. Preoperative Hemodynamic Parameters Predict Adverse Outcomes in Patients Undergoing Biventricular Conversion with Damus-Kaye-Stansel Takedown

Melissa A. Herrin, Breanna L. Piekarsk, David Zurakowski, Christopher W. Baird, Wayne Tworetzky, Puja Banka, Gerald R. Marx, Roger E. Breitbart, Audrey C. Marshall, *Pedro J. del Nido, Sitaram M. Emani

Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *E. Dean McKenzie

Objective: Patients with variants of hypoplastic left heart syndrome (HLHS) and unbalanced atrioventricular canal defect (AVC) who underwent Damus-Kaye-Stansel (DKS) procedure may be candidates for biventricular (BiV) repair. However, clinical criteria to predict risk of adverse outcomes are incompletely characterized. We investigated association between pre-operative hemodynamic parameters and postoperative outcomes in pediatric patients undergoing DKS takedown to BiV conversion.

Methods: A retrospective review was performed on patients who underwent DKS takedown surgery to BiV repair at a single institution from January 2003 to July 2015. Patients are selected to undergo BiV conversion based on imaging parameters demonstrating favorable response of LV volume and function following recruitment procedures. Predictor variables in our analysis included diagnosis, age and weight at time of surgery, left ventricle (LV) dimension, LV end diastolic volume, LV mass, and LV end diastolic pressure (LVEDP). Outcome variables included death, heart transplant, reversal operation to single ventricle anatomy (reversal), and right ventricular pressure greater than $\frac{2}{3}$ systemic blood pressure ($RV > \frac{2}{3}SBP$).

Results: Of 49 patients, 10 of which had a primary outcome of death ($n = 6$), transplant ($n = 3$), or reversal to single ventricle ($n = 1$), median pre-operative LVEDP was significantly greater (13; interquartile range (IQR) 11.8–19) compared to those patients that did not experience an event (11; IQR 10–12.5) ($p = 0.018$). Multivariate

logistic regression demonstrated that primary outcome event was independently associated with elevated pre-operative LVEDP when adjusted for age, weight, diagnosis, and RVP > $\frac{1}{4}$ SBP (OR = 1.19, p = 0.04). Patients with a postoperative RVP > $\frac{1}{4}$ SBP (n = 17) had a significantly greater median preoperative LVEDP (13; IQR 11–15.5) compared to those with RVP < $\frac{1}{4}$ SBP (11; IQR 10–12). Receiver operating curve analysis demonstrated a cutoff of LVEDP less than 13 as optimal to predict a postoperative RVP < $\frac{1}{4}$ SBP. Furthermore, independent of diagnosis and weight, preoperative LVEDP > 13 mm Hg was significantly associated with a composite outcome consisting of death, transplant, reversal, or postoperative RVP > $\frac{1}{4}$ SBP (OR = 6.00, p = 0.01). Although patients with HLHS (n = 32) were more likely to experience this composite outcome compared to unbalanced AVC (n = 17), these differences did not reach statistical significance (p = 0.06).

Conclusions: Preoperative LVEDP is a risk factor for suboptimal postoperative hemodynamics and adverse events after biventricular conversion; furthermore, those patients with a preoperative LVEDP <13 mm Hg are less likely to experience unfavorable outcomes.

MONDAY, MAY 16

18. Effect of Preoperative Administration of Allopurinol on Postoperative Outcomes in Patients Undergoing Repair of Tetralogy of Fallot

Sachin Talwar, Murugan Selvam Sathiya, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balram Airan

All India Institute of Medical Sciences, New Delhi, India

Invited Discussant: *J. William Gaynor

Objective: To determine the effects of preoperative administration of allopurinol on post operative outcomes following intracardiac repair of Tetralogy of Fallot (TOF).

Materials and Methods: In this prospective double-blind randomized study, 50 patients undergoing intracardiac repair of TOF were randomized to 2 groups of 25 each: (a) the allopurinol group, in which patients were administered allopurinol (10 mg/kg prior to surgery) and (b) placebo group. Plasma troponin I, superoxide dismutase (SOD) levels, levels of Interleukins IL1beta and IL6 and Malondialdehyde (MAD) levels were analyzed preoperatively and immediately following release of aortic cross clamp and 2 hours after weaning from Cardio pulmonary bypass (CPB). Postoperatively assessed parameters were inotropic score, rhythm, duration of mechanical ventilation, non-invasive monitoring of cardiac output and intensive care unit (ICU) and hospital stay.

Results: There was one early death due to pulmonary haemorrhage in the allopurinol group. The inotropic score was significantly lower in the allopurinol group compared to placebo group (11.04 ± 5.70 versus 17.50 ± 7.83 , p = 0.017). Mean duration of ICU stay in the allopurinol group was 33.71 ± 12.03 hours compared to 55.40 ± 28.95 in the placebo group (p = 0.007). The hospital stay was 5.29 ± 0.69 days in the allopurinol and 7.12 ± 2.35 days in placebo group (p=0.01).

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The plasma levels of SOD (U/ml) (a) preoperative were (2.87 ± 1.21 vs 2.31 ± 0.97 , $p = 0.048$), (b) immediately following release of cross clamp (5.32 ± 2.81 vs 4.5 ± 2.08 , $p = 0.05$) and (c) after termination of CPB (3.43 ± 1.99 vs 2.17 ± 0.77 , $p = 0.05$) between the allopurinol group vs placebo group respectively. Similarly there were significant differences in the preoperative and postoperative levels of IL1 beta and IL6. But there was no significant difference in the levels of troponin I between the 2 groups. The levels of MAD (pg/ml) in the preoperative sample and the sample in the period following release of aortic cross clamp were similar in both groups. But there was significant difference in the levels of MAD 2 hours following termination of CPB (11.80 ± 2.94 pg/ml in the placebo group vs 9.16 ± 3.02 in the allopurinol group, $p = 0.003$), indicating reduction in end products of lipid peroxidation are following CPB.

Conclusion: Pre-operative administration of allopurinol in patients undergoing intracardiac repair of TOF is associated with improved early outcomes. The levels of antioxidants as reflected by superoxide dismutase levels are more in these patients and there is reduction in inflammatory markers as seen by the reduced levels of interleukins. The levels of end products of lipid peroxidation are also less following bypass even though it is higher in the period following release of aortic cross clamp. Further studies are needed to confirm these findings and address the timing, dosage and duration of therapy.

Table: Summary of Results

	Variables	Placebo	Allopurinol	p-Value	Variables	Placebo	Allopurinol	p-Value
Post-operative parameters	Inotropic Score	17.50 ± 7.83	11.04 ± 5.70	0.017	Post clamp IL-6	34.47 ± 31.18	13.02 ± 26.05	0.024
	ICU stay (hrs)	55.40 ± 28.95	33.71 ± 12.03	0.007	Post CPB IL-6	102.4 ± 51.15	46.50 ± 37.94	0.005
	Hospital stay (days)	7.12 ± 2.35	5.29 ± 0.69	0.01	Prebypass IL-1	0.25 ± 0.20	0.25 ± 0.2	0.724
Cardiac index	Immediate postop	3.31 ± 0.49	3.57 ± 0.48	0.071	Post clamp IL-1	10.89 ± 13.42	1.43 ± 3.83	0.005
	After 4 hours	3.36 ± 0.68	3.87 ± 0.70	0.012	Post CPB IL-1	10.08 ± 12.26	3.80 ± 10.10	0.010
	Prebypass SOD	2.31 ± 0.97	2.87 ± 1.2	0.048	Prebypass Trop-I	0.61 ± 0.93	0.31 ± 0.66	0.345
Oxidative biochemical markers	Post clamp SOD	4.5 ± 2.08	5.32 ± 4.8	0.05	Post CPB Trop-I	29.8 ± 13.25	22.96 ± 10.53	0.090
	Post CPB SOD	2.17 ± 0.77	3.43 ± 1.99	0.05	Pre CPB MAD	3.84 ± 2.59	3.68 ± 1.31	0.396
	Prebypass IL-6	4.90 ± 5.71	1.67 ± 2.69	0.258	Post CPB MAD	11.80 ± 2.94	9.16 ± 3.02	0.003
Interleukins								



Late-Breaking Clinical Trial

LB2. The Miniaturized Pediatric Continuous Flow Device: Pre-Clinical Assessment in the Chronic Sheep Model

Iki Adachi¹, Sarah Burki¹, David Horne¹, Gil G. Costas², Robert Jarvik³, John Teal³, J. Timothy Baldwin⁴, Kurt Dasse⁵, Jeff Conger², *William E. Cohn², *Charles D. Fraser, Jr.¹

¹Texas Children's Hospital, Houston, TX; ²Texas Heart Institute, Houston, TX; ³Jarvik Heart, Inc., New York, NY; ⁴National Heart, Lung and Blood Institute, Bethesda, MD;

⁵Geno, LLC, Cocoa, FL

Invited Discussant:

5:00 PM

Adjourn

MONDAY AFTERNOON, MAY 16, 2016

2:00 PM

General Thoracic Surgery

Ballroom IV, BCC

Simultaneous Scientific Session

8 minute presentation, 12 minute discussion

Moderators: *Sudish C. Murthy and *Thomas K. Waddell

Late-Breaking Clinical Trial

LB3. Early Oral Feeding Following McKeown Minimally Invasive Esophagectomy: A Randomized Controlled Study

Yin Li, Hai-Bo Sun, Xian-Ben Liu, Rui-Xiang Zhang, Zong-Fei Wang, Yan Zheng, Shi-Lei Liu, Jian-Jun Qin, Xian-Kai Chen, Zhao Wu

Henan Cancer Hospital, The Affiliated Cancer Hospital of Zhengzhou University, Zhengzhou, China

Invited Discussant:

20. Achieving a 3-Star Lobectomy Ranking by Using Continuing Process Improvement, Lean Methodology and Root Cause Analysis

*Robert Cerfolio¹, Benjamin Wei¹, Caroline Watson¹, Douglas Minnich¹,

*Malcolm DeCamp²

¹University of Alabama, Birmingham, AL; ²Northwestern University, Chicago, IL

Invited Discussant: *Stephen D. Cassivi

Objective: Few know the metrics used for the recent Society of Thoracic Surgeons (STS) lobectomy ranking. Our purpose is to identify them and to show how we used root cause analysis with lean and process improvements to improve patient care and outcomes in order to achieve a three star ranking.

Methods: This is a review of the STS reported data for our program from Jan 2006 until July 2014.

Results: The STS metrics used for ranking are: 30-day mortality, pneumonia, acute respiratory distress syndrome, broncho-pleural fistula, pulmonary embolus, initial ventilator support greater than 48 hours, re-intubation/respiratory failure,



tracheostomy, myocardial infarction, or unexpected return to the operating room. Only 6% (12/194) programs were ranked 3-star. Our most common root cause analysis was failure to escalate care. The lean and process improvements employed that may have improved outcomes were: increasing pulmonary rehabilitation prior to surgery, adding a respiratory therapist, eliminating (lean) non-valued steps such as Foley catheters, arterial and central lines, favoring stereotactic radiotherapy and segmentectomy instead of lobectomy (especially left upper lobectomy) for marginal patients and using minimally invasive lobectomy for 88% of the last 493 lobectomies. The table shows the outcomes using the STS metric. There was a decrease in major respiratory complications (14% to 5.2%, $p = 0.001$) and mortality (2.0% to 0, $p < 0.0001$).

STS database results

	# lobectomies performed	30-day mortality	pneumonia	ARDS	Reintubation
1/06 - 12/08	357	2.0%	2.2%	0.8%	3.6%
7/08 - 6/09	124	1.6%	0.8%	0	4.8%
7/09 - 6/10	148	1.4%	2.7%	0.7%	3.4%
7/10 - 6/11	157	0.6%	1.9%	0	2.5%
7/11 - 6/12	125	0.8%	0.8	0%	1.8%
6/12 - 7/13	107	0%	0.9	0.9%	1.8%
6/13 - 7/14	99	0%	1%	0%	0

Conclusion: The metrics the STS uses to rank lobectomy programs are 30-day mortality and predominantly respiratory complications. Root cause analysis coupled with lean and process improvements have allowed us to improve our lobectomy patient outcomes and achieve a three star ranking. These results may be obtainable by others.

21. Is There a Hospital Volume Threshold for Operative Mortality for Lung Resections?

Anna Bendzsak, Nancy N. Baxter, Gail E. Baxter, Peter C. Austin, David R. Urbach
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Benjamin D. Kozower

Objective: To determine whether there is a threshold effect for the volume-outcome relationship between institutional volume and mortality from lung resection.

Methods: For all lung resections in Ontario, Canada, between 2004 and 2010, institutional information, and operative mortality (either in-hospital or 30-day mortality) were captured using provincial health administrative databases. The hospital volume in the 12 months prior to each resection was calculated. Mortality was regressed on hospital volume using logistic regression models that adjusted for the following variables: age, sex, Charlson comorbidity score, income quintile and calendar year. Restricted cubic splines were used to model the relationship between hospital volume and the log-odds of mortality. This allowed for a smooth, non-linear relationship between hospital volume and mortality.

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Results: 18,419 lung resections occurred between 2004–2010 in Ontario, Canada. The number of hospitals performing surgery during this time period ranged from 36 to 43 per year. The average annual hospital volume ranged from 19.1 to 159.4 cases per year. The highest absolute 12-month hospital volume was 350 resections. For the lowest 12-month hospital volume variable, one resection per 12 month period, the operative mortality was the highest at 4.78% (Figure 1). Operative mortality decreased with increasing hospital volume until 12-month hospital volume reached 124 cases per year with an operative mortality of 2.54%. After 124 cases, mortality was relatively stable, with a slight increase in mortality to 2.81% for hospitals performing 212 cases per 12-month period. After 212 resections per 12-months, operative mortality continued to decline to 1.45% for hospital performing 350 resections per 12-month period.

Conclusions: There are two threshold levels for the relationship between hospital volume and operative mortality for lung resections. Mortality decreased until 124 cases per 12-month period, and then remained stable until 212 cases per 12-month period. After 212 cases per year operative mortality continued to decline to very low levels. A reasonable threshold to define a “high volume” hospital for lung resection is approximately 125 cases per year. The high annual volume required to reach the first plateau for operative mortality, and the presence of two threshold levels will be of interest to policy makers interested in centralizing care for lung resections.

22. Unplanned Readmission Following Esophagectomy: Complete Follow Up in a One Year Cohort with Identification of Risk Factors

Karen J. Dickinson, James Taswell, *Mark S. Allen, *Shanda H. Blackmon, *Francis C. Nichols, III, *K. Robert Shen, *Dennis A. Wigle, *Stephen D. Cassivi
Mayo Clinic, Rochester, MN

Invited Discussant: *Antoon E. Lerut

Objective: Unplanned readmissions are adverse events, which negatively impact patients and healthcare resources. Identifying risk factors predicting readmissions might permit improved patient management and outcomes. Our objectives were to compile a complete account of readmissions after esophagectomy to identify potentially modifiable risk factors.

Methods: All patients undergoing elective esophagectomy between 1 August 2013–31 July 2014 were contacted directly to ascertain whether they had been readmitted to any institution within 30 days of hospital dismissal following their index admission for esophagectomy at our institution. Demographic data was supplemented from our prospectively maintained database. Follow-up was complete in 100% of patients.

Results: 107 patients underwent esophagectomy during the study period. 16 patients were excluded for various reasons (unresectable, complex non-gastric reconstruction, research consent declined); 84 patients met study inclusion criteria. Median age at surgery was 75 years. Male:female ratio was 68:16. The commonest operative approach was transthoracic (Ivor Lewis) esophagectomy (72%). 7% of cases were performed by a minimally invasive approach. 30-day mortality

was 2%. Anastomotic leak occurred in 8%. The rate of unplanned 30-day readmission was 19% (88% to our institution, 12% to other medical institutions). Median length of stay was 15 days for patients with unplanned readmission and 11 days for patients without unplanned readmission ($p = \text{NS}$). The median interval between discharge and readmission was 7 days. Using multivariable analysis, factors significantly associated with unplanned readmission were postoperative ICU admission ($p = 0.02$), perioperative blood transfusion ($p = 0.01$). Increased postoperative Day-1 glucose levels were also associated with unplanned readmission ($p = 0.06$). ASA score, sex, BMI, neoadjuvant therapy, postoperative pain scores were among those factors not associated with unplanned readmission. The commonest reasons for readmission were pulmonary-44% and gastrointestinal-36% (including anastomotic complications). Median duration of readmission was 4.5 days.

Conclusions: The unplanned readmission rate following esophagectomy was 19%, with most being due to respiratory or gastrointestinal issues. Risk factors in the perioperative and postoperative setting were identified that may provide opportunities for decreasing morbidity and improving readmission rates.

3:20 PM – 3:55 PM Coffee Break in the Exhibit Hall

23. Predicting Readmission After Resection for Non-Small Cell Lung Cancer: A Progression Toward Prevention

Trevor A. Davis, Craig M. Hooker, Alicia Hulbert, Chen Chen, *Richard Battafarano, *Malcolm V. Brock, Daniela Molena, *Stephen C. Yang
The Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: *Tomasz Grodzki

Objective: Readmission following surgery has emerged as an important healthcare focus due to unnecessary expenditure and impact on patient care. We aimed to (1) assess perioperative factors associated with the risk of readmission and (2) characterize the nature of readmission for NSCLC patients who underwent lung resection.

Methods: A hospital-based nested case-control study was performed, which included 92 cases and 203 controls from a prospectively maintained database of 1200 patients who underwent lung resection for stage I-III NSCLC between 2002–2014. Multiple logistic regression was used to analyze factors associated with 30-day readmission, defined as inpatient rehospitalization within 30 days after index surgical stay.

Results: There were no differences in distribution by sex, age, race, histology, stage, or procedure. The 30-day readmission rate was 7.67% (92/1200). Median postoperative length of stay (LOS) was 6 days among readmitted patients compared to 5 days for patients not readmitted. Patients readmitted within 30 days experienced a greater proportion of intraoperative complications (12% vs. 2.5%; $p = 0.001$), ICU readmissions (13% vs. 3.5%; $p = 0.002$), and OR returns (6.5% vs. 1.5%; $p = 0.02$). Furthermore, 47% (43) experienced at least one postoperative complication (POC) as compared to 19% (38) for those not readmitted ($p = 0.001$). The most common POCs experienced by patients readmitted were pulmonary (22%, 20/92) followed by cardiac (14%, 13/92). Patients who were readmitted within 30 days

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were more likely to be discharged with an unresolved POC per discharge notes (32% vs. 4%; $p < 0.001$). According to multivariable logistic regression analysis, patients discharged with unresolved complications were associated with 7.3 times greater odds of 30-day readmission as compared to patients discharged complication free, which was statistically significant after adjusting for LOS, intraoperative complications, ICU readmission, OR returns, and POCs. Among those readmitted, the median length between index surgical discharge and initial readmission was 12 days (IQR 7–18 days) regardless of complication status at discharge. Median readmission LOS was 3 days (IQR 2–8). Of the 92 patients readmitted, 10% (9) had multiple readmissions within 30 days. Furthermore, 60% (55) were readmitted for reasons related to their index surgery. Of those 55 patients, 73% (40) had a pulmonary complication. Among patients readmitted for reasons unrelated to their index surgery, 30% (11/37) had a GI complication.

Table: Factors Associated with 30-Day Readmission After Lung Resection for NSCLC

	Crude Odds			Adjusted Odds		
	Ratio	95% CI	p-Value	Ratio	95% CI	p-Value
Length of Postoperative Hospital Stay (days)	1.10	(1.03–1.18)	0.004	0.99	(0.90–1.08)	0.742
Intraoperative Complication	5.38	(1.81–15.97)	0.002	2.98	(0.81–10.97)	0.100
ICU Readmission	4.20	(1.60–11.05)	0.004	1.51	(0.44–5.13)	0.513
OR Return During Index Surgical Stay	4.65	(1.14–19.03)	0.032	1.71	(0.32–9.00)	0.528
1 or more Postoperative Complications	3.81	(2.22–6.54)	< 0.001	2.32	(1.09–4.94)	0.028
Unresolved Complication at Discharge	11.22	(4.88–25.80)	< 0.001	7.30	(3.03–17.57)	< 0.001

Conclusions: POCs that are unresolved at time of discharge are associated with increased odds of 30-day readmission. Regardless of discharge status, however, a majority of readmitted patients returned with a complication related to their index surgery. This study suggests that complications not sufficiently addressed prior to discharge, particularly pulmonary, lead to readmission.

24. Pulmonary Metastasectomy with Curative Intent for Soft Tissue Sarcoma

Neel P. Chudgar, Murray F. Brennan, Rodrigo R. Munhoz, Peter R. Bucciarelli, Kay See Tan, Sandra P. D'Angelo, *Manjit S. Bains, Matthew Bott, ♦James Huang, *Bernard J. Park, *Valerie W. Rusch, *Prasad S. Adusumilli *David R. Jones
Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *Garrett L. Walsh

Objective: Soft tissue sarcoma (STS) is a heterogeneous disease with lung metastases occurring in up to 50% of patients. The role of pulmonary metastasectomy (PM) for STS is controversial. Current data are derived from a small number of studies with limited sample sizes. Primary bone sarcomas, which may represent a distinct disease, are often included in these analyses. The purpose of this study is to guide the operative selection of patients for PM for STS only by determining factors associated with improved survival.

Methods: We reviewed a prospectively maintained database of 803 patients who underwent pulmonary resection for metastatic STS from September 1991 to June 2014. Of these, 539 patients underwent 760 PMs with curative intent. Diagnostic resections were excluded. Clinicopathologic variables, characteristics of surgical and medical treatment, recurrence, overall survival (OS) and disease-free survival (DFS) were examined. Survival, defined from the time of first PM, was evaluated using the Kaplan-Meier method and compared between groups using the log-rank test. Factors associated with the risk of death were identified using univariable analysis and subsequent multivariable Cox proportional hazards models.

Results: Median age at diagnosis of the primary tumor was 51 and median age at first PM was 54. Median duration of followup was 27 months. Repeat PM was performed in 154 (29%) patients. Median OS was 33.2 months (95% CI, 29.9–37.1) with 3 and 5-year OS of 47% and 34% respectively, and median DFS was 6.8 months (95% CI, 6.0–8.0, range 0–107.0 months). Univariable and multivariable analyses (Table 1) indicate prolonged OS in patients with a diagnosis of leiomyosarcoma ($p = 0.001$), a primary tumor ≤ 10 cm ($p = 0.004$), increasing time from resection of the primary tumor to development of pulmonary lesions with >24 months being most protective ($p < 0.001$) and ≤ 3 lung metastases ($p < 0.001$). Patients presenting with isolated pulmonary metastases experienced extended OS compared to those with simultaneous extrapulmonary metastases ($p < 0.001$). Minimally invasive resection was associated with a decreased risk of death (HR 0.73, 0.56–0.96). While associated with survival on univariable analysis, extent of resection and resection outcome were not significant on multivariable analysis.

Conclusions: In a large single institution study, selected patients undergoing PM for STS can achieve significant 5 year survival. Primary tumor histology and size, number of metastases, time from initial resection of the primary, absence of extrapulmonary disease and thoracoscopic resection are associated with improved survival. These factors should be considered when identifying patients who will most benefit from PM.

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Table 1: Association of Prognostic Factors with Overall Survival (n = 539)

Variable	Median Survival (Months)	Univariable Log-Rank p-Value	Multivariable Hazard Ratio (95% CI)
Histology		0.001	
PS/MFH* (n = 130, 24%)	23.6		1.00
Leiomyosarcoma (n = 169, 31%)	42.0		0.68 (0.50, 0.92)†
Size of Primary		0.004	
≤10 cm* (n = 275, 51%)	35.6		1.00
>10 cm (n = 204, 38%)	26.0		1.38 (1.10, 1.73)†
Interval to First Metastasis		<0.001	
<6 mo* (n = 63, 12%)	18.6		1.00
6–12 mo (n = 102, 19%)	29.3		0.90 (0.62, 1.32)
12–24 mo (n = 127, 24%)	31.5		0.63 (0.44, 0.92)†
>24 mo (n = 176, 33%)	46.2		0.51 (0.35, 0.75)†
# of Presenting Pulmonary Nodules		<0.001	
≤3* (n = 373, 69%)	39.2		1.00
>3 (n = 166, 31%)	24.4		1.62 (1.25, 2.09)†
Simultaneous Extrapulmonary Disease		<0.001	
No* (n = 483, 90%)	35.5		1.00
Yes (n = 56, 10%)	20.0		1.58 (1.11, 2.24)†
Type of Surgery		0.007	
Open* (n = 383, 71%)	29.9		1.00
Minimally-invasive (n = 156, 29%)	44.3		0.73 (0.56, 0.96)†
Extent of Resection		0.035	
Wedge* (n = 422, 78%)	34.3		1.00
Lobectomy (n = 107, 20%)	23.0		1.07 (0.80, 1.45)
Pneumonectomy (n = 10, 2%)	27.0		1.15 (0.56, 2.34)
Resection Outcome		0.003	
R0* (n = 490, 91%)	33.8		1.00
R1/R2 (n = 49, 9%)	25.3		1.09 (0.74, 1.60)

PS, pleomorphic sarcoma; MFH, malignant fibrous histiocytoma; *Reference group; †Statistically significant

25. A Propensity Matched Comparison of Robotic, Thoracoscopic and Transsternal Thymectomy for Non-Thymomatous Myasthenia Gravis

*Richard K. Freeman, Anthony J. Ascoti, Megan Dake, Raja S. Mahidhara
St. Vincent's Health and Hospital System, Indianapolis, IN

Invited Discussant: *Kemp H. Kerstine

Objective: Controversy exists as to the optimal surgical approach for thymectomy for Myasthenia Gravis (MG). This investigation compares patients undergoing extended thymectomy via a robotic, thoracoscopic or sternotomy approach.

Methods: The Premiere database for 90 hospitals was used to identify patients undergoing thymectomy for non-thymomatous Myasthenia Gravis (MG) over a ten year period. Robotic (R), video assisted thoracoscopic (V) and sternotomy (S) cohorts were populated using propensity-matching. The cohorts were compared for length of stay, morbidities, cost and improvement of MG symptoms utilizing the Myasthenia Gravis Foundation of America's standardized index of post intervention improvement.

Results: During the study period, 151 patients underwent (R) thymectomy and were propensity matched to (V) and (S) patients. Significant differences were identified in the rate of extubation within 4 hours of surgery, mean lengths of stay, mean interval from surgery to return to work, and costs between the S group and V & R groups. The R group differed significantly from the V group in mean length of surgery, frequency of a bilateral approach and conversion to an open procedure. The rate of significant MG symptom improvement was similar between all three groups (Table).

Table: Thymectomy Result Comparison

	Sternotomy	Robotic	Thoracoscopic	p
N	151	151	151	
Age (mean yrs)	47	49	51	0.13
Extubation <4 hrs after surgery	79 (52%)	127 (84%)	119 (79%)	<0.0001
Bilateral approach		5 (3%)	72 (48%)	0.0001
Conversion to open technique		11 (7%)	24 (16%)	0.02
Length of stay (mean days)	6	3	4	<0.0001
Cost (mean)	\$66,000	\$48,000	\$52,000	<0.0001
Return to work (mean days from surgery)	43	23	27	<0.0001
Myasthenia Gravis improvement	119 (79%)	126 (83%)	123 (81%)	0.6

Conclusions: Robotic and video assisted thoracoscopic extended thymectomy resulted in reduced length of stay, cost and interval from surgery to return to work compared to the sternotomy technique. The robotic technique also resulted in fewer conversions to a bilateral or open technique than the thoracoscopic approach. Extended thymectomy using a robotic or thoracoscopic technique should be considered a cost effective option for patients requiring thymectomy which results in a comparable rate of improvement for MG to thymectomy via sternotomy.

5:00 PM Adjourn

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MONDAY AFTERNOON, MAY 16, 2016

2:00 PM

Perioperative Care

Room 337, BCC

Simultaneous Scientific Session

8 minute presentation, 7 minute discussion

Moderators: *Gosta B. Pettersson and *Glenn J. Whitman

26. Pre-Operative Hyperglycemia – A Risk Factor for Adverse Outcomes in Patients Undergoing Coronary Artery Surgery

Pradeep Narayan, Sarang Naresh Kshirsagar, Chandan Kumar Mandal, Emmanuel Rupert, Saibal Roy Chowdhury, Debasis Das, Mrinalendu Das
Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata, India

Invited Discussant: *Harold L. Lazar

Objective: Management of patients with hyperglycemia undergoing coronary artery surgery has gone a sea change in recent times. Strict glycemic control protocols have been developed to reduce complications. Aim of this study was to assess if pre-operative hyperglycemic state remains a cause of adverse outcome in patients undergoing coronary surgery.

Methods: 4678 patients undergoing primary, elective, isolated CABG in a single institution over a 4 year period were included in the study. Data collected prospectively was analyzed retrospectively. Pre-operative hyperglycemia was defined as a Glycosylated hemoglobin (HbA1c) level ≥ 6.5 and patients grouped as euglycemic (HbA1c < 6.5) or hyperglycemic (HbA1c level ≥ 6.5). Strict glycemic control was maintained in all patients in the post-operative period. Data was compared for baseline, operative and post-operative outcomes.

Results: Groups were well matched in terms of age, EuroSCORE, recent myocardial infarction (MI), concomitant carotid artery disease, and Chronic Obstructive Airway Disease and grafts received. Univariate analysis showed that pre-operative hyperglycemia was associated with risk of sternal dehiscence [11 (0.44%) vs. 28 (1.27%), $p = 0.002$]; respiratory complications [450 (18.17%) vs. 468 (21.25%), $p = 0.008$]; renal failure [73 (2.95%) vs. 96 (4.36%), $p = 0.01$]; CNS complications [45 (1.82%) vs. 72 (3.27%), $p = 0.001$]; and increased mortality [108 (4.90%) vs. 82 (3.31%), $p = 0.007$]. Multivariate analysis identified pre-operative hyperglycemia to be a risk factor for sternal dehiscence (OR 2.19, 95% CI 1.30–3.691) and respiratory complications (OR 1.25, 95% CI 1.062–1.471).

Conclusions: Despite strict in-hospital glycemic control, pre-operative hyperglycemia continues to be a risk factor for adverse outcome and where situation permits effort should be made to achieve pre-operative euglycemia in patients undergoing coronary surgery.

27. Goal-Directed Resuscitation Following Cardiac Surgery Reduces Acute Kidney Injury: A Quality Initiative Pre-Post Analysis

Lily E. Johnston, Robert H. Thiele, Emily A. Downs, James M. Jaeger, Ravi K. Ghanta,
*Irving L. Kron, James M. Isbell

University of Virginia, Charlottesville, VA

Invited Discussant: *John V. Conte

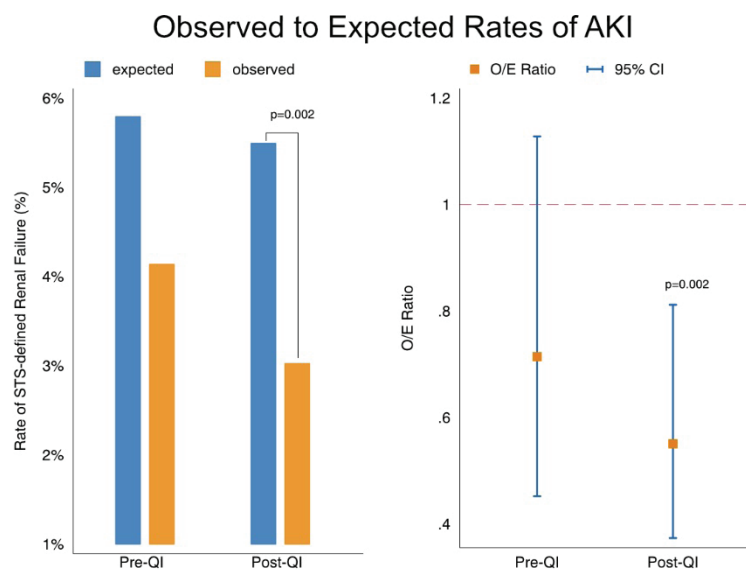
Objective: Acute kidney injury (AKI) occurs in 20% of patients following cardiac surgery. In an effort to reduce AKI in our institution, a multi-disciplinary quality improvement (QI) initiative was instituted using a goal-directed volume resuscitation protocol after cardiac surgery. Our protocol was designed to achieve specific, quantifiable physiologic goals (e.g., cardiac index >2.5, MAP >65) using fluid administration and vasoactive pharmacologic agents as appropriate. A major component of our algorithm was classification of patients as fluid responders or non-responders through the use of pulse pressure variation and/or passive leg raise. The objective of this study was to evaluate rates of AKI in the pre- and post-QI eras, with the hypothesis that rates of AKI would decrease in the post-QI era.

Methods: We queried our institutional Society of Thoracic Surgeons (STS) database to identify records of patients who underwent cardiac surgery operations from July 2011–July 2015, which were then linked to pre- and post-operative creatinine levels. Baseline and postoperative glomerular filtration rates (GFR) were calculated using the Modification of Diet in Renal Disease formula. Kidney injury was determined using the lowest postoperative GFR within 7 days of surgery and standard Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease (RIFLE) classification criteria of 25%, 50%, or 75% decrease in GFR from baseline defined as renal risk, injury, and failure respectively. In addition, to evaluate O/E rates, we utilized the STS criteria for renal failure, which is based on creatinine alone and not GFR. The primary outcome was the rate and relative risk of AKI in the post- vs. pre-QI eras.

Results: A total of 2,885 patients met selection criteria for analysis, of whom 1,110 were in the pre-QI cohort, and 1,775 in the post-QI cohort. Overall, rates of RIFLE risk, injury and failure were 37.3%, 9.4%, and 1.2% respectively. RIFLE risk and injury were significantly reduced in the post-QI cohort (34.9% vs 41.2%, $p = 0.001$; 7.5% vs 12.4%, $p < 0.001$). By STS criteria, the overall rate of renal failure was 4.8%. In unadjusted analyses there was no difference in STS-reported renal failure or dialysis requirement, but the O/E rate of renal failure based on STS predicted risk of renal failure was significantly lower in the post-QI era (see Figure). A multivariable logistic regression adjusting for baseline GFR, multiple demographic characteristics and comorbidities, and STS predicted risk of morbidity or mortality demonstrates a 42% reduction in odds of AKI in the post-QI cohort (AOR 0.58, 95% CI 0.39–0.88, $p = 0.009$; model c-statistic 0.77).

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Conclusions: A goal-directed volume resuscitation protocol centered on patient fluid responsiveness significantly reduces risk for AKI after cardiac surgery. Protocol-driven approaches should be employed in intensive care units to improve outcomes.

28. Phase of Care Mortality Analysis: A Unique Method for Comparing Mortality Differences Among TAVR and Surgical AVR Patients

Todd C. Crawford, J. Trent Magruder, Joshua C. Grimm, Kaushik Mandal, Joel Price, Jon R. Resar, Matthew Chacko, Rani K. Hasan, *Glenn J. Whitman, *John V. Conte
Johns Hopkins University, Baltimore, MD

Invited Discussant: *Rakesh M. Suri

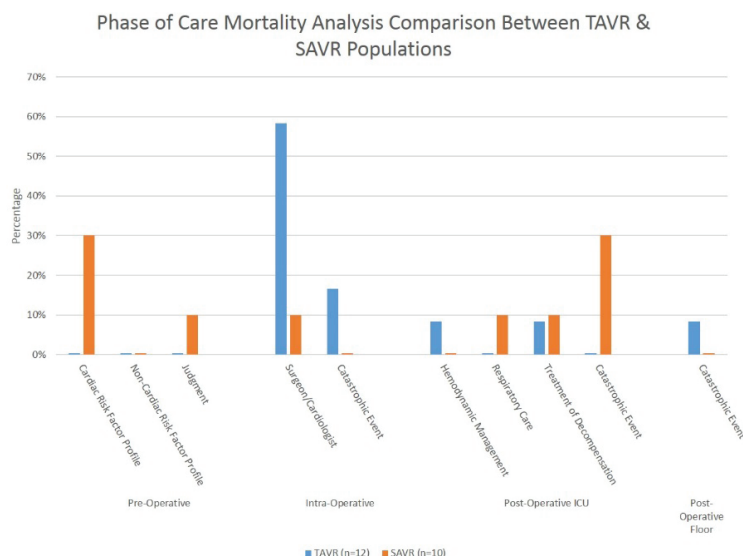
Objectives: Phase of care mortality analysis (POCMA), introduced by the Michigan Society of Thoracic and Cardiovascular Surgeons (MSTCVS), is an effective tool to evaluate the root cause of in-hospital mortality in cardiac surgery patients. TAVR is a novel method for treating aortic stenosis in high risk patients, but still carries a considerable mortality rate. To our knowledge, POCMA has not been utilized to compare operative mortalities among TAVR and surgical AVR (SAVR) populations, and may provide insight that could impact patient safety initiatives and improve outcomes in aortic valve surgery.

Methods: We included all patients who underwent TAVR or isolated SAVR between 2011 and March 31, 2015 and suffered mortality prior to hospital discharge. A multidisciplinary heart team made POCMA assignments as part of the weekly morbidity and mortality conference, pinpointing the phase of care and subcategory that

directly caused or had the greatest impact on each mortality. Differences in these phases and subcategories were compared among TAVR and SAVR patients.

Results: During the study period, 240 patients underwent TAVR and 530 underwent SAVR. Unadjusted mortality rates were significantly higher in the TAVR group, 5.0% (n = 12) compared to SAVR, 1.9% (n = 10) (p = 0.016). The average age for patients that expired in the hospital was 85.3 ± 5.8 years for the TAVR population and 74.2 ± 9.1 for SAVR (p = 0.002). The average calculated STS predicted mortality did not significantly differ between the two groups, 16.8% for TAVR vs 9.1% for SAVR (p = 0.061).

TAVR deaths by phase of care were: 0 for pre-operative, 9 (72.8%) for intra-operative, 2 (18.2%) for post-operative ICU, and 1 (9.1%) for post-operative floor. By comparison, 4 (40%) SAVR deaths had a root cause in the pre-operative phase, 1 (10%) in the intra-operative phase, and 5 (50%) in the post-operative ICU phase. POCMA subcategorization for TAVR demonstrated that surgeon/cardiologist (n = 7) and catastrophic event (n = 2) were the two subcategories comprising all intra-operative phase mortalities. For the SAVR population, cardiac risk factor profile (n = 3) in the pre-operative phase and catastrophic events during the post-operative ICU phase (n = 3) emerged as the two largest contributors to in-hospital mortality. Over 50% of all TAVR mortalities had an inciting event related to intra-operative technical challenges encountered by the surgeon/cardiologist, whereas only 1 SAVR mortality was related to intra-operative complications (comprehensive comparison in Figure 1).



Conclusions: POCMA is a novel method of categorizing in-hospital mortalities. Our single institution review revealed different profiles for TAVR and SAVR patients. TAVR patients more often expired as a result of intra-operative technical or procedural issues while the root cause of SAVR deaths was split between pre-operative risk profiles and post-operative complications.

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29. Preoperative MRSA Screening and Targeted Decolonization in Cardiac Surgery

Manoj Kumar Saraswat, J. Trent Magruder, Julia Michele Gardner, Avinash Gadala, Damon Duquaine, Marc Steven Sussman, Lisa Lockerd Maragakis, *Glenn Joseph Robert Whitman

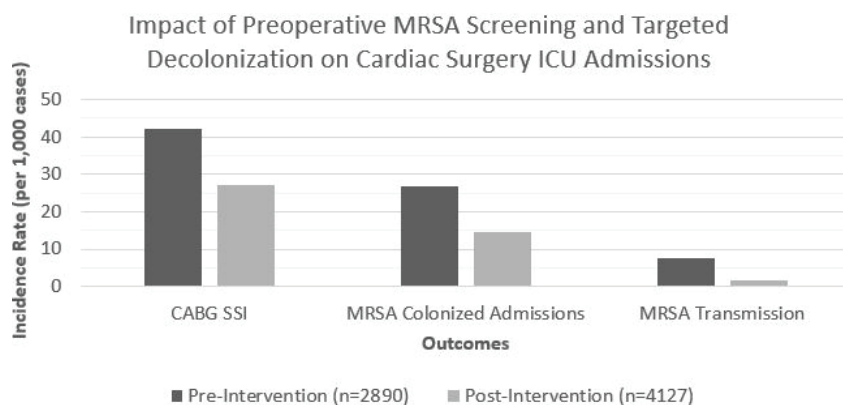
Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: *Richard J. Shemin

Objective: The purpose of this study was to determine the effectiveness of a preoperative methicillin-resistant staphylococcus aureus (MRSA) screening and targeted decolonization program in reducing the postoperative incidence of coronary artery bypass grafting (CABG) surgical site infections (SSI), perioperative MRSA colonization, and intensive care unit (ICU) MRSA transmission in cardiac surgery patients.

Methods: We reviewed patients undergoing cardiac surgery at our institution between January 1, 2007 and December 31, 2014, and divided them into pre- and post-intervention eras based on implementation of the intervention on May 1, 2010. Patients operated upon during a “run-in” period from May 1, 2010 to December 31, 2010 were excluded. The intervention consisted of preoperative nasal screening of all patients for MRSA within 30 days of surgery. Those testing positive for MRSA received twice-daily intranasal mupirocin and once-daily chlorhexidine baths for five consecutive days. MRSA-positive patients received intraoperative vancomycin (all patients received perioperative cefazolin prophylaxis) and were on contact precautions throughout the hospital stay. Upon ICU admission, repeat nasal cultures for MRSA were obtained in all patients. Our primary outcomes were the incidence of CABG SSI, perioperative MRSA colonization, and ICU MRSA transmission. Multivariable logistic regression analysis was used to predict CABG SSIs and MRSA colonization on ICU admission while controlling for differences in patient and operative characteristics between eras. We utilized Poisson regression analysis to predict MRSA transmission while controlling for monthly variation in ICU patient days and STS predicted morbidity/mortality.

Results: There were 7017 postoperative ICU admissions: 2890 pre-intervention (Era 1: Jan 1, 2007–Apr 30, 2010) and 4127 post-intervention (Era 2: Jan 1, 2011–Dec 31, 2014). Between eras, cases differed significantly on age, race, diabetes, preoperative infection, operation type, bypass time, and urgent/emergent operative status (all $p \leq 0.04$). After risk adjustment, the intervention was associated with a significantly reduced incidence of SSI (OR 0.58, 95% CI 0.39–0.86, $p = 0.006$), MRSA ICU admission culture positivity (OR 0.56, 95% CI 0.39–0.80, $p < 0.001$), and ICU MRSA transmission (IRR 0.29, 95% CI 0.13–0.65, $p = 0.002$). In patients who pre-screened positive for MRSA, days between initiation of preoperative therapy and surgery had a protective effect against MRSA culture positivity upon ICU admission (OR 0.82, 95% CI 0.69–0.98, $p = 0.03$).



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Conclusions: Preoperative MRSA screening and targeted decolonization is associated with a reduced risk of CABG SSI, MRSA colonization and transmission. Greater duration between initiation of preoperative therapy and date of surgery is associated with reduced risk of colonization on ICU admission.

30. Does Timing of Delayed Sternal Closure Affect Short- and Long-Term Outcomes in Patients with Open Chest Management Following Cardiac Surgery?

Joshua K. Wong, Devang J. Joshi, Amber L. Melvin, William J. Archibald, Alcina Lidder,

*George L. Hicks, Peter A. Knight

University of Rochester, Rochester, NY

Invited Discussant: *Bruce J. Leavitt

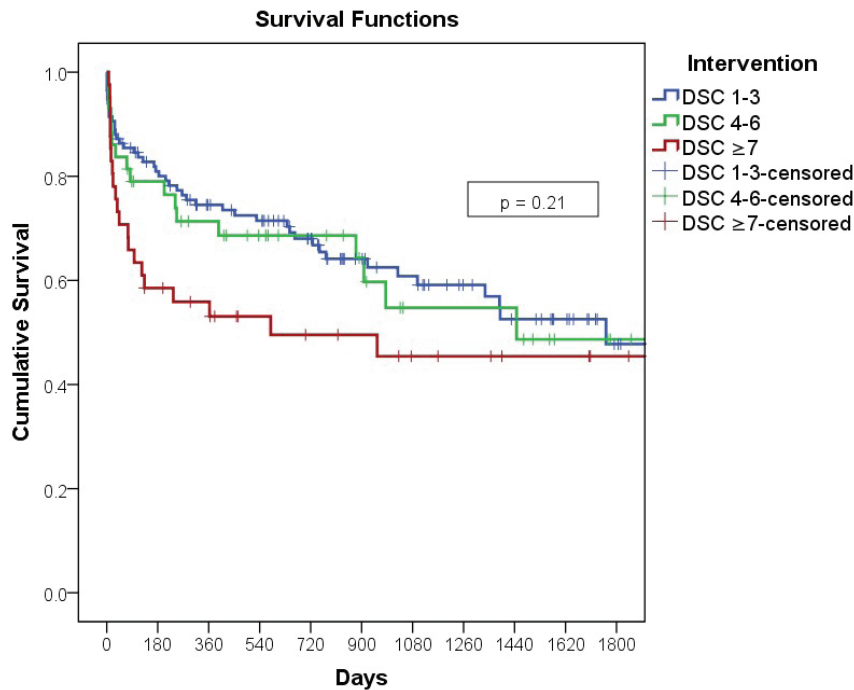
Objective: Delayed sternal closure (DSC) is an established technique for the management of patients who are unable to undergo safe sternal closure following cardiac surgery. However, there is little data on the short and long-term outcomes of patients who require prolonged periods of DSC in the current era.

Methods: Patients undergoing DSC from January 2009 to December 2014 were reviewed at a single institution. Pre-operative variables, indications for DSC, and post-operative complications were analyzed and are reported. Comparative analyses were performed by timing of DSC into 3 categories; 1–3 days, 4–6 days, ≥ 7 days. Outcomes of interest included: composite of major infections (mediastinitis, pneumonia, bacteremia, sepsis), requirement for renal replacement therapy (RRT), multi-system organ failure (MOF), new-onset atrial-fibrillation, 30-day mortality, and long-term survival. Kaplan-Meier estimates were used for long-term survival analyses and were compared using the log-rank test.

Results: A total of 201 patients underwent DSC during the study period, of which 117 had DSC: 1–3 (days) (58.2%), 43 had DSC: 4–6 (days) (21.4%) and 41 had DSC: ≥ 7 (days) (20.4%). The most common surgeries requiring DSC were ventricular assist device implants in 74 patients (36.8%) and major aortic procedures in 45 patients (22.4%) while the most common indications for DSC were coagulopathy and hemodynamic instability in 142 (70.6%) and 18 patients (9.0%) respectively.

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Major infections occurred in 29 patients (24.8%) with DSC: 1–3 (days), 24 patients (55.8%) with DSC: 4–6 (days), and 27 patients (65.8%) with DSC: ≥ 7 (days) ($p < 0.001$). Requirement for RRT was necessary in 9 patients (7.7%) with DSC: 1–3 (days), 14 patients (32.6%) with DSC: 4–6 (days), and 13 patients (31.7%) with DSC: ≥ 7 (days) ($p < 0.001$), while MOF developed in 5 patients (4.3%) with DSC: 1–3 (days), 7 patients (16.3%) with DSC: 4–6 (days), and 13 patients (31.7%) with DSC: ≥ 7 (days) ($p < 0.001$). There was no statistical difference in the incidence of atrial-fibrillation with increasing time to DSC ($p = 0.88$). Thirty-day mortality occurred in 14 (12.0%), 6 (14.0%) and 12 patients (29.3%) with DSC: 1–3, 4–6 and ≥ 7 days respectively ($p = 0.03$). Despite increasing short-term morbidity and mortality, no observable difference was noted in the long-term survival distribution for all 3 groups by Kaplan-Meier estimates ($p = 0.21$).



Conclusions: The results from this study suggest that patients who require prolonged DSC are associated with increasing short-term morbidity and mortality. However, as long-term survival was not affected by a protracted interval until DSC, the support of patients who require this should be continued in the immediate peri-operative period until resolution of the initial surgical insult.

3:15 PM – 3:45 PM

Coffee Break in the Exhibit Hall

31. Early Extubation After Cardiac Surgery: Should Six Hours Be the Standard

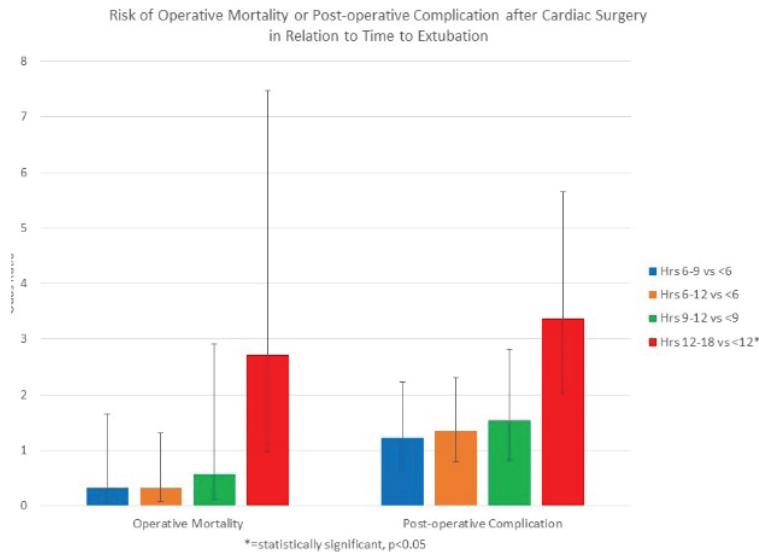
Todd C. Crawford, J. Trent Magruder, Joshua C. Grimm, Christopher M. Sciortino,
*John V. Conte, Bo S. Kim, *Robert S. Higgins, *Duke E. Cameron, Marc Sussman,
*Glenn J. Whitman

Johns Hopkins University School of Medicine, Baltimore, MD

Invited Discussant: *J. Michael DiMaio

Objectives: Shorter intubation periods after cardiac surgery are associated with fewer infectious complications, shorter ICU length of stay, and decreased operative mortality. Although the Society of Thoracic Surgeons (STS) defines early extubation as within six hours of completion of cardiac surgery, and uses this as a reportable benchmark, the time threshold above which complications increase is unknown.

Methods: Using an institutional STS database, we identified 3007 adult patients who underwent one of seven index cardiac surgery operations from 2010–2014. Patients were stratified by the duration of time to extubation after surgery: 0–6, 6–9, 9–12, 6–12, and 12–18 hours. These cohorts were compared head-to-head in a regression model to assess for differences in the risks of experiencing the primary outcomes of operative mortality and a composite of any post-operative complication (renal failure, stroke, reoperation, or deep surgical site infection); secondary outcomes included prolonged length of stay (>14 days) and reintubation. Multi-variable logistic regression analysis was used to control for differences in patient and operative characteristics.



Results: From 2010–2014, 36.4% of patients were extubated within 6 hours of completion of cardiac surgery, 38.1% in hours 6–12, and 10.5% in hours 12–18. 25.5% of patients were extubated after hour 12. Neither operative mortality nor the composite complication outcome differed significantly in patients extubated in hours 0–6 versus 6–9 or 6–12, nor in hours 0–9 versus 9–12. However, patients

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extubated in hours 12–18 versus <12 hours experienced a significantly higher risk of operative mortality (OR 2.72, $p = 0.05$) and the composite complication outcome (OR 3.38, $p < 0.01$) (Figure 1). Likewise, significant differences in the risk of prolonged hospital LOS (OR 1.66, $p = 0.05$) and reintubation (OR 2.07, $p = 0.02$) were only observed once time to extubation extended to 12–18 hours compared to <12 hours.

Conclusions: Minimizing the duration of intubation after cardiac surgery is an essential task. Our results indicate that after adjusting for case mix, the risks of operative mortality, post-operative complications, prolonged hospital LOS, and reintubation do not differ significantly between those extubated within 6 hours versus hours 6–12. However, a significant difference is observed in later time frames. Consequently, these results suggest that the STS should consider revising the metric for early extubation to 12 hours.

32. Outcomes of Octogenarians Discharged Home After Prolonged ICU Length of Stay After Cardiac Surgery

Rizwan A. Manji, Rohit K. Singal, Brett Hiebert, *Alan H. Menkis, *Rakesh C. Arora
University of Manitoba, Winnipeg, MB, Canada

Invited Discussant: *Ko Bando

Objective: Octogenarians being offered complex cardiac surgery (CS) frequently experience a prolonged ICU length of stay (prICULOS) following their procedure. Patients surviving to hospital discharge have been reported to have high rates of hospital readmissions. We sought to determine rates of 1-year non-institutionalized survival (“functional survival”), and 1-year re-hospitalization rates in octogenarian prICULOS cardiac surgery patients. Secondly, we sought to determine risk factors associated with rehospitalization and poor functional survival in these vulnerable postoperative patients.

Methods: Data of CS patients ≥ 80 years old with prICULOS (defined as ICULOS of 5 or more consecutive days) from Jan 1, 2000 to Dec 31, 2011 were extracted from linked clinical and administrative provincial databases. Regression analysis was used to determine predictors of rehospitalization within 1-year of discharge and predictors of poor 1-year functional survival post discharge home.

Results: There were 80/683 (11.7%) octogenarian patients discharged home who experienced prICULOS following CS during the study period. The ICU and total hospital LOS was more than twice as long in prICULOS patients, with more than twice as many patients with prICULOS requiring transfer to another hospital for further convalescence (Table 1). Despite this, functional survival at 1-year for octogenarians discharged alive was 92% and 81% respectively ($p = 0.002$).

Cumulative 1-year rehospitalization rates were 38% and 48% for the non-prICULOS and prICULOS patients respectively (Table 1). Of all octogenarians rehospitalized during the study period, 41% were rehospitalized with 30 days of discharge. The most frequent ICD-9/10 diagnoses at time of rehospitalization were heart failure,

diabetes and ischemic heart disease. Regression analysis demonstrated living in a rural setting (OR = 1.83; p = 0.004) and hospital acquired pneumonia during the index cardiac surgery hospitalization (OR = 3.15; p = 0.02) were associated with re-hospitalization within 30 days of discharge. Lack of physician visits within 30 days of discharge (OR = 5.04; p < 0.001), diabetes (OR = 2.75; p < 0.001) and hospital LOS during the initial hospitalization (OR = 1.03; p < 0.001) were predictors of poor functional survival at 1-year of discharge home from initial surgery (AUC = 0.729).

Table 1: Characteristics of Octogenarians Discharged Home after Cardiac Surgery Based on ICU Length of Stay

Variable	Non-PrICULOS Cohort (N=603)	PrICULOS Cohort (N=80)	P- Value
ICU Length of Stay (d) - median (IQR)	1.24 (0.90 - 2.62)	6.84 (5.83 - 9.92)	<0.01
Total hospital LOS (d) - median (IQR)	13 (8 - 21)	30 (22 - 51)	<0.01
Transfer to community hospital for convalescence (%)	12.9%	26.3%	<0.01
Hospital LOS if Rehospitalized (d) - median (IQR)	6.0 (3.0 - 11.0)	6.5 (3.0 - 14.0)	0.51
30 Day Rehospitalization Rate (%)	15.4	21.3	0.18
365 Day Rehospitalization Rate (%)	38.2	47.5	0.11

Conclusions: Octogenarians with and without prICULOS have acceptable functional survival at 1-year but experience high rates of rehospitalization. Regression analysis suggests access to health services may influence rehospitalizations and future non-institutionalized survival. This data suggest that close follow-up of these vulnerable patients following hospital discharge is warranted.

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33. The Effects of Steroids on Coagulation Dysfunction Induced by Cardiopulmonary Bypass: A Steroids in Cardiac Surgery Trial Sub-Study

Domenico Paparella¹, *Alessandro Parolari², Crescenza Rotunno¹, Jessica Vincent³, Veronica Myasoedova⁴, Francesco Alamanni⁵, Piero Guida¹, Micaela de Palo¹, Vito Margari¹, Philip Devereaux⁶, Andre Lamy⁶, Salim Yusuf⁶, Richard Whitlock⁶

¹University of Bari, Bari, Italy; ²Policlinico San Donato, University of Milan, San Donato Milanese (MI), Italy; ³Hamilton Health Science and McMaster University, Hamilton, ON, Canada; ⁴Centro Cardiologico Monzino, Milan, Italy; ⁵Centro Cardiologico Monzino, Milano, Italy; ⁶Population Health Research Institute Mc Master University, Hamilton, ON, Canada

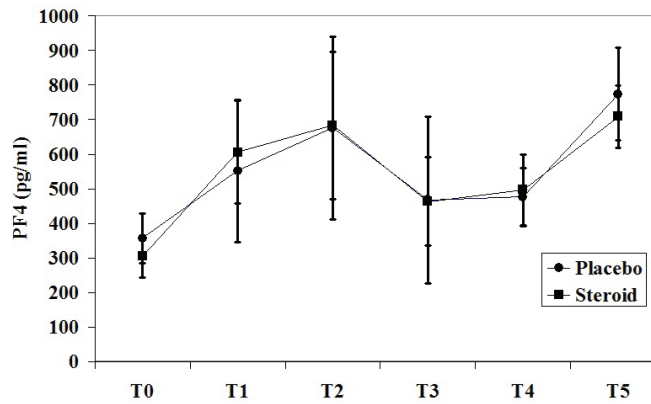
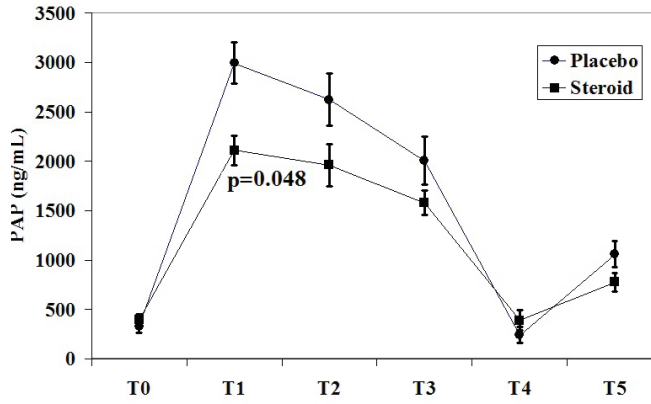
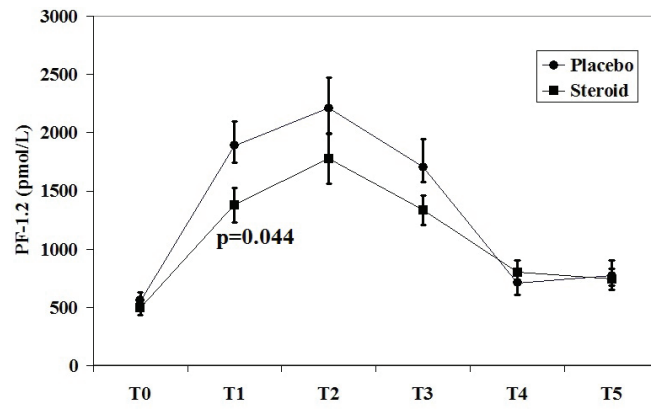
Invited Discussant: *Hersh Maniar

Objective: Cardiopulmonary bypass (CPB) surgery, despite heparin administration, elicits the activation of the coagulation system with consequent coagulation factors consumption, excessive fibrinolysis and coagulopathy. A significant interaction exists between inflammation and coagulation. All major inflammatory pathways, activated by CPB, lead to haemostatic derangement. Steroids treatment has demonstrated to attenuate the inflammatory reaction induced by CPB but its effects on the coagulation system are unknown. The primary objective of this study is to assess the effects of steroids on coagulation function by evaluating thrombin generation, fibrinolysis, and platelet activation in high-risk patients undergoing cardiac surgery with CPB.

Methods: The Steroids In cardiac Surgery (SIRS) study is a double-blind, randomized, controlled trial performed on 7507 patients worldwide assigned to methylprednisolone (n = 3755) and to placebo (n = 3752). Patients were randomized to receive either intravenous methylprednisolone, 250 mg at anaesthetic induction and 250 mg at initiation of CPB, or placebo. A substudy was conducted in three sites, to collect blood samples peri-operatively (preoperatively T0, 30 minutes after CPB start T1, 15 minutes after clamp release T2, ICU arrival T3, postoperative day 1 T4 and day 5 T5) to measure prothrombin fragment 1.2 (PF 1+2, marker of thrombin generation), plasmin antiplasmin complex (PAP, marker of fibrinolysis), platelet factor 4 (PF-4 marker of platelet activation) and fibrinogen.

Results: In the general population of the SIRS trial a significant reduction of post-operative blood loss was observed in steroids treated patients (440 ml (280–720) vs. 480 ml (300–760) p = 0.0007). In the 81 patients enrolled in the substudy (37 placebo vs. 44 in the active treatment group), surgery caused changes of all plasma biomarkers with greater values than baseline in both groups. This reaction was attenuated significantly in the active group for PF-1.2 (p = 0.044) and PAP (p = 0.048) values that were lower than placebo at the first intra-operative measurement (Figure). No difference between groups was detected for PF4 and fibrinogen.





Conclusion: Steroids treatment attenuates activation of the coagulation system in high-risk patients undergoing CPB surgery. The reduction of thrombin generation and fibrinolysis activation may lead to reduced blood loss after surgery.

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34. Unilateral Antegrade Cerebral Perfusion During Moderate Hypothermic Circulatory Arrest: Using Intraoperative EEG and Cerebral Oximetry to Improve Outcomes

Arminder S. Jassar, Steven R. Messe, *Joseph E. Bavaria, Prashanth Vallabhajosyula, ♦Nimesh D. Desai, Rita K. Milewski, Jacob Gutsche, William J. Vernick, *W. Clark Hargrove, III, *Wilson Y. Szeto
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Eric E. Roselli

Objective: Optimal strategy for cerebral perfusion during moderate hypothermic circulatory arrest (MHCA) remains a matter of debate. Some authors advocate unilateral antegrade cerebral perfusion (uACP), while others prefer bilateral ACP. However, little data exist regarding effects of ACP on cerebral oxygenation and cortical function. In this report we analyze changes in regional cerebral oxygenation (rSO₂) and electroencephalographic activity (EEG) during MHCA and uACP for aortic hemiarch reconstruction.

Methods: Ninety three patients underwent aortic hemiarch replacement under MHCA (core temp = $27.3 \pm 1^\circ\text{C}$, mean circulatory arrest time = 17 ± 4 minutes). uACP was instituted by direct cannulation of the innominate artery. Cortical function was monitored by recording spontaneous EEG activity from each hemisphere. Near-infrared spectroscopy (NIRS) was used to monitor change in regional oxygen saturation (rSO₂) within the frontal lobes of the cerebral cortex bilaterally.

Results: In-hospital/30-day mortality and stroke rate was 1% each (n = 1 each). There was relative slowing and reduced amplitude in the left hemisphere on EEG in 30 (32%) patients during circulatory arrest, but symmetry returned in all but 4 (4.3%) patients before the end of the operation. Changes in rSO₂ levels are presented in the Table. The decrease in rSO₂ levels was more pronounced on the left side compared to the right. There was similar decrease in rSO₂ level in patients who demonstrated EEG asymmetry as compared to patients who maintained symmetrical EEG. ACP flow adjustments were made based on rSO₂ levels and EEG asymmetry in 32 (34.4%) patients and resulted in significant improvement in cerebral oximetry levels in both the left ($38.4 \pm 11.5\%$ vs $47.2 \pm 14.7\%$, $p < 0.01$) and the right (52.8 ± 11.6 vs 56.9 ± 12.4 , $p < 0.01$) hemispheres.

Conclusions: We observed a high incidence of EEG asymmetry and reduced rSO₂ levels in the left hemisphere during MHCA with right-sided uACP. Although these changes did not lead to significant clinical neurological adverse events, they may indicate presence of subclinical transient cerebral ischemia during circulatory arrest. Similar decrease in rSO₂ levels in patients with and without EEG asymmetry underscores the utility of dual modality monitoring for these patients to identify cerebral ischemia. Active management of ACP flow rate can significantly improve rSO₂ levels. Based on these observations, instituting bilateral ACP may be advisable in patients with longer circulatory arrest times to increase margin of safety.

Table: Regional Cerebral Oxygenation During Moderate Hypothermic Circulatory Arrest and Unilateral ACP

	rSO2 (%) All Patients N = 93	rSO2 (%) All Patients N = 93	rSO2 (%) Patients with EEG Asymmetry N = 30		rSO2 (%) Patients with EEG Asymmetry N = 30		rSO2 (%) Patients without EEG Asymmetry N = 63	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
Pre-Circulatory arrest	65.4 ± 9.9	65.2 ± 9.4	62.8 ± 9.1	63.8 ± 9.7	66.7 ± 10.0	65.9 ± 9.3		
Lowest value during circulatory arrest	46.2 ± 12.1 ^a	56.8 ± 10.8 ^{a,b}	43.0 ± 12.2 ^a	57.0 ± 12.0 ^b	47.8 ± 11.8 ^a	56.7 ± 10.3 ^{a,b}		
% change in rSO2 (rSO2 during circulatory arrest/rSO2 Pre-circulatory arrest *100)	70.5 ± 14.2	87.5 ± 12.6 ^b	67.7 ± 14.7	89 ± 12.8 ^b	71.8 ± 13.8	86.8 ± 12.5 ^b		

rSO2 = regional cerebral Oximetry

a = p < 0.05 pre-circulatory arrest vs. during circulatory arrest

b = p < 0.05 Left vs Right side.

The decrease in rSO2 levels in patients with EEG asymmetry vs. patients without EEG asymmetry was not significantly different

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35. Optimal Blood Pressure During Cardiopulmonary Bypass Defined by Cerebral Autoregulation Monitoring and Its Association with Severe Coronary Artery Disease

Daijiro Hori, Yohei Nomura, Masahiro Ono, Brijen Joshi, Kaushik Mandal,

*Duke Cameron, Charles Hogue

The Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: Kenneth Shann

Objective: Maintaining blood pressure during cardiopulmonary bypass (CPB) within the cerebral blood flow (CBF) autoregulation range may ensure better organ perfusion than empirically chosen mean arterial pressure (MAP) targets. Cerebral autoregulation monitoring, however, remains a research tool. To provide clinicians with guidance on blood pressure management during CPB, we examined the distribution of the lower limit of CBF autoregulation (LLA) and optimal blood pressure in patients undergoing CPB. Since it is often associated with cerebral vascular disease, we further assessed whether history of severe coronary artery disease (CAD) influences these variables.

Methods: Cerebral autoregulation was monitored continuously with transcranial Doppler (TCD) measurement of middle cerebral artery CBF velocity in 614 patients undergoing CPB. A moving Pearson's correlation coefficient was calculated between low-frequency changes in CBF velocity and MAP to generate the variable mean velocity index (Mx). Impaired autoregulation results in Mx approaching one as CBF and MAP are correlated; while it approaches zero when CBF is autoregulated (ie, CBF is independent of MAP). The LLA and the upper limit (ULA) of CBF autoregulation was defined as the MAP where Mx increased to ≥ 0.4 with declining or rising blood pressure, respectively. Optimal blood pressure was defined as the MAP with the lowest Mx, or the MAP with the best autoregulation. Severe CAD was defined as coronary stenosis requiring surgical or percutaneous intervention and that with prior myocardial infarction.

Results: The median LLA during CPB was 65 mmHg (IQR, 55–75), the ULA was 85 mmHg (IQR 75–90) and the median optimal MAP was 75 mmHg (IQR, 70–85). A LLA during CPB was observed in 432 (70.3%) of 614 patients, and an ULA in 323 (52.6%) patients, while optimal MAP was observed in all patients. The LLA was higher for patients with compared with those without severe CAD (65 mmHg, IQR 55–75 vs. 60 mmHg, IQR 55–70, $p = 0.003$). Similarly, optimal blood pressure was higher in those patients with severe CAD compared with those without severe CAD (80 mmHg, IQR 70–85 vs. 75 mmHg, IQR 70–85, $p = 0.026$). For patients with severe CAD, 273 (74.2%) patients were within their cerebral autoregulation range at population median optimal MAP of 80 mmHg. For patients without severe CAD, 119 (80.4%) patients were within their autoregulation range at population median optimal MAP of 75 mmHg.

Conclusions: These data suggests that the median optimal MAP during CPB is 80 mmHg (IQR 70–85) and 75 mmHg (IQR 70–85) for patients with and without severe CAD, respectively. However, approximately 20% of patients will have an MAP either below or above their autoregulation limits at the population optimal MAP suggesting that real time monitoring of CBF autoregulation may better ensure precise blood pressure management during CPB.

5:00 PM

Adjourn

5:00 PM **19th Annual C. Walton Lillehei Resident Forum** Room 340, BCC
Supported by an educational grant from St. Jude Medical
 7 minute presentation, 5 minute discussion

Chairs: *Juan A. Crestanello and *Benjamin D. Kozower

L1. Thoracic-Radiation Induced Tumor Immunomodulation: Mechanistic Insights and Translational Rationale for Combining with Chimeric Antigen Receptor T-Cell Therapy for Thoracic Cancers

Jonathan Villena-Vargas, Marissa Mayor, Andreas de Biasi, *David R. Jones, Michel Sadelain, *Prasad S. Adusumilli
Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *Dao M. Nguyen

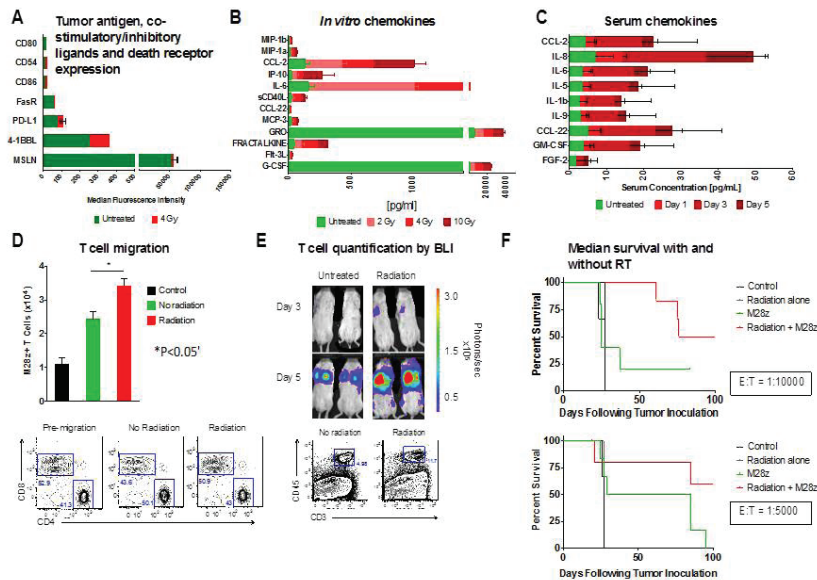
Objective: Recent studies on the antitumor efficacy of tumor-targeted radiation therapy (RT) have shifted focus from tumor cell cytotoxicity to regional and systemic immunomodulation: enhanced antigen expression, release of pro-inflammatory cytokines, and induction of death receptors by tumor cells. Encouraged by the success of (RT) for mesothelioma (SMART trial) we sought out mechanistic insights into thoracic RT-induced tumor immunomodulation. Herein we systematically explore the immunobiologic effects of thoracic RT in a clinically-relevant orthotopic mesothelioma model, and further translate our observations to chimeric antigen receptor (CAR) T-cell therapy. We hypothesized that immunomodulatory effects of RT may prime thoracic tumors and promote CAR T-cell antitumor efficacy.

Methods: Mesothelioma (MSTO-211H) and lung cancer cell lines (A549, H1299) were characterized for expression of mesothelin (MSLN)/FasR/PD-L1/ICAM-1/CD86/CD80/4-1BBL (Flow cytometry [FACS]). Using CAR transduced human T cells, we evaluated the effects of radiation *in vitro* on T-cell cytotoxicity (Cr51-release assay), chemotaxis (Boyden-chamber), proliferation (cell-count assay, CFSE), cytokine-release (PCR, ELISA), phenotype and chemokine receptor profiles (PCR, FACS). *In vivo* assessment was performed on established thoracic tumors with and without thoracic RT. We monitored therapy response by survival, T-cell kinetics, proliferation, and persistence by utilizing T-cell and tumor bioluminescent imaging (BLI), and analysis of tumor/splenic/peripheral blood T-cell phenotype.

Results: *In vitro*, RT modulation of tumor antigen expression, co-stimulatory/inhibitory ligands, death receptors or CAR T-cell cytotoxicity was not significant at low doses tested (Figure 1A). RT induced tumor secretion of chemokines in a dose and time dependent manner with concomitant increase in T-cell chemotaxis (Figure 1B, C & D). *In vivo*, a single low-dose of RT alone did not decrease tumor burden, however, RT primed thoracic tumors, leading to robust early infiltration and higher intratumoral CD8/CD4 ratio in comparison to T-cell therapy alone as demonstrated by T-cell BLI ($p < 0.05$, Figure 1E) and *ex vivo* tumor analysis by flow cytometry (Figure 1E). This potentiated CAR T-cell efficacy (median survival 30 d vs. 79 d, $p = 0.02$) with at least 50% tumor eradication up to 100 days even with a 30-fold decreased dose (Figure 1F).

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Conclusions: Our results demonstrate that RT induced, chemokine mediated enhancement of T-cell chemotaxis/infiltration is a possible immunobiological mechanism which can be exploited for thoracic malignancies. This priming strategy of RT prior to CAR T-cell therapy may replace current preconditioning and is immediately translatable to thoracic cancer clinical trials.

L2. Utilization of Lungs for Transplantation Following Donor Cardiac Death in the Field Is Successful with Targeted Drug Delivery During Ex Vivo Lung Perfusion

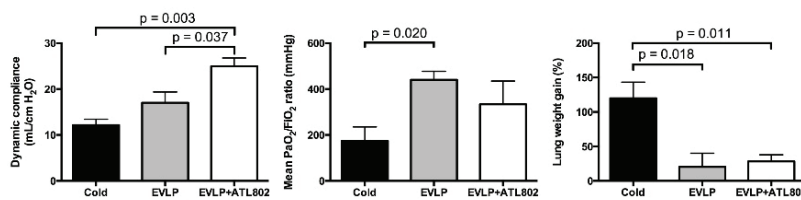
Eric J. Charles, J. Hunter Mehaffey, Ashish K. Sharma, James M. Isbell, *Christine L. Lau, *Curtis G. Tribble, Victor E. Laubach, *Irving L. Kron
University of Virginia Health System, Charlottesville, VA

Invited Discussant: *Thomas K. Waddell

Objective: Current criteria used to accept donor lungs for transplantation has led to a major shortage of organs and high wait list mortality. Transplantation of lungs from donors suffering uncontrolled cardiac death in the field would increase the donor pool, decrease wait times, and improve survival, but is limited by the risk of primary graft dysfunction and ischemia reperfusion injury. We hypothesized that use of *ex vivo* lung perfusion (EVLP) with targeted drug therapy would allow for successful rehabilitation and transplantation of donation after cardiac death (DCD) lungs exposed to two-hours of warm ischemia time.

Methods: Donor porcine lungs were procured after hypoxic cardiac arrest and a two-hour period of warm ischemia, followed by a four-hour period of either cold preservation or normothermic EVLP. Left lungs were then transplanted into recipient pigs and reperfused for four-hours. ATL802, an adenosine A2B receptor antagonist, was administered to select groups as targeted drug therapy for attenuation of ischemia reperfusion injury. Four groups ($n = 4/\text{group}$) were randomized: cold preservation alone (Cold), cold preservation with ATL802 administered during reperfusion (Cold+ATL802), EVLP rehabilitation alone (EVLP), and EVLP rehabilitation with ATL802 administered during EVLP (EVLP+ATL802). After reperfusion, left superior and inferior pulmonary vein samples were obtained for final mean PaO₂/FiO₂ ratios. Airway pressures were recorded for calculation of dynamic lung compliance, and percent change in left lung wet weight (before and after reperfusion) was measured.

Results: Administration of targeted drug therapy with ATL802 during the four-hours of EVLP significantly improved dynamic lung compliance after reperfusion compared with EVLP rehabilitation alone (25.0 ± 1.8 compared with 17.0 ± 2.4 mL/cm H₂O, respectively). Furthermore, oxygenation was significantly improved (440.4 ± 37.0 compared with 174.0 ± 61.3 mmHg) and percent weight gained during reperfusion was significantly less (20.3 ± 19.8 compared with $119.8 \pm 23.4\%$) in the EVLP group compared with the Cold group. No significant differences in oxygenation or lung weight gained were observed between groups EVLP and EVLP+ATL802, and administration of ATL802 during reperfusion of cold preservation lungs did not significantly improve outcomes after transplantation compared with cold preservation alone. Figure 1 highlights significant results.



Conclusions: Targeted drug therapy during EVLP rehabilitation of severely injured DCD lungs exposed to two-hours of warm ischemia time improves lung function and outcomes after transplantation. Successful utilization of lungs following uncontrolled donor cardiac death in the field is possible and may improve both wait list times and mortality.

L3. Pathogenesis of De Novo Lung-Restricted Autoimmunity Following Lung Transplantation

Stephen Chiu¹, Vijay Subramanian², *Daniel Kreisel², G.R. Scott Budinger¹, Harris Perlman¹, *Malcolm McAvoy DeCamp, Jr.¹, Thalachallour Mohanakumar², Ankit Bharat¹

¹Northwestern University, Chicago, IL; ²Washington University, St. Louis, MO

Invited Discussant: ♦Jonathan D'Cunha

Objective: Over 90% of lung recipients develop de novo autoimmunity against lung-specific self-antigens, collagen type V (ColV) and k-alpha 1 tubulin (KAT), that strongly predispose to chronic allograft rejection. However, the pathogenesis of autoimmunity following transplantation remains unknown. Here, we demonstrate a novel “two-hit” injury mechanism comprised of lung tissue injury and loss of CD4+CD25+Foxp3+ regulatory T cells (Tregs) that leads to the development of lung-specific autoimmunity.

Methods: Donor specific antibodies (DSA) were analyzed by flow cytometry. Respiratory viral infections (RVIs) were diagnosed by microbial culture. Antibodies (Abs) were analyzed by standardized ELISA. C57BL/6J wild-type (WT) mice were administered anti-H2Kb (anti-MHC class I) or hydrochloric acid (HCl, 0.1N) intratracheally to induce lung injury. C1.18 (isotype) Abs were used as control. Sublethal (5K) dose of parainfluenza Sendai virus (SdV) was used to infect recipients. Foxp3-DTR mice were injected with diphtheria toxin (DT), to deplete Tregs, or phosphate-buffered saline (PBS), as control. Data are presented as mean \pm SD. Significance was set at $p < 0.05$ and all comparisons met significance unless otherwise noted.

Results: Human: RVIs led to a decrease in Tregs [post-infection (post): $3.6 \pm 1.1\%$ vs. pre-infection (pre): $5.4 \pm 0.7\%$] that recovered by 3 months ($5.2 \pm 0.8\%$). Twelve of 20 recipients developed anti-ColV (post: 535.3 ± 158.9 ng/ml, normal: 133.0 ± 23.2 ng/ml) and KAT (post: 327.4 ± 117.6 ng/ml, normal: 101.7 ± 22.6 ng/ml). Of these 12 recipients, all had a source of allograft injury from DSA ($n = 8$) or acid reflux ($n = 4$).

Murine: SdV infection induced loss of Tregs within 1 week (post: $3.2 \pm 0.3\%$ vs. pre: $5.9 \pm 0.4\%$), similar to human subjects. In WT mice, pre-treatment with anti-H2Kb, but not C1.18, followed by SdV infection induced development of 1) IFN- γ producing T-cells specific to ColV [850 ± 89 spots per million (spm) vs. 101 ± 46 spm] and KAT (1189 ± 101 spm vs. 201 ± 66 spm) but not against non-lung antigen collagen type II [(ColII), <15 spm for all]; and 2) IgG anti-ColV (905 ± 56 ng/ml vs. 243 ± 45 ng/ml) and KAT (16 ± 5 ng/ml vs. 5 ± 3 ng/ml) but not ColII (<10 ng/ml for all). Development of autoimmunity was associated with luminal obliteration on histology, a hallmark of chronic human lung allograft rejection. In FoxP3-DTR mice, treatment with anti-H2Kb or HCl, but not anti-C1.18, followed by DT injection induced anti-ColV (anti-H2Kb: 643 ± 103 ng/ml; Acid: 877 ± 125 ng/ml, C1.18: 59 ± 15 ng/ml) but not ColII (<54 ng/ml for all). Treatment with anti-H2Kb or HCl followed by injection of PBS did not induce anti-ColV or ColII (<50 ng/ml for both, $p = \text{NS}$).

Conclusions: Ongoing tissue injury can reveal sequestered tissue-specific self-antigens which can become target of autoimmunity. Concomitant loss of Tregs along with tissue injury therefore induces de novo tissue-specific autoimmunity.

L4. Overexpression of the RNA-Binding Protein CUG-BP1 Promotes Esophageal Cancer Cell Proliferation by Enhancing Mtor Expression

Daniel Mansour¹, Kimberly Byrnes¹, Pornima Phatak¹, Douglas Turner²,

*Richard Battafarano³, James Donahue¹

¹University of Maryland Baltimore, MD; ²Baltimore Veteran Affairs Medical Center, Baltimore, MD; ³John Hopkins Hospital, Baltimore, MD

Invited Discussant: *Jessica S. Donington

Objective: CUG-BP1 is an RNA-binding protein that post-transcriptionally regulates the expression of a variety of target mRNAs through its interaction with specific binding sites in the 3'-untranslated region (UTR). CUG-BP1 has been shown to be upregulated in several malignancies, including lung cancer, where its expression has been correlated with decreased survival. Recent work in our laboratory has demonstrated that (1) CUG-BP1 is overexpressed in esophageal cancer cell lines and in human esophageal cancer specimens compared to esophageal epithelial cells and (2) CUG-BP1 regulates the expression of the anti-apoptotic protein survivin in esophageal cancer cells. Based on its ability to regulate multiple target mRNAs, CUG-BP1 could serve as a master regulator in esophageal cancer. The goal of this study is to identify a target other than survivin that may contribute to the development of the malignant phenotype in esophageal cancer. As the 3' UTR of mTOR mRNA contains several potential CUG-BP1 binding sites, we sought to determine whether CUG-BP1 is able to bind and stabilize mTOR mRNA, and if so, whether this interaction modulates cellular proliferation.

Methods: Studies were conducted in human esophageal epithelial (hESO) cells and in TE7 and TE10 human esophageal cancer cells. Levels of protein expression were measured by Western blot. Binding of CUG-BP1 to mTOR mRNA was examined by biotinylated RNA pull-down assays. The stability of mTOR mRNA was determined by measuring its half-life after addition of Actinomycin D. CUG-BP1 function was tested by its overexpression and silencing. Cellular proliferation was assessed by MTT assays and cell cycle analysis.

Results: mTOR mRNA and protein levels are markedly increased in TE7 and TE10 esophageal cancer cells compared to hESO cells. Silencing CUG-BP1 results in decreased mTOR mRNA and protein levels in TE7 and TE10 cells. In addition, levels of phosphorylated S6 kinase, a direct target of mTOR, are similarly reduced following CUG-BP1 silencing. In complementary experiments, overexpression of CUG-BP1 in hESO cells leads to increased mTOR expression. Biotinylated RNA-pull down assays confirm direct binding of CUG-BP1 to the 3' UTR of mTOR mRNA. mTOR mRNA stability is decreased following silencing of CUG-BP1. Furthermore, silencing CUG-BP1 leads to decreased cellular proliferation. This effect was found to be related to reduced levels of Cyclin E, a downstream target of mTOR, resulting in G1 arrest.

Conclusion: These data indicate that CUG-BP1 contributes to esophageal cancer cell proliferation through its regulation of mTOR. Coupled with its ability to modulate sensitivity to chemotherapy-induced apoptosis through regulation of survivin, our findings suggest that CUG-BP1 may play an important role in esophageal carcinogenesis. Future efforts aimed at determining its role as a potential biomarker and therapeutic target are warranted.

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L5. Mechanistic Insights Into the Pathophysiology of Pulmonary Vein Stenosis

Rachel D. Vanderlaan¹, Yaquin Yana Fu², Jingyi Pan², Anouk Martine-Teichert Martine-Teichert², Jiaquan Zhu², Mauro Lo Rito², Jason Maynes², *John Coles², Jaques Belik², *Christopher A. Caldarone²

¹University of Toronto, Toronto, ON, Canada; ²Hospital for Sick Children, Toronto, ON, Canada

Invited Discussant: ♦Massimo Caputo

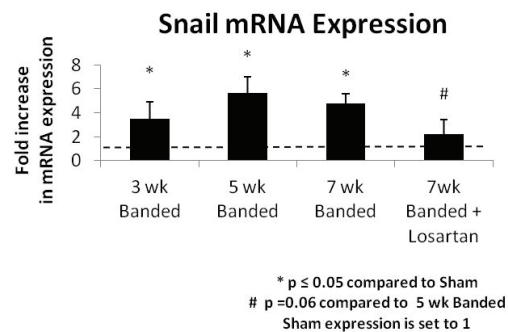
Objective: Progressive pulmonary vein stenosis (PVS) in pediatric patients is often lethal with no known therapy. We have previously reported that pulmonary vein banding in piglets replicates clinical presentation of PVS with pulmonary hypertension, progressive neointimal hyperplasia and extracellular remodeling. We investigated mechanisms contributing to the progression of PVS and how they are modulated by losartan therapy.

Methods: We used molecular and biochemical techniques to characterize key changes in the progression of PVS at 3, 5 and 7 weeks post banding. Additionally, losartan treated banded animals were harvested at 7 weeks.

Results: We found early increased mRNA expression (expressed as fold change compared to sham) of TGF- β 1 (4.5 ± 0.7 (5 wk) and 3.7 ± 0.9 (7 wk), $p < 0.05$) and the angiotensin II type 1 receptor (5.4 ± 1.2 (5 wk) and 4.0 ± 1.4 (7 wk), $p < 0.05$), which corresponded with increased myofibroblast deposition. Early increased mRNA expression of snail supports a role for endothelial to mesenchymal transition in myofibroblast accumulation in the subendothelium (3.5 ± 1.4 (3 wk), 5.7 ± 1.3 (5 wk) and 4.8 ± 0.9 (7 wk), $p < 0.05$). Losartan treated banded animals had attenuated TGF- β 1, angiotensin II type 1 receptor and snail mRNA expression (Figure 1A) and this was associated with decreased neointimal hyperplasia.

To understand the impact of PVS on pulmonary vein physiology, we performed myograph studies. Intrapulmonary veins from banded animals were more sensitive to vasoconstriction by U46619 compared to shams. Intrapulmonary veins from banded animals had similar vascular smooth muscle dependent vasodilation; however, endothelial dependent relaxation was impaired in intrapulmonary veins from banded animals compared to shams (Figure 1B), suggesting endothelial dysfunction and eNOS uncoupling. Given the central role of reactive oxygen species (ROS) signaling in eNOS uncoupling, we investigated the role of NADPH oxidases (NOX) in PVS pathophysiology. Banded animals had increased mRNA expression (expressed as fold change compared to sham) of NOX2 (2.2 ± 1.4 (5 wk), $p \leq 0.05$) and NOX4 (3.4 ± 0.7 (3 wk), 2.9 ± 0.8 (5 wk) and 3.1 ± 0.7 (7 wk), $p \leq 0.05$) and subunits p47-phox (4.7 ± 1.1 (5 wk), and 3.5 ± 1.5 (7 wk), $p < 0.05$) and p22-phox (1.7 ± 0.6 (5 wk) and 1.7 ± 0.07 (7 wk), $p < 0.05$). Supportive of ROS production, protein carbonylation was increased in banded animals compared to sham. Losartan treated banded animals had decreased NOX-related signaling (Figure 1C). These data suggest that impaired relaxation in intrapulmonary veins due to ROS mediated endothelial dysfunction may contribute to the progression of PVS into upstream intrapulmonary veins.

Fig 1A



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Fig 1B

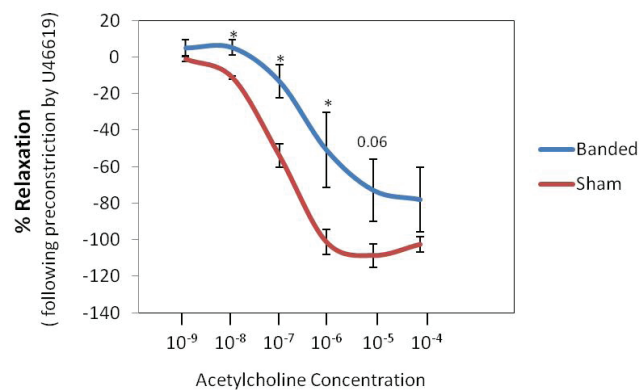
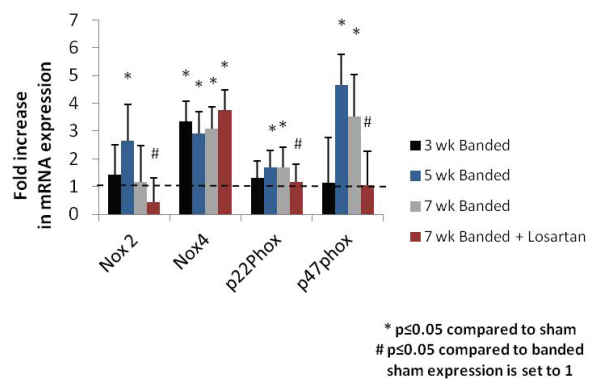


Fig 1C



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Conclusions: Our study provides insights into mechanisms involved in the pathophysiology of PVS and support the use of losartan as a novel medical therapy for PVS in pediatric patients.

L6. Obtaining the Biomechanical Behavior of Ascending Aortic Aneurysm by Using Novel Speckle Tracking Echocardiography

Mohammed S. Alreshidan, Kevin Lachapelle, Sr., Richard Leask, Sr.

McGill University, Montreal, QC, Canada

Invited Discussant: *Abe DeAnda Jr.

Objectives: Biomechanics may provide important information regarding risk of rupture or dissection even in aortas less than 5.5. The obvious problem is that mechanics are till now only measured following resection. We hypothesize that the ability to measure biomechanics of the aorta *in vivo* and noninvasively may provide meaningful information regarding aortic risk prediction. In this study we sought to determine whether we could measure aortic biomechanics using speckle tissue tracking during trans esophageal echo TEE and correlate this with *ex vivo* measures.

Methods: Biomechanics of the ascending aorta of patients undergoing resection were performed *in vivo* and *ex vivo*. *In vivo* biomechanics were estimated by intra operative TEE Vivid 7 GE with simultaneous ECG tracking. From the short axis the deformation—strain of the tissue was obtained by using the speckled tracking—GE EchoPAC station by mapping of the circumference of the aorta using advanced Q Analysis. The average stress of the tissue was calculated from the circumferential strain and peripheral blood pressure recorded simultaneously by a radial artery line tracing then using the following $\beta = \ln (SBP/DBP)/(Ao-S)$ (β stiffness; Ps Systolic BP; Pd Diastolic BP, AOs circumferential strain). Ascending aortic tissue was obtained intra operatively then mechanical tested using a biaxial tissue tester Bose ELF 3200 to obtain the stress/strain curve around the circumference of Anterior, Posterior, Inner and Outer curvature of aortic wall. We compared the *ex vivo* apparent stiffness at 25% strain in circumferential direction with echo estimated stiffness in all 4 regions.

Results: Nineteen patients—11 males with a mean age of 60 years \pm 16 and a mean aortic diameter of 5 cm \pm 1—eleven tricuspid aortic valve TAV and eight bicuspid aortic valve BAV were included in the study. AscAA stiffness depended on location—Two way ANOVA, $p = 0.0417$. *In vivo* mean stiffness at IC, Anterior, OC and Posterior walls were 0.054, 0.029, 0.041 and 0.050 MPa respectively. *Ex vivo* mean stiffness at IC, Anterior, OC and Posterior walls were 0.057, 0.036, 0.040 and 0.033 MPa respectively. The stiffness was not significantly different between the *ex vivo* and *in vivo* measures—Two way ANOVA $p = 0.8252$. However, the variability of the IC was highest and the difference between measured *ex vivo* stiffness and estimated echo stiffness at the posterior wall was greatest Figure 1.

Conclusion: *In vivo* strain imaging using speckle tracking echo captures the regional mechanical properties associated with ascending aortic diseases, and appears to be a promising tool in assessing the mechanical state of AscAA *in vivo*.

L7. Calpain Inhibition Modulates GSK-3 β Pathways in a Swine Model of Chronic Myocardial Ischemia in the Setting of Metabolic Syndrome: A Proteomic and Mechanistic Analysis

Brittany A. Potz, Ashraf A. Sabe, Nassrene Y. Elmadhun, Jun Feng, Richard A. Clements, Ruhul M. Abid, *Frank W. Sellke

Brown University, Providence, RI

Invited Discussant: *Juan A. Crestanello

Objectives: Calpain inhibition (CI) has been found to increase microvascular density and improve collateral dependent perfusion in a pig model of chronic myocardial ischemia in the setting of metabolic syndrome (MetS). Calpain activity may promote dysregulated glycogen synthase kinase 3 beta (GSK-3 β) activation which may have anti-angiogenic effects. We hypothesized that CI works in part through reduced GSK-3 β activity, and examined if GSK-3 β inhibition promotes angiogenesis and collateral formation in response to chronic ischemia in MetS swine.

Methods: Pigs were fed a high fat diet for 4 weeks, then underwent placement of an ameroid constrictor to their left circumflex artery. Three weeks later animals received either: no drug (CON), a high (HCI) or low dose (LCI) calpain inhibitor, or a GSK-3 β inhibitor (GSK-3 β I). The diets and CI/GSK-3 β I were continued for an additional 5 weeks, followed by myocardial tissue harvest. Protein expression of the harvested myocardial tissue samples were analyzed via proteomic analysis (LC-MS/MS) and western blotting.

Protein	GKSI (Fold)	CON (Fold)	P value
Blood Flow Ischemic Rest (microspheres)	0.865 \pm 0.125	0.579 \pm 0.642	0.048
Perfusion Ratio Lcx/LAD Rest	1.238 \pm 0.383	0.60 \pm 0.318	0.07
Non-Ischemic- Capillary (vessel counts)	166.05 \pm 55.244	129.95 \pm 50.888	0.04
Non-Ischemic-Arteriole (vessel counts)	12.65 \pm 8.661	4.9 \pm 2.406	<0.01
Ischemic- Capillary (vessel counts)	156.6 \pm 56.517	131.85 \pm 41.435	0.06
Ischemic- Arteriole (vessel counts)	14.15 \pm 12.240	4.725 \pm 3.654	<0.01
ERK	10.615 \pm 13.861	1.0	0.17
P-AKT	0.664 \pm 0.423	1.0	0.06
INOS	2.388 \pm 2.013	1.0	0.52
Beta Catenin	2.706 \pm 1.398	1.0	0.07
BAD	0.140 \pm 0.082	1.0	0.06
FoxO1	3.342 \pm 2.088	1.0	0.054
AMPKA	6.930 \pm 8.9222	1.0	0.08
ENOS	2.586 \pm 2.073	1.0	0.12
VEGF1	3.833 \pm 2.192	1.0	0.046
AKT	1.987 \pm 1.102	1.0	0.033
Gamma-Catenin	4.693 \pm 5.297	1.0	0.02
P fox	2.830 \pm 0.921	1.0	0.03
VE Cadherin	2.083 \pm 0.576	1.0	0.01
VEGF-2	0.950 \pm 0.698	1.0	0.60
SOD2	2.753 \pm 1.327	1.0	0.09
Catalase	1.810 \pm 0.997	1.0	0.06
Protein	LCI (Fold)/HCI (Fold)	CON (Fold)	P value
GSK-3 β	2.129 \pm 0.372/2.478 \pm 0.342	1.00	0.01
B-Catenin	1.887 \pm 0.256/2.586 \pm 0.216	1.0	<0.01
ERK1/2	2.391 \pm 0.278/3.420 \pm 0.165	1.0	<0.01
P-Beta Catenin	0.638 \pm 0.130/0.5733 \pm 0.123	1.0	0.097

Results: There was a significant increase in GSK-3 β (P < 0.01) and B-catenin expression (P < 0.01) and decreased B-catenin phosphorylation (P = 0.097) in the CI groups compared to the CON group consistent with GSK-3 β inhibition. Similar to

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CI groups, coronary blood flow and myocardial perfusion ratios (LCx/LAD) were increased in the GSK-3 β I group compared to the CON group ($P = 0.048$ and $P = 0.01$, respectively). The increased arteriolar and capillary densities were also observed in the GSK-3 β I group as compared to the CON group ($P < 0.01$). There was a trend to increase antioxidant proteins catalase ($P = 0.057$) and SOD2 ($P = 0.09$) in the GSK-3 β I group compared to the CON group. There was a trend to decrease the pro-apoptotic protein BAD ($P = 0.06$) in the GSK-3 β I group. There was an increase in anti-apoptotic protein AKT ($P = 0.03$) and a trend toward increase in phosphorylated-AKT ($P = 0.06$) and AMPK- α ($P = 0.08$). There were increases in pro-angiogenic proteins including β -catenin ($P = 0.04$), VE-cadherin ($P = 0.01$), γ -catenin ($P = 0.02$), p-Fox ($P = 0.03$), and VEGF receptor 1 ($P = 0.046$) with a trend toward increased ERK ($P = 0.17$), eNOS ($P = 0.12$), and FoxO1 ($P = 0.05$) in the GSK-3 β I group compared to the CON group. Quantitative proteomics and systems analysis revealed that CI and GSK-3 β I significantly modulated expression of proteins enriched in cytoskeletal regulation, metabolism and respiration, and calcium binding pathways compared to the CON group including upregulation of NADH dehydrogenase 1 α -subcomplex, myosin 10 and B1-catenin in the GSK-3 β I group ($P < 0.05$).

Conclusion: In the setting of MetS, inhibition of calpain and GSK-3 β activity leads to increased blood flow and microvascular density in the chronically ischemic myocardium. Calpain or GSK-3 β -inhibition promotes similar angiogenic, cell survival and cell differentiation pathways.

L8. Aortic Valve Repair Using Autologous Pericardium: To Fix or Not to Fix?

Janet Mee Chin Ngu, Hadi Daood Toeg, Reza Jafar, Benjamin Sohmer, Vincent Chan, Michel Labrosse, ♦Munir Boodhwani

University of Ottawa Heart Institute, Ottawa, ON, Canada

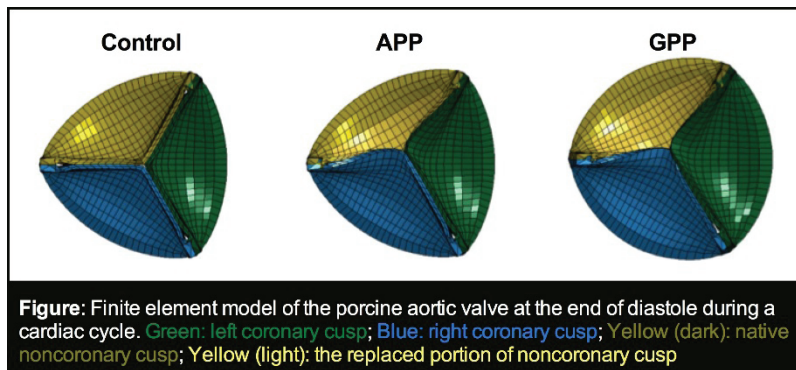
Invited Discussant: *Frederick Y. Chen

Objective: The use of a pericardial patch in aortic valve (AV) repair (AVr) has been associated with reduced repair durability. The optimal preparation of autologous pericardium and its impact on valve function, leaflet dynamics, and stress is unclear. We compared autologous porcine pericardium (APP) and glutaraldehyde-fixed porcine pericardium (GPP), by using an *ex-vivo* porcine AV cusp replacement model, combined with biaxial biomechanical testing and finite element (FE) modeling.

Methods: Porcine aortic roots with intact AVs (control, $n = 9$) underwent baseline assessment in a ViVitro left heart simulator mounted with a high-speed camera, hemodynamic monitoring, and 3D echocardiography. 80% of the noncoronary cusp was excised and replaced with autologous porcine pericardium (APP, $n = 8$), or porcine pericardium fixed in 0.6% glutaraldehyde for 20 minutes (GPP, $n = 8$). Hemodynamic parameters and valve dynamics were assessed. The biomechanical properties were measured using a CellScale biaxial testing system. FE models of the AV and root complex were constructed to evaluate cusp geometry, hemodynamic characteristics, and leaflet stresses during the cardiac cycle.

Results: The geometric orifice area after repair were reduced compared to control ($2.56 \pm 0.21 \text{ cm}^2$) in both the APP ($2.10 \pm 0.10 \text{ cm}^2$, $p = 0.03$) and GPP groups ($1.84 \pm 0.19 \text{ cm}^2$, $p = 0.02$), while the effective cardiac output and left ventricular work were preserved. APP demonstrated similar biomechanical properties as those of the native AVs, whereas GPP demonstrated higher strains (typical max circumferential Green strains of 0.05 vs 0.08 vs 0.13; typical max radial Green strains of 0.15 vs 0.15 vs 0.25 for native porcine leaflets, APP and GPP, respectively, under typical equibiaxial 2nd Piola-Kirchhoff stress of 60N/m), indicating higher elasticity. FE modeling of the AVs showed preserved end diastolic Von Mises stress in the replaced cusp (+1%) and nonreplaced cusps (-0.3%) in the APP group. In the GPP group, the stress was increased in the replaced cusp (+59%), with compensatory increased stress in the nonreplaced cusps (+10%). Leaflet coaptation surface area was preserved (2.48 vs 2.45 cm^2) in the APP group with a small reduction in effective height (9.0 vs 10.4 mm). Both the coaptation surface area (1.73 vs 2.45 cm^2) and the effective height (4.6 vs 10.4 mm) were markedly reduced in the GPP group. Small effective regurgitant orifice was present in the GPP group (0.04 cm^2), but was absent in both the control and APP groups.

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Conclusions: AVr using fresh autologous pericardium demonstrates a remarkably similar profile to the native AV leaflet. Glutaraldehyde preparation increases elasticity and is associated with reduced leaflet coaptation surface area and effective height in this model. Increased leaflet stresses observed with glutaraldehyde-fixed pericardium may be responsible for late repair failure.

6:40 PM Adjourn

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MONDAY EVENING, MAY 16, 2016

5:00 PM **Innovations in Transcatheter Valve Therapies:
What You Need to Know for Today and the Future** Room 327, BCC

Course Chair: *Vinod H. Thourani, *Emory University*

Course Directors: *A. Marc Gillinov, *Cleveland Clinic Foundation*

 *Vinod H. Thourani, *Emory University*

 *Mathew R. Williams, *New York University*

See page 27 for schedule.

5:00 PM **Emerging Interfaces in Advanced Imaging
and Interventions in Structural CV Disease** Room 343, BCC
Supported by an educational grant from Siemens

Course Co-Chairs: *Juan B. Grau, *The Valley Hospital/Cleveland Clinic
Foundation*

 Mani Vannan, *Ohio State University*

See page 28 for schedule.

TUESDAY MORNING, MAY 17, 2016

7:00 AM **Cardiac Surgery Forum** Ballroom IV, BCC
5 minute presentation, 5 minute discussion

Moderators: *Jennifer S. Lawton and *Craig H. Selzman

**F1. Oxygenation of the Cerebrospinal Fluid with Nanobubbles Can Ameliorate a
Spinal Cord Ischemic Injury in a Rabbit Model**

Keisuke Kanda, Osamu Adachi, Satoshi Kawatsu, Ko Sakatsume, Kiichiro Kumagai,
Shunsuke Kawamoto, Yoshikatsu Saiki
Tohoku University, Sendai, Japan

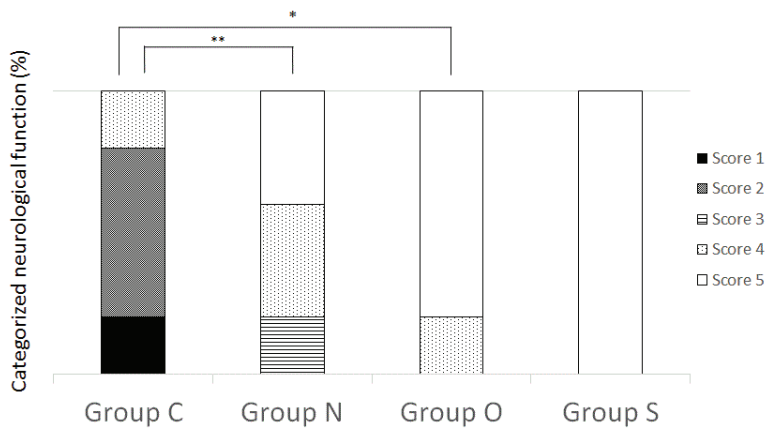
Invited Discussant: *T. Brett Reece

Objective: We evaluated the effect of cerebrospinal fluid (CSF) oxygenation with nanobubbles for the prevention of spinal cord ischemic injury (SCII) after infrarenal aortic occlusion in a rabbit model.

Methods: Twenty white Japanese rabbits were categorized into the following 4 groups (5 in each): Group S (sham), balloon catheter insertion on to the aorta; Group C (control), spinal cord ischemic injury by infrarenal abdominal aortic balloon occlusion for 15 min; Group N (non-oxygenated), SCII with CSF replacement

by non-oxygenated artificial CSF; Group O (oxygenated), SCII with CSF replacement by nanobubble-oxygenated artificial CSF. The changes in CSF-partial pressure of oxygen (pO₂), modified Tarlov score, and histopathology of the spinal cord were evaluated 48 h after aortic occlusion.

Results: CSF-pO₂ significantly increased in group O compared to group N after CSF replacement. (254.5 ± 54.8 vs 136.1 ± 43.5 mmHg, $P = 0.01$) After 15 min of SCII, CSF-pO₂ in group C decreased to 65.8 ± 18.6 mmHg compared to baseline (148.8 ± 20.6 mmHg, $P < 0.01$), whereas CSF-pO₂ in group O was maintained at remarkably high levels after SCII (291.9 ± 51.8 mmHg), which was associated with improved neurological function, with 20% of SCII having less than 5 Tarlov score compared to 100% of SCII in group C. Preservation of anterior horn neurons was confirmed by histopathological analysis with significant reduction of normal neurons to <30% of the level in group C.



Figure, Frequency and extent of modified Tarlov score in Group C, N, O, and S.
* $P < .01$, ** $P < .05$: Mann – Whitney U test.

Conclusions: CSF oxygenation with nanobubbles can exert a protective effect against SCII in rabbits.

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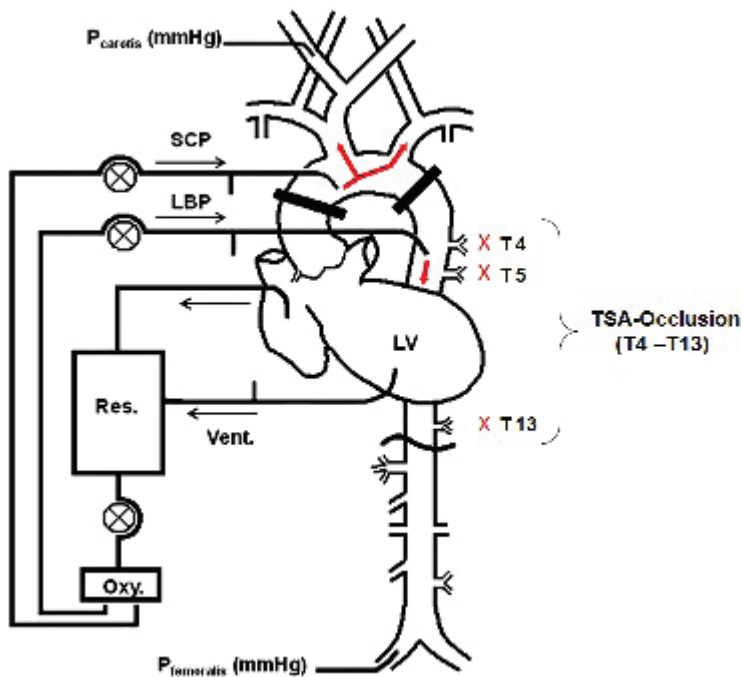
F2. Lower Body Perfusion for Spinal Protection in a Frozen Elephant Trunk Simulation Model

Peter Lukas Haldenwang¹, Lorine Häuser¹, Daniel Zieburg¹, Nora Prochnow¹, Andreas Baumann¹, Markus Schlömacher¹, Hildegrad Christ², Justus Thomas Strauch¹
¹BG University Hospital Bergmannsheil Bochum, Bochum, Germany; ²University of Cologne, Cologne, Germany

Invited Discussant: ♦Ourania Preventza

Objective: The ‘frozen elephant trunk’ procedure (FET) using isolated selective cerebral perfusion (SCP) at moderate hypothermia is associated with an increased risk for spinal cord ischemia. Aim of this study was to evaluate the neuroprotective effect of a combined selective and lower body perfusion (CLBP) in a porcine model.

Methods: 20 pigs (46 ± 5 kg) were cooled on CPB to 28°C. After aortic clamping and occlusion of the thoracic segmental arteries (TSA T4-T13) a pressure controlled SCP (50 mmHg) was established for 90 min. Randomly, in n = 10 animals an additional lower body perfusion was performed with 15 ml/kg/min (CLBP). Regional spinal blood flow (SCBF), liquor pressure (LP) and motor evoked potentials (MEP) were registered at six time points. The animals were sacrificed after 120 min of weaning from CPB, and the spinal cord analyzed histologically using a schematic grading system (Kleinman-Score: 0 = normal, 8 = total necrosis).



Results: Isolated SCP led to a SCBF-decrease from 18.5 ± 9.4 to 0.9 ± 1.4 ml/min/100g in the L1–L5 region ($p = 0.005$) whereas CLBP preserved an almost physiologic lumbar SCBF of 11.3 ± 5.3 ml/min/100g. LP decreased in both groups during cooling and SCP/CLBP to 70–80% and increased during reperfusion to 150%, showing higher values after isolated SCP. In the L1–L5 region significant differences in MEP changes could be observed: During aortic arch clamping and TSA-occlusion SCP-animals showed significant lower MEP-amplitudes, when compared to CLBP treated animals: $60 \pm 9\%$ vs. $90 \pm 3\%$ ($p = 0.0005$) in the vastus medialis muscle and $52 \pm 19\%$ vs. $74 \pm 15\%$ ($p = 0.0005$) in the tibialis anterior muscle area. Only animals treated with CLBP recovered completely after systemic reperfusion and weaning from bypass: $99 \pm 7\%$ vs. $70 \pm 13\%$ in the vastus medialis muscle area ($p = 0.0005$) and $96 \pm 6\%$ vs. $62 \pm 22\%$ in the tibialis anterior muscle area ($p = 0.005$).

All animals with isolated SCP, but only 40% of the CLBP-animals presented a Kleinman-Score >5 , showing at least a manifest necrosis of both anterior horns. Another 40% of the CLBP-animals showed only minor necrotic lesions in the lumbar spine. The mean Kleinman-Score was higher in the SCP-group (5.9 ± 0.6), when compared to the CLBP-group (3.6 ± 2.8), even if this difference had only a trend to significance in the statistical evaluation ($p = 0.093$).

Conclusions: 90 min of SCP provide an insufficient lumbar spinal cord protection during FET-procedure at 28°C . Functional and structural spinal damage may be reduced using CLBP.

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F3. MRI Assessment of Cardiac Function in a Swine Model of Hibernating Myocardium Three Months Following Bypass Surgery

Laura Hocum Stone¹, Cory Swingen¹, Christopher T. Holley¹, Christin A. Wright¹, Melanie Crampton¹, *Herbert B. Ward¹, Edward O. McFalls², *Rosemary F. Kelly¹

¹University of Minnesota, Minneapolis, MN; ²Minneapolis VA Medical Center, Minneapolis, MN

Invited Discussant: *Michael K. Pasque

Objective: Clinical studies have suggested that functional recovery of hibernating myocardium may be delayed following CABG surgery. We have created a large animal model of hibernating myocardium that is subsequently revascularized with a left internal mammary artery to the left anterior descending artery. Initial studies showed partial but incomplete functional and biochemical recovery one month following CABG using transthoracic echocardiography. Our current study used cardiac-gated magnetic resonance imaging to characterize myocardial viability, changes in blood flow, and cardiac function in a swine model of hibernating myocardium at 1 and 3 months following CABG.

Methods: Female Yorkshire swine ($N = 8$) underwent left thoracotomy for placement of a 1.5 mm constrictor around the proximal LAD artery to create single vessel territory hibernating myocardium by 12 weeks. At 12 weeks, MRI imaging was performed to confirm hibernation without infarction in all animals. Baseline function and with dobutamine infusion (5 and $10 \mu\text{g/kg/min}$) was measured. 2 animals were terminated after 12 weeks as hibernation controls. In 6 animals, off-pump revascularization with a left internal mammary artery graft to the LAD artery

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was performed. Animals were allowed to recover for 4 weeks (N = 4) or 12 weeks (N = 2). MRI imaging was repeated in all 6 animals just prior to the termination surgery. MRI studies of cardiac function were performed at baseline and during an infusion of low dose dobutamine (10 $\mu\text{g/kg/min}$). Microspheres were administered at baseline and 10 $\mu\text{g/kg/min}$ dobutamine infusion for blood flow analysis.

Results: Global function as measured by ejection fraction is not impaired in this model of single vessel disease. MRI confirmed myocardial viability in the LAD region for all animals. However, regional wall motion abnormality in hibernating regions is evident by MRI imaging. The percent wall thickening is notably reduced in hibernation, but with dobutamine infusion shows evidence of contractile reserve and confirmation of viability (Figure 1). At one month following bypass, wall thickening shows only slight improvement at baseline with normalization during dobutamine infusion. Three months following bypass, regional wall motion has normalized both at baseline and with dobutamine infusion. Comparison of blood flow as measured by fluorescent microspheres in LAD territories shows improvement following bypass at one month and the improved flow is sustained at 3 months.

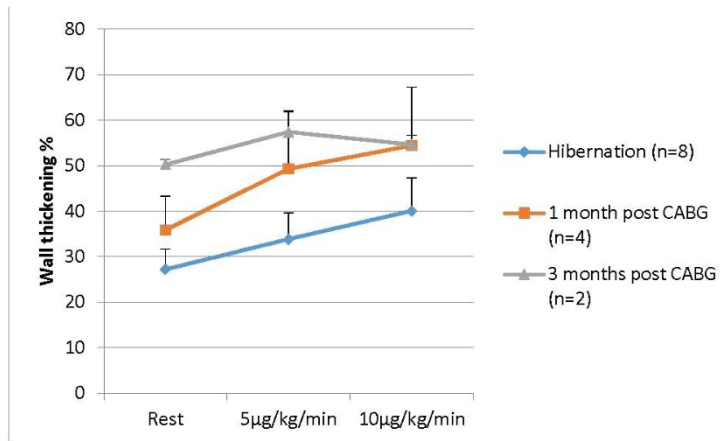


Figure 1. Percent wall thickening in hibernating regions as measured by MRI at rest and during low dose dobutamine infusion.

Conclusions: MRI demonstrates improvement in regional functional impairment in revascularized hibernating myocardium in a large animal model. MRI imaging techniques allow for precise longitudinal assessment of functional improvement. Full recovery of blood flow and function is evident at three months but not at one month following bypass.

F4. Myocardial Rescue with Autologous Mitochondrial Transplantation in a Porcine Model of Ischemia/Reperfusion

Aditya K. Kaza¹, Isaac Wamala¹, Ingeborg Friehs¹, Joseph Kuebler¹, Rahul H. Rathod¹, Ignacio Berra¹, *Sidney Levitsky², *Pedro J. del Nido¹, Douglas B. Cowan¹, James D. McCully¹

¹Boston Children's Hospital, Boston, MA; ²Beth Israel Deaconess Medical Center, Boston, MA

Invited Discussant: *Juan A. Crestanello

Objective: To demonstrate the clinical efficacy of autologous mitochondrial transplantation to significantly enhance myocardial cell viability following ischemia/reperfusion in the *in vivo*, clinically-relevant, large animal (swine) model in preparation for an anticipated translation to human application.

Methods: A left mini thoracotomy was performed on Yorkshire pigs (female, 40 kg). The pectoralis major was dissected and two small pieces of skeletal muscle tissue were removed using a number 6 biopsy punch and used for the isolation of autologous mitochondria. The heart was made regionally ischemic (RI) by temporarily snaring the circumflex artery for 25 minutes.

Following 24 minutes of RI hearts received either 8 × 0.1 ml injections of sterile vehicle (RI-Vehicle, n = 6) into the area-at-risk or 8 × 0.1 ml injections of sterile vehicle containing mitochondria $9.7 \times 10^6 \pm 1.7 \times 10^6/\text{ml}$ (RI-Mitochondria, n = 6). Injections were made using a sterile 1 ml insulin syringe with a 28 gauge needle. The snare was released at 25 minutes. The thoracotomy was closed and the pigs were allowed to recover for 4 weeks and then the pigs were euthanized and the heart was removed for analysis.

Results: Electrocardiograms showed ST elevation following ligation of the circumflex artery in both RI-Vehicle and RI-Mitochondria groups. There were no electrocardiogram abnormalities observed in any animal following surgery or during recovery. There was no significant difference in animal body weight or left ventricular weight between RI-Vehicle and RI-Mitochondria groups either prior to surgery or after 4 weeks recovery. At three days following surgery creatinine kinase MB (CKMB) and cardiac troponin I (cTnI) were increased significantly ($p < 0.05$) to $42.5 \pm 1.9 \text{ ng/mL}$ and $14.0 \pm 1.7 \text{ ng/mL}$ respectively in RI-Vehicle as compared to $27.7 \pm 3.8 \text{ ng/mL}$ and $8.2 \pm 0.7 \text{ ng/mL}$ in RI-Mitochondria. Immune and inflammatory markers and cytokine activation showed no significant difference between groups at 30 days following surgery. There was no significant difference in the area at risk (AAR, %LV mass) between RI-Vehicle ($18.8 \pm 4.3\%$) and RI-Mitochondria ($32.2 \pm 4.3\%$), however, infarct size (% AAR) was significantly increased ($p < 0.05$) in RI-Vehicle ($14.2 \pm 4.1\%$ AAR) as compared to RI-Mitochondria ($5.6 \pm 1.7\%$ AAR). Echocardiography showed no significant differences in global function. However, in RI-Vehicle hearts the posterior and lateral walls had a worse global circumferential strain pattern correlating with the region affected by circumflex occlusion. Histochemistry and electron microscopy analyses showed damaged tissue in RI-Vehicle hearts that was not apparent in RI-Mitochondria hearts.

Conclusion: Autologous mitochondrial transplantation provides a novel technique to significantly enhance myocardial cell viability following ischemia and reperfusion in the clinically-relevant swine model.

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F5. Layered Smooth Muscle Cell-Endothelial Progenitor Cell Sheets Augment Post-Infarction Ventricular Function; Implications for Translating Multi-Lineage Cellular Tissue Engineering

Yasuhiro Shudo¹, Andrew B. Goldstone¹, Jeffrey E. Cohen¹, Masashi Kawamura¹, Jay Patel¹, Michael S. Hopkins¹, Bryan B. Edwards¹, Shigeru Miyagawa², Yoshiki Sawa², *Joseph Woo¹

¹Stanford University, Stanford, CA; ²Osaka University Graduate School of Medicine, Osaka, Japan

Invited Discussant: *Joseph T. McGinn

Objective: The angiogenic potential of endothelial progenitor cells (EPCs) may be limited by the absence of their natural biologic foundation, namely smooth muscle pericytes. We hypothesized that joint delivery of EPCs and smooth muscle cells (SMCs) in a novel, totally bone marrow derived cell sheet will mimic the native architecture of a mature blood vessel and act as a supratherapeutic angiogenic construct to limit post infarction ventricular remodeling.

<i>Transdifferentiation of MSC into SMC</i>					
	MSC cultured on fibronectin coated dish (n=6)	MSC cultured on collagen type IV coated dish (n=6)	MSC cultured on laminin coated dish (n=6)	Primary MSC (n=6)	p value
Proportion of SMC marker by flow cytometry					
α SMA (%)	65.1±6.5	42.3±6.9	59.3±7.0	39.9±3.1	0.02
SM22α (%)	74.2±6.7	56.0±7.7	60.4±8.7	44.9±3.6	0.15
Overall cell proliferation					
Cellular proliferative capacity (%)	9.8±2.5	9.0±2.3	4.3±1.3	9.8±2.8	0.17

MSC=mesenchymal stem cell, SMC=smooth muscle cell, α SMA=alpha smooth muscle actin. Data are presented as mean value ± SE.

<i>In vivo study</i>				
	No treatment group (n=12)	Cell-sheet group (n=9)	Sham group (n=7)	p value
Cardiac MRI analysis				
LVEDV (μl)	703±44	584±41	435±22	0.001
LVESV (μl)	480±40	322±34	168±14	0.001
LVEF (%)	32.4±2.0	45.7±2.5	61.7±1.8	0.001
Histological examination				
Fibrotic extension (%)	55±9	28±4	-	0.04
Vessel density (vWF/α SMA ⁺ , /mm ²)	20±5	63±28	-	0.08

MRI=magnetic resonance imaging, LVEDV=left ventricular end-diastolic volume, LVESV=left ventricular end-systolic volume, LVEF=left ventricular ejection fraction, vWF=von Willbrand Factor, α SMA=alpha smooth muscle actin. Data are presented as mean value ± SE.

Methods and Results: Primary EPCs and mesenchymal stem cells (MSCs) were isolated from bone marrow of Wistar rats. Transdifferentiation of MSCs into SMCs preserved proliferative capacity, and was most efficient when cultured on fibronectin compared with collagen IV or laminin (P = 0.02, Table). Confluent SMCs topped with confluent EPCs were detached from the Upcell dish to create a SMC-EPC bi-level cell-sheet. A rodent model of ischemic cardiomyopathy was created by ligating the left anterior descending artery. Rats were divided into three groups: cell sheet transplantation (n = 9), no treatment (n = 12), and sham surgery control (n = 7). Four weeks post infarction, co-administered EPCs and SMCs considerably upregulated expression of key effectors of vessel recruitment (VEGF-A, 41 fold;

VEGFR-2, 28 fold) and maturation (Angiopoietin-1, 17 fold; Tie-2, 86 fold) within the infarct borderzone. Similarly, mature vessel density was increased in cell sheet-treated animals compared with controls. The robust angiogenic effect of this cell sheet enhanced ventricular function ($P = 0.001$) and attenuated ventricular remodeling ($P = 0.001$) as demonstrated by MRI (Table).

Conclusions: The bone marrow derived, spatially arranged SMC-EPC bi-level cell sheet is a novel, multi-lineage cellular therapy obtained from a translationally practical source. Interactions between SMCs and EPCs augment mature neovascularization, limit adverse remodeling, and improve ventricular function after myocardial infarction.

F6. Evaluating a Bioprosthetic Anterior Mitral Valve Leaflet Made from Autologous Jugular Vein and Expanded Polytetrafluoroethylene Chordae in a Sheep Model

Jacques Janson¹, Andre Coetzee¹, Gawie Rossouw¹, Izak Loftus², Riaan Murray¹, Pieter Rossouw¹, Philip Herbst¹

¹Stellenbosch University, Tygerberg, South Africa; ²Pathcare, Somerset West, South Africa

Invited Discussant: *Clifford W. Barlow

Objective: The objective of this study was to evaluate whether an autologous vein graft supported by expanded polytetrafluoroethylene (ePTFE) chordae can be used to replace an anterior mitral valve leaflet.

Methods: An autologous jugular vein graft, used as a double layer, supported by ePTFE chordae was used to create a functional anterior mitral valve leaflet in 21 sheep. No ring annuloplasty was used to support the annulus. The mitral valve function was monitored with echocardiography for up to 10 months. The surviving sheep were euthanized between 6–10 months and all vein leaflets were examined histologically.

Results: The average cross-clamp time was 99 minutes (76 to 151 min) and the average bypass time was 137 minutes (109 to 188 min). One sheep died intra-operatively. The post-operative echocardiogram demonstrated laminar diastolic flow across the mitral valve with an average opening area of 2.8 cm². Fourteen sheep had trace to mild mitral regurgitation (MR), 5 sheep had mild to moderate MR and 1 sheep had moderate to severe MR. The body of the vein leaflet tends to billow during systole which increases stress on the ePTFE chordae.

Three sheep died 2 to 3 days postoperatively and seven sheep died between 1 and 6 months. Four sheep developed infective endocarditis on the mitral valve.

Echocardiography at 6 months showed that the mitral regurgitation (MR) progressed with time in most of the sheep: 3 out of 11 sheep had mild MR, 5 had mild to moderate MR and 3 had moderate to severe MR. The progression of MR was due to lack of secondary chordal support of the vein leaflet and mitral annulus, leading to progressive annular dilatation, decreased leaflet coaptation length and increased tension on the primary Gore-Tex chordae. Durability of the valve should be improved by adding an annuloplasty ring and supporting the leaflet with secondary chordae.

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The vein leaflet developed intimal fibroplasia and fibrous proliferation between the 2 vein layers as a response to the increased stress upon the tissue. This caused leaflet thickening, but the vein remained flexible without shortening or contraction. The 6 to 10 month vein implants showed viable endothelium and the underlying vein layers clearly showed viability with myofibroblasts, collagen and elastin. A normal healing pattern was seen at the suture lines and no calcification was seen in the vein leaflet apart from the ePTFE sutures. No vein growth was demonstrated.

Conclusions: Autologous vein has the potential to be used as a valve leaflet substitute, because it remains viable in the intracardiac position for up to 10 months and is able to withstand the stress and deformation of a valve leaflet. Histologically it showed the ability to heal and to morphologically adapt to the new environment.

F7. Topographical Mapping of Left Ventricular Regional Contractile Injury in Ischemic Mitral Regurgitation

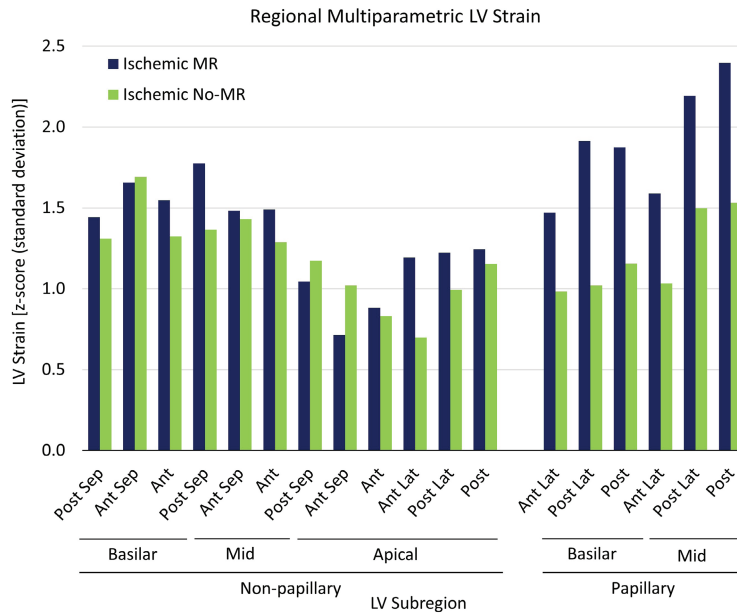
Timothy S. Lancaster, Julia Kar, Brian P. Cupps, Matthew C. Henn, Kevin Kulshrestha, Danielle J. Koerner, *Michael K. Pasque
Washington University, St. Louis, MO

Invited Discussant: Tomasz A. Timek

Objective: Until clinically applicable metrics are developed to predict post-repair recurrence of ischemic mitral regurgitation (MR), the significant (33%) recurrence of regurgitation after repair will fuel the argument that mitral valve replacement (MVR) may be the best option in these patients. The 67% of these patients who would do well with repair should not be abandoned to MVR for a lack of prognostic metrics. Since regional contractile injury is the pathophysiologic basis for ischemic MR, the patient-specific 3D topographical mapping of left ventricular (LV) contractile injury provided by MRI-based multiparametric strain analysis may predict post-repair recurrence of regurgitation in these patients.

Methods: A total of 146 study participants underwent MRI-based multiparametric strain analysis. In each, strain data was calculated for each of 15,300 LV grid points. Strain metrics from ischemic MR (n = 10) and ischemic no-MR (n = 36) patients were *normalized* to a normal human strain database (n = 100) with quantification by z-score (standard deviation) calculation. Mean multiparametric strain z-scores were calculated for 18 LV subregions at basilar/mid/apical levels in anterior (A), anterolateral (AL), posterolateral (PL), posterior (P), posteroseptal (PS), and anterosseptal (AS) regions. Subregions were divided into papillary muscle (basilar/mid levels of AL, PL, P) and non-papillary muscle (all other subregions) groups. Using a mixed-design ANOVA analysis, the mean z-scores for the papillary and non-papillary muscle subregions were compared between ischemic MR and ischemic no-MR groups.

Results: The topographical distribution of *normalized* LV contractile injury in the ischemic MR group was significantly different than that seen in the ischemic no-MR group ($p = 0.014$). In the papillary muscle regions, multiparametric strain mean z-score values were significantly higher (more injury) in ischemic MR patients versus those seen in ischemic no-MR patients (mean z-scores 1.91 ± 0.98 vs 1.20 ± 0.89 , respectively, $p = 0.036$), while remaining similar in the non-papillary muscle regions (1.31 ± 0.87 vs 1.18 ± 0.82 , respectively, $p = 0.664$). The Figure compares subregional mean multiparametric strain z-score data in papillary and non-papillary muscle-related subregions for both ischemic MR and ischemic no-MR patient groups.



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Conclusions: Multiparametric strain analysis demonstrated severe *normalized* LV contractile injury in the basilar/mid levels of the papillary muscle-related regions (AL, PL, P) in patients with ischemic MR. The mean degree of normalized injury approached 2 SD and was significantly worse than the near-normal levels seen in ischemic no-MR patients. MRI-based topographical mapping of LV contractile injury may hold potential to provide clinically applicable metrics to predict post-repair recurrence of mitral regurgitation in ischemic MR patients.

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F8. Epicardial Erythropoietin Hydrogel Improves Post-Ischemic Cardiac Performance and Accelerates Proliferation and Tissue Transformation in the Intramyocardial Mesenchyme

Christian Klopsch¹, Heiko Lemke¹, Marion Ludwig¹, Anna Skorska¹, Ralf Gaebel¹, Robert Jaster¹, Stefan Jockenhoevel², Robert David¹, Gustav Steinhoff¹

¹Rostock University Medical Center, Rostock, Germany; ²RWTH Aachen University, Aachen, Germany

Invited Discussant: *Sunjay Kaushal

Objectives: Local erythropoietin (EPO) release from an epicardial hydrogel might improve the therapy of myocardial infarction (MI) through an early boost of intracardiac key mechanisms in the intracardiac mesenchyme.

Methods: An EPO-plus-fibrin patch (dose 300 U/kg) was implanted epicardially after MI in rats and compared with conventional EPO treatments and untreated controls. *In-vivo* cardiac catheterisation, histological gene and protein expressions as well as cardiac FACS analyses have been performed. *In-vitro* EPO responsiveness (dose 100 U/ml) and its pleiotropic effects on extra- and intracardiac mesenchymal cell types were tested in Western Blot, ELISA, real-time PCR, laser-scanning confocal microscopy and RAMAN spectroscopy.

Results: The cardiac EPO patch therapy revealed superior cardiac functions and beneficial remodeling. Early intracardiac mesenchymal cell proliferation was increased by more than 2-fold. The cardiac EPO patch therapy enhanced key signals in myocardial regeneration (SDF-1, CXCR-4, CD34, Bcl-2, Cyclin D1, Cdc-2, MMP-2) and augmented TGF-beta expression and WNT signaling in proliferating intracardiac mesenchymal stem cell-like clusters. Cardiac FACS revealed 57% mesenchymal cells in the non-leukocyte non-myocyte fraction early after MI. Exemplary, co-cultures with neonatal cardiomyocytes and human mesenchymal stem cells (MSCs) illustrated that a single EPO boost does not alter cardiomyocytic differentiation whereas prolonged EPO conditioning induced fibroblastic differentiation in MSCs. Subcellular analyses underlined that EPO activated ERK/FOS/TGF-beta axis, TGF-beta secretion and canonical WNT signaling in MSCs.

Conclusions: A temporary elevation of intracardiac EPO concentration might accelerate early tissue transformation and rapid proliferation after MI for an enhanced cardiac recovery. Preliminary results show great importance of the post-ischemic intracardiac mesenchyme.

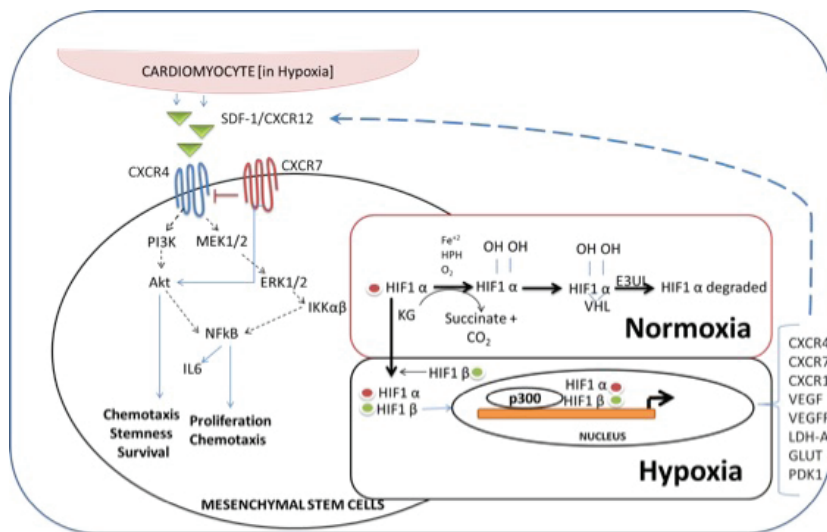
F9. Hypoxia Modulates Cell Migration and Proliferation by Activating Akt and ERK Through the SDF-1 α /CXCR4 Axis in Placenta-Derived Mesenchymal Stem Cells for Cardiac Repair

Li Li, Prashant Kumar Jaiswal, Rishi Jurakhan, Kaviyanka Selvasandran, Khalid Ridwan, Georges Makhoul, Minh Ngoc Duong, Renzo Cecere
McGill University, Montreal, QC, Canada

Invited Discussant: *Todd K. Rosengart

Objective: Mesenchymal stem cells (MSCs) from different sources have been evaluated in cell therapy for myocardial infarction (MI). Human Placenta-Derived MSCs (hPD-MSCs) are primitive cells and have multipotency for differentiation. The therapeutic potential of hPD-MSCs has been reported to be greater than that of human Bone Marrow-Derived MSCs (hBM-MSCs), indicating that hPD-MSCs could likely be an alternative cell source to hBM-MSCs for stem cell therapy in the treatments post-MI. Our study focuses on the potential of the stromal cell-derived factor 1 α (SDF-1 α)/ C-X-C chemokine receptor type 4 (CXCR4)-mediated cell homing of hPD-MSCs and its other characteristics. Therefore, the objective of this study is to compare the potentials of hPD-MSCs and hBM-MSCs with respect to cell homing, cell survival, and cell proliferation *in vitro* for myocardial regeneration.

Methods: Cell surface localization of CXCR4 was detected and validated by immunofluorescence. Cell viability and MTT cell proliferation assays were performed for optimizing cell culture conditions. CXCR4 cDNA was detected by semi-quantitative RT-PCR. To understand cell signaling, protein expression of CXCR4, HIF-1 α , IL-6, IL-10, Akt, p-Akt, ERK, and p-ERK were analyzed by western blot. CXCR4 positive cells were sorted and analyzed by fluorescence-activated cell sorting (FACS).



Results: CXCR4 was expressed by both hBM-MSCs and hPD-MSCs at the basal level. hPD-MSCs had a significantly greater cell migration potential than hBM-MSCs towards SDF-1 α in a dose-dependent manner. The expressions of CXCR4 were significantly increased ($p < 0.05$) after the treatment of CoCl₂ than the treatment of

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SDF-1 α and glucose in both hPD-MSCs and hBM-MSCs. In hypoxic condition, the expression of CXCR4 was significantly increased ($p < 0.0001$) in hPD-MSCs, compared to hBM-MSCs. CXCR4/MEK/ERK pathway was significantly activated ($p < 0.05$) in hPD-MSCs, whereas, CXCR4/PI3K/Akt pathway was significantly activated ($p < 0.01$) in both cell types in hypoxic conditions.

Conclusions: The sensitivity to SDF-1 α of both hBM-MSCs and hPD-MSCs indicated that there might be other SDF-1 α -mediated pathways involved in regulating the cell homing activities of both cell types. Complex downstream signaling cascades of SDF-1 α /CXCR4 axis are activated, including PI3K/Akt and/or MEK/ERK/IKK $\alpha\beta$ pathways in the hypoxic condition. Overall, our data provides new insights into comparative molecular mechanisms that regulate MSCs migration derived from different tissue sources (bone and placenta). Based on the findings mentioned above, we can conclude that hPD-MSCs could represent an effective and efficient alternative to hBM-MSCs for experimental studies and clinical trials for the treatment of myocardial regeneration post-MI. This holds great promise for the future.

F10. Endothelial Primary Cilia Regulate Cardiac Fibrosis by Guiding Mesenchymal Fate Decisions

Krishna K. Singh, Yi Pan, Adrian Quan, Jonathan W. Yau, Jean-François Desjardins, Thomas G. Parker, Mohammed Al-Omran, *Subodh Verma
St. Michael's Hospital, Toronto, ON, Canada

Invited Discussant: ♦Thorsten Doenst

Objective: Cardiac fibrosis represents the final common pathway through which various risk factors lead to irreversible cardiac failure. It has been suggested that endothelial to mesenchymal transition (EndMT) represents an important source of fibroblasts that contribute to cardiac fibrosis. The primary cilium has emerged as a vital sensory organelle that responds to mechanical and biochemical stimuli and transduces intravascular signals to regulate nuclear expression patterns and guide fate and lineage decisions. We hypothesized that the primary cilium serves to limit aberrant EndMT and accordingly may limit cardiac fibrosis.

Methods: To conclusively evaluate the role of endothelial primary cilia towards cardiac fibrosis we used the Cre-loxP technology to generate mice with endothelial cell-specific conditional knock out of IFT-88 (IFT-88endo), a gene that regulates ciliary structure, assembly and function. IFT-88endo mice were subjected to transverse aortic constriction (TAC) for *in vivo* examination. EndMT and pro-fibrotic signaling pathways were evaluated *in vitro* with IFT-88-silenced human coronary endothelial cells (HCAECs).

Results: IFT-88-silenced HCAECs exhibited loss of primary cilia with marked morphological and ultra-structural changes, and a complete loss of the typical endothelial cobblestone appearance. Specifically, there was a marked increase in spindle-shaped morphology with cytoskeletal rearrangement typically observed in mesenchymal cells. IFT-88-silencing also promoted EndMT as evident by a marked reduction in the expression of the endothelial markers CD31, Tie-2 and VE-cadherin which was coincident with an increase in the mesenchymal markers α -SMA, N-cadherin and FSP-1. IFT-88 loss in HCAECs also resulted in a 3-fold higher

expression and activation of TGF β 1 and its receptors TGFBR1 and TGFBR2, the main upstream determinants of EndMT. These changes occurred in parallel with an increase in SMAD2/3 phosphorylation, gene expression of the pro-fibrotic genes collagen-I and CTGF, and Wnt/ β -catenin signaling. *In vivo*, lung endothelial cells isolated from IFT88endo mice demonstrated a mesenchymal phenotype with concomitant reductions in endothelial markers and elevations in mesenchymal markers. IFT-88endo mice exhibited 30% higher mortality following TAC, with evidence of increased cellular fibrosis, and cardiac dysfunction.

Conclusions: Endothelial primary cilia serves as a completely novel and previously unrecognized regulator of cardiac fibrosis *in vivo*. Mechanistically, loss of primary ciliary function serves to upregulate EndMT and promote mesenchymal fate preferences consistent with increased TGF- β and Wnt/ β -catenin signaling leading to increased fibrosis. The primary cilia may represent a novel translational target of cardiac fibrosis, for which, at the present time, there is no cure.

8:40 PM Adjourn

TUESDAY MORNING, MAY 17, 2016

7:00 AM General Thoracic Surgery Forum Room 343, BCC
5 minute presentation, 5 minute discussion

Moderators: *Benjamin D. Kozower and *Dao M. Nguyen

F11. Immunogenic Effect of Local Radiation Therapy in a Mouse Model of Mesothelioma

Luis De la Maza-Borja, Matthew Wu, Licun Wu, *Marc De Perrot
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Prasad S. Andusumilli

Our group developed a new approach focusing on Surgery for Mesothelioma After Radiation Therapy (SMART), with promising results in a phase I/II clinical trial. We believe that radiation is important to achieving activation of the immune system and may contribute to the benefits observed in patients.

Objective: To develop a mouse model to analyze the immunogenic effect of Local Radiation Therapy (LRT) and its impact on immune cell recruitment and activation in the context of MPM. We hypothesize that LRT administered to a tumor before surgery is immunogenic and contributes to tumor free survival.

Methods: AB12 cells were injected subcutaneously into the flank of BALB/C mice. Nine days after injection mice were randomized into the following groups 1) No treatment, 2) LRT 15 Gys, 3) Blunt surgery, 4) LRT 15 Gys and surgery. Radiated and untreated tumor were analyzed for CD8+T cell tumor infiltration. To analyze anti-tumor specific T cells C57BL/6 mice were injected subcutaneously with AE17 cells transfected with Ovalbumin (OVA). Tumors were analyzed with flow cytometry using H-2K^b tetramer SIINFEKL as wells as activation markers. To assess protective memory, AE17-OVA tumor bearing mice were treated with LRT and radical surgery or radical surgery alone. Mice cured were then rechallenged in the opposite flank and tumor growth was followed.

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Results: Mice treated with surgery alone showed accelerated tumor growth compared to untreated mice. Tumor growth slowed down in mice treated with LRT alone or LRT and blunt surgery. Tumors treated with LRT showed a significant increase in the number of infiltrating CD3+CD8+ cells compared to untreated tumors. Radiated tumor also showed greater proportion of tetramer specific CD8+ T cells. Furthermore, infiltrating tetramer-specific CD8+ T cells showed significant upregulation of the activation marker 4-1BB and significant downregulation of the exhaustion marker PD-1. In the rechallenge experiment, mice treated with LRT and radical surgery showed significant deceleration in tumor growth after rechallenge compared to radical surgery alone, moreover, 3 out of 10 mice in the LRT and radical surgery group completely rejected the tumor and 0 out of 10 mice in the radical surgery group.

Conclusions: Blunt surgery alone accelerated tumor growth rate compared to untreated tumors. Combined therapy was the most effective controlling tumor growth. LRT abrogated the negative effect observed with blunt surgery. This combination may have the advantage of removing the immunosuppressive tumor bulk, thus promoting the benefit of LRT activating the immune system. LRT before surgery induced proliferation and activation of specific anti-tumor CD8 T cells. These specific anti-tumor T cells may be responsible for rejection of the tumor after rechallenge. Activation of the immune system secondary to LRT may be further improved with immunotherapeutic drugs.

F12. A Prospective Study Comparing Targeted DNA Sequencing of Tumor Tissue with Noninvasive Liquid Biopsy of Circulating Tumor DNA in Surgical Non-Small Cell Lung Cancer Patients

Kezhong Chen¹, Fan Yang¹, Jingbo Zhang², Tian Guan¹, Feng Lou², Jun Wang¹

¹Peking University People's Hospital, Bei Jing, China; ²San Valley Biotechnology Incorporated, Beijing, China

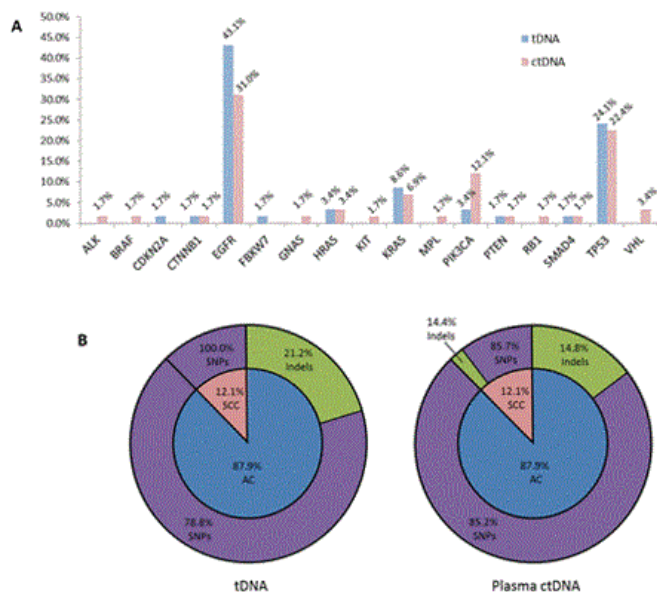
Invited Discussant: *David S. Schrupp

Objective: Noninvasive method liquid biopsy of circulating tumor DNA (ctDNA) is a promising approach in non-small cell lung cancer (NSCLC) patients. Previous studies have shown the feasibility of detecting mutation status in ctDNA, however, no clinical standard method has been established, and most previous studies were lack of prospective clinical data and aimed at advanced NSCLC. Whether liquid biopsy of ctDNA is applicable for early or locally advanced stage, resectable NSCLC is still under the concern.

Methods: A consecutive cases of NSCLC patients who underwent surgical treatments were enrolled prospectively (project approval number 2015PHB055-01). Primary tumor and plasma samples were collected in each patients and gene mutation analysis were performed immediately after surgery. We utilized the targeted DNA sequencing with a next-generation sequencing (NGS) platform to detect driver somatic mutations in matched tumor DNA (tDNA) and plasma ctDNA samples with matched white blood cell (WBC) DNA as a control. A total of 50 genes including EGFR, KRAS, PIK3CA and TP53 and other less frequent mutations were identified.

Results: 76 patients were included with an overall matched plasma ctDNA and tumor DNA concordance of 68.42%. The Sensitivity and the specificity of blood test were 75.61% and 60.00%, respectively. CtDNA was found in a higher proportion of samples with a much higher positive predictive value of NSCLC compared to regular tumor biomarkers and the concentration of ctDNA in plasma was significantly associated with stage. Plasma samples were analyzed for the presence of known tumor markers CA125, CA19-9, CEA, CYFRA21-1, and NSE. Collectively, 36 (47.37%) plasma samples were positive for any of these tumor protein markers, compared to 48 (63.16%) plasma samples positive by ctDNA detection. Of the 38 stage I patients, mutations in our 50 genes screening panel were identified in 30 (78.95%) tDNA and/or plasma ctDNA samples, with the concordance of 57.89%. Nonparametric-tests indicated tumor size larger than 4 cm or with a micropapillary or solid predominant subtype of histology had a significant higher concentration of ctDNA in stage I patients.

Fig. Comparison of the distribution of driver mutations identified in 76 matched tDNA and plasma ctDNA samples. **A)** Rates of gene mutations in tDNA vs. plasma ctDNA from matched sample pairs; **B)** Pie chart shows the distribution of mutation types identified in matched sample pairs of tDNA (left) and plasma ctDNA (right). Inner circle shows distribution of cancer type (AC and SCC), outer ring shows frequency of mutation type (SNP vs. Indel) per respective cancer type.



Conclusions: This is the first prospective study to compare gene detection by liquid biopsy with tumor tissue in early stage NSCLC patients. CtDNA mutation analysis in early or locally advanced stage surgical lung cancer patients via targeted DNA sequencing is feasible, has a much higher positive predictive value than tumor markers, and could be used as an initial screening tool in the early diagnosis and better inform clinical decision-making of NSCLC.

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F13. Highly Effective Heparanase-Based Therapy for Mesothelioma

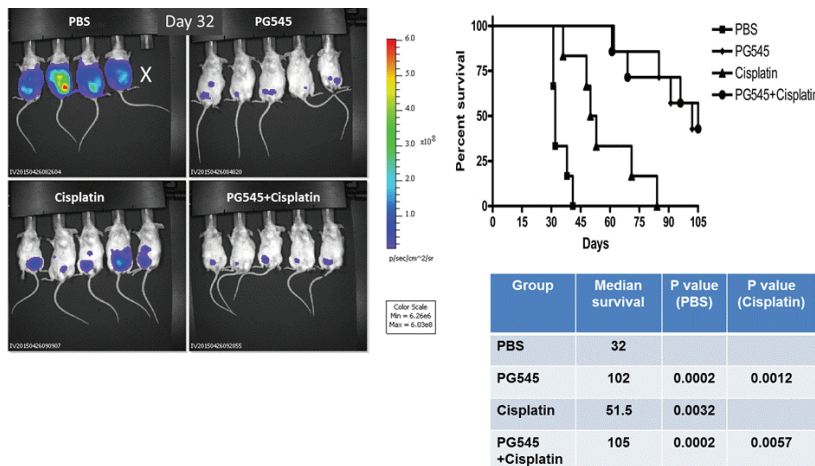
Moshe Lapidot¹, Uri Barash², Yaniv Zohar³, Neta Ilan², Israel Vlodavsky²

¹Brigham and Women’s Hospital, Boston, MA; ²Cancer and Vascular Biology Research Center, Technion, Haifa, Israel; ³Rambam Health Care Center, Haifa, Israel

Invited Discussant: *Jay M. Lee

Objectives: Malignant mesothelioma is a highly aggressive form of cancer that develops from cells of the mesothelium. It has a poor prognosis because of the lack of markers for early diagnosis and resistance to conventional therapies, thus encouraging the development of novel treatments. Heparanase is the only functional endoglucuronidase capable of cleaving heparan sulfate chains of proteoglycans. These macromolecules are most abundant in the sub-endothelial and sub-epithelial basement membranes and their cleavage by heparanase leads to disassembly of the extracellular matrix that becomes more susceptible to extravasation and dissemination of metastatic and immune cells. In this study we examined the role of heparanase in mesothelioma.

Methods: Heparanase expression and enzymatic activity was evaluated in human pleural mesothelioma cell lines (MSTO-211H, CD484, CD487), and heparanase inhibitor (PG545) was examined for its ability to restrain mesothelioma tumor growth in comparison with conventional chemotherapy (i.e., cisplatin based). We further established a mesothelioma mice model. Tumor growth in our model was inspected by In Vivo Imaging System (IVIS) methodology and mortality rates were compared between the study groups.



PG545 inhibits mesothelioma tumor growth and significantly increases mice survival. Luciferase-labeled MSTO-211H human mesothelioma cells (2x10⁶) were inoculated i.p in SCID mice. Mice were treated with PG545 (400 µg/mouse; once a week), Cisplatin (once/3 weeks; 3 mg/kg), or control vehicle (PBS) and tumor development was inspected by IVIS imaging. Quantification of the luciferase intensities is shown graphically. The effect of PG545 and cisplatin on mice survival are represented by Kaplan-Meier curves.

Results: We demonstrate that heparanase is expressed and highly enzymatically active in pleural mesothelioma cell lines. Moreover, AE17 mouse mesothelioma cells developed significantly smaller tumors when inoculated subcutaneously in heparanase knockout (Hpa-KO) vs control mice. Immunostaining revealed lower proliferation and higher apoptosis rates in tumors developed in heparanase knockout mice (Hpa-KO) associated with reduced ERK and c-Jun phosphorylation and VEGF expression. Likewise, heparanase gene silencing inhibit cell invasion *in vitro* and tumor xenograft growth *in-vivo*. Furthermore, heparanase inhibitor (PG545) attenuated cell invasion and anchorage independent growth of mesothelioma cell lines *in vitro*, and reduced mesothelioma tumor xenografts growth associating with decreased angiogenesis and Akt phosphorylation. Notably, the heparanase inhibitor PG545 significantly increased the survival rates of mice implanted with mesothelioma cells, beyond cisplatin based treatment ($p = 0.0012$).

Conclusion: Heparanase plays an important role in mesothelioma tumor progression, thus encouraging further development of heparanase inhibitors (e.g., PG545) for this incurable malignancy.

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F14. In Silico Immune Response Is the Most Predictive Factor of Overall Survival in Surgically Resected Pleural Mesothelioma

Hyun-Sung Lee¹, Rohan Shah¹, David Yoon¹, Shawn Groth¹, *Raphael Bueno²,

*David Sugarbaker¹, Bryan Burt¹

¹Baylor College of Medicine, Houston, TX; ²Brigham and Women's Hospital, Boston, MA

Invited Discussant: ♦Varun Puri

Objective: Malignant pleural mesothelioma (MPM) is an aggressive malignancy that is fatal. Recent evidence has suggested that MPM is an immunogenic tumor that responds favorably to immunotherapy including checkpoint inhibition. We set out to dissect the immune landscape of MPM using mRNA transcriptome data to identify novel immune biomarkers of prognosis and to potentially predict response to immunotherapy.

Methods: Immune Response In Silico (IRIS) is a collection of genes selected based upon their specific expression in immune cells. We analyzed the IRIS gene profile from mRNA expression data of 158 tumors from patients undergoing surgical resection of MPM. A discovery set was comprised of mRNA sequencing data from tumors of 69 patients in TCGA database. OS-associated IRIS (OSIRIS) signatures were validated in two independent cohorts obtained from MPM treatment centers in the United States ($n = 39$ and $n = 50$).

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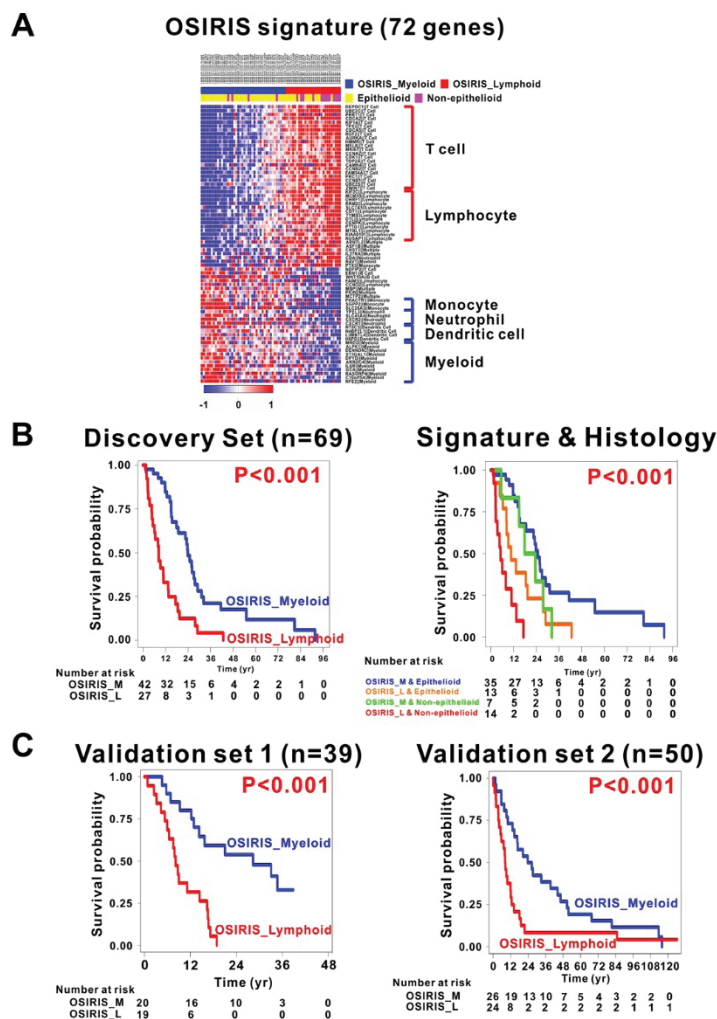


Figure 1. Prognostic Significance of Immune Response In Silico Signature in Malignant Pleural Mesothelioma.
A. Overall Survival-associated Immune Response In Silico (OSIRIS) signature by utilizing well-categorized immune gene sets from Immune Response In Silico (IRIS) database (<http://share.gene.com/share/clark.iris.2004/iris/iris.html>). B. Kaplan-Meier's overall survival curve in discovery set according to OSIRIS signature. C. Validation of OSIRIS signature in two independent MPM cohorts.

Results: We developed an OSIRIS signature with 72 immune genes whose expression was significantly associated with OS in the discovery cohort ($P < 0.001$). Semi-supervised clustering was used to divide the discovery set into two groups based upon OS. The group with improved OS demonstrated high expression of genes associated with myeloid cells and low expression of genes associated with lymphoid (T) cells (OSIRIS-myeloid). In contrast, the group with poor OS demonstrated high expression of genes associated with T cells and low expression of genes associated with myeloid cells (OSIRIS-lymphoid). Further, the OSIRIS signature stratified OS among epithelial and non-epithelial histology (Figure A-B), and was validated in two independent patient cohorts ($P < 0.001$) (Figure C). Multivariable analysis was

performed in the 89 patients of the 2 validation sets and demonstrated that the OSIRIS signature was an independent predictor of survival (HR 2.58; 95% CI 1.51–4.40; $P = 0.001$) that was superior to TNM staging (HR 1.52, $P = 0.006$) and histology (HR 1.76, $P = 0.045$). Deeper characterization of the OSIRIS-lymphoid signature revealed high expression of helper Th1, Th2, and activated memory T cell-related genes, and the OSIRIS-myeloid signature with associated with high expression of neutrophil and dendritic cell-related genes. Derivation of gene ontology biological processes from analyses comparing total mRNA transcriptomes between OSIRIS-myeloid and OSIRIS-lymphoid groups in each cohort demonstrated remarkable differences in genes related to mitotic cell cycle ($P = 1.42 \times 10^{-16}$) and microtubule-based processes ($P = 3.34 \times 10^{-13}$).

Conclusions: The novel OSIRIS prediction model constructed with immune-related genes can predict survival independently, and superior to TNM staging and histology in patients with MPM. This signature holds promise for prediction of response to immunotherapy in this disease and will be tested in a single institution clinical trial of checkpoint inhibition in MPM.

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F15. Novel Bio-Engineered Tracheal Patch Demonstrates Potential for Remodeling in a Growing Ovine Model

Farhan Zafar, Richard Scott Baker, Namheon Lee, Shiva Kumar Shanmukhappa, Michael D. Taylor, *David L. Morales
Cincinnati Childrens Hospital, Cincinnati, OH

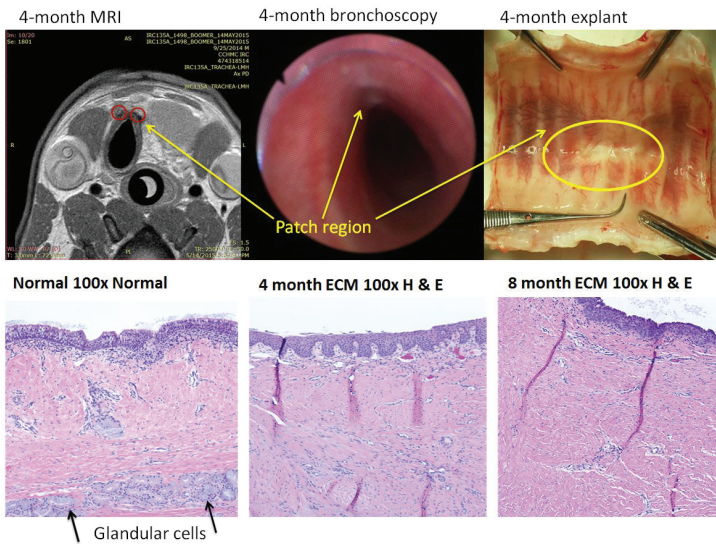
Invited Discussant:

Objective: Small intestinal submucosa derived extracellular matrix (SIS-ECM) patch has been successfully used to repair a variety of tissues and may be capable of morphologic and physiologic remodeling into surrounding tissue. This study evaluates the morphologic remodeling and formation of granulation tissue, of an SIS-ECM tracheal patch (TP) implanted in a growing ovine model.

Methods: Four juvenile lambs underwent repair of surgically created 1×2 cm defect (at least 3 consecutive tracheal rings) in ventral trachea with a SIS-ECM TP. Serial bronchoscopy at 1.5, 4 & 8 months(m) and serial MRI at 4 and 8 months were performed, followed by histological and ultra-structural analysis at 4 & 8 m ($n = 2$ each).

Results: No procedural complications were noted. Bronchoscopy consistently revealed absence of granulation tissue. MRI confirmed expected, mild elliptical deformation of trachea in all sheep. (Figure) At 4 m the TP demonstrated complete restoration of the matrix architecture that included newly formed blood vessels and matrix components. Epithelium repair was robust with frequent presence of pseudostratified columnar epithelium and occasional stratified epithelium. However at 8 months, the entire epithelium was regenerated to respiratory epithelium. Sub-mucosal glands were absent in most of the patch implant. Immunohistochemistry (Ki67) indicated cell proliferation in the tracheal epithelium at 4 months that dissipated by 8 months. Ultra-structurally, at 8 months, the epithelium as well as matrix was similar to normal trachea except for the absence of sub-mucosal glands.

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Conclusions: This pilot study demonstrates the potential of SISECM TP for morphologic remodeling in native trachea without granulation tissue formation. A more formal investigation of this material in conjunction with a bio-absorbable exoskeleton to repair long segment tracheal defects is now planned. This could be a potential solution to repair of complex congenital tracheal defects, iatrogenic and traumatic tracheal injuries.

F16. Role of Interleukin-17A in Early Graft Rejection After Orthotopic Lung Transplantation in Mice

Qi-ruì Chen, Hui Li, Yao-zhong Ding

Beijing Chaoyang Hospital, Capital Medical University, Beijing

Invited Discussant: *Daniel Kreisel

Objective: The cellular and molecular mechanisms underlying lung allograft rejection remain poorly understood, especially obliterative bronchiolitis (OB). Previous studies in clinical and rodent models have implicated IL-17A in both acute and chronic rejection. A better understanding of the cellular and molecular mechanisms of lung graft injury will be critical to improving survival among lung transplant recipients. The specific aim of this study was to investigate the role of IL-17A during early rejection in a fully MHC mismatched mouse model of lung transplantation.

Methods: To generate an orthotopic lung transplantation model, lungs from C57BL/6 or BALB/c mice were transplanted into C57BL/6 mice (isograft and allograft models, respectively). The effects of anti-IL-17A treatment in allograft recipients were investigated. The histological features and rejection status of isografts and allografts were assessed at 3, 7, and 28 days after transplantation, and differences in graft infiltrating cells and mRNA expression of relevant cytokines were quantified at 3 and 7 days after transplantation.

Results: Isografts showed no obvious signs of rejection, whereas allografts exhibited minimal-to-mild rejection (grade A1–A2) by day 3 and moderate-to-severe rejection (grade A3–A4) by day 7, without evidence of OB. However, by 28 days, evidence of OB was observed in 67% (2/3) of allografts and severe rejection (grade A4) was observed in all. IL-17 mRNA expression in allografts was increased with rejection, and interferon- γ and IL-6 mRNA expression levels followed a similar pattern. In contrast, IL-22 expression in allografts was only slightly increased. Antibody neutralization of IL-17A diminished the signs of acute rejection at 7 days after transplantation in allografts, and this early protection was accompanied by a decrease in cellular stress according to histological evaluation, suggesting the involvement of IL-17A in the development of early post-transplantation lesions. Moreover, increased $\gamma\delta$ T lymphocyte infiltration, especially V γ 4+ $\gamma\delta$ T cells, was observed in allografts and may represent a source of IL-17A post-transplantation.

Conclusion: Our data indicate that IL-17A may play an important role in the pathophysiology of allograft rejection, and neutralization of IL-17A is a potential therapeutic strategy to preventing lung transplant rejection.

TUESDAY, MAY 17

F17. Cigarette Smoke Enhances Growth and Metastatic Potential of Lung Cancer Cells in-Vivo

Elvin Hekimoglu, Eden Payabyab, Mary Zhang, Julie A. Hong, Emily S. Reardon, Paul L. Feingold, R. Taylor Ripley, Choung D. Hoang, Sichuan Xi, *David S. Schrumpp
National Cancer Institute, Bethesda, MD

Invited Discussant: ♦Sunil Singhal

Background: Recent studies suggest that cigarette smoking at time of diagnosis or during therapy is associated with significantly worse response to treatment and overall survival of lung cancer patients. To date the mechanisms underlying this phenomenon have not been fully elucidated. The present study was undertaken to examine the effects of cigarette smoke on lung cancer growth and metastatic potential using a novel *in-vivo* model.

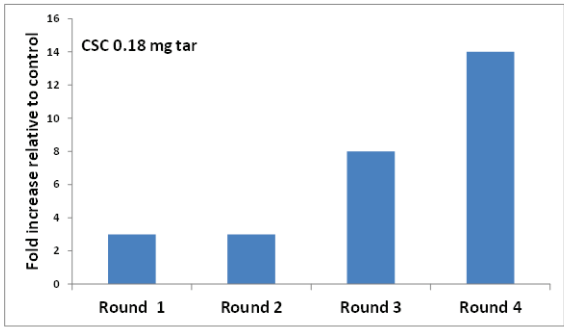
Methods: Athymic nude mice with early established subcutaneous A549 lung cancer xenografts were randomly allocated to receive intraperitoneal (IP) injections of saline or cigarette smoke condensate (CSC) generated with a precision smoking apparatus every Monday, Wednesday and Friday for 3–4 weeks. Approximately 25–30 days following initiation of treatment, tumors were harvested, enzymatically digested, and then re-injected into additional nude mice for continuation of IP saline or CSC injections. Additional mice received tail vein injections of xenograft cell suspensions from CSC-treated or control mice. Quantitative RT-PCR techniques were used to evaluate expression levels of a broad panel of genes mediating pluripotency, growth and metastatic potential of lung cancers.

Results: CSC mediated progressive and dose-dependent increases in growth of subcutaneous lung cancer xenografts (Figure 1). Furthermore, xenograft cells isolated from CSC treated mice exhibited increased potential for pulmonary metastases following tail vein injection. These phenomena coincided with marked up-regulation of ABCG2 encoding a xenobiotic pump protein associated with pluripotency and chemoresistance, BMI1 encoding an anti-apoptotic Polycomb Group protein

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required for proliferation of bronchiolalveolar stem cells in response to oncogenic stimuli, as well as KLF4 and MYC, which encode two of the four oncoproteins necessary for reprogramming of fully differentiated somatic cells to pluripotency. These alterations were associated with marked repression of DKK1, a downstream target of BMI1, which encodes an antagonist of Wnt signaling critical for expansion and maintenance of cancer stem cells.

Figure 1: Cigarette Smoke Enhances Growth of Lung Cancer Xenografts



Conclusions: Cigarette smoke enhances a stemness phenotype, and augments growth and metastatic potential of lung cancer cells. This *in-vivo* model may prove useful for further delineating mechanisms of tobacco-induced lung cancer progression, and the identification of novel targets for treatment and prevention of lung cancer metastases.

F18. Optimization of Image Capture Properties for Intraoperative Molecular Imaging of Lung Adenocarcinoma

Jarrod D. Predina, Olugbenga Okusanya, Jane Keating, ♦Sunil Singhal
University of Pennsylvania, Philadelphia, PA

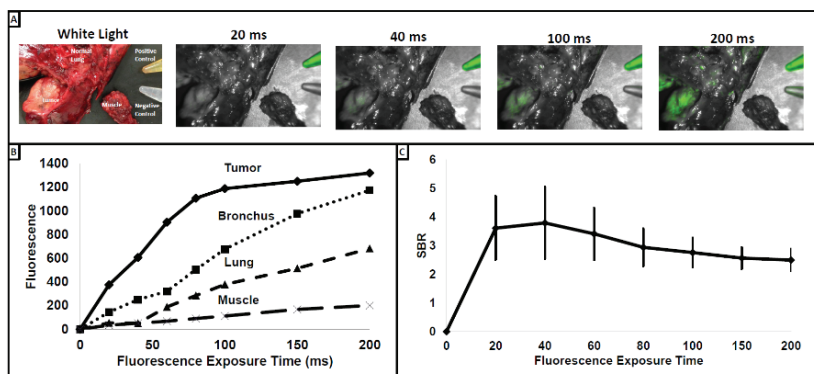
Invited Discussant: *Andrew C. Chang

Objective: Intraoperative molecular imaging is an emerging technology which can be used to identify tumor location and margins in the operating room. Unfortunately, this technology has been limited by issues such as background noise and autofluorescence. Our goal was to optimize the capture properties to maximize signal detection from tumors as opposed to fluorescent signal from native tissues.

Methods: Autofluorescence of intrathoracic structures and tissues was first assessed in the absence of a fluorescent tracer. We then confirmed that lung adenocarcinomas possess upregulated levels of the folate receptor alpha using

flow cytometry and immunohistochemistry. Next 10 patients were enrolled in a pilot study in which patients received a fluorescent tracer (folate-FITC) two hours prior to thoracotomy with intraoperative imaging. To optimize the detection signal from lung cancers, resected specimen were imaged *ex vivo* at various fluorescence exposure times (0 to 200 milliseconds (ms) at 20 ms increments). Signal to noise ratio (SNR) for images were generated using region of interest (ROI) software and compared.

Results: We confirmed that lung adenocarcinomas highly express the folate receptor alpha and that folate-FITC avidly binds the tumor thus allowing for intraoperative detection. Significant autofluorescence from native thoracic tissues was found with the highest levels being from bronchial lamina propria (547 ± 98 , range 423–699), cortical bone (266 ± 17 , range 243–287) and adventitia of blood vessels (267 ± 64 , range 200–374). Lung parenchyma, pneumocytes and alveolar tissue showed low autofluorescence (183 ± 49 , range 136–257). The SNR of tumors was improved by altering exposure settings at the time of the imaging, and was maximized at a fluorescent exposure time of 100 ms (Figure). These alterations improved the SNR nearly 1.5 fold ($p < 0.01$) which allowed for consistent and accurate interpretation by a group of three blinded surgeons.



Conclusions: Exposure properties can be manipulated to maximize SNR thus allowing for successful intraoperative detection of lung adenocarcinomas using visible wavelength intraoperative molecular imaging. This sets the stage for additional clinical trials utilizing molecular imaging techniques which can aid the surgeon at the time of cancer resection.

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F19. Progression of EGFR Mutant Lung Adenocarcinoma Is Driven by Alveolar Macrophages

Bryan M. Burt¹, Don-Hong Wang², Hyun-Sung Lee¹, David Yoon¹, Gerald Berry², Thomas M. Wheeler¹, Farrah Kheradmand¹, *David J. Sugarbaker¹, Edgar Engleman²

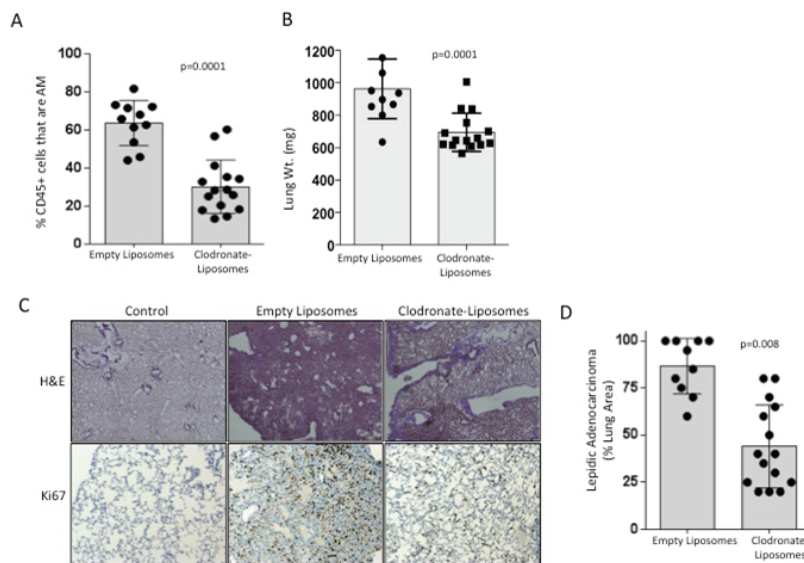
¹Baylor College of Medicine, Houston, TX; ²Stanford University School of Medicine, Stanford, CA

Invited Discussant: ♦James Huang

Objective: Despite recent advances in targeted therapy of epidermal growth factor receptor (EGFR)-mutant lung cancer, narrow therapeutic indices and frequent acquired resistance limit their overall success rate. We reasoned that inhibition of immunologic pathways that support tumor growth and maintenance could represent an alternative treatment approach to provide long-lived tumor destruction in this disease.

Methods: We utilized a genetically engineered bi-transgenic mice mouse model of EGFR mutant lung adenocarcinoma in which mice express a lung-specific mutant human EGFR gene governed by a tetracycline operator (TetO) promoter that is activated by doxycycline administration.

Results: EGFR oncogene-dependent lung tumor progression and remission were respectively dependent upon the expansion and contraction of alveolar macrophages (AM). Induction of oncogenic EGFR signaling resulted in an increase in AM from 18% to 81% of all lung immune cells at 7 weeks. Local proliferation of AM, not recruitment of blood monocytes, was the dominant mechanism underlying the AM expansion in tumor-bearing mice. Intraperitoneal administration of a monoclonal antibody to CSF-1R to dox-fed mice depleted circulating monocytes, yet had no effect on AM. Immunohistochemistry for F4/80 and the proliferation marker Ki-67 revealed that $44 \pm 6\%$ of AM in dox-fed mice expressed Ki-67, compared with $4 \pm 8\%$ in control mice. AM isolated from tumor-bearing mice demonstrated an immunosuppressive phenotype with downregulated surface expression of MHC-II and costimulatory molecules CD40, CD80, CD86; increased production of CXCL1, CXCL2, IL-1RA; and increased phagocytosis. Given the striking expansion and immunosuppressive phenotype of AM, we hypothesized that tumor progression in EGFR mutant NSCLC is driven by these cells. To test this hypothesis, we depleted AM in dox-fed mice by intratracheal delivery of clodronate-encapsulated liposomes. After 6 weeks, mice receiving clodronate liposomes demonstrated decreased AM (Figure A) and decreased lung weight (Figure B). Evaluation of the lungs of clodronate-liposome treated mice by immunohistochemistry revealed significant decrease in tumor burden (Figure C-D). Whereas 0 of 15 mice treated with clodronate liposomes showed invasive foci of adenocarcinoma, 2 of 11 mice treated with control liposomes exhibited areas of invasive adenocarcinoma. Further, cessation of dox feeding, or treatment of mice with EGFR targeting clinical drugs erlotinib and cetuximab, resulted in a significant decrease in the numbers of AM in these mice.



Conclusions: AM play a critical role in the growth and survival EGFR mutant NSCLC and therapeutic strategies targeting AM in have potential to mitigate progression and survival in this disease. There may be an important role for combining immunotherapy-based inactivation of AM with targeted therapy to improve cancer survival.

F20. Inherited Immunologic Factors Affecting Lung Cancer Susceptibility

Saeed Arefanian, Ryuji Higashikubo, *Daniel Kreisel, Andrew E. Gelman,

*Alexander Sasha Krupnick

Washington University, St. Louis, MO

Invited Discussant: *Christine L. Lau

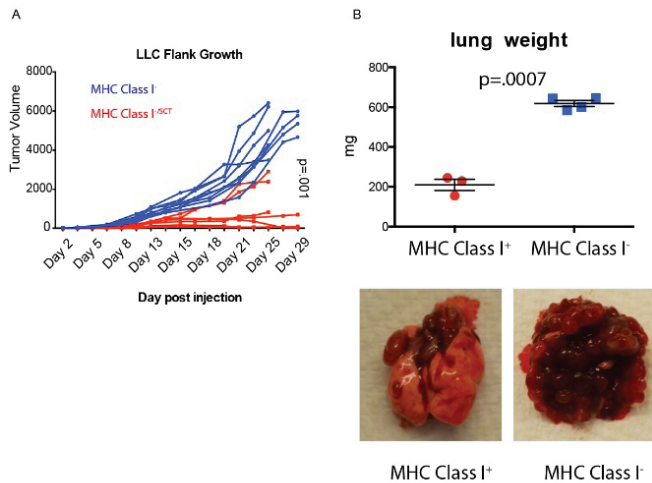
Objective: It is currently unknown why some individuals with little to minimal smoking develop lung cancer while many with extensive tobacco exposure do not. Our laboratory has previously demonstrated that natural killer (NK) cell cytotoxicity correlates with lung cancer susceptibility or resistance. The etiologies for such differences are unknown. Previous work has demonstrated that licensing, or education, as determined by exposure of natural killer cell inhibitory receptors to self major histocompatibility class I (MHC Class I) antigens, may contribute to their function. In humans multiple alleles of NK cell inhibitory receptors and major histocompatibility class I antigens exist and are located on separate chromosomes. These receptors are thus inherited separately from both parents, leading to various degrees of licensing or educational mismatches in man. It is thus critical to know if deficiencies in NK cell licensing can contribute to lung cancer susceptibility for both prognostic and therapeutic purposes.

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Methods: To investigate the role of NK cell licensing and lung cancer susceptibility we utilized two murine models. In the first model we completely eliminated NK cells licensing by using mice deficient in MHC Class I (MHC Class I⁻). In the second model licensing was limited to the inhibitory receptor Ly49c through the forced expression of an H2Kb MHC Class I subtype single chain trimer (MHC Class I^{-SCT}). Some mice were injected with 1×10^5 of the Lewis Lung Carcinoma (LLC) cell line intravenously in order to establish pulmonary disease and sacrificed 2 weeks post-injection. For other experiments mice were injected with 1×10^6 LLC subcutaneously and tumor growth followed daily through caliper measurement of tumor diameter.

Results: LLC tumor injected into the flank of MHC Class I^{-SCT} mice with Ly49C-licensed NK cells grew very slowly with only limited tumor burden day 25-post injection. Identical tumor injected into MHC Class I⁻ mice with fully unlicensed NK cells resulted in rapid tumor growth (Figure 1a). Intravenous injection of LLC into MHC Class I⁻ mice with fully unlicensed NK cells resulted in a significant pulmonary tumor burden 16 days later. Little pulmonary tumor was evident in MHC Class I⁺ mice, with fully licensed NK cells (Figure 1b).

Figure 1



NK cell licensing plays an important role in controlling lung cancer tumor. (A) Flank injection of Lewis lung carcinoma (LLC) cell line cells resulted in a significant higher tumor burden in mice without licensed NK cells. (B) Intravenous injection of LLC cells confirms the expected results from flank injection with higher involvement of lung in mice lacking MHC class I.

Conclusions: Our data demonstrate that genetically inherited licensing status of NK cells can affect lung cancer susceptibility. These data serve to explain at least one of the mechanisms contributing to immunologic susceptibility (or resistance) to lung cancer. Pro-inflammatory cytokines, such as interleukin-2, can reverse the unresponsiveness of poorly licensed NK cells. Thus our data provides further support for the use of high dose interleukin-2 therapy in lung cancer.

8:40 PM Adjourn

7:00 AM **Adult Cardiac Emerging Technologies and Techniques Forum** Ballroom III, BCC
5 minute presentation, 5 minute discussion
Moderators: *Gorav Ailawadi and *Himanshu J. Patel

T1. Multi-Center Assessment of Grafts in Coronaries: Long Term Evaluation of the C-Port Anastomotic Device (The MAGIC Study)

Husam H. Balkhy¹, Mahesh Ramshandani², Nirav Patel³, *Valavunar Subramanian³, Nicholas Augelli⁴, Gareth Tobler⁵, Tung Cai⁶

¹University of Chicago Medicine, Chicago, IL; ²Methodist Hospital, Houston, TX; ³Lenox Hill Hospital, New York, NY; ⁴Regional Medical Center, Appleton, WI; ⁵University of Arkansas for Medical Sciences, Little Rock, AR; ⁶The Heart Hospital Baylor Plano, Plano, TX

Objective: Distal Coronary anastomoses are traditionally performed using a hand-sewn technique. The commercially available C-Port distal anastomotic device (Cardica Inc. Redwood City, CA) is an automated miniature vascular stapler that performs the anastomosis expeditiously and is FDA cleared since 2007. This prospective multicenter registry sought to evaluate long term (12 month) graft patency using this device compared to hand sewn grafts.

Methods: Patients receiving at least one C-Port anastomosis during CABG surgery were enrolled at 8 sites in the US. Of the 117 patients enrolled (intent to treat population -ITT), 78 patients (67%) (104 C-Port vein grafts) completed the study to patency assessment via CT scanning (per protocol population-PP). Clinical follow up and index graft patency (assessed by Gated 64-slice CT scan) were performed at least 12-months following surgery. The primary efficacy endpoint was graft patency compared to a performance goal established using the peer-reviewed results from the PREVENT IV trial. The primary safety endpoint was MACE rate at 12 months in the ITT population.

Results: The patient population was consistent with the control PREVENT IV placebo cohort, (81% Caucasian, 30% smokers, 80% hypertensive, and 41% diabetic). The ITT group had an overall mortality at 12 months of 0.8% (1/117) and a MACE rate of 4.3% (5/117). Only two of these events (2/78) occurred in patients who were included in the PP population (2.6%) and both patients had patent grafts.

The C-Port vein graft occlusion rate was 16.3% (17/104) compared to 26.6% (597/2242) in the PREVENT IV trial, (p = 0.011 one-sided Fisher's Exact test). There were no significant differences in the occlusion rate between the C-Port vein grafts 16.3% (17/104) and the hand sewn vein grafts 14.9% (7/47) within the MAGIC study p = 0.821.

Conclusion: The C-Port anastomotic device is safe and effective when used to create the distal anastomosis in CABG surgery with equivalent patency rates to hand sewn grafts at 12 months. When compared to hand sewn anastomoses in a comparable population in a recent large prospective trial, the C-Port device demonstrated a statistically significant reduction in long -term graft occlusion rates. Further studies are required to evaluate the effect of this device in less invasive CABG surgery.

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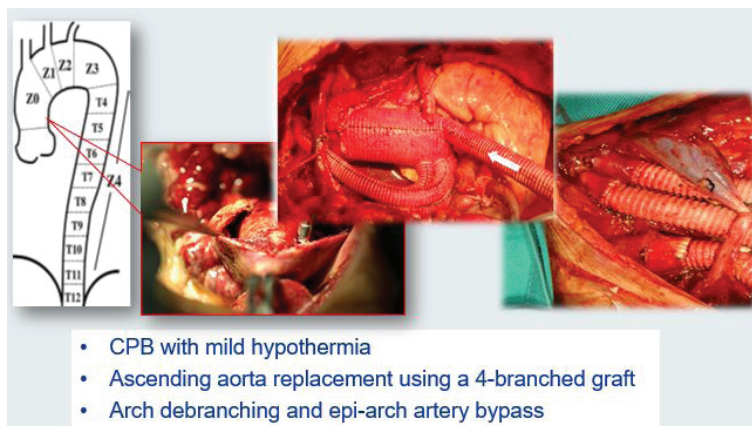
T2. Hybrid Repair of Extensive Aortic Arch Disease with Supra-Aortic Debranching and Endovascular Stent Graft Repair: Early and Long-Term Outcomes

Qian Chang, Yan Li, Xiangyang Qian, Xiaogang Sun, Cuntao Yu, Haitao Zhang
National Heart Center and Fuwai Hospital, Beijing, China

Background: Extensive aortic arch disease has conventionally been the domain of open surgical repair. Hybrid open and endovascular repair has evolved as an alternative treatment option with promising results. We describe our institutional experience with the hybrid arch repair, with early and long-term outcomes.

Methods: From 2009 to the 2014, 86 patients have undergone hybrid repair of complex arch disease (open plus endovascular approach). Only patients with extensive arch pathologies requiring debranching of three supra-aortic arteries were considered. All these patients had a median sternotomy approach for arch vessel debranching and antegrade/retrograde endovascular stent grafting of the arch. The early and follow-up data were investigated. Early outcomes of interest were in-hospital mortality and postoperative morbidities. Long-term event free survival was evaluated with Kaplan-Meier analysis.

Results: Stent graft deployment rate was 100% after supra-aortic debranching. Mean age was 61.8 ± 6.8 years. The aortic arch pathology was an acute type A aortic dissection involving the arch treated as emergency in 60 patients, atherosclerotic aneurysm or aneurysmal dilatation of a chronic dissection in 24 cases (32.7%), and pseudo-aneurysm in 2 patients (7.9%). Eighty-one patients had with proximal ascending aortic dissection or aneurysm underwent ascending aortic replacement, creating a Dacron ascending zone 0. Average cardiopulmonary bypass time was 132 ± 23 minutes, with a cross clamp time of 49 ± 14 minutes. Five patients with good native landing zones (zone 0 and zone 3/4) underwent supra-aortic debranching without use of cardiopulmonary bypass. In-hospital mortality was 4.66% ($n = 4$), stroke rate of 4.66% ($n = 4$), and rate of postoperative acute kidney injury was 16.3% ($n = 14$). There were no postoperative endoleaks. The median follow-up was 39 ± 17 months. Freedom from all-cause mortality was 92%, 88%, and 84% at 1, 3, and 5 years, respectively. All endografts and supra-aortic bypass grafts remained patent during follow up. No patient has a type 1 or 3 endoleak at latest follow-up.



Conclusions: The hybrid repair of complex aortic arch disease can be safely adopted with good early and long-term results in a cohort of patients who are high risk for conventional open surgical repair.

TEVAR 2016

*Wilson Y. Szeto, *University of Pennsylvania, Philadelphia, PA*

T3. Early Clinical Outcomes of a Novel Self-Expanding Transapical Transcatheter Aortic Valve Bioprosthesis in Patients at Higher Risk for Coronary Obstruction: First North American Experience

Michael W. A. Chu, Katie L. Losenno, Pantelis Diamantouros, Rodrigo Bagur, Patrick Teefy, Jill J. Gelinias, *Bob Kiaii
University of Western Ontario, London, ON, Canada

Objective: The Symetis Acurate TA bioprosthesis is a newer generation transapical TAVI prosthesis that engages the native aortic valve calcification towards the aortic annulus, away from the coronary ostia, which may offer additional safety benefit in patients at higher risk for coronary obstruction. The purpose of this study is to evaluate the early and one year outcomes of patients implanted with the Acurate TA bioprosthesis in patients with low coronary heights.

Methods: Between May 2014 and April 2015, 30 consecutive high-risk patients (85 ± 6 years, 63% female) with symptomatic, severe aortic stenosis underwent transapical TAVI with the Acurate TA bioprosthesis. All patients were in NYHA class III/IV, and the mean STS score was 8.4 ± 6.0 . Relevant patient characteristics included: re-operation 47% ($n = 14$), peripheral vascular disease 43% ($n = 13$), porcelain aorta 30% ($n = 9$), prior pacemaker 10% ($n = 3$). The mean left and right main coronary heights were 10.8 ± 1.5 mm and 16.4 ± 4.1 mm, respectively with the sinus of Valsalva:annular ratio of 1.3 ± 0.8 . All patients were approved by Health Canada under the Special Access Program.

Results: All 30 device implants were successful. The 30-day/in-hospital mortality was 3.3% ($n = 1$) and no patients experienced coronary obstruction or stroke. One patient (3.3%) experienced apical rupture requiring cardiopulmonary bypass for repair, 1 patient (3.3%) experienced a localized femoral artery dissection and 1 patient (3.3%) required a new pacemaker. There were no other complications. Mean/peak transaortic valve gradients decreased from $58 \pm 20/81 \pm 34$ mmHg to $14 \pm 7/28 \pm 12$ mmHg ($p < 0.001$), respectively. No patients experienced > mild paravalvular aortic insufficiency. Median intensive care unit and hospital lengths of stay were 1 and 6 days. At 30-days, there were no further deaths, strokes, vascular complications, bleeds or new pacemakers required. Twenty-nine patients (96.7%) were in NYHA class I/II. Survival at 30-days and 1 year was 97% and 90%, respectively.

Conclusions: The Symetis Acurate TA device demonstrates high procedural success and excellent early and one-year patient outcomes. It appears to have unique characteristics which allow safe implantation in patients at higher risk for coronary artery obstruction.

TUESDAY, MAY 17

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T4. Radiation Exposure During Transcatheter Aortic Valve Replacement: What Cardiac Surgeons Need to Know

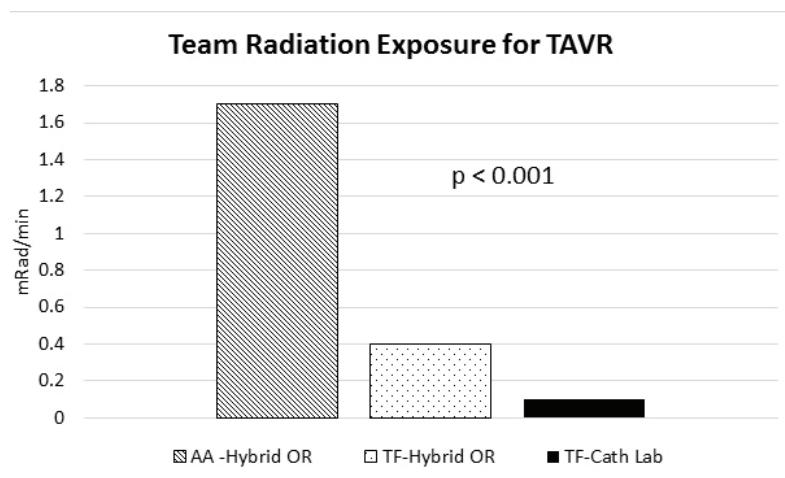
Alex Aquino, Alan Zajarias, Spencer Melby, Nishath Quader, Brian Lindman,
John Lasala, *Hersh Maniar
Washington University, St. Louis, MO

Objective: Transcatheter Aortic Valve Replacement (TAVR) procedures expose cardiac surgeons and interventional cardiologists to intra-procedural radiation. Operator radiation exposure during TAVR is affected by operator position, imaging equipment specifications, and the amount of radiation shielding available. The purpose of this study was to compare operator radiation exposure during TAVR when performed as a transfemoral (TF) procedure vs. alternative access (AA) approach, when performed in a dedicated catheterization lab vs. a hybrid operating room, and to evaluate the effect of disposable scatter radiation shields during these procedures.

Methods: Individual dosimeters were worn during TAVR-TF (n = 50) and TAVR-AA (n = 31) procedures by both primary and secondary operators. All TAVR-AA procedures were performed in a hybrid room whereas TF procedures were done in both a catheterization lab (n = 16) and hybrid room (n = 34). Disposable radiation shielding pads (RPAD) or placebo (SHAM-PAD) were utilized in a blinded fashion with operators unaware as to the type of PAD placed. Radiation dosimetry measurements were summed for both operators reflecting team radiation exposure for each TAVR procedure. Radiation exposure results were reported as median values with accompanying 1st and 3rd quartiles.

Results: Average fluoroscopy use was greater in TF procedures than AA procedures (20 ± 7 vs 11 ± 3 minutes, $p < 0.001$). Despite this, team radiation exposure was higher with TAVR-AA vs TAVR-TF (15.1 (8.6, 32.4) vs 5.5 (2.4, 9.8) mRads, $p < 0.001$). When evaluating TF procedures only, while there was no difference in fluoroscopy use whether TAVR was performed in a hybrid room vs. a catheterization lab (20 ± 7 vs 19 ± 6 minutes, $p = 0.55$), the radiation exposure for operators remained higher for TAVR when performed in the hybrid room (9.0 (4.5, 11.9) vs 2.2 (1.3, 2.8) mRads, $p < 0.001$).

Operator radiation exposure, when indexed by fluoroscopy time, was greatest for TAVR-AA and higher for TAVR-TF done in a hybrid operating room (Figure). The use of RPAD did not decrease operator exposure in either overall exposure (9.4 (2.8, 19.5) vs 9.0 (4.5, 14.7) mRads, $p = 0.82$), or when exposure was indexed by fluoroscopy duration (0.6 (0.1, 1.6) vs 0.5 (0.3, 1.3) mRads/min, $p = 0.73$).



TUESDAY, MAY 17

Conclusions: TAVR procedures performed using AA approaches expose operators to higher levels of radiation that is likely due to operator positioning and proximity to the radiation source. Radiation shielding in the hybrid operating room may be inferior to that within a dedicated catheterization lab. The use of disposable radiation shielding in this series, did not attenuate operator radiation exposure. This study highlights the need for operators to be aware of radiation safety and mandates that radiation shielding within hybrid operating rooms be scrutinized in an effort to remain on par with that found within cardiac catheterization labs.

So You Want to Start a TMVR or TAVR Program: Necessary Tools and Approaches for Clinical and Fiscal Success

*Vinod H. Thourani, Emory University, Atlanta, GA

*AATS Member ♦ AATS New Member

T5. Feasibility of Transcatheter Mitral Valve Replacement Using a Beating Heart Transapical Delivery System in Human Beings

Robert S. Farivar, Wesley Pedersen, Paul Sorajja, Richard Bae, *Benjamin Sun
Abbott Northwestern Hospital, Minneapolis, MN

Objectives: To determine the feasibility of beating heart transapical transcatheter mitral valve replacement in human beings via a resheathable, tether-based catheter approach for mitral valve replacement.

Methods: Seven patients with severe mitral regurgitation who were deemed high risk for conventional mitral valve repair or replacement at our institution were screened for transcatheter mitral valve replacement. This novel valve is a self expanding nitinol outer frame with a contained porcine pericardial trileaflet valve. The valve is resheathable and retrievable. Patients were a combination of degenerative, functional and mixed mitral insufficiency etiologies. Mean age for enrolled patients was 76 y (65–82).

Results: All patients had procedural and follow up success. There were no deaths, strokes, myocardial infarction, reoperations or paravalvar leaks. There was no residual mitral regurgitation in any patient. All patients were followed up at 1 month and regularly thereafter. One patient had acute kidney injury which resolved without dialysis. Procedural time averaged 120 minutes (71–150). Preoperative ejection fraction was on average of 37%. One month follow up echo demonstrated an improvement to 50% ($p < 0.05$). Mitral valve mean gradient was 3.6 mm Hg (2–5.4). All patients had an improvement in EF except for 1 patient (Graph). Length of stay averaged 7.9 d (5–10 d). Complications included pleural effusion (2), left atrial clot (1), pneumothorax (1) and mild SAM (1).

Change in Ejection Fraction, pre and post MVR



Conclusions: Transcatheter transapical mitral valve replacement was feasible. Further studies are warranted to evaluate whether the improvement in ejection fraction is a function of left ventricular off loading vs tether-resaping of the left ventricle or both.

T6. Up to One Year Follow Up Results of Transfemoral System for Mitral Valve Reconstruction Multicentre Trial

Paolo Denti¹, Alec Vahanian², Francesco Maisano³, Karl-Heinz Kuck⁴, *Ottavio Alfieri¹, Antonio Colombo¹, Stephan Baldus⁵, Georg Nickenig⁶

¹San Raffaele University Hospital, Milan, Italy; ²Bichat Hospital, Paris, France;

³University Hospital Zurich, Switzerland, Zurich, Switzerland; ⁴St. George Hospital Hamburg, Germany, Hamburg, Germany; ⁵University Hospital Köln, Germany, Köln, Germany; ⁶University Hospital Bonn, Germany, Bonn, Germany

Objective: The transfemoral mitral valve reconstruction system enables percutaneous implantation of an adjustable “surgical-like” device for mitral remodelling and MR reduction using a transseptal approach. The aim of this multi-center study was to evaluate the feasibility, safety and up to 12 month outcome of Cardioband in patients with secondary mitral regurgitation (MR).

Methods: Between February 2013 and August 2015, 45 high-risk patients with significant Secondary MR were enrolled at 6 sites in Europe. All patients were screened by echocardiography and cardiac CT to assess feasibility.

Results: Mean age was 71 years (range 49–81), thirty four patients were males (76%). Mean EuroScore II was $7.7\% \pm 6.7\%$ and median STS score 7.2% (1.0%-34.0%). At baseline 87% of patients were in NYHA class III-IV with mean left ventricular ejection fraction of $32 \pm 11\%$ (15%-59%). Device implantation was feasible in 100% patients. Procedural success (device successfully implanted with reduction of MR $\leq 2+$ at discharge) was achieved in 95.6% of patients (43/45). After device cinching, an average ~20% reduction of the septo-lateral diameter was observed (from 39 ± 6 mm to 34 ± 7 mm; $p < 0.01$). Thirty-day mortality was 4.4% (adjudicated as unrelated to the device). At 12 months follow up (N = 20), 71% of patients presented NYHA class I-II with improvement in quality of life (MLWHFQ from 38 to 19; $p < 0.05$ and significant improvement in 6MWT from 256 to 386 meters; $p < 0.05$); 95% of patients (N = 19) had MR $\leq 2+$.

Conclusions: Transseptal mitral repair with the system resulted in MR reduction by reconstruction of the mitral valve. Safety profile is similar and comparable to other transcatheter mitral procedures. MR severity reduction is stable and consistent up to 12 months, with clinical benefit.

8:40 PM Adjourn

TUESDAY, MAY 17

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TUESDAY MORNING, MAY 17, 2016

7:00 AM **General Thoracic Emerging Technologies and Techniques Forum** Room 337, BCC

5 minute presentation, 5 minute discussion

Moderators: *Steven R. DeMeester and *Henning A. Gaissert

T7. Preliminary Experience with Per-Oral Endoscopic Myotomy by a Thoracic Surgical Service

Lara W. Schaheen¹, David D. Odell², Ernest G. Chan¹, ♦Jonathan D'Cunha¹, Ryan Levy¹, Omar Awais¹, Katie Nason¹, Inderpal Sarkaria¹, *James D. Luketich¹

¹University of Pittsburgh, Pittsburgh, PA; ²Northwestern University, Chicago, IL

Objectives: Examine the safety, efficacy, and symptomatic outcomes of per-oral endoscopic myotomy (POEM) for patients with achalasia performed by the thoracic surgical service at our institution.

Methods: POEM was performed in 21 patients with manometrically proven achalasia between May 2014 and October 2015 by a single thoracic surgeon at our institution. Pre-operative assessment included symptom score, barium esophagram, esophageal manometry and upper endoscopy. A review of retrospectively collected data included pre and post-operative symptom scores, operative time, myotomy length, intraoperative events, post-operative complications, time to resume oral intake and hospital length of stay. Postoperative barium esophagram and symptom scores were completed on all patients. Pre and post operative data were compared using paired nonparametric statistics.

Results: Twenty-one patients (6F, 15M) with manometrically confirmed achalasia underwent POEMS at our institution between May 2014 and October 2015. All cases were performed by the same primary thoracic surgeon and two assistants. The mean patient age was 57.5 years with a range of 18–92. Patient BMI ranged from 16.6–41.3 kg/m² with a mean BMI of 26.72 kg/m². The mean duration of symptoms was 4 years with a range of 6 months to 12 years. Seventy-six percent (16/21) of patients had a preoperative Eckardt stage of 2 or greater, with 38% (8/21) having Eckardt stage 3 disease. Ninety percent (19/21) of patients had a history of prior dilations or botox injections. The mean operative time was 197 minutes. Length of myotomy ranged from 6–18 cm with a mean of 11.5 cm. There were no inadvertent perforations requiring surgical closure, intraoperative conversions to laparoscopic repair or hemorrhage. An esophageal stent was electively placed in one patient due to difficulty obtaining satisfactory mucosal closure with endoscopic clips. Non-hemodynamically significant capnoperitoneum was decompressed in 2 patients. All patients resumed oral intake on POD 1, with a median hospital stay of 3 days to allow observation during our early experience. Postoperative barium swallows demonstrated an improvement in esophageal relaxation and emptying in all patients. Significant improvements in Eckert scores were seen at 30 day follow-up (preoperative mean of 5.57, postoperative mean of 0.33, $p < 0.05$). All patients experienced dysphagia relief with a mean decrease in dysphagia score from 1.86 to 0.19. Subjective reflux controlled with medication was reported in 33% (7/21) of patients. No serious complications related to POEM were experienced.

Conclusions: Per-oral endoscopic myotomy is a safe, less invasive and effective endoscopic alternative to surgical myotomy for achalasia in patients with an older age, history of multiple prior interventions or end stage achalasia when performed by an experienced thoracic surgical team.

Complex Airway Reconstructipon In the Era of Biologics Stem Cells and 3D Printers

*Henning A. Gaissert, *Massachusetts General Hospital, Boston, MA*

T8. A Novel System for Identifying Pulmonary Air Leaks with an Inhaled Marker

*Joseph Friedberg

University of Maryland, Baltimore, MD

Objective: Air leaks, spontaneous or iatrogenic, remain a significant source of morbidity and even mortality and are a common cause for increased length of hospital stay in thoracic surgery. Suturing, stapling or applying a topical sealant can mitigate air leaks, but identifying all but the most obvious leaks still requires the archaic process of submerging an inflated lung and looking for bubbles. Even then it may be difficult or impossible to identify the leaks that need to be sealed. An accurate and easy way to identify leaks would be highly desirable.

Methods: *Ex vivo* sheep lungs, similar in size to human lungs, were suspended in an apparatus that simulated a patient with an air leak and a chest tube on -20 cm suction. Different types of air leaks were created, simulating a needle puncture or post-surgical leak. Methylene blue was then aerosolized to a specific particle size and introduced into the inspired air until it flowed from the leak. The lungs were then dissected to assess the extent of lung staining resulting from this procedure.

Results: The dye identified all the leaks in a very short time, often several seconds. This included leaks that were unknown, in retrospect incurred at the time of harvest. Within minutes the dye would often form a stream out of the hole. When the lungs were dissected, only the exposed parenchyma in the injury was stained blue, the rest of the lung remained pink and without any evidence of dye (see Figure). This phenomenon was 100% reproducible in over a dozen lungs.

Conclusion: This proof of principle experiment is the first demonstration that an inhaled particle can be used to identify an air leak. The hypothesis is that if the particle has the correct size (and density), it will be small enough to be carried along the forward air stream through the bronchi and bronchioles to the area of the air leak, but large enough that it does not distribute throughout the entire lung. Accomplishing this with methylene blue, a very safe dye used for many medical purposes, raises the realistic possibility that this same technique could be used intraoperatively to find leaks. Although there are multiple scenarios where this might be beneficial, two particularly appealing uses include identifying air leaks for application of a lung sealant after robotic or thoracoscopic lobectomy and identifying the site of the air leak(s) responsible for spontaneous pneumothoraces. The possibility also exists that this technique could be used to deliver an inhaled lung sealant, to be used at the conclusion of pulmonary surgery to prevent leaks or obviating the need for surgery with persistent air leaks of any cause.

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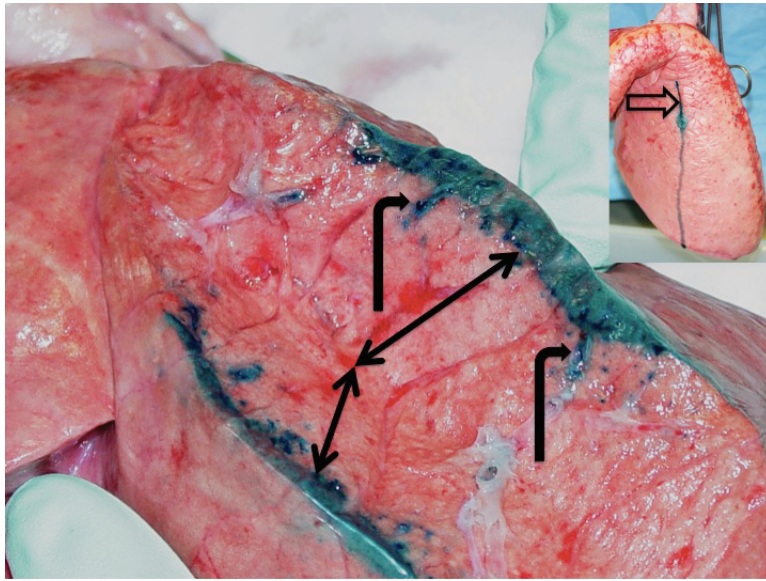


Figure: Inset shows lung two minutes after initiating aerosol delivery with 5 mm deep incision (open arrow) and leaking methylene blue. Main image shows the bivalved lung, straight arrows define the extended incision, curved arrows highlight the two stained bronchioles.

T9. Management of Complex Airway Defects with Bioprosthetic Materials

Brooks Van Udelsman¹, Jessica Eaton², Ashok Muniappan¹, Christopher R. Morse¹,
*Cameron Dorrans Wright¹, *Douglas James Mathisen¹

¹Massachusetts General Hospital, Boston, MA; ²University of Louisville, Louisville, KY

Objective: Patients with complicated airway defects that exceed the limits of primary repair represent a challenging clinical problem and require alternative treatments. The aim of this study is to consider the use of bioprosthesis to repair large tracheal and bronchial defects.

Methods: Retrospective chart review of patients treated at a single tertiary center from 2008 to 2015 who underwent repair of large tracheal or bronchial defects with a bioprosthetic, namely aortic homograft or acellular dermal matrix.

Results: Retrospective chart review identified eight patients, three males and five females with a mean age of 54 ± 13 years. All but one patient underwent prior operative or stenting procedures. Three patients had isolated airway defects, while five had fistulas between the airway and gastrointestinal tract. Defects involved the membranous wall of the trachea (5), the anterior wall of the trachea (1) or the main stem bronchus (2). Five patients underwent repair with aortic homograft and three with acellular dermal matrix. Bioprosthetic was buttressed with muscle flap (4), omentum (2), or left unbuttressed (2). Pneumonia was the most common short term complication (<30 days post-operative), occurring in two patients. An

additional patient developed pneumomediastinum secondary to an esophageal defect, which was treated with stenting and antibiotics. There was no post-operative mortality or cases of reoccurrence in short-term follow up. All bioprosthetics demonstrated granulation tissue on post-operative bronchoscopy (Figure). Two repairs required debridement of granulation tissue and one additional repair required balloon dilation. Six patients (75%) resumed an oral diet and five patients (63%) achieved decannulation. Progression of underlying metastatic disease comprised the majority of long-term mortality.

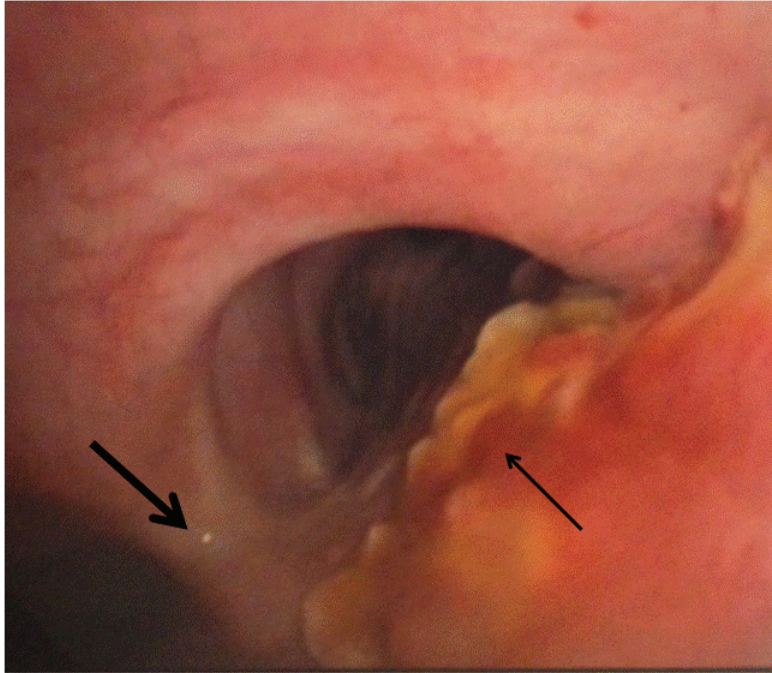


Figure: Aortic homograft repair (small arrow) extending just proximal to the carina (large arrow) as visualized by bronchoscope. Well incorporated with granulation tissue and no evidence of stricture or malacia.

Conclusions: Bioprosthetics represent a viable option for repair of large airway defects that exceed the limits of primary closure. These materials provided immediate airtight closure and correction of defects without evidence of reoccurrence in short-term follow up.

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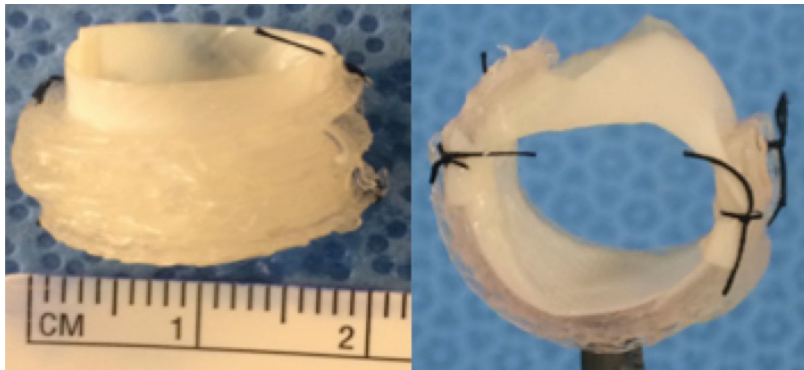
T10. Using 3D BioPrinting As a Tool for Tracheal Segment Tissue Engineering

Todd A. Goldstein, Daniel Grande, Benjamin Smith, Lee P. Smith, David Zeltsman
North Shore – LIJ Health System, Manhasset, NY

Objective: The fabrication of a tissue engineered, 3D printed-biodegradable epithelialized tracheal segment, containing the patient's own cells; will be used as an avenue for tracheal reconstruction. This proof of concept study seeks to address reconstructive techniques that are unable to tackle large segment pathologies.

Methods: A 3D-CAD template was created from human CT images. The 3D rendering was modified to generate a printable scaffold containing a chondrocyte specific bio-ink. The tracheal segments were printed on a modified MakerBot® Replicator® 2X Experimental 3D Printer in a biological safety cabinet out of poly-lactic acid (PLA) and the chondrocyte specific bio-ink. Each segment contains ~10,000 cells per mm³ that were suspended in the bio-ink prior to printing. Additionally the segment is augmented with an endothelial luminal layer. The segments were incubated in a bio-incubator @ 37°C for 2, 7, 14, 21, and 28 days. The samples were analyzed for viable cell-numbers/proliferation assay, histological staining, and mechanical testing.

Results: 30 scaffolds were divided into 3 groups: 2-Empty scaffold, 2-non-cellular control, and 2-cell seeded segments. The cells survived the printing process, were able to continue dividing, and produce the extracellular matrix expected of tracheal chondrocytes. There was no significant difference between the proliferation rates of the experimental group compared to the controls grown in T150 cell culture flasks. The luminal layer remained cellularized and airtight. The segments retained their strength, contour, and rigidity/flexibility compared to the non-cellular controls. In addition, quantities of extracellular matrix increased as time progressed. Histological staining with Fast Green/Safranin O expressed formation of cartilage components within the segment.



Conclusions: The fabrication of a tissue-engineered, 3D printed-biodegradable tracheal segment with an airtight lumen, can address an unmet clinical need in tracheal reconstruction. Although further development is necessary for a viable clinical treatment, this proof-of-concept model indicates that this technology is potentially an answer when there are no other methods available.

Image Guidance in Thoracic Surgery: Ready for Prime Time?

Daniela Molena, Memorial Sloan Kettering Cancer Center, New York, NY

T11. The Use of Electromagnetic Navigational Bronchoscopic Guidance for Intraoperative Localization of Nonpalpable Small Lung Nodules

♦Abbas E. Abbas, Sagar Kadakia, Vishu Ambur *Larry R. Kaiser

Temple University, Philadelphia, PA

Objective: Localizing small and deep lung nodules for sublobar resection may be difficult during thoracoscopic surgery and often requires larger resections or conversion to thoracotomy. Also, with robotic surgery, there is lack of tactile feedback. Electromagnetic navigational bronchoscopy (ENB) may provide a tool to help in localizing these nodules.

Methods: A single institution retrospective study of all patients (40) who underwent ENB for intraoperative localization of pulmonary nodules that were deeper than 1 cm and smaller than 2 cm from 2013 to 2015. Localization was done by ENB-guided transbronchial injection of different agents that included methylene blue, methylene blue plus a fiducial or methylene blue plus indocyanine green. Immediately following localization, the patients underwent video assisted thoracoscopic surgery (VATS) for evaluation prior to proceeding with robotic assisted thoracoscopic surgery (RATS) for anatomical resection.

Results: ENB successfully localized the nodules for initial sublobar resection in 39 of 40 (97.5%) patients. It failed to identify the nodule in 1 patient, who had a visible marker and initially underwent a wedge resection. However, intraoperative pathology did not identify the nodule and a robotic assisted right lower lobe basilar segmentectomy was then performed, which successfully resected the nodule. Minimally invasive thoracoscopic surgery was successfully performed in 38 of 40 (95%) patients. Sublobar resection was performed by RATS in 36 of 40 (90%) and by VATS in 4 of 40 (10%) patients. Of the 4 patients who underwent only VATS, 2 patients required thoracotomy secondary to extensive adhesions and the other 2 had small peripheral nodules which were resected, found to be benign and thus did not require proceeding with robotic assisted anatomical resection. Final diagnosis was adenocarcinoma in 21 patients (52.5%), metastatic disease in 6 patients (15%), carcinoid tumor in 2 patients (5%) and benign in 11 of 40 patients (27.5%). There were no 90 day mortalities. A pneumothorax requiring chest tube reinsertion occurred in 1 patient (2.5%). Discharge with a Heimlich valve for persistent air leak was required in 2 of 40 (5%) patients.

Conclusions: ENB allows accurate localization of small and deep pulmonary nodules for sublobar resection during robotic assisted thoracoscopic surgery. This technique may help avoid the need for conversion to open surgery or for requiring larger resections. In robotic surgery, it may help compensate for the lack of tactile palpation.

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T12. Thoracoscopic Anatomic Lung Sub-Segmentectomy Using Three-Dimensional Computed Tomography Simulation Without Tumor Markings for Non-Palpable, Small-Size Lung Nodules

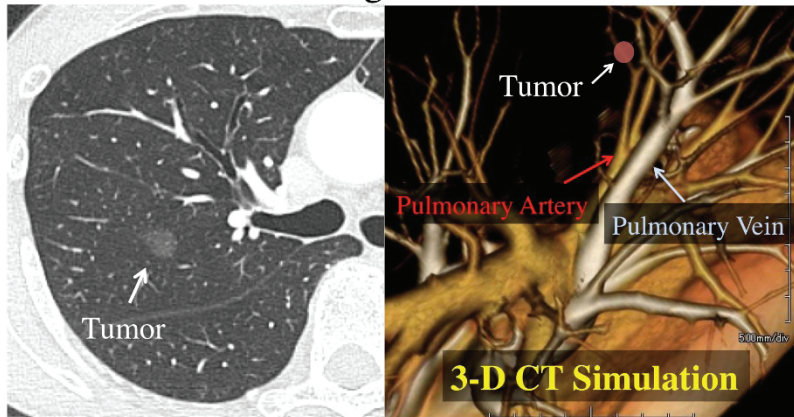
Hirohisa Kato, Hiroyuki Oizumi, Makoto Endoh, Jun Suzuki, Hikaru Watarai, Akira Hamada, Katsuyuki Suzuki, Mitsuaki Sadahiro
Yamagata University, Yamagata-shi, Japan

Objective: While wedge resection can be curative for small lung tumors, tumor markings are sometimes required for resection of non-palpable or non-visualized lung nodules; however, the marking sometimes fails, and rarely causes serious complications. We investigated if thoracoscopic sub-segmentectomy using three-dimensional computed tomography (3-D CT) simulation can facilitate complete resection without tumor markings.

Methods: Between 2004 and 2015, a total of 233 consecutive patients underwent thoracoscopic segmentectomies or sub-segmentectomies using 3-D CT simulation. The simulation images were used to identify sub-segmental arteries, inter-sub-segmental veins, and venous branches in the affected sub-segment that were to be divided. The operations were performed while comparing and contrasting the simulation images with real-time conditions in the surgical field, by rotating and resizing the 3-D CT images (Figure). Twenty-three patients with non-palpable or non-visualized lung nodules resected by thoracoscopic sub-segmentectomies without tumor markings were enrolled in this study. The indications for 3-D CT simulation were as follows: (1) distant tumor from the parenchyma that was non-palpable and non-visualized during surgery; (2) cT1aN0M0 lung cancer with non-solid composition; and (3) metastatic lung tumors. We assessed primary outcome variables, including the peri-operative course, pathology, tumor size, tumor location, recurrence, and survival.

Results: Seventeen, 5 and 1 patient underwent mono-, bi- and tri-sub-segmentectomies, respectively. All of the tumors were correctly contained within the resected sub-segments by thoracoscopic sub-segmentectomies based on the 3-D CT simulation without tumor markings. Eighteen patients were diagnosed with lung cancer; 4 had metastatic lung tumor and 1 had a benign tumor. The mean tumor size was 10 mm (range, 8–16 mm), and the mean tumor distance from the pleura was 18 mm (range, 3–36 mm). Fifteen nodules were non-solid, 2 were partially solid, and 6 nodules had a solid composition. The mean surgical time was 175 minutes (range, 71 to 324 minutes). The median blood loss was 10 ml (range, 0–517 ml), the median duration of chest tube placement was 1 day (range, 1–7 days), and the median post-operative hospital stay was 6 days (range, 4–12 days). No complications or recurrences occurred during the mean follow-up period of 37.4 months (range, 4–97 months).

Figure



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Conclusions: Thoracoscopic anatomic sub-segmentectomy using 3-D CT simulation can be performed safely, correctly resect non-palpable or non-visualized lung nodules without tumor markings, and be used for the curative removal of lung tumors without fails. 3-D CT simulation can facilitate reliable tumor resection by thoracoscopic anatomic sub-segmentectomy. This procedure can become an alternative option of wedge resection needing tumor markings.

T13. A Novel Minimally Invasive Near-Infrared Thoracoscopic Localization Technique of Small Pulmonary Nodules: A Phase I Feasibility Trial

Hideki Ujiie, Tatsuya Kato, Hsin-Pei Hu, Priya Patel, Hironobu Wada, Daiyoon Lee, Kosuke Fujino, Robert Weersink, Elsie Nguyen, ♦Marcelo Cypel, Andrew Pierre, *Marc de Perrot, *Gail Darling, *Thomas K. Waddell, *Shaf Keshavjee, *Kazuhiro Yasufuku

University of Toronto, Toronto, ON, Canada

Objective: Localization and resection of small, non-visible, non-palpable nodules during minimally invasive surgery can be challenging. Commonly used CT guided percutaneous microcoil placement prior to video-assisted thoracoscopic surgery (VATS) requires intraoperative radiation exposure. The purpose of our study was to determine the feasibility and safety of indocyanine green (ICG) fluorescence localization and resection of small pulmonary nodules using a near-infrared (NIR) fluorescence thoracoscope.

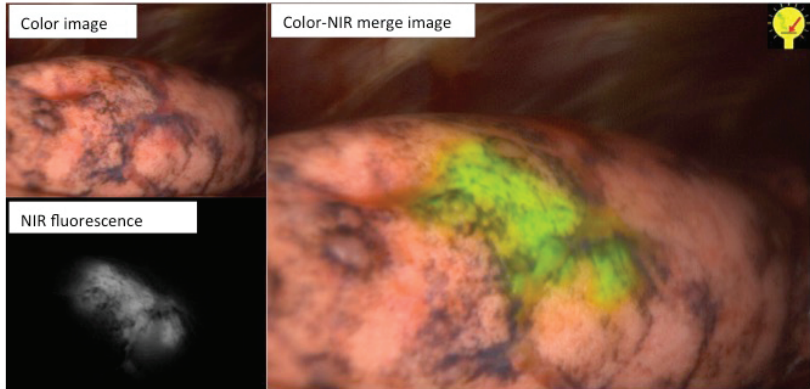
Methods: Patients with undiagnosed small peripheral nodules scheduled for CT guided microcoil placement followed by VATS wedge resection were approached for the study. All procedures were performed in the Guided Therapeutic Operating Room equipped with a CT scanner and robotic cone-beam CT. Using local anesthetic, sterile and coaxial technique with an outer 19-gauge needle, the microcoil was deployed adjacent or within the target nodule through a 22-gauge needle. After deployment of the microcoil, 100 µl of diluted ICG was injected using a separate 22-gauge needle. The patient was then transferred to the cone-beam CT oper-

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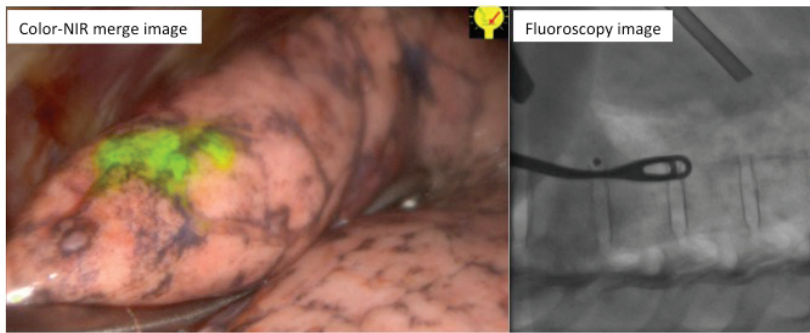
ating table for general anesthetic induction. During the initial phase of VATS, the NIR thoracoscope was solely used to localize the nodule with ICG fluorescence (Figure A). Thoracoscopic instruments were used to clamp the lung to set an imaginary staple line. Fluoroscopy was then used to confirm the location of the microcoil in relation to the instrument (Figure B). Endo staplers were used to perform the wedge resection.

Figure

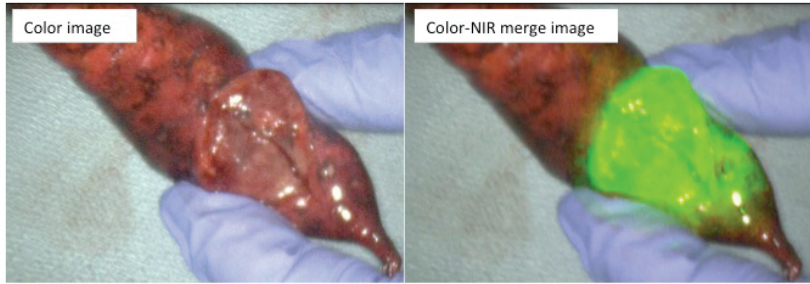
A: Intraoperative image of fluorescent indocyanine green (ICG) with a near-infrared (NIR) thoracoscope



B: Intraoperative image of identifying the location of the microcoil.



C: Image of specimen cut surface with a near-infrared (NIR) thoracoscope



Results: Fourteen patients, median age 68.5 yr (range: 54–82) with small peripheral nodules underwent NIR image guided VATS resection. The median CT tumor size was 1.1 cm (range: 0.5–2.4) and the median depth from the nearest pleural surface was 1.65 cm (range: 0.2–3.7). Pathological diagnoses were adenocarcinoma (n = 10), squamous cell carcinoma (n = 1), metastatic cancer (n = 1), small cell carcinoma (n = 1) and perivascular lymphoid infiltrate (n = 1). The median CT guided intervention time was 35 min (range: 25–59) and VATS procedural time was 53 min (range: 28–84). ICG was successfully injected and ICG fluorescence was clearly identified in all cases. Intraoperative NIR localization and determination of staple line was successful in all cases without the use of fluoroscopy. All nodules were successfully removed with negative surgical margin (Figure C). There were no adverse effects related to ICG injection.

Conclusions: CT-guided percutaneous ICG injection and intraoperative NIR thorascopic localization of small pulmonary nodules is safe and feasible. It offers surgeons the ease of localization through direct ICG fluorescence imaging without the use of fluoroscopy and appears to be equivalent in localization accuracy to preoperative microcoil placement for non-visible, non-palpable intrapulmonary nodules during VATS resection.

Late-Breaking Clinical Trial

LB4. Phase 1 Clinical Trial Evaluating the Safety of Pulmonary Artery Branch Sealing Using an Ultrasonic Energy Vessel-Sealing Device in Open Pulmonary Lobectomy

Eric Goudie, Vicky Thiffault, Adeline Jouquan, Edwin Lafontaine, *Pasquale Ferraro,

♦[Moishe Liberman](#)

Centre Hospitalier de l'Université de Montreal, Montreal, QC, Canada

Invited Discussant:

8:40 PM

Adjourn

TUESDAY, MAY 17

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TUESDAY MORNING, MAY 17, 2016

7:00 AM

Video Session

Room 340, BCC

10 minute presentation

Moderators: *Mark S. Bleiweis, *Subroto Paul and *Vivek Rao

V1. Posterior Airway Stabilization Using Polypropylene Mesh for Tracheobronchomalacia

Tovy Haber Kamine, Jennifer L. Wilson, *Sidhu P. Gangadharan

Beth Israel Deaconess Medical Center, Boston, MA

Objective: To describe the operative technique of tracheobronchoplasty for tracheobronchomalacia in adults.

Case Video Summary: Patients are selected for posterior mesh airway splinting tracheobronchoplasty (TBP) after a thorough preoperative workup demonstrating tracheobronchomalacia with $\geq 90\%$ luminal narrowing and a trial of stent stabilization yielding symptomatic improvement. The patient is intubated with a modified left sided double lumen tube to achieve single lung ventilation. A right 4th inter-space posterolateral thoracotomy is performed. The lung is retracted anteriorly and the azygous vein divided. The posterior membranous airway is fully dissected, and care is taken to avoid thermal injury or devascularization. Exposure ranges from the proximal trachea at the thoracic inlet to the distal left mainstem bronchus (LMSB) and distal bronchus intermedius (BI). Next, the transverse diameter of the posterior airway is measured at the proximal trachea, distal trachea, right mainstem bronchus (RMSB), LMSB, and BI. A polypropylene mesh in the shape of a Y is then fashioned and secured to the airway using rows of partial thickness 4-0 polypropylene sutures. Each row consists of four sutures and each row is spaced ~4–5 mm apart on the mesh and ~7–10 mm apart on the native airway. Posterior membrane plication is accomplished with mattress suture placement as follows:

1. At the right edge of mesh and through a cartilage ring near the junction with the posterior membrane
2. Close to the right edge mesh suture, then in the posterior membrane, 1/3rd of the way across the airway
3. Close to the left edge of mesh, then in the posterior membrane, 2/3rd of the way across the airway
4. At the left edge of mesh, and through a cartilage ring near the junction with the posterior membrane

By grouping the sutures near the edge of the mesh but keeping them evenly spaced on the airway, the redundant membrane is pulled tautly. Post-plication bronchoscopy is performed to aspirate secretions and check the stability of the TBP as well as the appearance of the airways beyond the extent of the repair (e.g., cervical trachea or lobar or segmental bronchi).

Conclusions: TBP is a complex operation which requires suture-to-suture adjustments to effect optimal remodeling of the malacic airway.

V2. Robotic-Assisted Resection of Superior Sulcus Ganglioneuroma

Khalid Alshehri, Adil Ayub, Ahmad Altaweel, Chyun-Yin Huang, Norberto Santana-Rodriguez, Sadiq Rehmani, Adnan M. Al-Ayoubi, Wissam Raad, [Faiz Bhora](#)
Mount Sinai Health System, New York, NY

Objective: To describe and discuss the technique of robotic-assisted resection of a large superior sulcus ganglioneuroma.

Case Video Summary: The video discusses the case of a 31 year old gentleman who presented with a 3 month history of neck stiffness, upper back and arm pain. His neurologic exam was normal. Chest CT scan demonstrated a 6 cm right superior sulcus mass suspicious for a neurogenic tumor. MRI demonstrated extension from the level of T1 through T4 without neural foramen extension. The mass was abutting the proximal right subclavian and vertebral arteries and trachea. The risks were discussed with the patient and he was taken to the operating room for robotic-assisted resection of the mass. He was positioned in a left lateral decubitus position. We utilized a 5-port approach (one 5 mm, two 8 mm and two 12 mm ports). Adhesions involving the right upper lobe were taken down and the upper lobe was retracted inferiorly. We had excellent visualization of the tumor which extended from the posterior superior mediastinum into the thoracic inlet. We first proceeded with dissection just above the azygos vein. The pleura over the tumor was opened inferiorly and posteriorly. All dissections was done using bipolar cautery and with care taken to stay as close to the tumor as possible so as to minimize nerve (recurrent laryngeal nerve, brachial plexus, and sympathetic chain) and vascular (subclavian artery) injury. The dissection was then carried out medially and superiorly. The tumor arose from the T1 nerve root and this was dissected proximally into the rib interspace and divided using bipolar cautery. More superiorly and medially, the tumor was dissected off the proximal subclavian and vertebral arteries, and the trachea. The tumor was removed in an endocatch bag and a multilevel intercostal nerve block was performed. A channel drain was left at the camera port site and the other port sites were closed in layers.

Conclusions and Results: The patient tolerated the procedure well and there were no complications. Chest tube was removed on POD 1 and he was discharged on POD 2. Final pathology confirmed a 6.5 cm ganglioneuroma with an intact capsule.

The robotic-assisted resection of benign tumors of the thoracic inlet is feasible and safe. The main advantage of the robotic approach is a magnified view of critical structures in the area, combined with the ability to perform fine dissection.

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V3. Trans-Cervical Mediastinal Cyst Resection with a Video Mediastinoscope

Eric Goudie, ♦Moishe Liberman

University of Montreal, Montreal, QC, Canada

Objective: Symptomatic mediastinal cysts can be resected via: thoracotomy, sternotomy, VATS or robotic approaches. Lesions located between the aortic arch, innominate artery and vein and trachea may be difficult to approach using standard techniques due to complex anatomy limiting access. We demonstrate a transcervical technique for mediastinal cyst resection.

Case Video Summary: A 71-year-old female presented with an $8.5 \times 5.1 \times 4.5$ cm mediastinal cyst extending from the left tracheobronchial region between the trachea, the aortic arch and the innominate vein and artery. It showed no change from a previous CT scan performed nine years earlier, however, the patient had become symptomatic with severe dysphagia. Anatomic location made standard surgical approaches difficult. A transcervical approach for cyst resection was chosen.

The patient was placed under general anesthesia in supine position with the neck extended. An incision immediately superior to the sternal notch was made and the strap muscles were divided. With a video mediastinoscope, the cyst was identified laterally to the left of the trachea. The trachea was dissected off the mass with suction and the left recurrent laryngeal nerve was identified and protected. Due to the size of the cyst, the cyst was emptied, was dissected off of the esophagus and completely removed through the neck. A mediastinal drain was left in place and the strap muscles and skin closed. The patient had an uneventful recovery and was discharged on postoperative day one. Post-operative barium swallow was normal. Follow-up at five weeks showed no dysphagia and a normal voice. Pathological analysis showed a parathyroid cyst.

Conclusions: A transcervical approach for mediastinal lesions using a video mediastinoscope is feasible. It has the advantage of potentially being associated with less postoperative pain, shorter length of stay and shorter recovery time compared to other described approaches including thoracotomy, sternotomy, VATS or robot.



V4. Robotic Morgagni Hernia Repair

Jennifer L. Philip, Ryan Macke

University of Wisconsin, Madison, WI

Background: Morgagni Hernia is a congenital herniation through a retrosternal defect in the diaphragm. They represent 3% of congenital diaphragmatic hernias. Repair of Morgagni Hernia is recommended given risk of complications. Laparoscopic repair has been demonstrated to be safe and effective. Robotic repair of Morgagni Hernia has yet to be described.

Case Video Summary: We present the case of a 21 year old male who presented with intermittent abdominal pain and was diagnosed with Morgagni hernia confirmed by CT imaging. We proceeded with robotic assisted laparoscopic Morgagni Hernia repair. Patient was placed in supine position. Three robotic ports (two instrument ports and one camera port) and one assistant port were utilized for repair. Robotic approach provided adequate exposure and working area to expose and fully reduce the Morgagni hernia. Omental fat, small bowel, and transverse colon were reduced. The robotic approach facilitated safe and easy excision of the hernia sac. Defect size of 5×3 cm was observed. Repair was accomplished with PTFE patch secured via interrupted sutures. Satisfactory tension free repair was accomplished. Patient had an uncomplicated post-operative course and was discharged by POD#2 tolerating general diet and with minimal pain. Pre-operative symptoms resolved and there is no evidence of recurrence after 6 months.

Conclusions: Robotic assisted laparoscopic repair of Morgagni hernia is a feasible, safe approach that provides ability to satisfactory tension free repair.

TUESDAY, MAY 17

V5. Right Ventricular Free Wall Teratoma Requiring Surgical Intervention Secondary to Refractory Ventricular Tachycardia

Awaiz Ashfaq, Tabitha Moe, Justin Ryan, Paul Dickman, Steve Taylor, Daniel Velez, Robert Puntel, Andrew Papez, John Nigro

Mayo Clinic, Phoenix, AZ

Background: Cardiac teratoma is an extremely rare cardiac tumor and generally found attached to the pulmonary artery or aorta. We present a patient with an intracardiac teratoma arising from the free wall of the right ventricle (RV), who underwent tumor resection for intractable ventricular tachycardia.

Case Video Summary: Fetal ultrasound revealed an intracardiac RV tumor. The patient was born at 36 weeks of gestation as a product of twin pregnancy. Postnatal echocardiogram revealed a 1.8×1.7 cm mass arising from anterolateral wall of RV without associated RV outflow tract obstruction. The patient demonstrated sustained monomorphic ventricular tachycardia at 220–280 beats per minute, which was refractory to antiarrhythmic therapy. Cardiac MRI revealed a heterogenous well circumscribed mass arising from mid anterior RV free wall with punctate calcifications and cystic portions radiologically consistent with a teratoma. Surface ECG mapping of the arrhythmia was consistent with an origin in or about the cardiac mass. The patient underwent tumor resection at 43 days of life. A right atriotomy was performed, and inspection of the mass through the tricuspid valve suggested the mass was adherent to the subvalvular apparatus and chordae. A transverse

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right ventriculotomy was made, and the mass was carefully dissected off of the RV wall and the tricuspid apparatus. Ventriculotomy was closed primarily using autologous pericardium to buttress the suture lines, the patent foramen ovale was closed, and the right atriotomy repaired. Post cardiopulmonary bypass, intraoperative transesophageal echocardiogram showed normal biventricular function and no tricuspid valvular stenosis or insufficiency. Final tissue pathology revealed immature teratoma with elements including bone, cartilage, glioneural element, and secretory glands. The patient had an uneventful postoperative course and was discharged without any antiarrhythmics. Follow up transthoracic echocardiogram six weeks postoperatively demonstrated normal tricuspid apparatus with trivial regurgitation and normal biventricular function. Follow up Holter monitors have demonstrated complete resolution of the ventricular tachycardia.

Conclusion: Intracardiac teratoma is extremely rare, and indications for surgical intervention can include medically intractable dysrhythmias and obstructive physiology. Surgical resection warrants careful planning including multi-modality imaging and can provide excellent outcomes.

V6. Simplifying the Repair of Barlow's Disease: A Solution to Excess Leaflet Tissue Without Resection

Sabet W. Hashim, Rajesh B. Sekar, Peter W. Hashim, Roland Assi, Irena Vaitkeviciute
Yale University, New Haven, CT

Objective: In this video, we describe a surgical technique for Barlow's mitral valve regurgitation that makes its repair easy and reproducible. Barlow's mitral valve is characterized by excess leaflet tissue. Ring annuloplasty, an essential component of any repair, produces crowding of leaflet tissue inside the ring that causes systolic anterior motion (SAM). Surgical techniques to prevent SAM use resection of posterior leaflet tissue adjacent to a planned triangular or quadrangular resection. Our technique uses advancement of the annuloplasty ring from the valve annulus to the posterior leaflet placing all excess leaflet tissue outside the ring.

Case Video Summary: Annular sutures are placed in the usual fashion. The height of the posterior leaflet is assessed, and using an ink pen, a line is drawn 2 cm away from the edge of the leaflets. This line marks the new site in which the annuloplasty ring will rest. The two arms of an annular suture are rethreaded through the annulus into the posterior leaflet, exiting at the ink line. Rethreading of the sutures is repeated for all annular sutures that face the ink line. The end result is a line of insertion of the ring 2 cm away from the edge of the posterior leaflet. The line may be undulating, but the flexibility of the ring allows it to conform to the course. When the ring sutures are tied, the entire portion of excessive posterior leaflet tissue is imbricated and excluded outside the prosthetic ring.

Conclusions: In the symmetric form of Barlow's, the ring advancement is the sole technique required to correct regurgitation and avoid SAM. In the asymmetric form of Barlow's, the ring advancement will focalize the disease and reduce the number of additional steps required to achieve valvular competency without causing SAM. We have used this approach over 10 years in more than 150 patients without the need for any reoperation.

V7. Total Endovascular Repair of Aortic Arch Using Inner Branched Arch Endograft

Muhammad Aftab, *Eric Roselli, ♦Douglas R. Johnston, *Matthew Eagleton

Cleveland Clinic, Cleveland, OH

Hypothesis: We describe a technique of total endovascular repair of aortic arch using inner branched arch endograft.

Case Video Summary: An 80 year old man with history hypertension, idiopathic platelet dysfunction and severe congenital pectus excavatum presented with an aortic arch aneurysm 2 years after an acute type I aortic dissection repair. He had a negative exercise treadmill stress test. His transthoracic echocardiogram showed normal left ventricular function, moderate RV systolic dysfunction and no valvular abnormalities. He had no significant carotid artery stenosis. His CTA demonstrated an enlarging aortic arch and proximal descending thoracic aortic aneurysm, from 5.1 to 6.5 cm over 1 year, with a residual dissection distal to the surgical graft.

Preoperative planning included CT imaging analysis and measurements at multiple landmarks. Patient was found to be a suitable candidate for the endovascular arch repair using a custom made branched graft under an Investigational Device Exemption (IDE). He initially underwent a left carotid to subclavian bypass (CSCV) with an uneventful recovery. For the staged endovascular arch repair, three vessels access was obtained. Right femoral access to insert the endograft over a stiff wire positioned into the left ventricle, right common carotid artery to catheterize the innominate internal side branch and to insert the covered bridging stent and left axillary access to deliver the covered stent bridging the side branch to left common carotid artery. With concerns that dissection involving the innominate artery may result into retrograde flow into the aneurysm, we used the direct right carotid artery, instead of axillary approach, and performed a right CSCV bypass. This will allow us to extend the stent graft into distal undissected right carotid artery while maintaining the flow in the right arm from bypass. The arch main body stent was initially deployed under rapid pacing followed by cannulation of side branches of Innominate and left common carotid arteries. Two custom made bridging stents were placed for each internal side branch. The left subclavian artery was coil embolized and distal aortic stent graft was placed. Completion aortogram and postoperative CTA confirmed an excellent positioning of the device, patent arch branches and coronaries. Patient was discharged home on POD5 after an uneventful recovery. He initially had a post-operative endoleak, which resolved upon the 2 months follow up CT imaging.

Conclusions: Pure endovascular approach to repair the aortic arch aneurysm using an arch branch endograft is technically safe and feasible. Both current technique and device technology are in evolution with minimal data on the long term durability. However, this technology may benefit selected patients who may not be suited for conventional surgical repair.

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V8. Approaches to Reconstruction of Severe Primary Tricuspid Valve Defects

Domenico Mazzitelli¹, Yacine Elhmidi¹, *J. Scott Rankin², Jelena Kasnar-Samprec¹, Julie Cleuziou¹, *Ruediger Lange¹

¹German Heart Center, Munich, Germany; ²Cardiothoracic Surgery Associates, Nashville, TN

Hypothesis: Prosthetic replacement of the tricuspid valve (TV) for severe structural disease is associated with high early and late mortality, independent of valve type chosen. Accordingly, attempts might be made to explore more advanced reparative options, in an effort to improve results. This video shows 3 patients with severe structural TV disease who underwent extensive valve reconstruction using tissue-engineered and autologous pericardium.

Case Video Summary: The first patient was a 16 year-old boy with Tetralogy of Fallot, a small ventricular septal defect (VSD), and a balanced shunt. The VSD had become infected, and he presented with 3 weeks of symptoms, a small persistent VSD, tricuspid vegetations, severe TV regurgitation, and right ventricular outflow tract obstruction. The windsock of the VSD had become incorporated into the tricuspid septal leaflet, and the left aspects of the septal and anterior leaflets were involved with endocarditis. The windsock was excised, and a VSD patch inserted. The infected TV segments were resected and replaced with patches of tissue-engineered bovine pericardium. Gore-Tex artificial chords were constructed to the new leaflets, and an annuloplasty ring was inserted. Postoperatively, the leaflets moved well, the valve was fully competent, and the mean gradient was 2 mmHg. Two further patients, aged 39 and 44 years, presented with severe TV regurgitation from extensive endocarditis and congenital TV dysplasia, respectively. The dysplasia patient had a markedly dilated TV annulus. Neither had usable leaflets, and reconstruction was accomplished with hand-made cylinders of glutaraldehyde-treated autologous pericardium. A generous suture annuloplasty was performed on the TV dysplasia valve. After sizing and reshaping the native annuli, the appropriate sized cylinders were sutured at the level of the papillary muscles with 3 equally spaced 120-degree fixation points. Proximally, each cylinder was sutured to the TV annulus with a running technique. Both valves were fully competent, and post-repair echos showed no residual regurgitation, with mean gradients of 3–4 mmHg. Each of the patients recovered uneventfully.

Conclusions: In patients with severe structural TV disease, early and late outcomes after conventional valve replacement have been suboptimal. As an initial application, complex pericardial TV reconstruction seems to be a safe and effective alternative to prosthetic valves. More advanced technical approaches may improve repair durability and enhance long-term patient well-being. However, a larger number of patients with longer follow-up will be needed for full validation.

V9. Modified Nikaidoh Procedure with Double-Root-Translocation

Yiqun Ding

Shenzhen Children's Hospital, Shenzhen, China

Objectives: This video aims to demonstrate the modified Nikaidoh procedure with double-root-translocation (DRT) and to explore the safeguards and pitfalls of this procedure.

Case Video Summary: The patient was a 6-month-old female. The diagnosis was transposition of the great arteries (TGA) with ventricular septal defect (VSD) and moderate pulmonary stenosis (PS). Both ventricles were well developed and the functions were satisfactory. The pulmonary annulus was normal in size and pulmonary stenosis was caused by the bicuspid valve. The VSD was 5 mm, and the pulmonary annulus and cusps were partially functional, we employed DRT, a kind of modified Nikaidoh procedure by preserving the pulmonary annulus and cusps. A standard median sternotomy was performed followed by initiating cardiopulmonary bypass with bicaval cannulation. Under moderate hypothermia, the aorta and the pulmonary trunk were transected after aortic cross-clamp. Both coronary artery buttons were harvested. A horizontal incision was made on the right ventricular infundibulum, about 4 mm below the aortic annulus. The incision was extended to harvest the aortic root and the pulmonic root. When mobilize the posterior part of the pulmonic root, great care was taken to protect the anterior mitral leaflet. After the two roots were harvested "en bloc", they were rotated 180 degrees, so that the aortic root was above the left ventricular outflow tract and the pulmonic root was above the right ventricular outflow tract. The posterior part of the aortic root was anastomosed to the mitral valve annulus and the left ventricular outflow tract. An autologous pericardium patch was used to close the VSD to direct left ventricular blood to the neo-aorta. At the upper part of the VSD, the sutures were anchored to the muscular tissue between the aortic and the pulmonic roots. The anterior part of the pulmonic root was anastomosed to the right ventricular incision. After reconstruction of the aortic root with an autologous pericardium patch, the left coronary artery button was re-implanted to a new position of the aorta. Following the Lecompte maneuver, the aorta was anastomosed, and the right coronary button was reimplanted above the aortic incision. After the pulmonary trunk was anastomosed, the patient was weaned off the cardiopulmonary bypass and the operation was successfully terminated.

Conclusions: Modified Nikaidoh procedure with double-root-translocation is a complex procedure, but reproducible. It can act as an alternative approach for TGA/VSD/PS if both ventricles are well developed. Compared with REV, it can achieve a shorter and more straight left ventricular outflow tract.

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V10. One-Stage Definitive Repair for Patient with Complete Atrioventricular Septal Defect and Pulmonary Atresia with Major Aortopulmonary Collateral Arteries

Yujiro Ide, Masaya Murata, Kisaburo Sakamoto

Mt. Fuji Shizuoka Children's Hospital, Shizuoka City, Japan

Objective: Pulmonary atresia with ventricular septal defect and major aortopulmonary collateral arteries (PA/VSD/MAPCA) is well known congenital heart defects and unifocalization (UF) of MAPCAs during early infantile has become the standard treatment for this disease. However, combination of complete atrioventricular septal defect (CAVSD) and PA/MAPCAs is extremely rare. We would like to present our precious experience to treat this rare disease subset.

Case Video Summary: This patient was detected in a fetus as tetralogy of Fallot. After he was delivered by caesarean at the gestational age of 40 week with 2646g of birth weight, he was transferred to our center. His diagnosis was PA, MAPCAs, absent cPA, CAVSD (type C of Rastelli classification) with left side atrioventricular valvular regurgitation (AVVR) in moderate grade. Furthermore, the AAO was completely connected to the right ventricle (Ao from RV). His oxygen saturation was about 90% and he showed no symptoms of heart failure. The angiography at 4 month of age showed 4 MAPCAs originating from the descending aorta. His ventricular volume was good enough (LVEDV = 169% and RVEDV = 225%) and the Qp/Qs was 1.79.

At 7 month of age and with a body weight of 5.9 kg, he underwent a one-stage definitive repair. After CPB was established through sternotomy, three MAPCAs were divided from descending aorta (MAPCA#4 was sacrificed). UF was completed by anastomosing these three MAPCAs and autologous pericardial patch. After cardiac arrest, conventional right atriotomy was made. We resected interventricular septum beneath the aortic valve to create the non-obstructive left ventricular outflow tract before performing ventricular septation, because the aorta was connected to the right ventricle completely. Atrial and ventricular septation was performed according to the two-patch repair without making a fenestration. Then a hand-made valved EPTFE conduit was placed between the right ventricle and the neo pulmonary artery as an outflow tract and we completed the definitive repair. CPB time, Ao cross clamp time and operation time was about 7.5 hrs, 2.5 hrs and 12.5 hrs, respectively. Even though his hemodynamics was acceptable, we finished operation with his chest open because we concerned a postoperative sudden deterioration due to pulmonary hypertention and a necessity of ventricular fenestration. After we confirmed his hemodynamical stability, his chest was closed 7 days later. He was extubated at POD18 and discharged to home at POD39.

Post operative CT showed a good shaped pulmonary arterial tree without stenosis. Echocardiography revealed a well aligned LVOT and AV valve regurgitation bilaterally with mild grade. RV/LV pressure ratio was estimated 0.65.

Conclusions: We successfully achieved one-stage definitive repair for a very rare combination of congenital heart defects.

8:40 PM Adjourn

7:00 AM **VAD/ECMO Session** Ballroom I, BCC
5 minute presentation, 7 minute discussion

Moderators: *Anelechi C. Anyanwu and *Nader Moazami

36. The Hospital Volume-Outcome Relationship for Left Ventricular Assist Device Implantation in Medicare Patients in the United States

♦Nimesh D. Desai, Danielle Savino, Fenton H. McCarthy, Peter W. Groeneveld, Katherine McDermott, Danielle Spragan, Pavan Alturi, Dale Kobrin, Christian A. Bermudez, Eduardo Rame, *Michael A. Acker
University of Pennsylvania, Philadelphia, PA

Invited Discussant: Keki Balsara

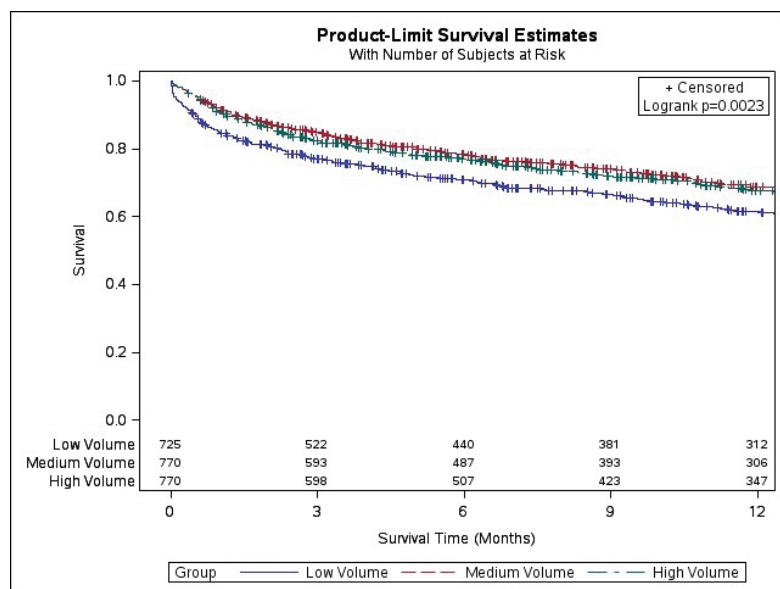
Objective: In recent years, there has been a dramatic increase in the use of Left Ventricular Assist Devices (LVADs), primarily driven by their use as destination therapy for heart failure patients. The institutional outcomes of this trend have not been fully evaluated. The aim of this study is to analyze the association between hospital LVAD volume and patient outcome.

Methods: All Medicare fee-for-service patients undergoing LVAD implantation (n = 2265) between January 2009 and December 2012 were identified using Health Care Procedure Classification Codes present on Center for Medicare & Medicaid Services carrier claims. LVAD patients who underwent pump exchanges, pump removals, heart transplants, or secondary implantation of heart assist devices were excluded. Elixhauser comorbidity Index and ICD-9 codes were used to generate common comorbidities present on implantation. Multivariable logistic regression and hierarchical models adjusting for patient characteristics was used for analysis.

Results: Claims were examined from 2265 Medicare patients undergoing LVAD implantations at 149 hospitals (median implants 9 per hospital per year; inter-quartile range (IQR) 5–14). Hospital implant volume was divided into low (median 4; IQR 3–5) medium (median 9; IQR 8–11) and high volume centers (median 17; IQR 14–20). Low volume center patients had significantly fewer comorbidities compared to medium and high volume centers including chronic obstructive pulmonary disease, pulmonary circulation disorder, anemia, and hypertension. In-hospital mortality rates were higher among low-volume centers than among medium and high-volume centers (low = 19%, n = 138; medium = 12%, n = 92; high = 14%, n = 108; p = 0.001). Ninety day mortality rates were higher among patients at low-volume VAD centers than among medium or high-volume institutions (low = 15%, n = 109; medium = 8%, n = 62; high = 9%, n = 70 p < 0.001), and low-volume VAD patients demonstrated worse survival through 1 year (logrank p < 0.001, Figure 1). Multivariable analysis confirmed that LVAD implantation at low volume centers was a predictor for increased thirty day mortality (odds ratio 1.7, 95% CI 1.3–2.4). Similar results were found using a robust hierarchical model (odds ratio 1.9, 95% CI 1.3–2.9).

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Conclusions: The overall outcomes for Medicare patients receiving VADs are acceptable up to one year in this generally older patient population with a high prevalence of comorbidities. Patients admitted to low-volume hospitals are associated with worse outcomes, indicated by higher in-hospital, ninety day, and one year mortality rates.

37. Novel Perspectives on Postcardiotomy Shock; New Insight to Improve Outcomes

Hiroo Takayama, Shinichi Fukuhara, Koji Takeda, Jiho Han, Scott DeRoo, Boyangi Li, Sowmyashree Sreekanth, Veli Topkara, Arthur Garan, Paolo Colombo, Melana Yuzefpolskaya, *Paul Kurlansky, *Yoshifumi Naka
Columbia University, New York, NY

Invited Discussant: ♦Edward G. Soltesz

Objective: The incidence and in-hospital mortality of postcardiotomy shock (PCS) are reported to be approximately 1% and 60%, respectively. There is an unmet need for improving this persistently high mortality. Previous series largely focused on analyses including only PCS patients. In contrast, this study undertook a novel approach in comparing PCS patients to subjects with other etiologies of refractory cardiogenic shock in order to better characterize and understand the nature of PCS cohort.

Methods: From February 2007 to May 2014, 316 patients received a total of 382 acute mechanical circulatory support device (MCSD) runs (178 extracorporeal membrane oxygenation (ECMO) and 204 short-term ventricular assist devices

(VADs) of a magnetically-levitated centrifugal pump). PCS was defined as need for MCS/D following non-transplant cardiac surgeries in the present study. The primary outcome of interest was in-hospital mortality.

Results: Patients were divided into the following groups based on etiology of refractory cardiogenic shock: PCS (n = 112), acute myocardial infarction (AMI) (n = 84), acute decompensated heart failure (ADHF) (n = 60), post-transplant graft failure (n = 47), and myocarditis (n = 13). The in-hospital mortality in each group was 58.9, 46.4, 46.7, 31.9 and 15.4%, respectively (p = 0.003). The PCS patients were older (60.3 vs 51.9 years old; p < 0.001), receiving higher doses of vasoactive pharmacological support immediately prior to the device insertion (vasoactive inotropic score; 32.7 vs 18.8; p = 0.002), and more likely to have received ECMO (66.1% vs 47.1%; p = 0.001) as initial device. Multivariable Cox regression analysis of all the patients who received a MCS/D for refractory cardiogenic shock showed that use of ECMO (hazard ratio (HR) 1.68; 95% confidence interval (CI) 1.14–2.45; p = 0.008), age (HR 1.23; 95% CI 1.09–1.38; p < 0.001) and vasoactive-inotropic score (HR 1.05; 95% CI 1.00–1.09; p = 0.046) were predictors of in-hospital mortality. On the contrary, etiology of PCS was NOT an independent predictor of mortality, despite the highest in-hospital mortality (58.9%).

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Table: Clinical Features at Time of Mechanical Circulatory Support Institution in Each Group.

Variable	PCS (n = 112)	AMI (n = 84)	ADHF (n = 60)	Graft Failure (n = 47)	Myocarditis (n = 13)	p-Value
ECMO as initial device	74 (66.1%)	51 (60.7%)	21 (35.0%)	20 (42.6%)	4 (30.8%)	<0.001
Active CPR	19 (17.0%)	22 (26.2%)	9 (15.0%)	6 (12.8%)	0	0.089
Age	60.3 ± 15.6	58.8 ± 12.4	45.9 ± 17.8	48.9 ± 15.0	44.0 ± 20.3	<0.001
Vasoactive inotropic score	32.7 ± 41.9	21.0 ± 23.7	16.8 ± 21.2	17.0 ± 21.9	19.7 ± 27.4	0.005
History of CAD	59 (52.7%)	65 (77.4%)	15 (26.8%)	12 (25.5%)	0	<0.001
In-hospital mortality	66 (58.9%)	39 (46.4%)	28 (46.7%)	15 (31.9%)	2 (15.4%)	0.003

Conclusions: Our results utilizing a large contemporary MCS/D database demonstrated not PCS but need for more vasoactive pharmacological support and use of ECMO as independent predictors of in-hospital mortality among patients with refractory cardiogenic shock. This suggests that the dismal outcome of PCS may be due to more conservative decision making for MCS/D therapy in this subgroup. Earlier use of VAD therapy in PCS might improve the persistently high mortality of this entity.

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38. Central Cannulation As a Viable Alternative to Peripheral Cannulation in Extracorporeal Membrane Oxygenation

David Ranney, Ehsan Benrashed, James Meza, Jeffrey Keenan, Mani Daneshmand
Duke University, Durham, NC

Invited Discussant: *Michael S. Firstenberg

Objective: The indications for extracorporeal membrane oxygenation (ECMO) as a method of short-term cardiopulmonary support in adults continue to expand. Cannulation of the aorta, axillary artery, and femoral artery are used in various settings of veno-arterial (VA) support although their inherent complications are not well characterized. The purpose of this study was to compare the outcomes and complication rates between aortic, axillary, and femoral arterial ECMO cannulation.

Methods: A single-institution, retrospective analysis was performed for patients undergoing VA ECMO cannulation between June 2009 and April 2015. Patient characteristics, clinical outcomes, and details related to deployment were extracted from the medical record. The rates of various complications were compared between patients by cannulation strategy. Kaplan-Meier analysis was used to compare overall survival.

Results: Of 131 patients undergoing VA ECMO cannulation during the study period, there were 36 aortic (27.5%), 16 axillary (12.2%), and 79 femoral (60.3%) cannulations. Other than a lower mean age with femoral cannulations (53.9 ± 13.9) versus aortic (60.3 ± 12.2) and axillary (59.8 ± 12.4) ($p = 0.032$), baseline patient characteristics and comorbidities were statistically similar between the three groups. Central cannulations were more frequent in patients transferred from outside facilities (74.3% central vs 51.6% peripheral) while femoral cannulations were more frequent with witnessed cardiac arrest (55.7% femoral versus 42.9% aortic and 6.3% axillary). Femoral cannulation was more commonly performed in the Emergency Department, Cath Lab, and ICU while aortic and axillary cannulations were mostly performed in the operating room. Seven of 36 aortic cannulations were via minimally invasive thoracotomy (19.4%). Forty of 131 patients were extracorporeal CPR patients (30.5%), 33 of whom were femoral cannulations and seven of whom were emergent open-chest aortic cannulations. Complications and outcomes by cannulation strategy are summarized in Table 1.

Complication/Outcome	Aorta	Axillary	Femoral	Total	p
Cannula site infection	0 (0%)	0 (0%)	1 (1.3%)	1 (0.8%)	0.718
Significant cannulation site bleeding	11 (30.6%)	6 (37.5%)	11 (13.9%)	28 (21.4%)	0.032
Peripheral vascular complications	0 (0%)	5 (31.3%)	23 (29.1%)	28 (21.4%)	0.001
GI perforation	0 (0%)	0 (0%)	3 (3.8%)	3 (2.3%)	0.364
GI bleed	2 (5.6%)	0 (0%)	2 (2.5%)	4 (3.1%)	0.512
Mesenteric ischemia	0 (0%)	1 (6.3%)	0 (0%)	1 (0.8%)	0.027
Stroke	6 (16.7%)	2 (12.5%)	9 (11.4%)	17 (13%)	0.736
Seizures	0 (0%)	1 (6.3%)	1 (1.3%)	2 (1.5%)	0.227
Diffuse cerebral edema	4 (11.1%)	1 (6.3%)	5 (6.3%)	10 (7.6%)	0.653
Delirium/encephalopathy at discharge	4 (11.1%)	0 (0%)	6 (7.6%)	10 (7.6%)	0.379
New onset dialysis	8 (22.2%)	0 (0%)	11 (13.9%)	19 (14.5%)	0.107
Dialysis at discharge	1 (2.8%)	0 (0%)	1 (1.3%)	2 (1.5%)	0.719
Hospital length of stay (days)	25.3 ± 23	29.5 ± 22	26.5 ± 24.9	26.5 ± 24.9	0.860
Duration of ECMO (days)	6.1 ± 6.5	5.6 ± 5.7	4.3 ± 4.5	5.0 ± 5.3	0.245
In-hospital mortality	21 (58.3%)	7 (43.8%)	48 (60.8%)	76 (58%)	0.453

Table 1. Complication rate versus type of arterial cannulation

Conclusions: Indications for ECMO continue to expand necessitating more precise characterization of its complications and outcomes. While location of deployment often dictates arterial cannulation strategy, our results suggest that direct aortic cannulation is a safe modality with similar complication and survival rates compared to axillary and femoral cannulation. Central cannulation is thus a viable alternative to avoid or manage the challenges of limb malperfusion and other complications that are inherent to peripheral cannulation.

39. Bridge to Durable Left Ventricular Assist Device Using Various Short-Term Mechanical Circulatory Support Devices for Patients with an INTERMACS I Profile

Koji Takeda, Hiroo Takayama, A. Reshad Garan, Veli K. Topkara, Jiho Han,
*Paul Kurlansky, Melana Yuzefpolskaya, Paulo C. Colombo, *Yoshifumi Naka
Columbia University, New York, NY

Invited Discussant: *Ashish S. Shah

Objective: The role of short-term mechanical circulatory support (ST-MCS) has increased in patients with cardiogenic shock (INTERMACS level I). ST-MCS can be used as a bridge to recovery, transplant, and a durable left ventricular assist device (LVAD). However, little data exists about the outcomes of bridge to durable LVAD strategy in INTERMACS I patients. The purpose of this study is to elucidate short and long-term outcomes in patients receiving a durable LVAD after bridging with ST-MCS.

Methods: We retrospectively reviewed 392 patients who underwent continuous-flow LVAD insertion between March 2004 and December 2014. Of these patients, 43 (11%) were bridged with ST-MCS and received because of various etiology of cardiogenic shock. We compared the early and late outcomes with the non-bridging population.

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Results: Mean age of entire cohort was 57 ± 14 and 81% were male. Of these patients, 43 (11%) received ST-MCS prior to LVAD insertion (Heartmate II 41, Heartware 2). The reasons for ST-MCS implantation were decompensated chronic heart failure in 19 (44%), acute myocardial infarction in 18 (42%), post-cardiotomy in 3 (7.0%), fulminant myocarditis in 2 (4.7%), and other 1 (2.3%). Types of ST-MCS were Centrimag ventricular assist device in 26 (60%), extracorporeal membrane oxygenation in 11 (26%), Impella in 5 (12%), and other in 1 (2.3%). Median duration of ST-MCS support was 13 days (range 0–61). In-hospital mortality was significantly higher in ST-MCS group (17% vs. 6.2%, $p = 0.03$). Incidence of right ventricular assist device use was significantly higher in the ST-MCS group compared to non-bridging group (25% vs. 5%, $p = 0.0002$). Kaplan Meier survival at 2-year was 66% in the ST-MCS group and 77% in the non-bridging group ($p = 0.16$). After receiving durable LVAD, seventeen (40%) received cardiac transplant and 3 (7%) showed myocardial recovery enough to be weaned from durable LVAD.

Conclusion: Bridge to durable LVAD strategy using ST-MCS is a reasonable strategy for refractory cardiogenic shock patients. Although this cohort is still high-risk cohort, long-term survival comparable to non-bridging cohort can be expected.

Mechanical Circulatory Support in High Risk Cardiac Surgery – Back-Up, Adjunct, Bailout and Alternative

*Lyle D. Joyce, Mayo Clinic, Rochester, MN

40. Emergency Implantation of Durable Left Ventricular Assist Devices As Primary Therapy for Refractory Cardiogenic Shock

Amit Pawale, Yosef Schwartz, Sean Pinney, *David H. Adams, *Anelechi C. Anyanwu
Mount Sinai Medical Center, New York, NY

Invited Discussant: Scott C. Silvestry

Objective: Surgical therapy for refractory primary cardiogenic shock has largely been based on emergent placement of ECMO or short-term ventricular assist devices. Short-term devices allow simpler initial surgery, but are often associated with high mortality, long periods in ICU (with attendant complications), and need for subsequent operations in survivors (such as conversion to a durable left ventricular assist device (LVAD)). We hypothesized that an alternate strategy of primary placement of durable LVADs could lead to a less complicated course, quicker recovery, and, possibly, better outcomes, by allowing early extubation and ambulation, reducing ICU stay, and obviating need for repeat surgeries. We have adopted a strategy of routine emergency implantation of durable LVADs as a ‘one-stop’ initial therapy for refractory cardiogenic shock and report our experience.

Methods: We retrospectively reviewed data on 40 consecutive patients (mean age 55 y, Male 32) with refractory shock treated with this strategy in our center. Dominant cause of shock was myocardial infarction (23, 58%). Patients were on maximal non-surgical circulatory support and predominantly in multiorgan failure (Table). All had a standardized surgical approach with implantation of durable LVAD, and

adjunctive procedures as required. Temporary RVADs were used for profound RV failure only. Primary outcome measure was competing outcome (dead vs alive on LVAD, recovery or transplant) at six months.

Table: Preoperative Characteristics

CPR within 24 hours of LVAD	7 (18%)
Unknown neurological status	5 (13%)
Mechanical ventilation	24 (60%)
Percutaneous LVAD	7 (18%)
Potent antiplatelet therapy within 48 h	16 (40%)
Prior sternotomy	5 (13%)
Creatinine (mean)	1.64 mg/dl
Bilirubin (mean)	2.38 mg/dl
AST (mean)	1001 U/l
Lactate	3.0 mmol/l

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Results: All patients received an implantable LVAD as planned (axial flow – 34, centrifugal 5, pulsatile 1). Mean operative time was 332 mins and CBP time 88 mins. Temporary RVAD was used in 7 cases (18%), 6 of which were successfully explanted. Eighteen underwent concurrent cardiac procedures. Major complications included operative mortality 13% (5/40), reoperation for bleeding 8% (3/40) and stroke 5% (2/40). Median time to extubation was 2.5 days, ICU discharge 9 days, and hospital discharge 23 days. At 6 months, competing analysis showed 16% had died, 16% were transplanted, 0% had been explanted for recovery and 68% remained on LVAD support. Actuarial survival was $85 \pm 5.8\%$ at six months and $74.8 \pm 8.3\%$ at 12 months.

Conclusions: Our data may challenge the notion that patients in refractory cardiogenic shock are best served by initial period of stabilization on ECMO or short term devices. Despite long operations and surgical challenges, we have safely implanted durable LVADs emergently in the setting of refractory shock and multiorgan dysfunction, with success rates that are comparable, and possibly superior, to those reported with conventional “bridge to bridge” strategies. We believe this approach is worth further investigation as it may offer unique advantage including earlier ambulation, shorter and less complicated ICU stay, avoidance of repeat surgery, and possibly less overall cost and resource utilization.

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41. Left Ventricular Failure After Surgery to Correct Right Ventricular Pressure Overload in Pulmonary Hypertension Patients

Tom Verbelen, Alexander Van De Bruaene, Bjorn Cools, *Dirk Van Raemdonck, Marion Delcroix, Filip Rega, Bart Meyns
University Hospitals Leuven, Leuven, Belgium

Invited Discussant: *Michael M. Madani

Objective: Temporary left ventricular (LV) dysfunction, both after pulmonary thromboendarterectomy (PTE) for chronic thromboembolic pulmonary hypertension (CTEPH) and after bilateral lung transplantation (bLTx) for pulmonary arterial hypertension (PAH), is well described. True LV-failure has only been described in PAH patients. We sought to identify the factors that cause LV-failure to emerge and to identify preventive strategies.

Methods: From our pulmonary hypertension database all PAH patients that underwent bLTx (n = 24) and all CTEPH patients that underwent PTE-surgery, with a minimal reduction of 800 dynes.s.cm⁻⁵ (n = 22), were selected. Perioperative demographic and echocardiographic data were analyzed.

Results: In CTEPH vs PAH patients, pulmonary hypertension was diagnosed at younger age (39.1 ± 14.0 vs 57.5 ± 14.2 years, $p < 0.001$), time between diagnosis and surgery was longer (1928 ± 1562 vs 505 ± 691 days, $p < 0.001$) and preoperative right ventricular (RV) diastolic area was larger (39.8 ± 10.2 vs 29.0 ± 4.4 cm², $p < 0.01$). After surgery, cardiac output (4.6 ± 1.3 vs 5.7 ± 1.1 L/min, $p < 0.05$) and stroke volume (53 ± 15 vs 65 ± 17 ml, $p < 0.05$) were lower and MV E/A ratio (1.47 ± 0.86 vs 1.05 ± 0.33 , $p < 0.05$) was higher in PAH vs CTEPH patients. Six months later, these differences had disappeared. By then, the interventricular wall thickness and the LV posterior wall thickness had increased (12.2 ± 2.7 vs 10.7 ± 2.6 mm, and 11.3 ± 2.8 vs 8.6 ± 1.9 mm, respectively, both $p < 0.05$) in PAH patients without atrial septostomy (AS). This was not seen in CTEPH patients, neither in PAH patients in whom an AS was created before bLTx (n = 5).

Conclusions: Longer periods of LV underfilling before curative surgery to treat RV pressure overload cause a more profound postoperative LV diastolic dysfunction in PAH patients compared to CTEPH patients. This explains the occasional development of LV-failure in PAH patients after bLTx. Palliative procedures (AS) to relieve RV pressure overload may offer a training period for the LV prior to bLTx and thereby avoiding the development of LV-failure.

42. Continuous Flow LVAD Minimally Invasive Implantation in INTERMACS Class Score I-II Patients: The Evolution of Surgical Technique in a Single Centre Experience

Alvise Guariento, Lorenzo Bagozzi, Jonida Bejko, Massimiliano Carrozzini, Marina Comisso, Giacomo Bortolussi, Michele Gallo, Vincenzo Tarzia, Tomaso Bottio, *Gino Gerosa

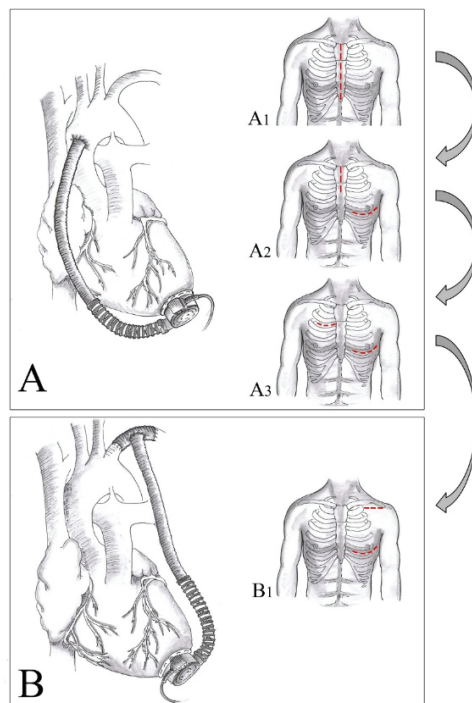
University of Padua, Padova, Italy

Invited Discussant: *Walter P. Dembitsky

Objective: To evaluate our surgical experience in the implantation of continuous flow left ventricular assist devices (LVAD), from the original full sternotomy approach to less invasive surgical strategies comprehending mini-sternotomy and/or mini-thoracotomies. We analyze our LVAD surgical evolution experience.

Methods: We enrolled patients undergoing surgical implantation of one of the two LVAD types used in our centre (both are small, intra-pericardially positioned, continuous-flow centrifugal LVAD), to reduce possible bias related to the device. Out of a total of 91 LVADs implanted in our centre, we retrospectively reviewed 42 patients (46.1%) who received the specific LVAD examined, in the period from February 2012 to August 2015. In this analysis we focused on the surgical technique used during the procedure. Most of the patients (95.2%) were affected of end-stage heart failure due to post-ischemia or dilatative cardiomyopathy, receiving the LVAD in INTERMACS class score of I-II in the totality of cases. Mean age, left ventricular ejection fraction and New York Heart Association class were 52.3 years, 19.0% and 3.97, respectively.

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Results: The implantation of LVAD was performed via full sternotomy in 10 patients (23.8%), whilst it was conducted throughout a mini-invasive procedure in the remaining 32 ones (76.2%). Mini-invasive approaches were combined upper mini-sternotomy with left mini-thoracotomy (20 patients, 62.5%), combined bi-mini-thoracotomy (7 patients, 21.9%) and a recently developed combined left mini-thoracotomy with isolation of left axillary artery (5 patients, 15.6%). The most common postoperative complications were right ventricular failure (26.2%) and revision for bleeding (21.4%), both significantly related to a full sternotomy approach ($p < 0.001$). The most frequent cause of death was stroke (ischemic or hemorrhagic) (16.7%). Cumulative survival (on device or transplanted) at two years was $68 \pm 7\%$ and 18 patients were transplanted.

Conclusions: Satisfactory mid-term survival in severely compromised patients was recorded in our series. Trend versus a decrease in post-operative bleeding, right ventricular failure, mechanical ventilation and additionally reduced postoperative in-hospital stay was observed during time-technique evolution towards mini invasive surgical technique.

8:40 AM **Adjourn**

TUESDAY, MAY 17, 2016

8:45 AM **Plenary Scientific Session** Hall E, BCC
8 minute presentation, 12 minute discussion

Moderators: *Joseph S. Coselli and *Marc R. Moon

43. External Stenting: A Reliable Technique to Relieve Airway Obstruction in Small Children

Makoto Ando¹, Yuuzou Nagase², Hisaya Hasegawa³, Yukihiro Takahashi¹

¹Sakakibara Heart Institute, Tokyo, Japan; ²Ginza Heart Clinic, Tokyo, Japan;

³Tokyo Women's Medical University Medical Center East, Tokyo, Japan

Invited Discussant:

Objective: An airway obstruction manifested during early childhood can be life threatening, and caused by reasons including vascular compression and congenital malacia. It is also frequently associated with congenital cardiovascular anomalies. Incomplete relief of the obstruction may lead to obstructive pulmonary vascular disease, which is unfavorable for patients with congenital heart disease, especially functionally single ventricle. An aortopexy offers a reasonable option, especially for vascular compression, but may be ineffective for situations such as aortic arch compression. After the arterial switch operation, the anterior retraction of the arch may especially be hampered by the anteriorly located pulmonary artery. To solve these problems, we developed our own original external stenting technique, suspending the airway to the two separate pieces of oversized ring-reinforced polytetrafluoroethylene prosthesis as a reliable option to expand and stabilize the airway for small children.

Methods: From April 1997 to July 2015, 98 patients underwent external stenting. There were 43 female and 55 male patients. The median birth weight was 2.7 kg (0.7–4.4). Cardiovascular anomalies were noted in 82 (83.7%) with 18 having aortic arch obstruction. Fourteen had functionally single ventricular hearts and expecting future Fontan operations. Thirty-nine had chromosomal abnormality, or multiple organ malformations. Eight patients had previously undergone an unsuccessful aortopexy.

Results: The median age at the 1st operation was 7.2 (1.0–77.1) months, with 71 (72.4%) under one year of age. The obstruction site was the trachea (T, 27), right bronchus (RB, 4), left bronchus (LB, 32), T+ RB (12), T+LB (17) and T+RB+LB (6). The mechanisms were congenital malacia (52), vascular compression (43) and a combination of both (3). Patients underwent a total of 127 external stentings. There were 14 (eight in-hospital and six after-discharge) mortality cases. Nine required reoperation for re-stenosis at 1.0 (0.1–14.4) month's interval, and four required stent removal: three for infection and one for pulmonary vein compression. Of the 84 survivors, 74 (88.1%) have been successfully weaned from the ventilator at a median of five days. The negative pressure threshold to induce airway collapse was measured for 58 procedures for congenital malacia and showed improved stability of the airway with the mean value changing from -15.9 to -116.0 cmH₂O. A follow-up CT scan (>2.0 years interval from the operation) was performed in 23 patients (max = 8.7 years), showing the diameter of the stented area being $94.6 \pm 14.2\%$ of the age-matched control.

Conclusions: The external stenting is a relatively non-invasive and reliable method to relieve airway compression for small children. A late obstruction has not been a concern, probably due to the non-circumferential and oversized design of the prosthesis.

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44. 10-Year Endpoint of RAPCO Is Reached: Clinical and Angiographic Results of a Randomised Trial of Radial Artery Versus Right Internal Thoracic Artery or Saphenous Vein for the Second Graft

*Brian F. Buxton¹, Philip A. Hayward², George Matalanis², Simon C. Moten², Mark Horrigan², Alexander Rosalion³, Jai Raman⁴, David L. Hare¹

¹University of Melbourne, Melbourne Australia; ²Ausitn Hospital, Melbourne, Australia;

³Vincent's Hospital, Melbourne, Australia; ⁴Rush University Medical Center, Chicago, IL

Invited Discussant: *Stephen E. Fremes

Objective: The Radial Artery Patency and Clinical Outcomes trial is a randomised controlled study designed to compare the radial artery with its alternatives for the second coronary graft, in order to assess whether it confers improved clinical or angiographic outcome over long-term follow up.

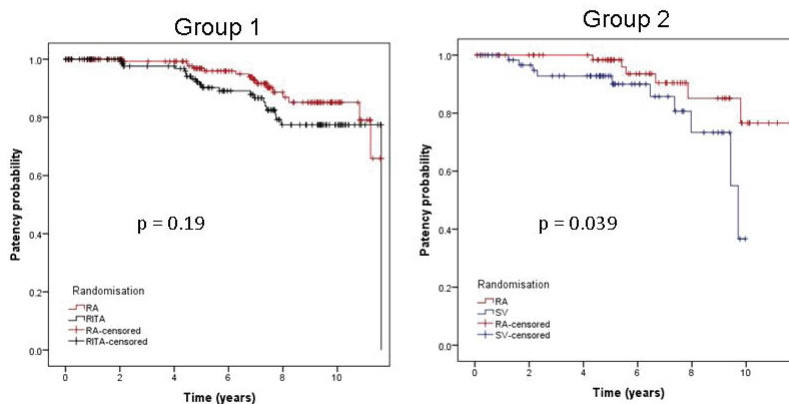
Methods: 619 patients undergoing primary isolated coronary bypass surgery were enrolled between 1996–2004. Patients were followed annually after surgery by both physician review and telephone follow up to capture all clinical events. Patency was established by a protocol directed graft angiogram, whose timing was randomly assigned at enrolment to occur between 1 month and 10 years

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following surgery, with the bulk of angiography weighted towards the 2nd half of follow up. Supplementary angiography was optional at 5- and 10-year points. All patients received a LITA graft to the LAD. For the second graft, patients <70 years (or <60 years if diabetic) were randomised, as Group 1, to a radial artery (RA) or right internal thoracic artery (RITA). Older patients comprised Group 2, and were randomised to a radial artery or saphenous vein (SV). 3rd and 4th order grafts utilised any remaining conduit, as per surgeon preference. Perioperative care was standardised where possible. Analysis was by intention to treat, with time to a clinical event (myocardial infarction, revascularisation or death) or to angiographic study graft failure (defined as occlusion, string sign or conduit stenosis >80%) recorded as primary end points.

Results: Among 394 patients randomised in group 1, there were 18 vs 32 deaths, 12 vs 14 myocardial infarcts, and 23 vs 26 repeat revascularisations within 10 years in the RA vs RITA arms respectively, with 1 patient lost from follow up. Among 225 patients randomised in group 2, there were 31 vs 39 deaths, 8 vs 10 myocardial infarcts, and 9 vs 11 repeat revascularisations within 10 years in the RA vs SV arms respectively, with 1 patient lost from follow up. Angiographic failures of study grafts occurred in 15 vs 21 patients in RA vs RITA in Group 1, and 6 vs 12 patients in RA vs SV in Group 2. Actuarial survival was superior with a RA compared with a RITA in group 1 ($p = 0.032$) with a trend to better event free survival ($p = 0.085$), despite no significant difference in actuarial study graft patency ($p = 0.19$). Neither actuarial survival nor event free survival differed in group 2 ($p = 0.24$, $p = 0.18$), although patency of RA was superior to that of SV over 10 years ($p = 0.039$).

Patency of study grafts on protocol angiography



Conclusions: The RA, RITA and SV are all associated with excellent long-term clinical and angiographic outcome when used for the 2nd graft during primary CABG. In older patients, patency of RA is superior to SV without influencing survival, but effect on symptom recurrence is not known. In younger patients, surprisingly RA confers superior survival despite equivalent patency to RITA, the mechanism of which is not clear.

45. Cost-Effectiveness of Invasive Mediastinal Staging in Non-Small Cell Lung Cancer

Kasia Czarnecka-Kujawa¹, Ursula Rochau², Uwe Siebert³, Eshetu Atenafu¹,

*Gail Darling¹, *Thomas Kenneth Waddell¹, Andrew Pierre¹, *Marc De Perrot¹,

♦Marcelo Cypel¹, *Shaf Keshavjee¹, *Kazuhiro Yasufuku¹

¹University of Toronto, Toronto, ON, Canada; ²Institute of Public Health, Hall, Austria;

³UMIT – University for Health Sciences, Medical Informatics and Technology, Hall, Austria

Invited Discussant: *Felix G. Fernandez

Objective: To assess the cost effectiveness of various modes of mediastinal staging in non-small cell lung cancer (NSCLC) in a single payer health care system.

Methods: We developed a decision tree representing the possible events in the decision process and follow-up of mediastinal staging in a cohort of hypothetical NSCLC patients with clinical N0 disease (We assumed a prevalence of mediastinal metastasis [pN2] of 9%). We performed a decision analysis to compare the health outcomes and initial and downstream costs of four mediastinal staging strategies: 1) no invasive staging; 2) Endobronchial Ultrasound-guided Transbronchial Needle Aspiration (EBUS-TBNA); 3) Mediastinoscopy (Med); 4) EBUS-TBNA followed by confirmatory Med if EBUS-TBNA is negative (EBUS-TBNA-Med). Decision tree probabilities were derived from published evidence. Further model input parameters included extracted economic data from patients referred to Thoracic Surgery at a tertiary Canadian cancer center for management of NSCLC between 1/1/2003 and 31/12/2014. Per procedure total cost was extracted for each patient. The average procedure costs were compared between the strategies. Costs of chemotherapy and radiation were extracted from provincial data sources. All costs were adjusted to 2015 Canadian dollars using the consumer price index from the Bank of Canada. Utilities were obtained from the National Population Health Survey and converted to Quality Adjusted Life Years (QALYs) using life expectancy data from prior studies. We determined Incremental Cost Effectiveness Ratios (ICER) for all strategies and performed comprehensive deterministic sensitivity analyses using a willingness to pay threshold of \$100,000/QALY.

Results: Under the base-case scenario, the no invasive mediastinal staging strategy was least effective (QALY 5.80) and least expensive (\$11,863), followed by Med alone, EBUS-TBNA alone, and EBUS-TBNA-Med with 5.86, 5.87, and 5.88 QALYs, respectively. The ICER was \$26,254/QALY for EBUS-TBNA staging and \$1,426,019/QALY for EBUS-TBNA-Med. The Med strategy was dominated (It was more expensive and less effective than the EBUS-TBNA strategy). Once pN2 exceeds 10%, EBUS-TBNA staging is cost effective (\$24,187/QALY). Once the pN2 reaches 51%, EBUS-TBNA-Med is cost effective (ICER \$97,481/QALY). Once EBUS-TBNA sensitivity exceeds 19%, EBUS-TBNA staging is cost effective (ICER \$98,160/QALY). Once pN2 exceeds 51%, confirmatory Med, regardless of EBUS-TBNA sensitivity, is the preferred diagnostic strategy (Figure 1).

Conclusion: Invasive mediastinal staging in NSCLC is unlikely to be cost effective in clinical N0 patients if pN2 <10%. In patients with moderate probability of mediastinal metastasis (pN2 between 10% and 51%) EBUS-TBNA is cost effective as the only staging modality. Confirmatory Med should be considered in high risk patients (pN2 > 51%) in case of negative EBUS-TBNA.

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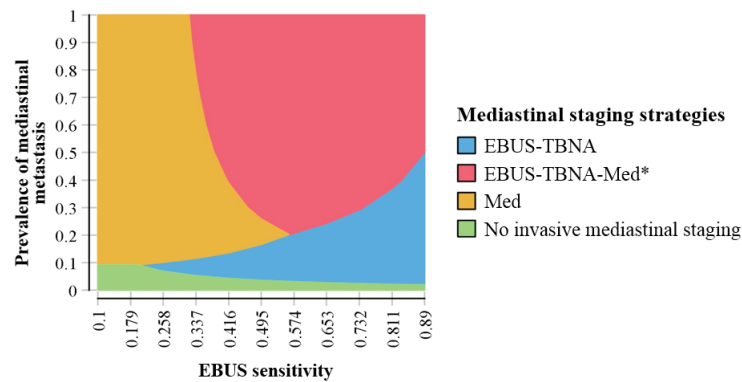


Figure 1. Two way sensitivity analysis on the prevalence of mediastinal LN metastasis and EBUS-TBNA sensitivity. Color-coding represents the most cost-effective diagnostic pathway for the combination of the two varied parameters. EBUS-TBNA- Endobronchial Ultrasound-guided Transbronchial Needle Aspiration; Med-mediastinoscopy.
* In this pathway, Med is performed only in patients with negative EBUS-TBNA

46. Impact of Protected Cardiothoracic Surgical Research Time During Residency on Careers in Academic Surgery

J. Trent Magruder¹, Joshua C. Grimm¹; Todd C. Crawford¹, *Ashish S. Shah¹, *Timothy J. Gardner², *Bruce A. Reitz¹, J. Alexander Haller¹, *Vincent C. Gott¹, *Duke E. Cameron¹, *William A. Baumgartner¹

¹Johns Hopkins, Baltimore, MD; ²Christiana Care Health Services, Newark, DE

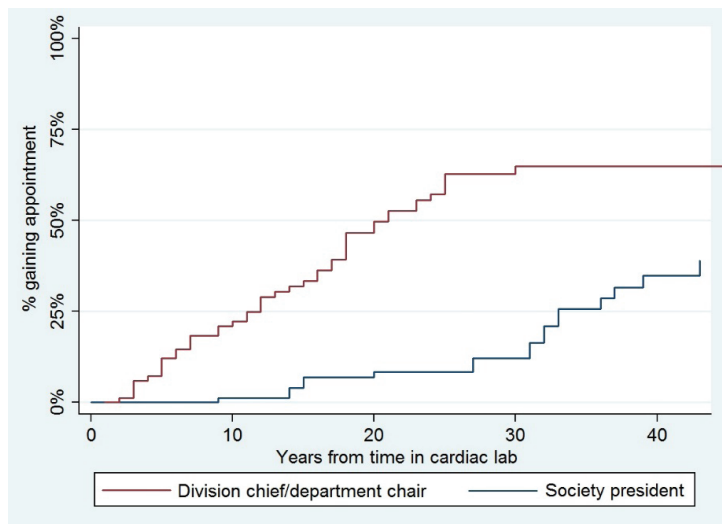
Invited Discussant: *Richard Lee

Objective: Since 1942, our institution has offered interested general surgery residents 1–2 years of protected research time in our cardiac surgery research laboratory. We sought to quantify the volume of research produced during this time, and to determine its association with academic surgical career trajectories amongst this cohort of residents.

Methods: We reviewed the publications of all residents who were involved in the lab from 1942 through 2015. Followup was obtained on all residents via interviews with former involved faculty members and residents in order to confirm resident involvement and to help assess the career paths of former laboratory residents. We defined two outcomes: appointment as a division chief or department chair of an academic surgical institution, and appointment as a president of an academic surgical society. Kaplan-Meier analysis was used to determine latency to these outcomes, while logistic regression was used to assess the relationship between research activity and outcome.

Results: Between 1942 and 2015, a total of 86 surgery residents from our institution spent 1 or 2 years in the CSRL. These residents published a total of 581 papers which were directly attributable to research executed in the CSRL. The median

number of first-author publications per resident directly related to lab work was 6 (IQR 3–9). By Kaplan-Meier analysis, the 30-year probability of appointment as a division chief or department chair was 64.9%, while the 30-year probability of society presidential appointment was 34.8% (Figure 1). Logistic regression analysis revealed that the number of first-author lab papers written per resident were associated with an increased chance of both becoming a chair or chief (OR 1.46, 1.15–1.85, $p = 0.002$) as well as a society president (OR 1.28, 1.07–1.52, $p = 0.006$).



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FIGURE 1 KEY: Proportion of residents becoming division chiefs or department chairs, and proportion of residents becoming academic surgical society presidents, displayed as a time-to-event analysis measuring years from time spent in the cardiothoracic surgery research laboratory.

Conclusions: Though it was impossible to control for pre-intervention confounders like personal work ethic or interest in cardiothoracic surgery, the data suggest that a program of protected laboratory research time is associated with academic productivity and successful careers in academic surgery.

10:05 AM Coffee Break in The Exhibit Hall

10:10 AM – 10:30 AM

AATS/ISHLT Guidelines for Cardiac Transplantation and Mechanical Circulatory Support Exhibit Hall, AATS CT Theater I, Booth #103
Not for Credit

*Ranjit John, *University of Minnesota*

*James K. Kirklin, *Children's Hospital of Alabama*

Panelists: *John V. Conte, *Johns Hopkins Hospital*

*Scott C. Silvestry, *Florida Hospital Transplant Institute*

*AATS Member ♦AATS New Member

10:30 AM Award Presentations

Hall E, BCC

47. Mitral Valve Surgery in the US Veterans Administration Health System: 10-Year Outcomes and Trends

*Faisal G. Bakaeen¹, A. Laurie Shroyer², *Marco A. Zenati³, *Vinay Badhwar¹², *Vinod H. Thourani⁵, *James S. Gammie⁶, *Rakesh M. Suri⁷, *A. Marc Gillinov⁷, *Joseph F Sabik, III⁷, Danny Chu⁴, Laura A. Graham⁸, Mary T. Hawn⁹, *G. Hossein Almassi¹⁰, Lorraine D. Cornwell¹, *Frederick L. Grover¹¹, *Todd K. Rosengart¹, Shuab Omer¹

¹Baylor College of Medicine and Texas Heart Institute, Houston, TX; ²Northport VA Medical Center and Stony Brook School of Medicine, Stony Brook, NY; ³The West Roxbury VAMC and Harvard Medical School, Boston, MA; ⁴University of Pittsburgh, Pittsburgh, PA; ⁵Emory University, Atlanta, GA; ⁶University of Maryland, Baltimore, MD; ⁷Cleveland Clinic Foundation, Cleveland, OH; ⁸University of Alabama at Birmingham, Birmingham, AL; ⁹Stanford University, Stanford, CA; ¹⁰Medical College of Wisconsin and VA Medical Center, Milwaukee, WI; ¹¹University of Colorado Denver, Aurora, CO; ¹²West Virginia University, Morgantown, WV

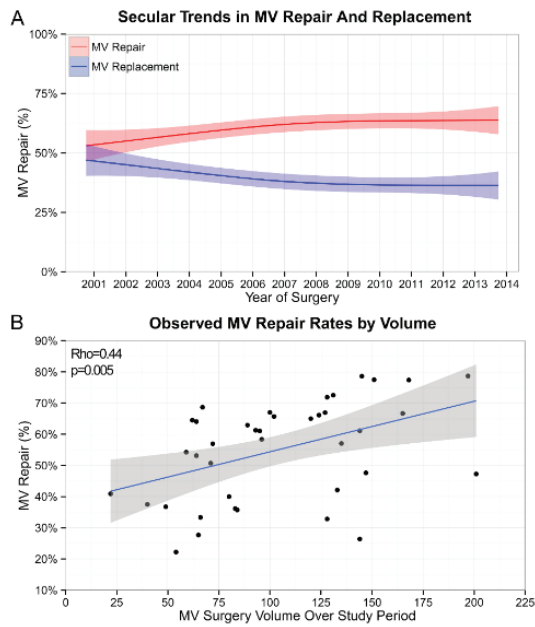
Invited Discussant: *David H. Adams

Objective: To compare trends in mitral valve repair (MVRRepair) and mitral valve replacement (MVRReplace) in the largest US government healthcare system.

Methods: Data were retrospectively reviewed from 4165 patients in the Veterans Affairs Surgical Quality Improvement Program (VASQIP) who underwent MVRRepair or MVRReplace with or without CABG at 40 centers during 2001–2013. Longitudinal follow-up data through July 2015 were available for all patients. Trends in the rate of MVRRepair versus MVRReplace were examined with bivariate analyses, followed by backward stepwise selection and parsimonious multivariate logistic modelling to determine the effect of preoperative comorbidities and facility-level factors on MVRRepair rates. A pathoanatomic subgroup analysis was performed on data from patients who underwent elective primary MV surgery for isolated primary degenerative mitral regurgitation (MR), which was defined as non-stenotic, non-rheumatic, and non-ischemic in origin (EF \geq 35%, no history of myocardial infarction or CABG). The effect of MVRRepair versus MVRReplace strategy on risk-adjusted outcomes in patients with primary MR was evaluated with logistic regression, and survival analysis was performed.

Results: The overall MVRRepair (vs MVRReplace) rate increased from 48% in 2001 to 63% in 2013 ($p < 0.001$; Figure, panel A). The median number of mitral operations performed was 7/center/y (range 0–29). The MVRRepair rate varied widely among centers (Figure, panel B); center volume explained only 19% of the total variation in facility-level MVRRepair rates after adjustment for case mix ($R^2 = 0.19$, $p = 0.005$). In the subgroup with primary MR ($n = 1107$), the rate of MVRRepair also increased over time, from 55% in 2001 to 67% in 2013 ($p = 0.02$). Unadjusted 180- and 365-day mortality rates were lower for the MVRRepair (vs MVRReplace) patients (2.2% vs 4.9%, $p = 0.02$, and 2.7% vs 5.6%, $p < 0.01$, respectively), and life-table analysis found lower unadjusted long-term mortality after MVRRepair for up to 10 years

postoperatively (28.0% vs 36.7%, $p = 0.01$). In adjusted mortality models, 30-day mortality did not differ between MVRepair and MVReplace patients (OR 0.88, 95% CI 0.66–1.16) in the primary MR subgroup; however, MVRepair was associated with lower overall 180-day and 365-day mortality rates (OR 0.73, 95% CI 0.60–0.90 and OR 0.83, 95% CI 0.68–0.99). Overall, MVRepair was associated with marginally lower long-term (10-y) mortality (HR 0.82, 95% CI 0.65–1.05).



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Conclusions: In the VA health system, mitral valve operations are performed with low mortality, even though the VA system includes low-volume centers. MVRepair has a greater short-term protective effect against mortality than MVReplace has in patients with primary degenerative MR. Despite this survival advantage, the rate of MVRepair is low at some centers; therefore, there is clearly an opportunity for quality improvement.

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48. Towards Making Lung Transplantation a Semi-Elective Procedure: Outcomes Following Clinical Lung Transplantation with Over Twelve Hours of Preservation Time

Jonathan C. Yeung, *Kazuhiro Yasufuku, *Marc de Perrot, Andrew F. Pierre,

*Thomas K. Waddell, *Shaf Keshavjee, ♦Marcelo Cypel

University of Toronto, Toronto, ON, Canada

Invited Discussant: *Bartley P. Griffith

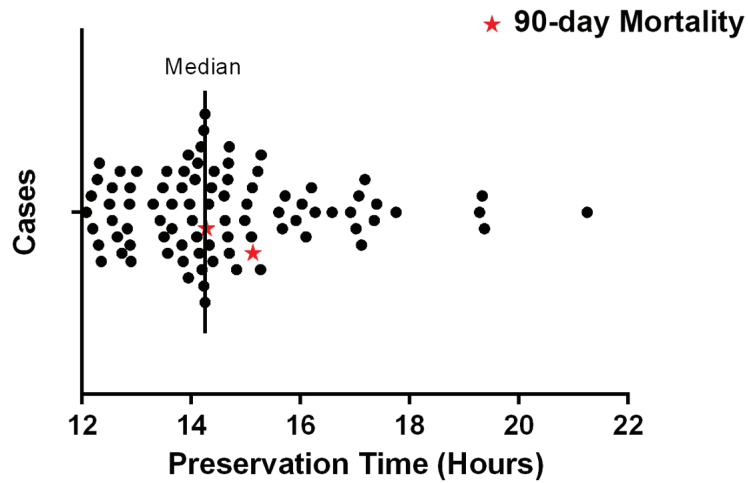
Objective: The use of *ex vivo* lung perfusion (EVLP) for lung preservation interrupts cold ischemia and safely extends total preservation time in pre-clinical models of lung transplantation. We evaluated the outcomes following clinical transplantation of lungs with over 12 hours of preservation time.

Methods: Patients (Jan 2006–April 2015) who received a lung with a preservation time of over 12 hours were identified. Re-transplant, heart-lung transplant, and transplant of patients bridged with extracorporeal life support were excluded. The longer preservation time of the two lungs were used for analysis. Outcomes were compared to the general lung transplant population using univariate and multivariate models.

Results: 88 patients received lungs with >12 h of preservation time (mean = 14.4 ± 2.3 h, range 12.1 to 21.3 h) and 786 patients received lungs with <12 h of preservation time (mean = 6.7 ± 2.6 h, range 0.8 to 11.9 h). The distribution of preservation times in the >12 h group is shown in Figure 1A. In the >12 h group, preservation time was split into a first cold ischemic time (4.81 ± 1.7 h), EVLP time (4.9 ± 0.91 h), and second cold ischemic time (4.8 ± 1.9 h). The >12 h group had a higher proportion of EVLP lungs and donation after cardiac death (DCD) lungs than the <12 h group (88/88 (100%) EVLP vs 45/786 (5.7%), $p < 0.001$; 28/88 (32%) DCD vs 60/786 (7.6%) DCD, $p < 0.001$). Donor pO₂ in the >12 h group was lower than in the <12 h group (415.9 ± 92.2 mmHg vs 452.5 ± 84.6 mmHg, $p = 0.0002$). Donor age was similar between groups ($p = 0.44$). Median hospital and ICU length of stay were similar between the two groups (<12 h: 22.5 ± 12.6 days vs >12 h: 22.5 ± 13.3 days, $p = 0.73$; <12 h: 4 ± 4.4 days vs >12 h: 4 ± 2.9 days, $p = 0.93$). Incidence of Grade 3 primary graft dysfunction was not different between the two groups at 72 h post-transplant ($p = 0.45$). Kaplan-Meier survival curves between the two groups did not show any difference (Figure 1B; $p = 0.408$). Multivariate survival analysis using Cox's model demonstrated recipient age and pulmonary vascular disease as indication for transplant to be significant variables affecting survival ($p = 0.02$, $p = 0.007$, respectively). Preservation time, donor pO₂, and use of EVLP were not ($p = 0.36$, $p = 0.46$, $p = 0.71$, respectively).

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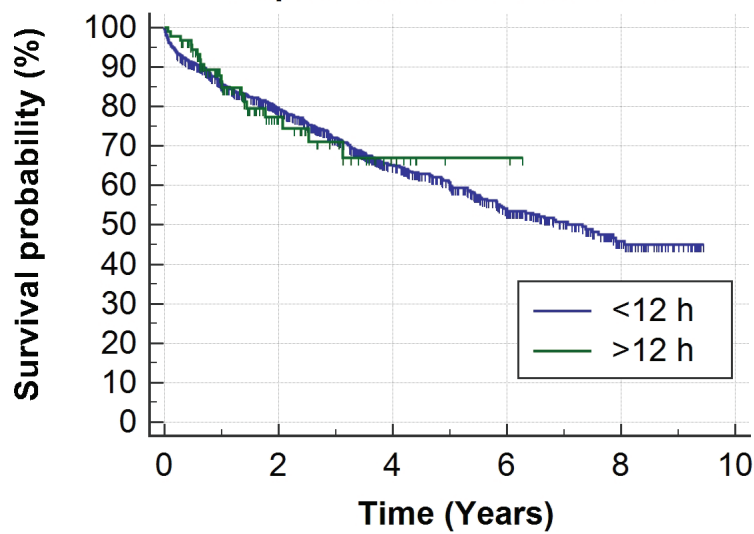
Distribution of Preservation Times >12 hours



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B

Kaplan-Meier Survival Curve



Conclusions: Extension of preservation time using EVLP does not negatively impact early lung transplant outcomes. This data supports safe transplantation of lungs preserved for more than 12 h.

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49. Providing Cardiothoracic Services in 2035: Signs of Trouble Ahead

*Susan Moffatt-Bruce, *Juan Crestanello, David Way, *Thomas Williams

The Ohio State University, Columbus, OH

Invited Discussant: *John S. Ikonomidis

Objective: As the population ages, we will present the reality around being able to meet the needs of our population. In particular, we will present that providing cardiothoracic (CT) services in 2035 with a shortage of surgeons and an unknown caseload may be an impossibility

Methods: Using data from the American Board of Thoracic Surgery (ABTS) we estimate that in 2010 4,000 CT surgeons did more than 530,000 cases. Additionally, CT residency programs train and certify on average 90 new surgeons every year. To estimate the number of cases for 2035 we consulted the Census Bureau figures for 2010 and projections for 2035. In 2010 we had a population of 310,233,000 of which 40,229,000 were 65 and older. In 2035 we will have a population of 389,531,000 of which 77,543,000 will be 65 and older, representing a significant increase in the population 65 years and older. Fifty percent of the heart surgery cases will be done on those under 65 years of age; and fifty percent will be done on those 65 and older. For lung cancer the figures are 30% under 65 and 70% on those 65 and older. For esophageal surgery, the figures are 37% under 65 and 63% over 65. To calculate the caseloads we multiplied the cases in 2010 by the percentage increase in population and by the ratio of under 65 and over 65. For instance, in heart surgery on those under 65 we multiply 291,410 by 1.155 and then by 50% (or .5) and get 168,289. For those over 65 we multiply 291,410 by 1.928 and then by 50% (or .5) and get 280,919. We add both ages and get a total of 449,208 cases for 2035. We completed the same calculations for lung and esophageal cancers.

Results: In 2010 our surgeons did more than 530,000 cases. By 2035 there will be 853,947 cases to do, an increase from 2010 to 2035 of 61% nationally. The cases per surgeon per year in 2010 averaged 135 for almost 4,000 surgeons. In 2035 the average caseload per surgeon will be 299 cases representing an increase of 121% for the individual surgeon. This is unmatched by the number of surgeons we are training and certifying every year.

Conclusions: By 2035 CT surgeons will be responsible for more than 850,000 patients needing surgery, representing a 61% increase in the national case load and a potential for a 121% increase for each CT surgeon. We feel this is not feasible and a sign of a problem that must be addressed head on so to increase the number of those successful trained and willing to increase their case volume in a time of value-based care.

11:40 AM Honored Guest Lecture

Hall E, BCC
Not for Credit

Brian Kelly, *Notre Dame Head Football Coach*

12:30 PM Adjourn for Lunch in the Exhibit Hall

12:45 PM – 1:35 PM

Cardiac Studies in Progress

Exhibit Hall, AATS CT Theater II, Booth #181

5 minute presentation, 7 minute discussion

Not for Credit

Chair: *Thomas G. Gleason

Panelists: *John S. Ikonmidis and *J. Michael DiMaio

LB5. The COMMENCE FDA Clinical Trial: A Benchmark for Isolated Aortic Valve Replacement in Low Risk Patients

*John D. Puskas¹, *Joseph E. Bavaria², *Lars G. Svensson³, *Eugene H Blackstone³, *Bartley P. Griffith⁴, *James S. Gammie⁴, David A. Heimansohn⁵, Jerzy Sadowski⁶, Jacek Rozanski⁷, ♦Douglas R. Johnston³, *Leonard N. Girardi⁸, *Charles T. Klodell⁹, Mubashir M. Mumtaz¹⁰, Francis G. Duhay¹¹, *Craig R. Smith¹²

¹Mount Sinai Beth Israel, New York, NY; ²University of Pennsylvania, Philadelphia, PA;

³Cleveland Clinic Foundation, Cleveland, OH; ⁴University of Maryland, Baltimore, MD;

⁵St. Vincent Heart Center, Indianapolis, IN; ⁶Jagiellonian University, Krakow, Poland;

⁷Instytut Kardiologii Warsaw, Poland; ⁸New York Weill Cornell Medical Center, New York, NY;

⁹University of Florida, Gainesville, FL; ¹⁰Pinnacle Health, Harrisburg, PA; ¹¹Edwards Lifesciences, Irvine, CA; ¹²Columbis Presbyterian Medical Center, New York, NY

LB6. One Year Clinical Outcomes After Rapid Deployment Aortic Valve Replacement – FOUNDATION REGISTRY: A Real World Series of 518 Patients

*Mattia Glauber¹, Günther Laufer², Alfred Kocher², Mauro Cassesse³, Marco Solinas⁴, Francesco Alamanni⁵, Gianluca Polvani⁵, Bruno Podesser⁶, Jose Ignacio Aramendi⁷, Jose Arribas⁸, Olivier Bouchot⁹, Ugolino Livi¹⁰, Rainald Seitelberger¹¹, Kim Terp¹², Christophe Giot¹³, Christopher Young¹⁴

¹Hospital San Raffaele, Milano, Italy; ²Allgemeines Krankenhaus Wien, Wien, Austria;

³Casa di Cura Santa Maria, Bari, Italy; ⁴Ospedale Del Cuore, Massa, Italy; ⁵Centro Cardiologico Monzino, University of Milan, Milano, Italy; ⁶Landeskrankenhaus St. Pölten,

St. Pölten, Austria; ⁷Hospital Universitario de Cruces, Barakaldo, Spain; ⁸Hospital Universitario Virgen de La Arrixaca, Murcia, Spain; ⁹CHU du Bocage, Dijon, France;

¹⁰University Hospital Santa Maria della Misericordia, Udine, Italy; ¹¹Salzburger Universitätsklinikum, Salzburg, Austria; ¹²Aarhus University Hospital Skejby, Aarhus,

Denmark; ¹³Edwards Lifesciences, Nyon, Switzerland; ¹⁴St. Thomas' Hospital, London,

United Kingdom

LB7. Operative Strategies to Reduce Cerebral Embolic Events During Coronary Artery Bypass Surgery: A Prospective Randomized Trial

*Michael E. Halkos¹, Aaron Anderson¹, Jose Binongo¹, Anthony Stringer¹,

*Vinod H. Thourani¹, Omar M. Lattouf¹, *Robert A. Guyton¹, Kim T. Baio¹, Eric Sarin¹,

William B. Keeling¹, N. Renee Cook¹, Katherine Carssow¹, Alexis Neill¹, *John D. Puskas²

¹Emory University, Atlanta, GA; ²Mount Sinai Beth Israel Hospital, New York, NY

LB8. A Prospective Study of External Stenting of Saphenous Vein Grafts to the Right Coronary Artery: The VEST II Study

*David P. Taggart, Jasmina Djordjevic, Sanaz Amin, E.K. Oikonomou, Sheena Thomas, A.M. Kampoli, Nik Sabharwal, Andrew Kelion, Keith Channon, Charis Antonaides, George Krasopoulos

University of Oxford, Oxford, United Kingdom

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12:45 PM – 2:00 PM

Moderated Poster Competitions

5 minute presentation

Exhibit Hall, Aisle 600, BCC

Not for Credit

Adult Cardiac Moderated Poster Competition

Moderator: *Richard Lee, *St. Louis University*

P1. The IMPACT-CABG Trial: A Multicenter Randomized Clinical Trial of CD133+ Stem Cell Therapy During CABG for Ischemic Cardiomyopathy

*Terrence M. Yau¹, Samer Mansour², *Richard Weisel¹, Louis-Mathieu Stevens², Katherine Tsang¹, Eric Larose², Shu-Hong Li¹, Neil Spiller¹, Minh Quan Vu², Andrew Crean¹, Denis-Claude Roy², Ignacio Prieto², Ren-Ke Li¹, Nicolas Noiseux²

¹Toronto General Hospital, Toronto, ON, Canada; ²Hospital Hotel-Dieu, Montreal, QC, Canada

Objective: The IMPACT-CABG trial (NCT01033617) is the first North American multicenter phase I/II randomized study of autologous CD133+ stem cell delivery in patients with ischemic cardiomyopathy (LVEF 25–45%) undergoing CABG. The primary objective of the trial was to demonstrate safety, including freedom from major adverse cardiac events (MACE), with a secondary objective to evaluate feasibility of a same-day autologous cell preparation protocol. While the trial was not powered to evaluate LV function, exploratory data was also collected.

Methods: After an initial 5 (Center A) or 2 (Center B) open-label patients who received cells, patients were randomized in a 2:1 (Center A, N = 15) or 1:1 (Center B, N = 18) ratio to receive stem cells or placebo (N = 40 total, 20 in each center). Patients underwent preoperative stress echo and stress perfusion MRI. All patients had 100–150 cc of bone marrow aspirated on the morning of surgery, from which CD133+ cells were isolated. After bone marrow aspiration, patients were randomized to receive CD133+ cells or placebo in a double-blinded fashion. After completion of the distal coronary anastomoses, the cell preparation containing up to 10 million CD133+ cells or placebo was injected in 10–15 sites into the infarct and border zone as identified by preoperative MRI. Patients were followed up clinically and underwent repeat echocardiography and stress perfusion MRI 6 months postoperatively.

Results: Patient demographics, intraoperative data and hospital outcomes are presented in Table 1 for all 40 patients. Same-day autologous stem cell isolation procedures yielded cell preparations meeting release criteria in all patients randomized to cell delivery. There were no procedural complications at the time of cell injection. There was no in-hospital mortality. No patient had a perioperative MI, 4 had renal failure, one had a superficial wound infection and one had a seizure. During the 6-month follow-up period, one patient died from a pulmonary embolus. Pre-operative and 6 month postoperative MRIs revealed that LVEDV and LVESV were reduced, and LVEF increased, in all groups, but the magnitude of these changes did not differ between patients receiving CD133+ cells or placebo (Table).

Baseline Characteristics	Center A	Center B
Patients (N)	20	20
Age (years)	64.1 ± 8.1	65.5 ± 6.6
Male gender (%)	80%	95%
BMI	26.9 ± 4.5	30.1 ± 5.4
Hypercholesterolemia (N, %)	14 (93.3%)	18 (90%)
Currently smoking (N, %)	6 (40%)	3 (15%)
Hypertension (N, %)	11 (73.3%)	17 (85%)
Diabetes mellitus (N, %)	8 (40%)	9 (45%)
Previous stroke (N, %)	4 (20%)	2 (10%)
Peripheral vascular disease (N, %)	6 (30%)	5 (25%)
Recent MI (<6 months) (N, %)	7 (35%)	6 (30%)
Old MI (>6 months) (N, %)	13 (65%)	6 (30%)
Atrial fibrillation (N, %)	2 (10%)	3 (15%)
Renal insufficiency (N, %)	1 (5%)	2 (10%)
Anemia (N, %)	2 (13.3%)	8 (40 %)
Parsonnet	5.0 ± 2.5	5.1 ± 2.5
EuroScore	3.2 ± 1.5	4.6 ± 2.5
NYHA class III-IV symptoms (N, %)	15 (75%)	14 (70%)
CCS class	2.9	2.9
LVEF (echo) (mean±SD)	37.3 ± 4.5 %	39.8 ± 7.9 %
LVEF (MRI) (mean±SD)	37.6 ± 5.4 %	36.2 ± 5.9 %
<u>Intraoperative</u>		
Incomplete revascularisation	0 (0%)	4 (20%)
Crossclamp (min)	52 ± 12	76 ± 18
Cardiopulmonary bypass (min)	69 ± 20	96 ± 19
Number of puncture sites (mean)	14.4	12.5
<u>Outcomes</u>		
Hospitalisation time (days)	7.7 ± 3.1	9.8 ± 3.2
ICU stay (days)	1.9 ± 1.9	3.4 ± 2.4
In-Hospital Mortality	0	0
MI	0	0
Acute renal failure	2	2
Return for bleeding	0	0
Transfusions	2	7
Atrial Fibrillation	7	15
Infection	0	1
Stroke	0	0
Seizure (%)	1	0
Change in LVEDV (all cell pts)	-23.3±42.2	P=0.9
Change in LVEDV (all placebo pts)	-25.7±24.3	
Change in LVESV (all cell pts)	-24.7±36.4	P=0.5
Change in LVESV (all placebo pts)	-32.9±25.1	
Change in LVEF (all cell pts)	+6.2±8.0	P=0.2
Change in LVEF (all placebo pts)	+10.0±7.2	

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Conclusions: This multicentre randomized double-blinded clinical trial of intramyocardial delivery of CD133+ stem cells for chronic ischemic cardiomyopathy successfully met both primary and secondary objectives, demonstrating that same-day isolation and autologous CD133+ cell delivery with CABG is safe and feasible, with no protocol-related complications. The trial was not powered to evaluate changes in LV function, but LV volumes and EF were improved in both groups. The upcoming IMPACT-CABG 2 trial will evaluate higher cell doses and pharmacological augmentation of autologous cells to determine whether CD133+ stem cells improve perfusion and regional function.

P2. Sternal Closure Using Rigid Plate Fixation Versus Conventional Wire Cerclage: Results from a Prospective, Randomized Multi-Center Study

*Keith B. Allen¹, *Vinod H. Thourani², *Yoshifumi Naka³, Kendra J. Grubb⁴, John Grehan⁵, Nirav Patel⁶, *T. Sloane Guy⁷, *Kevin Landolfo⁸, Marc Gerdisch⁹, Mark Bonnell¹⁰, *David J. Cohen¹

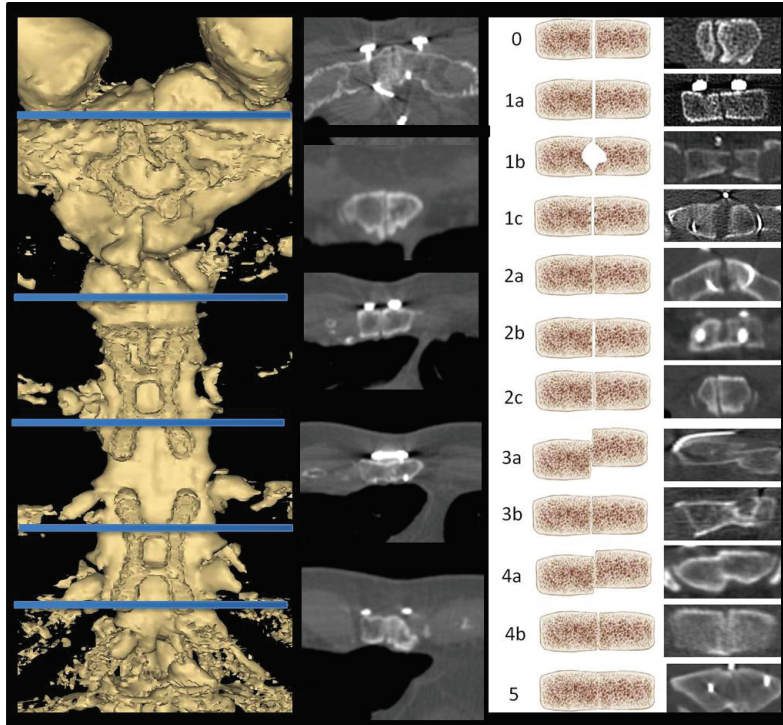
¹St. Luke's Mid America Heart Institute, Kansas City, MO; ²Emory University, Atlanta, GA; ³Columbia University Medical Center, New York, NY; ⁴University of Louisville, Louisville, KY; ⁵United Heart and Vascular Clinic, AllinaHealth, Saint Paul, MN; ⁶Lenox Hill Hospital, New York, NY; ⁷Temple University, Philadelphia, PA; ⁸Mayo Clinic, Jacksonville, FL; ⁹Franciscan St. Francis Health, Indianapolis, IN; ¹⁰University of Toledo, Toledo, OH

Objective: Rigid fixation is the primary method of stabilization for all fractures and osteotomies except sternotomies. We evaluated sternal healing and complications in patients undergoing cardiac surgery following sternal closure with rigid plate fixation (RPF) or wire cerclage (WC).

Methods: This prospective, single-blinded trial at 12 US centers (NCT01783483) enrolled patients undergoing elective cardiac surgery with a full sternotomy and randomized them at the time of sternal closure to either RPF or WC. The primary endpoint, sternal healing, was evaluated using computed tomography (Figure 1). Sternal complications were defined as any adverse event related to the method of sternal closure through 90 days and included deep and superficial wound infections as defined by the STS. Adjusted analyses were performed using linear and exact logistic regressions.

Results: Between March 2013 and June 2015, 236 patients were randomized to either RPF (n = 116) or WC (n = 120). At baseline, patients were well matched including pre and intra-operative risk factors for sternal complications. Operative times were similar between groups (5.5 ± 1.5 vs. 5.6 ± 1.3 hours; p = 0.62) but sternal closure times were shorter for WC (16.2 ± 9.0 min vs. 18.6 ± 9.1 min; p = 0.04). Three month CT scans were available for 87.9% (203/231) of eligible patients and demonstrated significantly better sternal healing scores in the RPF group as compared to WC group (2.6 ± 1.1 vs. 1.8 ± 1.0; p < 0.0001). Univariate predictors for worse sternal healing scores were sternal closure using WC (p < 0.0001), BMI (p = 0.009), diabetes (p = 0.01), and male gender (p = 0.02); multivariate predictors were WC (p < 0.0001), BMI (p = 0.007) and gender (p = 0.02). Rigid plate fixation resulted in fewer sternal complications [0% (0/116) vs. 5% (6/120); p = 0.03] and

a trend towards fewer sternal wound infections [0% (0/116) vs. 4.2% (5/120); $p = 0.06$] which included three deep and two superficial wound infections in the WC group. In an exact logistic regression model, sternal closure with WC was the only predictor of sternal complications (OR = 11.5; $p = 0.02$) and sternal wound infections (OR = 10.7; $p = 0.03$). Re-hospitalizations directly attributable to sternal complications resulted in an additional 94 days of hospitalization in the WC group, although index LOS was similar between RPF and WC (5.9 ± 2.5 vs. 5.8 ± 2.8 days; $p = 0.79$).



Sternal healing was independently evaluated using computed tomography by two core lab radiologists using a validated 6-point scale to score five *a priori* defined anatomic locations (higher score equals better healing).

Conclusions: This is the first randomized trial comparing rigid plate fixation to wire cerclage in patients undergoing elective cardiac surgery via a median sternotomy. At three months, sternal closure with rigid plate fixation resulted in improved sternal healing and fewer sternal complications compared to wire cerclage.

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P3. Trends in Multi-Arterial CABG Surgery 2004–2014: A Tale of Two Continents

*Thomas A. Schwann¹, *James Tatoulis², *John D. Puskas³, *David Taggart⁴,

*Paul Kurlansky⁵, *Jeffrey Jacobs⁶, *Vinod H. Thourani⁷, Sean O'Brien⁸, Amelia Wallace⁸, Milo Engoren⁹, Robert F. Tranbaugh¹⁰, Mark R. Bonnell¹, Robert H. Habib¹¹

¹University of Toledo, Toledo, OH; ²Royal Melbourne Hospital, Parkville, Australia;

³Mount Sinai Beth Israel, New York, NY; ⁴University of Oxford, Oxford, United Kingdom;

⁵Columbia University, New York, NY; ⁶Johns Hopkins University, Baltimore, MD; ⁷Emory

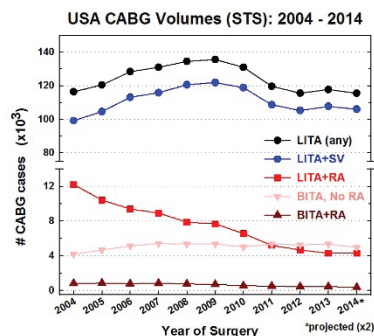
University, Atlanta, GA; ⁸Duke University, Durham, NC; ⁹University of Michigan, Ann

Arbor, MI; ¹⁰Cornell University, New York, NY; ¹¹American University of Beirut, Beirut,

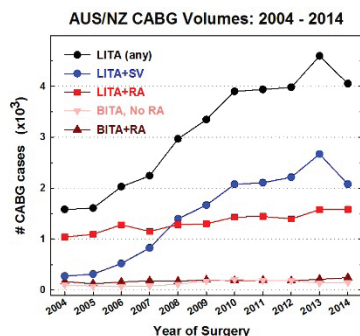
Lebanon

Introduction: Recent evidence shows that multi-arterial CABG (MABG) based on bilateral internal thoracic (BITA) or left internal thoracic (LITA) and radial artery (RA) improves long term outcomes compared to single arterial (LITA+SVG) grafting (SABG). How this evidence affected the worldwide use of MABG, if at all, is not well defined. Accordingly, we report 10 year temporal trends of MABG utilization from two continents.

Methods: A study population of 1,683,434 non-emergent, primary, isolated LITA based CABG (≥2 grafts) patients was derived from the Society of Thoracic Surgeons (STS) (1,307,528 (79.5%) of 1,644,388 isolated CABG; 1,179 centers) and the Australia New Zealand Cardiothoracic (ANZ) Databases (34,213 (87%) of 39,046 isolated CABG, 24 centers) between 2004–2014. Patients were excluded if no LITA, if arterial grafts other than radial artery (RA) or ITA, or if missing grafting data. The three MABG groups were: LITA+RA, BITA, BITA+RA. Grafting trends and their associated patient demographics were analyzed.



Year	#Hosp	LITA/SV %	LITA/RA %	BITA %	BITA/RA %
2004	620	85.2	10.5	3.6	0.7
2005	717	86.8	8.6	3.9	0.7
2006	798	88.1	7.3	4.0	0.6
2007	875	88.4	6.8	4.1	0.6
2008	948	89.6	5.8	4.0	0.6
2009	982	89.9	5.7	3.9	0.5
2010	1013	90.8	5.0	3.8	0.4
2011	1030	90.8	4.3	4.4	0.4
2012	1024	91.1	4.0	4.5	0.4
2013	1005	91.5	3.6	4.5	0.4
2014	1005	91.7	3.7	4.3	0.3



Year	#Hosp	LITA/SV %	LITA/RA %	BITA %	BITA/RA %
2004	6	17.3	65.8	6.3	10.6
2005	6	19.5	68.1	4.8	7.6
2006	6	25.6	63.2	3.5	7.7
2007	10	36.9	51.4	3.6	8.1
2008	16	47.1	43.3	3.8	5.8
2009	21	49.8	38.8	5.5	5.9
2010	24	53.2	36.7	5.3	4.8
2011	24	53.6	36.7	4.8	4.9
2012	24	55.6	35.2	4.6	4.6
2013	24	58.1	34.4	2.9	4.6
2014	24	51.4	39.0	3.6	6.0

Results: SABG (89.3% STS, 51.4% ANZ) was the most common grafting strategy. MABG was most frequently accomplished by LITA+RA: (6.1%; STS, 22.1%; ANZ), followed by BITA: (4.1%; STS, 4.3%; ANZ), while ≥ 3 (BITA+RA) was rare in the STS (0.5%), but more common in ANZ (5.9%). In the STS, between 2004–2014, SABG rates systematically increased from 85.2% to 91.7%, BITA grafting was essentially unchanged from 3.6% to 4.3%, while RA use decreased systematically from 10.5% to 3.7%. In the ANZ, SABG rates increased from 17.3% to 51.4%, BITA grafting decreased from 6.3% to 3.6%, while RA grafting decreased from 65.8% to 39.0%. [Fig/Table] Compared to SABG patients, BITA patients were younger (STS; median age 59. vs 66, $p < 0.0001$, ANZ; mean age 62 vs 68, $p < 0.001$), more male (STS; 84% vs 73%, $p < 0.0001$, ANZ; 86% vs 79%, $p = 0.001$), $p30 \text{ kg/m}^2$ in STS (37% vs 42%, $p < 0.0001$), more obesity in the ANZ (33% vs 32%, $p = 0.001$) and less diabetes (STS; 26% vs 43%, $p < 0.0001$, ANZ; 25% vs 37%, $p < 0.001$) while RA patients were intermediate in age (STS; 61, ANZ; 65], in male sex (STS; 82%, ANZ; 81), in the prevalence of diabetes (STS; 40%, ANZSCTS; 34%), and were most obese (STS; 47%, ANZ; 34%).

Conclusion: A decade long analysis of STS reveals a counter intuitive declining use (driven by decreasing RA use) of MABG: a potentially superior grafting strategy compared to SABG. In contra distinction, ANZ documents a distinctly different CABG practice pattern, with a higher MABG utilization rate and a proportional decrease in RA use. The reasons for these practice patterns and declining MABG use is unclear.

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P4. The Risk of Reoperative Cardiac Surgery in Radiation Induced Valvular Disease

Julius I. Ejiogor, Anju Nohria, Yamine Maroun, Siobhan McGurk, Anthony V. Norman, *Sary F. Aranki, Prem Shekar, *Lawrence H. Cohn, Tsuyoshi Kaneko
Brigham and Women's Hospital, Boston, MA

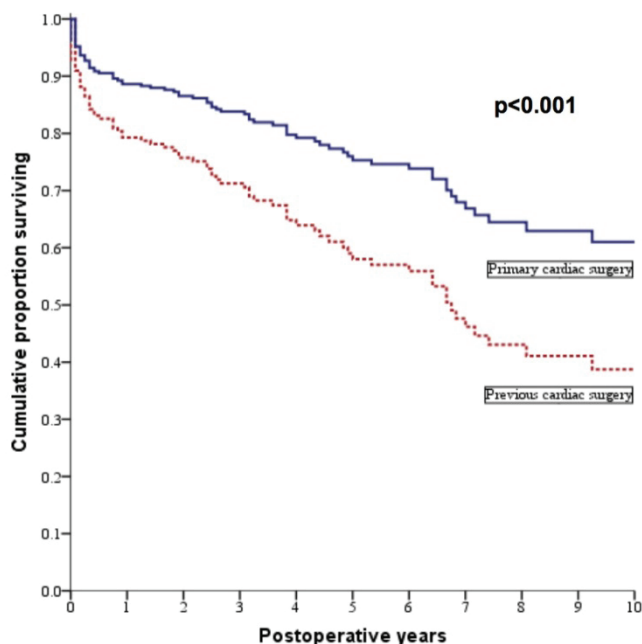
Objective: Mediastinal radiation is a risk factor for poor outcomes after cardiac surgery and is not incorporated in the STS risk algorithm. We hypothesized reoperative valve surgery in the setting of previous mediastinal radiation would be associated with substantially worsened postoperative outcomes.

Methods: We reviewed patients who underwent valve surgery between January 2002 and March 2015; 261 (2.7%) of 9659 patients had prior mediastinal radiation. Outcomes of interest included postoperative complications, length of stay (LOS) and survival. Findings were compared to a post-hoc control cohort of non-irradiated patients, matched on STS risk score, demographic and operative data.

Results: Mean age was 62.7 years (± 12.7) and 174/261 were females. The most common indications for mediastinal radiation were Hodgkins lymphoma (126/261) and breast cancer (94/261). Overall, 47 patients (18%) had reoperative and 214 (82%) had primary procedures. Reoperative patients had more renal insufficiency (12.8% vs 4.2% $p = 0.034$), peripheral vascular disease (PVD) (27.7% vs 9.3%, $p = 0.002$) previous stroke (6.4% vs. 0.9%, $p = 0.042$) and were more likely to be in NYHA class III/IV (57.4% vs 36.0%, $p = 0.008$). A total of 202/261 (77.4%) patients had aortic valve replacements (79% of primary vs. 68% of reoperative patients, $p = 0.12$). Reoperations had longer median cardiopulmonary bypass (248 min vs

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131 min) and cross-clamp times (145 min vs 92 min) (both $p \leq 0.001$). Operative mortality was 17% (8/47) for reoperative vs. 3.7% (8/214) for primary patients ($p = 0.003$) with a higher rate of operative room take-backs (8.5% vs 1.9%, $p = 0.037$). Reoperative patients had longer median ventilation times (20.3 hrs vs 7.0 hrs), ICU stays (122 hrs vs 51 hrs) and LOS (15d vs 7d), (all $p \leq 0.001$). Cox proportional hazard modeling [Figure] revealed that reoperative status (HR = 1.92, 95% CI 1.14–3.22, $p = 0.012$), diabetes (HR = 2.14, 95% CI 1.31–3.59, $p = 0.002$), and PVD (HR = 1.99, 95% CI 1.17–3.40, $p = 0.013$) affected survival. Operative mortality for reoperative patients in the matched non-irradiated controls was 2.6%, the odds ratio (OR) for reoperative status for irradiated cases was 7.937 (95% CI = 2.618–24.390, $p \leq 0.001$). Thus, compared to matched non-irradiated reoperative controls, the excess OR of operative mortality conferred by radiation was 5.40 (95% CI 1.91–15–23, $P = 0.002$).



Conclusions: Valvular heart patients with mediastinal radiation had significantly increased operative mortality. Reoperation in these patients poses significantly higher risk of operative mortality than is associated with reoperative status in matched patients without prior radiation. Careful patient selection is important and other approaches such as transcatheter approach may be considered.

P5. Prosthesis Selection in Patients Undergoing Mitral Valve Repair for Type II Dysfunction

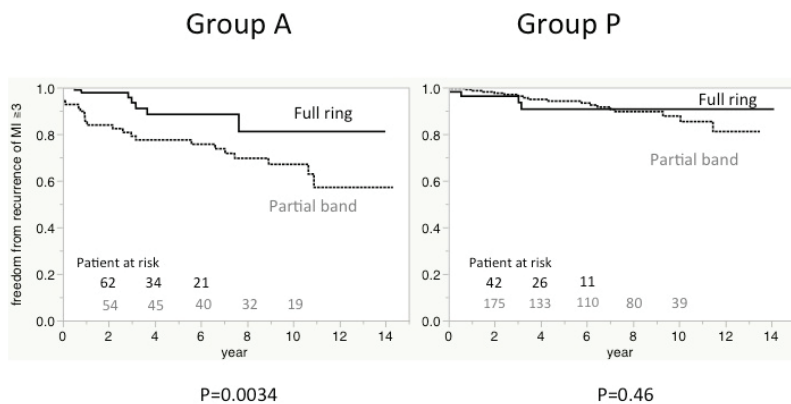
Naonori Kawamoto, Tomoyuki Fujita, Hiroki Hata, Yusuke Shimahara, Yuta Kume,
*Junjiro Kobayashi

National Cerebral and Cardiovascular Center, Suita, Japan

Objective: In patients with severe mitral insufficiency (MI) due to type II dysfunction, prosthesis selection for mitral valve repair is a matter of concern. This study aims to analyze the impact of prosthesis selection on long term outcomes in patients undergoing mitral valve repair for type II dysfunction.

Methods: This study was a retrospective cohort study at single institution. We reviewed 452 patients (298 male, median 61 years, range 19–84 years) with MI who underwent mitral valve repair for type II dysfunction between 2001 and 2014. Of these, 167 patients (Group A) presented anterior leaflet prolapse and 284 (Group P) presented posterior prolapse. Full rings were applied in 95 patients of Group A and 55 of Group P, and partial bands were applied in 72 of Group A and 229 of Group P. Serial follow-up echocardiography evaluated valve function. MI was graded from 0 to 4.

Freedom from recurrence of MI \geq grade 3



Results: Follow-up rate was 99%. The 30-day mortality was 0.2% and the survival rate at 10-year was 90.6% in Group A and 89.5% in Group P (p = 0.25). Postoperative NYHA was significantly improved from 1.88 to 1.02 (1.03 in Group A, 1.01 in Group P, p = 0.28). Postoperative echocardiography presented MI grades were significantly improved similarly in both group (0.63 in Group A, 0.76 in Group P, p = 0.35). Follow-up echocardiography revealed that recurrent MI were detected in 58 patients, and the regurgitant jet were from medial orifice in 34 (59%), middle in 22 (38%) and lateral in 21 (36%). There were 21 patients who required reoperation, due to hemolysis in 11, heart failure in 10 and infective endocarditis in 1. A 10-year freedom from recurrence of MI (grade = 3 or greater) was lower in Group A (74.2%

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and 87.6%, $p < 0.01$) and a 10-year freedom from reoperation was lower in Group A (84.9% and 96.2%, $p < 0.01$). In the Group A, a 10-year freedom from recurrence was lower in patients with partial band (81.1% with full ring, 67.0% with partial band, $p < 0.01$), although there were no significant difference in Group P (Figure). There were no significant differences in freedom from reoperation between partial band and full ring for both group.

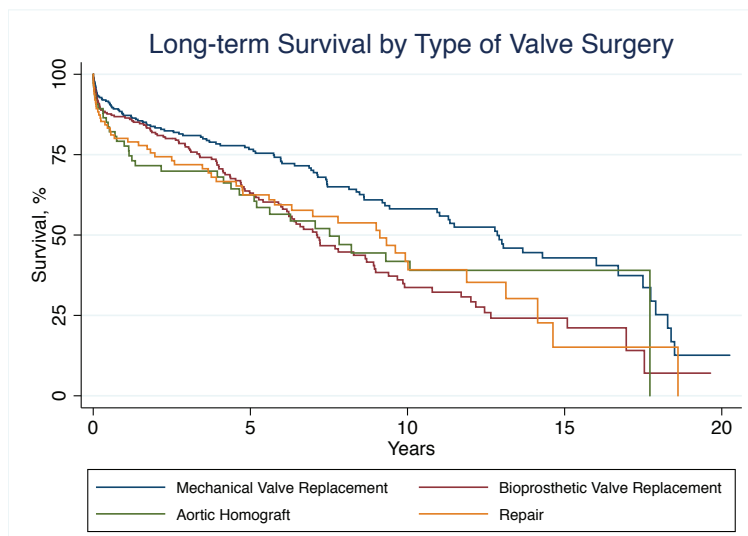
Conclusion: Mitral valve repair using partial band or full ring provided similar clinical and echocardiographic outcome in patients with posterior lesion. However, more recurrence was observed in patients with partial band used for anterior lesion. Thus, full ring is recommended in patients with anterior lesion.

P6. Long-Term Outcomes of Surgery for Infective Endocarditis: A Single-Center Experience of 801 Patients

Sameh M. Said, Zaid M. Abdelsattar, *Hartzell V. Schaff, ♦Kevin L. Greason,
*Richard C. Daly, *Alberto Pochettino, *Lyle D. Joyce, *Joseph A. Dearani
Mayo Clinic, Rochester, MN

Objective: To review the short- and long-term outcomes for adult patients undergoing surgery for endocarditis and identify risk factors for early and late mortality.

Methods: We reviewed the clinical and operative characteristics of all patients undergoing valve surgery for infective endocarditis between Jan 1995 and Dec 2013 from a prospectively maintained database. We used multiple logistic regression, Kaplan-Meier survival analyses and Cox proportional hazards models to identify risk factors associated with early and late mortality.



Results: In total, 801 patients (586 [73%] males, mean age \pm SD = 60 ± 14.7 years) underwent surgery for endocarditis. Of those, 372 (46.4%) had native valve endocarditis. Most patients (71%) had single valve involvement, with the aortic valve (49%) being the most commonly affected. Preoperative stroke was present in 149 (19%), and 62 (8%) were on dialysis prior to surgery. Valve repair was possible in 122 (15%). Mechanical valves were used in 312 (39%) patients, and aortic homografts were used in 84 (11%) patients. The 30-day mortality rate was 8%. On multivariable analysis, active endocarditis (adjusted odds ratio [aOR] = 2.7, $p = 0.002$), postoperative dialysis (aOR = 4.0, $p0.2$). With a mean follow-up of 5 ± 4.8 years (max = 20 years) the overall survival at 5-, 10-, and 20-years was 68%, 45%, and 8%, respectively. In the Cox model, need for dialysis (adjusted Hazard Ratio [aHR] = 4.4, $p < 0.001$), previous CABG (aHR = 2.0, $p < 0.001$), mitral valve surgery (aHR = 1.7, $p = 0.002$) and tricuspid/multiple valve involvement (aHR = 1.8, $p < 0.001$) were associated with worse survival. Mechanical valves were associated with the best long-term survival when compared to valve repair, bioprosthesis and homografts (Figure, $p = 0.001$).

Conclusions: In this large series, we identified several risk factors for early and late mortality after valve surgery for endocarditis. Preoperative stroke was not associated with perioperative mortality, and mechanical valves were associated with the best long-term survival.

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P7. Mid-Term Results of Mitral Valve Repair Using Flexible Bands Versus Complete Rings in Patients with Degenerative Mitral Valve Disease: A Prospective Randomized Study

Alexander V. Afanasyev, Alexander V. Bogachev-Prokophiev, Sergei I. Zheleznev, Vladimir M. Nazarov, Ravil M. Sharifullin, Alexander M. Karas'kov

Novosibirsk State Research Institute of Circulation Pathology, Novosibirsk, Russian Federation

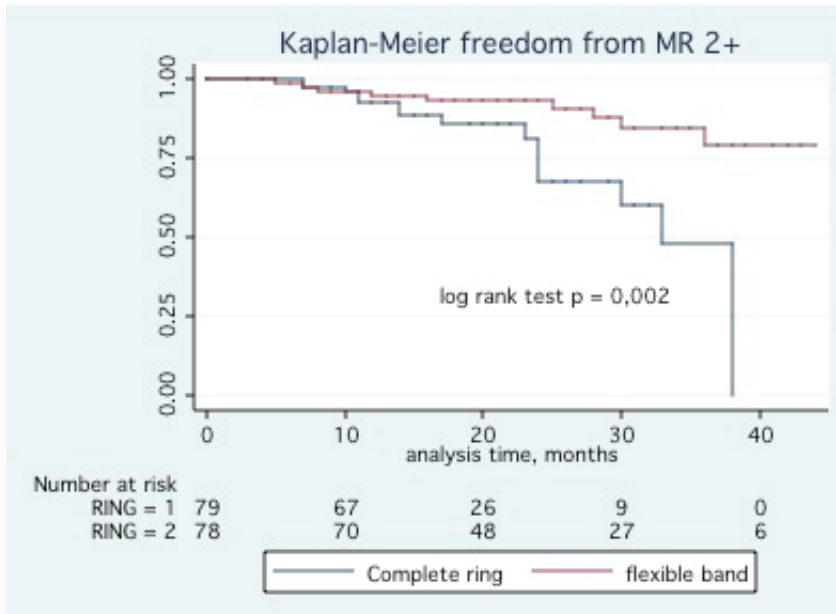
Objective: The aim of this study was to compare flexible bands and complete rings for mitral valve repair in patients undergoing mitral valve repair for degenerative mitral valve disease.

Methods: Since 2011 through 2014, 186 consequently patients underwent mitral valve surgery for degenerative mitral valve disease. Patients were randomly assigned to receive complete ring (group I, $n = 93$) or undergo mitral valve repair with flexible band (group II, $n = 93$). Fifteen patients who had undergone replacement because of failure of initial repair were excluded in per-protocol study, and 171 patients were analyzed (complete ring group, $n = 85$; flexible ring group, $n = 86$). Mean age was 57 (42;65) and 54 (41;63) years for the complete and flexible ring groups, respectively. There was no significant difference between the two groups in baseline characteristics and preoperative echocardiography. Intention-to-treat and per-protocol analysis were used to avoid bias.

Results: There were no early mortalities. Mean follow up was 24.7 (95% CI 23.5;27.0) months. Actuarial survival at mean follow up was $97.2 \pm 2.0\%$ and $94.3 \pm 2.8\%$ of patients in group I and II respectively (log rank test 0.411). The left

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ventricular end-diastolic diameter, left ventricular end-systolic diameter, and left atrial size were significantly decreased in both groups and didn't differ between groups. However, there were higher transmitral peak (8.5 (6.9;11) vs 6 (4.4;8.3) mm Hg, $p < 0.001$), mean (3.7 (2.5;4;1) vs 2.8 (1.9;3.5) mm Hg, $p = 0.001$) pressure gradients and systolic pulmonary artery pressure (34.5 (28;41) vs 29.5 (23;33) mm Hg, $p < 0.001$) in complete ring group (measured in sinus rhythm patients). The 2-year freedom from recurrence of significant mitral regurgitation (grade 2+) was $80,8 \pm 6,5\%$ in the complete ring group and $92,8 \pm 3,1\%$ in the flexible group (log rank test 0.002; ITT-log rank test 0.012). Independent prognostic factor for recurrence of mitral regurgitation (Cox regression analysis) was residual mild to moderate mitral regurgitation revealed by intraoperative transesophageal echocardiography. The 3-year freedom from reoperation was $90,3 \pm 6,8\%$ and 100% respectively (log rank test 0.044; ITT-log rank test 0.031).



Conclusions: Patients with degenerative mitral valve disease may benefit of the valve repair with flexible bands. Residual mitral regurgitation is independent risk factor for late insufficiency recurrence.

P8. A Predictive Model for Early Outcome of Surgical Treatment of Heart Valve Infective Endocarditis: The Italian EndoSCORE

Michele Di Mauro, Guglielmo M. Actis Dato, Pasquale Santè, Fabio Barili, Sandro Gelsomino, Alessandro Della Corte, Antonio Carrozza, Ester Della Ratta, Carlo Fino, Diego Cugola, Roger Devotini, Riccardo Casabona, *Francesco Santini, Roberto Scrofani, Carlo De Vincentiis, Andrea Biondi, Cesare Beghi, Alberto Pozzoli, Francesco Nicolini, *Davide Pacini, Giacomo Ravenni, Roberto Lorusso, Gabriele Di Giammarco, Daniele Marinelli, Emmanuel Villa, Giovanni Troise, Domenico Paparella, Vito Margari, Francesco Tritto, Giuseppe Scarscia, Salvatore Zaccaria, Attilio Renzulli, Giuseppe Serraino, Giovanni Mariscalco, *Alessandro Parolari, Giannantonio Nappi
Italian Group of Research for Outcome in Cardiac Surgery (GIROC), Rome, Italy

Objective: The aim of the present retrospective study is to build a risk score model to predict early mortality in patients with heart valve infective endocarditis (IE) undergoing surgical treatment.

Methods: From 1979 to 2014, 2823 patients with endocarditis were admitted to 19 Cardiac Surgery Centers to be operated: 2244 (79%) on native valves, 521 (19%) on heart valve prostheses and in 58 (2%) cases on both native valves and prostheses. Mean age was 69 ± 9 with gender ratio (F:M = 832:1991). A parsimonious risk model was built using logistic binary regression where target endpoint was 30-day mortality for all causes. Preoperative and surgical variables were tested with univariate analysis (T-test, Mann-Whitney U test, Chi-Square). Those variables with $p < 0.2$ were included into the initial model. The final model was obtained with a stepwise procedure to achieve high fitting (Hosmer-Lemeshow test $p > 0.05$) and good calibration (ROC curve: area under curve, $AUC > 0.75$). Then, the final model was internally validated in 1000 bootstrap samples. The characteristic of predictive model were reported as β -coefficient, bootstrap distortion of β -coefficient, standard error, odds ratio (OR) 95% confidence limits and p-value. Finally an additive score was realized stratifying the risk on the basis of OR; the logistic score model was built using the value of β -coefficient.

Results: Early mortality was 12%. The final model is summarized in the Table 1. Hosmer-Lemeshow chi-square was 7.9 ($p = 0.45$); AUC was 0.78 (Figure 1). At bootstrapping, all the p-value were still below the significant level and the amount of distortion was very low. The entire cohort was stratified in 3 groups of risk: low risk (0–3) 1182, medium risk (4–6) 1093 and high risk (>6) 548.

No statistical significance was found between observed (obs) and expected (exp) mortality in low-risk cohort (4.5% obs vs 4.2% exp, $p = 0.75$), in medium-risk cohort (10.2% obs vs 8.2% exp, $p = 0.10$) and in high-risk (29.4% obs vs 25.4% exp, $p = 0.12$).

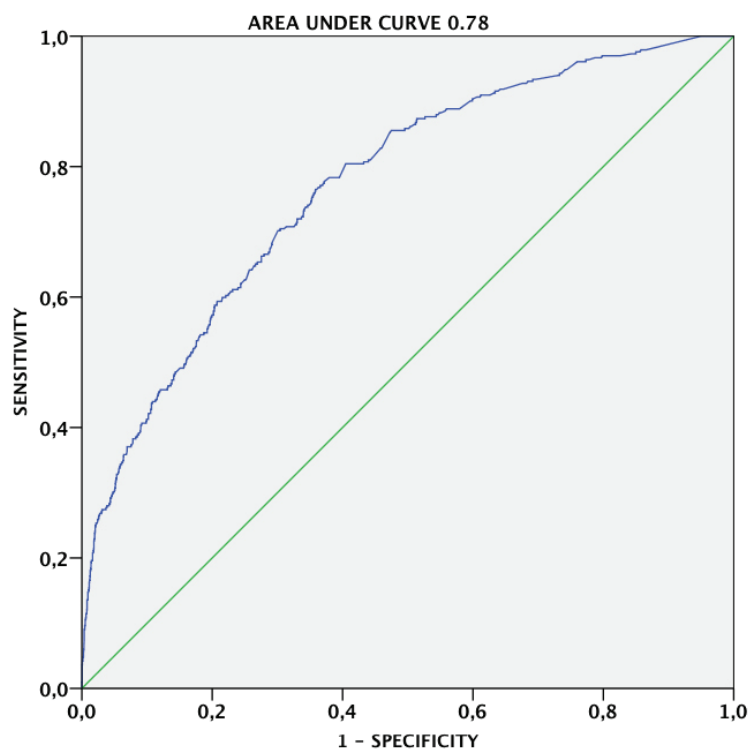
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Table: The Final Model of EndoSCORE

Variables	B Coefficient	Bootstrap Distortion	Standard Error	P-Value	Or	95 Lower Limit	95 Upper Limit	Score Value
Age Class	0,47	0,005	0,17	<0,001	1,60	1,15	2,23	1
60–69 yrs	0,90	-0,001	0,16	0,005	2,45	1,79	3,37	2
70–79 yrs	1,32	-0,003	0,26	<0,001	3,73	2,25	6,19	3
≥80 yrs	0,41	-0,003	0,13	<0,001	1,51	1,17	1,96	1
				0,002				
Female Gender	0,41	-0,003	0,13	0,002	1,51	1,17	1,96	1
EF (Continuous)	-0,02	0,000	0,01	0,004	0,98	0,97	0,99	EF 31–50 1 EF ≤ 30 3
Copd	0,88	0,004	0,22	<0,001	2,41	1,57	3,70	2
CRF (Creatinine >2.0 Mg/Dl)	0,65	-0,002	0,20	0,001	1,92	1,29	2,84	2
Preoperative Shock	1,44	0,000	0,16	<0,001	4,24	3,07	5,85	4
Number of Treated Valves	0,37	0,001	0,16	<0,001	1,45	1,07	1,96	2
Two Valves	1,74	-0,022	0,38	0,02	5,70	2,71	12,00	4
Three Valves				<0,001				
Abscess	1,58	0,024	0,23	<0,001	4,84	3,09	7,59	4
Reoperation	0,58	0,009	0,14	<0,001	1,78	1,36	2,34	2
Constant	-2,43	-0,021	0,35	<0,001	0,09			

Legend. Yrs = Years; EF = Ejection Fraction; COPD = Chronic Obstructive Pulmonary Disease; CRF = Chronic Renal Failure; Or = Odds Ratio



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Conclusions: To the best of our knowledge, this is the first risk model (both additive and logistic) to predict early mortality in patients with heart valve IE undergoing surgical treatment. This model has been developed from a very large registry including 35 years of surgery for IE. It has good fit and calibration. Waiting for an external validation, the model showed a good internal validation.

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P9. A Single Center's Experience with Pacemaker Implantation After the Cox Maze Procedure for Atrial Fibrillation

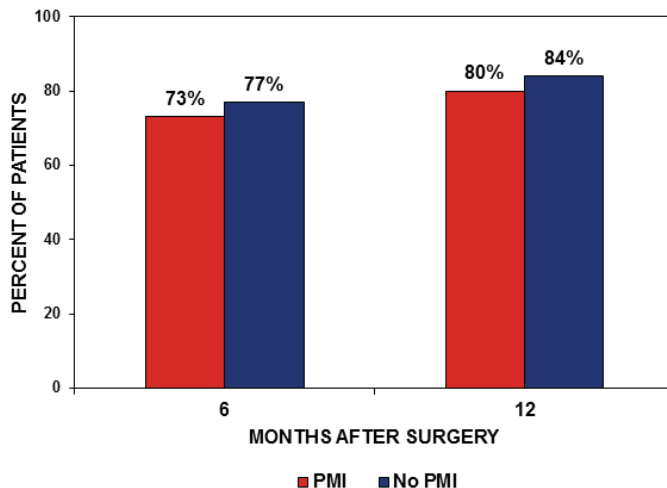
*Niv Ad, Sari Diana Holmes, Deborah J. Shuman, Deborah Lamont

Inova Heart and Vascular Institute, Falls Church, VA

Objective: The Cox maze procedure (CM), performed appropriately, is a safe and effective treatment for all atrial fibrillation (AF) types. A recent CTSN randomized trial found alarming rates of pacemaker implantation (PMI) during hospitalization of CM patients. The purpose of this study was to assess the rate of PMI and its impact on success after CM.

Methods: The incidence of PMI was captured for all patients who had CM (2005–2015; N = 831) with or without other cardiac procedures. Pre- and postoperative data were collected prospectively. Multivariate logistic regression was conducted to determine the predictors for PMI, including age, AF duration, left atrium (LA) size, AF type, type of procedure, and surgery year. For patients since 2011, propensity score matching was conducted between patients who had concomitant CM and patients who did not have surgical ablation to examine in-hospital incidence of PMI.

Results: Fifty-two patients (6.3%) had in-hospital PMI after CM. The most common primary indication for PMI was sick sinus syndrome (67%), followed by complete heart block (23%) and sinus bradycardia (10%). Patients who had two or more concomitant valve procedures had the highest total incidence of PMI (PMI = 12%). A rate of 3% PMI was recorded for patients who had isolated CM. The only predictor for in-hospital PMI was type of procedure ($P = 0.019$); patients who had multiple valve procedures were at greater risk than all other categories (OR = 2.21–8.70, $P < 0.05$). STS-defined perioperative outcomes for patients with PMI were similar to those for patients without in-hospital PMI. Return to sinus rhythm off antiarrhythmic drugs did not differ by PMI (Figure). After propensity score matching to simulate randomization and balance covariates ($n = 292$ in each group), the incidence of in-hospital PMI was similar in patients who had concomitant CM and those who did not have surgical ablation (6% vs. 4%, $P = 0.261$).



Conclusions: PMI was not associated with increased morbidity or inferior rhythm outcome after CM. When CM is performed appropriately, the incidence of PMI is much lower than recently reported, even in more complicated multiple valve procedures. Matched-sample evidence suggests that adding CM is not associated with excess PMI risk. Efforts to increase surgeon training and experience with CM, particularly during complicated concomitant procedures, are warranted to minimize adverse outcomes, including PMI.

P10. Permanent Pacemaker After Surgical and Catheter Atrial Fibrillation Ablation: Incidence, Indications and Outcomes

Stephane Leung¹, Wai Sang¹, *Patrick M. McCarthy¹, Jane Kruse², Adin-Cristian Andrei², Adam Iddriss¹, *Richard Lee³, *S. Chris Malaisrie¹, Rachel Kaplan¹, Rod S. Passman¹

¹Northwestern University, Chicago, IL; ²Bluhm Cardiovascular Institute, Northwestern Medicine, Chicago, IL; ³St. Louis University School of Medicine, St. Louis, MO

Objective: Permanent pacemaker (PPM) after surgical atrial fibrillation ablation (SAF) is not uncommon and often is attributed to preexisting sick sinus syndrome (SSS). Similar rates, however, are not observed following catheter AF ablation (CAF). Spontaneous recovery of sinus and/or AV nodal (AVN) function has been reported, suggesting transient dysfunction not the unmasking of underlying conduction disease, but this has not been carefully studied. We sought to determine the frequency and risk factors for PPM after SAF and CAF, and investigate rhythm recovery in follow-up.

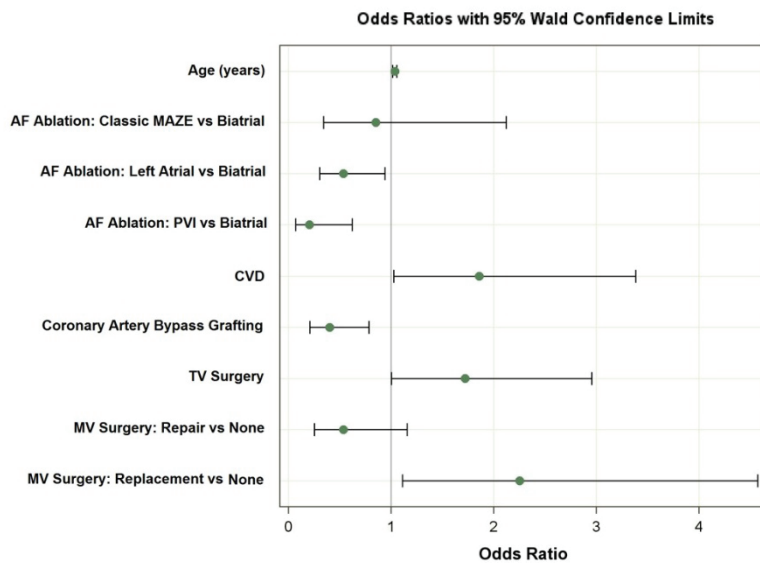
Methods: Analyses of prospectively maintained databases of patients undergoing SAF and CAF at a single institution were performed. Univariate and multivariate predictors of the primary endpoint, need for PPM within 30 days of procedure, were examined. Long-term pacing dependency, defined as a non-paced heart rate <40 BPM 3 months post-implant, was determined from outpatient records.

Results: From 2004 through 2014, 968 patients (including 47% with persistent or longstanding persistent AF) underwent SAF and 519 patients underwent CAF (including 31% with persistent or longstanding persistent AF) from 2010 to 2014. In the SAF group 82 patients (8%) needed a new ppm (61% for AVN; 35% for SSS; and 4% for both) and none (0%) were required in the CAF group. Based on an internally validated multivariable logistic model (Figure 1) factors associated with lower odds of pre-discharge PPM after SAF were left atrial ablation (versus biatrial ablation) [0.54 (0.30, 0.94), $p = 0.032$], pulmonary vein isolation (versus biatrial ablation) [0.21 (0.07, 0.63), $p = 0.005$] and CABG [0.40 (0.21, 0.79), $p = 0.008$]. Greater odds of pre-discharge PPM implant after SAF were associated with age (years) [odds ratio (OR) 1.04, 95% confidence interval (CI) 1.01–1.06, p -value = 0.004], cerebrovascular disease (CVD) [1.86 (1.02, 3.39), $p = 0.042$], tricuspid valve surgery [1.72 (1.00, 3.00), $p = 0.049$] and mitral valve (MV) replacement (versus no MV surgery) [2.25 (1.11, 4.58), $p = 0.025$]. After SAF, rhythm recovery at 3 months in the AVN group was 59.5% (25/42) and in the SSS group, rhythm recovery was 84.5% (22/26; $p = 0.030$ between groups).

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Figure 1 Forest plot based on an internally-validated multivariable logistic regression model for pre-discharge permanent pacemaker among patients undergoing surgical atrial fibrillation ablation



Conclusions: PPM after SAF is common and its absence in the CAF group indicates that it is not primarily due to pre-existing SSS but rather is related to the surgical procedure itself. Rhythm recovery within 3 months is common, particularly for patients implanted for SSS. Modification of the surgical procedure, such as a limited use of biatrial lesions, and perhaps heart rate accelerating medications for select patients with slow junctional rhythm, may reduce the need for PPM and warrant further study.

P11. Cardiometabolic Syndrome in TAVR and SAVR

Lillian L. Tsai, Hanna A. Jensen, Jose . Condado, Yi Lasanajak, Omar M. Lattouf, Vasilis Babaliaros, Eric Sarin, Chandan Devireddy, Bradley Leshnower, James Stewart, *Edward Chen, Kreton Mavromatis, *Michael Halkos, Peter C. Block, *Robert A. Guyton, Patricia Keegan, Amy Simone, Jessica Forcillo, *Vinod H. Thourani
Emory University, Atlanta, GA

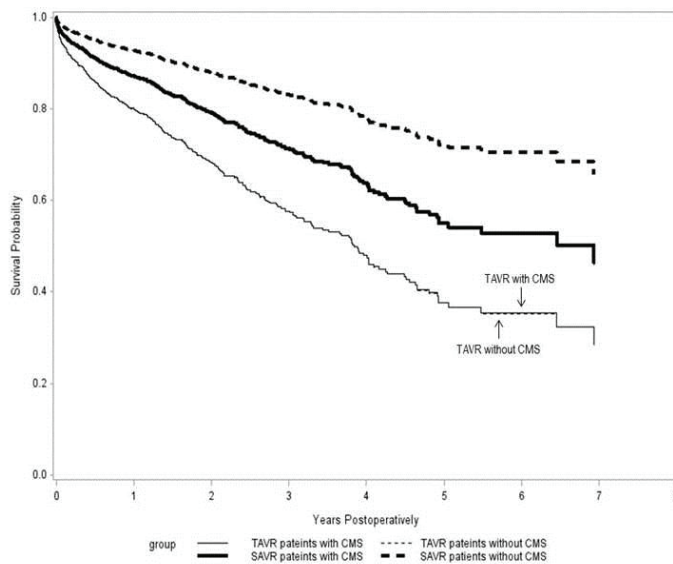
Objective: Cardiometabolic syndrome (CMS) is associated with increased risk of adverse post-operative events, accelerated deterioration of bioprosthetic valves, and reduced long-term survival after surgical aortic valve replacement (SAVR). This study aimed to determine if CMS has a differential effect on outcomes and survival after SAVR versus transcatheter aortic valve replacement (TAVR).

Methods: A retrospective review was conducted of all TAVR (n = 712) and SAVR (n = 1,444) cases at a US academic institution from 1/2007 to 12/2014. Patients were categorized by procedure type and presence of CMS and short-term clinical

outcomes were assessed. Long-term survival data were extracted from the Social Security Death Index or patient contact. Cox proportional hazard regression analysis was used to examine survival after adjusting using a propensity score.

Results: CMS was present in 308 (43%) TAVR and 432 (30%) SAVR patients. For both TAVR and SAVR, those with CMS had higher Society of Thoracic Surgeons Predicted Risk of Mortality scores, greater prevalence of pulmonary disease, previous myocardial infarction, and previous cardiac surgery compared to those without CMS. After adjustment, CMS was not associated with an increased risk of 30-day mortality in SAVR ($p = 0.93$) or TAVR ($p = 0.20$). The observed/expected 30-day mortality ratio was 0.4 for TAVR and 0.6 for SAVR in CMS patients, and the corresponding ratios were 0.3 for TAVR and 1.0 for SAVR in patients without CMS. However, patients with CMS who underwent SAVR had a higher long-term mortality compared to those without CMS (1.83 95% CI: (1.36, 2.45)). In contrast, long-term mortality in the TAVR cohort was similar in the CMS and non-CMS patients (0.999 95% CI: (0.76, 1.31), Figure).

Figure 1. Survival curves for TAVR and SAVR patients with and without CMS. TAVR patients CMS vs no CMS; HR 0.999(0.761, 1.31). SAVR patients CMS vs no CMS HR 1.827(1.361, 2.453).



Conclusions: A significant number of CMS patients are presenting for SAVR and TAVR. There is no increase in short-term mortality in CMS patients undergoing SAVR or TAVR. However, in those patients undergoing SAVR, CMS is an independent predictor of increased long-term mortality, whereas TAVR appears to risk-neutralize the impact of CMS on long-term mortality.

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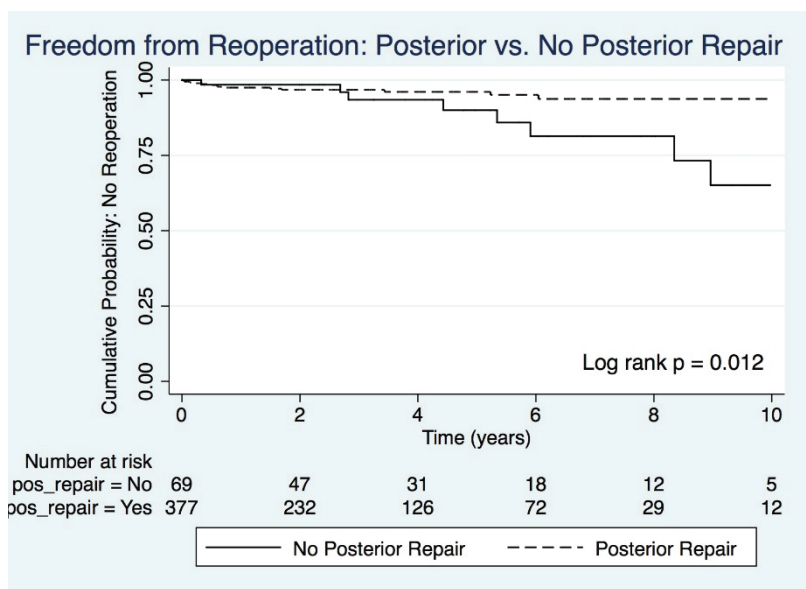
P12. Predicting Long-Term Outcomes After Complex Mitral Valve Repair: A Single Center 15-Year Experience

James M. Tatum, Michael E. Bowdish, Wendy J. Mack, Adrienne Quinn, Dawn Hui, Mark L. Barr, Fernando Fleischman, Amy Hackmann, *Craig Baker, *Robbin G. Cohen, Mark J. Cunningham, *Vaughn A. Starnes
University of Southern California, Los Angeles, CA

Objective: To evaluate long-term outcomes and risk factor modelling for recurrence of mitral regurgitation (MR) after complex mitral valve repair.

Methods: Between 5/1999 and 6/2015, 446 patients underwent complex mitral valve repair (age 60 ± 6.6 years, 66% male). 393 (88%) had degenerative or myxomatous valve disease. Repairs were isolated to the anterior leaflet in 69 (16%), posterior leaflet in 314 (70%), and involved both leaflets in 63 (14%). Ring annuloplasty was performed in 434 (97%). Posterior repairs were typically quadrangular resections and sliding valvuloplasty, while anterior repairs were usually neochords. Survival was confirmed with the Social Security Death Index. Mean follow up is 39 ± 17 months. Postoperative echocardiograms were obtained in 334 patients (75%) at a mean of 24.3 ± 13.7 months after repair. Kaplan-Meier analysis was used to assess overall survival, freedom from progression of MR by echocardiogram greater than 2 grades, and mitral valve reintervention. Cox-proportional hazard analysis was used to determine contributing factors.

Results: Overall survival was 98%, 96%, 94%, and 91% at 1, 3, 5, and 10 years. Freedom from mitral valve reoperation was 98%, 96%, 95% and 85% at 1, 3, 5, and 10 years. Freedom from recurrent MR > 2 grades over baseline was 96%, 90%, and 80% at 1, 3, and 5 years. Those undergoing a posterior repair had later recurrence of MR (log rank $p = 0.026$) and were less likely to undergo reoperation (log rank $p = 0.012$) (Figure). Freedom from composite endpoint of death, recurrence of mitral regurgitation >2 grades by echocardiogram, or need for mitral valve reintervention was 94%, 89%, 82%, and 67% at 1, 3, 5, and 10 years, respectively. Cox proportional hazard models identified age per 10 years (hazard ratio [HR]: 1.26, 95% confidence interval [CI]: 1.04, 1.53), previous cardiac surgery (HR: 2.43, CI: 1.14, 5.21), concomitant other valve surgery (HR: 2.16, CI: 1.17, 4.01), and anterior leaflet repairs (HR: 1.77, CI: 1.07, 2.92) as risk factors for the composite endpoint. Posterior leaflet repairs (HR: 0.47, CI: 0.28, 0.81), posterior leaflet pathology (HR: 0.44, CI: 0.24, 0.80), and higher ejection fraction (HR: 0.64, CI: 0.54, 0.77) were protective from the composite endpoint. On multivariate analysis higher age (HR 1.33, CI: 1.09, 1.62) was predictive for the composite outcome, while higher preoperative ejection fraction (HR: 0.67, CI: 0.56, 0.80) and posterior repair (HR: 0.35, CI: 0.20, 0.62) were protective.



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Conclusions: Complex mitral valve repair has excellent outcomes, however there are still patients in whom it fails. Failures occur less in the young, in those with higher preoperative ejection fractions and in those who need repair to the posterior leaflet. Our results suggests that valve replacement, as opposed to complex repair, may be preferable in older patients with a reduced ejection fractions and lack of posterior pathology.

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Congenital Heart Disease Moderated Poster Competition

Moderator: *Carl L. Backer, *Lurie Children's Hospital*

P14. Outcomes of Multistage Palliation of Patients with Single Ventricle and Atrioventricular Septal Defect

*[Bahaaldin AlSoufi](#), Courtney McCracken, Subhadra Shashidharan, *Kirk Kanter,

*Brian Kogon

Emory University, Atlanta, GA

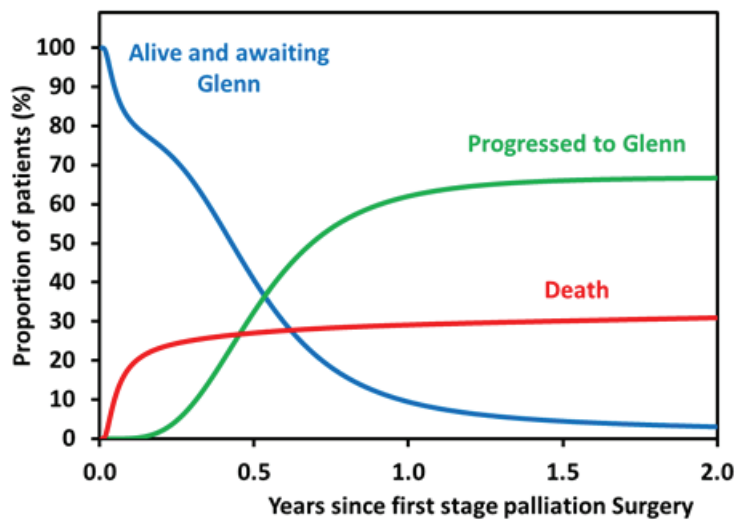
Objectives: Unbalanced atrioventricular septal defect (AVSD) represents less than 10% of single ventricle anomalies. Few reports focusing on multi-stage palliation outcomes of those patients exist in the literature and show poor survival that is inferior to that of hypoplastic left heart syndrome, in addition to high intervention rate for atrioventricular valve (AVV) regurgitation. We report recent results from our institution.

Methods: From 2002 to 2012, 80 infants with functional single ventricle and AVSD underwent multi-stage palliation. Competing risk analyses were performed to model events after first stage surgery (death, transition to Glenn) and after Glenn (death, transition to Fontan). Risk factors associated with outcomes were analyzed.

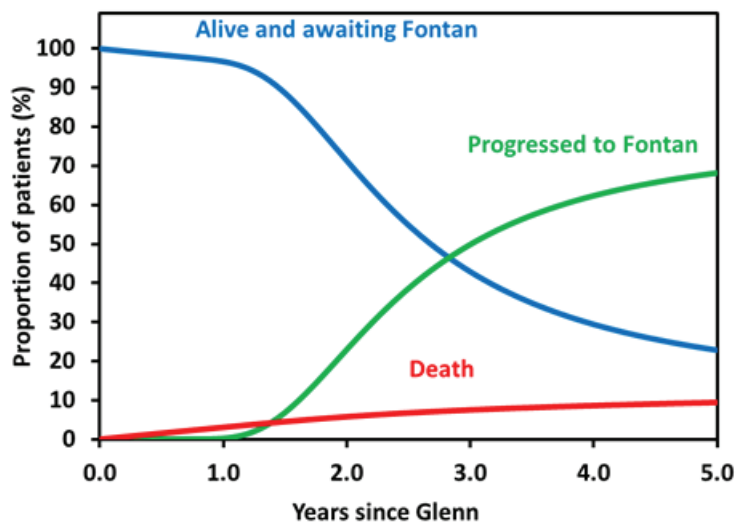
Results: Among the 80 patients in our cohort, the balance of the ventricles was 34% left-dominant and 66% right-dominant. Antegrade pulmonary blood flow was absent in 14 (18%), restricted in 29 (36%) and unrestricted in 37 (46%). Systemic outflow tract obstruction was evident in 26 (33%). Twenty-nine (36%) had total anomalous pulmonary venous connection (TAPVC, obstructed in 8/29). Extra-cardiac anomalies were common and present in 63 patients (79%). Sixty-eight patients (85%) required neonatal first stage palliation including modified Blalock-Taussig shunt (n = 33, 41%), Norwood (n = 20, 25%), pulmonary artery band (n = 15, 19%) while primary Glenn was the initial surgery in the remaining patients (n = 12, 15%).

Hospital mortality occurred in 15 patients (19%). By 2 years after first stage surgery, 68% had Glenn and 32% had died. Risk factors for death without Glenn included concomitant TAPVC repair (HR = 8.5 (2.1–34.3), $p < 0.001$) and extra-cardiac lesions (HR = 3.6 (0.4–33.8), $p = 0.036$). By 5 years after Glenn, 68% had Fontan, 9% had died, and 23% remained alive awaiting Fontan. Overall survival following initial surgery was 63% at 8 years (53% after shunt, 63% after Norwood, 52% after band and 100% after primary Glenn). Concomitant TAPVC repair (HR = 2.3 (1.0–5.2), $p < 0.001$), extra-cardiac lesions (HR = 2.0 (0.5–7.5), $p = 0.08$), and neonatal palliation (HR = 1.3 (0.5–3.1), $p = 0.05$) were associated with overall death.

At initial presentation, AVV regurgitation was \geq moderate in 14 patients (18%). Freedom from AVV repair or replacement was 75% at 5 years with 72% of patients with AVV regurgitation \geq moderate progressing to AVV intervention or death.



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Conclusions: Patients with functional single ventricle and AVSD are a distinct group with the common presence of additional cardiac and extra-cardiac lesions. Those lesions are associated with increased early mortality risk following first stage palliation surgery. Several patients develop progressive AVV regurgitation requiring surgical intervention at initial palliation or subsequent follow up. The management of those patients continues to be challenging and associated with low mid-term survival.

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P15. Cognitive, Neuropsychological and Social Status Is Impaired Two Decades After Neonatal Arterial Switch Operation

David Kalfa¹, Leila Kasmi², Michele Montreuil², Nikoleta Geronikola², Virginie Lambert³, Eleonora Murzi², *Emre Belli⁴, Damien Bonnet⁵

¹Columbia University, New York, NY; ²Université Paris, Saint Denis, France; ³Université Paris Sud, Le Plessis Robinson, France; ⁴Institut Jacques Cartier, Massy, France;

⁵Université Paris Descartes, Sorbonne Paris Cité, Paris, France

Objective: Neuropsychological and psychosocial outcomes in adults who underwent neonatal open-heart surgery still need to be investigated. The objective is to determine the neuropsychological and psychosocial outcomes of adult patients who had a neonatal arterial switch operation (ASO) for Transposition of the Great Arteries (TGA) and determine factors associated with pejorative outcomes.

Methods: Sixty-seven adults (>18 year-old) with operated d-TGA with or without ventricular septal defect (22.9 ± 3.3 years) and 43 healthy adults (23.8 ± 2.8 years) were matched in age, gender and socio-cultural level. The neuropsychological outcome was evaluated using Wechsler Adult Intelligence Scale (WAIS- III), Wisconsin Card Sorting test and California Verbal Learning test. The psychosocial outcome and quality of life were assessed using Mini International Neuropsychiatric Interview, SF-36 health survey and Qolibri.

Results: TGA patients had overall IQ scores within the normal range. But the mean scores of full-scale IQ, verbal IQ and performance IQ scores were significantly lower in TGA patients (94.9 ± 15.3 ; 96.8 ± 16.2 ; 93.7 ± 14.6 respectively) than in healthy subjects (103.4 ± 12.3 ; 102.5 ± 11.5 ; 103.7 ± 14.3 respectively). Working Memory Index (91.6 ± 14.4), Perceptual Organization Index (93.1 ± 15.9) and Processing Speed Index (95.4 ± 13.9) were also significantly lower than normal. TGA patients showed poorer performance in 8/13 WAIS-III subtests evaluating attentional capacities, visuospatial abilities and executive functions. They also had more depression (46.3% (n = 31) vs. 20.9% (n = 9), p = 0.007) and social phobia (23.9% (n = 16) vs 7% (n = 3), p = 0.022). Although the presence of cognitive or psychosocial deficits was significantly associated with a poorer quality of life, TGA patients have an overall good quality of life. Lower parents' educational level, longer aortic clamping time and the absence of prenatal diagnosis were significantly associated with lower patient's IQ (p < 0.001), altered episodic memory (p = 0.021) and working memory (p = 0.023) respectively.

Conclusion: Adults who underwent neonatal ASO for TGA appear to present an increased risk of cognitive, psychological and social impairments. An early identification of emerging difficulties could be helpful.

P16. Univentricular Pathway for Severe Neonatal Ebstein Anomaly and Tricuspid Dysplasia Is Superior to Total Biventricular Approach at Late Follow-Up

Jack Luxford¹, Nitin Arora², Julian Ayer², Charlotte Verrall², *Yves D'Udekem³, Gary Sholler², David Winlaw²

¹University of Sydney, Sydney, Australia; ²Children's Hospital at Westmead, Sydney, Australia; ³The Royal Children's Hospital, Parkville, Australia

Objectives: This study reviewed our 30-year experience of surgical and medical management of symptomatic neonates presenting with Ebstein anomaly or tricuspid dysplasia.

Methods: Between January 1985 and September 2015, we managed 78 neonates with Ebstein anomaly and 19 with tricuspid dysplasia. Their medical and surgical records were reviewed, and available neonatal echocardiogram re-assessed. Ebstein anomaly was confirmed where the septal leaflet was displaced more than 8 mm/m², whilst tricuspid dysplasia involved variable forms of valve dysplasia, without displacement. Primary outcome measures were early and late survival, freedom from re-operation and functional status.

Nine patients with Ebstein anomaly from a bi-national Fontan Registry were combined with the 3 who achieved Fontan in the current study to assess single-ventricle outcomes. Primary outcome measures were survival post-Fontan and functional status.

Results: Median age at presentation was one day old. Pulmonary atresia was present in 25 and critical pulmonary stenosis in 5. Thirty-nine (40%) patients required intervention: 17 received systemic-to-pulmonary (SP) shunts, 7 underwent balloon pulmonary valvotomy, 5 had right ventricular outlet tract obstruction relief (2 with a SP shunt), 4 underwent a Starnes, and 4 had other surgical procedures. Tricuspid dysplasia was associated with higher rates of pulmonary atresia (10, 53%; $p = 0.006$), prostaglandin infusion (15, 83%; $p = 0.008$), and neonatal intervention (12, 63%; $p = 0.027$), than Ebstein anomaly.

Early survival was 81% (79/97); 86% (67/78) for Ebstein anomaly and 63% (12/19) for tricuspid dysplasia ($p = 0.043$). One, 5, and 15-year survival estimates (with standard error) were 74% (4.5), 70% (4.8) and 64% (5.9). Fifteen-year survival estimate was 42% (9.8) for those in whom a biventricular repair was achieved, and 58% (18.9) for those who achieved a '1.5' or single ventricle pathway ($p = 0.043$). Fifteen-year survival estimate was improved from 51% (7.7) for those managed before 2000, to 81% (5.8) for those after ($p = 0.004$). In early survivors managed initially with two ventricles, freedom from re-operation at 10 years was only 22%. Functional status for long-term survivors was New York Heart Association (NYHA) class I/II for 97%.

In the 12 patients who have undergone Fontan completion there were no early deaths, and 10-year survival estimate was 88% (12). At recent follow-up, 10 (91%) of survivors were in NYHA class I/II.

Conclusions: Tricuspid dysplasia represents a more severe neonatal pathology than Ebstein anomaly. Intention to preserve a biventricular anatomy confers a higher mortality than early or late commitment to a single ventricle pathway. The single ventricle pathway should be considered in more severe cases, particularly those with pulmonary atresia or severe pulmonary stenosis.

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P17. Detrimental Effects of High Flow Mechanical Assistance of Systemic Ventricle in a Fontan Circulation-Insights from a Unique Ex-Vivo Model

Pranava Sinha¹, Nina Deutsch¹, Dingchao He¹, Mark Nuskowski¹, Erin Montague¹, Gerald Mikesell¹, Karthik Ramakrishnan¹, Edem Ziadinov¹, David Zurakowski²,
*Richard Jonas¹

¹Children's National Medical Center, Washington, DC; ²Harvard Catalyst, Boston, MA

Objective: We have previously demonstrated the efficacy of the 'Pull Strategy' in supporting a Fontan Circulation by mechanical assistance of the systemic ventricle in a large animal model. While mechanical assistance of the systemic ventricle may be helpful in a failing Fontan secondary to ventricular failure, higher flows with a ventricular assist device (VAD) may be detrimental, due to elevation of central venous pressure (CVP) and transpulmonary gradient (TPG). We sought to identify the effects of increasing systemic VAD flows on total cardiac output, CVP and TPG with differing preloading conditions, using a unique *ex-vivo* model of the Fontan circulation.

Methods: An *ex-vivo* model of the Fontan Circulation was created by connecting a 45 kg porcine systemic ventricle to simulated systemic vascular resistance (perfusion tubing using C clamps) and simulated lung (membrane oxygenator) in series. A centrifugal pump was attached to the circuit as a systemic VAD with atrial inflow and aortic outflow. Conditions I [no preload modulation-mean left atrial pressure responsive to VAD decompression, isovolemic circuit] and II [preload modulation-mean left atrial pressure maintained at 15 mmHg] were tested. Native cardiac output, VAD flow, total cardiac output, TPG, CVP and coronary blood flow (CBF) were measured. Conditions I & II were compared by two-way mixed model ANOVA, with pump RPMs as repeated measures and the F-test to compare slopes.

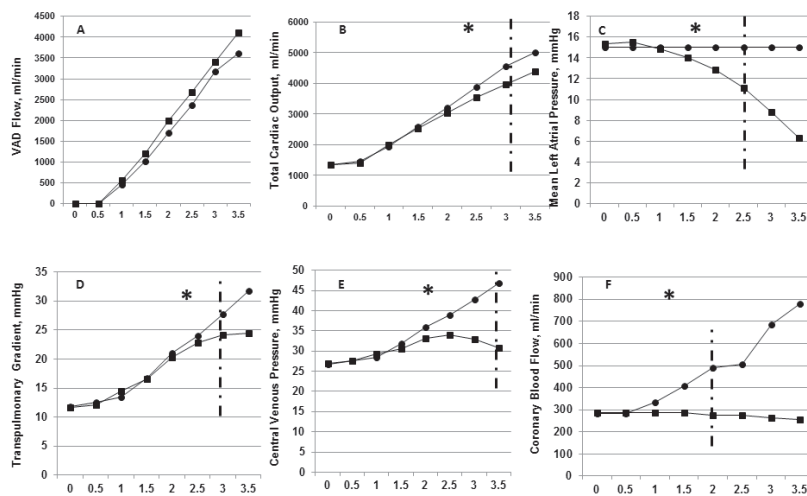


Figure 1: Effects of mechanical assistance of systemic ventricle in conditions I- No Preload Modulation, II- Preload Modulation.
A- Ventricular Assist Device (VAD) Flow, B-Total Cardiac Output, C Mean Left atrial pressure, D- Transpulmonary Gradient, E-Central Venous Pressure, F- Coronary Blood Flow
X Axis- Pump RPM X 1000
* Statistically significant differences between Conditions I & II
Vertical Dotted lines represent the inflexion point between conditions I & II.

■ Condition I- No Preload Modulation
● Condition II- Preload Modulation

Results: A significant increase in TPG was seen with higher pump RPM (Rotations Per Minute) in both conditions. The rise in TPG was faster in condition II ($F = 4.7$, $P < .001$). A rise in the CVP was seen with both conditions with increasing VAD RPM, however reduced LAP with increasing pump RPM blunted the rise in CVP in condition I at lower flows ($F = 14.6$, $P < .001$). Similar VAD flows were achieved with both conditions, however higher native cardiac output at higher RPM led to an overall higher total cardiac output in condition II ($F = 2.6$, $P = .02$). A significant increase in CBF was observed in condition II with increasing VAD RPM whereas CBF remained unchanged in condition I ($F = 59.5$, $P < .001$). (Figure 1).

Conclusions: High flow systemic ventricular assistance with VADs (Pull Strategy) can paradoxically increase the CVP and transpulmonary gradient in a Fontan circulation. Low flow assistance in a low preload situation may be the preferred strategy for supporting a failing systemic ventricle in a Fontan patient. The *ex-vivo* Fontan model allows easy and versatile testing of conditions optimal for mechanically supporting a Fontan circulation.

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P18. Long-Term Results of Anatomical Correction for Congenitally Corrected Transposition of the Great Arteries: A 19-Year Experience

Christian P. Brizard, Alice Lee, Tyson A. Fricke, *Yves d'Udekem, *Igor E. Konstantinov, Johann Brink, Michael M.H. Cheung
Royal Children's Hospital, Parkville, Australia

Objective: To review the long-term results of a policy of anatomical correction for congenitally corrected transposition of the great arteries (ccTGA) using one of the 3 procedures: double switch (DS) (Senning and arterial switch operation), Senning and Rastelli (SR) or Senning and Bex-Nikaidoh (SBN).

Methods: Retrospective, single institution study of all patients (pt) who underwent one of the 3 procedures between June 1996 and August 2015.

Results: Thirty-two pt underwent anatomical correction at a median age of 1.9 years (range 0.1 to 13.5). There were 21 DS (65.6%), 6 SBN (18.8%) and 5 SR (15.6%) performed. Eight pt received a sutureless Senning modification after 2012. One international pt was lost to follow-up, leaving 142.73 pt. year of follow-up for 31 pt. There were 4 deaths: one early (neurological complication) and 3 late: (2 congestive cardiac failure, 1 pulmonary hypertension). Freedom from reoperation was 95.7%, 65.6% and 49.2% at 1, 5 and 10 years, respectively. Seven pt had a Senning revision (2 early, 5 late). Median follow-up time is 4.7 years (range 0.1 to 17.8). One pt required a heart transplant 7 months after surgery. Of the remaining 25 pt, left (LV) and right ventricular function was normal in 18 (72.0%) and 23 (92.0%) pt, respectively. Previous pulmonary artery band (PAB) was related to late LV dysfunction ($p = 0.021$). The risk of LV dysfunction at follow-up increased with age at surgery (OR = 1.403, 95%CI 1.023–1.924, $p = 0.036$). Postoperatively, the degree of tricuspid regurgitation improved or remained stable except in one pt ($p = 0.003$). Two pt (1 DS, 1 SR) had a change from no aortic regurgitation pre-operatively to moderate or greater at late follow-up. Two pt had early aortic valve (AV) replacement and one had an early AV repair. Previous PAB was correlated with the

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need for AV surgery or neo-AV regurgitation moderate or greater ($p = 0.014$). Senning pulmonary venous baffles were mildly obstructed in 2 (8.0%) pt (one received an early Senning revision) but no pt with the Senning modification have obstruction or required revision. No SR pt had obstructed conduits. Overall, 7 (21.9%) pt required a pacemaker due to the development of iatrogenic AV block (4 DS, 2 SBN, 1 SR) with no difference across the 3 surgery types. At last follow-up, 23 (92.0%) pt were in NYHA class I, one in class II and one in class III.

Conclusions: Anatomical correction provides excellent haemodynamic outcomes in 70% of our patients. Continuous technical improvement should reduce the significant need for reoperations. The PAB may damage the neo-aortic valve and provide inadequate LV training. DS may be safer in infancy than later in life with PAB training. The Senning modification provides stable venous pathways. Surgery without need for LV training has better long-term LV function. The risk of iatrogenic AV block remains a significant challenge. Ongoing surveillance is required to monitor functional status over time.

P19. Re-Intervention Type and Rates Following Neonatal Tetralogy of Fallot (TOF) Repair Vary by Operative Intervention on the Right Ventricular Outflow Tract (RVOT)

Shyamasundar Balasubramanya, Michele J. Borisuk, Aditya K. Kaza, *Frank Pigula, Hua Liu, Sitaram Emani, *Pedro J. del Nido, Christopher W. Baird
Boston Children's Hospital, Boston, MA

Objective: The goal of this single-center series following neonatal repair of Tetralogy of Fallot (TOF) was to assess outcomes, differences in re-intervention and to identify independent predictors of re-intervention.

Methods: Data was retrospectively collected for 55 patients undergoing TOF repair with pulmonary stenosis (PS) or pulmonary atresia (PA) under 33 days of age from January 2005 to September 2015. Kaplan-Meier estimation and Cox proportional hazards regression methodologies were employed.

Results: Median age and weight at repair were 15 days (IQR, 9–23) and 2.9 kg (IQR, 2.5–3.6). Diagnosis was TOF/PS in 43 patients (78%) and TOF/PA in 12 patients (22%). Median pulmonary valve annulus diameter was 45 mm (Z-score -2.6) and RVOT gradient was 50 mm Hg. Operative approach on the right ventricular outflow tract (RVOT) was transannular patch (TAP) in 36 (65%; median age 14 days) and valve sparing repair in 19 (35%, median age 16 days). Median follow-up was 3.8 years (IQR, 1.1–7.0). Overall survival was 98% with one early death. Early (<6 months) RVOT re-intervention (Table 1) occurred in 15% of patients and was higher in patients having a valve-sparing approach (26%) vs. TAP (6%) (Hazard ratio 4.3, P value = 0.028). Median time to RVOT re-intervention (73 vs. 109 days) was also shorter in valve sparing patients. The median number of total RVOT re-interventions per patient was 2 (range, 1–5). RVOT re-intervention was not associated with gender, age, PV annulus, RVOT gradient or TAP. The only identifiable independent risk factor for RVOT re-intervention was weight ($P = 0.011$). Late pulmonary valve replacement occurred in 18% of patients and was higher in TAP patients (22% vs. 11%, Hazard ratio = 2.0, $P = 0.602$). Other re-interventions included left pulmonary artery (15), right pulmonary artery (6) and tricuspid valve repair (1).

	All patients	Valve sparing	TAP	Hazard Ratio	P value
Patients (n=)	55	19	36		
TOF/Pulmonary stenosis	43 (78%)				
TOF/Pulmonary atresia	12 (22%)				
Median age at initial repair (days) (IQR)	15 (9-23)	16 (12-28)	14 (6-23)		
Median weight at initial repair (kg) (IQR)	2.9 (2.5-3.6)	3.4 (2.5-3.9)	2.9 (2.5-3.3)		
Early (<6 months) RVOT re-intervention (n=)	7 (13%)	5 (26%)	2 (6%)	4.3	*0.028
Cath	6	4	2		
Surgery	1	1	0		
Median (days) to re-intervention (IQR)	73 (63-344)	73 (57-111)	109 (37, 180)		1.0
Late PVR (n=)	10 (18%)	2 (11%)	8 (22%)	2	0.285
Median (days) to PVR (IQR)	1239 (599-2392)	933 (876, 989)	1897 (403-2400)		0.602

Conclusions: Complete neonatal TOF repair in patients with pulmonary stenosis and atresia have excellent early outcomes. Smaller patients and those undergoing a valve-sparing approach had more than a 4-fold greater risk of early RVOT re-intervention while those undergoing TAP had a trend towards more late pulmonary valve replacements. Valve sparing repair can be performed safely in small patients; however, they are at an increased risk for early RVOT re-interventions.

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P20. Twenty-Five Year Outcomes of the Lateral Tunnel Fontan Procedure

Thomas G. Wilson¹, William Y. Shi¹, Ajay J. Iyengar¹, David S. Winlaw², Rachael L. Cordina³, Gavin R. Wheaton⁴, Andrew Bullock⁵, Thomas L. Gentles⁶, Robert G. Weintraub¹, Robert N. Justo⁷, Leeanne E. Grigg⁸, Dorothy J. Radford⁹, *Yves d'Udekem¹

¹Royal Children's Hospital, Parkville, Australia; ²The Children's Hospital at Westmead, Sydney, Australia; ³Royal Prince Alfred Hospital, Sydney, Australia; ⁴Women's and Children's Hospital, Adelaide, Australia; ⁵Princess Margaret Hospital for Children, Perth, Australia; ⁶Starship Children's Hospital, Auckland, New Zealand; ⁷Mater Children's Hospital, Brisbane, Australia; ⁸Royal Melbourne Hospital, Parkville, Australia; ⁹The Prince Charles Hospital, Brisbane, Australia

Objective: To identify specific late outcomes of the lateral tunnel Fontan procedure.

Methods: The outcomes of all patients who underwent a lateral tunnel Fontan procedure in Australia and New Zealand were analysed. Original files were reviewed and outcomes data were obtained through a binational Registry. Late failure of the Fontan circulation was defined as death, transplantation, Fontan conversion/revision/takedown, NYHA class III/IV or protein-losing enteropathy.

Results: Between 1980 and 2014, a total of 301 patients underwent a lateral tunnel Fontan procedure across 6 major centres. There were 13 hospital mortalities (4%), 24 late deaths, 8 Fontan conversions/revisions, 8 Fontan takedowns and 4 heart transplantations. Survival at 15 and 25 years was 90% (95% confidence inter-

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val [CI]: 86–93%) and 80% (95% CI: 69–91%), respectively. Protein-losing enteropathy or plastic bronchitis was observed in 14 patients (5%). Freedom from Fontan failure at 15 and 25 years was 87% (95% CI: 83–91%) and 80% (95% CI: 75–86%), respectively. Predictors of late Fontan failure were hypoplastic left heart syndrome (HR 4.6, 95% CI 1.3–16.3, $p = 0.018$), age >7 years at Fontan (vs. 3–5 years, HR 4.0, 1.6–10.0, $p = 0.003$), prolonged pleural effusions (HR 2.6, 1.0–6.8, $p = 0.049$) and greater length of hospital stay (per day, HR 1.02, 1.00–1.03, $p = 0.007$). The rates of death and late failure per 100 patient-years were 0.8 and 1.0, respectively. Supraventricular tachyarrhythmias (SVT) occurred in 59 patients (20%), bradyarrhythmias in 16 (5%), and pacemakers were implanted in 39 patients (13%). Freedom from dysrhythmia (SVT and/or bradyarrhythmias) after 15 and 25 years was 82% (95% CI: 77–87%) and 64% (95% CI: 54–74%), respectively. Independent predictors of late-onset dysrhythmia included age >5 years at Fontan (vs 3–5 years, HR 2.3, 95% CI 1.0–5.2, $p = 0.041$). At last follow-up, 112 of the 250 surviving patients with an intact Fontan circulation (45%) were on warfarin, and 93 (37%) were on aspirin. A patent fenestration was identified in 32 patients at last follow up. Thromboembolic events occurred in 46 patients (18 strokes), and freedom from symptomatic thromboembolism at 15 and 25 years was 88% (95% CI: 84–92%) and 77% (95% CI: 70–84%), respectively.

Conclusions: Over a twenty-five year period, the lateral tunnel technique has achieved excellent late survival. As this population ages, they are at an increasing risk of failure and adverse events, with evidence of significant arrhythmic burden. We are likely to see an increasing proportion of these survivors requiring heart transplantation and late reintervention.

P21. Predictors of Successful Biventricular Repair After Hybrid Treatment for Borderline Hypoplastic Left Heart

Can Yerebakan¹, Uygur Yörüker¹, Klaus Valeske¹, Hatem Elmontaser¹, Josephine Murray¹, Anita Windhorst², Josef Thul¹, Matthias Müller¹, Dietmar Schranz¹, Hakan Akintürk¹

¹Pediatric Heart Center, Giessen, Germany; ²Justus-Liebig-University, Giessen, Germany

Objective: To identify factors to serve as predictors in a statistical model for the feasibility of a successful biventricular repair in patients with borderline left ventricular structures who were treated with initial hybrid stage I procedure.

Methods: A group (I) of patients ($n = 35$) who are long-term survivors of biventricular repair after initial hybrid stage I was retrospectively compared to patients (group II, $n = 20$) who had to be directed to univentricular palliation following hybrid stage I procedure, non-survivors of biventricular repair ($n = 4$) or subsequently converted to univentricular palliation ($n = 1$). Both groups had at least two transthoracic echocardiographic studies before hybrid stage I (time point I) and biventricular repair or comprehensive stage II operation (time point II), respectively. The decision for the type of therapy was made before the second operation with the aid of echocardiographic parameters and cardiac magnetic resonance imaging 4 to 8 months after hybrid stage I. Echocardiographic measurements of left ventricular structures (aortic valve dimension, mitral valve dimension, left ventricular inflow length, left ventricular to right ventricular length ratio), body surface area and body weight at two different time points were added to a logistic regression analysis to determine

the most accurate model to estimate outcome of each patient. Positive predictive value (PPV, the probability to observe biventricular repair in group I) and negative predictive value (NPV, the probability to observe univentricular palliation in group II) were calculated for statistical models at each time point as well as for a combined multifactorial model.

Results: The pre-hybrid stage I model revealed a PPV of 83.7% and NPV of 85.7% (observed prevalence 64.7%). By employing only parameters before biventricular repair (group I) or comprehensive stage II (group II) PPV value reached 84.2% and NPV was 81.8% (observed prevalence 69.3%). The highest values for PPV and NPV were possible by combining parameter changes between time points I and II as well as echocardiographic parameters at time point II in a third model. These values were 88.6% and 91.7% for PPV and NPV (observed prevalence 68%), respectively.

Conclusions: In our small cohort the success of biventricular repair in patients with borderline left heart structures after initial hybrid stage I treatment was retrospectively predictable with a statistical accuracy of 89% based on a new multifactorial statistical model.

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P22. Outcomes of Univentricular Repair in Children with Unbalanced Atrio-Ventricular Septal Defect

Edward Buratto, Xin Tao Ye, Robert G. Weintraub, *Yves d'Udekem, Christian P. Brizard, *Igor E. Konstantinov

The Royal Children's Hospital, Parkville, Australia

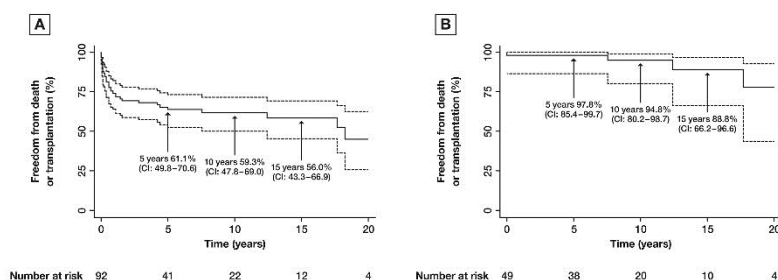
Objectives: Repair of unbalanced atrio-ventricular septal defect (uAVSD) is associated with poor outcomes. Limited data is available on the long-term results. We assessed the long-term outcomes in children, who underwent univentricular repair of uAVSD in a single institution.

Methods: From 1987 to 2015, 112 patients with a diagnosis of uAVSD underwent surgery at our institution. Univentricular repair was performed in 97 of these patients. Data were retrospectively reviewed.

Results: Of the 112 patients with uAVSD, 86.8% (97/112) underwent univentricular repair. Of these 97 patients, 50.5% (49/97) achieved Fontan completion, 28.9% (28/97) died prior to Fontan completion, 12.4% (12/97) were awaiting Fontan completion and 8.2% (8/97) were deemed unsuitable for Fontan completion. Early mortality after stage 1 repair was 10.3% (10/97), after stage 2 repair was 4.9% (4/81) and after Fontan completion was 4.1% (2/49). Although there were no statistical differences across decades, there have been no early deaths following Fontan completion in the last 10 years.

Mean follow up time was 6.0 ± 6.9 years (median 3.0 years, range 1 month to 28.4 years). Long-term freedom from death or transplantation for the whole cohort was 59.3% (95% CI 47.8–69.0) at 10 years and 49.4% (95% CI 32.7–64.1) at 20 years, as shown in **Figure 1A**. For patients who underwent Fontan completion, the 10- and 20-year survival rates were 94.8% (95% CI 80.2–98.8) and 88.8% (95% CI 66.2–96.6), respectively, as shown in **Figure 1B**.

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Surgery on the atrioventricular valve (AVV) was performed in 25.8% (25/97) of patients, but was not associated with poorer long-term survival. There was a significant rate of re-operation on the AVV following initial repair or replacement, reaching 24.1% at 5 years follow up. Since 2008, a “bridging technique” to facilitate AVV repair was used in 6 patients; none of these patients have required subsequent re-operations on the AVV.

Conclusion: Univentricular repair for uAVSD is associated with substantial mortality. Selected patients who survive to achieve Fontan completion have much better long-term survival. Surgery on the AVV is associated with a high rate of reoperation, necessitating better strategies for AVV repair.

P23. Exercise Restriction Is Not Associated with Increasing Body Mass Index Over Time in Patients with Coronary Arteries of Anomalous Aortic Origin

James M. Meza¹, Matthew Elias², Travis Wilder³, James E. O’Brien⁴, Richard W. Kim⁵, *Constantine Mavroudis⁶, *William G. Williams¹, Julie Brothers², Meryl Cohen², Brian W. McCrindle¹

¹The Hospital for Sick Children, Toronto, ON, Canada; ²The Children’s Hospital of Philadelphia, Philadelphia, PA; ³University of California San Diego, La Jolla, CA; ⁴Children’s Mercy Hospital, Kansas City, MO; ⁵Children’s Hospital of Los Angeles, Los Angeles, CA; ⁶Florida Hospital for Children, Orlando, FL

Objective: Physicians may restrict the exercise level of patients with anomalous aortic origin of the coronary arteries (AAOCA) to mitigate the risk of sudden death. We sought to determine if exercise restriction results in increasing body mass index (BMI) over time.

Methods: Between 2009 and 2015, 440 patients 5–30 years old were enrolled into the Congenital Heart Surgeons’ Society AAOCA Registry. Exercise restriction status was recorded for 143 of the 440 patients, which comprised the study population. Patient demographic, anthropometric, and exercise capacity measures were summarized. Using linear mixed model repeated measures analysis, risk factors for increasing BMI z-score over time were investigated.

Results: The 143 patients attended 558 clinic visits with exercise restriction status recorded. The mean number of clinic visits was 5 ± 3 visits and the median duration of follow-up was 1.7 years [interquartile range (IQR) = 0.5–4.4 years]. The mean

age at first clinic visit was 9.9 ± 4.7 years and 71% (101/143) were male. All patients were alive at their most recent follow-up. Surgical intervention occurred in 64% (92/143); 5% (5/92) had an operation before their first visit during the study. At the first clinic visit, 54% (78/143) were exercise restricted. During follow-up, exercise restriction status changed in 4% (6/143). Restricted patients were older at diagnosis (11.7 vs. 7.6 years, $p < 0.0001$) and had shorter mean overall follow-up intervals (2.2 vs. 3.3 years, $p < 0.0001$). More restricted patients underwent surgical intervention [72% (56/78) vs. 28% (22/78), $p = 0.03$] and were older on the day of surgery (12.4 vs. 11.0 years, $p = 0.08$). Exercise capacity measures, including maximum aerobic capacity (VO₂max), VO₂-max at anaerobic threshold, and working capacity, were available for 9% (13/143), 8% (12/143), and 3% (5/143) patients, respectively. These baseline measures did not differ significantly between restricted and non-restricted patients. BMI z-scores were calculated from heights and weights documented during the 558 clinic visits. The median baseline BMI z-score was 0.2 (IQR = -0.30.9) and was greater in restricted patients (0.4 vs. -0.1, $p = 0.02$). BMI z-score showed no significant association with time. Univariate repeated measures analysis demonstrated that exercise restriction at baseline, higher baseline BMI z-score, male gender, grade 4 dual orifices of the left coronary sinus, exercise restriction over time, and surgical intervention over time were all weakly associated with higher BMI z-score. In a multivariable model, only a higher baseline BMI z-score remained independently associated with increasing BMI z-score over time. No other variables reached significance.

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Table: Selected patient characteristics, overall and stratified by baseline exercise restriction

	Overall (n = 143)	Exercise Restricted (n = 78)	Not Exercise Restricted (n = 65)	P-Value
Male gender	71% (101/143)	76% (59/78)	65% (42/65)	0.14
AAOCA laterality	64% (92/143)			
Right	73% (67/92)	55% (43/78)	37% (24/65)	0.34
Left	27% (25/92)	17% (13/78)	18% (12/65)	0.34
Mean age at first visit (years)	9.9	11.7	7.6	<0.0001
Mean follow-up interval (years)	2.7	2.2	3.3	<0.0001
Surgical intervention	64% (92/143)	72% (56/78)	55% (36/65)	0.06
Mean age at operation (years)	11.9	12.4	11.0	0.08
Baseline BMI z-score	0.2	0.4	-0.1	0.02

Conclusions: In a multi-institutional cohort of patients with AAOCA, over a short follow-up period, exercise restriction does not appear to be linked to increasing BMI over time.

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P24. Oral Thyroxin Supplementation in Infants Undergoing Cardiac Surgery: A Double Blind Randomized Clinical Trial

Sachin Talwar, Amolkumar Bhoje, Rajesh Khadgawat, Vishnubhatla Sreenivas, Shiv Kumar Choudhary, Balam Airan

All India Institute of Medical Sciences, New Delhi, India

Objectives: Decrease in serum thyroxin and triiodothyronin (T3) levels occurs after cardiopulmonary bypass (CPB) reflected as poor outcomes in immediate postoperative period. Intravenous T3 is shown to be having some role in improving postoperative outcomes. We studied oral thyroxin supplementation and its effect on perioperative period in infants undergoing cardiac surgery under CPB.

Methods: The study was a prospective, double blind randomized, placebo-controlled trial involving 62 patients, 30 in the thyroxin group and 32 in the placebo group younger than 6 months age, undergoing cardiac surgery with CPB. Each mL of either drug A or B contained 5 mcg of oral Thyroxin tablet or placebo in a suspension form. Dose of the drug given was weight of the baby \times 1 ml of the assigned solution. First dose was given at 9 pm a day before the surgery considering the time of surgery as 9 am on the next morning. This was continued after surgery while the infant was in the ICU. The clinical endpoints were time for extubation, Intensive care unit (ICU) stay, and occurrence of low cardiac output syndrome (LCOS). Cardiac index was measured at different time points. Perioperative serum thyroid hormone and serum inflammatory markers Interleukin-6 (IL-6) and tumor necrosis factor (TNF- α) were measured.

Table: Summary of Results

Variables	Thyroid Group (Complex Lesions, n = 30)	Placebo Group (Complex Lesions, n = 32)	p-Value	Thyroid Group (Simple Lesions, n = 20)	Placebo Group (Simple Lesions, n = 18)	P-Value
Duration of Mechanical ventilation (hrs)	92.47 \pm 22.21	111.81 \pm 37.30	0.017	11.80 \pm 1.32	11.44 \pm 1.68	0.472
ICU stay (hrs)	163.03 \pm 54.32	199.88 \pm 74.22	0.03	94.90 \pm 24.86	88.33 \pm 11.26	0.311
Hospital stay (days)	15.73 \pm 4.77	19.88 \pm 5.34	0.002	8.75 \pm 3.46	8.67 \pm 1.45	0.925
Cardiac index -1	2.91 \pm 0.848	2.60 \pm 0.608	0.103	3.92 \pm 0.61	3.10 \pm 0.44	0.001
Cardiac index-2	3.13 \pm 0.640	2.54 \pm 0.680	0.001	4.2 \pm 0.618	2.9 \pm 0.59	0.001
Cardiac index-3	3.72 \pm 1.05	3.17 \pm 0.746	0.02	4.76 \pm 0.945	3.56 \pm 0.50	0.001
Inotropic score-1	20.07 \pm 8.37	28.22 \pm 8.15	0.001	13.70 \pm 4.26	15.61 \pm 4.07	0.858
Inotropic score-2	15.67 \pm 6.52	22.06 \pm 8.47	0.002	11.75 \pm 3.66	11.56 \pm 2.87	0.168
Therapeutic intervention score	53.80 \pm 3.71	57.38 \pm 4.36	0.001	36.3 \pm 5.99	35.39 \pm 4.32	0.59

Results: Demographic features were comparable between the groups. Mean duration of mechanical ventilation was 92.47 ± 22.21 and 111.81 ± 37.30 hours in thyroid and placebo groups respectively ($p = 0.017$). Mean ICU stay and hospital stay were 163.03 ± 54.32 and 199.88 ± 74.22 hours ($p = 0.03$) and 15.73 ± 4.77 and 19.88 ± 5.34 days ($p = 0.002$) in thyroid and placebo group respectively. Cardiac indices were higher in thyroid group at all-time points with overall $p = 0.004$. Average therapeutic interventional scores (TISS) for first 2 days were higher in placebo group. Area under curve for total thyroxine (TT4) were 479.90 ± 92.05 and 252.15 ± 58.95 for thyroid and placebo group ($p < 0.001$). Area under curve for total triiodothyronine (TT3) were 107.34 ± 11.21 and 43.44 ± 8.58 for thyroid and placebo group ($p < 0.001$).

Conclusion: Thyroid supplementation improves cardiac index but does not affect the incidence of clinical LCOS. Thyroxin supplementation reduces duration of mechanical ventilation, ICU stay and hospital stay and TISS scores thus reducing the cost of intensive care. Oral route maintained adequate serum levels of thyroid hormones which translated into desired physiological effects. Oral thyroxin supplementation in infants undergoing open heart surgery is safe and effective.

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General Thoracic Moderated Poster Competition

Moderator: *Jay M. Lee, *University of California, Los Angeles*

P25. Risk Factors for Progression of Ground Glass Opacities in Patients with Resected Pulmonary Adenocarcinoma

Rebecca W. Gao, *Mark F. Berry, Amanda Khuong, Joel W. Neal, Leah M. Backhus, *Joseph B. Shrager
Stanford University, Stanford, CA

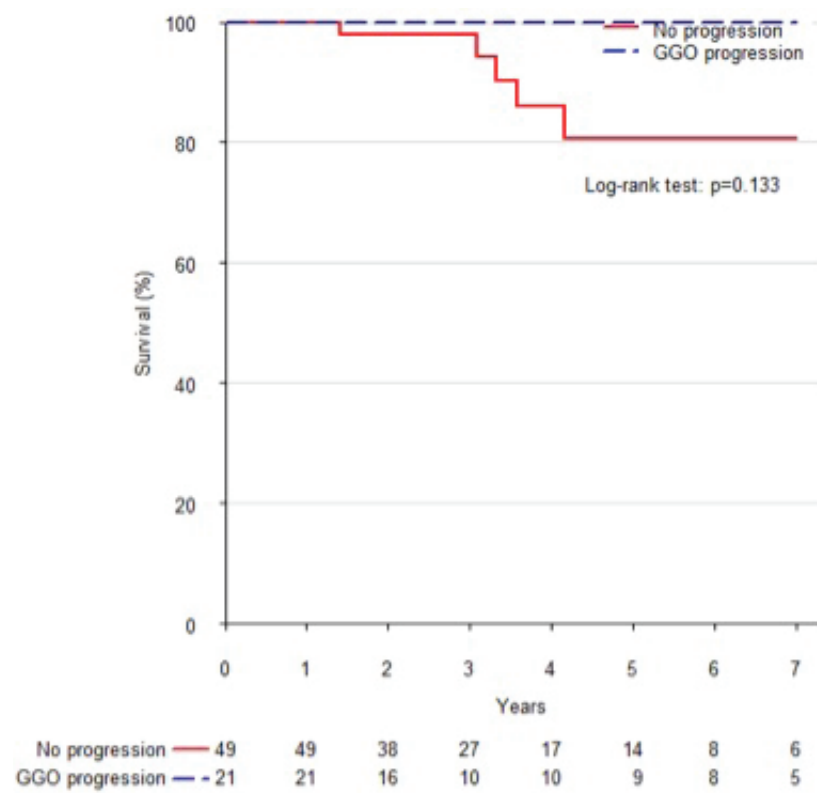
Objective: The few prior studies on surgical management of patients with multifocal lepidic-type adenocarcinoma have suffered from insufficient sample size and/or follow-up time to adequately evaluate progression of these slow-growing tumors. We therefore studied a large cohort with longer follow-up to establish the natural history of this tumor presentation and identify risk factors for progression that might guide management.

Methods: Retrospective review of 70 patients operated upon between 12/2001–1/2015 for a pN0, lepidic-containing adenocarcinoma as the resected dominant tumor (DT), who harbored at least one additional ground glass opacity (GGO). Survival and patient/tumor characteristics that may predict GGO progression, or need for subsequent intervention for a progressing GGO, were evaluated using Kaplan-Meier and logistic regression analyses.

Results: At presentation, subjects had between 1 and 6 GGOs in addition to their DT. 45 underwent anatomic resection alone, 16 underwent wedge resection alone, and 9 had a combination of these. Mean follow-up time was 4.1 ± 2.8 years. At least one GGO progressed after DT resection in 21 patients (30%). In 11 patients (15.7%) this progression prompted a subsequent resection ($n = 5$) or stereotactic radiation ($n = 6$). Mean time to these treatments was 2.7 ± 2.3 years. On univariate analysis, patients with GGO progression and those without progression differed

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significantly in age (73.6 ± 7.6 vs. 68.2 ± 11.2 , $p = 0.05$) but not in race, gender, or smoking history (all $p > 0.8$). Several measures of the overall tumor burden were significantly associated with GGO progression (more GGOs, larger GGOs, greater DT diameter and % solid component, poorer DT differentiation [all $p < 0.03$]) and with progression prompting an intervention (greater DT size, greater mean GGO diameter, greater size of the largest GGO [all $p < 0.01$]). In a multivariable logistic regression analysis, greater DT size (OR 1.07, $p = 0.03$) and an initial GGO over 1 cm (OR 5.99, $p = 0.01$) were the only factors independently associated with GGO progression. Importantly, survival was not negatively impacted by either progression (100% with vs. 80.7% without, $p = 0.133$; see Figure), or by progression prompting intervention (100% vs. 84.7%, $p = 0.39$).



Conclusions: Even at a mean follow-up of 4.1 years, only 15.7% of patients with unresected GGOs in the setting of a resected pN0 DT require subsequent intervention for a progressing GGO. While several features suggesting greater initial tumor burden predict GGO growth and/or subsequent intervention, neither growth nor requirement for an intervention negatively affects survival. This suggests that even those patients with this presentation who are at highest risk for progression should not be denied resection of the DT. Closer surveillance may be indicated in patients who have a larger DT or a GGO that is larger than 1 cm.

P26. Prognostic Impact of the Findings on Thin-Section Computed Tomography in Patients with Subcentimeter Non-Small Cell Lung Cancer

Aritoshi Hattori, Kenji Suzuki, Takeshi Matsunaga, *Kazuya Takamochi, Shiaki Oh
Juntendo University, Tokyo, Japan

Objective: Clinicopathological features and prognosis of subcentimeter non-small cell lung cancer (NSCLC) are still controversial. In this study, we investigated their prognostic impact based on the findings of thin-section computed tomography (CT).

Methods: We evaluated the clinicopathological features and prognosis of surgically resected 328 clinical-N0 NSCLC 1.0 cm or less in size. Consolidation tumor ratio (CTR) was evaluated for all, and tumors were classified into 3 group, i.e., non-solid (CTR = 0, n = 139), part-solid (0 < CTR < 1.0, n = 123), and solid (CTR = 1.0, n = 66). Significant prognostic factors for oncological outcomes were evaluated using a multivariate analysis. Survivals were calculated by Kaplan-Meier estimation methods using log-rank test.

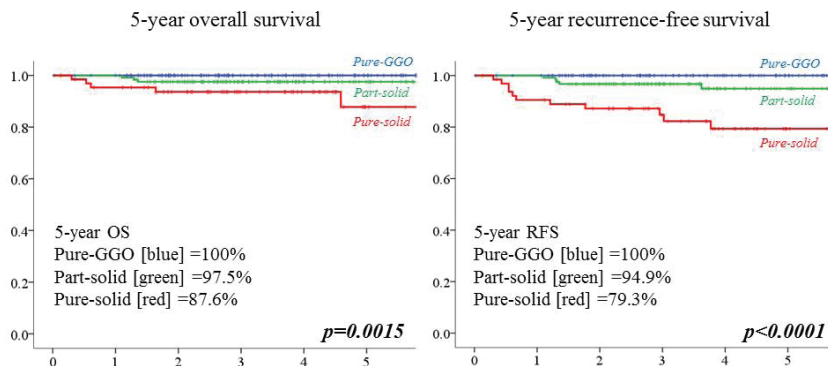


Figure.
The 5-year overall and recurrence-free survival in patients with c-N0 subcentimeter NSCLC based on the findings on thin-section CT scan.

Results: Pathological nodal involvement was observed in 7 patients, all of which were exclusively found in solid subcentimeter NSCLC (10.9%). Furthermore, a multivariate analysis revealed that the presence of GGO component was an independently significant clinical factors of overall survival (OS) and recurrence-free survival (RFS) in this cohort (OS: $p = 0.0340$, RFS: $p = 0.0018$). When we evaluated the OS and RFS based on CTR, the 5-year OS and RFS was extremely better in patients with non-solid (OS and RFS = 100%) or part-solid (OS = 97.5%, RFS = 94.9%), while that of solid subcentimeter NSCLC was 87.6% and 79.3% (OS, $p = 0.0015$; RFS, $p < 0.0001$), with a mean follow-up period of 43 months. Lung cancer specific OS was 100% in non-solid or part-solid subcentimeter NSCLC despite their operative modes, while that of solid subcentimeter NSCLC was 87.8% and recurrence was observed in 10 (15%) patients. Histological examination revealed that the frequency of the patients with atypical adenomatous hyperplasia, ade-

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nocarcinoma in situ, minimally invasive adenocarcinoma or lepidic predominant adenocarcinoma was 123 (89%) of non-solid and 92 (75%) of part-solid, while that of solid tumor was only 16 (25%) patients despite their subcentimeter size ($p < 0.0001$).

Conclusions: The findings of thin-section CT are extremely important when considering the prognosis of subcentimeter NSCLC. The presence of ground glass opacity component was a strong clinical factor of favorable survival due to their minimally invasive nature, while radiological solid subcentimeter NSCLC should be treated as invasive tumor regardless of their small tumor size.

P27. A Clinical Prediction Model for Prolonged Air Leak After Pulmonary Resection

Adam Attar, Daniel G. Winger, *James D. Luketich, Inderpal S. Sarkaria, *Neil A. Christie, Katie S. Nason

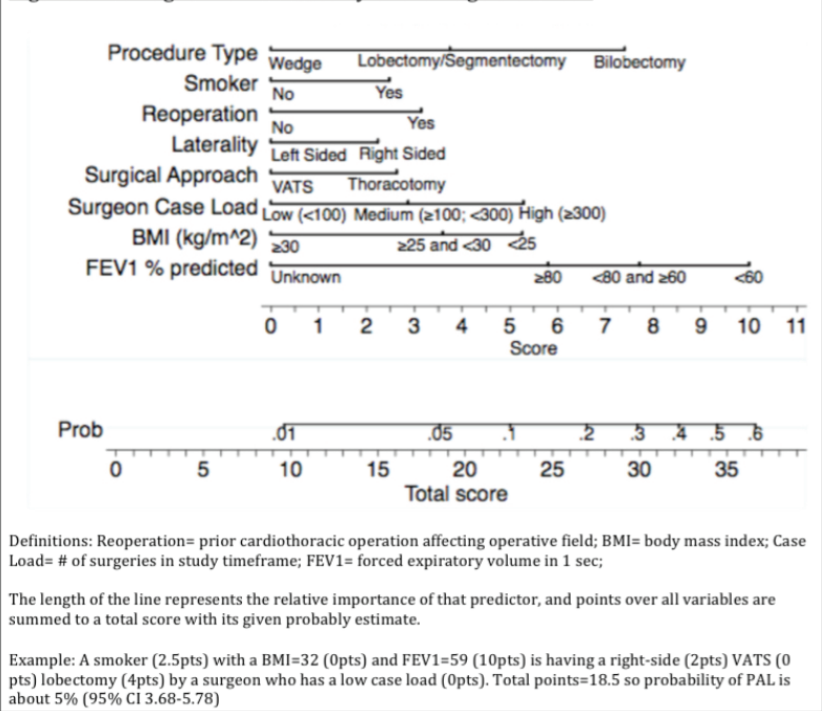
University of Pittsburgh, Pittsburgh, PA

Objective: Prolonged air leak (PAL) after lung resection is associated with increased hospital cost, length of stay, and adverse events. Preoperative risk stratification could potentially enable patient specific intra- and postoperative care pathways. Currently, there are no widely accepted risk stratification tools for PAL. Our aim was to identify factors associated with PAL, and to develop a clinically applicable prediction model that can reliably assess PAL risk.

Methods: We analyzed data for 2309 patients who underwent lung resection (excluding pneumonectomy/sleeve lobectomy) for benign and malignant lung tumors (1/2009–6/2014). Patients were stratified by PAL status (defined as a post-operative air leak >5 days; $n = 198$ [8.6%]). Preoperative and treatment variables known to be associated with increased risk of PAL from literature review and/or with $p < 0.10$ in univariable analysis were considered as candidate variables (21 predictors) for building the risk model. Backward stepwise logistic regression analysis was performed with bootstrap resampling technique for reliability and internal validation. A nomogram for assessing PAL risk was developed using regression coefficients from the final model to assign points for each predictor.

Results: Patients with PAL were older and more likely to have a body mass index (BMI) <25 , primary lung cancer, anatomic lung resection, low forced expiratory volume in 1 second (FEV1), prior lung resection and right sided surgery ($p < 0.01$ for all), among other predictors. Median hospital stay was significantly longer (10 versus 4 days; $p < 0.01$). The final model identified decreased FEV1, prior smoking, bilobectomy (versus lobectomy/segmentectomy), high surgeon case load, prior lung surgery, right sided resection and thoracotomy as factors increasing the odds of PAL while low surgeon case load, wedge resection, BMI ≥ 25 and unmeasured FEV1 were protective. The discriminatory accuracy of the nomogram (Figure 1) was 75% (95% CI 0.72–0.78). Using the nomogram score, patients were stratified into low [scores ≤ 20 ; $n = 1097$], intermediate [scores >20 to <25 ; $n = 682$], and high-risk groups [scores ≥ 25 ; $n = 496$]. Corresponding PAL rates were 3%, 10%, and 20%, respectively. Compared to the lowest risk group, the adjusted odds of PAL were 6.43 (95% CI 2.83–7.04) for the intermediate risk group, and 10.32 (95% CI 6.53–15.73) for the high risk group.

Figure 1. Nomogram for Probability of Prolonged Air Leak



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Conclusions: Using clinically applicable preoperative and treatment variables, we developed a nomogram and risk classification that reliably predicts incremental risk of PAL with good discriminatory ability. Further work will involve model refinement and external validation. If surgeons are able to stratify PAL risk, they can provide patient counseling, identify candidates for intraoperative preventive measures, and initiate patient-specific management.

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P28. Prediction of Lepidic Predominant Clinical-Stage IA Lung Adenocarcinoma with Radiological Pure-Solid Appearance for Possible Indications of Sublobar Resection

Aritoshi Hattori, Kenji Suzuki, Takeshi Matsunaga, *Kazuya Takamochi, Shiaki Oh
Juntendo University, Tokyo, Japan

Objective: Radiological pure-solid adenocarcinoma is considered to be invasive. In contrast, the prognosis of lepidic predominant adenocarcinoma (LPA) is favorable. Hence, we aimed to subdivide radiological pure-solid adenocarcinoma based on the histological malignancy for possible indications of sublobar resections.

Methods: Clinicopathological data was reviewed for surgically resected 200 c-stage IA pure-solid lung adenocarcinoma on thin-section computed tomography (CT). Radiological pure-solid tumor was defined as a tumor without GGO component, i.e., consolidation tumor ratio equal to 1.0. Tumors were subtyped according to the IASLC/ATS/ETS classification with 5% increments, and LPA was defined as a tumor that showed lepidic component most frequently. Significant prognostic factors to predict lepidic predominant clinical-stage IA pure-solid lung adenocarcinoma were evaluated using a multivariate analysis. Survivals were calculated by Kaplan-Meier estimation methods using log-rank test.

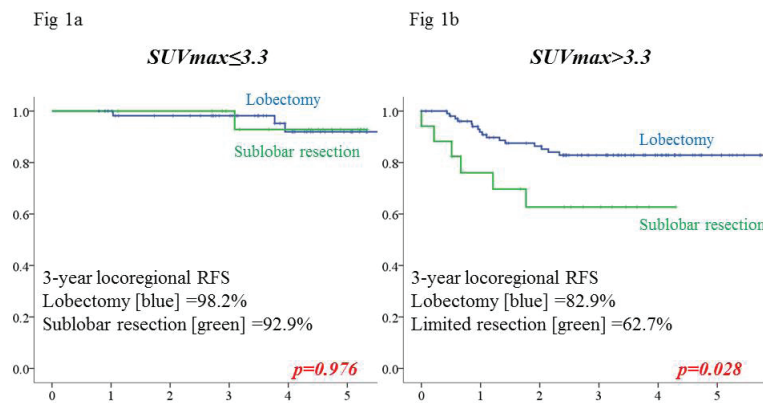


Figure
Locoregional recurrence-free survivals based on operative modes in patients with clinical-stage IA radiological pure-solid lung adenocarcinoma.

Results: Fifty-seven (29%) patients showed LPA. The 5-year overall (OS) and recurrence-free survival (RFS) of clinical-stage IA pure-solid adenocarcinoma was 83.4% and 75.3% with a median follow-up of 43.3 months, and those with LPA and non-LPA was 98.1% vs. 76.6% in the OS ($p < 0.001$), % 90.0% vs. 66.3% in the RFS ($p = 0.006$), respectively. A multivariate analysis revealed that maximum standardized uptake value (SUV_{max}) was an independently significant predictor of LPA (Hazard ratio = 0.764, 95% confidence interval 0.659–0.884, $p < 0.001$). The predictive criterion of LPA in clinical-stage IA radiological pure-solid adenocarcinoma was $SUV_{max} \leq 3.3$ (area under the curve = 0.76, sensitivity = 72.7%, specificity = 66.7%) based on a receiver operating characteristics curve. Based on the results, 77 (39%) patients who met this criterion had less pathologic invasiveness regarding lymphatic, vascular, pleural invasion, nodal metastasis ($p < 0.001$) and better

OS (91.7% vs. 78.6%, $p = 0.003$) and RFS (81.6% vs. 57.2%, $p = 0.002$) than those who did not. Moreover, the 3-year locoregional RFS was similar between sublobar resection arm and lobectomy arm in patients with SUVmax ≤ 3.3 (92.9% vs. 98.2%, $p = 0.976$, Figure 1a), while that of sublobar resection arm was significantly worse than that of the lobectomy arm if patients did not meet the criterion (62.7% vs. 82.9%, $p = 0.028$, Figure 1b).

Conclusions: Lower SUVmax was significant clinical predictor of LPA, and patients who met our criterion could be candidates for sublobar resection of clinical-stage IA pure-solid adenocarcinoma on thin-section CT scan.

P29. Evaluation of Acute and Chronic Pain Outcomes After Robotic, VATS, or Open Lobectomy

Sebastian Thomas Kwon, Lili Zhao, Rishindra Reddy, William Lynch, *Andrew Chang, Philip Carrott, *Mark Orringer, Chad Brummett, ♦Jules Lin
University of Michigan, Ann Arbor, MI

Objective: The advantages of robotic (RATS) lobectomy are debated and not well defined. While RATS may provide improved dexterity and visualization, the effect of RATS on pain, compared to VATS or open lobectomy, is poorly understood. This study evaluated acute and chronic pain following RATS, VATS, and open lobectomy.

Methods: A retrospective review of 498 patients (502 procedures total) who underwent RATS (74), VATS (228), and open lobectomy (200) at a single institution from February 2010 to June 2014 was performed to identify patient, intraoperative, and postoperative factors related to acute (≤ 10 days) and chronic (≥ 3 months) pain. Acute pain scores (low, high, and median) were analyzed over the first 9 postoperative days. Chronic pain outcomes were assessed using the validated Pain-DETECT survey mailed to patients who were more than 3 months postoperative (167/498 (34%) surveys completed). Univariate and multivariate logistic regression analyses were performed to determine significant associations.

Results: There was no significant difference in acute or chronic pain between RATS and VATS lobectomy. However, there was a significant decrease in acute pain scores for minimally invasive (MIS) compared to open lobectomy after postoperative day 4 ($p < 0.05$). Chronic pain (numbness) was significantly higher after open lobectomy (12% (13/112) MIS vs. 25% (14/55) Open; $p = 0.02$). Despite no significant difference in actual pain scores, more RATS patients felt the approach affected pain (69% (18/26) RATS vs. 44% (38/86) VATS; $p = 0.03$). For open patients, 36% (20/55) felt the approach affected pain versus 50% (56/112) MIS ($p = 0.004$) and were more likely to feel that the approach affected their pain negatively. On multivariate analysis, procedure type and comorbidities were not associated with acute or chronic pain. Younger age was associated with higher pain scores ($p < 0.0001$) and chronic pain ($p = 0.0008$), while major complications were associated with chronic pain ($p = 0.002$) and increased length of stay ($p < 0.0001$) in MIS patients.

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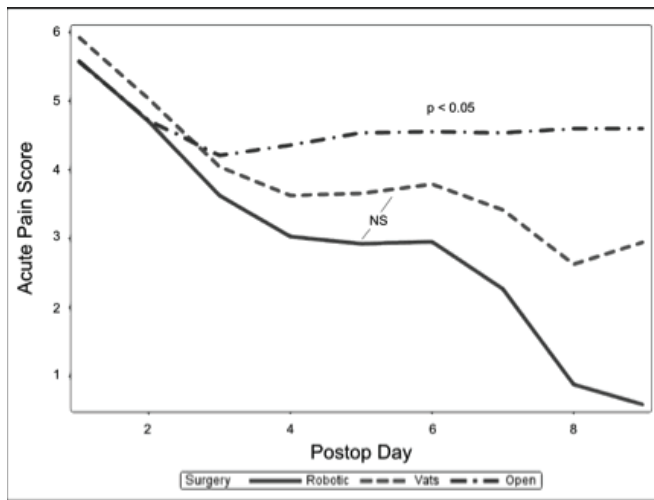


Figure 1. Daily high pain scores were significantly higher after open lobectomy but only after postoperative day 4. Pain scores were not significantly different between robotic and VATS.

Conclusions: As robotics becomes more common, evaluating outcomes like acute and chronic pain is important. While minimally invasive lobectomy resulted in less pain, there were no differences between RATS and VATS, despite claims that robotics decreases pain. In contrast to these findings, more RATS patients believed the approach affected their pain, suggesting a difference between reality and perception.

P30. Analytic Morphomics Predict Outcomes After Lung Volume Reduction Surgery

♦Jules Lin, William B. Weir, Tyler Grenda, Peng Zhang, John Donkersloot, Binu Enchakalody, Brian Derstine, Joshua Underhill, Steven H. Sun, Rishindra M. Reddy, *Andrew C. Chang, Stewart C. Wang
University of Michigan, Ann Arbor, MI

Objective: Patients with end-stage emphysema undergoing lung volume reduction surgery (LVRS) continue to have high morbidity. This study evaluated whether applying analytic morphomics to standard preoperative chest CTs could better predict outcomes after LVRS.

Methods: A retrospective review of 85 patients undergoing LVRS using NETT selection criteria was performed. Analytic morphomics were used to assess characteristics including volume, area, and density of the lung, dorsal muscle group (DMG), and mediastinal calcifications. Lung density (LD 1–5) was divided into five levels of increasing density (LD1, emphysema; LD2, normal lung). Outcomes including survival and length of stay (LOS) were analyzed using univariate and multivariate techniques.

Results: The mean age was 61.7 years. The mean FEV1 and DLCO were 27% and 36%, and 53% (44/83) had low exercise capacity. Hospital mortality was 5% (4/85). An air leak occurred in 68% (58/85) and was prolonged in 43% (37/85) while 22% (19/85) developed pneumonia. The mean ICU and hospital LOS were 2.81 and 11.39 days, and 14% (11/78) were readmitted within 30 days. The median survival was 9.33 years at last follow-up.

On univariate analysis (Table 1), increased coronary disease, FEV1 <20%, body circumference, DMG normal density area, LD4 Hounsfield Units (HU), subcutaneous fat density, and age and decreased BMD were significantly associated with decreased survival. Increased LD5:LD2, DMG normal density HU, age, low exercise capacity, LD5%, and mediastinal calcification area and decreased LD1 HU and LD2% significantly increased hospital LOS. Increased DMG low density area and decreased BMD and subcutaneous fat area were associated with 30-day readmission.

On multivariate analysis, increasing age ($p = 0.019$), LD4 volume ($p = 0.019$), and visceral fat area ($p = 0.014$), and decreased BMD ($p = 0.008$) were predictors of decreased survival. Increased age ($p < 0.001$), LD5:LD2 ($p < 0.0001$) and low exercise capacity ($p < 0.001$) were associated with increased hospital LOS while female gender ($p < 0.001$), FEV1<20% ($p = 0.003$), LD2 volume ($p = 0.007$), and LD1:LD2 ($p < 0.001$) were associated with a shorter hospital LOS.

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Table: Morphomic Variables Associated with LVRS Outcomes on Univariate Analysis

Outcome	Variable	HR; 95% CI	p-Value
Decreased survival	Increased Body circumference	1.70; 1.229–2.348	0.018
Decreased survival	Increased lung density 4 HU	1.53; 1.075–2.181	0.018
Decreased survival	Decreased BMD	0.53; 0.347–0.802	0.003
Increased hospital LOS	Increased LD5:LD2		0.001
Increased hospital LOS	Decreased lung density 1 HU		0.004
Increased hospital LOS	Increased mediastinal calcification		0.041
30-day Readmission	Decreased BMD		0.002
30-day Readmission	Decreased subcutaneous fat		0.003

HR, Hazard ratio; CI, Confidence Interval; BMD, bone mineral density; HU, Hounsfield Units; LD, lung density (increasing from 1 to 5 where LD2 is normal lung); LOS, length of stay.

Conclusions: Despite improvement in patient selection using NETT criteria, morbidity after LVRS remains high. BMD and visceral fat area were predictors of survival independent of age, exercise capacity, or PFTs. Patients with more severe emphysema (increased LD1:LD2) likely benefit more from LVRS and had a shorter LOS. Increased lung density (LD4 and LD5) may be related to scarring and COPD exacerbations and were associated with increased LOS and decreased survival. Factors reflecting frailty were associated with 30-day readmission (decreased BMD and subcutaneous fat) and decreased survival (decreased BMD). These results suggest that analytic morphomics on standard preoperative chest CTs can improve risk stratification and patient selection.

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P31. Accuracy in Predicting Stage I Non-Small Cell Lung Cancer in CALGB 140503 (Alliance)

*Leslie Kohman¹, Lin Gu², *Nasser Altorki³, Linda Veit¹, Xiaofei Wang²

¹SUNY, Syracuse, NY; ²Duke University, Durham, NC; ³Cornell University, New York, NY

Objective: CALGB 140503 is an ongoing multi-center randomized trial assessing whether sub-lobar resection is equivalent to lobectomy for the treatment of suspected NSCLC ≤ 2 cm in diameter. The objective of this report is to determine the reasons precluding intra-operative randomization.

Methods: In CALGB 140503 patients are pre-registered based on clinical suspicion of NSCLC; pre-operative confirmation of histology is not required. Intra-operative randomization to lobectomy versus sublobar resection occurs only after the diagnosis of NSCLC is confirmed, and the required nodal stations are determined free of disease by frozen section. From June 15, 2007 to March 22, 2013, 637 patients were preregistered to the trial. Three hundred eighty-nine were successfully randomized and 248 patients were not randomized (38.9%). We analyzed the reasons for non-randomization among a subset of the non-randomized patients (188) on which additional data were available.

Results: The reasons for non-randomization among these 188 patients are shown in the Table (some patients had more than one factor precluding randomization; only the primary reason is counted).

Of the 188 patients preregistered but not randomized for known reasons, undiagnosed benign nodules (93, 49.5%) and failure to accurately determine the clinical stage of NSCLC as IA (45, 23.9%) were the dominant reasons precluding randomization. Forty-five (10.3%) of a total of 434 patients with NSCLC (389 randomized plus 45 non-randomized for more advanced NSCLC) were inaccurately staged as small (≤ 2 cm) IA. These patients had unsuspected nodal metastases (26 patients) or other more advanced NSCLC.

At least 93 patients (14.6% of 637 preregistered) had surgery for benign disease ≤ 2 cm. These small benign nodules may not have required resection for therapy. If the reasons for non-randomization were the same in the 60 patients with missing information as in the 188 with known reasons for non-randomization, the number of resections for small benign nodules could be as great as 123 patients (19.3% of total preregistered).

Many of the patients with more advanced NSCLC or other malignancy also may not have benefited from a thoracic surgical procedure.



Table

Reason	# (%) of 188 Patients Non-Randomized for Known Reason	# (%) of 188 Patients Non-Randomized for Known Reason
Not NSCLC—Benign	93 (49.5%)	—
Granuloma		23 (12.2%)
Hamartoma		9 (4.8%)
Infection		11 (5.9%)
Other		50 (26.6%)
Not NSCLC—Other malignancy	15 (8.0%)	
Small cell lung cancer		2 (1.1%)
Carcinoid		4 (2.1%)
Lymphoma		5 (2.7%)
Metastatic, other site		4 (2.1%)
NSCLC but ineligible	45 (23.9%)	
Positive nodes		26 (13.8%)
Satellite nodule		6 (3.2%)
2 nd cancer in other lobe		3 (1.6%)
Pleural effusion		2 (1.1%)
Tumor >2 cm		6 (3.2%)
Other		2 (1.1%)
Technical Reasons	10 (5.3%)	
Unable to sample nodes		2 (1.1%)
Unsuitable for sublobar resection		5 (2.7%)
Hemorrhage		1 (0.5%)
Difficult anatomy		2 (1.1%)
Administrative/Other/ Unknown	25 (13.3%)	
Patient refusal/ withdrawal		8 (4.3%)
Surgeon decision		7 (3.7%)
Other		7 (3.7%)
Unknown		3 (1.6%)

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Conclusions: Surgeons remain inaccurate in their preoperative diagnosis of lung nodules <2 cm, and in their clinical staging of small Stage IA NSCLC. Increasing the rate of preoperative biopsy of nodules and nodes may reduce the number of non-therapeutic thoracic procedures. Accuracy in preoperative diagnosis and staging are increasingly important as more such small nodules are discovered through lung cancer screening.

P32. Treatment of Stage I Non-Small Cell Lung Cancer: What's Trending?

Puja M. Shah¹, Timothy L. Mcmurry¹, Pamela Samson², Clifford G. Robinson², James M. Isbell¹, *Benjamin D. Kozower¹

¹University of Virginia, Charlottesville, VA; ²Washington University, St. Louis, MO

Objective: Stage I non-small cell lung cancer (NSCLC) is traditionally treated with lobectomy. Patients with severe comorbidities and limited pulmonary function may be treated with sublobar resection unless their surgical risk is considered prohibitive. Stereotactic body radiation therapy (SBRT) provides an alternative for this medically inoperable group, although the definition of medically inoperable is not well defined. We hypothesized SBRT is being used more frequently in clinical practice, despite this imprecision. The purpose of this study was to determine the national treatment trends for stage I lung cancer over the past decade.

Methods: The National Cancer Data Base (NCDB) captures 70% of newly diagnosed cancers and was queried for all clinical stage I NSCLC patients (1998–2012). Treatments were categorized into: surgery, SBRT, conventional radiation, or no treatment. Surgical patients were further divided by procedure type. Patients were excluded if they received chemotherapy only or if they underwent multimodal regimens with unknown treatment sequence. Continuous variables were analyzed using ANOVA and categorical variables were compared using Chi-square test.

Results: The NCDB contained 369,931 clinical stage I NSCLC patients and 349,363 (94%) were eligible for inclusion. The majority of patients were treated with lobectomy (64%, 194,873) and 18% (55,769) were treated with sublobar resection. 9% (26,498) received no treatment and 3% (8,246) were treated with SBRT. Median age for patients undergoing lobectomy was 69 (IQR 61–75), younger than for SBRT patients (75, IQR 69–81) ($p < 0.001$). Median size for all stage I tumors significantly decreased over the study period (2.8 cm vs. 2.4 cm, $p < 0.001$). Median lobectomy tumor size (2.5 cm, IQR 1.7–3.5) was significantly larger than for SBRT (2.1 cm, IQR 1.5–2.9) ($p < 0.001$). Although the diagnosis of stage I NSCLC steadily increased over the 12-year period, the rate of surgical resection decreased from 74% in 1998 to 69% in 2012 ($p = 0.049$). The first recorded cases of SBRT are in 2003 and have grown rapidly, comprising 8% (2,281) of all patients treated in 2012 (Figure 1).

Figure 1. Annual number of Stage I NSCLC diagnoses and operations from 1998–2012 is shown on the left y-axis. Annual SBRT cases for the 14-year period are depicted on the right y-axis. Although numbers of surgeries are increasing, surgery rate is decreasing. Conversely, the SBRT rate is increasing.



Conclusions: Results from the largest national cancer registry in the U.S. demonstrate that although the numbers of clinical stage I NSCLC diagnoses continue to increase, the rate of surgical resection is decreasing. Meanwhile, SBRT treatments have increased exponentially over a five-year period. These data suggest that SBRT is rapidly becoming an accepted treatment modality, despite the absence of high quality comparative effectiveness studies. However, SBRT may increase the number of patients receiving treatment. Thoracic surgeons should play an active role in delineating who is appropriate for operative management versus SBRT.

P33. CT-Guided Fine Needle Aspiration Biopsy Performed by Thoracic Surgeons: A Paradigm Shift in Image-Guided Thoracic Procedures

Seth L. Welborn, Katie S. Nason, *Arjun Pennathur, Omar Awais, *Neil A. Christie, *James D. Luketich, *Matthew J. Schuchert
University of Pittsburgh, Pittsburgh, PA

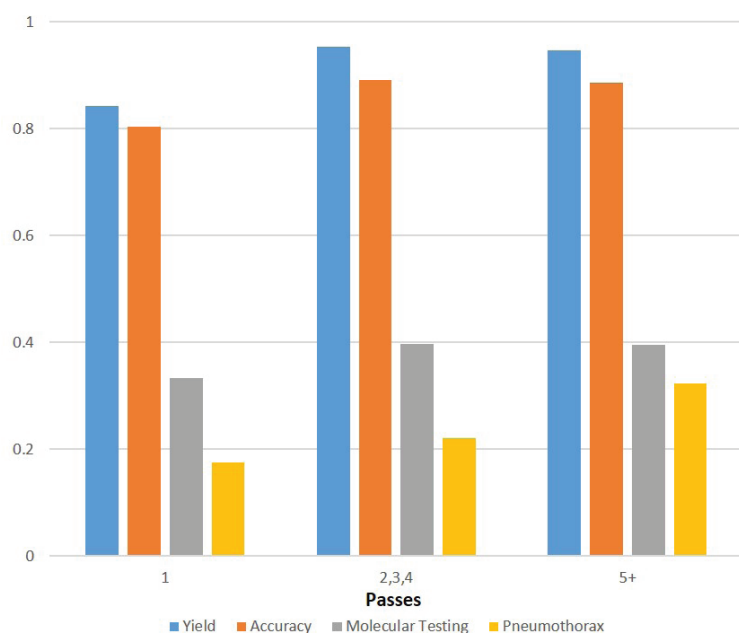
Objectives: The overwhelming majority of computer tomographic (CT)-guided intrathoracic procedures are currently performed by interventional radiologists. With increasing identification of smaller lung nodules, thoracic surgeons are faced with the need to obtain accurate and expeditious tissue diagnoses and molecular testing to assist in definitive management. In this series we analyzed the diagnostic and clinical outcomes of our experience with image-guided percutaneous biopsies performed by a dedicated group of thoracic surgeons.

Methods: Retrospective analysis of all patients undergoing CT-guided fine-needle aspiration (FNA) by the thoracic surgery service from June 2006 until March 2014. A total of 889 cases were performed by 17 thoracic surgeons (total of 936 biopsied lesions). 394 cases (44.3%) were a combination of FNA and other percutaneous, endobronchial or endoscopic procedures. CT-FNAs of pulmonary, pleural, mediastinal and chest wall lesions were included. Primary outcome variables included diagnostic yield and accuracy, number of needle passes, complication rates and success in molecular testing.

Results: The average nodule size was 2.8 ± 1.8 cm (Range: 0.4 to 13.2 cm). A satisfactory diagnostic specimen was obtained in 840 cases (94.5%). All surgeons had a diagnostic yield above 80%. Diagnostic yield was significantly improved by increasing the number of passes from one to 2–4 passes ($p = 0.005$). Performing 5 or more passes did not enhance yield ($p = 0.816$). Diagnostic accuracy was 91.3%, and did not increase with 5 or more passes ($p = 0.8745$) [See Figure]. The average number of needle passes was 3.3 ± 1.5 (Range: 1–14), and has increased from 2.3 ± 1.0 in 2006 to 4.6 ± 1.9 in 2014 ($p = 0.005$). Core biopsies were performed in conjunction with FNA in 6.4% of cases; this increased from 5.2% prior to 2013, to 13.7% in 2013–2014 ($p = 0.0012$). Molecular testing was successful in 63 out of 150 attempted cases (42%)—39.5% for FNA alone and 53.8% for FNA with core biopsy ($p = 0.56$). The pneumothorax rate for FNA alone was 23.9%, and was higher when 5 or more passes were performed ($p = 0.021$). The median length of stay for FNA alone was 0 days (Range: 0–74 days), with same day discharge in 65.2% of patients.

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Conclusions: Thoracic surgeons can perform CT-FNA with excellent diagnostic yield and accuracy. Results are enhanced by specific training in thoracic oncology, CT interpretation and an intimate knowledge of intrathoracic anatomy. These procedures can be done safely under local sedation in the OR setting where CT scanners are available, and complications can be immediately identified and treated by surgeons trained in their specific management.

P34. Outcome of Various Transplant Procedures (Single, Sparing, Inverted) in Living-Donor Lobar Lung Transplantation

*Hiroshi Date, Akihiro Aoyama, Kyoko Hijiya, Hideki Motoyama, Tomohiro Handa, Hideyuki Kinoshita, Shiro Baba, Toshiyuki Mizota, Kenji Minakata, Toyofumi F. Chen-Yoshikawa
Kyoto University, Kyoto, Japan

Objective: In standard living-donor lobar lung transplantation (LDLLT), the right and left lower lobes from two healthy donors are implanted in the recipient in place of whole right and left lungs. Due to difficulty encountered in finding two donors with ideal size matching, various transplant procedures have been developed in our institution. The purpose of this study was to compare outcome of non-standard LDLLT with that of standard LDLLT.

Methods: Between June 2008 and September 2015, we performed 61 LDLLTs for critically ill patients who were unlikely survive the long wait for cadaveric lungs (N = 30 male, 31 female, 18 children, 43 adults; average age 36.2). Functional size

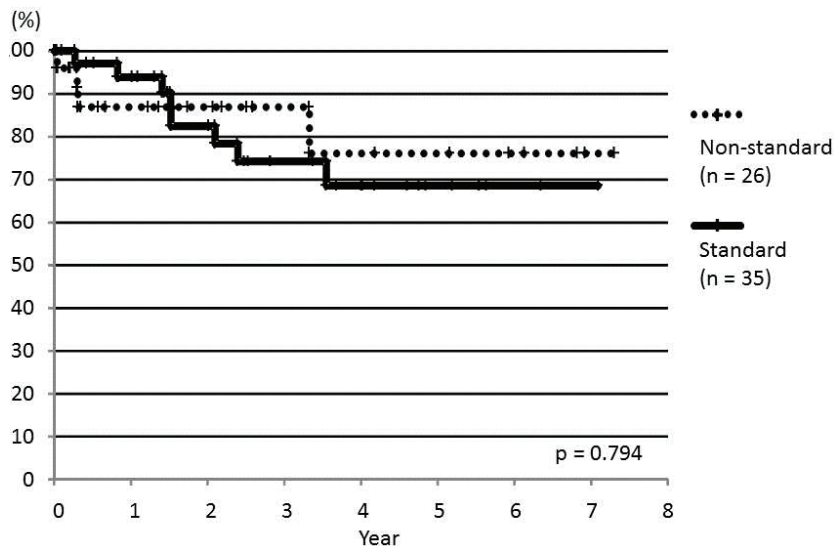
matching was performed by estimating graft forced vital capacity (FVC) based on the donor's measured FVC and the number of pulmonary segments implanted. For anatomical size matching, 3D-CT volumetry was performed both for the donor and the recipient. In cases of oversize mismatch, single lobe transplant or downsizing transplant was performed. In cases of undersize mismatch, native upper lobe sparing transplant or right-left inverted transplant was performed. In right-left inverted transplants, donor right lower lobe (5 segments) was inverted and implanted into the recipient's left chest cavity instead of the donor left lower lobe (4 segments). All data were analyzed retrospectively as of October 2015.

Results: Twenty six patients (42.6%) received non-standard LDLLT which included 10 single lobe transplants, 6 native upper lobe sparing transplants, 5 right-left inverted transplants, 1 downsizing transplant and 4 combined transplants (single + downsizing, single + inverted, middle lobe inverted, sparing + inverted). Thirty five patients (57.4%) received standard LDLLT.

Duration of postoperative mechanical ventilation required was similar between non-standard LDLLT and standard LDLLT (18.4 days vs 16.5 days, $p = 0.77$). Hospital death occurred in three patients after non-standard LDLLT and in one after standard LDLLT (11.5% vs 2.7%, $p = 0.18$). Three and five year survival rates were similar between the two groups (86.9% and 76.0% after non-standard LDLLT vs 74.2% and 68.5% after standard LDLLT, $p = 0.794$, Figure).

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Survival after living-donor lobar lung transplantation (n = 61)



Conclusions: Various transplant procedures such as single, sparing and inverted transplants are valuable options when two donors with ideal size matching are not found in LDLLT.

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P35. Intraoperative Use of Taurolidine In Cystic Fibrosis Patients Undergoing Lung Transplantation and Impact on Bacterial Colonization: A Propensity Score Matched Analysis

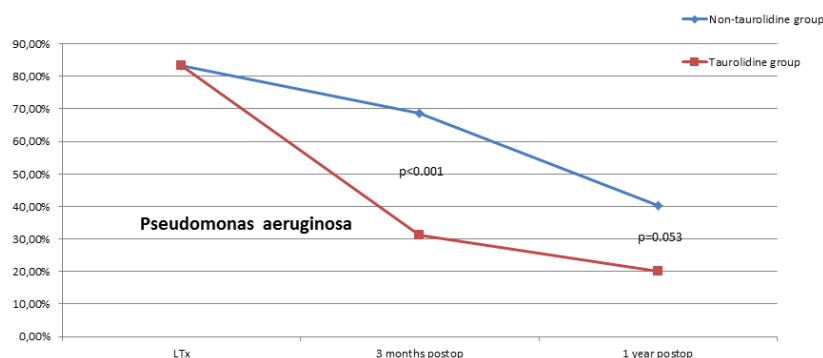
Mohamed Zeriouh¹, Nikhil P. Patil¹, Anton Sabashnikov², Prashant N. Mohite¹, Bartlomeij Zych¹, Diana Garcia¹, Achim Koch¹, Simona Soresi¹, Alexander Weymann³, Ashham Mansur⁴, Jens Wippermann², *Thorsten Wahlers², Fabio De Robertis¹, Andre R. Simon¹, Aron-Frederik Popov¹

¹Royal Brompton and Harefield Hospital, Middlesex, Harefield, London, United Kingdom; ²University Hospital of Cologne, Cologne, Germany; ³University of Heidelberg, Heidelberg, Germany; ⁴Georg August University, Goettingen, Germany

Objective: The presence of bacterial colonization that causes chronic pulmonary infections in cystic fibrosis (CF) patients remains a key issue before Lung transplantation (LTx). We sought to assess the impact of intraoperative Taurolidine lavage on bacterial colonization and long-term outcomes following LTx in CF patients.

Methods: Between 2007 and 2013, 114 CF patients underwent LTx at our institute. Taurolidine 2% bronchial lavage was applied in all CF patients since 2010. Detailed analysis of donor and recipient bacterial colonization status in treatment and control groups was performed. Kaplan-Meier survival estimation was applied in Taurolidine- and non-Taurolidine group for survival analysis and freedom from BOS. Propensity score matching (PSM) was conducted to reduce confounding bias.

Figure 3. Reduction in PA colonization observed over one-year follow-up in the Taurolidine group with a statistically significant decrease in the proportion of patients colonized: from 83.3% at baseline to 31.3% at 3 months ($p < 0.001$) and 20% at 1 year ($p < 0.053$). Non-Taurolidine group was only associated with a trend towards reduced colonization: from 83.3% at baseline to 68.8% at 3 months and 40.3% at 1 year.



Results: After one year, a significant decrease of *Pseudomonas aeruginosa* (PA) from 83.3% to 20% ($p < 0.053$) and a complete eradication of *Burkholderia cepacia* (BCC) and *Stenotrophomonas maltophilia* (SM) colonizations could be achieved in the Taurolidine group, whereas in the non-Taurolidine group a non-significant

decrease in PA colonization from 83.3% to 40.3% and persisting BCC and SM colonizations were observed. After PSM, the outcome in the Taurolidine group was superior regarding FEV1 3 and 6 month after surgery with 74 ± 14.9 vs. 60.8 ± 17.6 ($p = 0.01$) and 80.2 ± 17.4 vs. 67.3 ± 17.2 ($p = 0.022$) percent of predicted values respectively. In terms of long-term overall survival ($p = 0.277$) and freedom from BOS ($p = 0.979$), both groups were comparable.

Conclusions: Taurolidine may significantly reduce the proportion of CF patients colonized with multiresistant pathogens particularly with PA, potentially leading to better outcomes after LTx.

TUESDAY AFTERNOON, MAY 17, 2016

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2:00 PM **Cardiothoracic Surgical Trials Network: Implications for Clinical Practice** Hall E, BCC

See page 46 for schedule.

3:20 PM – 3:55 PM **Coffee Break in the Exhibit Hall**

3:55 PM **Adult Cardiac Surgery Simultaneous Scientific Session** Hall E, BCC
5 minute presentation, 7 minute discussion

Moderators: *Niv Ad and *Song Wan

50. The Role of Deliberate Practice in Achieving Technical Proficiency in Coronary Anastomosis Simulation: A Randomized Study of Surgical Novices

Dawn S. Hui, *Hendrick Barner, Mark Kohn, Erica R. Holbrook, Christopher Odehnal, Aravinth Karunanandaa, *Richard Lee
St. Louis University, St. Louis, MO

Invited Discussant:

Objective: Simulation is a mandated component of cardiothoracic surgical training, but there is little data on predictors of time to achievement of technical proficiency. Further, the role of deliberate unsupervised practice remains unclear. This study sought to identify whether such predictors exist and to examine the role of unsupervised practice

Methods: Medical students in this single-blinded randomized controlled trial were randomized 1:1 to Training (weekly supervised practice) or Practice (weekly supervised alternating with independent unsupervised practice). Weekly videotaped performances were rated independently by 3 cardiothoracic surgeons blinded to randomization and utilizing a verified 13-point rating tool. The endpoint was achievement of proficiency by a score of >4 for each item and an overall pass rating from all raters. Baseline characteristics and 3 validated cognitive measures were compared. Associations were explored using Mann-Whitney U. Logistic regression was used to evaluate Rapid Learning (<4 weeks to proficiency).

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Results: From January 2014–May 2015, 50 students achieved proficiency (22 Training, 28 Practice). Baseline characteristics, cognitive scores, and Week 1 scores were similar, except more Training participants had hobbies involving fine motor skills ($p = 0.036$) (Table 1). Median time to proficiency was 5 weeks for both groups (Training IQR 3.3–7, range 2–10; Practice IQR 4.0–5.0, range 2–8) and did not differ between groups ($p = 0.8$). Stratified analysis showed correlation of Week 1 score with time to proficiency, with moderate negative correlation in both groups [Training, $p = 0.03$, $r_s(20) = -0.44$; Practice, $p = 0.049$, $r_s(26) = -0.375$]. There was no association with baseline characteristics or cognitive scores. Logistic regression showed an effect of Week 1 score on rapid learning (OR 0.09, 95% CI 0.011–0.720, $p = 0.02$); no effect of cognitive scores or fine motor skill hobbies. The dropout rate before proficiency was 41% ($n = 35$). Associations with dropout before proficiency were cognitive scores (PSVT-R, $p = 0.02$; MRT, $p = 0.02$), Week 1 score ($p = 0.04$), and gain score from weeks 1–3 ($p = 0.017$). Randomization did not affect dropout.

	Time to Proficiency		Proficiency versus Withdrawal
	Training (n=28)	Practice (n=22)	
Age ^A	0.88	0.65	0.56
Gender ^B	0.34	0.69	0.79
Cognitive Tests ^A			
PSVT-R	0.46	0.26	0.02*
RAPM	0.81	0.27	0.40
MRT-A	0.35	0.59	0.02*
Extent of prior OR experience ^C	0.88	0.63	0.12
Extent of prior CT surgery experience ^C	0.21	0.24	0.35
Previous experience with surgical simulator ^B	0.28	0.36	0.77
Interest in CT surgery as a career ^B	0.12	0.45	0.57
Science Major ^B	0.53	0.77	0.67
Hobbies ^B			
Sports ^B	0.22	0.49	0.23
Musical Instrument ^B	0.16	0.46	1
Fine Motor Skill ^B	0.51	0.69	0.41
Video Games ^C	0.34	0.56	0.60
Foreign Language Fluency ^B	0.06	0.8	0.71
Week 1 Score	0.02*	0.008*	0.03*
Gain Score Weeks 1-2	0.49	0.83	0.59
Gain Score Weeks 2-3	0.46	0.49	0.19
Gain Score Weeks 1-3	0.67	0.46	0.02*

Table 1. Significance level of associations

^APearson's or Spearman's; ^BMann-Whitney U; ^CKruskal-Wallis; * $p < 0.05$

PSVT-R, Purdue Spatial Visualization Test; Rotations; RAPM, Raven's Advanced Progressive Matrices; MRT, Mental Rotations Test A

Conclusions: Baseline competency predicts achievement of and time to technical proficiency. Unsupervised practice had no effect on correcting for baseline performance. In a structured supervised curriculum, additional efforts towards unsupervised practice may have limited effect on the training process. This suggests that there may be benefit to technical skills screening prior to training.

51. Longitudinal Outcomes After Surgical Repair of Postinfarction Ventricular Septal Defect

George J. Arnaoutakis¹, Sunghee KIM², J. Matthew Brennan², Brian C. Gulack², Jane M. Han³, *Fred H. Edwards⁴, *Jeffrey P. Jacobs⁵, *John V. Conte⁵

¹University of Pennsylvania, Philadelphia, PA; ²Duke University, Durham, NC; ³Society of Thoracic Surgeons, Chicago, IL; ⁴University of Florida, Jacksonville, FL; ⁵Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: *Hossein Almassi

Purpose: Patients undergoing postinfarction ventricular septal defect (VSD) repair are at high risk for early morbidity and mortality, but little is known about subsequent clinical events. This study uses short-term clinical data from the Society of Thoracic Surgeons (STS) National Database linked with Medicare data to examine longer-term outcomes in these patients.

Methods: This was a retrospective review of the STS National Database to link with Medicare data all adults (≥ 65 years) who underwent post-MI VSD repair between 2008–2012. Patients with congenital heart disease were excluded. Successfully linked patients were matched on site, DOB, admit date, discharge date, and sex in both databases. The primary outcome measure was 1-year mortality. Subgroup analysis was performed according to operative status (elective/urgent vs emergent/salvage). Risk factors for 1-year mortality were modeled using a multivariable logistic regression.

Results: There were 1,238 patients found in the STS database and 537 (45.1%) were successfully linked with CMS data. Median age was 74 years, and 277 (52%) were men. 192 (36%) were supported preoperatively with an intra-aortic balloon pump. Concomitant CABG was performed in 353 (66%). Surgical status was emergent or salvage in 138 (26%). 158 (29%) died within 30-days and 207 (39%) patients died within 1-year. On unadjusted analysis, 1-year non-survivors were older ($p < 0.05$) and had worse preoperative renal function ($p < 0.05$). Among patients who survived to hospital discharge, 44% were discharged to a facility, and 141 (26%) experienced at least one all-cause re-admission within 1-year. There was a significant difference in unadjusted 1-year mortality rates when stratified by operative status (13% in elective vs. 42% in urgent vs. 69% emergent vs. 80% in salvage, $p < 0.01$). On multivariable analysis, emergent/salvage status and concomitant CABG were independently associated with worse 1-year mortality (Table 1).

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Table 1: Multivariable Logistic Regression Analysis for 1-Year Mortality

Variables	Odds Ratio	95% CI	P-Value
Age 75–84 (vs. 65–74) yrs	1.22	(0.84,1.77)	0.30
Age 85+ (Vs. 65–74) yrs	1.26	(0.68,2.35)	0.45
Male (vs. Female)	1.03	(0.84,1.28)	0.75
BMI 25–29.9 (vs. < 25)	0.85	(0.65,1.12)	0.26
BMI ≥ 30 (vs. < 25)	1.18	(0.86,1.61)	0.30
Hypertension	1.51	(0.90,2.55)	0.12
Insulin Dependent Diabetes	0.90	(0.41,1.90)	0.79
Chronic Lung Disease—mild/moderate (vs. none)	1.21	(0.77,1.91)	0.42
Chronic Lung Disease—severe (vs. none)	0.81	(0.42,1.50)	0.52
Preop Renal Failure	1.28	(0.83,1.97)	0.27
Cerebrovascular Accident	1.15	(0.52,2.52)	0.72
EF = 45%)	1.09	(0.65,1.85)	0.74
EF 30–44% (vs. ≥ 45%)	0.88	(0.59,1.30)	0.52
Operative Status—Urgent (vs. Elective)	1.12	(0.85,1.47)	0.42
Operative Status—Emergent/Salvage (vs. Elective)	3.58	(2.59,5.01)	<.01
Concomitant CABG	1.84	(1.14,3.00)	0.01
SurgYear 2009 vs 2008	1.29	(0.87,1.90)	0.21
SurgYear 2010 vs 2008	0.98	(0.65,1.47)	0.92
SurgYear 2011 vs 2008	1.17	(0.75,1.81)	0.48
SurgYear 2012 vs 2008	0.77	(0.50,1.17)	0.23

Conclusions: These data suggest the greatest mortality risk in this patient population occurs in the first 30-days. Emergent or salvage status strongly predicts 1-year mortality. Optimizing physiologic derangements prior to operative repair with percutaneous closure devices or temporary mechanical circulatory support may be considered when possible in this subgroup of patients.

Late-Breaking Clinical Trial

52. Is Subvalvular Repair Worthwhile in Severe Ischemic Mitral Regurgitation?

Results from a Randomized Clinical Study

Francesco Nappi¹, Cristiano Spadaccio², Antonio Nenna³, Mario Lusini³, Massimo Chello³, Christophe Acar⁴

¹Centre Cardiologique du Nord, Paris, France; ²Golden Jubilee National Hospital, Glasgow, United Kingdom; ³University Campus Bio-Medico, Rome, Italy; ⁴Hopital La Pitie Salpetriere, Paris, France

Invited Discussant: *Manuel J. Antunes

Objective: To compare survival and valve durability following aortic valve replacement (AVR) in 50–60 year-old patients in order to better inform optimal prosthetic valve decision-making.

Methods: All patients undergoing AVR at our institution since 1960 have been prospectively followed for survival and explant on an annual basis. Expected survival was calculated for each patient from age-gender-operative year matched US life tables. Observed and expected survival curves were plotted and compared using Mortality Risk Ratio (MRR = total observed deaths/total expected deaths). The cumulative incidence function (CIF) was used to determine valve explant rates at 20 years.

Results: There were 1,021 AVR patients 50–60 years of age at the time of AVR (1961–2014) with 10,083 patient-years of follow-up. From this group the survival and explant outcomes of all consecutive pericardial AVR implants (n = 230, 1992–2014, 1,558 patient-years follow-up) were compared to those of the contemporaneous series of 278 consecutive mechanical AVR implants (2,470 patient-years follow-up) (Table). There were no significant differences in age, gender, incidence of concomitant CABG, or 30-day operative mortality (0.9% versus 2.9%, p = 0.12). Observed long-term survival for pericardial AVR was equal to expected survival (MRR = 1.1, P = NS) at all time points. Long-term survival for mechanical AVR was significantly worse than expected (MRR = 1.61, P < 0.05) and diverged from the expected survival curve after 7.1 years. The cumulative incidence of pericardial AVR explant at 20 years is relatively low at 22%, but it is still three fold higher than that of mechanical AVR.

Table: Consecutive AVR; 1992–2014; 50–60 Year-Old Patients

	Pericardial AVR (N = 230)	Mechanical AVR (N = 278)
Mean Age (years)	56.2	55.6
% Male	70	67
% CABG	24.8	22.7
Total observed deaths	37	86
Total expected deaths	34	54
Mortality Risk Ratio	1.1	1.6 +
20-yr CIF Explant Rate (%)	22	7 *
20-yr Death + CIF Explant (%)	41	65 *

+ P < 0.05 Observed versus Expected Deaths

* P < 0.05 compared to Pericardial AVR

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Conclusions: In 50–60 year-old patients, pericardial AVR restores expected survival, whereas mechanical AVR does not. The tradeoff between a higher explant rate with preserved survival (pericardial AVR) versus a lower explant rate with reduced survival (mechanical AVR) should be taken into account when discussing valve options with patients undergoing AVR. Current guideline recommendations for AVR prosthesis choice should be re-examined with additional consideration given to restoration of expected survival.

53. Infective Endocarditis in Dialysis Patients: Is It Worth Operating?

Sajjad Raza, Asif Ansari, Jeevanantham Rajeswaran, Amr Arafat, Matteo Trezzi, Syed T. Hussain, Haris Riaz, Sunil Panwar, Sevag Demirjian, Thomas Fraser, *Joseph F. Sabik, *Eugene H. Blackstone, *Gosta B. Pettersson
Cleveland Clinic, Cleveland, OH

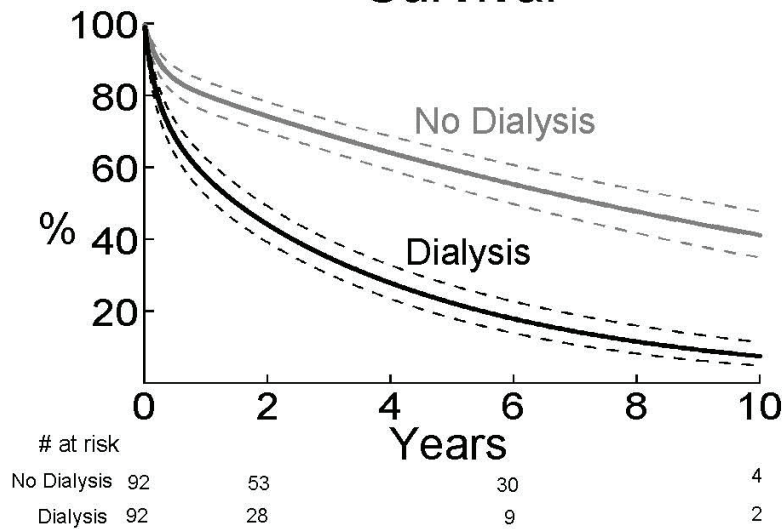
Invited Discussant: *Frank W. Sellke

Objective: Short-term risk in hemodialysis patients undergoing valve surgery for infective endocarditis (IE) is presumed to be high and long-term outcomes are not well known. Therefore, we sought to determine in-hospital and long-term mortality in hemodialysis vs. non-dialysis patients and risk factors for early and late mortality after surgery in hemodialysis patients.

Methods: From 1/1997 to 1/2013, 1413 patients underwent valve surgery for active IE; 1233 (87%) were non-dialysis patients, 144 (10%) patients were on chronic hemodialysis, 8 (0.6%) on chronic peritoneal dialysis, and 28 (2%) patients had acute renal failure requiring dialysis. End-points of the study were in-hospital and long-term mortality. A total of 6,267 patient-years of follow-up data were available for analysis. Propensity-matching was used and 92 well-matched patient-pairs were identified for risk-adjusted comparison between chronic hemodialysis and non-dialysis patients. Multivariable analysis was performed to identify risk factors for early and late mortality after surgery in chronic hemodialysis patients.

Results: Unadjusted hospital mortality was 13% for hemodialysis patients vs. 6.1% for non-dialysis patients ($P = .0037$). Hospital mortality amongst propensity-matched pairs was 12% for hemodialysis patients vs. 4.3% for non-dialysis patients ($P = .06$). Unadjusted survival at 1, 3, 5, 7, and 10 years was 58%, 34%, 20%, 12%, and 5.6% in hemodialysis patients and 86%, 78%, 72%, 65%, and 57% in non-dialysis patients ($P < .0001$). At these same time points, survival in matched-pairs (Figure) was 57%, 35%, 22%, 14%, and 7.5% for hemodialysis patients, and 80%, 69%, 60%, 51%, and 41% for non-dialysis patients ($P < .0001$). Risk factors for early mortality after surgery in hemodialysis patients were higher bilirubin, $\geq 50\%$ stenosis in circumflex coronary artery, and history of peripheral arterial disease. Risk factors for late mortality included higher body mass index, lower grade of aortic valve regurgitation, presence of arteriovenous graft for vascular access and preoperative pacemaker.

Survival



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Conclusions: Surgery for IE in hemodialysis-patients is associated with higher early mortality and worse long-term survival compared to non-dialysis patients. Although higher risk and a single center series, 35% and 22% of hemodialysis-patients lived beyond 3 and 5 years, respectively supporting continued surgery for IE in this high-risk population.

54. Long-Term Outcome of Total Arterial Myocardial Revascularization Versus Conventional Coronary Artery By-Pass in Diabetic and Non Diabetic Patients: A Propensity-Match Analysis

*Claudio Muneretto, Lorenzo Di Bacco, Gianluigi Bisleri, Laura Giroletti, Alberto Repossini
University of Brescia, Brescia, Italy

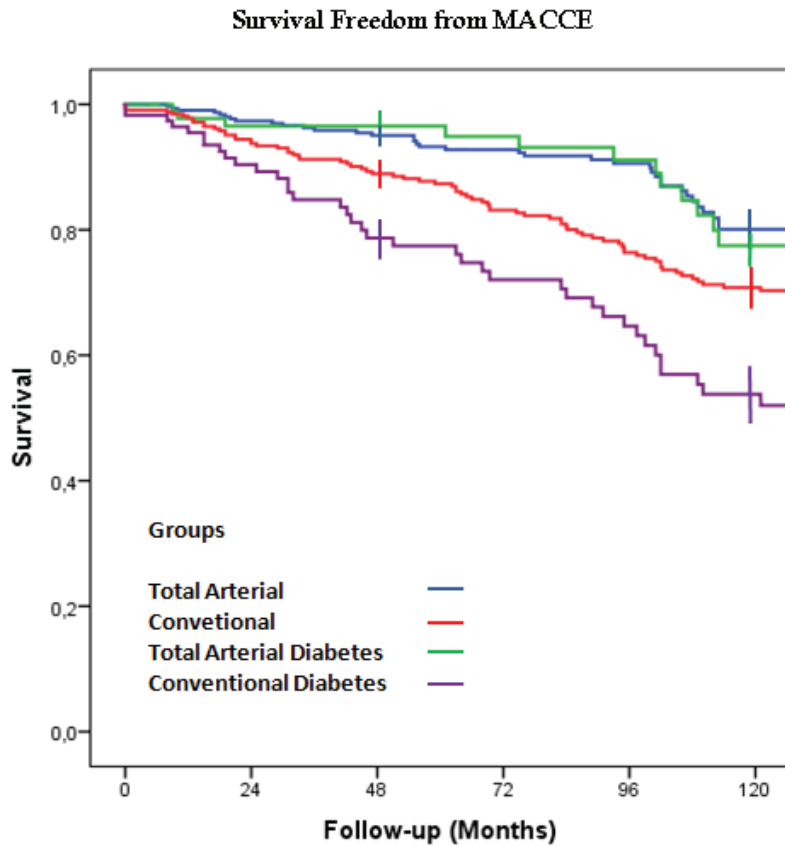
Invited Discussant: *John D. Puskas

Objective: To evaluate with a propensity match comparison the long-term outcome of patients with and without diabetes undergoing total arterial versus conventional myocardial revascularization.

Methods: Among 1000 consecutive patients undergoing CABG surgery, we performed a propensity-match analysis in a population with double and triple vessels disease in order to compare patients receiving total arterial grafting (G1, 618 pts.) with patients receiving conventional myocardial revascularization by means of LIMA on LAD plus saphenous vein grafts (SVGs) (G2, 382 pts.). Primary end-point were survival freedom from all-cause death and cardiac-related mortality while

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secondary end-point was the occurrence of MACCEs (defined as cardiac death, myocardial infarction, repeated revascularization on grafted vessels, stroke). Following propensity matching two homogeneous groups of 359 patients each were obtained.



Results: There were no significant differences between the groups in terms of pre-operative continuous and discrete variables and risk profile (EuroSCORE II: G1 $1.9\% \pm 0.8$ vs G2 $1.7\% \pm 0.7$, $p = 0.783$, SYNTAX score: G1 23.9 ± 8.6 vs G2 24.7 ± 7.9 , $p = 0.364$) nor there were any differences in terms of number of grafted vessels (G1 = 2.63 ± 0.43 vs G2 = 2.62 ± 0.6 ; $p = 0.41$). CPB duration was significantly longer in G2 (G1 61 min vs G2 87 min) because of the time required for proximal anastomosis. There were no differences between the groups in terms of 30-day mortality (G1: 0 pts vs G2: 1 pts, 0.3%, $p = 0.91$) and major peri/post-operative complications. At a median follow-up of 101 months (range 11–185 months), total arterial grafting was associated with significantly better overall survival (G1 = $76.5 \pm 3.0\%$ vs G2 = $66.0 \pm 3.1\%$; $p < 0.001$), survival freedom from cardiac death (G1 = $90.8 \pm 2.1\%$ vs G2 = $84.2 \pm 1.9\%$; $p = 0.043$) and occurrence of MACCEs (G1 = $80.1 \pm 3.2\%$ vs G2 = $70.8 \pm 2.9\%$; $p > 0.001$). Diabetic patients receiving total arterial revascularization

showed a significant improvement in outcome when compared to those receiving saphenous vein grafts in terms of freedom from cardiac death (G1: 84.7 ± 2.1 vs G2: 79.3 ± 3.4 ; $p = 0.035$) and freedom from MACCEs (G1: 77 ± 6 vs G2: 53 ± 5.8 ; $p < 0.001$). Multivariate Cox regression analysis identified Diabetes (HR = 1.94, CI 95% = 1.12–2.93; $p < 0.001$) and the use of saphenous vein grafts (HR = 1.81, CI 95% = 1.32–2.65; $p < 0.001$) as independent predictors for all-cause death. In diabetic patients Cox regression analysis identify the use of saphenous vein grafts as the strongest independent predictor of MACCEs (HR = 2.41, CI 95% = 1.27–4.59; $p = 0.007$) and cardiac death (HR = 3.24, CI 95% = 1.69–6.23; $p < 0.001$).

Conclusions: Total arterial revascularization is associated with improved long-term outcomes when compared to LIMA plus multiple SVGs. Survival benefits are particularly relevant in diabetic patients in whom the use of SVG might be avoided.

55. Trends in 30 Day Readmission After CABG in the Medicare Population: Longitudinal Analysis Over 13 Years

Kathleen Kwedar, Christian McNeely, Stephen Markwell, Christina Vassileva
Southern Illinois University, Springfield, IL

Invited Discussant: *Jennifer S. Lawton

Objective: To examine trends in 30-day readmission following CABG in the Medicare population over a 13 year period.

Methods: The study included isolated CABG procedures in the Medicare population from 1/2000 through 11/2012. Comorbidities were determined using ICD-9-CM diagnostic codes. Trends in patient characteristics and hospital outcomes were assessed with Cochran-Armitage trend tests. Hierarchical logistic regression was used to model 30-day readmission, as well as mortality after readmission, while accounting for clustering within hospitals as well as baseline characteristics.

Results: The study cohort included 1,116,991 patients. Overall 30-day readmission rate was 18.9%. Readmission rates decreased over time from 19.5% in 2000 to 16.6% in 2012, $p = 0.0001$. Adjusted readmission rates accounting for differing patient comorbidity profiles over time, demonstrated a significant improvement in 30-day readmission after CABG by 26%, OR 1.26 (95% CI 1.22–1.30) in 2012 compared to 2000. Adjusted readmission rates were significantly related to annual hospital CABG volume: OR 1.15 (95% CI 1.11–1.20) for volume <50 cases/year compared to annual hospital CABG volume >200. Readmission rates were higher for patients who presented with acute MI at the time of their index CABG compared to those without acute MI (OR 1.10, 95% CI 1.08–1.11), for females compared to males (OR 1.33, 95% CI 1.32–1.35), for non-Caucasians compared to whites (OR 1.09, 95% CI 1.07–1.11) and for non-elective admission status (OR 1.35, 95% CI 1.31–1.39 for emergent, OR 1.24, 95% CI 1.23–1.26 for urgent). Median LOS for the readmission episode was 5 days (IQR 3–8) overall and 4 days from 2009–2014. The majority of readmitted patients (70.4%) had only one readmission during the 30-day period. The primary readmission diagnosis was heart failure (HF) in 13.1%, atrial fibrillation (AF)/flutter in 4.4%, chronic ischemic heart disease in 3.6%, angina in 2.9%, ischemic stroke in 2.9%. A small minority of patients had PCI (1.3%) or CABG (0.1%) during readmission. Of the factors examined, the most

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significant predictors of 30-day readmission were history of HF OR 1.46 (95% CI 1.44–1.48), history of AF OR 1.39 (95% CI 1.37–1.41), history of COPD OR 1.36 (95% CI 1.35–1.38), and emergent CABG at the initial operation OR 1.35 (95% CI 1.31–1.39). Hospital mortality during the readmission episode was 2.8% overall and showed a significant downward trend over time to 2.4% in 2012, $p = 0.0001$.

Conclusions: In a large cohort of over 1 million Medicare patients undergoing CABG over a 13 year period, we noted a slight decrease in 30-day readmission rates, despite worsening preoperative profiles. Lower CABG volume is associated with higher 30-day readmission rates after CABG in the Medicare population. Hospital mortality during readmission is low but may identify an important group of patients for future quality improvement initiatives.

56. The Cox-Maze IV Procedure for Atrial Fibrillation Has Similar Efficacy for Rheumatic and Degenerative Mitral Valve Disease

Jonathan E. Labin, Nowrin Haque, Laurie A. Sinn, Richard B. Schuessler, *Marc R. Moon, *Hersh S. Maniar, Spencer J. Melby, *Ralph J. Damiano, Jr.
Washington University, St. Louis, MO

Invited Discussant: *Vinay Badhwar

Objective: The Cox-Maze IV procedure (CMPIV) has been established as the gold standard for surgical ablation of atrial fibrillation (AF) associated with non-rheumatic mitral valve disease. However, the relative success of the CMPIV in patients with rheumatic mitral valve disease remains ill-defined. The aim of this study was to determine whether the underlying etiology of mitral valve disease (MVD), due to either rheumatic or degenerative pathology, influenced long-term outcomes following the CMPIV.

Methods: Between February 2001 to July 2015, 245 consecutive patients received a CMPIV and concomitant mitral valve operation. Patients were separated into two cohorts based on their underlying etiology of MVD, degenerative ($n = 153$) and rheumatic ($n = 92$). Patients were followed prospectively (mean follow up of 41 ± 37 months) and were monitored for recurrent AF via Holter monitoring, pacemaker interrogation, interrogation of implantable cardiac loop recorders, or EKGs. Perioperative variables and long-term freedom from AF on and off anti-arrhythmic drugs (AADs) were assessed and analyzed retrospectively.

Results: The two groups differed in that patients with rheumatic MVD were younger, had a higher proportion of females, a larger preoperative left atrial diameter, AF of longer duration, a higher percentage of longstanding persistent AF, and worse New York Heart Association functional class ($P \leq 0.001$). While there was no difference in operative mortality or overall major complications between the groups, the median ICU length of stay was longer in the rheumatic cohort (4 vs 3 days, $P = 0.002$). Freedom from AF up through 5 years was similar when comparing the rheumatic to the degenerative MVD cohort [84% (62/74) and 91% (114/126) at 6 months; 91% (61/67) and 89% (107/120) at 1 year; 87% (48/55) and 83% (55/66) at 3 years; 72% (23/32) to 72% (26/36) at 5 years, Figure 1]. Follow up available at 3 months, 6 months and 1 through 5 years was 96% (219/229), 91% (200/220), 89% (187/211), 85% (152/179), 85% (121/143), 84% (93/111), and 83% (68/82)

respectively. Predictors of recurrence included failure to use a box-lesion to isolate the posterior left atrium ($P = 0.012$), the duration of preoperative AF ($P = 0.001$), and early occurrence of atrial tachyarrhythmias (ATAs) ($P = 0.015$).

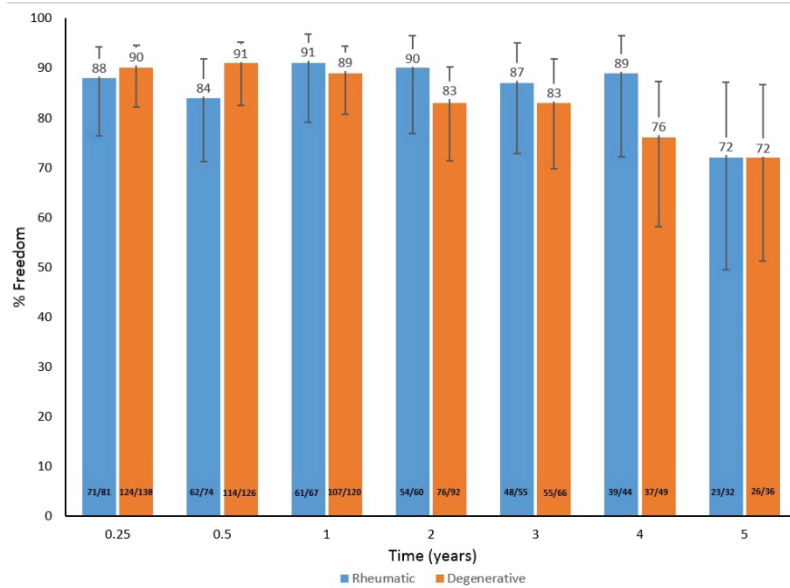


Figure 1: Five-year follow-up comparing freedom from AF on and off antiarrhythmic drugs after a concomitant CMIV + MV procedure for AF associated with rheumatic versus degenerative MVD. There was no significant difference through 5 years ($P > 0.102$).

Conclusions: The long-term efficacy of the CMPIV in restoring sinus rhythm was similar in patients with either rheumatic or degenerative mitral valve disease. Despite representing a sicker patient population with longer duration of preoperative AF and larger LA diameters, patients with AF associated with rheumatic MVD equally benefit from the CMPIV.

Late-Breaking Clinical Trial

LB9. Long-Term Follow-Up at 8 Years of the Clopidogrel After Surgery for Coronary Artery Disease Double-Blind, Randomized, Placebo-Controlled Trial

Ali Hage¹, Pierre Voisine¹, Fernanda Erthal², David Glineur², Benjamin Chow², Hugo Tremblay¹, Jacqueline Fortier², Gifford Ko², Dai Une², Michael Farkouh³, Thierry G. Mesana², Michel LeMay², ♦Alexander Kulik⁴, *Marc Ruel²

¹Quebec Heart and Lung Institute, Quebec, QC, Canada; ²University of Ottawa Heart Institute, Ottawa, ON, Canada; ³University Health Network, Toronto, ON, Canada;

⁴Lynn Heart & Vascular Institute, Boca Raton, FL

Invited Discussant: *Sary F. Aranki

5:35 PM

Executive Session, AATS Members Only

Hall E, BCC

*AATS Member ♦AATS New Member

3:55 PM

**Aortic/Endovascular Surgery
Simultaneous Scientific Session**

Ballroom I, BCC

5 minute presentation, 7 minute discussion

Moderators: *Anthony L. Estrera and *Steven L. Lansman

57. Deep Circumferential Annuloplasty As a Repair Adjunct in Regurgitant Bicuspid Aortic Valves with a Dilated Annulus: The Need to Address the Septum

Omar Nawaytou¹, ♦Munir Boodhwani², ♦Laurent de Kerchove¹, *Gebrine El Khoury¹

¹*Cliniques Universitaires Saint-Luc, Brussels, Belgium;* ²*University of Ottawa Heart Institute, Ottawa, ON, Canada*

Invited Discussant: *Malakh L. Shrestha

Objective: Ventriculoaortic junction (VAJ) dilatation is an important contributor to bicuspid aortic valve (BAV) regurgitation as well as a predictor of repair failure, if inadequately treated. This VAJ dilatation invariably involves the difficult to access, anterior and deep portion of the annulus including the interventricular septum and remains untreated by commonly used annuloplasty techniques. We evaluate the results of bicuspid aortic valve repair with deep circumferential annular support, in particular to the interventricular septum.

Methods: Between February 1999 and June 2015, 265 patients underwent BAV repair. Out of these, 100 consecutive patients with aortic regurgitation (AR) $\geq 2+$ and a dilated VAJ (≥ 26 mm) who had an adjunctive circumferential annuloplasty (reimplantation procedure or ring) were identified. There were 13 Type 0 and 87 Type 1 BAV. 79 patients displayed anterior (septal) leaflet prolapse. External root dissection to accommodate the annuloplasty was carried deep along the anterior aspect of the annulus in the plane between the right ventricular outflow tract and the muscular interventricular septum. Various cusp repair techniques were used in 99 patients. Patients' records, unedited operative videos and perioperative echocardiograms were assessed. Follow up was complete in 95 patients with a median follow up of 32 months and a total of 360 patient-years. 88 patients had follow up echocardiograms.

Results: The mean age was 40.7 ± 11.5 years and 94 were males. Six patients had previous cardiac operations out of which 3 were previous aortic valve repairs. The grade of AR was 2+ in 17 patients, 3+ in 52, and 4+ in 31. The mean VAJ, sinus of Valsalva, sinotubular junction and ascending aortic diameter was 30 ± 4 , 42 ± 7 , 37 ± 8 , and 42 ± 10 mm, respectively. Cusp repair techniques, used solely or in conjunction, were central plication in 71, direct raphe closure in 15, triangular resection in 12 and Gortex free edge resuspension in 22 patients. A pericardial patch was used in 4 patients for cusp extension, in 3 for raphe repair and in 3 for commissural reconstruction. 93 patients underwent a reimplantation procedure and 7 an annuloplasty ring. There were no in-hospital deaths or early reinterventions for repair failure. Seven patients required permanent pacemaker implantation. Only one patient had 2+ AR on discharge. There was one late non-cardiac death at follow up. There were 2 cases of late thromboembolism and one of infective endocarditis. Freedom from AR $\geq 2+$ and from reoperation was 88% and 97% at 15 years, respectively.

Conclusions: Regurgitant BAVs with a dilated annulus display anterior cusp prolapse towards the septum in the majority of cases. A deep circumferential annuloplasty combined with cusp repair provides a durable result in these patients.

58. Cardiovascular Operations for Loeys-Dietz Syndrome: Intermediate Results

Nishant D. Patel, Todd Crawford, Jonathan T. Magruder, Diane E. Alejo, Narutoshi Hibino, Harry C. Dietz, James Black, *Luca A. Vricella, *Duke E. Cameron

Johns Hopkins Medical Institutions, Baltimore, MD

Invited Discussant: Michael P. Fischbein

Objectives: Early experience with Loeys-Dietz Syndrome (LDS) suggested an aggressive aortopathy with high risk for aneurysm rupture and dissection at younger ages and smaller aortic diameters than in other connective tissue disorders. We reviewed our LDS experience to re-examine our indications and outcomes of surgical management.

Methods: We reviewed all patients with a diagnosis of LDS who underwent cardiovascular surgery at our institution. The primary end-point was mortality, and secondary end-points included postoperative complications and need for re-intervention.

Results: Seventy-nine operated patients with LDS were identified. Mean age at first operation at our institution was 25 years, 39 (49%; n = 79) were female, and 38 (48%; n = 79) were children (age <18 yrs). Six (8%; n = 79) patients presented with acute dissection. Five (6%; n = 79) patients had a bicuspid aortic valve, and all presented with an ascending aortic aneurysm with a mean root diameter of 3.5 cm. Twenty (25%; n = 79) patients had a previous sternotomy. Sixty-five (82%; n = 79) patients underwent aortic root replacement, of which 52 underwent a valve-sparing operation and 4 had concomitant arch replacement. Mean aortic root diameter in this group was 4.2 cm. Nine (11%; n = 79) patients underwent aortic arch replacement, 2 (3%; n = 79) had isolated ascending aorta replacement, and 3 (4%; n = 79) underwent open thoracoabdominal repair. There were 2 (3%; n = 79) operative and 8 (10%; n = 77) late deaths. Nineteen (25%; n = 77) patients underwent subsequent operations for late aneurysm and/or dissection; of these 19 patients, 6 had late descending replacement, 5 had ascending replacement, 8 had aortic root replacement, and 10 had arch replacement. Two patients required late mitral valve repair/replacement and 4 required repair of a coronary button aneurysm/pseudoaneurysm. Of the 61 patients that had isolated root replacement, 4 (7%; n = 61) required late ascending repair and 7 (11%; n = 61) had late arch repair. Kaplan-meier survival was 88% at 10 years.

Conclusions: Growing experience with LDS has confirmed the early impressions of its aggressive nature and proclivity toward aortic catastrophe, and has also revealed unique features in valvar disease. Surgical outcomes are favorable, but reintervention rates are high. Meticulous clinical follow-up with cardiovascular surveillance imaging remain important for management, particularly as clinical LDS subtypes are characterized and more tailored treatment for these subtypes is developed.

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59. Are Outcomes of Thoracoabdominal Aortic Aneurysm Repair Different in Men Versus Women?

Konstantinos Spiliotopoulos, ♦Ourania Preventza, Matt Price, Qianzi Zhang,

*Joseph Coselli, *Scott LeMaire

Baylor College of Medicine, Houston, TX

Invited Discussant: *Li-Zhong Sun

Objective: Women have poorer outcomes than men following many cardiovascular operations, including coronary artery bypass and heart valve surgery. We sought to determine whether patient gender affects outcomes after thoracoabdominal aortic aneurysm (TAAA) repair.

Methods: We evaluated data regarding 3353 consecutive patients who underwent TAAA repair between 10/1986 and 07/2015. Data were collected retrospectively (1986–2006) and prospectively (2006–2015). There were 2072 men (61.8%) and 1281 women (38.2%). We compared preoperative characteristics, surgical variables, and outcomes between genders in the overall group as well as the subgroup of patients who underwent extent II repair, because these repairs carry the highest risks of morbidity and mortality. Outcomes of interest included operative death (30-day or in-hospital death), permanent stroke, permanent paraplegia or paraparesis, renal failure necessitating dialysis, and a composite of these outcomes, termed adverse event.

Results: Men had a significantly higher prevalence of comorbid conditions, including hypertension, hyperlipidemia, obesity, and coronary artery disease, and presented more often with dissection, whereas women were slightly older [median age 69 y (IQR 62–74) vs 67 y (IQR 57–73); $p < 0.0001$] and more often symptomatic. Men were more likely to undergo a reoperation and to receive protective perfusion strategies (i.e., left heart bypass, selective visceral and cold renal perfusion), whereas women were more likely to have an urgent operation and undergo an extent I or III repair. The incidence of early death and major adverse events were comparable in both genders (see Table). Overall length of stay was slightly longer for women. Although long-term survival was slightly better in men in the unadjusted Kaplan-Meier analysis, this difference disappeared when adjusted for age. Men and women also had similar outcomes after extent II repair.

Table: Outcomes After 3353 Thoracoabdominal Aortic Aneurysm Repairs Stratified by Gender

Outcomes	Men (n = 2072)	Women (n = 1281)	P-Value
Operative death	150 (7.2%)	100 (7.8%)	0.5
Permanent stroke	51 (2.5%)	28 (2.2%)	0.6
Permanent paraplegia/paraparesis	118 (5.7%)	61 (4.8%)	0.2
Permanent renal failure necessitating dialysis	114 (5.5%)	77 (6.0%)	0.5
Composite adverse events*	293 (14.1%)	189 (14.7%)	0.6
Length of stay (days, median; IQR)	11 (9–17)	12 (9–18)	0.001
Estimated long-term survival, adjusted for age (%; 5, 10, 15 years)	66.1 ± 1.1 38.6 ± 1.3 17.3 ± 1.3	67.7 ± 1.3 39.6 ± 1.6 18.5 ± 1.5	0.6

*Adverse event is a composite endpoint comprised of operative death or permanent stroke, paraplegia, paraparesis, or renal failure necessitating dialysis. Permanent is defined as present at time of hospital discharge or early death.

Conclusions: Men and women undergoing TAAA repair presented with important differences in several perioperative factors. Unlike several other cardiovascular operations, men and women had remarkably similar early and long-term outcomes.

60. Natural History and Management of DeBakey Type II Aortic Dissection

Harleen K. Sandhu, Kristofer M. Charlton-Ouw, Robert D. Rice, Charles C. Miller, III, Rana O. Afifi, *Hazim J. Safi, *Anthony L. Estrera
University of Texas Health Science Center, Houston, TX

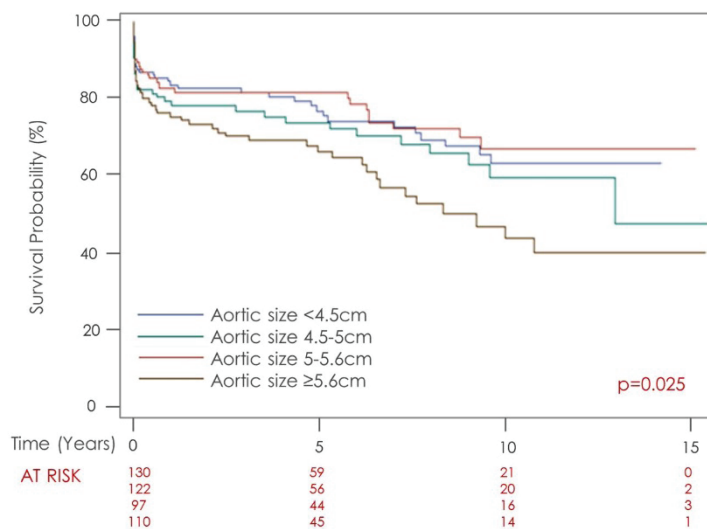
Invited Discussant: *S. Chris Malaisrie

Objective: The fate of DeBakey type I aortic dissection (T1AD) has received considerable attention over the years. Less has been written about DeBakey type II aortic dissections (T2AD). We reviewed our single-center experience with management of DeBakey II dissection over 15 years.

Methods: We reviewed all patients with aortic dissections involving the ascending/arch aorta between 1999 and 2014. Baseline, intraoperative, and postoperative outcomes were analyzed. To assess the effect of extent and acuity, we compared T1AD and T2AD in acute dissection population. Data were analyzed by contingency table and by multiple logistic and Cox regression.

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Effect of proximal aortic size on survival in acute aortic dissection



Results: We identified 161 cases of T2ADs. Of these, 90 (56%) were chronic and 71 (44%) acute. Compared to acute T1AD (475/546, 87%), in T2AD (71/546, 13%) mean age (58 ± 14 vs 60 ± 17 years; $p = 0.37$) and gender (130/475, 27% vs 27/71, 38% females; $p = 0.06$) were not different. Intramural hematoma (27% vs 18%; $p =$

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0.056), bicuspid aortic valves (17% vs 5.3%; $p < 0.001$), and mean aortic size (5.6 ± 1 vs 5.1 ± 0.9 ; $p = 0.01$) were greater in T2AD compared to T1AD. T2AD had fewer symptoms (89% vs 65%; $p < 0.001$), hypertension (78% vs 62%; $p = 0.004$), retrograde dissection (10.3% vs 1.4%; $p = 0.02$), shorter circulatory arrest time (30 ± 11 vs 24.7 ± 11 min; $p < 0.001$), and shorter retrograde perfusion time (29 ± 10 vs 23 ± 9 mins; $p < 0.001$). Postoperative dialysis rate was lower (9% vs 18%; $p = 0.05$). In-hospital mortality did not differ between extents ($p = 0.79$). Over median follow-up of 3.5 years, survival at 5 and 10 years among acute T1AD and T2AD was 71% and 57% vs 75% and 54%, respectively ($p = 0.91$). Larger aortic size (>5.6 cm) was significantly associated with reduced long-term survival ($p = 0.025$, Figure).

Conclusions: Despite the limited extent and less symptomatic presentation, acute T2AD is associated with equivalent morbidity and mortality. Larger aortic size portends worse long-term outcomes.

61. Isolated Aortic Valve Repair in Bicuspid and Tricuspid Valve Morphology

Diana Aicher, Lena Winter, Ulrich Schneider, Christopher Hofmann, Janine Scheibel, Hans-Joachim Schäfers

University Hospital Homburg/Saar, Homburg, Germany

Invited Discussant: *Himanshu J. Patel

Objective: While valve-sparing aortic root replacement is becoming more and more popular, isolated repair of the regurgitant aortic valve (iAVR) in aortic regurgitation (AR) is less frequently practiced. We analyzed our results of iAVR.

Methods: Between 07/1999 and 06/2015, 1083 patients underwent iAVR for relevant AR. Valve morphology was bicuspid in 500 patients (BAV: $f = 71$; $m = 429$; age 45 ± 14 years) and tricuspid in 583 patients (TAV: $f = 194$; $m = 389$; age 63 ± 14 years). Cusp prolapse was corrected by central plication or triangular resection. Pericardial patches were used for cusp augmentation or to close fenestrations. Thirty-five patients had emergency operation for acute dissection type A (BAV: $n = 6$ [1.2%]; TAV $n = 29$ [5%]). From 01/2009 an annular stabilization (AS) was added in patients with an aortoventricular junction of more than 26 mm (BAV $n = 261$ [52%]; TAV $n = 150$ [26%]). In 428 patients (BAV $n = 159$ [32%]; TAV $n = 269$ [46%]) additional sinotubular junction remodeling was performed. Concomitant procedures were coronary artery bypass grafting (BAV $n = 26$ [5%]; TAV $n = 129$ [22%]), mitral valve repair (BAV $n = 29$ [6%]; TAV $n = 94$ [16%]), tricuspid valve repair (BAV $n = 11$ [2%]; TAV $n = 47$ [8%]), left atrial ablation (BAV $n = 14$ [3%]; TAV $n = 82$ [14%]) and replacement of the aortic arch (partial (BAV $n = 36$ [7%]; TAV $n = 149$ [26%]); total (BAV $n = 2$ [0.4%]; TAV $n = 6$ [1%]). All patients were followed (99% complete, mean 69 ± 45 months, 2 to 211 months).

Results: Hospital mortality was 1.3%, pacemaker implantation was necessary in 6 (0.5%) patients ($n = 2$ BAV, $n = 4$ TAV). 10-year survival was 78% in TAV and 97% in BAV. Valve-related reoperations were necessary in 109 patients ($n = 62$ BAV; $n = 47$ TAV) 9 days to 140 months postoperatively. Freedom from reoperation at 5, 10 and 15 years was 90%, 78% and 71% in BAV and 94%, 84% and 81% in TAV. With AS, 5-year freedom from reoperation was significantly improved in BAV ($p = 0.03$),

while there was no difference in TAV ($p = 0.59$). During follow-up no bleeding complications occurred; 7 patients developed endocarditis and 9 had thromboembolic events. The 10-year freedom from all valve-related complications was 76% in BAV and 83% in TAV.

Conclusions: Long-term results for iAVR are good, valve-related complications are rare, making iAVR a good alternative to aortic valve replacement. AS improves mid-term stability in BAV, but not TAV.

62. Reoperative Aortic Root Replacement: Clinical Outcomes in a Contemporary Complex Series Following Previous Aortic and/or Cardiac Surgery

Jiro Esaki¹, Bradley G. Leshnower², Jose N. Binongo², Yi Lasanajak², LaRonica McPherson², *Michael E. Halkos², *Vinod H. Thourani², *Robert A. Guyton², *Edward P. Chen²

¹Otsu Red Cross Hospital, Otsu, Japan; ²Emory University, Atlanta, GA

Invited Discussant: *Anthony L. Estrera

Objectives: Reoperative aortic root replacement (REDO) following previous aortic or cardiac surgery is a challenging procedure and, depending on the specific clinical scenario, can be associated with significant mortality and morbidity. The purpose of this study was to investigate the outcomes of REDO when performed in a number of complex settings and identify risk factors for operative mortality and long-term survival.

Methods: From 2002–2015, 296 consecutive patients underwent REDO in the setting of previous aortic and/or cardiac operations at an academic center. Logistic regression analysis was used to determine risk factors for operative mortality while the Cox proportional hazard model was used to determine risk factors for long-term survival.

Results: The mean age was 52.3 years. Prior operations were proximal aortic replacement in 122 patients (41.2%), including root replacement in 69 pts (23.3%) and type A dissection repair in 52 pts (17.6%), valve surgery in 232 pts (78.4%), and CABG in 51 pts (17.2%). Operative indications were aneurysmal disease in 171 pts, infection in 57 pts, pseudoaneurysm in 20 pts, and AVR with small root/root calcification in 24 pts. Concomitant procedures included hemiarch replacement in 109 pts (36.8%), total arch replacement in 29 pts (9.8%), CABG in 78 pts (26.4%), mitral valve repair/replacement in 19 pts (6.4%), tricuspid repair in 5 pts (1.7%), pulmonic replacement in 25 pts (8.5%). CPB time was 254 ± 74 min, cross clamp time was 202 ± 49 min and circulatory arrest time was 32 ± 16 min. Operative mortality was 15.5% (46/296). ICU stay was 118 ± 166 hours and LOS was 9.8 ± 8.7 days. The incidence of permanent stroke was 4.7% (14/296), transient neurological dysfunction 3.4% (10/296), renal failure requiring dialysis 5.4% (16/296), prolonged ventilation 37.8% (112/296), permanent pacemaker 4.1% (12/296), and re-exploration for bleeding 10.8% (32/296). 8-year survival was 79.4%. Univariate analysis did not find previous root replacement (OR 0.652; 95% CI 0.289–1.474; $p = 0.3$), prior type A repair (OR 1.602; 95% CI 0.752–3.411; $p = 0.22$) or prior aortic surgery (OR 0.81; 95% CI 0.423–1.55; $p = 0.52$) and concomitant arch replacement (OR 0.625; 95% CI 0.327–1.195; $p = 0.16$) to be risk factors for operative death. In the adjusted analysis, age, peripheral artery disease, emergent status, CAD, mitral

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valve surgery and cross clamp time were risk factors for operative mortality (Table). Renal failure was a risk factor for reduced long-term survival (HR 4.284; 95% CI 1.241–14.795; $p = 0.02$).

Conclusions: In the setting of previous cardiac and aortic operations, REDO represents complex procedures carrying acceptable morbidity and mortality. Operative outcome was not impacted by prior aortic procedures, while long-term survival was reduced in pts with renal failure. Using appropriate clinical indications in the current era, REDO remains a viable surgical option.

63. Does the Status of the False Lumen Impact Long-Term Outcomes and the Fate of the Residual Dissected Aorta Following Repair of DeBakey 1 Aortic Dissection?

Jolian Dahl¹, *Edward P. Chen¹, *Vinod H. Thourani¹, *Michael E. Halkos¹, W. Brent Keeling¹, Eric L. Sarin¹, Yi Lasanajak², Jose N. Binongo², *Robert A. Guyton¹, Bradley G. Leshnower¹

¹Emory University, Atlanta, GA; ²Rollins School of Public Health, Atlanta, GA

Invited Discussant: *Scott A. LeMaire

Objective: Early mortality following surgery for acute DeBakey 1 aortic dissection (aD1AD) is well characterized. There is a paucity of data regarding the fate of the residual dissected aorta and the impact of false lumen (FL) thrombosis. This study examined the impact of FL thrombosis on outcomes and determined risk factors associated with re-intervention and late mortality following aD1AD repair.

Methods: From 2004–2015, 339 patients underwent emergent surgery for aD1AD at a US academic center. Of the 298 survivors of the initial surgery, 189 patients had at least one postop CT or MRI scan, and 107 patients had two postop scans >6 months apart that were analyzed. Follow-up was complete in 89% (302/339). Multivariate analyses and Cox hazards regression (HR) were conducted to identify risk factors for aortic re-intervention and mortality.

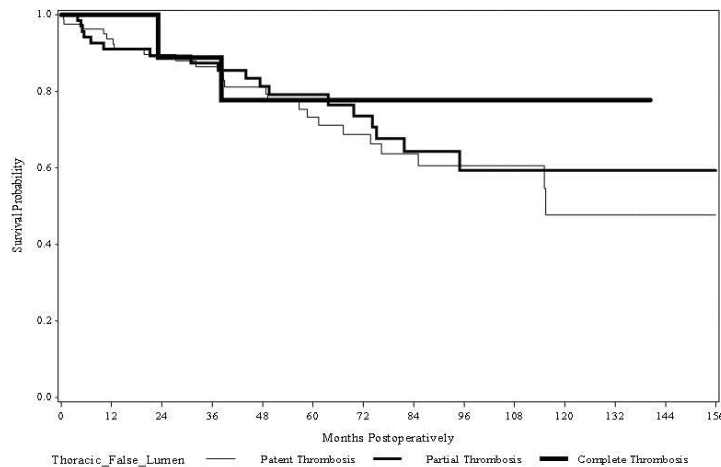
Results: The mean age of patients was 55 ± 14 years. The incidence of root and total arch replacement were 24.5% (83/339) and 8.6% (29/339). Operative mortality was 12.1% (41/339) with an incidence of stroke and temporary neurologic dysfunction of 6.8% (23/339) and 4.1% (14/339). In the cohort of survivors, aortic re-intervention was required in 23.2% (69/298) with a total of 81 procedures performed (root/arch, $n = 31$; descending/thoracoabdominal, $n = 50$). Mortality was 14.1% (42/298) for the re-intervention procedure.

Overall survival for the series was 64.1% (217/339) and the median survival was 95 months. On the initial postop scan, the thoracic FL was patent in 48%, partially thrombosed in 43%, and completely thrombosed in 9%. The abdominal FL was patent in 73%, partially thrombosed in 20% and completely thrombosed in 7%. The initial postop diameters of the thoracic ($p = 0.32$) or abdominal ($p = 0.81$) aorta were not associated with late death. FL status was not associated with late death.

In the subset of patients ($n = 107$) with two postop scans, the median growth rates of the thoracic and abdominal aorta were 2.1 mm/yr (IQR, 0.7, 5.4) and 1.3 mm/yr (IQR, 0.4, 3.4). The thrombosis status of the thoracic ($p = 0.48$) or abdominal ($p = 0.66$) FL did not impact aortic growth rates.

An initial postop diameter ≥ 4.9 cm in the thoracic aorta (HR 1.033, $p < 0.01$) was predictive of distal aortic re-intervention. Age, diabetes, postop dialysis and tracheostomy were independent risk factors for long-term survival ($p < 0.05$). The FL thrombosis status did not impact the incidence of aortic re-intervention or long-term survival (Figure 1).

Figure 1. Kaplan-Meier Survival by False Lumen Status.
Log-rank test p-value=0.74



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Conclusions: The thrombosis status of the false lumen does not significantly impact aortic growth rates, the incidence of aortic re-intervention, nor long-term survival in patients who survive aD1AD. Surveillance imaging is paramount as a postop thoracic aortic size of ≥ 4.9 cm is predictive of re-intervention on the distal dissected aorta.

64. Computational Fluid Dynamics Simulation of the Right Subclavian Artery Cannulation

Satoshi Numata, Keiichi Itatani, Sachiko Yamazaki, Kiyoshi Doi, Keiichi Kanda, Hitoshi Yaku

Kyoto Prefectural University of Medicine, Kyoto, Japan

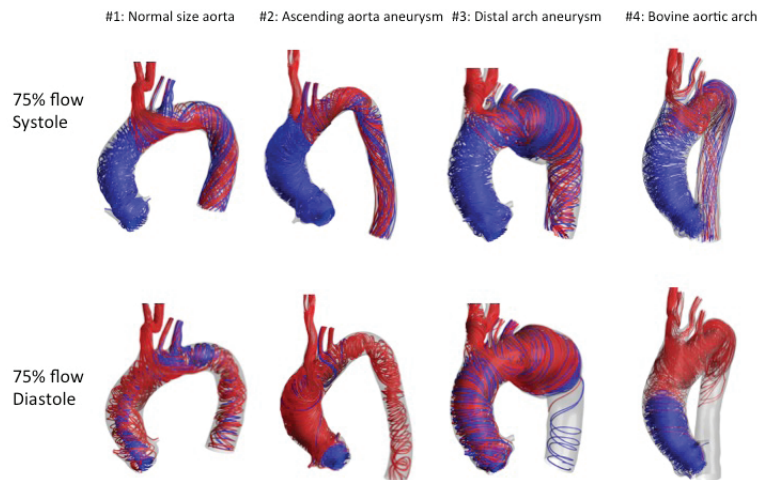
Invited Discussant: *Subodh Verma

Objective: The right subclavian artery (rSCA) perfusion could avoid potential embolization by an atheromatous plaque in the ascending aorta and a lower incidence of stroke with rSCA cannulation has been reported. The purpose of this study was to reveal the efficacy of the right subclavian artery cannulation as an inflow of the cardiopulmonary bypass using computational fluid dynamics (CFD).

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Methods: Patient-specific models of the aortic arch were made with four different patterns (#1: Normal sized thoracic aorta, #2: Ascending aorta aneurysm with unicuspid valve, #3: Distal arch aneurysm, #4: Bovine aortic arch) based on the computed tomographic images. CFD models with finite volume methods were created to simulate the physiological pulsatile flow including the peripheral reflection wave, characteristic impedance, and autonomous regulation system. Perfusion flow through the rSCA was set to 2.50 L/min (50% flow) and 3.75 L/min (75% flow) at a constant steady flow and a three-dimensional movie was made of one cardiac cycle to evaluate the streamline of the blood flow inside the aorta.

Results: In both 75% and 50% flow simulation, the blood streamline from the rSCA produced retrograde flow of the brachiocephalic artery and antegrade flow of the right common carotid artery throughout the entire cardiac cycle in all models. Inside aortic arch retrograde blood streamline from brachiocephalic artery became spiral. In model #1, the left subclavian artery was dominantly perfused by blood flow from own heart even in diastole. However, in other 4 models, the left common carotid artery and the left subclavian artery were perfused by blood flow from the rSCA during almost all of the cardiac cycle with the 75% flow simulation, except during the systolic phase. With 50% flow, during systole, the left common carotid artery and the left subclavian artery were perfused by both rSCA flow and the own heart flow in all models.



Conclusions: With both 50% and 75% flow simulations, the blood streamline from the rSCA produced retrograde flow of the brachiocephalic artery and deflects blood flow from the own heart. This may explain how the atherosclerotic emboli were protected by the rSCA perfusion especially when the atherosclerotic plaque was located on the ascending aorta or proximal aortic arch.

5:35 PM

Executive Session, AATS Members Only

Hall E, BCC

TUESDAY AFTERNOON, MAY 17, 2016

2:00 PM **Congenital Heart Disease** Ballroom III, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion
Moderators: *J. William Gaynor and *Jorge D. Salazar

Late-Breaking Clinical Trial

LB10. A Novel Bioabsorbable Vascular Graft in a Modified Fontan Procedure – the First Clinical Experience

*Leo Bockeria¹, Oleg Svanidze², Alex Kim¹, Konstantin Shatalov¹, Vladimir Makarenko¹

¹*Bakoulev Center for Cardiovascular Surgery, Moscow, Russian Federation*; ²*Xeltis AG, Zurich, Switzerland*

Invited Discussant:

65. Concept of an Expandable Cardiac Valve for Surgical Implantation in Infants and Children

Sitaram M. Emani, Breanna L. Piekarski, David Zurakowski, Christopher A. Baird, Gerald Marx, Wayne Tworetzky, Audrey C. Marshall, James E. Lock, *Pedro J. del Nido
Boston Children's Hospital, Boston, MA

Invited Discussant: *Thomas L. Spray

Objective: Options for cardiac valve replacement in children are limited to fixed diameter prostheses that do not accommodate for somatic growth. An externally stented bovine jugular vein graft has been modified for surgical valve replacement in pediatric patients, with the intention of subsequent valve expansion in the catheterization laboratory as the child grows.

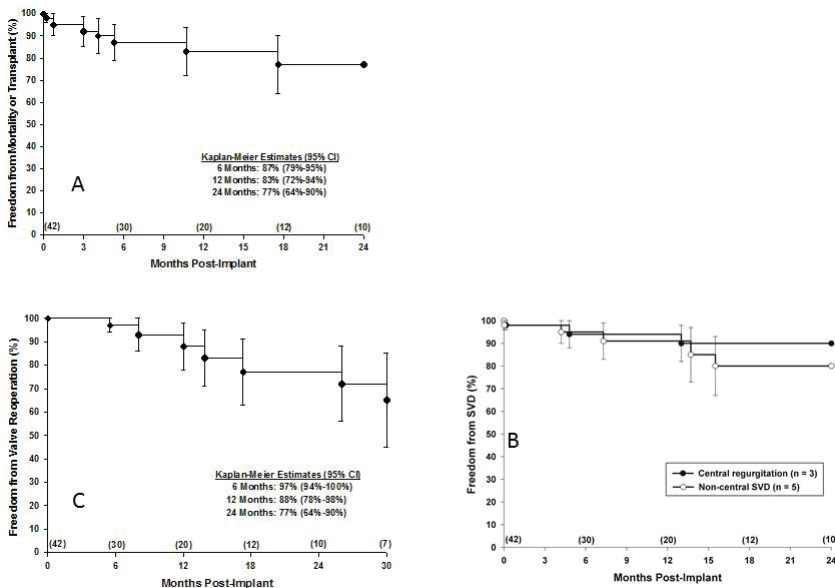
Methods: Pediatric patients at a single institution who underwent surgical implantation of expandable bovine jugular vein valve between 2010 and 2014 were retrospectively reviewed. Forty-two patients had implantation at a median age 10 months (range 3 weeks to 5.8 years) in aortic, mitral, pulmonary or tricuspid positions. Techniques of valve modification and implantation included stent shortening, addition of a pericardial sewing cuff, intraoperative balloon expansion, and fixation of the distal stent to the inferior left ventricle wall.

Results: The valve was competent with low gradient acutely postoperatively in all patients. There were seven deaths, and one patient underwent planned cardiac transplantation. The Kaplan-Meier estimated freedom from mortality or transplant was 83% at 12 months and 77% at 24 months (Figure A). Eight patients have experienced central or paravalvular deterioration, and seven have required reoperation for valve-related adverse outcomes. The Kaplan-Meier curves show that 94% of patients at 12 months are expected to be free from central valve deterioration, defined as regurgitation resulting from malcoaptation of leaflets, with a 95% confidence interval from 88% to 100% (Figure B). The Kaplan-Meier curves show that 91% of patients at 12 months are expected to be free from non-central valve deterioration, defined as development of perivalvular leak or stent fracture, with a 95% confidence interval from 83% to 99% (Figure B). Twenty patients have undergone 32 episodes of catheter-based balloon expansion of the valve following somatic

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growth with significant decrease in median gradient from 12 mmHg to 8 mmHg ($P < 0.001$) without significant increase in grade of regurgitation. At 12 months after implantation, Kaplan-Meier analysis indicates that 88% are expected to be free from reoperation (95% CI: 78%-98%) (Figure C).



Figure

Conclusions: Surgically implanted externally reinforced bovine jugular vein demonstrates acceptable short-term function, and is amenable to catheter-based enlargement as the child grows. Modification of valve design and implantation techniques are necessary to reduce peri-valvular complications.

66. 10-Year Outcomes After Implant of Decellularized Pulmonary Allografts for RVOT Reconstruction

*John W. Brown², John D. Oswalt², Jennifer Christel Romano³, *James S. Tweddell⁴, *Pirooz Eghtesday⁵, Kent E. Ward⁶, Michael Felix Teodori⁷, John Paul Kupferschmid⁸, Donna Johnson²

¹Indiana University, Indianapolis, IN; ²Cardiothoracic and Vascular Surgeons, P.A., Austin, TX; ³University of Michigan, Ann Arbor, MI; ⁴Cincinnati Children's Hospital, Cincinnati, OH; ⁵Washington University, St. Louis, MO; ⁶University of Oklahoma, Oklahoma City, OK; ⁷Phoenix Children's Hospital, Phoenix, AZ; ⁸Methodist Children's Hospital, San Antonio, TX

Invited Discussant: *Richard A. Hopkins

Objective: The SynerGraft decellularized pulmonary allograft (SGPV) received FDA's 510(k) Clearance in 2008. The SynerGraft process removes donor cells from the allograft prior to cryopreservation and reduces the patient's Panel Reactive Antibody (PRA) response after implant as compared to a standard allograft. This Post-Clearance Study evaluated the longer-term performance and clinical outcomes after SGPV implant.

Methods: Patients included retrospective (subset used in support of 510(k) Clearance) and prospective (SGPV implanted after 510(k) Clearance) Ross (n = 68; mean age = 28.4 years) and RVOT reconstruction (n = 72, mean age = 12.5 years) patients from eight centers. Mean follow-up was 5.7 years (13 year maximum; 802 total patient years). Demographic, clinical follow-up and hemodynamic function data (peak or mean gradient and insufficiency (PI) at pre-op, discharge and most recent) were collected. Adverse events were assessed using Kaplan-Meier analysis. Data from SGPV patients undergoing RVOT reconstruction are presented.

Results: The RVOT reconstruction subset was predominantly pediatric with only 8 patients ≥ 18 years of age (n = 11%). Patients undergoing RVOT reconstruction with the SGPV experienced a low occurrence of adverse events through 10 year follow-up. The freedom from mortality, explant, reintervention, endocarditis, non-structural dysfunction, perivalvular leak, bleeding, thromboembolism, thrombosis or hemolysis was 75% at 10 years. In these patients, freedom from explant, reintervention, and endocarditis at 10 years was 88%, 81%, and 96%, respectively. Overall, the mean peak gradient of 21.4 mmHg for RVOT reconstruction patients with only 7.6% patients with a significant (≥ 40 mmHg) gradient at a mean of 5 year follow-up. The gradient was similar for prospective patients with follow-up of 2.2 years and retrospective patients at 8.2 years at 21.9 mmHg and 21.2 mmHg. The occurrence of PI \geq Moderately Severe PI was 6% at 6.3 years overall, 0% for prospective patients at a mean of 2.1 years and 8% at a mean of 8.0 years for retrospective patients. Functionally, the SGPV maintained a similar hemodynamic profile for prospective (mean time = 2.1 years) and longer-term follow-up (mean time = 8.2 years).

Conclusions: The 10 year results from this FDA reviewed Post Clearance Study further confirm the consistent functional safety and performance of the SGPV when utilized for RVOT reconstruction procedures in a pediatric patient population. The decellularized SGPV provides a surgical option for RVOT reconstruction which compares favorably with conventional allograft literature, demonstrating similar if not improved performance, resistance to infection and durability.

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*AATS Member ♦ AATS New Member

67. Small Sized Conduits in the Right Ventricular Outflow Tract in Young Children: Bicuspidalized Homografts Perform Better than Xenografts

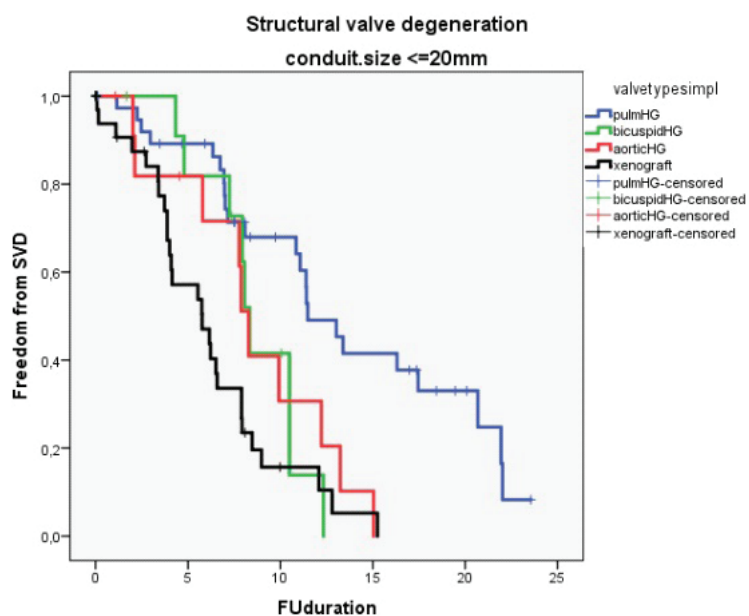
Katrien François, Katya De Groote, Kristof Vandekerckhove, Joseph Panzer, Hans De Wilde, Daniel De Wolf, Julie De Backer, Laurent Demulier, Thierry Bové
University Hospital Gent, Gent, Belgium

Invited Discussant: *John W. Brown

Objective: For reconstruction of the right ventricular outflow tract (RVOT) in infants and children, homografts (HG) are usually considered the conduit of choice. However, due to the limited availability of small sized HG, the use of xenografts gained popularity. We have adopted the technique of downsizing a large HG through bicuspidalization since two decades, and sought to investigate the durability of this conduit in comparison to other alternatives.

Methods: A cohort of 290 RVOT conduits, implanted over a 23-years period in 225 patients, was investigated in a retrospective analysis. Of these, 106 conduits sized ≤ 20 mm constituted the object of this study. Endpoints were survival, need for conduit replacement, and structural valve degeneration (SVD), defined as a peak gradient of ≥ 40 mmHg, pulmonary incompetence $> 2/4$ or valve explantation. Valve types consisted of 40 pulmonary HG, 12 aortic HG, 17 bicuspidalized HG, and 37 xenografts.

Results: The median age and weight at conduit implantation were 1,2 years and 8,7 kg respectively. The mean conduit diameter and valve z-value at implantation were $16,3 \pm 2,7$ mm and $2,8 \pm 1,2$ respectively. Valve position was extra-anatomical in 68 and orthotopic in 38 patients. At a mean follow-up (98% complete) of $7,3 \pm 5,8$ years, survival was $88 \pm 3\%$. Freedom from conduit explant and SVD at 5 years was $80 \pm 4\%$ and $77 \pm 5\%$ and at 10 years $46 \pm 6\%$, and $42 \pm 6\%$ respectively. Freedom from SVD at 10 years was $68 \pm 8\%$ for adequately sized pulmonary HG, $42 \pm 16\%$ for bicuspidalized HG, $31 \pm 15\%$ for aortic HG, and $16 \pm 7\%$ for xenografts (logrank $p < 0.0001$). Multivariate Cox-regression analysis indicated initial conduit size (HR 0.79, 95%CI 0.69–0.89, $p < 0.001$), extra-anatomic position (HR 1.9, 95%CI 1.0–3.8, $p = 0.05$) and use of xenografts (HR 3.7, 95%CI 1.8–7.7, $p < 0.001$) as significant predictors for accelerated SVD. Moreover, the lower mean z-value at the time of conduit change for pulmonary HG (-2.1 ± 1.1) and bicuspidalized HG (-1.7 ± 1.2) compared to xenografts (-0.8 ± 1.9) ($p = 0.09$), suggested a tendency that outgrowth was more frequently responsible for explantation of pulmonary HG.



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Conclusion: We demonstrated that appropriately sized pulmonary homografts are the best option when a RVOT conduit smaller than 20 mm is required in young children. However, in the event that a small pulmonary homograft is unavailable, bicuspidalization of a larger pulmonary homograft offers a valid alternative, which is preferred to the use of xenograft conduits.

3:20 PM – 4:10 PM Coffee Break in the Exhibit Hall

3:30 PM – 4:00 PM

Deep Dive Session

Exhibit Hall, AATS CT Theater I, Booth #103

Moderator: *Charles D. Fraser

Not for Credit

AATS Consensus Guideline: Anomalous Coronary

Artery Origin from Wrong Sinus

*James S. Tweddell, *Cincinnati Children's Hospital*

*AATS Member ♦AATS New Member

68. Pulmonary Root Translocation Is an Effective Approach for Left Coronary Artery Arising Anomalously from the Aorta with an Intramuscular Course in the Right Ventricle

Timothy Martens, S. Ram Kumar, Subhadra Shashidharan, *Vaughn A. Starnes
Children's Hospital Los Angeles, Los Angeles, CA

Invited Discussant: *James S. Tweddell

Objective: Anomalous Aortic Origin of Coronary Artery (AAOCA) represents a heterogeneous group of uncommon congenital coronary anomalies associated with an increased risk of sudden death. Prior reports have described approaches to address ostial abnormalities in this disease. Infrequently, a left coronary artery (LCA) arising from the right sinus runs an intramuscular course posterior to the base of the pulmonary root and is subject to dynamic constriction by muscle contraction during the cardiac cycle. We describe a novel technique of pulmonary root translocation (PRT) to relieve the intramuscular course of the anomalous LCA.

Methods: Twenty-seven cases of AAOCA were surgically corrected at our institution between 2009–2014. In all patients, after establishing cardiopulmonary bypass (CPB), the aorta was opened and the anomalous coronary probed from within and ostium unroofed if necessary. If the course of the LCA was determined to be intramuscular through the pulmonary root, the root was harvested as an autograft exposing the course of the LCA. The muscle bridges overlying the LCA were completely excised until the LCA was unroofed along its entire course. The autograft root was re-implanted deeper into the right ventricle away from the course of the unroofed LCA.

Results: Six patients (22%) required PRT. Median age at time of PRT was 14 years (range 9–27). Presenting symptoms included chest pain (n = 5), arrhythmia (n = 1), and syncope (n = 1). All patients were approached via median sternotomy with bicaval (n = 4) or right atrial (n = 2) cannulation for CPB. Median CPB and crossclamp times were 54 minutes (range 37–72) and 31 minutes (range 26–53). Median hospital length of stay was 4 days (range 4–10 days). Median follow-up is 3 years (range 1–4 years). All patients have normal EKGs and no recurrence of presenting symptoms.

Conclusion: In the subset of patients with AAOCA and intramuscular course of anomalous LCA behind the pulmonary root, PRT is a novel and effective surgical approach.

69. Comparison of Thoracotomy Versus Thoracoscopic Vascular Ring Division in Children and Young Adults

Melissa A. Herrin¹, David Zurakowski², Francis Fynn-Thompson¹, Christopher W. Baird¹,
*Pedro J. del Nido¹, Sitaram M. Emani¹

¹Boston Children's Hospital, Harvard Medical School, Boston, MA; ²Harvard Catalyst, Boston, MA

Invited Discussant: *Carl L. Backer

Objective: The division of complete vascular rings can be addressed by minimally invasive video-assisted thoracoscopic (VATS) or open thoracotomy approach. Previous literature has not demonstrated significant benefit to either approach. We sought to compare open with VATS approach for vascular ring division with regards to short- and intermediate-term outcomes.

Methods: A retrospective review was performed on patients with a diagnosis of complete vascular ring who underwent division via open left thoracotomy or VATS approach at a single institution January 1991–July 2015. Patients were excluded for weight at surgery <3.2 kg, a diagnosis of pulmonary artery sling or innominate artery compression, or for undergoing median sternotomy or concomitant repair of other congenital cardiac abnormalities. Outcome variables included operation length (OR time), hospital length of stay (LOS), postoperative complications, and need for re-intervention surgery. Outcomes were compared between groups using Chi-Square and multivariate logistic regression analysis.

Results: Of 200 patients who were followed for a median of 2.1 years (IQR: 0.04–7.1), 1.5% were asymptomatic at presentation. Of those with preoperative symptoms, 125 (63%) displayed respiratory symptoms, 29 (15%) displayed gastrointestinal, and 41 (21%) had both. Patients who underwent VATS had a significantly greater age and weight compared to open (Table 1). A diagnosis of double aortic arch (DAA) with patent arches (n = 51) was more often repaired via open approach, whereas patients with DAA with atresia (n = 32) or right aortic arch with aberrant left subclavian/ligamentum (n = 113) were more likely to undergo VATS (p < 0.001). Those patients who underwent VATS had a significantly shorter postoperative LOS compared to open, independent of age, weight, OR time, and diagnosis (p = 0.004). Rates of complications and re-interventions did not differ by diagnosis (p = 0.94 and p = 1.0, respectively), suggesting that patients with DAA with patent arches may be managed by VATS approach. Among 111 patients for whom operation time was available, mean OR time was 3.2 hours (SD = 1.2) with no significant difference in operation length between the groups (p = 0.71). Among 130 patients with clinical follow-up >6 months, 49% were asymptomatic at follow-up, with no significant difference between groups (p = 0.72).

Table 1: Patient Characteristics and Outcomes

	VATS (n = 117)	Open (n = 83)	p-Value
Age, years, median (IQR)	2.6 (0.9–6.5)	0.80 (0.19–4.3)	<0.001
Male (%)	64 (54.7)	46 (55.4)	0.92
Weight, kg, median (IQR)	14.2 (8.6–24.0)	8.8 (4.9–16.2)	<0.001
Hospital LOS, days, mean (SD)	2.7 (3.7)	5.4 (6.2)	<0.001
Complications (%)	6 (5.1)	7 (8.4)	0.39
Re-intervention (%)	4 (3.4)	5 (6.0)	0.49

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Conclusions: Thoracoscopic approach to vascular ring division is associated with significantly shorter length of hospital stay compared to open thoracotomy. Both approaches are associated with similar rates of symptom resolution as well as low complication rate and need for re-intervention, which were not significantly different between the two approaches.

70. A Common Polymorphism in the Mannose-Binding Lectin Gene MBL2 Is Associated with Poor Neurodevelopmental Outcomes Following Infant Cardiac Surgery

Ryan Robert Davies, Julia S. Barthold, Erica Sood, Yanping Wang, Edward Woodford,
*Christian Pizarro

Nemours/A.I. duPont Hospital for Children, Wilmington, DE

Invited Discussant: *Jorge D. Salazar

Objective: Risk for poor long-term neurodevelopmental (ND) outcomes following infant cardiac surgery varies between individuals. Genetically-determined variation in complement activation, mediated by polymorphisms in the gene (MBL2) for mannose-binding lectin (MBL), influences outcomes following stroke and cerebral injury. A common polymorphism (termed "AA") in MBL2 occurs in approximately 60% of the population and is associated with poor outcomes after stroke. Whether this polymorphism might also influence short- and long-term neurologic and neurodevelopmental outcomes following infant cardiac surgery has not been previously investigated.

Methods: A single-institution retrospective study of infants ≤ 6 months of age undergoing cardiac surgery with cardiopulmonary bypass (CPB) for repair of congenital heart defects. Blood samples ($n = 196$) were collected prior to CPB. Serum MBL levels were ascertained and genotyping was performed for polymorphisms within the MBL2 gene. ND evaluations were conducted at 6, 12, and 24 months of age using the Bayley Scales of Infant Development, 3rd Edition (BSID-III). Univariable and multivariable analysis was performed to assess whether MBL2 genotype was associated with late ND outcomes.

Results: Allele frequencies were in Hardy-Weinberg equilibrium and consistent with previously published data in similar populations: AA (homozygous at-risk) 58.8%, AO (heterozygous) 35.2%, OO (homozygous low-risk) 6.1%. MBL2 genotype was not associated with the risk of neurologic complications (stroke or paraplegia) prior to discharge. ND testing was performed in 96 patients. After adjusting for pre- and postoperative covariates—including gestational age, birthweight, genetic syndromes, sex, cardiac diagnosis, perfusion times, and apolipoprotein E genotype, the at-risk "AA" genotype was associated with lower BSID-III motor ($p = 0.01$, $\beta -11.8 \pm 4.4$), cognitive ($p = 0.02$, $\beta -8.3 \pm 3.2$, Table) and language ($p = 0.01$, $\beta -11.7 \pm 4.4$) composite scores at 12 months, and cognitive ($p = 0.03$, $\beta -9.6 \pm 4.3$) scores at 24 months. There was a trend toward lower motor scores at 24 mths ($p = 0.09$, $\beta -8.7 \pm 4.9$).

Table: Multivariable Model of BSID-III Cognitive Composite Scores at 12 Months

Variable	Parameter Estimate (\pm SE)	p-Value
Intercept	103.1 \pm 3.3	--
MBL2 "AA" Genotype	-8.3 \pm 3.2	0.02
Gender (male)	13.3 \pm 3.1	0.0001
Cardiac Class 3 (Single ventricle without arch obstruction)	-23.6 \pm 7.6	0.004
Apolipoprotein ϵ 2 allele	-6.8 \pm 4.3	0.12
Length of stay (per day)	-0.22 \pm 0.03	<0.0001
Genetic Syndrome	-7.2 \pm 3.9	0.07

Conclusion: The "AA" MBL2 genotype (which results in higher levels of complement activation) is associated with worse neurodevelopmental outcomes at 12 months and 24 mths of age among children undergoing infant cardiac surgery. The effect was independent of gestational age, sex, birthweight, genetic syndromes, cardiac diagnosis, perfusion time, and apolipoprotein E genotype. Understanding the etiologic connection between genetic determinants of complement activation, ischemia-reperfusion injury and neuroresiliency and ND outcomes may enable individualization of surgical strategies and targeted therapeutic interventions.

TUESDAY, MAY 17

71. Interrupted Arch Repair with Direct Anastomosis and Homograft Augmentation Patch: Outcome at 25 Years with a Standardised Technique

Mohammed Mohsin Uzzaman¹, Ben Davies², John Stickley¹, Natasha Khan¹, Timothy Jones¹, William Brawn¹, David Barron¹

¹Birmingham Children's Hospital, Birmingham, United Kingdom; ²Great Ormond Street Hospital, London, United Kingdom

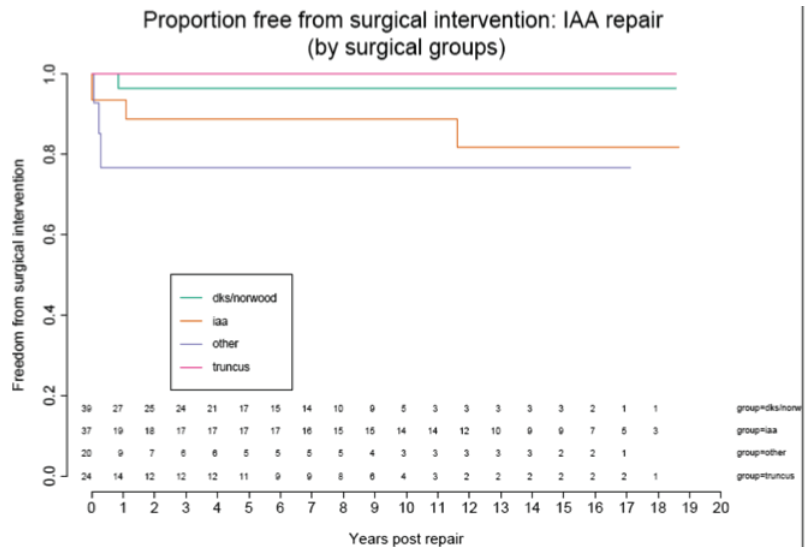
Invited Discussant: *Jeffrey M. Pearl

Objective: Interrupted Aortic Arch (IAA) can be repaired with a variety of techniques. It is also associated with several different complex intracardiac lesions. These factors make it difficult to interpret the role of the arch repair in late outcomes. The aim of this study was to analyze the 25 year outcomes using a standardized technique to assess the long-term function of the arch and to identify patterns of IAA associated with intra-cardiac lesions.

Methods: Single Institution study from 1988–2015 analyzing 120 cases of IAA repair. All were repaired using the same technique of direct anastomosis with pulmonary homograft patch augmentation. Patients were divided into four groups: IAA with VSD (iVSD, n = 37), IAA with Norwood (iNorwood, n = 39), IAA with Truncus (iTruncus, n = 24) and miscellaneous group (iMisc, n = 20), which included AortoPulmonary (AP) window, Double-outlet right ventricle (DORV) and transposition of the great arteries (TGA).

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Results: Interruptions were predominantly Type B (n = 81, 68%) and Type A (n = 34, 28%). Type B IAA was commonest in the iTruncus group, followed by the iNorwood group, whereas Type A was strongly associated with iMisc and TGA (p = 0.02). Freedom from surgical re-intervention on the arch was 92% (CI 86–98%) at 10 years and 88% (CI 78–98%) at 20 years. Freedom from re-intervention was significantly better in the iTruncus and iNorwood (100% and 95% at 20 years) compared to other groups (Figure 1). Catheter re-intervention was commoner with overall freedom from catheter or surgical re-intervention of 82% (CI 71–90%) at 10 years and 71% (CI 58–88%) at 20 years in the whole series. All but one of the catheter interventions were performed within 18 months of the initial surgery. There were no cases of bronchial obstruction. Cox proportional hazard model showed that weight at surgery ≤ 2.5 kg and the era of surgery were most predictive of outcome. Survival was similar in all study groups.



Conclusions: Repair of IAA with the Direct Anastomosis and Patch Augmentation technique is applicable to all variants and provides good long-term arch patency, particularly in terms of low surgical re-intervention. The patterns of IAA are different depending on the associated lesions with Type A being commoner in the AP-Window and TGA group, and Type B commonest in the iTruncus group. Survival is strongly associated with weight at surgery.

TUESDAY AFTERNOON, MAY 17, 2016

2:00 PM **General Thoracic Surgery** Ballroom IV, BCC
Simultaneous Scientific Session
8 minute presentation, 12 minute discussion
Moderators: ♦Abbas E. Abbas and ♦David R. Jones

72. Thorascopic Sympathectomy for Medically Refractory Recurrent Ventricular Arrhythmias

*Justin Van Meeteren, Dennis Wigel, *Shanda Blackmon, *Stephen Cassivi,
*K. Robert Shen, *Mark Allen
Mayo Clinic, Rochester, MN

Invited Discussant: *Mark J. Krasna

Objective: Medically refractory recurrent ventricular tachycardia is a life threatening condition. In recent years, several studies have shown sympathectomy is an effective and safe treatment. Video Assisted Thoracic Surgery (VATS) cardiac sympathetic denervation is a possible therapeutic intervention; however, no study has looked at which subsets of adult patients may or may not benefit from this treatment. We report our single-institution experience with VATS sympathectomy for recurrent ventricular arrhythmias to better understand which patients benefit most from this therapy.

Methods: Between October 2010 and January 2014, 30 patients underwent VATS sympathectomy for life threatening ventricular arrhythmias. Associated conditions which were thought to induce the arrhythmias included non-ischemic cardiomyopathy, ischemic cardiomyopathy, long-QT syndrome, right ventricular cardiomyopathy, catecholaminergic polymorphic ventricular tachycardia (CPVT) and others. Medical records were reviewed for demographics, surgical procedure and outcomes were analyzed for recurrence of arrhythmia requiring further intervention or hospitalization.

Results: Median age at surgery was 48 years (range 15–84 years). There were no operative mortalities and morbidity occurred in 7 patients, including a hemothorax in 4 patients (one required surgical control), Horner's syndrome in 2 patients (one required intervention for ptosis) and one chylothorax (required operative control). Follow-up was complete in all 30 patients and the median follow up was 24 months (range 1–50 months). At last follow up 19 (63%) patients were free of recurrence and did not require further intervention. Eleven patients had recurrence, 5 underwent orthotopic heart transplant, 2 underwent further ablations of the heart, 2 were managed by medication adjustments and 2 resulted in death.

Conclusion: VATS sympathectomy for recurrent medically refractory ventricular arrhythmias controls the arrhythmias in approximately 2/3rds of the patients. Patients with non-ischemic cardiomyopathy and recurrent ventricular arrhythmias will likely require orthotopic heart transplant.

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*AATS Member ♦AATS New Member

73. A Modified Technique of Laryngotracheal Reconstruction Without the Need for Prolonged Postoperative Stenting

Konrad Hoetzenecker, Thomas Schweiger, Imme Roesner, Matthias Leonhard, Gabriel Marta, Doris-Maria Denk-Linnert, Berit Schneider-Stickler, Wolfgang Bigenzahn, *Walter Klepetko

Medical University of Vienna, Vienna, Austria

Invited Discussant: *Joel D. Cooper

Objective: Repair of a giant paraesophageal hernia (GPEH) is a complex procedure requiring surgical expertise and long term follow-up to critically evaluate results. High recurrence rates are a major concern for laparoscopic repairs and the incidence depends on how recurrence is defined and the length of follow up. The objective of this prospective study was to evaluate all patients undergoing elective GPEH repair at our institution for radiographic recurrence and quality of life (QOL) one year after surgery.

Methods: Patients undergoing elective GPEH repair between 2011 and 2014 were prospectively enrolled. GPEH was defined as greater than 30% of the stomach in the chest. Demographics, comorbidities and hernia characteristics were evaluated preoperatively. Postoperatively, patients were evaluated at 1 month and 1 year. Radiographic recurrence was defined using a strict definition of GE junction or any stomach above the diaphragm on barium swallow. QOL was evaluated pre- and post-operatively using the gastroesophageal reflux disease (GERD-HRQL) questionnaire.

Results: 109 patients were enrolled. Median age was 67 years. Half of the patients had previous thoracic/abdominal surgery and 11.9% were redo GPEH repairs. 95.1% of patients had Type III or IV PEH, with an average of 63.2% of the stomach herniated above the diaphragm. Laparoscopy was used for 77.1% (84) of patients, 6.4% (7) required laparotomy and left thoracotomy was used in 15.6% (17). Esophageal lengthening was performed in 64.2% (70) of patients and 73.4% (80) had a partial fundoplication. Postoperatively, there was no in-hospital or 30-day mortality and median length of stay was 3 days. 75.2% had no complication; the most common complication was arrhythmia (10.0%). Reoperation was performed in 5 patients: 4 (3.7%) for PEH recurrence and 1 (0.9%) for leak. At one month follow-up, 94.5% (103) of patients were symptom free and radiographic recurrence was 1.8% (2 patients). At one year follow-up, 58.9% of patients were symptom free and radiographic recurrence was 38.5% (35 patients). The majority (93.2%) of radiographic recurrences were type I hernias. GERD-HRQL data are shown in Table 1. One year after surgery, GERD-HRQL scores were significantly better following GPEH repair, even in patients with radiographic recurrence ($p < 0.001$).

Table 1: GERD-HRQL—Comparisons Are Made to Preoperative Assessments

QOL:	n =	GERD-HRQL	p-Values
Pre-operative:	108	22.38 ± 12.18	
1 mo. Post-operative:	106	6.04 ± 8.05	<0.0001
1 year Post-operative:	86	11.17 ± 10.50	<0.0001
— With Recurrence:	32	15.5	0.0016
— Without Recurrence:	54	8.66	<0.0001

Conclusions: Repair of GPEH can be performed with very low perioperative mortality and morbidity. One year radiographic recurrence may occur more frequently than commonly appreciated when recurrence is critically defined. However, the majority of these are small sliding (type I) hernias. Patient symptoms and QOL improve significantly following PEH repair, including patients with hernia recurrence. Importantly, even longer follow-up is needed to accurately study the true impact of this procedure and better inform patient and surgeon decision making.

TUESDAY, MAY 17

74. A Randomized Controlled Trial of Continuous Subpleural Bupivacaine After Thoracoscopic Surgery

Daniel L. Fortes, Charles D. Ghee, Sandeep J. Khandhar, Heather A. Prentice
Inova Fairfax Hospital, Falls Church, VA

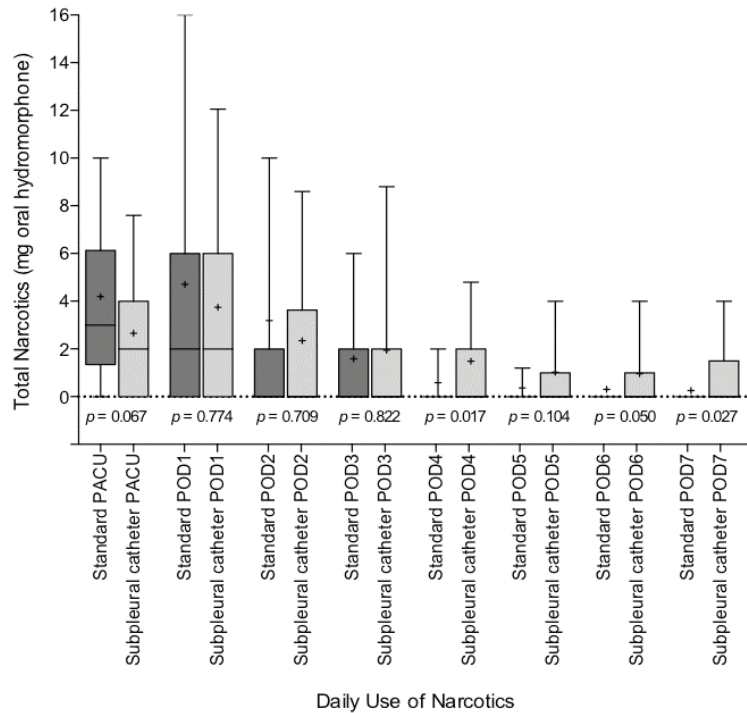
Invited Discussant: ♦Daniel J. Boffa

Objectives: Thoracoscopic surgery is associated with significant pain, which can limit postoperative pulmonary function and recovery. Our surgeons routinely use an axial subpleural tunneled pain catheter delivering local anesthetic, creating a functional multilevel rib block. We seek to evaluate the benefit of such a strategy in regards to overall pain control and decreased use of narcotic medication.

Methods: Eighty-six patients were randomized into either the study arm (use of a pain catheter) or the standard of care arm (local injection of bupivacaine at incision sites) and underwent thoracoscopic surgery utilizing 2 incisions. All patients received similar anesthetic management and a standardized post-operative pain regimen composed of acetaminophen (APAP), non-steroidal anti-inflammatory drug (NSAID) plus oral or intravenous hydromorphone. Patients in the experimental arm received thoracoscopic guided placement of a tunneled axial subpleural catheter which was attached to a bulb pre-filled with 335 ml of 0.125% bupivacaine infusing at 2 ml per hour. Patients were followed post-operatively for 30 days. In the first 7 consecutive days patients recorded pain scores plus the amount of each medication taken (APAP, NSAID, hydromorphone) three times per day. On post-operative day 7 they completed a modified narcotic side effect questionnaire. At 30 days all patients received a phone call to assess overall pain level, return to work/activity, and persistent paresthesias.

*AATS Member ♦AATS New Member

Results: At the conclusion of the study there were no significant differences between the patient demographics in the two arms. Patients in the two arms did not report a significant difference in overall usage of Narcotic ($p = 0.574$), APAP ($p = 0.965$), or NSAID ($p = 0.340$). There was also no statistically significant difference in daily use of narcotic or APAP. A statistically significant difference was noted in the study arm which used more NSAIDs from POD 5 through 7 ($p = 0.027$, 0.008 , 0.005 , respectively). There was no significant difference in length of hospital stay ($p = 0.728$). At 30 days postoperatively, there was no significant difference in par-esthesia, pain medication usage, return to work, return to physical activity, nor overall satisfaction.



Conclusions: Our results did not show any objective differences between the study arm and standard of care arm to justify routine use of axial tunneled sub-pleural catheters. The main limitation of our study was its relatively low statistical power. The differences noted in NSAID use in the pain catheter arm may actually suggest slightly worse pain control in those patients, although the clinical significance seems to be minimal. Further studies are needed in order to identify potential regimens that will further decrease the use of post-operative narcotic medications and quicken patients' recovery.

75. Near-Infrared Optical Imaging During Resection of Mediastinal Thymomas Improves Assessment of Surgical Margins

Jane J. Keating, Jarrod D. Predina, Sarah Nims, Ollin Venegas, Charuhas Deshpande, John Kucharczuk, ♦Sunil Singhal
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Yolonda L. Colson

Objective: Thymomas are typically surgically removed. If there is transcapsular invasion (modified Masaoka stage II or greater), patients may be offered radiation due to the concern of tumor extension into mediastinal fat. We hypothesized that imaging during thymoma resection with a near-infrared (NIR) contrast agent may improve intraoperative assessment of tumor margins.

Methods: Twenty patients undergoing resection of a mediastinal tumor suspicious for a thymoma were enrolled in an intraoperative imaging clinical trial. Patients underwent intravenous injection of indocyanine green (ICG) prior to surgery. Intraoperatively, masses were resected with simultaneous NIR imaging. The resection margins that displayed fluorescence were dissected wider to obtain a clear margin away from the tumor. The distance of surgical margins to tumor was measured pathologically, and this distance was compared to the margins from 20 historical control cases performed without molecular imaging.

Results: All patients underwent intravenous injection of ICG without toxicity. Mean tumor size was 4.9 cm (range 2.9–7.0 cm). Cases were performed either by robot-assisted (n = 4), video-assisted (n = 7) or sternotomy (n = 9). During surgery, all 20 thymomas were fluorescent. The mean tumor-to-background ratio (TBR) of the tumor to surrounding mediastinal fat was 3.2 (IQR 2.9–3.5). There was no false uptake in the surrounding tissues (background fluorescence <1.2). In 16 cases, the surgeon modified the resection due to fluorescence at the tumor margins. In 6 cases, the left phrenic nerve was close to the tumor border, and NIR imaging improved the surgeon's confidence that the tumor had been removed with adequate margins. All patients had thymomas on final pathology with 8 patients (40%) with transcapsular invasion (Masaoka Stage II). No patients had tumor at the resection margins, though several challenges arose in pathology in assessing precise margins in fatty tissue surrounding thymomas. The 8 patients with transcapsular invasion underwent adjuvant radiation therapy, and 75% of the patients developed morbidity including skin irritation, hypothyroidism, and pneumonia. Specimens removed with intraoperative imaging had significantly (p-value < 0.05) greater distance between surgical margin and thymoma when compared to controls (mean distance to margin 1.0 cm (IQR 0.5–1.5 cm) vs 0.4 cm (IQR 0.2–0.7 cm), respectively).

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Conclusions: This is the first description of intraoperative NIR imaging to remove thymomas and suggests that imaging improves the distance from the tumor to the resection margins. This may reduce the need for radiation in patients with Masaoka Stage II thymomas, particularly in patients who might be poor candidates for adjuvant therapies. We believe a randomized study comparing surgery with NIR imaging with or without postoperative radiation should be considered.

3:20 PM – 4:10 PM Coffee Break in the Exhibit Hall

3:30 PM – 4:00 PM

Deep Dive Session

Exhibit Hall, AATS CT Theater II, Booth #181

Moderator: ♦Jonathan D'Cunha

Not for Credit

P25. Risk Factors for Progression of Ground Glass Opacities in Patients with Resected Pulmonary Adenocarcinoma

Rebecca W. Gao, *Stanford University, Stanford, CA*

P26. Prognostic Impact of the Findings on Thin-Section Computed Tomography in Patients with Subcentimeter Non-Small Cell Lung Cancer

Aritoshi Hattori, *Juntendo University, Tokyo, Japan*

P28. Prediction of Lepidic Predominant Clinical-Stage IA Lung Adenocarcinoma with Radiological Pure-Solid Appearance for Possible Indications of Sublobar Resection

Aritoshi Hattori, *Juntendo University, Tokyo, Japan*

76. A Risk Score to Predict the Incidence of Prolonged Air Leak After Video-Assisted Thoracoscopic Lobectomy: A European Multicenter Analysis

Cecilia Pompili¹, Pierre Emmanuel Falcoz², Michele Salati³, Zalan Szanto⁴,

*Alessandro Brunelli¹

¹St. James University Hospital, Leeds, United Kingdom; ²University Hospital Strasbourg, Strasbourg, France; ³Ospedali Riuniti, Ancona, Italy; ⁴University of Pecs, Pecs, Hungary

Invited Discussant: *Robert J. Cerfolio

Objective: The occurrence of prolonged air leak (PAL) after video-assisted thoracoscopic surgery (VATS) may negatively impact its intended benefits in terms of reduced hospital stay, costs and improved patient satisfaction. The objective of this study was to develop an aggregate risk score for predicting the occurrence of PAL after VATS lobectomy based on patients registered in the European Society of Thoracic Surgeons (ESTS) database.

Methods: 5,069 VATS lobectomy patients from July 2007 to August 2015 submitted to the ESTS database were analyzed. Exclusion criteria: sublobar resections or pneumonectomies, lung resection associated with chest wall or diaphragm resections, sleeve resections, need for postoperative assisted mechanical ventilation.

PAL was defined as an air leak longer than 5 days. Many baseline and surgical variables were screened for a possible association with PAL by univariable analysis and included in a stepwise logistic regression analysis (dependent variable: PAL) validated by bootstrap resampling technique. Only predictors with a $p < 0.1$ in more than 50% of 1,000 bootstrap samples were retained in the final model and were proportionally weighed according to their regression estimates (assigning 1 point to the smallest coefficient).

Results: PAL was observed in 504 patients (9.9%). The following variables were found reliably associated with PAL after logistic regression and were scored according to their regression estimates: male gender ($p < 0.0001$, bootstrap frequency 99.7%, score = 1), FEV1<80% ($p < 0.0001$, bootstrap frequency 99%, score = 1), body mass index $< 18.5 \text{ kg/m}^2$ ($p < 0.0001$, bootstrap frequency 99%, score = 2).

PAL score was calculated for each patient by summing the individual scores assigned to each variable and ranged from 0 to 4. According to the score, patients were grouped into 4 classes with an incremental risk of PAL (p2 points, 117 patients) 25%. The PAL score was tested using bootstrap resampling within each class of risk: in the lowest risk class (A), PAL incidence was lower than 7% in 86% of samples, whereas PAL incidence was greater than 20% in 87% of samples in the highest risk class (D).

Conclusions: A simple aggregate risk-score was created to reliably stratify the incidence of PAL after VATS lobectomy. The score can be used for patient counseling and to identify those patients who may benefit from additional intra-operative preventative measures.

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77. Salvage Pulmonary Resection Following SBRT: A Feasible and Safe Option for Local Failure

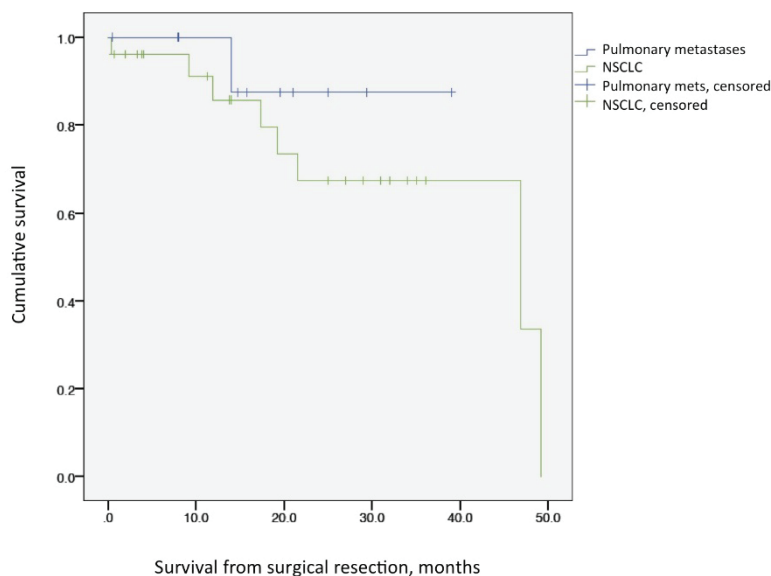
Mara B. Antonoff, Arlene Correa, Boris Sepesi, Quynh-Nhu Nguyen, *Garrett Walsh, *Stephen Swisher, *Ara Vaporciyan, *Reza Mehran, *Wayne Hofstetter, *David Rice
UT MD Anderson Cancer Center, Houston, TX

Invited Discussant: *Stephen R. Hazelrigg

Objective: For inoperable patients with early staged non-small cell lung cancer (NSCLC) and pulmonary metastases, stereotactic body radiotherapy (SBRT) has surfaced as a reasonable therapeutic option. In recent years, use of SBRT for pulmonary lesions in potentially operable candidates has gained interest. However, the ideal management of local recurrence following SBRT remains unclear. As the use of SBRT for potentially operable patients with primary NSCLC and metastatic disease continues to expand, we may anticipate an increasing number of local failures that may require surgical salvage. In this study, we aimed to investigate the outcomes of pulmonary resection following local failure of SBRT.

Methods: A retrospective review was conducted of patients at a single institution who underwent operative resection between 2009–2015 of pulmonary lesions previously treated with SBRT. Data were collected from a departmental database and supplemented with chart review. Variables collected pertained to demographics, comorbidities, histology, staging, radiation, operative details, recurrence, and vital status. In addition, a literature search was conducted to identify previous reports of pulmonary resection for local SBRT failures, in order to allow cumulative analyses of all previously published cases. Kaplan Meier analyses were performed to evaluate survival.

Results: 21 patients met inclusion criteria at our institution. Among these individuals, median preoperative FEV-1 and DLCO were 71% and 58% of predicted, respectively. Median time between SBRT and surgery was 16.2 months (range 6.4–71.5). Postoperative complications were seen in 7 (18.9%), with the most frequent complications being atrial arrhythmia and prolonged air leak ($n = 2$ for each, 5.4%). Recurrence occurred in 5/21 (23.8%), with a median time to recurrence of 36.2 months and median disease-free survival of 19.2 months. All post-operative recurrences were distant. 30- and 90-day mortality were both 1 (4.8%). The cumulative review included 37 patients at 4 institutions, comprised of 26 (78.8%) NSCLC and 11 (29.7%) pulmonary metastases. 8 (21.6%) were deemed medically inoperable at initial presentation. Overall median time between SBRT and surgery was 16.1 months (range 6.4–104 months). The median overall survival following surgery was 46.9 months, and 3-year survival was 70.1% (Figure).



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Conclusions: Following local failure of SBRT, pulmonary salvage resection remains a viable option, with acceptable morbidity and reasonable survival. As indications for SBRT continue to expand, further studies to evaluate the optimal management for local failure are in need.

78. Prospective Trial of Giant Paraesophageal Hernia Repair with 1-Year Follow-Up

John R. Stringham¹, Jennifer V. Phillips¹, Timothy L. McMurry¹, Drew L. Lambert¹,

*David R. Jones², James M. Isbell¹, *Christine L. Lau¹, *Benjamin D. Kozower¹

¹University of Virginia, Charlottesville, VA; ²Memorial Sloan Kettering Cancer Center, New York, NY

Invited Discussant: *James D. Luketich

Objective: The surgical standard technique for correction of subglottic stenosis is a cricotracheal resection, first described by Pearson and Grillo. It is associated with good long-term results. However, this method is not suitable in the situation of pronounced side-to-side narrowing extending upwards into the glottic and the level of the vocal cords. For such a high type of stenosis, laryngotracheal reconstruction (LTR) with cartilage interposition becomes necessary. This reconstruction technique, as first described by Couraud, requires a prolonged postoperative stabilization with internal T-tube stenting, which imposes significant morbidity and discomfort to the patient. In this paper, we describe our initial experience with a modified LTR technique that avoids the need for prolonged postoperative stenting.

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Methods: From 11/2012–05/2015 five adult patients with a glotto-subglottic stenosis were operated. All patients suffered from a combination of pronounced submucosal thickening and scar formation in combination with advanced side-to-side narrowing extending up to the level of the vocal cords. Operative technique consisted of a complete anterior and posterior laryngeal split followed by rib cartilage interposition in the cricoid plate posteriorly in order to enlarge the glotto-subglottic diameter. The lateral edges of the rib graft were trimmed in a way that lateral flanges were created, which allowed a stable positioning of the graft between the two halves of the cricoid. The distal trachea was then slid into the larynx in a way that the posterior defect was completely covered by a liberal flap of the membranous portion and the anterior defect was enlarged by a V shaped part of the anterior tracheal wall.

Results: This modified technique of LTR provided immediate stability without the need for temporary endoluminal stenting. The perioperative course was uneventful in all patients. The functional outcome was excellent with significantly improved ventilation, normal swallowing and acceptable voice quality three months after the operation, as evaluated by bronchoscopy, lung function testing, voice evaluation and structured swallowing tests.

Conclusions: We conclude that this modified technique of LTR represents a valid treatment option for patients with complex glotto-subglottic stenosis, avoiding the need for prolonged postoperative stenting.

Late-Breaking Clinical Trial

LB11. A Prospective Clinical Trial of Intra-Operative Tissue Oxygenation Measurement and Its Association with Anastomotic Leak Rate After Ivor Lewis Esophagectomy

*Prasad S. Adusumilli¹, Marom Bikson², Nabil Rizk¹, *Valerie W. Rusch¹, Boris Hristov¹, Rachel Grosser¹, Kay See Tan¹, Inderpal Sarkaria¹, ♦James Huang¹, Daniela Molena¹, *David R. Jones¹, *Manjit S. Bains¹

¹Memorial Sloan Kettering Cancer Center, New York, NY; ²City College of New York, New York, NY

Invited Discussant:

5:35 PM **Executive Session, AATS Members Only**

Hall E, BCC

WEDNESDAY MORNING, MAY 18, 2016

7:30 AM **Adult Cardiac Surgery** Ballroom I, BCC
Simultaneous Scientific Session
 5 minute presentation, 6 minute discussion
Moderators: *Faisal G. Bakaeen and *Clifford W. Barlow

79. Haemodynamic Performance and Early Outcome of Freedom Solo Stentless Valve Versus TAVR for Aortic Valve Replacement in Patients with Intermediate Risk Profile: A European, Multicenter Experience

Alberto Repossi¹, Laura Giroletti¹, Lorenzo Di Bacco¹, Bruno Passaretti², Gianluigi Bisleri¹, Christina Schafer³, Benjamin Claus³, Herko Grubitzsch³, Thierry Folliguet⁴, Roberto Di Bartolomeo⁵, Juan Pablo Maureira⁴, Francois Laborde⁶, *Claudio Muneretto¹

¹University of Brescia, Brescia, Italy; ²Humanitas Gavazzeni Hospital, Bergamo, Italy; ³Charité Universitätsmedizin Berlin, Berlin, Germany; ⁴CHU de Nancy, Vandoeuvre les Nancy, France; ⁵University of Bologna, Bologna, Italy; ⁶Institut Mutualiste Montsouris, Paris, France

Invited Discussant: *Jay K. Bhama

Objective: Stentless aortic valves have been developed to overcome the obstructive limitations associated with stented bioprostheses and their performances are considered the gold standard in terms of haemodynamics. The Freedom Solo (FS) bovine pericardial valve is a third generation stentless bioprosthesis introduced in 2004 and FDA approved in 2014. The use of TAVR is spreading even in patients with intermediate/low risk also in reason of their haemodynamic performances when compared to conventional stented bioprostheses. Then a comparative hemodynamic evaluation with last generation high performance stentless bioprostheses is mandatory. The aim of the current multi-institutional study was to compare haemodynamics of TAVR and FS in a intermediate risk population with AVR.

Methods: From 2010 to 2014, 420 consecutive patients (mean age 75.3 ± 8.2 years, 180 [43.0%] females) underwent isolated aortic valve replacement (AVR) with the FS. In the same period 375 patients underwent TAVR. Only patients with intermediate operative risk (STS score between 4 and 10) and small aortic annulus (≤ 23 mm) have been included in the study. After a propensity matched analysis 142 FS patients were compared with 142 TAVR patients. Post procedural transthoracic echo-Doppler parameters at discharge were reported in terms of peak (mean) gradients and effective orifice area (EOA).

Results: Mean STS score was 6.7 ± 3.2 for FS and 7.2 ± 2.9 ($p = 0.7$) for TAVR group. Mean diameter was 22.2 ± 0.9 mm for FS and 22.4 ± 1.0 mm for TAVR. Overall in hospital mortality was 2.1% in the FS group and 6.3% ($p = 0.02$) in TAVR group. Pre-operative FS peak (mean) gradients were 79.9 ± 30.7 mmHg (48.7 ± 18.2 mmHg) and decreased to 19.1 ± 9.6 mmHg (10.8 ± 5.9 mmHg) after implantation; preoperative TAVR gradients were 77.9 ± 20.8 mmHg (48.4 ± 14.5 mmHg) and decreased

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to 20.2 ± 9.5 mmHg (10.7 ± 6.9 mmHg) $p = 0.57$ (0.88). Post-operative effective orifice area (EOA) was 1.93 ± 0.52 cm² for FS and 1.83 ± 0.3 cm² ($p = 0.65$) for TAVR. There was no prostheses-patient-mismatch (PPM) in both groups. Postoperative grade 2–3 aortic regurgitation was present in 9.8% in TAVR group and 0.7% in FS group. Post operative permanent pacemaker implant rate was 12% in TAVR group and only one case (0.7%) was reported in FS group ($p < 0.001$).

Conclusion: In patients with small aortic annuli and intermediate risk profile both FS valve and TAVR showed similar excellent hemodynamic performances. Nevertheless the use of TAVR negatively affected the short term outcome with significant higher early mortality, higher incidence of prosthetic regurgitation and atrioventricular blocks requiring pacemaker implant. Further studies are necessary to validate TAVR indications in patients with intermediate low risk profile and small aortic annulus.

80. Safety and Effectiveness of Robotically-Assisted Mitral Valve Surgery: Analysis of 1,000 Consecutive Cases

*A. Marc Gillinov, *Tomislav Mihaljevic, Hoda Javadikasgari, *Rakesh Suri, Stephanie Mick, *Jose Navia, Milind Desai, Johannes Bonatti, Mitra Khosravi, Jay Idrees, Ashley Lowry, *Eugene Blackstone, *Lars Svensson
Cleveland Clinic Foundation, Cleveland, OH

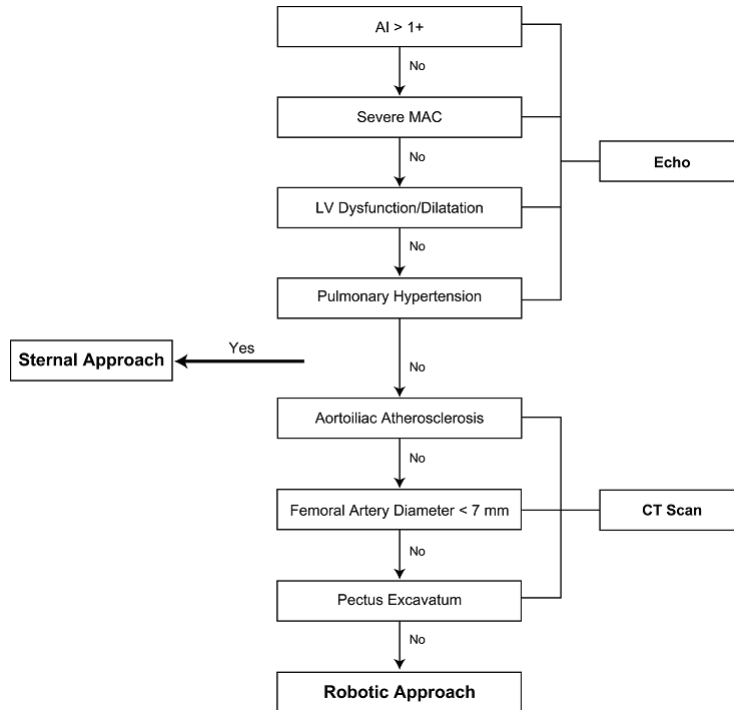
Invited Discussant: *T. Sloane Guy

Objective: Although robotically-assisted mitral valve surgery represents the least invasive surgical approach to the mitral valve, perceived technical complexity and questions concerning its effectiveness have limited its adoption. The objective of this study was to assess the technical performance and clinical outcomes of robotically-assisted mitral valve surgery by examining our first 1,000 consecutive cases.

Methods: From 2006 to 2014, 1000 consecutive patients (mean age 55.7 ± 10.5 yrs, $n = 770$ (77%) male) underwent robotically assisted mitral valve surgery; concomitant procedures included atrial septal defect/patent foramen ovale closure ($n = 90$, 9%), atrial fibrillation ablation ($n = 72$, 7.2%), and tricuspid valve repair ($n = 2$, 0.2%). With increasing experience, we developed and applied a clinical algorithm to identify candidates for robotically-assisted surgery (Figure). Etiologies of mitral valve disease were degenerative ($n = 960$, 96%), endocarditis ($n = 26$, 2.6%), rheumatic ($n = 10$, 1%), ischemic ($n = 3$, 0.3%), and fibroelastoma ($n = 1$, 0.1%). All procedures were performed via right chest access with femoral artery cannulation and either aortic balloon occlusion ($n = 263$, 26%) or transthoracic clamp ($n = 737$, 74%).

Results: Mitral valve repair was attempted in 997 patients (2 planned replacements and 1 resection of fibroelastoma); 992 of these patients underwent mitral valve repair, while 5 had replacement. Intraoperative post-repair echocardiography confirmed that 99% of repair patients left the operating room with mitral regurgitation (MR) that was graded as 1+ or less, and predischarge echocardiography confirmed MR grade 1+ or less in 98%. Conversion to sternotomy occurred in 19 patients (1.9%); reasons for conversion included management of residual MR ($n = 7$), bleeding ($n = 5$), inadequate surgical exposure ($n = 4$), myocardial ischemia

(n = 1), aortic valve injury (n = 1) and aortic dissection (n = 1). There was one hospital death (0.1%) and fourteen patients (1.4%) suffered a stroke; the risk of stroke declined from 2% (10 events) in the first 500 cases to 0.8% (4 events) in the second 500 cases. Over the course of the aggregate experience, time trends demonstrated significant declines in myocardial ischemic and cardiopulmonary bypass times (P-value < 0.0001), transfusion rate (P-value = 0.003), and intensive care unit and hospital lengths of stay (P-value < 0.05). All other indices of operative safety and effectiveness remained constant over time.



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Conclusion: Robotically-assisted mitral valve surgery is associated with very low operative mortality and a high rate of mitral valve repair. The combination of careful patient selection and increased experience enhance both clinical outcomes and procedural efficiency. Robotically-assisted mitral valve surgery sets a standard for comparison with emerging percutaneous mitral valve interventions.

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81. Aortic Valve Repair with Geometric Ring Annuloplasty for Aortic Insufficiency Associated with Ascending Aortic/Root Aneurysms

Domenico Mazzitelli¹, Theodor J.M. Fischlein², *J. Scott Rankin³, Yeong-Hoon Choi⁴, Christof Stamm¹, Jan Pirk⁵, Steffen Pfeiffer², Christian Noebauer¹, *Christian Schreiber¹, *Thorsten Wahlers⁴, *Friedhelm Beyersdorf⁶, *Ruediger Lange¹

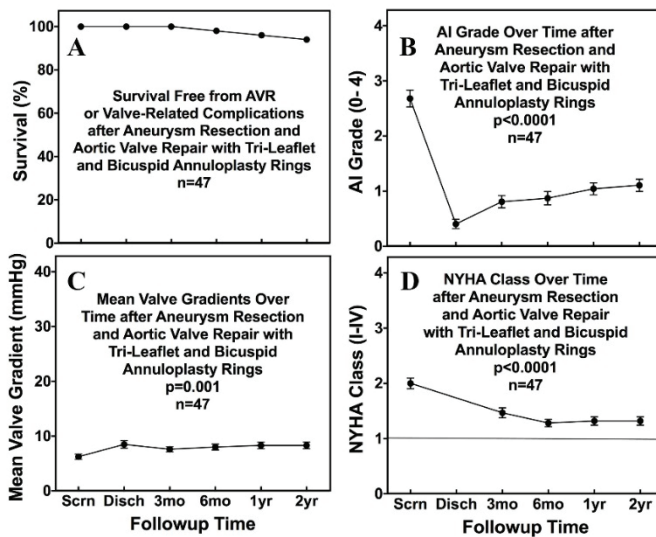
¹German Heart Center Munich, Munich, Germany; ²Klinikum Nürnberg, Paracelsus Medical University, Nuremberg, Germany; ³Cardiothoracic Surgery Associates, Nashville, TN; ⁴University of Cologne, Cologne, Germany; ⁵Institute for Clinical and Experimental Medicine, Prague, Czech Republic; ⁶Heart Center Freiburg University, Freiburg, Germany

Invited Discussant: *Gebrine El Khoury

Objective: Geometric ring annuloplasty is standard for mitral and tricuspid valve repair, and could be useful for aortic valve reconstruction. Accordingly, this study evaluated intermediate-term outcomes of internal geometric ring annuloplasty for repair of tri-leaflet and bicuspid aortic insufficiency (AI) associated with ascending aortic and/or root aneurysms.

Methods: Under regulatory supervision, 47 patients with AI and ascending aortic (n = 22) and/or aortic root (n = 25) aneurysms were managed with aortic valve repair and aneurysm resection. Valve repair was performed using tri-leaflet (n = 40) or bicuspid (n = 7) internal geometric rings, together with leaflet reconstruction. Tri-leaflet ring diameter was determined as leaflet free-edge length/1.5. Bicuspid rings were selected to keep inter-commissural distance constant. The 3-dimensional rings were computer-milled from one-piece Titanium blocks and covered with Dacron. Both types of rings had equidistant subcommissural posts that flared outward by 10–15 degrees, and both were sutured beneath the valve with 9 trans-annular horizontal mattress sutures. Ascending aortic and/or remodeling root replacements were performed with Dacron grafts 5–7 mm larger than the rings. An independent Echo Core Lab provided serial transthoracic echocardiographic (TTE) assessment in a blinded fashion, and changes over time were evaluated using non-parametric analysis of variance.

Results: Average age was 60 ± 14 years (± SD), 57% (27/47) were male, 15% (7/47) had bicuspid valves, 87% (41/47) had moderate-to-severe AI, and 13% (6/47) had mild AI. Relative to leaflet size, all patients had significant annular dilatation, averaging 26.5 ± 2.6 mm before repair, and ring size averaged 21.7 ± 1.7 mm. Maximal followup was 42 months, and mean followup was 27 months. No operative mortality or late valve-related complications were observed. Two patients died beyond 1-year from alcoholic liver failure and pancreatic cancer. Neither had significant AI. One patient required late prosthetic valve replacement for failed Gore-Tex leaflet reinforcement. Thus, survival free of complications or valve replacement was 94% at 3 years (Figure). On serial TTE's, prolonged and stable AI reduction was observed (p < 0.0001), and mean valve gradients remained low. Reduction in NYHA class for congestive heart failure also was significant (p < 0.0001). No new heart block or direct complications of the rings occurred.



Legend: Complication-free survival, aortic valve function, and symptomatic status from preoperative screening (Scrn) to 2 years of followup. Disch=discharge, mo=months, yr=years.

Conclusions: Internal aortic valve annuloplasty with geometric rings seemed safe and effective for repair of tri-leaflet and bicuspid AI associated with aortic aneurysms. Survival free of valve-related complications was excellent, gradients were low, and AI reduction was significant and stable over the intermediate-term. This approach could simplify and standardize aortic valve repair, but more experience will be required for full validation.

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82. Mid-Term Multi-Center Clinical and Hemodynamic Results of a High Performance Pericardial Surgical Valve

*Scott Goldman¹, Anson Cheung², *Joseph E. Bavaria³, Michael R. Petracek⁴, Mark A. Groh⁵, *Hartzell V. Schaff⁶

¹Lankenau Heart Institute, Wynnewood, PA; ²University of British Columbia, Vancouver, BC, Canada; ³University of Pennsylvania, Philadelphia, PA; ⁴Vanderbilt University, Nashville, TN; ⁵Mission Health and Hospitals, Asheville, NC; ⁶Mayo Clinic, Rochester, MN

Invited Discussant: *Y. Joseph Woo

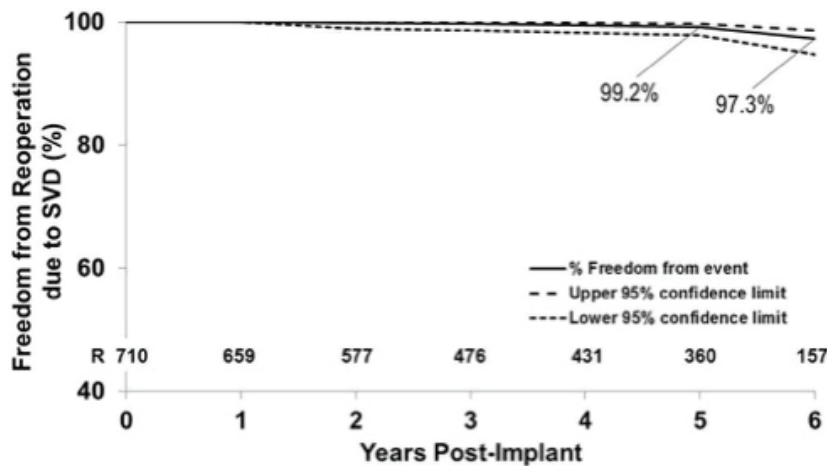
Objective: The objective of the study is to evaluate the mid-term clinical safety and effectiveness of a new generation surgical pericardial aortic heart valve.

Methods: In a multicenter, prospective, nonrandomized, follow-up study at 9 centers within the United States and 2 centers in Canada, 710 patients underwent surgical implantation of a third generation pericardial stented prosthesis designed for supra-annular placement. The valve incorporates a single sheet of bovine pericardium mounted externally onto a titanium stent allowing maximal cylindrical opening during systole with minimal leaflet stresses. Subjects were followed on

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an annual basis with either an in-clinic visit or a telephone follow-up. Each in-clinic visit consisted of a transthoracic echocardiogram and assessments for NYHA classification, and recording of serious adverse events and general clinical status. All echocardiograms were assessed by an independent core lab and adverse events were adjudicated by an independent Clinical Events Committee.

Results: Operations were performed from 2007 to 2009, and mean age was 72.4 ± 9.3 years; 471/710 (66%) were men. Smaller valve sizes (19 mm and 21 mm) were implanted in 275/710 (39%) of patients. Preoperatively 361/710 (50.9%) of patients were in NYHA Class III or IV, and at six years postoperatively 92/96 (95.8%) were NYHA Class I or II. Six years postoperatively, average mean gradient (MG) across all valve sizes was 11.0 mmHg. The average MG for the 19 mm and 21 mm valves combined increased from 9.2 to 13.1 mmHg between 1 year and 6 years post-implant. The average EOAI across all valve sizes was 0.80 cm²/m² at six years. Freedom from moderate to severe valvular regurgitation at six years was 95% (80/84). The linearized late adverse event rate (number per 100 late patient-year) based on 2873.4 late patient years included: 0.87 emboli (including 0.42 TIA and 0.31 stroke), 0 thrombosis, 1.77 major bleeds, 0.21 endocarditis, 0.38 reoperations due to structural deteriorations, 0.24 nonstructural dysfunction (0.17 paravalvular leak), 0.63 reoperations, and 1.98 deaths (0.21 valve-related). Six years postoperatively, freedom from nonstructural dysfunction and paravalvular leak were 98.6% and 98.9%, respectively; freedom from reoperation due to structural valve deterioration was 97.3% (95% confidence limits 98.6–94.7, Figure).



Conclusion: These midterm results demonstrate that this new generation aortic heart prosthesis is a safe and effective valve substitute with excellent hemodynamic performance that is maintained through the 6-year follow-up.

Innovation in Cardiac Surgery

*Ralph J. Damiano, Jr., Washington University, St. Louis, MO

83. Frozen Elephant Trunk for Type A Aortic Dissection in Marfan Syndrome: Long-Term Single-Center Experience in 106 Patients

Long-Fei Wang¹, Wei-Guo Ma², Jun Zheng¹, Tian-Hua Rong¹, Bulat A. Ziganshin², Sven Peterss², Wei Zhang¹, Yong-Min Liu¹, Jun-Ming Zhu¹, Qian Chang³, *John A. Elefteriades³, *Li-Zhong Sun¹

¹Capital Medical University, Beijing, China; ²Yale-New Haven Hospital, New Haven, CT;

³Fu Wai Hospital and Cardiovascular Institute, Beijing, China

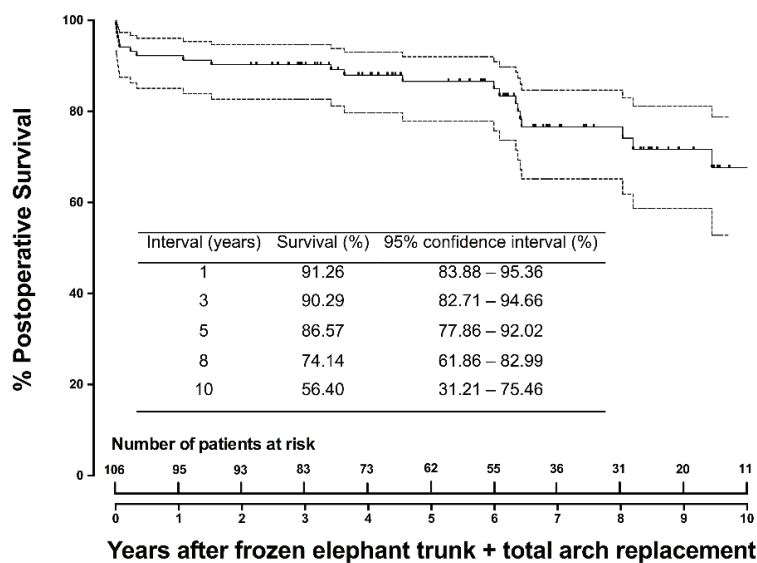
Invited Discussant: *Wilson Y. Szeto

Objective: Type A aortic dissection (TAAD) is a lethal complication in patients with Marfan syndrome (MFS). The extent of surgical repair and the use of frozen elephant trunk (FET) technique are controversial, and few data exist on long-term outcomes after TAAD in such patients. We evaluate the efficacy of FET and total arch replacement (TAR) in MFS patients with TAAD involving the aortic arch and/or descending thoracic aorta.

Methods: Between April 2003 and August 2013, 106 patients with MFS (by revised Ghent criteria) underwent FET + TAR for TAAD involving the arch and/or descending aorta. Mean age was 34.5 ± 9.7 years (range, 17–65) and 80 were male (75.5%). TAAD was acute in 40 cases (37.7%). Aortic regurgitation was seen in 68 patients (64.2%), hypertension in 35 (33.0%), previous cardiovascular surgery in 23 (21.7%), and malperfusion syndrome in 4 (3.8%). The entry tear was located in the ascending aorta in 55 cases, arch in 12, descending aorta in 9, multiple in 25 and unidentified in 5. Bentall procedure was performed in 74 patients, aortic valve repair in 7, aortic valve replacement in 1, extra-anatomic bypass in 8 and mitral valve replacement in 2. The times of CPB, cross-clamp and cerebral perfusion were 187 ± 35 , 105 ± 25 and 24 ± 10 minutes, respectively.

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Kaplan-Meier Survival



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Results: Operative mortality was 6.6% (7/106). The cause of death was multiorgan failure in 6 cases and aortic rupture in 1. Early morbidity occurred in 17 cases (16.0%), including spinal cord injury in 1 (0.9%), stroke in 1 (0.9%), reexploration for bleeding in 6 (5.7%), renal failure in 3 (2.8%), limb ischemia in 4 (3.8%) and recurrent laryngeal nerve injury in 2 (1.9%). Extra-anatomic bypass was the leading risk factor for early mortality and morbidity (odds ratio [OR], 7.120; 95% confidence interval [CI], 1.018–49.790; $P = .048$). Follow-up was complete in 97.0% (96/99) averaging 6.3 ± 2.8 years (range 0.3–12.0). Late death occurred in 17 cases. Survival was 91.3%, 90.3%, 86.6% and 74.1% at 1, 3, 5 and 8 years, respectively (Figure 1). Patients with acute TAAO were less prone to late death than those with chronic TAAO (OR, 0.112; 95% CI, 0.021–0.587; $P = .048$). Late reoperations were needed in 12 patients at mean 2.3 years (median, 1.3; range, 0.4–7.7), including thoracoabdominal aortic repair in 8, TEVAR for distal endoleak or new entry in 3 and proximal anastomotic repair in 1. Freedom from reoperation was 94.7%, 90.5%, 88.8% and 84.2% at 1, 3, 5 and 8 years, respectively. Risk factors for late reoperation were time from diagnosis to surgery (in days) (OR, 1.160; 95% CI, 1.043–1.289; $P = .006$) and Bentall procedure (OR, 12.012; 95% CI, 1.041–138.606; $P = .046$).

Conclusions: Despite controversy regarding use of FET for TAAO in MFS, this study shows that FET + TAR can be safely performed in such patients with low operative mortality, favorable late survival and low incidence of late reoperation. These results argue favorably for the use of FET + TAR in the management of TAAO in MFS.

84. Alternative Approaches in Transcatheter Aortic Valve Replacement and Costs in the U.S. Medicare Population

Fenton H. McCarthy, Danielle D. Spragan, Katherine M. McDermott, Peter W. Groeneveld, Ashley C. Hoedt, Howard C. Herrmann, Saif Anwaruddin, Jay Giri, *Joseph E. Bavaria, *Wilson Y. Szeto, ♦Nimesh D. Desai

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Vinod H. Thourani

Objective: Transcatheter aortic valve replacement (TAVR) in the US operates on a transfemoral- (TF) first platform, but many TAVR candidates are ineligible for TF TAVR. This analysis aims to describe the US experience with transapical (TA) and transaortic (TAO) TAVR by examining utilization, cost, and outcomes in the Medicare population.

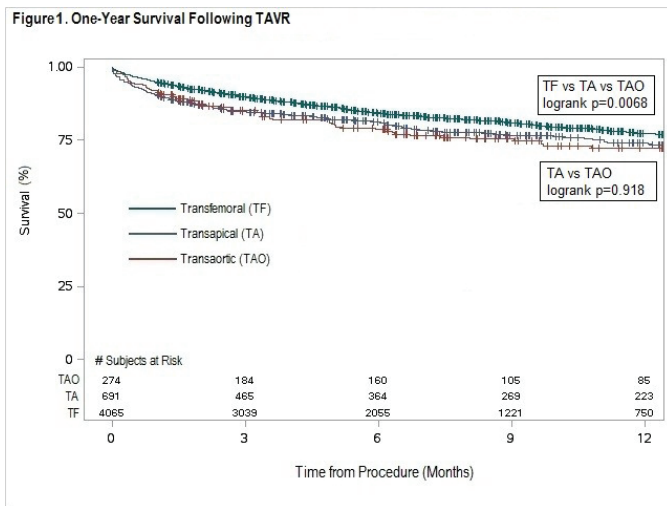
Methods: All Medicare fee-for-service patients undergoing TF ($n = 4065$), TA ($n = 691$), or TAO ($n = 274$) TAVR between January 1, 2011 and November 30, 2012, were identified using Health Care Procedure Classification Codes present on CMS carrier claims. Mortality data were collected by linking index hospitalization records to death records in Medicare denominator files using beneficiary identification number. A modified Elixhauser comorbidity index was applied to ICD-9 codes in order to generate common comorbidities present on arrival. Medicare claims provided hospital charges, which were converted to costs using hospital-specific Medicare cost-to-charge ratios.

Results: TA and TAO patients were similar in age, race, and common comorbidities (Table 1). Compared to TF patients, TA and TAO patients were more likely to be female and to have peripheral vascular disease, chronic lung disease, and renal failure. Thirty-day mortality rates were higher among TA and TAO patients than among TF patients (TA = 9.6%, TAO = 8.0% TF = 5.0%, $p < 0.001$), and TF patients demonstrated better survival through 1 year (logrank $p = 0.0068$, Figure 1); survival was comparable between TA and TAO TAVR (logrank $p = 0.913$). TF patients were less likely than TA or TAO to have at least one readmission within 30 days post-procedure, and TF hospital costs were lower at index, 30 and 90 days. TAO patients were more likely than TA patients to have at least one readmission within 30 days of their TAVR procedure (28% vs. 20%, $p = 0.013$), but cumulative costs at 30 and 90 days were similar (Table 1).

	All TAVR n=5030	TA n=691	TAO n=274	p (t-test or Fisher)	TF n=4065	p (ANOVA or χ^2)
Age (Mean \pm SD)	83.8 \pm 7.6	83.8 \pm 7.1	83.9 \pm 6.7	0.8578	83.8 \pm 7.7	0.9810
Male	51% (2566)	46% (317)	45% (124)	0.8862	52% (2125)	0.0012
Black	3% (166)	2% (16)	1% (4)	0.465	4% (146)	0.0476
Congestive Heart Failure	92% (4642)	94% (648)	93% (254)	0.564	92% (3740)	0.2624
Peripheral Vascular Disease	81% (4064)	87% (599)	83% (227)	0.1283	80% (3238)	0.0001
Neurological Disorder	20% (992)	18% (127)	15% (42)	0.3015	20% (823)	0.0892
COPD	57% (2884)	62% (427)	65% (178)	0.3763	56% (2279)	0.0006
Diabetes	25% (1281)	27% (190)	28% (77)	0.8733	25% (1014)	0.2137
Renal Failure	53% (2645)	57% (396)	54% (149)	0.4287	52% (2100)	0.0190
Liver Disease	5% (243)	5% (36)	4% (10)	0.402	5% (197)	0.5917
Coagulopathy	23% (1157)	21% (144)	24% (65)	0.3409	23% (948)	0.3432
Obesity	20% (1007)	18% (121)	19% (51)	0.7093	21% (835)	0.1537
Weight Loss (Frailty)	13% (631)	12% (81)	15% (40)	0.2362	13% (510)	0.4772
Depression	18% (887)	16% (108)	20% (55)	0.1054	18% (724)	0.2100
	All TAVR	TA	TAO	p	TF	p
Early (30d) Mortality	5.8% (292)	9.6% (66)	8.0% (22)	0.5356	5.0% (204)	<0.001
Post-Procedure LOS	6.9 \pm 5.9	8.7 \pm 7.2	9.6 \pm 6.8	0.102	6.5 \pm 5.5	<0.001
Readmission within 30 Days	21% (1066)	20% (140)	28% (76)	0.013	21% (850)	0.023
Readmission within 90 Days	36% (1506)	35% (194)	45% (97)	0.017	36% (1215)	0.028
Index Admission Hospital Costs [Median (IQR)]	\$49,100 (\$38,300 - \$63,800)	\$53,200 (\$41,100 - \$68,400)	\$49,800 (\$40,100 - \$66,200)	TA vs. TAO 0.075	\$48,500 (\$37,800 - \$62,800)	TA vs. TF <0.001 TAO vs. TF 0.0278
Cumulative 30-Day Hospital Costs [Median (IQR)]	\$51,100 (\$39,500 - \$68,200)	\$56,000 (\$41,500 - \$74,900)	\$52,600 (\$40,900 - \$73,400)	TA vs. TAO 0.262	\$50,600 (\$39,000 - \$66,800)	TA vs. TF <0.001 TAO vs. TF 0.027
Cumulative 90-Day Hospital Costs [Median (IQR)]	\$53,200 (\$40,000 - \$73,600)	\$57,200 (\$41,200 - \$78,200)	\$54,700 (\$40,900 - \$78,100)	TA vs. TAO 0.864	\$52,700 (\$39,800 - \$72,200)	TA vs. TF <0.001 TAO vs. TF 0.080

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Conclusion: For patients ineligible to receive transfemoral TAVR, transaortic and transapical approaches offer similar clinical outcomes at similar cost with acceptable operative- and one-year survival; however, transaortic TAVR results in a higher rate of early readmissions than transapical TAVR, and transapical TAVR may thus represent a lower burden of care.

85. Clinical Outcomes in Low and Intermediate-High Risk Groups with a Sutureless Heart Valve

*Axel Haverich¹, Theodor Fischlein², Kavous Hakim-Meibodi³, Martin Misfeld⁴,

*Thierry Carrel⁵, *Marian Zembala⁶, Francesco Madonna⁷, François Laborde⁸

¹Hannover Medical School, Hannover, Germany; ²Paracelsus Medical University, Nuremberg, Germany; ³Ruhr-Universität Bochum, Bad Oeynhausen, Germany;

⁴Herzzentrum Universitaet Leipzig, Leipzig, Germany; ⁵Universitätsklinik für Herz- und Gefäßchirurgie Inselspital, Bern, Switzerland; ⁶Silesian University Zabrze, Poland;

⁷Hopital Cardiologique Du Haut-Leveque, Pessac, France; ⁸Institute Mutualiste Montsouris, Paris, France

Invited Discussant: *Niv Ad

Objectives: Aim of this study is to evaluate patients characteristics and one-year clinical outcomes of two subgroups with different STS- PROM (Predictive Risk of Operative Mortality) score implanted with a sutureless valve prosthesis.

Methods: In-hospital and one-year follow-up outcomes were collected from patients included in a multicentric, prospective, international trial with a sutureless aortic valve prosthesis (mean age 78.3 years; 40% octogenarians; 64.4% females; mean STS score 7.2). A stratified analysis based on STS-PROM score was performed on patients with available data (616). Group 1 was defined as low risk group (STS score < 4%; 297 patients) and Group 2 as Intermediate/High/Very High risk group (STS score ≥ 4%; 319 patients).

Table 1: Mortality and Morbidity per Patients Risk Group

	Group 1 n = 297			Group 2 n = 319		
	Early 0–30 Days	Late 31–365 Days	Overall 0–365 Days	Early 0–30 Days	Late 31–365 Days	Overall 0–365 Days
All cause mortality (n, %)	3 (1.0)	6 (2.0)	9 (3.0)	20 (6.3)	21 (6.6)	41 (12.8)
Cardiac death (n, %)	1 (0.3)	2 (0.7)	3 (1.0)	15 (4.7)	10 (3.1)	25 (7.8)
Explant (n, %)	1 (0.3)	4 (1.3)	5 (1.7)	5 (1.6)	2 (0.6)	7 (2.2)
Aortic insufficiency (n, %)	1 (0.3)	2 (0.7)	3 (1.0)	8 (2.5)	2 (0.6)	10 (3.1)
PVL (n, %)	1 (0.3)	0	1 (0.3)	3 (0.9)	2 (0.6)	5 (1.6)
PVL+ Intraprosthetic Leak (n, %)	1 (0.3)	0	1 (0.3)	2 (0.6)	0	2 (0.6)
Intraprosthetic Leak (n, %)	0	0	0	3 (0.9)	0	3 (0.9)
Structural valve deterioration (n, %)	0	0	0	0	0	0
Thromboembolism (n, %)	11 (3.7)	5 (1.7)	16 (6.4)	17 (5.3)	6 (1.9)	23 (7.2)
Stroke	5 (1.7)	2 (0.7)	7 (2.4)	9 (2.8)	3 (0.9)	12 (3.8)
Endocarditis	0	7 (2.4)	7 (2.4)	1 (0.3)	1 (0.3)	2 (0.6)
Hemolysis, clinically significant	1 (0.3)	1 (0.3)	2 (0.7)	0	0	0
AV block III leading to pacemaker implantation	26 (8.7)	6 (2.0)	32 (10.8)	25 (7.8)	3 (0.9)	28 (8.8)

PVL: perivalvular leak.

Results: Concomitant cardiac procedures were performed in 68 (22.9%) patients from Group 1 (mean age: 76.6 ± 4.5 years; STS: 2.4 ± 0.7) and in 118 (37%) patients from Group 2 (mean age: 80.1 ± 5.9 years; STS: 11.7 ± 8.1). Perfusion and cross-clamp time were 58.6 and 35.7 minutes in Group 1, and 79.0 and 52.2 minutes in Group 2.

All cause early (0–30 day) and late (31–365 days) mortality was 0.3% (3) and 2.0% (6) in Group 1, and 6.3% (20) and 9.7% (21) in Group 2. Overall, 5 valves were explanted (1 early; 4 late) in Group 1, and 7 (2 early; 5 late) in Group 2. Aortic insufficiency was reported in 2 cases (0.7%) from Group 1 and 10 cases (3.1%) from Group 2.

No SVD occurred in both groups. Overall, 2.4% (7) of endocarditis and 2.4% (7) of stroke occurred in Group 1; 0.6% (2), and 3.4% (11) were reported in Group 2.

At 1 year, 10.8% (32) of patients required pacemaker implant due to complete AV Block in the low risk group, and 8.8% (28) in intermediate to very high risk group. Mean aortic pressure gradients were 13.2 and 12.4 mmHg in Group 1 and 2 respectively, and mean effective orifice area 1.3 and 1.5 cm².

Conclusions: The safety and the performance of the sutureless valve was confirmed in both groups regardless of the preoperative risk score. Short cross-clamp and perfusion time were reported, even though Group 2 had a higher incidence of concomitant procedures. The lack of propensity score matching represent a limitation. Long term outcomes in a stratified analysis on the risk score should be evaluated as soon as data become available.

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86. Long-Term Results of Transapical Off-Pump Echo Guided Mitral Valve Repair with Neochord Implantation

Andrea Colli, Laura Besola, Erica Manzan, Eleonora Bizzotto, Fabio Zucchetta, Roberto Bellu, Demetrio Pittarello, Cristiano Sarais, *Gino Gerosa
University of Padua, Padua, Italy

Invited Discussant: *Anelechi C. Anyanwu

Objective: Transapical Off-Pump mitral valve repair with Neochord implantation (TOP-MINI) is an innovative minimally invasive procedure to treat degenerative mitral regurgitation (MR) due to prolapse or flail. The aim of this single center independent study is to present results of patients treated with TOP-MINI.

Methods: Clinical and echocardiographic outcomes of consecutive patients were obtained from the Institutional database with a follow-up up to 1 year. Events were analyzed according to the recent published Mitral Valve Academic Research Consortium consensus report.

Results: From November 2013 to September 2015, 75 consecutive high surgical risk patients, with symptomatic moderate-to-severe or severe mitral regurgitation (MR) underwent TOP-MINI procedure. A 30-days follow up was obtained for all patients, whilst 56 reached a 6-months, 32 reached 1-year follow-up.

Median age 71 years (IQR 59–77), median STS score was 1.11% (IQR 0.5–2). Sixty-six patients (88%) presented a posterior leaflet disease, 6 (8%) an anterior leaflet disease and 3 (4%) a bileaflet disease. Three neochordae were implanted in 22 patients (29%), 4 in 34 (45%), 5 in 13 (18%), 6 in 5 people (7%), 8 in 1 (1%).

MVARC technical success was 74 (99%).

At 30-day follow-up MVARC procedural success was achieved for patients (94%). At 30 day 2 (3%) all cause death occurred (one periprocedural and one non periprocedural, both patients were a compassionate cases). MVARC early structural failure occurred in 2 patients (3%). MVARC device success was achieved in 72 patients (96%).

At 6 months follow-up MVARC patient success was reached for 54 patients (96%). Two patients presented a recurrence of moderate to severe MR and underwent surgery for MV replacement.

At 12 months MVARC patient success was for 31 patients (97%), one patient (3%) presented recurrence of moderate to severe MR but was not reoperated because of good clinical status and presence of high risk surgical condition (STS 9%).

Conclusions: Transapical off-pump echo guided mitral valve repair therapy is a safe therapeutic option. It has favorable early and long-term survival. The MR correction obtained with the TOP-MINI procedure provides acute good clinical and Echocardiographic results.

87. Thirty-Day and 1-Year Readmission Rate Following Transcatheter Aortic Valve Replacement in a High Volume Centre

Jessica Forcillo, Jose F. Condado, Vasilis Babaliaros, Jose Binongo, Yi-An Lasanajak, Eric Sarin, Chandan M. Devireddy, Bradley G. Leshnower, James P. Stewart,

*Robert A. Guyton, Kreton Mavromatis, Peter C. Block, Patricia Keegan, Amy Simone,

*Vinod H. Thourani

Emory University, Atlanta, GA

Invited Discussant: *Michael J. Reardon

Objective: Transcatheter aortic valve replacement (TAVR) has been increasingly utilized in high- or extreme risk patients in lieu of surgical aortic valve replacement (SAVR). In these elderly patients, readmissions after TAVR have been poorly studied and are the subject of increased scrutiny by healthcare systems. The objectives of this study were to determine a real-world incidence of and predictors for 30-days and 1-year cardiac and non-cardiac re-admission rates.

Methods: A retrospective review of prospectively collected data on 714 patients from 9/2007 to 1/2015 undergoing TAVR at an academic US institution was performed. Descriptive statistical analysis was performed and a multiple logistic regression was performed to determine correlates for re-admission in accordance to access site and other pre- and intra-operative patient variables.

Results: A total of 714 patients were included in this study. Median age was 83 years (IQ: 77, 87) and 46.6% (333/714) were female. Mean Society of Thoracic Surgeons score was 10.0% (IQ: 7.2–13.9). The 30-d readmission for the entire cohort was 10.8% (77/714) and the 1-yr was 38.9% (277/714). Pre-operative characteristics associated with 30-d readmission were prior percutaneous coronary intervention (PCI), (HR = 1.59 (1.02, 2.50)) and anemia (HR = 0.82 (0.72, 0.94)) and variables associated with 1-yr readmission were increasing age (HR = 1.02 (1.00, 1.03)), previous aortic valve surgery (HR = 1.29 (1.01, 1.64)), pre-operative aortic regurgitation (AR) (HR = 0.75 (0.57, 0.99)) and anemia (HR = 0.9 (0.84, 0.97)). They were no operative characteristics related to 30-d readmission; however, at 1-yr, the use of a 23 mm valve size was associated with re-admission (HR = 1.32 (1.04, 1.67)). Inversely, a 26 mm valve was related to less re-admissions at one year (HR = 0.79 (0.62, 1.01)); as was being discharged to a nursing facility immediately after the index operation (HR = 0.67 (0.51, 0.88)). There were no post-operative parameters associated with 30-d readmission. In contrast, length of hospital stay (HR = 1.03 (1.01, 1.04)), post-operative permanent stroke (HR = 2.75 (1.41, 5.34)) and post-operative renal failure (HR = 2.08 (1.03, 4.2)) were associated with a higher 1-yr readmission rate. Surprisingly, transfemoral versus alternative access approaches, a minimalist TAVR, and postoperative perivalvular leak were not associated with an increased 30-d or 1-yr re-admission rate.

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Table

Predictors of Readmission	30 Days	Hazard Ratio (95%CI)	p-Values	1 Year	Hazard Ratio (95%CI)	p-Values
Pre-operative	–Prior PCI	1.59 (1.02, 2.50)	0.04	–Age	1.02 (1.00,1.03)	0.04
	–Anemia	0.82 (0.72,0.94)	<0.01	–Previous aortic valve surgery	1.29 (1.01,1.64)	0.04
				–Aortic regurgitation	0.75 (0.57,0.99)	0.04
				–Anemia	0.9 (0.84,0.97)	<0.01
Operative	–	–	–	–Use of a 23 mm valve	1.32 (1.04,1.67)	0.02
Post-operative	–	–	–	–Length of hospital stay	1.03 (1.01,1.04)	<0.01
				–Permanent stroke	2.75 (1.41,5.34)	<0.01
				–Renal failure	2.08 (1.03,4.2)	0.04

Conclusions: In this unique study evaluating re-admission following TAVR, anemia and prior PCI were associated with a higher 30-days re-admission rate. Meanwhile, older age, pre-operative AR severity, previous aortic valve surgery, anemia, use of a 23 mm valve size, longer length of stay, procedure stroke and renal failure were associated with 1-yr readmission. A more aggressive follow-up maybe required in these patient populations in order to decrease the rate of re-admissions.

9:35 AM – 9:50 AM Coffee Break

WEDNESDAY MORNING, MAY 17, 2016

7:30 AM **Congenital Heart Disease** Ballroom III, BCC
Simultaneous Scientific Session
 5 minute presentation, 6 minute discussion

Moderators: *Jonathan M. Chen and *Pedro J. del Nido

88. Left Ventricular Assist Device As Destination Therapy in Cardiac End Stage Dystrophinopathies: Midterm Results

Gianluigi Perri¹, Sergio Filippelli², Rachele Adorisio², Roberta Iacobelli², Francesca Iodice², Giuseppina Testa², Fabrizio Gandolfo², Domenico D'Amario¹, Massimo Massetti¹, Antonio Amodeo²

¹A. Gemelli Hospital, Rome, Italy; ²Bambino Gesù Children Hospital, Rome, Italy

Invited Discussant: *Kristine J. Guleserian

Objective: End-stage dilated cardiomyopathy (DCM) is one of the most challenging complication in patients with dystrophinopathies. We report our experience with use of left ventricular assist device (LVAD) as destination therapy (DT) for the management of this subgroup of patients.

Methods: From February 2011 to September 2015, 6 patients with dystrophinopathies and DCM were assisted with LVAD. Five patients had Duchenne Muscular Dystrophy (DMD) while one β 2 sarcoglycan deficit. Median age and weight at surgery were 16.5 years (range 14,2–23,4) and 44 Kg (range 34–70) respectively.

All patients were admitted at our Institution for acute heart failure and were pre-operatively evaluated by multidisciplinary approach, including cardiology, cardiothoracic surgery, neurology, pulmonologist, otolaryngology and hematology. Five patients received LVAD after long-term medical inotropic support while one underwent implantation after 12 days of VA-ECMO.

Results: All patients survived to hospital discharge. After extubation, all required non-invasive positive pressure ventilation and cough machine cycles. LVAD surgery was performed on cardiopulmonary bypass except in one case carried out on beating heart through minimally invasive approach. The early post-operative course was characterized in one patient by several abdominal complication needed urgent splenectomy while another patient has undergone cholecystectomy for gallstones development. Both required post-operative discontinuation of heparin infusion due to abdominal or retropharyngeal bleeding for 35 and 33 days respectively. One child, one year from surgery, developed osteolysis at the pedestal site of device which required surgical displacement of pedestal position while the last 3 patients not presented complications after LVAD surgery. At median follow-up time of 21.7 months (range 1–44.8) we have 3 late deaths: one patient died after 44,8 months for sepsis due to *Staphylococcus Aureus* pulmonary infection, the second died in a peripheral hospital for massive bleeding due to an otorhinolaryngology maneuver after 28,6 months and the last died for cerebral hemorrhage after 14.8 from LVAD implantation.

Conclusions: The prolonged life expectancy in DMD patients up to 3th/4th decade of life poses the DCM the main cause of death. Our experience showed the possibility to use VAD as DT in dystrophinopathies patients with end stage DCM. Our results suggest that the use of VAD as DT may be a palliative time-limited therapy for the treatment of these patients with otherwise no therapeutic options.

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89. A Transapical to Aorta Double Lumen Cannula-Based Neonate LVAD Efficiently Unloads the LV in Neonate Lambs

Cheng Zhou, Dongfang Wang, Cherry Croft, Francesca Condemi, Hassan K. Reda,
*Joseph B. Zwischenberger

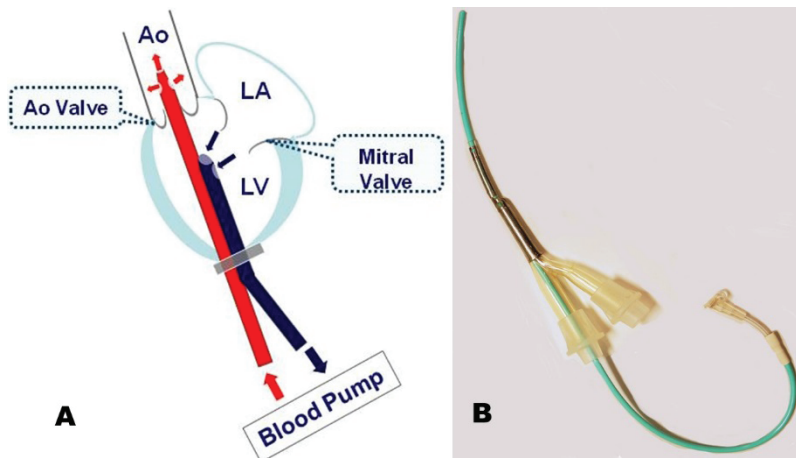
University of Kentucky, Lexington, KY

Invited Discussant: *David L. Morales

Objective: Although mini pumps have been developed, their installation is challenging in neonatal application. We are developing a TransApical to Aorta double lumen cannula (TAA DLC) for a less invasive/more dependable neonatal LVAD. This DLC, which consists of a main dual lumen body and an extension infusion cannula, is inserted from apex through LV-aortic valve into the ascending aorta. Coupled with a blood pump, the DLC withdraws blood from the LV and delivers blood into the aorta, unloading the LV (Figure A).

Methods: The 16 Fr TAA DLC prototypes were made of stainless steel wire-reinforced polyurethane (Figure B). The prototype performance was initially bench tested in 37% glycerin, and the 6 hr *in vivo* test was performed in 6 neonate lambs aged 7–21 days (5–10 kg). Under general anesthesia, the cardiac apex was exposed through a small left subxiphoid incision. A TAA DLC with introducer was inserted through a mattress stitch on the apex, passing the LV-aortic valve, into the ascending aorta. The DLC insertion and deployment was guided by pressure waveform monitoring. After removing introducer, the TAA DLC was connected to a CentriMag™ pump. Hemodynamics, pumping flow, and cardiac output were continually monitored. Cardiac output was measured by a perivascular flow sensor on the PA. To evaluate potential DLC-induced aortic valve regurgitation, the aortic root blood flow was measured by a perivascular flow sensor and continuously recorded by a data acquisition system. Blood was sampled before pump hook-up and after 6 hrs of LVAD support to evaluate blood damage and platelet count. Activated clotting time (ACT) was targeted at 180 to 250 sec by heparin infusion.

Results: The bench test showed that the 16 Fr DLC pumped up to 1.8 l/min flow against 63 mm Hg drainage pressure (huh? Seems way too high) and 145 mm Hg infusion pressure. In all 6 lambs, the DLC was successfully inserted and deployed properly within 1 minute on the first attempt. The pumping flow was maintained at 1.2–1.3 l/min. After initiation of pumping, the systolic arterial pressure decreased, diastolic arterial pressure and mean arterial pressure increased, indicating decreased afterload, and increased perfusion pressure. Left ventricle end diastolic pressure (LVEDP) decreased from 13 ± 1 mm Hg to 6 ± 2 mm Hg and remained stable, indicating decreased preload. Aortic root backward flow was $2.4 \pm 0.6\%$ without DLC in and $3.5 \pm 0.8\%$ with the DLC in, indicating no significant DLC-induced aortic valve regurgitation. After 6 hrs of LVAD, the free hemoglobin (fHgb) did not increase (<5 mg/dl) and hemoglobin (Hgb)/platelets remained unchanged. At necropsy, no significant thrombus was found in pumps/DLCs, and no trauma was found in LV, aortic valve, and aorta.



Conclusions: A TransApical to Aorta Double Lumen Cannula-based Neonate LVAD Efficiently Unloads the LV in Neonate Lambs.

90. Preservation of Umbilical Vein Segments for Use As an Autologous Shunt Conduit in Neonates

David M. Hoganson¹, Dane A. Cooper¹, Kimberly N. Rich¹, Breanna L. Piekarski¹, Joseph P. Gaut², *John E. Mayer¹, Elena Aikawa³, Sitaram M. Emani¹

¹Boston Children's Hospital, Boston, MA; ²Washington University in St. Louis, St. Louis, MO; ³Brigham and Womens Hospital, Boston, MA

Invited Discussant: *Minoo Kavarana

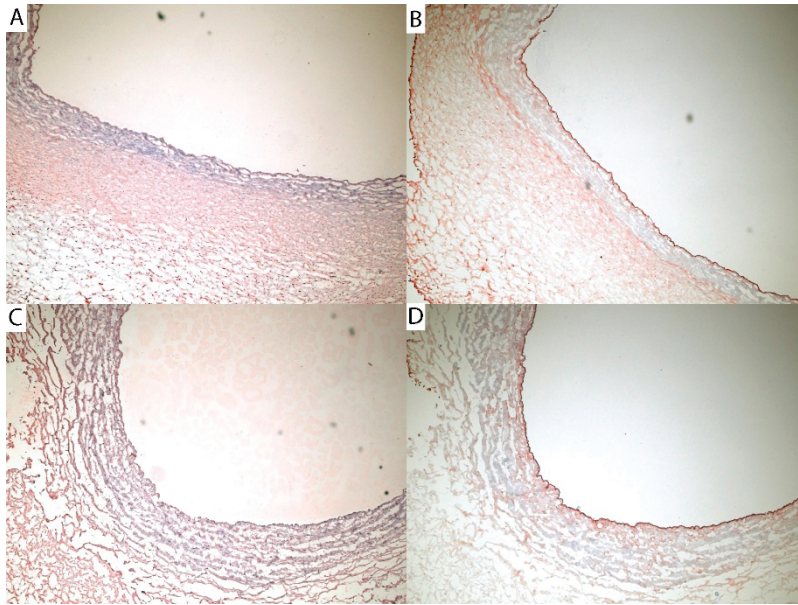
Objective: To optimize short-term preservation of umbilical vein segments in culture prior to implantation as an autologous BT shunt or RV-PA conduit in neonates with complex congenital heart disease. An autologous endothelialized tissue could reduce thrombosis as a shunt or provide growth without calcification as a patch or valve leaflet repair material.

Methods: Umbilical cords were collected in sterile conditions at the time of delivery and stored in University of Wisconsin (UW) solution or Hank's buffered salt solution with antibiotics at 4°C until dissection of the umbilical vein at 1 to 24 hours. Umbilical vein segments (5 cm in length) were burst pressure tested at the time of dissection and after two weeks in culture at 37°C in endothelial basal medium with 2% fetal bovine serum. Subgroups of umbilical veins segments (5–10 mm in length) were cultured on shaker table at 4°C in UW solution with (n = 10 veins, 44 segments) or without (n = 9 veins, 32 segments) 5% human plasma lysate (HPL) as a clinical fetal bovine serum substitute for one week (n = 27 with HPL, n = 21 without HPL) or two weeks (n = 17 with HPL, n = 11 without HPL). In addition, umbilical vein segments (5 cm in length) were evaluated with a flow-based culture at physiologic shear stress (5 dynes/cm²) for one week at 4°C in UW with 5% HPL (n = 3 veins, 4 segments). Cultured umbilical veins were assessed with H&E staining and immunohistochemistry for overall morphology.

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Results: Umbilical veins have no difference in burst pressure acutely ($n = 16$) compared to two weeks in culture ($n = 11$) (431 ± 229 vs. 438 ± 244 mmHg). Histological evaluation of the acute specimens demonstrated intact morphology, extracellular matrix and confluent endothelium (CD31 $n = 7$). One and two week samples treated in static condition at 4°C showed preserved morphology and viability of the vessel segments evaluated with H&E staining (all segments stained) and immunohistochemistry ($n = 3$ for each condition) with positive staining for smooth muscle alpha actin (α -SMA) and endothelium for vWF and eNOS. Qualitatively, there was slightly improved endothelial and smooth muscle cell morphology and overall architecture in the one week cultured samples with uW and 5% HPL compared to the samples without HPL or the two week samples. Umbilical veins cultured in flow conditions had positive endothelial staining for vWF and eNOS and robust α -SMA staining. Shown in the Figure, the flow-based samples had superior endothelial morphology and vascular wall architecture (A – α -SMA, B – vWF) compared to the static culture samples (C – α -SMA, D – vWF).



Conclusion: Umbilical veins have adequate burst strength to function in the systemic circulation. Culture at 4°C demonstrated preservation of endothelium, smooth muscle cells and overall vascular wall morphology with flow-based culture conditions having qualitatively better preservation than static culture.

91. Routine Preoperative Laboratory Testing in Elective Pediatric Cardiothoracic Surgery Is Largely Unnecessary

R. Michael Nieto, Luis E. De León, Kimberly A. Krauklis, *Charles D. Fraser, Jr.

Texas Children's Hospital, Houston, TX

Invited Discussant: *Andrew J. Lodge

Objective: Routine preoperative laboratory testing is common practice in pediatric cardiothoracic surgery, which results in an enormous cost burden to patients and families. We sought to examine the value of routine preoperative laboratory testing in patients undergoing elective pediatric cardiothoracic surgery.

Methods: We conducted a retrospective study of all surgical case cancellations in patients scheduled for elective pediatric cardiothoracic surgery at a single institution from 2012 to 2014. Inpatients were excluded. Patient charts were reviewed to determine if the cancellation was due to an abnormal routine preoperative laboratory value. Routine preoperative laboratory testing consisted of a complete blood count (CBC), prothrombin time (PT), partial thromboplastin time (PTT), urinalysis (UA), chemistry 7 panel (Chem7), electrocardiogram (ECG), and 2 view chest radiograph (CXR).

Results: Between 2012 and 2014, a total of 2,584 cardiothoracic surgery cases were performed at a single pediatric institution. Routine preoperative laboratory testing was completed for 1,174 scheduled elective cases. Seven (0.6%) cancellations were due to abnormal preoperative laboratory test Results: 5 abnormal CBCs and 2 abnormal UAs. Hospital charge for routine preoperative laboratory testing averaged \$2,064. Total hospital charges for preoperative laboratory tests completed during this study period were \$2,423,136. One hundred and sixty-eight routine preoperative laboratory tests, which generated a total hospital charge of \$346,752, were required to capture 1 abnormal test significant enough to cancel surgery. A total charge of \$2,169,552 was generated on PT, PTT, Chem7, ECG, and CXR and none of these tests resulted in a case cancellation.

Conclusions: Routine preoperative laboratory testing does not significantly impact the decision-making process of surgical timing in elective pediatric cardiothoracic surgery. The decision to order a specific screening test should be clinically driven. Selective preoperative laboratory testing may have a positive impact on healthcare costs without affecting outcomes.

MCS for Failing Fontan

*Mark D. Rodefeld, *Indiana University School of Medicine, Indianapolis, IN*

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92. Another Look at the Appropriateness of Technical Performance Scores: A Single Center Exploratory Analysis of Surgical Factors Associated with Complications, Reoperation, and Length of Stay Following Tetralogy of Fallot Repair

Daud Lodin¹, Orestes Mavrothalassitis², Naveen Swami³, Tara Karamlou³

¹San Juan Bautista, Caguas, PR; ²University of Maryland, Baltimore, MD; ³University of California, San Francisco, CA

Invited Discussant: *Christian Pizarro

Objective: Technical performance scores (TPS) were developed as a broad assessment tool to examine the quality of surgical repair in infants with Tetralogy of Fallot (TOF). With the goal of decreasing health burden and cost of care, this system relies on predischARGE echocardiogram data to score repairs. Several intraoperative and physiological factors are not, however, taken into consideration when assessing each procedure. This study examined factors not included in TPS that may contribute to increased post-operative length of stay (POLOS), complications, and risk for reoperation after primary repair.

Methods: This retrospective study utilized single site medical records from TOF patients undergoing repair between 2007–2014. Variables include preoperative diagnoses, intraoperative techniques, and post-operative results. Outcomes of interest included POLOS, complications associated with recovery, and the need for reoperation. Univariable analysis was conducted utilizing odds ratios (OR), chi squared p-values, t-testing, and Pearson correlation. Multivariable logistic regression identified important cofactors for the outcomes of interest.

Results: Patient population (n = 121) consisted primarily of males (59%, 71/121) with a mean weight of 5.5 kilograms (SD = 1.8) and a mean age of repair (AOR) of 129 days (SD = 102). Most had a pulmonary valvar obstruction (68%, 83/121) and only a minority had additional cardiac abnormalities (24%, 29/121), a genetic anomaly (13%, 15/121), or required palliation prior to repair (16%, 19/121). Mean POLOS was 10.2 days (SD = 11.2). There was one death and no postoperative mediastinitis.

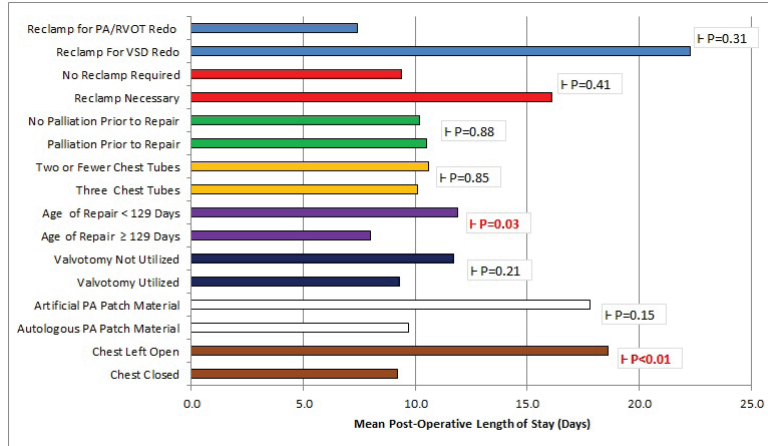


Figure 1. Intra-Operative Techniques and Variation versus Mean Post-Operative Length of Stay (Days) in Patients with Primary Repair of Tetralogy of Fallot (n=121), 2015

The risk for reoperation was greater in patients with higher than average cross-clamp (OR = 2.4, P = 0.07) and cardiopulmonary bypass (CPB) time (OR = 2.0, P = 0.15) and trended towards a higher risk in patients that did not receive autologous pericardial pulmonary artery (PA) patch material (20%, 3/15). Mean POLOS was increased in repairs requiring return to CPB to address issues with VSD closure (22.3 days, SD = 38.8), yet decreased in those needing added bypass runs for additional PA treatment (7.4 days, SD = 1.7). Mean POLOS decreased with intraoperative chest closure (9.2 vs. 18.6 days, P < 0.01), utilization of autologous versus synthetic PA patch material (9.9 vs. 17.8 days, p = 0.15), and a greater than average AOR (8.0 vs. 11.9 days, p = 0.03). Multivariable analysis identified male patients, lower weight, and palliation prior to repair as important factors contributing to greater POLOS (P < 0.05).

Conclusion: Although cross-clamp time and additional bypass runs are not included as disadvantages in the current technical performance score, they contribute to greater patient morbidity and resource utilization, demonstrating that current TPS criteria may be inadequate in assessing adverse outcomes and greater healthcare costs for patients undergoing TOF repair.

93. Proactive Platelet and Cryoprecipitate Transfusion During Neonatal Cardiopulmonary Bypass Rapidly Normalizes Platelet Count, Fibrinogen and Functional Rotational Thromboelastometry Parameters

John P. Scott¹, Robert A. Niebler¹, Eckehard A.E. Stuth¹, D. Woodrow Benson¹, Ronald K. Woods¹, *James S. Tweddell¹, Regina Cole¹, *Michael E. Mitchell¹, Rachel S. Bercovitz¹, Pippa Simpson¹, Robert Montgomery¹, Alan Mast², Susan Maroney², Ke Yan¹, Rowena Punzalan¹, Debra K. Newman²

¹Medical College of Wisconsin, Milwaukee, WI; ²Blood Research Institute, Milwaukee, WI

Invited Discussant: *Mark S. Bleiweis

Objectives: Dilutional thrombocytopenia and hypofibrinogenemia during neonatal cardiopulmonary bypass (CPB) contribute to perioperative bleeding and associated morbidity. This study examined hemostatic parameters in neonates treated with an established standard protocol of platelet and cryoprecipitate transfusion initiated prior to separation from CPB. We hypothesized that platelet and cryoprecipitate transfusion during complex neonatal CPB would normalize standard clinical and rotational thromboelastometry (ROTEM) based assays of platelets and fibrinogen, thus reducing or eliminating inadequate hemostatic function as a contributor to post-CPB bleeding.

Methods: Twenty-five neonates (age < 30 days) undergoing cardiac surgery on CPB were included in this prospective observational study. Exclusion criteria included weight less than 2.5 kg, previous CPB, or ECMO. Prior to termination of CPB, all patients were transfused with ¼ single donor apheresis platelet (SDP) unit and 1 unit of cryoprecipitate. Following CPB an additional ¼ SDP unit from the same donor was transfused. Blood samples were obtained prior to incision, on CPB, following CPB, and post-operatively. ROTEM assays performed included extrinsically activated (ExTEM) and fibrinogen polymerization (FibTEM) assays. ROTEM

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parameters measured included Clot Amplitude at 10 Minutes (A10) and Maximal Clot Firmness (MCF). Receiver operator characteristic (ROC) curves were constructed for these variables.

Results: Platelet count, ExTEM A10, and ExTEM MCF on CPB were significantly ($p < 0.05$) lower than baseline. Platelet transfusion on CPB significantly increased each parameter, and post-CPB platelet transfusion normalized platelet count and ExTEM clot amplitudes. ExTEM A10 correlated highly with platelet count ($R = 0.891$), and ExTEM A10 >47.5 mm (sensitivity 0.97, specificity 0.88) was the best predictor of platelet count $>125,000/\mu\text{l}$ with an area under the curve (AUC) of 0.97. Fibrinogen level, FibTEM A10, and FibTEM MCF on CPB were significantly lower than baseline. Cryoprecipitate transfusion normalized fibrinogen levels and FibTEM clot amplitudes post-CPB and postoperatively. FibTEM A10 values correlated well with fibrinogen levels ($R = 0.580$), and FibTEM A10 >9.5 mm (sensitivity 0.77, specificity 0.71) was the best predictor of fibrinogen >200 mg/dl with an AUC of 0.83.

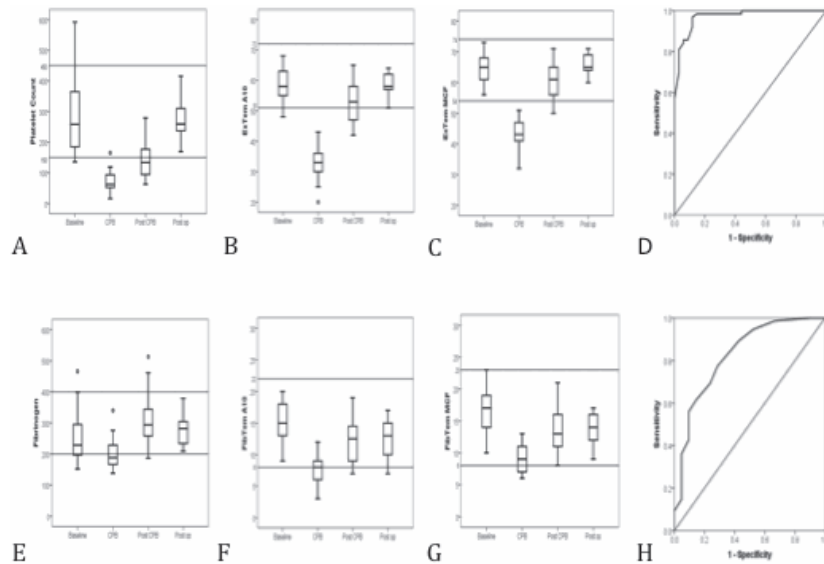


Figure 1. Results of conventional and ROTEM variables at four perioperative time points: (A) Platelet count, (B) ExTEM A10, (C) ExTEM MCF, (D) Receiver operating characteristic curve for ExTEM A10 using platelet count of $125,000/\mu\text{l}$ as a cutoff. (E) Fibrinogen level, (F) FibTEM A10, (G) FibTEM MCF, and (H) Receiver operating characteristic curve for FibTEM A10 using fibrinogen level of 200 mg/dl as a cutoff. Horizontal lines indicate published normal ranges.

Conclusions: Neonatal CPB is associated with significant thrombocytopenia and hypofibrinogenemia which are reflected in ROTEM clot amplitudes. Platelet and cryoprecipitate transfusion during CPB normalizes platelet count, fibrinogen level, and ROTEM based functional platelet and fibrinogen assays. Pre-transfusion ROTEM on CPB reliably predicts thrombocytopenia and hypofibrinogenemia. ROTEM A10 values are sensitive and specific for thrombocytopenia and hypofibrinogenemia, identifying hemostatic deficits within 10 minutes.

94. Shape Does Matter: 3-D Statistical Shape Analysis of the Aortic Arch After Coarctation Repair Reveals Shape Correlation with Left Ventricular Function

Jan L. Bruse¹, Kristin McLeod², Giovanni Biglino¹, Maxime Sermesant³, Xavier Pennec³, Tain-Yen Hsia¹, Andrew M. Taylor¹, Silvia Schievano¹

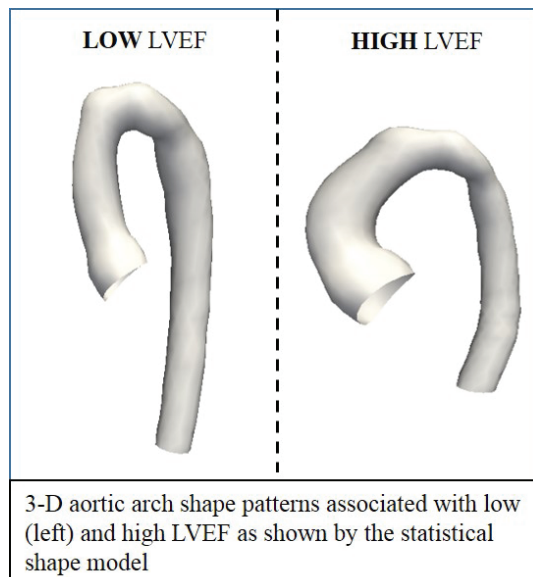
¹Great Ormond Street Hospital for Children, London, United Kingdom; ²Simula Research Laboratory, Lysaker, Norway; ³INRIA Sophia Antipolis-Méditerranée, Sophia Antipolis, France

Invited Discussant: *Luca A. Vricella

Objective: Despite improving survival rates, patients suffer from late complications post-aortic coarctation (CoA) repair. We sought to investigate the relationship of aortic arch 3D shape features with functional data obtained from routine cardiac magnetic resonance (CMR) scans.

Methods: We included 35 patients post CoA repair (age 20.0 ± 5.2 years; mixed types of repair at 0.54 ± 1.26 years of age) and reconstructed 3D arch shape models from CMR data. A novel validated statistical shape analysis method computed a mean anatomic shape of all aortic arches, and calculated deformation vectors of the mean shape towards each patient's arch anatomy. 3D shape patterns most related to left ventricular ejection fraction (LVEF), indexed end diastolic volume (iEDV) and resting blood pressure (BP) were extracted from the deformation vectors via partial least squares regression.

Results: Distinct arch shape features correlated significantly with LVEF ($r = 0.47$, $p < .01$), yet no significant correlations were found with iEDV ($r = 0.32$, $p = .08$) and BP ($r = 0.25$, $p = .21$). Low LVEF was thereby associated with an overall long and gothic aortic arch shape with a slim ascending but slightly dilated descending aorta, whereas higher LVEF correlated with a compact, rounded aortic arch with a dilated aortic root (Figure 1).



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Conclusions: Arch shape features of repaired CoA may be associated with left ventricular function. Analyzing 3D shape information via statistical shape modelling can be an adjunct to long-term risk assessment in patients following aortic arch operations.

95. Surgical Strategy for Aortic Arch Reconstruction After Norwood Procedure Based on a Virtual Operation with Numerical Flow Analysis

Shohei Miyazaki¹, Keiichi Itatani², Norihiko Oka¹, Shinji Goto³, Masanori Nakamura³, Tadashi Kitamura¹, Tetsuya Horai¹, Yuki Nakamura¹, ◆Kagami Miyaji¹

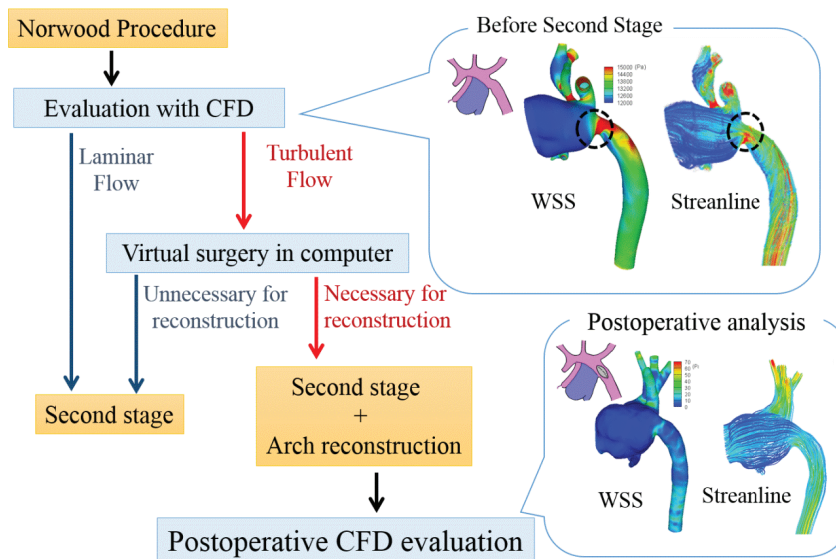
¹Kitasato University, Sagamihara, Japan; ²Kyoto Prefectural University of Medicine, Kyoto City, Japan; ³Saitama University, Saitama-Shi, Japan

Invited Discussant: *Charles D. Fraser

Objectives: Inefficient aortic arch flow after the Norwood Procedure is known to lead to the deterioration of systemic ventricular function due to an increased cardiac workload. To prevent the progression of aortic arch obstruction, arch reconstruction concomitant with second stage surgery is beneficial; however, indications remain to be determined. We performed a numerical flow analysis for patients who underwent the Norwood procedure based on computed tomography (CT) before the second stage procedure. When inefficient turbulent flow was detected, we aggressively performed arch reconstruction at the second stage (Figure). The aim of the present study was to determine the indications for reconstruction to avoid the endothelial degeneration and reduce the cardiac workload.

Methods: Fifteen patients who underwent the Norwood procedure were examined with numerical pulsatile flow analysis with the finite volume method based on enhanced thin-slice CT before the second stage. If the turbulent flow was prominent with a large flow energy loss (EL) or with high wall shear stress (WSS), virtual arch reconstruction was performed to predict the post-operative blood flow. If the reconstruction was found to be feasible, arch reconstruction was performed during the second stage procedure, and postoperative numerical flow analysis was performed. Peak WSS and flow EL corrected with the body surface area (ELI) were calculated in all patients.

Results: Six patients had no turbulent flow and underwent second stage without arch reconstruction. In one patient with high WSS but with laminar flow the arch reconstruction was not performed, because it was not effective in virtual simulation. Eight patients had prominent turbulent flow with swirling vortex and flow detachment, and underwent arch reconstruction, even though all of them had pressure drop less than 5 mmHg in peak systole in catheter examination. The WSS in reconstructed group was significantly greater than that in unreconstructed group (164.1 ± 89.6 Pa, vs. 37.4 ± 25.2 Pa, $P = 0.0110$). The ELI in reconstructed group was significantly greater than that in the unreconstructed group (84.8 ± 51.1 mW/m² vs. 18.9 ± 8.1 mW/m², $P = 0.0079$). After arch reconstruction, the WSS significantly decreased from 167.4 ± 96.2 Pa to 53.8 ± 40.8 Pa ($P = 0.0064$), and ELI prominently decreased from 92.9 ± 49.5 mW/m² to 25.0 ± 10.8 mW/m² ($P = 0.0142$). In addition, laminar arch flow was realized.



Conclusions: Reconstruction of the aortic arch during a second stage procedure could successfully reduce WSS and ELI in cases with $WSS > 100 \text{ Pa}$ and $ELI > 40 \text{ mW/m}^2$. Determining the surgical strategy for arch reconstruction based on the virtual operation with numerical flow analysis can effectively reduce the ventricular load even if no stenosis or pressure drop is observed on catheter examination or echocardiography.

9:35 AM – 9:50 AM

Coffee Break

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7:30 AM

**General Thoracic Surgery
Simultaneous Scientific Session**

Ballroom IV, BCC

5 minute presentation, 6 minute discussion

Moderators: *Shaf Keshavjee and *Gaetano Rocco

**96. Prognostic Factors of Tumor Recurrence in Stage I Adenocarcinoma of Lung:
Influence of Preoperative Biopsy**

Chien-Sheng Huang, Po-Kuei Hsu, Chun-Ku Chen, Yi-Chen Yeh, Mei-Han Wu,
Chih-Cheng Hsieh, Han-Shui Hsu, Teh-Ying Chou, Wen-Hu Wu, Biing-Shiun Huang
Taipei Veterans General Hospital, Taipei, Taiwan

Invited Discussant: *Haiquan Chen

Objective: To evaluate whether preoperative biopsy affects failure patterns in patients undergoing pulmonary resection for early stage lung adenocarcinoma.

Methods: Prospective medical records between 2006 and 2013 were retrospectively reviewed. Treatment failure patterns and survivals between perioperative prognostic factors and different approaches for preoperative biopsy including computed tomographic-guided needle biopsy (CTGNB), trans-bronchial biopsy (TBB) and intraoperative frozen section were compared.

Results: A total of 982 patients underwent pulmonary resection for pathological stage I lung cancer between 2006 and 2013 in a tertiary referral center. After excluding 145 sublobar resections, 5 R1 resections, 4 surgical mortalities, 82 non-adenocarcinomas and 237 patients received postoperative adjuvant chemotherapy, 509 patients with lung adenocarcinoma enrolled into this study. Among 509 patients, 183 patients had preoperative CTGNB, 46 patients had preoperative TBB and 280 patients diagnosed as lung adenocarcinoma by intraoperative frozen section. A total of 65 (12.8%) patients had disease recurrence during a median 53.3 months follow-up period. Multivariate analysis demonstrated tumor with radiological solid-appearance (odds ratio 6.99, $p < 0.001$), preoperative biopsy (CTGNB+TBB) (OR 2.24, $p = 0.010$) and tumor presented with angiolymphatic invasion (ALI; OR 2.90, $p = 0.001$) were independent predictors of overall treatment failure. Furthermore, when recurrence was confirmed initially, 11 patients (2.2%) had local recurrence with pleural disseminations (LRPD) and preoperative CTGNB was an independent predictor of LRPD (OR 6.46, $p = 0.020$) in multivariate analysis. For survival analysis, the 5- year disease-free survival (DFS) rate (76.4% versus 92.9% months) was significantly lower in the group of patients with preoperative biopsy than in the group of patients with intraoperative frozen section (HR 3.45; $p < 0.001$). In addition, accumulated risk analysis showed that the DFS of patients with preoperative biopsy is significantly worse in patients above 70 year-old ($p = 0.002$), tumor size more than 3 cm ($p = 0.038$), tumor with radiological solid-appearance ($p = 0.011$), tumor at subpleural location ($p < 0.001$) preoperatively and tumor presented with ALI ($p = 0.008$), poorly differentiated ($p = 0.007$), pleural invasion ($p = 0.001$) and high grade of predominate pattern ($p = 0.013$) postoperatively in further stratified analysis.

Conclusions: Preoperative biopsy was an independent predictor of local and overall treatment failure in stage I adenocarcinoma of lung underwent at least anatomic lobectomy without postoperative adjuvant chemotherapy. To avoid treatment failure for early stage lung cancer, the method of tissue proof before operation should be considered carefully, especially for the tumors presented with radiological solid-appearance.

97. Characteristics and Outcomes of Pathologic Node Positive Esophageal Cancer Patients Receiving Adjuvant Chemotherapy Following Induction Chemotherapy and Esophagectomy

Pamela Samson¹, ♦Varun Puri¹, A. Craig Lockhart¹, Clifford Robinson¹, Stephen Broderick², *G. Alexander Patterson¹, *Bryan Meyers¹, *Traves Crabtree¹

¹Washington University in St. Louis, St. Louis, MO; ²St. Luke's Hospital, Chesterfield, MO

Invited Discussant: *Antoon E. Lerut

Objective: Previous work has suggested that adjuvant chemotherapy may be associated with improved survival in esophageal cancer patients following primary resection in select cases. However, the patterns of adjuvant chemotherapy use and outcomes for patients that had induction chemotherapy prior to esophagectomy and remain pathologically node positive are not well understood.

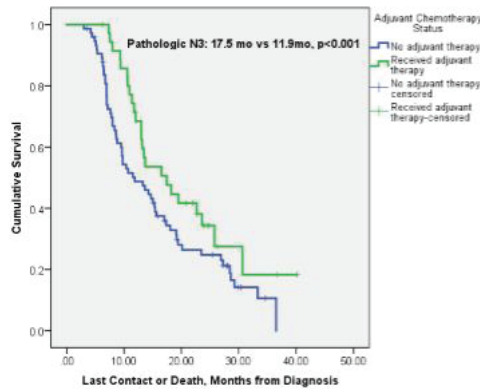
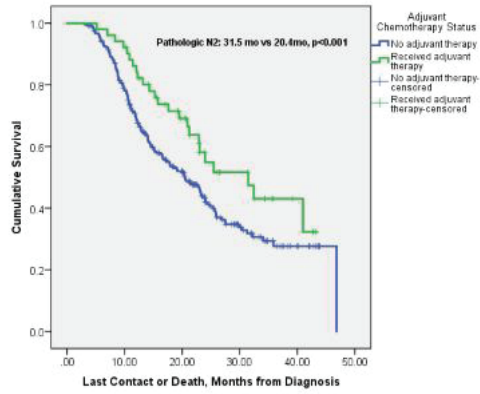
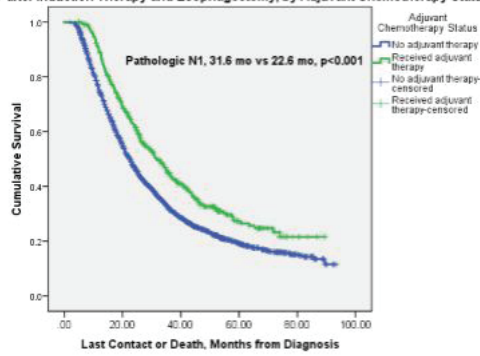
Methods: Treatment data for esophageal cancer patients receiving induction chemotherapy ± radiotherapy and esophagectomy was abstracted from the National Cancer Data Base (NCDB). Pathologic node positive patients were dichotomized by whether they received ≥ two cycles of adjuvant chemotherapy or less than two cycles. Kaplan Meier survival curves were generated and a Cox proportional hazards model was done to identify factors associated with overall survival (OS).

Results: From 2006–2012, there were 3652 patients with pathologic positive nodes after induction therapy and esophagectomy. 3095 (84.7%) did not receive adjuvant chemotherapy, while 557 (15.3%) did. Node-positive patients receiving adjuvant chemotherapy were younger (58.5 ± 9.5 vs 61.3 ± 9.5 , $p < 0.001$), had higher education levels (15.9% versus 11.5%, $p = 0.02$), received treatment closer to home (36.1 ± 83.4 miles vs 51.3 ± 126.8 , $p < 0.001$), had lower induction radiation therapy rates (71.5% vs 86.8%, $p < 0.001$), had more positive nodes (3.8 ± 3.9 vs 3.0 ± 3.2 , $p < 0.001$), a higher ratio of positive: examined lymph nodes (0.28 vs 0.25, $p = 0.001$), a higher pathologic nodal stage (30.9% N3 vs 16.6% N2 vs N1 14.1%, $p < 0.001$), and a shorter inpatient length of stay (10.9 ± 7.5 vs 13.6 ± 12.4 , $p < 0.001$). N3 nodal stage was associated with increased likelihood of receiving adjuvant chemotherapy (ref: N1, OR 2.18, 95% CI 1.48–3.22, $p < 0.001$), while increasing age (by year, OR 0.98, 0.97–0.99, $p < 0.001$), induction radiation therapy (OR 0.37, 0.29–0.47, $p < 0.001$), and increasing inpatient length of stay with esophagectomy (per day: OR 0.98, 0.97–0.99, $p < 0.001$) were associated with a decreased likelihood. Patients receiving adjuvant chemotherapy had improved OS at each pathologic nodal stage: 31.6 months vs 22.6 months for N1 disease, 31.5 months versus 20.4 months for N2 disease, and 17.5 months versus 11.9 months for N3 disease, $p < 0.001$ (Figure 1). An increase in OS with adjuvant therapy persisted even for patients with only one positive lymph node (39.8 months vs 25.5 months, $p < 0.001$) or a positive: examined lymph node ratio ≤ 0.10 (51.7 months vs 27.7 months, $p < 0.001$). Adjuvant therapy was also independently associated with decreased mortality hazard (HR 0.72, 95% CI 0.61–0.85, $p < 0.001$).

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Kaplan-Meier Curve for Pathologic Node Positive Esophageal Cancer Patients after Induction Therapy and Esophagectomy, by Adjuvant Chemotherapy Status



Conclusions: Patients receiving adjuvant chemotherapy following induction therapy and esophagectomy suggest a survival benefit at all positive nodal status stages. Prospective studies, such as a randomized controlled trial, may help further delineate this benefit.

98. Well Differentiated Neuroendocrine Carcinoma (Typical Carcinoid) with Mediastinal Lymph Node Metastases: Surgical Outcomes and Whole Exome Sequencing

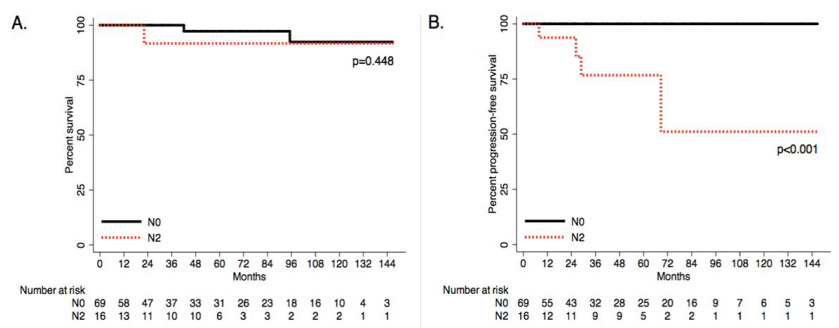
Eric Sceusi, Leiva-Juarez Miguel, *Reza Mehran, Neda Kalhor, Kenna Shaw, Andy Futreal, Arlene Correa, Cesar Moran, Ignacio Wistuba, Fujimoto Junya, Xiayu Rao, *Stephen Swisher, *Ara Vaporciyan, Jing Wang, Mara Antonoff, *Wayne Hofstetter, *David Rice, Boris Sepesi, *Garrett Walsh, *Jack Roth
MD Anderson Cancer Center, Houston, TX

Invited Discussant: *David R. Jones

Objective: Typical pulmonary carcinoids can present with N2 lymph node metastases (LNM) but are histologically identical to non-metastatic typical carcinoids. We analyzed the surgical outcomes of resected typical carcinoids with N2 LNM and performed whole exome sequencing (WES) to identify genetic changes associated with metastatic typical carcinoids compared to N0 typical carcinoids.

Methods: Patients who underwent surgical resection for typical pulmonary carcinoid tumors prospectively entered in a surgical database were retrospectively reviewed. We compared mortality, progression free survival, pathologic features, adjuvant therapy and postoperative complications between patients with N0 and N2 disease at the time of diagnosis. WES was performed on tissue from 6 LNM in N2 patients and 4 tumors from N0 patients using >5% allele frequency for mutation confirmation. Mutation type, frequency, copy number variation and pathways were analyzed.

Results: 85 patients who underwent pulmonary resection for typical carcinoid [N0 (69) and N2 (16)] were reviewed. Mean length of follow-up was 4.9 years for N0 and 4.5 years for N2. R0 resection was achieved in all N0 patients, with 2 (12.5%) R2 and 1 (6.25%) R1 resections in the N2 group. There were no operative deaths. Postoperative complications did not differ significantly between the two groups. Patients in the N2 group had more frequent lymphovascular invasion (LVI) (44% vs 9%) ($p < 0.001$) and pleural invasion (PI) (18.8% vs 1.5%) ($p = 0.003$) compared to N0. Overall survival was similar between the two groups ($p = 0.448$) (Figure 1A). However, N2 patients had a significantly worse progression free survival (PFS) (p6 mutations per megabase, a mutation rate comparable to non-small cell and small cell lung cancer. The most frequently mutated genes were related to the Integrin-linked Kinase pathway regulating cell proliferation and adhesion. MicroRNA genes regulating cell death pathways had increased copy numbers in LNM.



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Conclusions: Pulmonary typical carcinoids with N2 nodes have a high recurrence rate, but survival similar to patients with N0 following resection, suggesting that an aggressive surgical approach is beneficial. Tumors with metastases were associated with LVI and PI. Adjuvant radiation after resection of N2 disease did not affect PFS in our series. Mutations were more frequent in tumors that had metastasized. WES may identify typical carcinoids at high risk for metastases.

99. Survival Results and Gene Phenotype of Patients with Different Categories of Multiple Primary Lung Cancers

Kezhong Chen, Xun Wang, Fan Yang, Jingbo Zhang, Tian Guan, Jianhong Zhang, Jun Wang
Peking University People's Hospital, Beijing, China

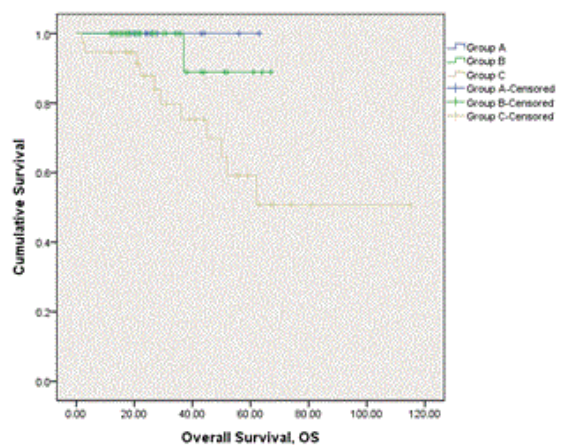
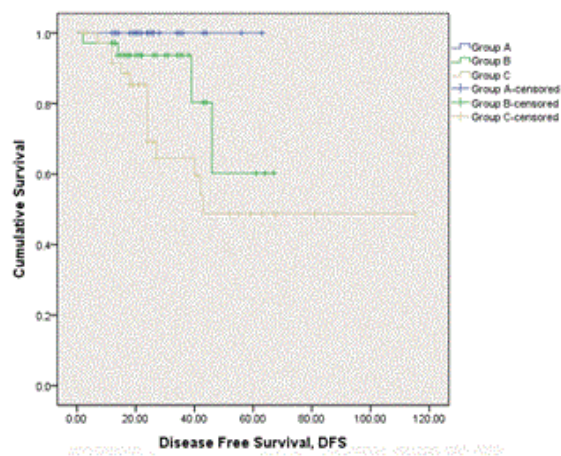
Invited Discussant:

Objective: The management of multiple primary lung cancers remains controversial. We reviewed the clinical characteristics and follow up record, evaluated a series of somatic mutations of patients with second primary lung cancers or multifocal primary lung cancers, in an attempt to identify the long term survival and treatment strategy for different categories of MPLC.

Methods: From 2007.1 to 2014.4, consecutive cases of 1561 patients underwent surgery of lung cancer. By Martini and ACCP modified guideline, 96 (6.1%) patients were diagnosed MPLC. According to consolidation/tumor ratio (CTR) on thin-section computed tomography, 96 cases were classified into three groups. Group A (multiple Ground-glass opacities CTR ≤ 0.5), Group B (with one solid dominant nodules, CTR > 0.5), Group C (with two solid dominant nodules). Mean follow up is 43.1 months. EGFR, Tp53, PIK3CA and KRAS somatic mutations were determined in focus with more than 50% tumor cells. Mutational analysis was performed on DNA extracted from frozen tumors tissues.

Results: There were 24, 35 and 37 patients in group A, B and C, respectively. More female (75%vs40.5%, $P = 0.008$), more non-smoker (75%vs48.6%, $P = 0.041$), younger (58.3y vs 66.0 y, $P = 0.003$), less maximum tumor size (1.22 cm vs 2.56 cm, $P = 0.002$) and more synchronous cancer (100%vs 51.4%, $P < 0.001$) patients in multifocal GGO patients than in multiple solid patients. All the patients in group A were stage 0 or I as the highest pathology stage, while 94.3% in group B and 73% in group C ($P = 0.004$). There was significant difference of surgical procedures between the three groups when the lesions were in different lobes ipsilateral lung ($P = 0.008$), and lobectomy for the dominant lesion and wedge resection for other lesions was the main operation (60.5%). The 3,5-year recurrence-free survival (RFS) were 78.7% and 63.6%, overall survival (OS) were 87.6% and 65.1% for all patients, respectively. Log rank tests were used to determine statistical significance between the three groups. The 3-year RFS was 100% in group A, 80.3% in group B and 64.5% in group C ($P = 0.014$), respectively. The 3-year OS were 100% in group A, 88.9% in group B and 75.2% in group C ($P = 0.024$), respectively. Multivariate Cox analysis demonstrated that size of dominant nodule larger than 2 cm was associated with poor RFS (HR;4.738, 95%CI;1.741–12.893, $P = 0.002$) and OS (HR;12.466, 95%CI;2.639–58.890, $P = 0.001$). Gene detection showed a high rate of variation growth. More patients in group A and B had different clonality than in group C, which further supported the concept of field cancerization of multifocal lung cancers.

Fig 1 DFS and OS of the three group patients after resection.



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Conclusions: Multifocal GGOs and Multiple solid lung cancers were different in biology. RFS and OS of patients with MPLC are strongly affected by tumor size. Whether these tumors are different or the same clonal, surgical resection is effective and should be performed discriminative to MPLC patients.

Surgical Management of IIIB NSCLC

*Elie Fadel, *Marie Lannelongue Hospital*

*AATS Member ♦AATS New Member

100. Partial Thymectomy Results In Similar Outcomes to Total Thymectomy in Masaoka-Koga Stages I And II Thymoma

Brian E. Louie¹, Xiaopan Yao², Eric Vallières¹, Zhitao Gu³, Yue Shang⁴, Ralph W. Aye¹,
♦Alexander S. Farivar¹, Wentao Fang³

¹Swedish Cancer Institute, Seattle, WA; ²Yale University, New Haven, CT; ³Shanghai Chest Hospital, Shanghai, China; ⁴The MathWorks, Inc., Natick, MA

Invited Discussant: *Joshua R. Sonett

Objective: Classic teaching is to perform a total thymectomy for a presumed thymoma. This allows achievement of an R0 resection, which is associated with the greatest potential for survival. Additionally, thymectomy limits potential development of MG and reduces recurrence due to multi-focal thymic disease. However, a partial thymectomy or thymomectomy will also achieve an R0 resection. We aimed to determine if partial thymectomy results in similar outcomes to total thymectomy.

Methods: We queried the International Thymic Malignancy Interest Group (ITMIG) retrospective database from 2000–2014 for patients with Masaoka-Koga stage I and II thymoma or thymic carcinoma undergoing primary total thymectomy (TT) or partial thymectomy (PT). Primary outcomes measures included: overall survival, recurrence, resection status, use of adjuvant radiation therapy and development of MG.

Results: A total of 1443 patients were identified with TT = 1150 (80%) and PT = 293 (20%). Total thymectomies were older (57 vs 52 yrs, $p < 0.001$) with slightly worse performance status while gender was equally distributed.

Surgical approaches ($p < 0.001$) included: sternotomy [TT = 800 (95%) vs PT = 39 (5%)]; VATS/Robotic [TT = 213 (63%) vs PT = 123 (37%)]; thoracotomy [TT = 124 (50%) vs PT = 126 (50%)]; and cervical [TT = 7 (64%) vs PT = 4 (36%).

Mean tumor size was similar at 6 cm in each group. Histology, pathologic stage and WHO tumor classification are shown in Table 1.

Adjuvant radiation was delivered less in the TT group (247, 21%) compared to PT (78, 26%) ($p = 0.059$).

Overall 10-year survival was TT = 85% vs PT = 86% ($p = 0.264$). Recurrence free survival at 10 years was TT = 3% vs PT = 10% ($p = 0.604$) whereas cumulative incidence of recurrence 10 years was TT = 0.06 (95% CI, 0.04–0.08) vs PT = 0.13 (95% CI, 0.04–0.27). Eighteen patients in the total group and 1 patient in the partial group developed myasthenia gravis in follow up ($p = 0.148$).

Table 1: Pathologic Stage and WHO Classification

		Total Thymectomy	Partial Thymectomy	p-Value
Histology	Thymoma	1088 (95%)	270 (92%)	0.111
	Thymic Carcinoma	62 (5%)	23 (8%)	
Stage	I	616 (54%)	187 (64%)	0.002
	IIa	262 (23%)	41 (14%)	
	IIb	259 (23%)	64 (22%)	
WHO Class	A	141 (13%)	36 (14%)	0.644
	AB	422 (40%)	113 (43%)	
	B1	213 (20%)	48 (18%)	
	B2	177 (17%)	37 (14%)	
	B3	94 (9%)	28 (11%)	

Conclusions: In Masaoka-Koga pathologic stage I and II thymoma or thymic carcinoma, a partial thymectomy or thymomectomy results in similar overall and disease free survival at 10 years when compared to total thymectomy. Development of new onset MG was similar. Unilateral surgical approaches were more likely to undergo partial thymectomy.

101. Role of Pulmonary Resection in Patients with Pleural Metastasis Encountered at the Time of Surgery

Samina Park, Yoohwa Hwang, Hyun Joo Lee, In Kyu Park, Chang Hyun Kang, Young T. Kim

Seoul National University Hospital, Seoul, Republic of Korea

Invited Discussant: ♦Abbas E. Abbas

Objective: Non-small cell lung cancer (NSCLC) with solitary metastasis can be treated by resecting both primary and metastatic lesions. However, there is no evidence whether the resection of the lung can improve survival of patients with pleural metastasis encountered at the time of surgery. A single center retrospective study was conducted.

Methods: Among 4683 lung surgeries performed between 1995 and 2014, 132 patients (2.8%) were identified to have pleural metastasis. Excluding two patients whose medical records were not complete, 130 patients' data were collected. Only a diagnostic pleural and/or lung biopsy was performed in 90 patients, whereas the lung mass was resected in 40 patients (lobectomy; 21, wedge; 16, pneumonectomy; 3). Majority of patients (110 patients; 84.6%) received systemic chemotherapy. Survival data were confirmed through medical records, telephone survey and national insurance database. Data were analyzed to test the role of lung resection and to identify other predictors of long-term survival.

Results: The mean age was 61.5 years (male: female = 75: 55). The mean follow-up duration was 29.8 months. There was no lost case. Overall 5-year survival rate was $20.1 \pm 4.2\%$. Patients who received systemic chemotherapy survived longer compared to those who did not (5-year survival rate; $22.3 \pm 4.8\%$ vs. $6.2 \pm 5.9\%$; $p =$

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0.000). The 5-year survival rate of the resection group ($34.7 \pm 9.4\%$) was superior to that of the biopsy group ($15.9 \pm 4.3\%$; $p = 0.016$). clinical N stage ($p = 0.043$), and adenocarcinoma histology ($p = 0.050$) were additional significant factors of good survival, whereas age ($p = 0.327$), sex ($p = 0.961$), and clinical T stage ($p = 0.580$) were not significant. In multivariable Cox's regression analysis, lung resection (HR [95% CI] = 0.593 [0.359–0.979]; $p = 0.041$), systemic chemotherapy (HR [95% CI] = 0.225 [0.124–0.406]; $p = 0.000$), clinical N stage (HR [95% CI] = 0.575 [0.364–0.910]; $p = 0.018$), and adenocarcinoma histology (HR [95% CI] = 0.382 [0.186–0.783]; $p = 0.009$) remained as significant factors for favorable outcome. However, the significance of lung resection was observed only in patients who received systemic chemotherapy (Figure).

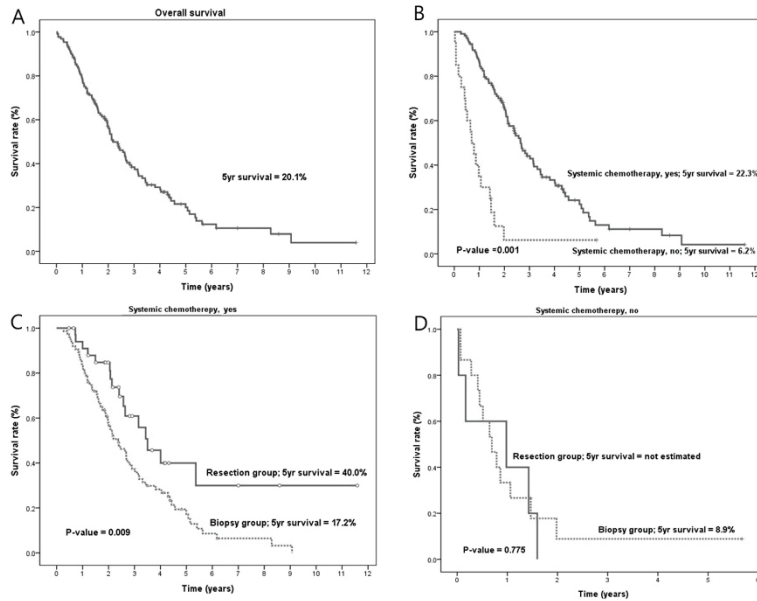


Figure. Kaplan-Meier survival curves of non-small cell lung cancer patients with pleural metastasis encountered at the time of surgery
A. Overall survival
B. Survival curves according to the systemic chemotherapy
C. Survival curves according to the lung resection in patients who received systemic chemotherapy
D. Survival curves according to the lung resection in patients who did not receive systemic chemotherapy

Conclusions: The main treatment for NSCLC patients with pleural metastasis is systemic chemotherapy. However, when pleural metastasis is encountered during surgical exploration, resection of the lung lesion can improve long-term survival in conjunction with systemic treatment, especially in patients with adenocarcinoma and no suspicious lymph node metastasis.

102. miRNA Profiling of Lung Squamous Cell Carcinoma in the Head and Neck Cancer Patient: Metastasis or Primary Tumor

Juan A. Muñoz, Praveen Sridhar, Adam C. Gower, Anita Deshpande, Yuriy O. Alekseyev, Carl J. O'Hara, *Hiran C. Fernando, *Virginia R. Litle
Boston University, Boston, MA

Invited Discussant: ♦Mark Onaitis

Purpose: Distinguishing between primary lung squamous cell carcinoma (LSCC) and a metastatic lung lesion in a patient with history of head and neck SCC (HNSCC) can be challenging even after pathologic assessment and genetic analysis. An accurate diagnosis through miRNA profiling could be useful to discriminate between these two, aiding in the selection of the appropriate surgical resection.

Methods: Specimens of resected primary HNSCC (n = 17) or LSCC (n = 18) were obtained from formalin-fixed paraffin embedded (FFPE) blocks. Histopathological examination confirmed ≥70% tumor content in all samples. FFPE samples were sectioned and deparaffinized, and total RNA was isolated using the QIAGEN miR-Neasy FFPE kit and profiled using Affymetrix miRNA 3.0 arrays. Affymetrix Expression Console was used to generate expression levels and detection (Present/Absent) calls for 1,733 mature human miRNAs in each sample.

Results: Twelve HNSCC and 16 LSCC samples were included for analysis (mean Relative Log Expression 20% miRNAs Present). Of the 690 miRNAs present in ≥25% of samples, 48 were differentially expressed (Student $p < 0.05$) between HNSCC and LSCC. Notably, six miRNAs (miR-379/411/299/381/134/409) located within a ~40 kb region of chromosome 14 were coordinately up-regulated in HNSCC. Interestingly, the ratio of miR-10a and -10b, which are highly conserved, nearly identical, and located within clusters of *Hox* developmental regulators, was associated with primary cancer site: miR-10a expression was higher than that of miR-10b in 15/16 LSCCs, but in just 5/12 HNSCCs.

Conclusion: The expression of miRNAs may be useful for discriminating between HNSCC and LSCC, including markers of possible copy number variation at 14q32.31 and the ratio of miR-10a:miR-10b. Candidate miRNAs will be validated with quantitative RT-PCR and metastatic lung cases tested in combination with survival data.

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103. Lung Transplantation Is Associated with a Survival Benefit in Patients with Chronic Obstructive Pulmonary Disease

Charles F. Evans, Zachary N. Kon, Min Zhan, June Kim, Irina Timofte, Aldo T. Iacono, *James S. Gammie, *Si M. Pham, *Bartley P. Griffith, Pablo G. Sanchez

University of Maryland, Baltimore, MD

Invited Discussant: ♦Marcelo Cypel

Objective: The survival advantage associated with lung transplantation for patients with chronic obstructive pulmonary disease (COPD) is not clear. Single institution and multi-institution analyses have conflicting results. Furthermore, the question has not been addressed since the adoption of the lung allocation score. The objective of this report is to clarify the association between lung transplantation and survival among patients with COPD.

Methods: Data came from the Organ Procurement and Transplantation Network Standard Transplant and Analysis Research file, which included data up to December 2014. All patients >18 years old with a diagnosis of COPD listed for primary lung transplantation after May 2005 were included. Missing data were addressed using multiple imputation. The main exposure, lung transplantation, was handled as a time-dependent covariate. The main outcome was time to death following transplantation, or removal from the wait list due to death or medical deterioration prior to transplantation. The propensity to undergo lung transplantation, based on available covariates, was calculated using logistic regression. A Cox regression model was used to compare the hazard of death between patients who did and did not undergo lung transplantation, adjusted for their propensity to undergo lung transplantation.

Results: 4990 patients were listed for lung transplantation. 51% (2535) were women and the median age was 60 years. The median lung allocation score at the time of listing was 32.7. Among all listed, 74% (3704) underwent lung transplantation and 26% (1286) did not. Among those who did not undergo transplantation, 37% (470) died or were removed because of medical deterioration, 26% (335) were removed for other reasons, and 37% (481) were still waiting. The propensity-adjusted hazard of death for those who underwent lung transplantation compared to those who did not was 0.64 (95% CL 0.55, 0.77, $p < 0.0001$).

Conclusion: Lung transplantation is associated with a significant reduction in the hazard of death for patients with COPD, and should continue to be offered as a treatment option for those with end-stage disease.

Late-Breaking Clinical Trial

LB12. Systematic Short-Term Pulmonary Rehabilitation Before Lung Cancer Lobectomy: A Single-Blind Randomized Trial

Yutian Lai, Mingming Wang, Guowei Che

West China Hospital, Sichuan University, Chengdu, China

Invited Discussant:

9:35 AM – 9:50 AM Coffee Break

WEDNESDAY MORNING, MAY 18, 2016

**9:50 AM Adult Cardiac Masters of Surgery
Video Session** Ballroom I, BCC

See page 60 for schedule.

**9:50 AM Congenital Masters of Surgery
Video Session** Ballroom III, BCC

See page 60 for schedule.

**9:50 AM General Thoracic Masters of Surgery
Video Session** Ballroom IV, BCC

See page 61 for schedule.

11:30 AM 96th Annual Meeting Adjourns

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Statement of Need

Cardiovascular disease and cancer are the leading causes of mortality and morbidity around the globe. Major advances in these conditions continue to be made at a rapid pace. Improvements in diagnostic techniques as well as interventional approaches to treatment, both surgical and percutaneous, challenge the clinical practitioner to remain current. Increasingly sophisticated technology to accomplish these aims is being developed and introduced into clinical practice. Exciting advances in basic and clinical science offer opportunities for participation in scientific studies and clinical trials. All of these elements create a significant educational need for the practicing cardiothoracic surgeon. The AATS Annual Meeting fills this need through a combination of lectures, original scientific presentations and discussion forums.

Educational Objectives

At the conclusion of the AATS Annual Meeting, through comprehensive lectures and discussions, participants will be able to:

- ☐ Identify the latest techniques and current research specifically related to Adult Cardiac Surgery, Congenital Heart Disease, General Thoracic Surgery and Perioperative Care.
- ☐ Select appropriate surgical procedures and other interventions for their own patients based upon results presented.
- ☐ Incorporate the basic science developments and emerging technologies and techniques across the spectrum of cardiothoracic surgery.
- ☐ Communicate current practice management necessary for the effective and safe delivery of patient care.
- ☐ Translate expanded knowledge into practice for the improvement of patient outcomes and satisfaction.

Target Audience

The AATS Annual Meeting is specifically designed to meet the educational needs of:

- ☐ Cardiothoracic Surgeons
- ☐ Physicians in related specialties including Cardiothoracic Anesthesia, Critical Care, Cardiology, Pulmonology, Radiology, Gastroenterology, Thoracic Oncology and Vascular Surgery

- ☐ Fellows and Residents in Cardiothoracic and General Surgical training programs
- ☐ Health Care Professionals involved in the care of cardiothoracic surgical patients including Physician Assistants, Nurse Practitioners, Nurses, Surgical Assistants and Perfusionists
- ☐ Medical students with an interest in cardiothoracic surgery

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Continuing Medical Education (CME) Accreditation

The American Association for Thoracic Surgery is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The American Association for Thoracic Surgery designates this live educational activity for a maximum of **34.75 AMA PRA Category 1 Credits™**. Physicians should only claim credit commensurate with the extent of their participation in the activity.

American Academy of Physician Assistants (AAPA) Accreditation



This program has been reviewed and is approved for a maximum of 67.25 hours of AAPA Category I CME credit by the Physician Assistant Review Panel. Physician assistants should claim only those hours actually spent participating in the CME activity.

This program was planned in accordance with AAPA's CME Standards for Live Programs and for Commercial Support of Live Programs.

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American Board of Cardiovascular Perfusion (ABCP) Accreditation

The American Board of Cardiovascular Perfusion designates this educational activity for a maximum of 40.1 Category 1 CEUs.

The American Association for Thoracic Surgery designates the following credit hours:

Saturday, May 14, 2016 – up to 6.5 hours (CME, AAPA, ABCP)

Adult Cardiac Skills, up to 6 hours

Congenital Skills, up to 5.25 hours

General Thoracic Skills, up to 6 hours

Interprofessional Cardiothoracic Team Symposium, up to 6 hours

Optimal Therapies for End-Stage Thoracic Organ Failure, up to 6.5 hours

Ethics Forum: Surgical Ethics Course, up to 5.75 hours

Sunday, May 15, 2016 – up to 7 hours (CME, AAPA, ABCP)

Adult Cardiac Surgery, up to 7 hours

Congenital Heart Disease, up to 7 hours

General Thoracic Surgery, up to 7 hours

Survival Guide for the Cardiothoracic Surgical Team, up to 3.75 hours

Monday, May 16, 2016 – up to 10.5 hours (CME, ABCP)

Plenary Scientific Session, Basic Science Lecture, Presidential Address, up to 3.5 hours

Ethics Forum Luncheon, up to 1.5 hours

Adult Cardiac Surgery Simultaneous Session, up to 2.5 hours

Congenital Heart Disease Simultaneous Session, up to 2.5 hours

General Thoracic Surgery Simultaneous Session, up to 2.5 hours

Perioperative Care Simultaneous Session, up to 2.5 hours

C. Walton Lillehei Resident Forum, up to 1.5 hours

Innovations in Transcatheter Valve Therapies: What You Need to Know for Today and the Future, up to 1.5 hours

Emerging Interfaces in Advanced Imaging and Interventions in Structural CV Disease, up to 1.5 hours

Tuesday, May 17, 2016 – up to 7 hours (CME, ABCP)

Cardiac Surgery Forum, up to 1.75 hours

General Thoracic Surgery Forum, up to 1.75 hours

Adult Cardiac Emerging Technologies and Techniques Forum, up to 1.75 hours

General Thoracic Emerging Technologies and Techniques Forum, up to 1.75 hours

Video Session, up to 1.75 hours

VAD/ECMO Session, up to 1.75 hours

Plenary Scientific Session, up to 2.25 hours

Honored Guest Lecture, not for credit

Cardiothoracic Surgical Trials Network: Implications for Clinical Practice, up to 1.25 hours

Adult Cardiac Surgery Simultaneous Session, up to 1.75 hours

Aortic/Endovascular Simultaneous Session, up to 1.75 hours

Congenital Heart Disease Simultaneous Session, up to 3 hours

General Thoracic Surgery Simultaneous Session, up to 3 hours

Wednesday, May 18, 2016 – up to 3.75 hours (CME, ABCP)

Adult Cardiac Surgery Simultaneous Session, up to 2 hours
Congenital Heart Disease Simultaneous Session, up to 2 hours
General Thoracic Surgery Simultaneous Session, up to 2 hours
Adult Cardiac Masters of Surgery Video Session, up to 1.75 hour
Congenital Masters of Surgery Video Session, up to 1.75 hours
General Thoracic Masters of Surgery Video Session, up to 1.75 hours

For further information on the Accreditation Council for Continuing Medical Education (ACCME) standards of commercial support, please visit www.accme.org.

CME Certificates and Letters of Attendance

CME (Continuing Medical Education) and CE credits and Letters of Attendance may be obtained at the CME/CE Pavilion located in the Pratt Street Lobby, Level 300 of the Baltimore Convention Center. The CME/CE Pavilion computers will allow attendees to manage all of their CME/CE credits and Letter of Attendance for the Annual Meeting. Access may also be obtained post-meeting by visiting <https://ceu.experientevent.com/aat161/>.

Attendees may email their CME/CE certificate and/or Letter of Attendance to themselves or they may print them out on site at the CME/CE Pavilion.

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*Anthony P. Furnary	Consultant with Edwards Lifesciences, Glysure; Speakers Bureau with Edwards Lifesciences
Vincent A. Gaudiani	Faculty Educator with Medtronic
*A. Marc Gillinov	Consultant with Abbot Vascular, AtriCure, Clear Catheter Systems, Tendyne, On-X; Speakers Bureau with Edwards Lifesciences, Intuitive Surgical, Medtronic, St. Jude Medical; Grant/Research Support from St. Jude Medical, Tendyne
*Mattia Glauber	Consultant with Medtronic; Grant/Research Support from Edwards Lifesciences, Liva Nova; Patent Fee with Cardiomedical
*Scott Goldman	Consultant with Abbott, Edwards Lifesciences, LSI, St. Jude Medical
*T. Sloane Guy	Consultant with Edwards Lifesciences, Medtronic Inc., Ethicon/J&J; Grant/Research Support from Biomet
Peter Lukas Haldenwang	Grant/Research Support from Deutsche Stiftung für Herzforschung
*Michael E. Halkos	Consultant with Maquet Cardiovascular
David M. Hoganson	Consultant with and Grant/Research Support from DSM Biomedical
*Richard A. Hopkins	Consultant with Abbott Medical, St. Jude Medical; Grants/Research Support from NIH RO32 Grant; Honorarium from NIH Study Review Group
Daijiro Hori	Grant/Research Support from Japan Heart Foundation/Bayer Yakuhin Research Grant Abroad, CareFusion
*A. Pieter Kappetein	Grants/Research Support from Medtronic
*Shaf Keshavjee	Founder and Chief Scientific Officer of Perfusix Canada, Perfusix USA, XOR Laboratories; Research Support from XVIVO Perfusion, United Therapeutics, United Therapeutics
*Harold L. Lazar	Grants/Research Support from Eli Lilly
*Richard Lee	Consultant with Abbott, Cryolife, Maquet, Acelity

*Scott A. LeMaire	Advisor with Baxter Healthcare; Research Support from Medtronic, WL Gore & Associates, Cook, Inc., Edwards Lifesciences, Glaxo Smith Kline, Vascutek Terumo
Bradley G. Leshnower	Consultant with Cryolife, Inc.
♦Moishe Liberman	Grant/Research Support from Baxter, Boston Scientific, Covidien-Medtronic, Ethicon, Olympus
*James D. Luketich	Stock Shareholder with Abbott, Abbvie, Hospira
*Michael J. Mack	Manufacturer of Product with Edwards Lifesciences, Abbott Vascular
*Michael M. Madani	Consultant with Bayer, Actelion, Wexler Surgical
*S. Chris Malaisrie	Consultant with Abbott, Bolton, Edwards Lifesciences, Medtronic
James D. McCully	Grant/Research Support from Boston Scientific Corporation
*Joseph T. McGinn	Honorarium from Medtronic
Shohei Miyazaki	Grant/Research Support from Hitachi Aloka Medical, Ltd.
Daniela Molena	Honorarium from Novadaq Inc.
*David L. Morales	Grants/Research Support from CorMatrix; Consultant with CorMatrix, Syncardia, Berlin Heart Inc.; Financial/Material Support from CorMatrix
*Dao M. Nguyen	Speaker with Intuitive Surgical
Tom C. Nguyen	Consultant with Edwards Lifesciences
Thilo Noack	Speaker and Research Support from Siemens Healthcare
*Himanshu J. Patel	Consultant with WL Gore, Terumo
Cecilia Pompili	Grant/Research Support from Neomend Inc.
♦Ourania Preventza	Consultant with Medtronic; Financial/Material Support from Gore, Cook
*Vivek Rao	Consultant with Medtronic, Thoratec, CorMatrix Cardiovascular
*Michael J. Reardon	Consultant with Medtronic
Alberto Repossini	Consultant with Sorin Group
*Eric A. Rose	Board Member with Mesoblast Ltd.
*Eric E. Roselli	Consultant with Bolton, Gore, Medtronic, LivaNova; Financial/Material Support from Direct Flow; Honorarium from St. Jude, Vascutek, Cook, Edwards Lifesciences
*Todd K. Rosengart	Stock Shareholder with XyloCor Therapeutics
*Richard J. Shemin	Consultant with Sorin, Edwards Lifesciences
Scott C. Silvestry	Consultant with Thoratec and Heartware
*Craig R. Smith	Corporate organization with Edwards Lifesciences
♦Edward G. Soltesz	Honorarium from AtriCure, Edwards Lifesciences, St. Jude Medical
*Thoralf M. Sundt, III	Consultant for Thorasos, Inc.
*Rakesh M. Suri	Grant/Research Support from Sorin, St. Jude, Edwards Lifescience, Abbott Vascular

ACCREDITATION

*AATS Member ♦AATS New Member



*Wilson Y. Szeto	Consultant with Bolton Medical, Microinterventional Device; Grant/Research Support from Edwards Lifesciences, LivaNova, Medtronic
*Vinod H. Thourani	Advisor with Abbott Medical, Edwards Lifesciences, Medtronic; Research Support from Abbott Medical, Edwards Lifesciences, Medtronic, St. Jude, Claret, Boston Scientific
*James S. Tweddell	Consultant with Cormatrix
*Luca A. Vricella	Advisor with St. Jude Medical
*Song Wan	Speaker with St. Jude and Sorin; Consultant with St. Jude
Joshua K. Wong	Grant/Research Support from LSI Solutions
*Terrence M. Yau	Grant/Research Support from Miltenyi Biotec Inc.

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Iki Adachi	Grants/Research Support from Baylor College of Medicine; Consultant with New England Research Institutes, Sony-Olympus Medical Solutions; <i>Off-label/unapproved use discussion</i> – HeartWare HVAD, Thoratec HeartMate II, Abiomed Impella
Michael W.A. Chu	Consultant with Medtronic, Edwards Lifesciences; <i>Off-label/unapproved use discussion</i> – Symetis Acurate TA prosthesis
Domenico Mazzitelli	Consultant with Admedus Corp; <i>Off-label/unapproved use discussion</i> – Annuloplasty Rings are presently being reviewed by FDA and CE Mark
*David P. Taggart	Grant/Research Support and Speakers Bureau with VGS, Medistim; Consultant and Major Stockholder with VGS; <i>Off-label/unapproved use discussion</i> – VEST Device
*Thomas K. Waddell	Advisor with Perfusix US, Lunch Biotechnology Inc.; Consultant with United Therapeutics; Shareholder with XOR Labs Toronto, Inc.; <i>Off-label/unapproved use discussion</i> – Ex vivo lung perfusion technologies
*Mathew R. Williams	Consultant and Research Support from Medtronic, Edwards Lifesciences; <i>Off-label/unapproved use discussion</i> – Sapien Corevalve

AATS Staff

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