AATS 95TH ANNUAL MEETING 2015

AMERICAN ASSOCIATION FOR THORACIC SURGERY
We Model Excellence

SATURDAY & SUNDAY SYMPOSIA

April 25 – 29, 2015

Washington State Convention Center
Seattle, WA, USA

www.aats.org

WELCOME **ANNUAL MEETING**

Welcome to the AATS 2015 Saturday Courses and Sunday Symposia

SATURDAY **APRIL 25**

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. As you enter sessions, attendants will check the top right-hand corner of your badge for the code **"SAT"**. Those with the code will be admitted entry to the session and those who do not have a code but would like to attend, should visit Registration in the Atrium Lobby on Level 4 of the Washington State Convention Center to purchase registration to the Saturday courses.

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 Sessions you will see either an **"AHO, GTH, CHO** or **THO"** printed on the top right-hand corner of your badge. Those who do not have the Hands-On Session code printed but would like to attend, should visit the registration area to be placed on a stand-by list.

SUNDAY **APRIL 26**

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. As you enter sessions, attendants will check the top right-hand corner of your badge for the code **"SUN"**. Those with the code will be admitted entry to the session and those who do not have a code but would like to attend, should visit Registration in the Atrium Lobby on Level 4 of the Washington State Convention Center to purchase registration to the Sunday symposia.

Welcome Reception | 5:00 PM - 7:00 PM in the AATS Exhibit Hall

Join us as we officially celebrate the opening of this year's 95th Annual Meeting. Visit with our valued exhibitors and supporters in the AATS Exhibition Hall where you will learn cutting edge techniques, and discover groundbreaking new products while networking with other attendees.

The AATS Exhibition 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 2015 Mitral Conclave and 2014 Aortic Symposium
- AATS Graham Foundation Resident Poster Competition
- Allied Health Poster Competition
- Cardiothoracic Surgery Resident Top Gun Competition

ADULT CARDIAC SKILLS

How I Would Like My Operation Done

SATURDAY, APRIL 25, 2015 | 8:00 AM – 3:30 PM **Room 6B, WSCC**

Course Chair: *Lars G. Svensson, *Cleveland Clinic*
Course Co-Chair: *Michael A. Borger, *Columbia University*

7:55 AM - 8:00 AM **WELCOME / INTRODUCTION**
*Lars G. Svensson, *Cleveland Clinic*

8:00 AM - 8:08 AM
How I Would Like My Minimal Invasive J - Incision To Be Done for My Aortic Valve
*Volkmar Falk, *University Hospital Zurich*

8:08 AM - 8:16 AM
I Would Like a Right Thoracotomy for My Aortic Valve & How It Should Be Done
Mattia Glauber, *Sant' Ambrogio Clinic, Milan*

8:16 AM - 8:24 AM
I Would Like a Balloon Expandable Sutureless Valve for My Aortic Valve & How It Should Be Done
*Michael A. Borger, *Columbia University*

8:24 AM - 8:32 AM
I Would Like a Robotic Self- Expanding Sutureless Valve for My Aortic Valve & How It Should Be Done
*Rakesh M. Suri, *Mayo Clinic*

8:32 AM - 8:40 AM
Managing the Small Annulus & Lvot with a Biological Valve with or Without Myectomy
*Bruce W. Lytle, *Cleveland Clinic*

8:40 AM - 8:48 AM
Mechanical Valve for Small Annulus & How I Would Like My Annular Enlargement to Be Done
*Hartzell V. Schaff, *Mayo Clinic*

8:48 AM - 8:56 AM
How I Want Aortic My Valve Leaflets Repaired
*Allan S. Stewart, *Mount Sinai Medical Center*

8:56 AM - 9:04 AM **PANEL DISCUSSION**

9:04 AM - 9:12 AM
How I Would Like My Transapical Valve Inserted
*Vinod H. Thourani, *Emory University*

9:12 AM - 9:20 AM
How I Would Like My Direct Aortic Valve Inserted
*Michael J. Reardon, *Methodist DeBakey Heart Center*

9:20 AM - 9:28 AM
How I Would Like a Self- Expanding Valve Inserted Including Subclavain Backup
*Gregory P. Fontana, *Lenox Hill Hospital*

9:28 AM - 9:36 AM
How I Would Like My Inflatable Frame & Super Glue Valve Inserted
Reginald I. Low, *University of California, Davis*

9:36 AM - 9:44 AM
How I Would Like By Biological Valve Failure to Be Treated With a Valve - In -Valve
*Vinod H. Thourani, *Emory University*

9:44 AM - 10:00 AM **PANEL DISCUSSION**

10:00 AM - 10:30 AM **COFFEE BREAK**

10:30 AM - 10:38 AM
How I Would Like By Bicuspid Valve and Aneurysms Treated
*Thoralf M. Sundt, III, *Massachusetts General Hospital*

10:38 AM - 10:46 AM
Tips I Would Give My Surgeon Replacing My Aortic Root
*Lars G. Svensson, *Cleveland Clinic*

10:46 AM - 10:54 AM
How I Would Like My Aortic Arch Repaired With Debranching & Stents
*Joseph E. Bavaria, *University of Pennsylvania*

10:54 AM - 11:02 AM
How I Would Like My Elephant Trunk Procedure to Be Done
*Malakh L. Shrestha, *Hannover Medical School*

11:02 AM - 11:10 AM
How I Would Plan & Do My Descending Aorta Dissection with Stents
*Eric E. Roselli, *Cleveland Clinic*

11:10 AM - 11:18 AM
How I Would Like My Descending Aortic Aneurysm Treated With Coverage of the Left Subclavian Artery
*John S. Ikonomidis, *Medical University of South Carolina*

11:18 AM - 11:26 AM
What I Would Choose to Do for My Thoracoabdominal Aorta Repair
*Joseph S. Coselli, *Baylor College of Medicine*

11:26 AM - 11:34 AM
How I Would Like My Thoracoabdominal Aorta Stented
Matthew J. Eagleton, *Cleveland Clinic*

11:34 AM - 11:42 AM
How I Would Like My Acute Ascending Aortic Dissection to Be Treated
*D. Craig Miller, *Stanford University*

11:42 AM - 12:00 PM **PANEL DISCUSSION**

12:00 PM - 1:00 PM **LUNCHEON INTERVIEW with**
*Lawrence H. Cohn, *Brigham & Women's Hospital*

1:00 PM - 1:08 PM
What Would I Like To Be Done For My Ischemic Mitral Valve Regurgitation – Replace with Chordal Preservation?
*Irving L. Kron, *University of Virginia*

1:08 PM - 1:16 PM
Other Than Rings, What I Would Like For My Ischemic Mitral Regurgitation Repair
*Robert A. Dion, *Ziekenhuis Oost-Limburg*

1:16 PM - 1:24 PM
What Approach & Technique Would I Ask For My Degenerative Mitral Valve Repair: Five Techniques For 95% of Valves
*A. Marc Gillinov, *Cleveland Clinic*

1:24 PM - 1:32 PM
Complex Degenerative Valve Repair Techniques: The Other 5% of Valves
*David H. Adams, *Mount Sinai Medical Center*

1:32 PM - 1:40 PM
Severe MAC – What About Direct Placement of Self- Expanding Pulmonary Valve Device?
Ahmed El-Eshmawi, *Mount Sinai Medical Center*

1:40 PM - 1:48 PM
How I Would Do My Mitral Valve Clips
Francesco Maisano, *University Hospital Zurich*

1:48 PM - 1:56 PM
How I Would Do My Mitral Valve Replacement Valve – in – Valve
Anson Cheung, *University of Columbia*

1:56 PM - 2:04 PM
My Choice For Percutaneous Mitral Valve Replacement
Jose Luis Navia, *Cleveland Clinic*

2:04 PM - 2:12 PM
Tips I Would Give My Surgeon for My Double Valve (Aortic & Mitral) Endocarditis
*Gosta B. Pettersson, *Cleveland Clinic*

2:12 PM - 2:20 PM
How to Do a Mitral Valve Repair for Rheumatic Valve Disease
Taweezak Chotivatanapong, *Chest Disease Institute*

2:20 PM - 2:28 PM
What Lesion Set I Would Have Depending on My Atrial Fibrillation Type
*Ralph J. Damiano, Jr., *Washington University*

2:28 PM - 2:40 PM **PANEL DISCUSSION**

2:40 PM - 2:48 PM
How I Would Like My Arterial Grafting To Done With Bilateral Internal Arteries & Other Arterial Conduits
*Joseph F. Sabik, III, *Cleveland Clinic*

2:48 PM - 2:56 PM
How I Would Do My Robotic Coronary Artery Bypassing
Johannes Bonatti, *Cleveland Clinic Abu Dhabi*

2:56 PM - 3:04 PM
How I Would Do My Thorascopic Coronary Artery Bypassing
Robert S. Poston, *University of Arizona*

3:04 PM - 3:12 PM
How I Would Do My Anterior VSD Closure
*John V. Conte, *Johns Hopkins Hospital*

3:12 PM - 3:20 PM
How I Would Do My Inferior – Basal VSD Repair
*Tirone E. David, *Toronto General Hospital*

3:20 PM - 3:30 PM **PANEL DISCUSSION**

**AATS Member*

CONGENITAL HEART DISEASE SKILLS

Dealing with Challenging Conditions – Pearls and Pitfalls

SATURDAY, APRIL 25, 2015 | 8:00 AM – 3:30 PM **Room 6A, WSCC**

Course Chair: *Erle H. Austin, III, *University of Louisville*

8:00 AM - 8:05 AM **WELCOME / INTRODUCTION**

8:05 AM - 8:25 AM
PA/VSD/MAPCAs - Technique for Early Complete Repair
*Frank L. Hanley, *Stanford University*

8:25 AM - 8:45 AM
Neonatal Pulmonary Artery Rehab without Unifocalization
*Yves d'Udekem, *Royal Children's Hospital*

8:45 AM - 9:05 AM
Panel Discussion with Case Presentations
*Erle H. Austin, III, *University of Louisville*
*Yves d'Udekem, *Royal Children's Hospital*
*Frank L. Hanley, *Stanford University*

9:05 AM - 9:25 AM
The Borderline Left Ventricle: What is it? Recruit it or Forget it?
*James S. Tweddell, *Medical College of Wisconsin*

9:25 AM - 9:45 AM
Techniques for Recruiting the Borderline Left Ventricle
Sitaram Emani, *Boston Children's Hospital*

9:45 AM - 10:05 AM
Where to Draw the Line
*Thomas L. Spray, *Children's Hospital of Philadelphia*

10:05 AM - 10:20 AM **DISCUSSION**

10:20 AM - 10:50 AM **COFFEE BREAK**

10:50 AM - 11:05 AM
Modified Truncus Arteriosus
George Alfieris, *University of Rochester*

11:05 AM - 11:10 AM **QUESTION / ANSWER**

11:10 AM - 11:25 AM
Repairing/Replacing the Insufficient Truncal Valve
Mark Gerard Hazekamp, *Leiden University*

11:25 AM - 11:30 AM **QUESTION / ANSWER**

11:30 AM - 11:45 AM
Repair of Truncus Arteriosus with Interrupted Aortic
*Ralph S. Mosca, *NYU Langone Medical Center*

11:45 AM - 12:00 PM **QUESTION / ANSWER**

12:00 PM - 1:00 PM **LUNCH**

1:00 PM - 1:20 PM
Mechanical Support in the Pediatric Population
Holger Buchholz, *University of Alberta*

1:20 PM - 1:40 PM
ECMO: Decision Making, Preferred Components, Techniques
Peter D. Wearden, *Children's Hospital of Pittsburgh*

1:40 PM - 1:45 PM **QUESTION / ANSWER**

1:45 PM - 2:05 PM
Implantation of the Berlin Heart
Michael Hübler, *University of Zurich*

2:05 PM - 2:10 PM **QUESTION / ANSWER**

2:10 PM - 2:30 PM
Implantation of the Heartware Device
*Ivan M. Rebeyka, *University of Alberta*

2:30 PM - 2:35 PM **QUESTION / ANSWER**

2:35 PM - 2:55 PM
3 Dimensional Imaging of the Complex Congenital Heart
Ajit Yoganathan, *Georgia Institute of Technology*

2:55 PM - 3:15 PM
Impact of a 3D Model on Surgical Planning
*Glen Van Arsdell, *Hospital for Sick Children*

3:15 PM - 3:30 PM **DISCUSSION**

GENERAL THORACIC SKILLS

Implementing Innovation: What Future Leaders Need to Know

SATURDAY, APRIL 25, 2015 | 8:00 AM – 3:30 PM **Room 6C, WSCC**

Course Chair: *Ara Vaporciyan, *MD Anderson Cancer Center*
Course Co-Chair: *Pascal Thomas, *North University Hospital*

8:05 AM - 8:15 AM
Minimally Invasive Approaches to Diagnosis & Staging
*Ara A. Vaporciyan, *MD Anderson Cancer Center*

8:15 AM - 8:25 AM
Navigational Bronchoscopy
Daniel S. Oh, *University of Southern California*

8:25 AM - 8:35 AM
Radial Miniprobe TBLx
*Kazuhiro Yasufuku, *Toronto General Hospital*

8:35 AM - 8:55 AM **DISCUSSION**

8:55 AM - 9:05 AM
Tips & Tricks for EBUS with TBNA
*David C. Rice, *MD Anderson Cancer Center*

9:05 AM - 9:15 AM
NIR-SLN Mapping
*Yolonda L. Colson, *Brigham & Women's Hospital*

9:15 AM - 9:30 AM
What Does a Mediastinal Node Dissection Look Like?
*Frank C. Detterbeck, *Yale University*

9:30 AM - 9:40 AM
VAMLA
*Gunda Leschber, *ELK Berlin Chest Hospital*

9:40 AM - 10:00 AM **DISCUSSION**

10:00 AM - 10:20 AM **COFFEE BREAK**

10:20 AM - 10:30 AM
Treatment Small Non-palpable Lung Nodules
*Ara A. Vaporciyan, *MD Anderson Cancer Center*

10:30 AM - 10:40 AM
Image-guided Microcoil with CT Wedge
*Richard Finley, *University of British Columbia*

10:40 AM - 10:50 AM
Nuclear Guided Wedge
*K. Robert Shen, *Mayo Clinic*

10:50 AM - 11:00 AM
Virtual Assisted Lung Mapping
Masaaki Sato, *Kyoto University*

11:00 AM - 11:10 AM
iVATS
*Rapheal Bueno, *Brigham & Women's Hospital*

11:10 AM - 11:20 AM
Video ICG-guided Segmentectomy
Yasuo Sekine, *Indiana University*

11:20 AM - 11:30 AM
SBRT of Pulmonary Lesions
Douglas J. Minnich, *University of Alabama at Birmingham*

11:30 AM - 12:00 PM **DISCUSSION**

12:00 PM - 1:00 PM **FEATURED LUNCH**
Experiencing Atheer 3D Reality Glasses for Surgery (Not for Credit)
Sina Fateh, *Atheer Labs*
Allen Y. Yang, *Atheer Labs*

1:00 PM - 1:10 PM
Endoscopic Esophageal Disease
Thomas K. Varghese, Jr., *University of Washington*

1:10 PM - 1:25 PM
Chromoendoscopy, Endomicroscopy, OCT
Ross M. Bremner, *St. Joseph's Hospital*

1:25 PM - 1:33 PM **DISCUSSION**

1:33 PM - 1:45 PM
EMR ESD
*Wayne L. Hofstetter, *MD Anderson Cancer Center*

1:45 PM - 1:57 PM
RFA Cryo
*Daniel L. Miller, *WellStar Healthcare System*

1:57 PM - 2:05 PM **DISCUSSION**

**AATS Member*

2:05 PM - 2:25 PM **COFFEE BREAK**

2:25 PM - 2:31 PM
POEM
Jon Wee, *Brigham & Women's Hospital*

2:31 PM - 2:37 PM
Linx
Brian Louie, *Swedish Cancer Institute*

2:37 PM - 2:43 PM
Endoscopic Anti-reflux
*Hiran C. Fernando, *Boston Medical Center*

2:43 PM - 2:49 PM
Laproscopic PEH Repair
*Virginia R. Litle, *Boston Medical Center*

2:49 PM - 3:01 PM **DISCUSSION**

3:01 PM - 3:16 PM
Stitch, Stents, & Clips
*Shanda H. Blackmon, *Mayo Clinic*

3:16 PM - 3:30 PM **DISCUSSION**

ALLIED HEALTH PERSONNEL SYMPOSIUM

Advancing the Team Based Care Management Model in Cardiothoracic Surgery

In Collaboration with the Association of Physician Assistants in Cardiovascular Surgery (APACVS)

SATURDAY, APRIL 25, 2015 | 8:00 AM – 3:30 PM **Room 613, WSCC**

Course Chair: *Michael A. Acker, *University of Pennsylvania*
Course Co-Chair: Katherine J. Hoercher, *Cleveland Clinic*
Moderator: *Michael A. Acker, *University of Pennsylvania*

8:00 AM - 8:15 AM **WELCOME / INTRODUCTION**

Moderator: *Michael A. Acker, *University of Pennsylvania*

8:15 AM - 8:35 AM
Pay for Performance: ACOs, Bundled Payments in CV Care- Are You Ready?
PJ Brennan, *University of Pennsylvania*

8:35 AM - 8:55 AM
Changing Paradigm of Cardiovascular Care: Service Line versus Departmental
*Michael A. Acker, *University of Pennsylvania*

8:55 AM - 9:15 AM
The Role of the Nurse Navigator in Improving Outcomes & Patient & Family Satisfaction
Jo Anne Fante-Gallagher, *University of Pennsylvania*

9:15 AM - 9:35 AM
Perfecting Transitions of Care
Patricia Hickey, *Boston Children's Hospital*

9:35 AM - 9:55 AM
Transitioning from "Solution Shop" Model to "Focused Factory Model" in Cardiothoracic Surgery: The Expanded Role of RNs, PAs & NPs
David Cook, *Mayo Clinic*

9:55 AM - 10:25 AM **COFFEE BREAK**

Moderator: Katherine J. Hoercher, *Cleveland Clinic*

10:25 AM - 10:45 AM
Utilizing Registries & Guidelines in CV Care: Have They Improved Outcomes & Decreased Cost?
Amy Simone, *Emory University*

10:45 AM - 11:05 AM
The New Priority: Decreasing Readmissions after Cardiothoracic Surgery: How Do We Get There?
Michael Z. Tong, *Cleveland Clinic*

11:05 AM - 11:25 AM
Clinical & Practical Aspects of Establishing a Successful Structural Heart & Valve Clinic
Marci Damiano, *Washington University*

11:25 AM - 11:45 PM
Early Extubation & Accelerated Recovery Protocols in Cardiac Surgery
*Glenn J. Whitman, *Johns Hopkins Hospital*

12:00 PM - 1:00 PM **LUNCH**
Moderator: *Michael A. Acker, *University of Pennsylvania*

1:00 PM - 1:15 PM
Postoperative Glucose Control & SCIP Measures
*Gorav Ailawadi, *University of Virginia Health System*

1:15 PM - 1:30 PM
Emergent Management of Airway Complications in the OR & ICU
*Sudish C. Murthy, *Cleveland Clinic*

1:30 PM - 1:45 PM
Risk Factors, Management, & Outcomes of Neurological Dysfunction after CT Surgery: ICU Delirium to Stroke
*Sidney Levitsky, *Beth Israel Deconess Medical Center*

1:45 PM - 2:00 PM
Risk Factors & Management of Acute Renal Injury in CV Surgery
Robert S. Kramer, *Maine Medical Center*

2:00 PM - 2:15 PM **COFFEE BREAK**

2:15 PM - 2:30 PM
Management of Acute Shock & Right Heart Failure
*Nader Moazami, *Cleveland Clinic*

2:30 PM - 2:45 PM
Management of Infected Pleural Space/Empyema
*Michael T. Jaklitsch, *Brigham & Women's Hospital*

2:45 PM - 3:00 PM
Management of Perioperative Atrial Fibrillation
*Stephen D. Cassivi, *Mayo Clinic*

3:00 PM - 3:15 PM
Management of Postoperative Pleural & Pericardial Effusions
Eric Vallieres, *Swedish Cancer Institute*

3:15 PM - 3:30 PM
Advances in Transfusion & Blood Conservation
Arman Kilic, *Johns Hopkins Hospital*

OPTIMAL THERAPIES FOR END-STAGE THORACIC ORGAN FAILURE

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

SATURDAY, APRIL 25, 2015 | 8:00 AM – 3:30 PM **Room 608, WSCC**

Course Chair: *R. Duane Davis, Jr., *Duke University*
Course Co-Chair: *Herman Reichenspurner, *University Hospital Eppendorf*
Moderators: *R. Duane Davis, *Jr., Duke University*
*Hermann Reichenspurner, *University Hospital Eppendorf*

8:00 AM - 8:10 AM **WELCOME / INTRODUCTION**

Moderators: *R. Duane Davis, *Jr., Duke University*
*Hermann Reichenspurner, *University Hospital Eppendor*

8:10 AM - 8:25 AM
ECPR ECMO for Cardiogenic Shock: Patient Selection & Cannulation Strategies
Hiroo Takayama, *Columbia University*

8:25 AM- 8:40 AM
How & When to Convert From Peripheral to Central Cannulation & Ambulatory VA ECMO
Mani A. Daneshmand, *Duke University*

8:40 AM - 8:55 AM
Decision Making: Bridge to VAD, Transplant , Recovery or Oblivion
Evgenij V. Potapov, *Deutsches Herzzentrum Berlin*

8:55 AM - 9:10 AM
Establishing an Emergency ECMO Deployment Program: The Who & How's
*Ahshish S. Shah, *Johns Hopkins Hospital*

9:10 AM - 9:25 AM
Outcomes of ECMO for Cardiopulmonary Failure
Ashok N. Babu, *University of Colorado*

9:25 AM - 10:00 AM **COFFEE BREAK**

Moderators: *Matthew Bacchetta, *Columbia University*
*Shaf Keshavjee, *Toronto General Hospital*

10:00 AM - 10:15 AM
Hub & Spoke Systems & Transport
*Matthew Bacchetta, *Columbia University*

10:15 AM - 10:30 AM
ECMO for Respiratory Failure: When Should ECMO be Deployed in the Respiratory Failure Patient to Bridge to Recovery, Patient Selection, Cannulation, & Management?
Charles Hoopes, *University of Kentucky*

10:30 AM - 10:45 AM
ECMO as Bridge to Lung Transplant - Ambulatory V/V & V/VA ECMO: How to do it & Building the Team
Christian M. Hagl, *Munich University*

10:45 AM - 11:00 AM
Management of the Circuit, Critical Care & Complications
Michailis Varamis, *Columbia University*

11:00 AM - 11:15 AM
Outcomes of ECMO for Respiratory Failure
*Matthew Bacchetta, *Columbia University*

11:15 AM - 11:30 AM
ECMO/ MCS Finance 101: Managing the Changing Landscape - Program Needs and Health System Payments
Scott C. Silvestry, *Washington University*

11:30 AM - 11:45 AM
How Do You Start an EVLP Program?
Thomas C. Wozniak, *Indiana University Health*

11:45 AM - 12:00 PM
The OCS-system for EVLP
*Avel Haverich, *Hannover Medical School*

12:00 PM - 12:15 PM LUNCH
Moderator: Scott C. Silvestry, *Washington University*

12:15 PM - 12:30 PM
Experience with the New Technologies & Minimally Invasive LVAD's
Jan D. Schmitto, *Hannover Medical School*

12:30 PM - 12:45 PM
Alternative Surgical Approaches to Placement of VADs
Edwin Clyde McGee, *Northwestern Memorial Hospital*

12:45 PM - 1:00 PM
When & How to Replace an LVAD
*Nader Moazami, *Cleveland Clinic*

1:00 PM - 1:15 PM
Biventricular Support: Total Artificial Heart
*Francisco A. Arabia, *Cedars Sinai, Los Angeles*

1:15 PM - 1:30 PM
Biventricular Support: Non-TAH Support
Jan F. Gummert, *Klinik für Herzchirurgie*

1:30 PM - 1:45 PM
Initiation of DT LVAD Programs At Non-transplant Centers
Rohinton J. Morris, *Abington Memorial Hospital*

1:45 PM - 2:00 PM
Primary Graft Dysfunction after Heart Transplant: Incidence, Predictors & Management
*Carmelo A. Milano, *Duke University*

2:00 PM - 2:15 PM
Management of Vasoplegia in the Operating Room
Scott C. Silvestry, *Washington University*

2:15 PM - 2:45 PM COFFEE BREAK

Moderators: *Christine L. Lau, *University of Virginia*
*Kenneth R. McCurry, *Cleveland Clinic*

2:45 PM - 3:00 PM
ECMO vs. CPB for Intraoperative Support: How & What Do You Choose?
*Shaf Keshavjee, *Toronto General Hospital*

3:00 PM - 3:15 PM
Transplant Regulation & Finance: What You Really Need to Know
*R. Duane Davis, Jr., *Duke University*

3:15 PM - 3:30 PM
CMS/UNOS is Calling: How to Emerge from Regulatory Hell
*Christine L. Lau, *University of Virginia*

CARDIOTHORACIC ETHICS FORUM: SURGICAL ETHICS COURSE

SATURDAY, APRIL 25, 2015 | 8:00 AM – 3:30 PM **Room 603, WSCC**

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

8:00 AM – 8:30 AM **INTRODUCTION**
*Martin F. McKneally, *University of Toronto*
*Robert M. Sade, *Medical University of South Carolina*

8:30 AM – 10-15 AM
Talking to Patients: Consent and Disclosure of Errors

When is delegation of decision making appropriate?
*Thomas A. D'Amico, *Duke University*

Do patients need to understand as well as be informed in consent?
Robert F. Dunton, *Columbia University*

What do patients and families need to know when errors occur?
*Susan D. Moffatt-Bruce, *Ohio State University*

How should surgeons deal with other surgeons' errors?
*Paul W. Fedak, *Libin Cardiovascular Institute, University of Calgary*

10:15 AM – 10:45 AM **COFFEE BREAK**

10:45 AM – 12:00 PM
Innovation and Research

How is innovation different from research?
John W.C. Entwistle, III, *Thomas Jefferson University*

Is oversight for innovation adequate?
*Richard I. Whyte, Harvard Medical School

Are sham operations and placebos justifiable in research?
*Leslie J. Kohman, *SUNY Upstate Medical University*

12:00 PM – 1:00 PM **LUNCH**

1:00 PM – 2:00 PM
Organ Donation and Transplant Issues

Should the dead donor rule be abandoned?
Kathleen Fenton, *International Children's Heart Foundation*

Should organ donors be paid (everyone else is)?
Grayson H. Wheatley, III, *Temple University*

2:00 PM – 3:30 PM
Debate
Live Broadcast is a good idea.
*Tirone E. David, *Toronto General Hospital*

Here's why Live Broadcast is a bad idea.
*John S. Ikonomidis, *Medical University of South Carolina*

AATS/STS ADULT CARDIAC SURGERY SYMPOSIUM
Decision Making in Adult Cardiac Surgery

SUNDAY, APRIL 26, 2015 | 8:00 AM – 5:00 PM **Room 4E, WSCC**

Course Chair: *A. Marc Gillinov, *Cleveland Clinic*
Course Co-Chair: *Robert Dion, *Ziekenhuis Oost-Limburg*

8:00 AM - 8:05 AM **INTRODUCTION**

CABG
Modertors: *A. Marc Gillinov, *Cleveland Clinic*
*Craig R. Smith, *Columbia University*

8:05 AM - 8:20 AM
When is CABG Clearly Superior to PCI?
*A. Pieter Kappetein, *Erasmus MC*

8:20 AM - 8:35 AM
CABG & Arterial Grafts: How Many is Enough?
*Bruce W. Lytle, *Cleveland Clinic*

8:35 AM - 8:50 AM
How to Maintain Outcomes & Quality in CABG
*Clifford W. Barlow, *Southampton General Hospital*

**AATS Member*

8:50 AM - 9:05 AM
When to use Alternative Strategies: Hybrid, Connectors, Robot...
*John D. Puskas, *Mount Sinai Beth Isreal*

9:05 AM - 9:30 AM **ROUND TABLE DISCUSSION**

9:30 AM - 10:00 AM **COFFEE BREAK**

AVR & Aorta
Modertors: *Tirone E. David, *Toronto General Hospital*
*Robert A. Dion, *Ziekenhuis Oost-Limburg*

10:00 AM - 10:30 AM
Debate: Mechanical or Bioprosthesis?
Mechanical: *Thierry-Pierre Carrel, *University of Bern*
Bioprothesis: *Anelechi C. Anyanwu, *Mount Sinai Medical Center*

10:30 AM - 10:45 AM
The Ascending Aorta with a Bicuspid Aortic Valve: Replace, Repair or Ignore
*Michael A. Borger, *Columbia University*

10:45 AM - 11:00 AM
Repair for AI: Is it Durable?
*Gebrine El Khoury, *Université Catholique de Louvain*

11:00 AM - 11:15 AM
How to Avoid Patient-prothesis Mismatch
Philippe Pibarot, *Laval University*

11:15 AM - 11:30 AM
AS: Open vs. TAVI vs. Nothing
*Wilson Y. Szeto, *University of Pennsylvania*

11:30 AM - 11:45 AM
TEVAR for Dissection
*Eric E. Roselli, *Cleveland Clinic*

11:45 AM - 12:00 PM **ROUND TABLE DISCUSSION**

12:00 PM - 1:00 PM **LEGENDS LUNCHEON**
*Tirone E. David, *Toronto General Hospital*

MVR & AF
Moderators: *Lawrence H. Cohn, *Brigham & Women's Hospital*
*A. Marc Gillinov, *Cleveland Clinic*

1:00 PM - 1:15 PM
Mitral & Tricuspid Surgery: Lessons from New York State
*Joanna Chikwe, *Mount Sinai Medical Center*

1:15 PM - 1:30 PM
Avoid SAM
*Robert A. Dion, *Ziekenhuis Oost-Limburg*

1:30 PM - 1:45 PM
Long-term Outcomes (Beyond Reop.) & Quality after MV Repair
*Rakesh M. Suri, *Mayo Clinic*

1:45 PM - 2:00 PM
Ischemic MR: Repair or Replace?
*Michael A. Acker, *University of Pennsylvania*

2:00 PM - 2:15 PM
Who Should Get a Mitraclip?
*Hermann Reichenspurner, *University Hospital Eppendor*

2:15 PM - 2:30 PM
AF Ablation: Which Operation?
*A. Marc Gillinov, *Cleveland Clinic*

2:30 PM - 2:45 PM
Functional TR: When to Fix It
*James S. Gammie, *University of Maryland*

2:45 PM - 3:25 PM **COFFEE BREAK**

Cardiac Surgeon On Call
Moderators: *Robert A. Dion, *Ziekenhuis Oost-Limburg*
*Bruce W. Lytle, *Cleveland Clinic*

3:25 PM - 3:40 PM
Cath Lab Catastrophies
*R. Duane Davis, *Jr., Duke University*

3:40 PM - 3:55 PM
Post-pump Failure
*Nicholas G. Smedira, *Cleveland Clinic*

3:55 PM - 4:10 PM
Acute Aortic Dissection: Decision and Outcome
*Marc R. Moon, *Washington University*

4:10 PM - 4:25 PM
Postinfarct VSD: Operate or Wait?
*Louis P. Perrault, *Montreal Heart Institute*

4:25 PM - 4:40 PM
Traumatic Aortic Isthmus Rupture: Always an Emergency?
*Bartley P. Griffith, *University of Maryland*

4:40 PM - 5:00 PM **ROUND TABLE DISCUSSION**

AATS/STS CONGENITAL HEART DISEASE SYMPOSIUM

Unsettled and Unanswered Questions in Congenital Heart Surgery

SUNDAY, APRIL 26, 2015 | 8:00 AM – 5:00 PM **Room 6A, WSCC**

Course Chair: *Robert Jaquiss, *Duke University*
Course Co-Chair: *Victor Tsang, *Great Ormond Street Hospital*

7:50 AM - 8:00 AM **WELCOME / INTRODUCTION**

Controversies & Debates
Moderators: *Robert D. Jaquiss, *Duke University*
*Thomas L. Spray, *Children's Hospital of Philadelphia*

8:10 AM - 8:40 AM
Debate: Neonatal Aortic Stenosis Is a Surgical Disease
Pro: Viktor Hraska, *German Pediatric Heart Centre*
Con: Lee Benson, *Hospital for Sick Children Toronto*

8:40 AM - 9:10 AM
Debate: Anomalous Aortic Origin of a Coronary Artery is Always a Surgical Disease
Pro: *Pascal R. Vouhe, *L'Université Paris Descartes*
Con: *Ralph S. Mosca, *NYU Lagone Medical Center*

9:10 AM - 9:30 AM
Debate: Larger Centers Produce Better Outcomes In Pediatric Cardiac Surgery - Regionalization Is a Superior Model
Pro: *Charles D. Fraser, *Texas Children's Hospital*
Con:Mark Danton, *Royal Hospital for Sick Children Glasgow*

9:30 AM - 10:00 AM **COFFEE BREAK**

Getting Out of Trouble - Rescue - Tough Case Management
Moderator:
*Thomas L. Spray, *Children's Hospital of Philadelphia*
Expert Panelists:
*Scott M. Bradley, *Medical University of South Carolina*
*Charles D. Fraser, *Texas Children's Hospital*
Viktor Hraska, *German Pediatric Heart Centre*

10:00 AM - 10:05 AM
Introduction of Format & Panelists
*Victor T. Tsang, *Great Ormond Street Hospital*
10:05 AM - 10:35 AM **CASE ONE**
*James S. Tweddell, *Medical College of Wisconsin*

10:35 AM - 11:05 AM **CASE TWO**
*Kirk R. Kanter, *Emory University*

11:05 AM - 11:35 AM **CASE THREE**
*Christopher A. Caldarone, *University of Toronto*

11:40 AM - 12:00 PM
BREAK TO RETRIEVE LUNCH OUTSIDE ROOM

12:00 PM - 1:00 PM **LEGENDS LUNCHEON**
*Marc R. de Leval, *International Congenital Cardiac Centre, London*

The Single Ventricle & Its Problems
Moderators: *Fred A. Crawford, Jr., *Medical University of South Carolina*
*Robert D. Jaquiss, *Duke University*

1:05 PM - 1:25 PM
Lessons learned from the SVR Trial: Update at Three Years
*Richard G. Ohye, *University of Michigan*

1:25 PM - 1:45 PM
The Relentless Effects of Fontan Paradox
Jack Rychik, *Children's Hospital of Philadelphia*

1:45 PM - 2:05 PM
Transplantation for Fontan: Better than People Think
*Kirk R. Kanter, *Emory University*

2:05 PM - 2:20 PM
Is "Four-stage Management" the Future for Univentricular Hearts? – Destination Therapy in the Young
*Robert D. Jaquiss, *Duke University*

2:20 PM - 2:30 PM **DISCUSSION / QUESTIONS**

2:30 PM - 3:00 PM **COFFEE BREAK**

Outflow Valve Surgery in Children & Adults with Congenital Heart: Part I: Pulmonary & Aortic Valve Surgery
Moderators: *Robert D. Jaquiss, *Duke University*
*Victor T. Tsang, *Great Ormond Street Hospital*

3:00 PM - 3:12 PM
Preservation of the Pulmonary Valve (Not Just the Annulus) in Repair of Tetralogy of Fallot
*Giovanni Stellin, *University of Padova*

3:12 PM - 3:24 PM
Mechanical Pulmonary Valve Replacement
*Joseph A. Dearani, *Mayo Clinic*

3:24 PM - 3:36 PM
Are Stented Bioprostheses Appropriate for Aortic Valve Replacement in Young Patients
*Frank A. Pigula, *Boston Children's Hospital*

3:36 PM - 3:48 PM
Transcatheter/Hybrid Aortic Valves in the Young
Mirko Doss, *Kerckhoff Heartcenter*

3:48 PM - 4:00 PM **DISCUSSION / QUESTIONS**

Outflow Valve Surgery in Children & Adults with Congenital Heart: Part II: Aortic Valve Replacement
Moderators: *Pedro J. del Nido, *Boston Children's Hospital*
*Victor T. Tsang, *Great Ormond Street Hospital*

4:00 PM - 4:12 PM
Reinforced Ross Procedure
*Thierry-Pierre Carrel, *University of Bern*

4:12 PM - 4:24 PM
When & How to Enlarge the Aortic Root
*Victor T. Tsang, *Great Ormond Street Hospital*

4:24 PM - 4:36 PM
Mechanical AVR in the Young: Lower Anticoagulation - Pregnancy - Novel Anticoagulants
*Hartzell V. Schaff, *Mayo Clinic*

4:36 PM - 4:48 PM
Aortic Valve Repair in Teenagers & Young Adults: When to Do It & When Not to Do It
*Pedro J. del Nido, *Boston Children's Hospital*

4:48 PM - 5:00 PM **DISCUSSION / QUESTIONS**

AATS/STS GENERAL THORACIC SURGERY SYMPOSIUM

The Evolving Role of Thoracic Surgeons

SUNDAY, APRIL 26, 2015 | 8:00 AM – 5:00 PM

Course Chair: *Gail E. Darling, *Toronto General Hospital*
Course Co-Chair: *Gaetano Rocco, *National Cancer Institute*

8:00 AM - 8:10 AM **WELCOME / INTRODUCTION**

Lung Cancer: The Role of Surgeons in Diagnosis & Staging
Moderators: *Gail E. Darling, *Toronto General Hospital*
*Gaetano Rocco, *National Cancer Institute*

8:10 AM - 8:25 AM
Lung Cancer Screening: How to Set Up a Lung Cancer Screening Program - How, Who, What Happens Next?
Betty C. Tong, *Duke University*

8:25 AM - 8:40 AM
Lung Cancer Screening: Opportunity for Molecular Diagnosis? Biomolecular Markers in Breath Samples & Plasma Based Biomarkers
*Jessica S. Donington, *NYU Langone Medical Center*

8:40 AM - 8:55 AM
Minimally Invasive Diagnostic Techniques for Tissue Diagnosis of Lung Lesions: Radial Miniprobe, Navigational Bronchoscopy—Do We Need Percutaneous Biopsy?
*Kazuhiro Yasufuku, *Toronto General Hospital*

8:55 AM - 9:10 AM
The Current Practice of Invasive Mediastinal Staging: EBUS, Mediastinoscopy, Mediastinal Lymphadenectomy, VAMLA - Differences between Guidelines & Reality: When is mediastinal Node Sampling not Indicated?
*Paul De Leyn, *Catholic University Leuven*

9:10 AM - 9:30 AM
Gladiators - Who Should Be Responsible for the Initial Diagnosis & Staging of Lung Cancer? Surgeons vs. Non-Surgeons: Competition or Collaboration?
*Sidharta P. Gangadharan, *Beth Israel Deconess Medical Center*
Moishe Liberman, *Centre Hospitalier de l'Universite de Montreal*

9:30 AM - 10:00 AM **COFFEE BREAK**

Lung Cancer
Moderators: *Joseph B. Shrager, *Stanford University*
*Dennis Wigle, *Mayo Clinic*

10:00 AM - 10:20 AM
Wedge Resection Is a Palliative Procedure for Lung Cancer
*Thomas A. D'Amico, *Duke University*
*Douglas E. Wood, *University of Washington*

10:20 AM - 10:40 AM
SBRT & Wedge Resection Are Equivalent Therapies for Early Stage Lung Cancer & Oligometastatic Disease
*David C. Rice, *MD Anderson Cancer Center*
*Scott J. Swanson, *Brigham & Women's Hospital*

10:40 AM - 10:50 AM
Surgeons & SBRT: How to Incorporate SBRT Into Your Practice
*Stephen R. Hazelrigg, *Southern Illinois University*

10:50 AM - 11:10 AM
Ask the experts - Small Lung Nodules: What do They Really Do?
Moderator & Expert: *Dennis Wigle, *Mayo Clinic*
Experts:
*Thomas A. D'Amico, *Duke University*
*Hiroshi Date, *Kyoto University*
*Frank C. Detterbeck, *Yale University*
Henrik Jessen Hansen, *Rigshospitalet*

11:10 AM - 11:25 AM
Locally Advanced Lung Cancer - Complex Pulmonary Resections: Indications, Evaluation, Technique, Tips & Tricks, & Results - Is it Worth the Risk?
Olaf Mercier, *Marie Lannelongue Hospital*

11:25 AM - 11:40 AM
N2 - Current Evidence: Is There Role for Surgery? Is There a Role for Postop Radiation for Surprise N2?
Linda W. Martin, *University of Maryland*

11:40 AM - 12:00 PM
Surgery for Stage IIIA N2 is a Surgical Disease
*Philippe G. Dartevelle, *Marie Lannelongue Hospital*
*Frank C. Detterbeck, Yale University

12:00 PM - 1:00 PM **LEGENDS LUNCHEON**
*Jean Deslauriers, *Institut Universitaire De Cardiologie Et De Pneumologie de Québec*

Infectious Problems in Thoracic Surgery
Moderator: *Joseph B. Zwischenberger, *University of Kentucky*

1:00 PM - 1:15 PM
Surgery for Mycobacterial Disease - TB & Atypical TB: Increasing Role for Surgery, Relearning Old Lessons
*John D. Mitchell, *University of Colorado*

1:15 PM - 1:30 PM
Extracorporeal Lung Support for Pneumonia: Indications & Results
Marcelo Cypel, *Toronto General Hospital*

1:30 PM - 1:45 PM
Post Pneumonic Empyema: Is There Still a Role for Surgery?
*M. Blair Marshall, *Georgetown University*

1:45 PM - 2:00 PM
Does the Surgeon Have a Role in the Management of Early (HGD- T1a) Esophageal Cancer?
Brian E. Louie, *Swedish Cancer Institute*

Esophageal Disease
Moderators: *Gail E. Darling, *Toronto General Hospital*
*Gaetano Rocco, *National Cancer Institute*

2:00 PM - 2:15 PM
Surgery for Squamous Cell Cancer of the Esophagus: Only for Salvage or as Part of Combined Modality Therapy?
*Stephen G. Swisher, *MD Anderson Cancer Center*

2:15 PM - 2:30 PM
T2 Esophageal Cancer: Does it Exist? Should You Give Preop Therapy?
*Traves D. Crabtree, *Washington University*

2:30 PM - 2:45 PM
Rescue for Complications Post Esophagectomy: The Role of Early Diagnosis & Intervention
*Andrew C. Chang, *University of Michigan*

2:45 PM - 3:00 PM
Primary Surgical Management of Esophageal Achalasia – POEM vs. Laparoscopic Myotomy
*Steven R. DeMeester, *University of Southern California*

3:00 PM - 3:15 PM
Transthoracic Hiatal Hernia Repair: Of Historic Interest Only?
*Thomas K. Varghese, Jr., *University of Washington*

3:15 PM - 3:30 PM **COFFEE BREAK**

3:30 PM - 3:45 PM
Why Quality Is the New Black
*Shaf Keshavjee, *Toronto General Hospital*
Thoracic Surgery - Metrics & Third Party Payers
Moderator: **Claude Deschamps, University of Vermont*

3:45 PM - 4:00 PM
What the Surgeon Needs To Know About Databases: How They Can Help You or Hurt You
*Alessandro Brunelli, *St. James's University Hospital*

4:00 PM - 4:15 PM
Outcome vs. Process Quality Indicators: What Is the Difference & How to Use Them
*Cameron D. Wright, *Massachusetts General Hospital*

4:15 PM - 4:30 PM
Never Ever Events in Surgery
*Stephen D. Cassivi, *Mayo Clinic*

4:30 PM - 5:00 PM
Ask the Experts - How to Practice Thoracic Surgery in the Pay for Quality Era
Moderator & Expert: *Douglas E. Wood, *University of Washington*
Experts:
*Alessandro Brunelli, *St. James's University Hospital*
*Stephen D. Cassivi, *Mayo Clinic*
*Claude Deschamps, University of Vermont
*Shaf Keshavjee, *Toronto General Hospital*
*Cameron D. Wright, *Massachusetts General Hospital*

*AATS Member

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
- Allied Health 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

DIDACTIC **COMMITTEE**

Pedro J. del Nido, Chair
David H. Adams, Co-Chair
Yolonda L. Colson, Co-Chair
Michael A. Acker
Erle H. Austin
Michael A. Borger
Duke E. Cameron
Joseph S. Coselli
Gail E. Darling
R. Duane Davis, Jr.
Steven R. DeMeester
Robert A. Dion
A. Marc Gillinov
Katherine J. Hoercher
Robert D. Jaquiss
Marc R. Moon
Hermann Reichenspurner
Gaetano Rocco
Thoralf M. Sundt, III
Lars G. Svensson
Pascal Thomas
Vinod H. Thourani
Victor T. Tsang
Ara A. Vaporciyan

ACCREDITATION **INFORMATION**

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 35 AMA PRA Category 1 Credits™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

American Academy for Nurse Practitioners (AANP) Accreditation

This program is approved for 16.1 contact hours of continuing education by the American Academy of Nurse Practitioners. Program ID 1402111. This program was planned in accordance with AANP CE Standards and Policies and AANP Support Standards.

American Academy of Physician Assistants (AAPA) Accreditation

This program has been reviewed and is approved for a maximum of 13.5 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 44.1 Category 1 CEUs.

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

Saturday, April 25, 2015 – up to 6 hours (CME, AANP, AAPA, ABCP)

- Adult Cardiac Skills, up to 6 hours
- Congenital Skills, up to 6 hours
- General Thoracic Skills, up to 5.75 hours
- Allied Health Personnel Symposium, up to 5.5 hours
- Optimal Therapies For End-Stage Thoracic Organ Failure, up to 6 hours
- Ethics Forum: Surgical Ethics Course, up to 5.5 hours
- Advanced Techniques for State of the Art Coronary Bypass Surgery Session, up to 2 hours

Sunday, April 26, 2015 – up to 8 hours (CME, AANP, AAPA, ABCP)

- Adult Cardiac Surgery, up to 8 hours
- Congenital Heart Disease, up to 7.5 hours
- General Thoracic Surgery, up to 8 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 on the Atrium Lobby on Level 4 of the Washington State Convention Center across from Registration. 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/aat151. 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.

For further information on the Accreditation Council for Continuing Medical Education (ACCME) Standards of Commercial Support, please visit www.accme.org.

GENERAL **INFORMATION**

DISCLOSURE **POLICY**

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 pharmaceuticals or medical devices occur.

DISCLOSURE **LIST**

Didactic Committee
The following committee members have disclosures with regard to commercial support.

***Michael A. Acker**
Consultant with Thoratec, Inc, HeartWare
***David H. Adams**
Inventor with Royalties from Edwards Lifesciences, Medtronic; National Co-PI with Medtronic
***Michael A. Borger**
Honorarium from Edwards Lifesciences, St. Jude Medical, Sorin
***Yolonda L. Colson**
Invited Speaker with Novadaq Technologies;
***Joseph S. Coselli**
Grants/Research Support from Glaxo Smith Kline, Vascutek Terumo; Consultant with Vascutek Terumo; Honorarium from Vascutek Terumo
***R. Duane Davis, Jr.**
Speaker with Atricure; Consultant with Transplant Management Group, Allmed, UAB, Bayer; Research Support from Vitrolife, NIH, Perfusix
***Steven R. DeMeester**
Grants/Research Support from Novadaq, Bard / Davol, C2 Therapeutics; Consultant with Bard, Novadaq
***Robert A. Dion**
Speaker with Edwards Lifesciences, Sorin Biomedical; Consultant with Sorin Biomedical
***A. Marc Gillinov**
Speaker with Edwards Lifesciences, Medtronic, AtriCure, Intuitive; Consultant with Edwards Lifesciences, Medtronic, AtriCure, Tendyne, On-X, Abbott; Shareholder with Clear Catheter; Research Support from St. Jude Medical
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Consultant with Thorasos, Inc.
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***Pascal Thomas**
Speaker with Ethicon Endosurgery, Covidien
***Vinod H. Thourani**
Grants/Research Support from Edwards Lifesciences, St. Jude Medical, Medtronic, Sorin Medical; Consultant with Edwards Lifesceinces, Boston Scientific, Abbott Medical, St. Jude Medical; Stock Shareholder with Apica
***Victor T. Tsang**
Research Support from Great Ormond Stree Children's Charity Grant, NIHR Grant on Morbidity Project, EUT Grant

The following committee members have nothing to disclose with regard to commercial support.

***Erle H. Austin**
***Duke E. Cameron**
***Gail E. Darling**
***Pedro J. del Nido**
Katherine J. Hoercher
***Robert D. Jaquiss**
***Marc R. Moon**
***Hermann Reichenspurner**
***Gaetano Rocco**
***Ara A. Vaporciyan**

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

***Michael A. Acker**
Consultant with Thoratec, Inc, HeartWare
***David H. Adams**
Inventor with Royalties from Edwards Lifesciences, Medtronic; National Co-PI with Medtronic
***Gorav Ailawadi**
Consultant with Abbott Vascular, Edwards Lifesciences, Mitralign; Honorarium from St. Jude
***Francisco A. Arabia**
Consultant with Syncardia
Lee Benson
Honorarium from Medtronic Inc
Ross M. Bremner
Grants/Research Support from Ethicon Endo-Surgery; Consultant with Endostim
***Alessandro Brunelli**
Consultant with Medela Healthcare, Switzerland
***Stephen D. Cassivi**
Manufacturer for Patent Pending in Brachytherapy Delivery Device
***Andrew C. Chang**
Financial/Material Support from Michigan Society of Thoracic and Cardiovascular Surgery Taweezak Chotivatanapong Honorarium from Edwards Lifescience.
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Grants/Research Support from Medtronic, Boston Scientific; Consultant with Medtronic, Carbomedics; Honorarium from Medtronic
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Grants/Research Support from Glaxo Smith Kline, Vascutek Terumo; Consultant with Vascutek Terumo; Honorarium from Vascutek Terumo
***Traves D. Crabtree**
Consultant with Ethicon Endosurgery
***Yves d'Udekem**
Consultant with MSD
***Ralph J. Damiano, Jr.**
Grants/Research Support from Edwards; Consultant with AtriCure; Honorarium from Edwards Lifesciences
***Thomas A. D'Amico**
Consultant with Scanlan
***R. Duane Davis, Jr.**
Speaker with Atricure; Consultant with Transplant Management Group, Allmed, UAB, Bayer; Research Support from Vitrolife, NIH, Perfusix
***Malcolm M. DeCamp**
Consultant with PneumRx, Pumonx, Holaira
***Steven R. DeMeester**
Grants/Research Support from Novadaq, Bard / Davol, C2 Therapeutics; Consultant with Bard, Novadaq
***Robert A. Dion**
Speaker with Edwards Lifesciences, Sorin Biomedical; Consultant with Sorin Biomedical
Sitaram Emani
Consultant with Teva Pharmaceuticals
***Volkmar Falk**
Grants/Research Support from Phillips; Consultant with Medtronic, Valtech; Honorarium from Edwards
***Hiran C. Fernando**
Consultant with CSA MEdical, Galil
***A. Marc Gillinov**
Speaker with Edwards Lifesciences, Medtronic, AtriCure, Intuitive; Consultant with Edwards Lifesciences, Medtronic, AtriCure, Tendyne, On-X, Abbott; Shareholder with Clear Catheter; Research Support from St. Jude Medical
Mattia Glauber
Advisory Board with Sorin; Honorarium from Sorin, Medtronic
Henrik Jessen Hansen
Honorarium from Covidien
Mark Gerard Hazekamp
Financial/Material Support from Admedus Company, Perth, Australia
***Sidney Levitsky**
Consultant with On-X Life Technologies
Moishe Liberman
Grants/Research Support from Ethicon Endosurgery, Boston Scientific
Brian Louie
Grants/Research Support from Torax Medical Incorporated; Consultant with Torax Medical Incorporated
***M. Blair Marshall**
Consultant with Ethicon
Linda W. Martin
Consultant with St. Jude Medical, Veryan Medical; Financial/Material Support from Boston Scientific, Abbott
***D. Craig Miller**
Consultant with GenTAC/ NHLBI, Abbott Vascular MitraClip, Medtronic Cardiovascular Division, PARTNER U.S. Trial, Edwards PARTNER Trial
***John D. Mitchell**
Consultant with Covidien
Jose Luis Navia
Consultant with Edwards Lifesciences
Daniel S. Oh
Consultant with Covidien
***Richard G. Ohye**
Consultant with Sorin
Philippe Pibarot
Grants/Research Support from Edwards Life Sciences, V-Wave Ltd.
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Consultant with Medtronic
***David C. Rice**
Consultant with Olympus America, Inc.
***Joseph F. Sabik**
Grants/Research Support from Edwards, Abbott; Consultant with Sorin, Medtronic; Honorarium from Medtronic
NoJan D. Schmitto
Consultant with HeartWare, Thoratec
***Joseph B. Shrager**
Consultant with Maquet, Inc.; Varian, Inc.
Scott C. Silvestry
Grants/Research Support from Thoratec; Consultant with Thoratec, Heartware

Amy Simone
Honorarium from Edwards Lifesciences
***Nicholas G. Smedira**
Consultant with Edwards Lifesciences
***Thoralf M. Sundt , III**
Consultant with Thorasos, Inc.
***Rakesh M. Suri**
Grants/Research Support from Sorin, Edwards, Abbott, St. Jude; Consultant with Sorin, Abbott; Financial/ Material Support from Abbott, St. Jude Medical
***Lars G. Svensson**
Speaker with Svensson LG; Shareholder with Cardiosolutions, ValveExchange, Posthorax
***Scott J. Swanson**
Consultant with Ethicon
***Stephen G. Swisher**
Consultant with GlaxoSmithKline; Honorarium from Memorial Sloan Kettering Cancer Center
***Wilson Y. Szeto**
Grants/Research Support from Edwards Lifesciences, Medtronic, Sorin
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***James S. Tweddell**
Consultant with CorMatrix
Eric Vallieres
Consultant with GSK Bio, Myriad, Uptake Medical; Honorarium from Genentech
***Glen Van Arsdell**
Stock Shareholder with CellAegis
Thomas K. Varghese
Grants/Research Support from Nestle Healthcare Institute, Pacira Pharmaceuticals
***Douglas E. Wood**
Grants/Research Support from Spiration; Consultant with Spiration
***Kazuhiro Yasufuku**
Grants/Research Support from Olympus Medical Systems Corp, Intuitive Surgical Inc, Siemens; Consultant with Olympus America Inc, Intuitive Surgical Inc, Covidien, Ethicon
***Joseph B. Zwischenberger**
Research Support Recipient: NIH; Royalties fromAvalon LLC/Maquet

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George Alfieris
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The following faculty members have nothing to disclose with regard to commercial support. The following faculty members plan on discussing unlabeled/investigational uses of a commercial product.

Holger Buchholz
Off-label/unapproved use discussion - HeartWare
Mani A. Daneshmand
Off-label/unapproved use discussion - Quadrox - I Oxygenator
***Pedro J. del Nido**
Off-label/unapproved use discussion - Melody valve from Medtronic use in mitral position
Ahmed El-Eshmawi
Off-label/unapproved use discussion - Implantation of a percutaneous Melody Valve into the Mitral position under the FDA humaniterian exemption
***Richard Finley**
Off-label/unapproved use discussion - Fuzzy microcoil
***Nader Moazami**
Off-label/unapproved use discussion - Impella RD pump for RV failure
Evgenij V. Potapov
Off-label/unapproved use discussion - HeartWare RVAD
Masaaki Sato
Off-label/unapproved use discussion - Synapse Vincent
Hiroo Takayama
Off-label/unapproved use discussion - Rotaflow, CentriMag

The following faculty members have disclosures with regard to commercial support. The following faculty members plan on discussing unlabeled/investigational uses of a commercial product.

***Michael A. Borger**
Honorarium from Edwards Lifesciences, St. Jude Medical, Sorin; *Off- label/unapproved use discussion* - Edwards Intuity valve
***Rapheal Bueno**
Grants/Research Support fromGenentech, Myriad, Siemens, Novartis, Verastem; *Off-label/unapproved use discussion* - T-bar for marking lung nodules
Anson Cheung
Consultant with St. Jude Medicals, Edwards Lifesciences, HeartWare Inc, Neovasc Inc, Entourage Medicals, Kardium Medicals; Honorarium from St. Jue Meidcals, Edwards Lifesciences, HeartWare Inc, Neovasc Inc. *Off- label/ unapproved use discussion* - use of transcatheter valve use in mitral valve- in-valve (non-FDA approved indication)
***Yolonda L. Colson**
Invited Speaker with Novadaq Technologies; *Off-label/ unapproved use discussion* - Lymphatic migration of indocyanine green
Matthew J. Eagleton
Consultant with Cook Medical, Bolton Medical; *Off-label/ unapproved use discussion* - The use of branched aortic endografts (investigational within the United States and are placed as part of IDE studies)
***Gregory P. Fontana**
Grants/Research Support fromSt Jude Medical; Consultant with Sorin Medical; Stock Shareholder with Entourage Medical Technology; *Off-label/unapproved use discussion* - Will present some devices not yet commercially available in USA
Reginald I. Low
Consultant with Abbott Vascular, Boston Scientific, Direct Flow Medical; Stock Shareholder with Direct Flow Medicial; *Off-label/unapproved use discussion* - Direct Flow Medical TAVR
***Michael J. Mack**
Consultant with Edwards Lifesciences, Abbott Vascular; *Off-label/unapproved use discussion* - Valve in Valve
***Eric E. Roselli**
Consultant with Medtronic, Edwards; Stock Shareholder with Apica; Honorarium from Terumo, Cook, Sorin. *Off-label/unapproved use discussion* - thoracic stentgrafts
***Malakh L. Shrestha**
Consultant with Vascutek terumo, Edwards lifesciences, Sorin; *Off- label/unapproved use discussion* - Thoraflex hybrid frozenelephant trunk

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

AATS 96TH ANNUAL MEETING 2016

SAVE THE DATE

May 14 – 18, 2016

Baltimore Convention Center
Baltimore, MD, USA

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500 Cummings Center, Suite 4550 | Beverly, MA 01945
978-927-8330 | Fax 978-524-0498 | meetings@aats.org | www.aats.org

95TH

AATS ANNUAL MEETING 2015

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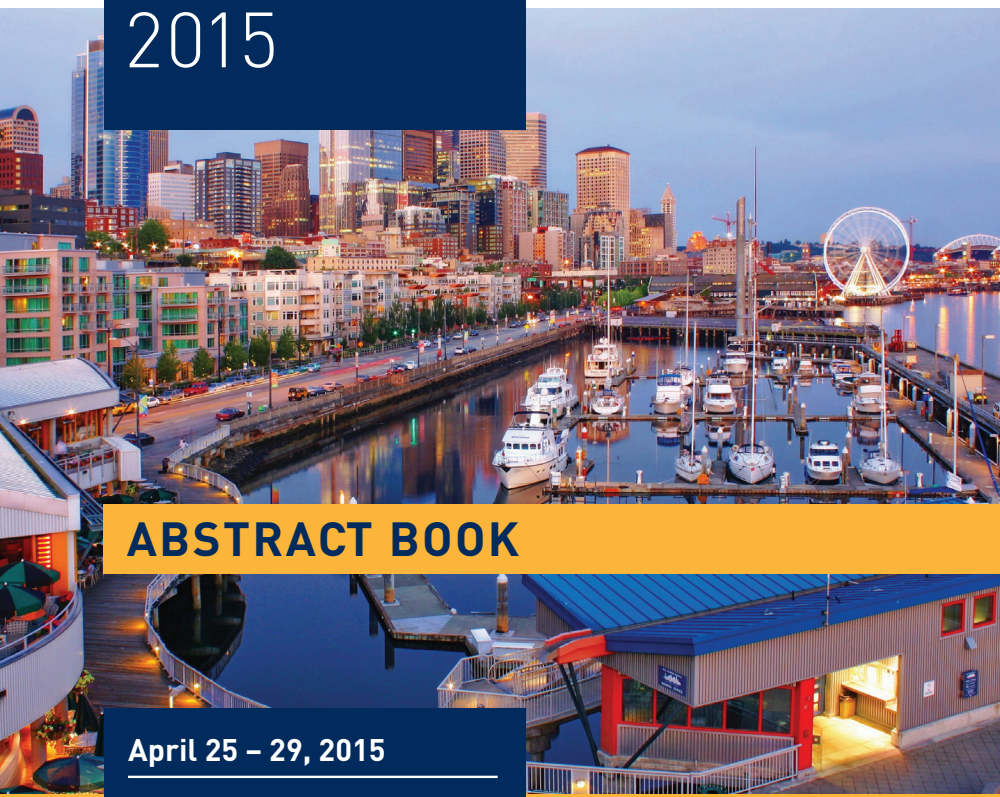

ABSTRACT BOOK

April 25 – 29, 2015

Washington State Convention Center
Seattle, WA, USA

TABLE OF CONTENTS

AATS – PROMOTING SCHOLARSHIP IN THORACIC AND CARDIOVASCULAR SURGERY

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.

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
- ❑ Allied Health 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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ACCREDITATION INFORMATION

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 **35 *AMA PRA Category 1 Credits***™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

American Academy for Nurse Practitioners (AANP) Accreditation

This program is approved for 16.1 contact hours of continuing education by the American Academy of Nurse Practitioners. **Program ID** 1402111.

This program was planned in accordance with AANP CE Standards and Policies and AANP Support Standards.

American Academy of Physician Assistants (AAPA) Accreditation

This program has been reviewed and is approved for a maximum of 13.5 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 44.1 Category 1 CEUs.

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

Saturday, April 25, 2015 – up to 8 hours (CME, AANP, AAPA, ABCP)
Adult Cardiac Skills, up to 6 hours
Congenital Skills, up to 6 hours
General Thoracic Skills, up to 5.75 hours
Allied Health Personnel Symposium, up to 5.5 hours
Optimal Therapies For End-Stage Thoracic Organ Failure, up to 6 hours
Ethics Forum: Surgical Ethics Course, up to 5.5 hours
Advanced Techniques for State of the Art Coronary Bypass Surgery Session, up to 2 hours

Sunday, April 26, 2015 – up to 8 hours (CME, AANP, AAPA, ABCP)
Adult Cardiac Surgery, up to 8 hours
Congenital Heart Disease, up to 7.5 hours
General Thoracic Surgery, up to 8 hours

Monday, April 27, 2014 – up to 8 hours (CME, ABCP)
Plenary Scientific Session, Basic Science Lecture, Presidential Address, up to 3.5 hours
Ethics Forum Lunch, 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 Session, up to 1.5 hours
Integrating Advanced Imaging in Planning Interventions, up to 1.5 hours
Functional MR: A Surgical Disease?, up to 1.5 hours

Tuesday, April 28, 2014 – 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 Speaker Lecture, not for credit
Adult Cardiac Surgery Simultaneous Session, up to 3 hours
Congenital Heart Disease Simultaneous Session, up to 3 hours
General Thoracic Surgery Simultaneous Session, up to 3 hours
Aortic/Endovascular Simultaneous Session, up to 3 hours

Wednesday, April 29, 2014 – up to 3 hours (CME, ABCP)
Adult Cardiac Surgery Simultaneous Session, up to 1.5 hours
Congenital Heart Disease Simultaneous Session, up to 1.5 hours
General Thoracic Surgery Simultaneous Session, up to 1.5 hours
Adult Cardiac Masters of Surgery Video Session, up to 1.5 hour
Congenital Masters of Surgery Video Session, up to 1.5 hours
General Thoracic Masters of Surgery Video Session, up to 1.5 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 Atrium Lobby on Level 4 of the Washington State Convention Center across from Registration. 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/aat151.

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.

DISCLOSURE POLICY

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 pharmaceuticals or medical devices occur.

For further information on the Accreditation Council for Continuing Medical Education (ACCME) Standards of Commercial Support, please visit www.accme.org.

Disclosure List

Abstract and Education Committees

The following committee members have disclosures with regard to commercial support.

***Michael A. Acker**	Consultant with Thoratec, Inc., HeartWare, Inc.
***David H. Adams**	Royalties from Edwards Lifesciences, Medtronic; National Co-PI with Medtronic
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***Frank C. Detterbeck**	Speaker with Lilly; Consultant with Covidien; Research Support from Medela Corporation
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***Daniel L. Miller**	Advisor with Ethicon Endosurgery, Inc., Davol-Bard, Inc.
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***Thomas K. Waddell**	Stock Shareholder with XOR Labs Toronto Inc., Perfusix US
***Joseph B. Zwischenberger**	Research Support from NIH; Royalties from Maquet, Inc., Avalon, LLC

The following committee members have nothing to disclose with regard to commercial support.

***Anelechi C. Anyanwu**
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***Michael A. Acker**	Consultant with Thoratec, Inc., HeartWare, Inc.
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***Gorav Ailawadi**	Consultant with Abbott Vascular, Edwards Lifesciences, Mitralign; Honorarium from St. Jude
***G. Hossein Almassi**	Grant/Research Support from Eli Lilly
***Emile A. Bacha**	Speaker and Advisor with CorMatrix
Vinayak Bapat	Advisor with Edwards Lifesciences; Research Support from Edwards Lifesciences
***Friedhelm Beyersdorf**	Consultant with Dr. Kohler Chemie, Germany
***Eugene H. Blackstone**	Grants/Research support and Consultant with Edwards Lifesciences
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***Stephen D. Cassivi**	Manufacturer for Patent Pending in Brachytherapy Delivery Device
Anson Cheung	Consultant with Edwards Lifesciences, Entourage Medical, HeartWare Inc., Neovasc Inc., St. Jude Medical; Speakers Bureau with HeartWare Inc., St. Jude Medical
***Yolonda L. Colson**	Invited Speaker with Novadaq Technologies
***Joseph S. Coselli**	Speaker with Vascutek Terumo; Consultant with St. Jude Medical, Inc., WL Gore & Associates; Medtronic, Inc., Vascutek Terumo; Research Support from Glaxo Smith Kline, WL Gore & Associates, Medtronic, Inc., Edwards Lifesciences; Royalties from Vascutek Terumo
***Juan A. Crestanello**	Research Support from Medtronic, Inc., Abbott Vascular
***Ralph J. Damiano**	Consultant with AtriCure; Grants/Research Support & Speaker Honorarium from Edwards Lifesciences
***R. Duane Davis, Jr.**	Speaker with Atricure; Consultant with Transplant Management Group, Allmed, UAB, Bayer; Research Support from Vitrolife, NIH, Perfusix
***Abe DeAnda**	Consultant with Baxter, Inc.
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Benoit de Varennes	Consultant with Medtronic
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Todd Dewey	Consultant with Edwards Lifesciences
***Robert A. Dion**	Speaker with Edwards Lifesciences, Sorin Biomedical; Consultant with Sorin Biomedical
Augusto D'Onofrio	Consultant with Edwards Lifesciences
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Theodor J.M. Fischlein	Consultant with Sorin Italia
Ann C. Gaffey	Grant/Research Support from TSFRE Nina Starr Braunwald Research Fellowship

Sebastien Gilbert	Major Stockholder with BMS, Lilly Eli Co., Merck, Pfizer, Sanofi; Financial/Material Support from Meldela Inc.
***A. Marc Gillinov**	Speaker with Edwards Lifesciences, Medtronic, AtriCure, Intuitive; Consultant with Edwards Lifesciences, Medtronic, AtriCure, Tendyne, On-X, Abbott; Shareholder with Clear Catheter; Research Support from St. Jude Medical
***Thomas G. Gleason**	Grant/Research Support from Medtronic; National Screening and Steering Committees with Medtronic
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***Scott J. Swanson**	Consultant with Ethicon
***Wilson Y. Szeto**	Grant/Research Support from Edwards Lifesciences
***David P. Taggart**	Consultant & Grant/Research Support from Vascular Graft Solutions
***Vinod H. Thourani**	Advisor: Abbott Medical, St. Jude Medical, Edwards Lifesciences; Research Support from St. Jude Medical, Edwards Lifesciences, Medtronic, Sorin Medical; Royalties from Apica Cardiovascular IP

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Kazumasa Tsuda	Grant/Research Support from Grants-In-Aid for Scientific Research of the Japanese Ministry of Education, Culture, Sports, Science and Technology
***Stephen G. Swisher**	Consultant with GlaxoSmithKline
Mani Vannan	Speaker & Research Support from Siemens Healthcare
***Thomas K. Waddell**	Advisor with Perfusix US, Lunch Biotechnology Inc.; Shareholder with XOR Labs Toronto, Inc.
Brian K. Whisenant	Speaker with Edwards Lifesciences
***Mathew Williams**	Consultant with Medtronic, Edwards Lifesciences, Abbott; Research Support from Medtronic
***Kazuhiro Yasufuku**	Consultant with Olympus America Inc., Intuitive Surgical Inc., Covidien, Ethicon; Grants/Research Support from Olympus Medical Systems Corp, Intuitive Surgical Inc., Siemens
George L. Zorn	Consultant with Edwards Lifesciences, Medtronic
***Joseph B. Zwischenberger**	Research Support from NIH; Royalties from Maquet, Inc., Avalon, LLC

The following faculty 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.

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***Tirone E. David**
***Marc De Perrot**
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***Pedro J. del Nido**
Eva Maria Delmo Walter
***Todd L. Demmy**
***Frank C. Detterbeck**
Ashley Dickens
Yiqun Ding
Richard Dobson
***Jesssica S. Donington**
Tacy E. Downing
James R. Edgerton
***Pirooz Eghtesady**
***Gebrine El Khoury**
Daniel H. Enter
Assunta Fabozzo
Giovanni Ferrari
Pier Luigi Filosso
Christian J. Finley
Tyson A. Fricke
***Joseph S. Friedberg**
Shinichi Fukuhara
***David A Fullerton**
***Mark E. Galantowicz**
***James S. Gammie**
***Sidharta P. Gangadharan**
Mario F.L. Gaudino
***J. William Gaynor**
Cengiz Gebitekin
Galal R. Ghaly
Erin A. Gillaspie
Mark E. Ginsburg
***Leonard Girardi**
David Glineur
Igor Gosev
***Juan B. Grau**
Joshua C. Grimm
***Peter J. Gruber**
Tianxiang Gu
Zhitao Gu
Brian C. Gulack
***David H. Harpole**
Kohei Hashimoto
Jianxiang He
Meghana R.K. Helder
Matthew C. Henn
***Jennifer C. Hirsch-Romano**
Katherine J. Hoercher
Sophie C. Hofferberth
***Charles B. Huddleston**
***G. Chad Hughes**

*Hajime Ichikawa
Jahanzaib Idrees
*John S. Ikonomidis
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*David R. Jones
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Daniel Kim
Joon Bum Kim
*James Kirklin
Terumoto Koike
*Nicholas T. Kouchoukos
*Benjamin D. Kozower
*Alexander S. Krupnick
*Francois G. Lacour-Gayet
Timothy S. Lancaster
Damien J. LaPar
*Jennifer S. Lawton
*Harold L. Lazar
*Jay M. Lee
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Shoujun Li
Yin Li
Mauro Lo Rito
*Andrew J. Lodge
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*James D. Luketich
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*Hersh S. Maniar
Khalil Masabni
*David P. Mason
*John E. Mayer
Fenton H. McCarthy
*E. Dean McKenzie
Robert A. Medairos
Ju Mei
Spencer J. Melby
Carlos M. Mery
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*Susan D. Moffat-Bruce
*Ralph S. Mosca
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Matthew Mulligan
*Claudio Muneretto
*Sudish C. Murthy
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Kazunori Okabe
*Steve O'Neill
Maral Ouzounian
Shakirat Oyetunji
Muralidhar Padala
*Himanshu J. Patel
Ed Peng
*Arjun Pennathur
*Gosta B. Pettersson
*Si Mai Pham
Jennifer L. Philip
Eitan Podgaetz
*Joel Price
*Jose L. Pomar
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Xuefeng Qiu
*James A. Quintessenza
Siva Raja
Keshava Rajagopal
Sajjad Raza
*T. Brett Reece
Rob Rice
R. Taylor Ripley
*Nabil Rizk
Michael Robich
*Todd K. Rosengart
*Marc Ruel
Mark Ruzmetov
Siavash Saadat
*Robert M. Sade
Pablo G. Sanchez
*Shunji Sano
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Jonathan E. Sargent
Erin M. Schumer
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*Lars G. Svensson
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Yusuke Terasaki
Pasquale Totaro
Robert F. Tranbaugh
Masaki Tsukashita
Hiroyuki Tsukui
*Ching Tzao
Chikara Ueki
Prashanth Vallabhajosyula
*Ara A. Vaporciyan
Olivier Villemain
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*Glenn J. Whitman
*Richard Whyte
Travis J. Wilder
Andrea S. Wolf
*Y. Joseph Woo
*Douglas E. Wood
Geena Wu
Fucheng Xiao
David W. Yaffee
Chi-Fu Yang
Can Yerebakan
Byron Yip
Matthew Yong
Yang Yu
Yang Zhao
Yunge Zhao
Yifan Zheng
Jiaquan Zhu

*AATS Member

The following faculty members have nothing to disclose with regard to commercial support. The following faculty members plan on discussing unlabeled/investigational uses of a commercial product.

Andrea Colli	*Off-label/unapproved use discussion* – NeoChord DS 1000, NeoCord Inc
Krista J. Hachey	*Off-label/unapproved use discussion* – Lymphatic mapping using the Novadaq PINPOINT endoscopic system and Indocyanine Green (ICG).
Narutoshi Hibino	*Off-label/unapproved use discussion* – CorMatrix

The following faculty members have disclosures with regard to commercial support. The following faculty members plan on discussing unlabeled/investigational uses of a commercial product.

Lenard Conradi	Consultant & Grants/Research Support fromEdwards Lifesciences; *Off-label/unapproved use discussion* – valve in valve procedures with THV intended for native aortic stenosis or regurgitation
Ourania Preventza	Consultant with Medtronic, Vascutek; Financial/ Material Support from Cook Medical, Gore; *Off-label/ unapproved use discussion* – Gore TAG thoracic stent graft and C- TAG thoracic stent graft
***Malakh Shrestha**	Consultant with Vascutek; *Off-label/unapproved use discussion* – thoraflex hybrid

AATS Staff

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

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SATURDAY, APRIL 25, 2015

4:00 PM **ADVANCED TECHNIQUES FOR STATE OF THE ART CORONARY BYPASS SURGERY SESSION** Room 6A, WSCC

Course Chair: *John D. Puskas, *Icahn School of Medicine at Mount Sinai*

Course Co-Chairs: *David P. Taggart, *University of Oxford*
*Joseph F. Sabik, *Cleveland Clinic Foundation*

4:00 PM – 4:05 PM
Welcome and Introduction
*John D. Puskas, *Icahn School of Medicine at Mount Sinai*

4:05 PM – 4:20 PM
BITA Grafting: Why to Do It (Evidence for BITA)
*David P. Taggart, *University of Oxford*

4:20 PM – 4:30 PM
BITA Grafting: When to Do It (When to Not Do It)
*Joseph F. Sabik, *Cleveland Clinic Foundation*

4:30 PM – 4:40 PM
BITA Grafting: How to Do It (Skeletonization Made Easy)
*John D. Puskas, *Icahn School of Medicine at Mount Sinai*

4:40 PM – 4:55 PM
Radial Artery Grafting: Why to Do It (Evidence for RA Grafting)
*David P. Taggart, *University of Oxford*

4:55 PM – 5:05 PM
Radial Artery Grafting: When to Do it (When to Not Do It)
*Joseph F. Sabik, *Cleveland Clinic Foundation*

5:05 PM – 5:15 PM
Radial Artery Grafting: How to Do it (ERH, Pharmacology, etc.)
*John D. Puskas, *Icahn School of Medicine at Mount Sinai*

5:15 PM – 5:20 PM
Configurations of Arterial Grafts: In Situ Versus Composite Arterial Conduits
*David P. Taggart, *University of Oxford*

5:20 PM – 5:30 PM
Configurations of Arterial Grafts: Configurations of ITA, RA and SVG Grafts
*Joseph F. Sabik, *Cleveland Clinic Foundation*

5:30 PM – 5:40 PM
Configurations of Arterial Grafts: When to Use a SVG Graft
*Joseph F. Sabik, *Cleveland Clinic Foundation*

5:40 PM – 5:45 PM
Clampless CABG Techniques: Clampless Anastomotic Facilitating Devices
*John D. Puskas, *Icahn School of Medicine at Mount Sinai*

5:45 PM – 5:50 PM
Clampless CABG Techniques: Anaortic CABG with ITA Inflow(s)
*John D. Puskas, *Mount Sinai Beth Israel*

5:50 PM – 6:00 PM
How I Decide Conduits and How I Do It: Case Review by Expert Panel
*John D. Puskas, *Icahn School of Medicine at Mount Sinai*
*David P. Taggart, *University of Oxford*

MONDAY, APRIL 27, 2015

6:30 AM **Maintenance of Certification Information Breakfast** Room 6E, WSCC
Not for Credit

Faculty: *Bryan Meyers, *Chair, ABTS MOC Committee*
*Richard Shemin, *Chair, American Board of Thoracic Surgery*

In response to changes instituted by the American Board of Medical Specialties, and in accordance with trends seen in all other member certifying boards, the American Board of Thoracic Surgery has fine-tuned the requirements for Diplomates who face a 5-year and 10-year Milestone in the Maintenance of Certification process. This Early Riser Session will clearly outline expectations that Diplomates may face during this process. This session will be useful and pertinent to all ABTS Diplomates, but it will be most useful for those in the 4th, 5th, 8th, 9th and 10th year of the ABTS MOC cycle. Potentially, 40% of AATS members who are ABTS certified will have important duties with regard to MOC in the next 6–18 months. An important change is occurring this year with regard to the MOC Part III secure examination that is required in the 8th, 9th or 10th year of the cycle.

*AATS Member

7:20 AM **Business Session,** *AATS Members Only*

7:30 AM **PLENARY SCIENTIFIC SESSION** Room 4E, WSCC
8 minute presentation, 12 minute discussion
Moderators: *Pedro J. del Nido and *Marc R. Moon

1. Outcomes of 3264 Thoracoabdominal Aortic Aneurysm Repairs
*Joseph S. Coselli, Ourania Preventza, Kim I. de la Cruz, *Denton A. Cooley, Matt D. Price, Susan Y. Green, Courtney C. Nalty, *Todd K. Rosengart, *Scott A. LeMaire
Baylor College of Medicine, Texas Heart Institute, Houston, TX

Invited Discussant: *Nicholas T. Kouchoukos

2. Late Survival and Right Ventricular Performance in 332 Matched Children: Classic Norwood-BT Shunt Versus Norwood-Sano Modification
Travis J. Wilder[1], Brian W. McCrindle[2], *Eugene H. Blackstone[3], Rajeswaran Jeevanantham[3], *William G. Williams[1], *William M. DeCampli[4], *Jeffery P. Jacobs[5], *Marshall L. Jacobs[6], Tara Karamlou[7], *Paul M. Kirshbom[8], *Gary K. Lofland[1], Alistair B. Phillips[9], *Gerhard Ziemer[10], Edward J. Hickey[2]
[1]Congenital Heart Surgeons Society Data Center, Toronto, ON, Canada; [2]The Hospital for Sick Children, Toronto, ON, Canada; [3]The Cleveland Clinic, Cleveland, OH; [4]Arnold Palmer Hospital for Children University of Central Florida College, Orlando, FL; [5]All Children's Hospital, Saint Petersburg, FL; [6]Johns Hopkins, Newtown Square, PA; [7]University of California, San Francisco School of Medicine, San Francisco, CA; [8]Yale University, New Haven, CT; [9]Cedars Sinai Medical Center, Los Angeles, CA; [10]University of Chicago Medical Center, Chicago, IL

Invited Discussant: *Richard G. Ohye

3. Randomized Trial of Digital Versus Analog Pleural Drainage in Patients with or Without a Pulmonary Air Leak After Lung Resection
Sebastien Gilbert[1], Anna L. McGuire[2], Ramzi Addas[1], Sonam Maghera[2], Andrew J.E. Seely[1], Donna E. Maziak[1], Patrick J. Villeneuve[1], Farid M. Shamji[1], *Sudhir Sundaresan[1]
[1]University of Ottawa, Ottawa, ON, Canada; [2]University of British Columbia, Vancouver, BC, Canada

Invited Discussant: *Robert J. Cerfolio

4. Positive Impact of Concomitant Tricuspid Annuloplasty on Tricuspid Regurgitation, Right Ventricular Function, and Pulmonary Artery Hypertension After Degenerative Mitral Repair
*Joanna Chikwe, Shinobu Itagaki, *Anelechi Anyanwu, *David H. Adams
The Icahn School of Medicine at Mount Sinai, New York, NY

Invited Discussant: *A. Marc Gillinov

8:50 AM **AWARD PRESENTATIONS**

9:05 AM **INTERMISSION – VISIT EXHIBITS/COFFEE BREAK**

9:45 AM **BASIC SCIENCE LECTURE**
Biologically Inspired Engineering: The Next Technology Wave
Donald E. Ingber, MD, PhD
Wyss Institute for Biologically Inspired Engineering

10:25 AM **PLENARY SCIENTIFIC SESSION**
Moderators: *Joseph S. Coselli and *Marc R. Moon

5. Transcoronary Infusion of Cardiac Progenitor Cells in Hypoplastic Left Heart Syndrome: 2.5-Year Follow-Up of the TICAP Trial
*Shunji Sano, Shuta Ishigami, Takuya Goto, Daiki Ousaka, Suguru Tarui, Michihiro Okuyama, Sadahiko Arai, Kenji Baba, Shingo Kasahara, Shinichi Otsuki, Hidemasa Oh
Okayama University, Okayama, Japan

Invited Discussant: *John E. Mayer

6. A Multicenter Propensity-Score Analysis of 991 Patients with Severe Aortic Stenosis and Intermediate-High Risk Profile: Conventional Surgery Versus Sutureless Valves Versus TAVR
*Claudio Muneretto[1], *Ottavio Alfieri[2], Michele De Bonis[3], Roberto Di Bartolomeo[4], Gianluigi Bisleri[1], Carlo Savini[4], Gianluca Folesani[4], Lorenzo Di Bacco[1], Manfredo Rambaldini[5], Juan Pablo Maureira[6], Francois Laborde[7], Maurizio Tespili[8], Alberto Repossini[1], Thierry A. Folliguet[9]
[1]University of Brescia Medical School, Brescia, Italy; [2]Università Vita-Salute San Raffaele, Milano, Italy; [3]San Raffaele University Hospital, Milan, Italy; [4]University of Bologna, Bologna, Italy; [5]Azienda Ospedaliera Carlo Poma, Mantova, Italy; [6]CHU de Nancy, Nancy, France; [7]Institut Mutualiste Montsouris, Parigi, France; [8]Ospedale di Seriate, Seriate, Italy; [9]Centre Hospital-Universitaire Brabois ILCV, Vandoeuvre les Nancy, France

Invited Discussant: *Friedrich W. Mohr

11:05 AM **NEW MEMBER INDUCTION**

11:25 AM **PRESIDENTIAL ADDRESS**
Technological Innovation in Cardiothoracic Surgery: A Pragmatists Approach
***Pedro J. del Nido**, *Boston Children's Hospital*

12:15 PM **ADJOURN FOR LUNCH – VISIT EXHIBITS**

*AATS Member

12:30 PM **ETHICS FORUM LUNCH** Room 613, WSCC
Separate Registration Required
Should a Physician Inform an Innocent Contact About HIV Exposure, Against State Law?
Moderator: *Robert M. Sade
Pro: *Richard I. Whyte
Con: Steve F. O'Neill

12:30 PM **PREPARING YOURSELF FOR AN ACADEMIC CAREER LUNCHEON** Room 6E, WSCC *Not for Credit*
Residents, Fellows, and Medical Students Only

MONDAY AFTERNOON, APRIL 27, 2015

2:00 PM **ADULT CARDIAC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 6B, WSCC
8 minute presentation, 12 minute discussion
Moderators: *John D. Puskas and *Leonard N. Girardi

7. Appropriate Patient Selection or Healthcare Rationing? Lessons from Surgical Aortic Valve Replacement in the PARTNER-I Trial
*Eugene H. Blackstone[1], *Wilson Y. Szeto[2], *Lars G. Svensson[1], Jeevanantham Rajeswaran[1], John Ehrlinger[1], *Rakesh M. Suri[3], *Craig R. Smith[4], *Michael Mack[5], *D. Craig Miller[6], *Patrick M. McCarthy[7], *Joseph E. Bavaria[8], *Lawrence H. Cohn[9], Paul J. Corso[10], *Robert A. Guyton[11], *Vinod H. Thourani[11], *Bruce W. Lytle[1], *Mathew R. Williams[12], John G. Webb[13], Samir Kapadia[1], E. Murat Tuzcu[1], *David J. Cohen[14], *Hartzell V. Schaff[3], Martin B. Leon[4]
[1]Cleveland Clinic, Cleveland, OH; [2]University of Pennsylvania Medical Center, Philadelphia, PA; [3]Mayo Clinic, Rochester, MN; [4]New York-Presbyterian Hospital, Columbia University, New York, NY; [5]Baylor Health Care System, Plano, TX; [6]Stanford University, Palo Alto, CA; [7]Northwestern Memorial Hospital, Chicago, IL; [8]University of Pennsylvania, Philadelphia, PA; [9]Brigham and Women's Hospital, Boston, MA; [10]Washington Hospital Center, Washington, DC; [11]Emory University Hospital, Atlanta, GA; [12]NYU Langone Medical Center, New York, NY; [13]St. Paul's Hospital, Vancouver, BC, Canada; [14]Saint Luke's Cardiovascular Consultants, Kansas City, MO;

Invited Discussant: *David A. Fullerton

8. Prosthesis-Patient Mismatch in High Risk Patients with Severe Aortic Stenosis in a Randomized Trial of a Self-Expanding Prosthesis
George L. Zorn, III[1], Stephen H. Little[2], Peter Tadros[1], *G. Michael Deeb[3], John Heiser[4], Jeffrey J. Popma[5], *David H. Adams[6], *Michael J. Reardon[2]
[1]University of Kansas, Kansas City, KS; [2]Houston Methodist DeBakey Heart and Vascular Center, Houston, TX; [3]University of Michigan, Ann Arbor, MI; [4]Spectrum Health Hospitals, Grand Rapids, MI; [5]Beth Israel Deaconess Medical Center, Boston, MA; [6]Mount Sinai Medical Center, New York, NY

Invited Discussant: *Craig R. Smith

9. Transcatheter Valve-in-Valve Therapy Using Five Different Devices in Four Anatomic Positions – Clinical Outcomes and Technical Considerations
Lenard Conradi, Miriam Silaschi, Moritz Seiffert, Edith Lubos, Stefan Blankenberg, *Hermann Reichenspurner
Ulrich Schaefer, Hendrik Treede University Heart Center Hamburg, Hamburg, Germany

Invited Discussant: Vinayak Bapat

3:00 PM – 3:35 PM COFFEE BREAK/VISIT EXHIBITS

DEEP DIVE SESSION IN THE EXHIBIT HALL AATS CT Theater 2
TAVR vs. SAVR *Not for Credit*

Moderated by *Vinod H. Thourani

6. A Multicenter Propensity-score Analysis of 991 Patients with Severe Aortic Stenosis and Intermediate-high Risk Profile: Conventional Surgery versus Sutureless Valves versus TAVR

7. Appropriate Patient Selection or Healthcare Rationing? Lessons from Surgical Aortic Valve Replacement in the PARTNER-I Trial

8. Prosthesis-Patient Mismatch in High Risk Patients with Severe Aortic Stenosis in a Randomized Trial of a Self-Expanding Prosthesis

9. Transcatheter Valve-in-Valve Therapy Using Five Different Devices in Four Anatomic Positions – Clinical Outcomes and Technical Considerations

10. Implications of Lesion Complexity on Process and Outcomes of Mitral Valve Repair for Degenerative Mitral Regurgitation
*Anelechi C. Anyanwu, Shinobu Itagaki, *Joanna Chikwe, Ahmed El-Eshmawi, *David H. Adams
Mount Sinai Medical Center, New York, NY

Invited Discussant: *Y. Joseph Woo

11. A Contemporary Analysis of Pulmonary Hypertension in Patients Undergoing Mitral Valve Surgery: Is This a Risk Factor?
Daniel H. Enter, Anthony Zaki, Brett Duncan, Jane Kruse, Andrei Adin-Cristian, Carrie Li, Travis Abicht, Hyde Russell, Sukit Chris Malaisrie, Sanjiv Shah, James Thomas, *Patrick McCarthy
Northwestern University, Chicago, IL

Invited Discussant: *James S. Gammie

12. Long-Term Outcomes of the Cox-Maze IV Procedure for Atrial Fibrillation
Matthew C. Henn, Timothy S. Lancaster, Jacob R. Miller, Laurie A. Sinn, Richard B. Schuessler, Spencer J. Melby, Hersh S. Maniar, *Ralph J. Damiano, Jr.
Washington University, St. Louis, MO

Invited Discussant: *Richard Lee

Late-Breaking Clinical Trial

LB1. European Prospective Multicenter Study of Hybrid Thoracoscopic and Transcatheter Ablation of Persistent Atrial Fibrillation: The Historic – AF Trial

*Claudio Muneretto[1], Gianluigi Bisleri[1], Gianluca Polvani[2], Antonio Curnis[1], Luca Bontempi[1], Fabrizio Rosati[1], Elisa Merati[2], Gaetano Fassini[2], Massimo Moltrasio[2], Claudio Tondo[2], Ralf Krakor[3]

[1]University of Brescia, Brescia, Italy; [2]University of Milan, Milan; [3]THG Staedtisches Klinikum, Dortmund, Germany

Invited Discussant: *Niv Ad

5:00 PM **ADJOURN**

MONDAY AFTERNOON, APRIL 27, 2015

2:00 PM **CONGENITAL HEART DISEASE SIMULTANEOUS SCIENTIFIC SESSION** Room 6A, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Carl L. Backer and *Pirooz Eghtesady

13. Outcomes Following Simple and Complex (Damus-Kaye-Stansel Takedown) Ross Operations in 58 Consecutive Pediatric Patients

Alejandra Bueno, David Zurakowski, Suyog A. Mokashi, Vijayakumar Raju, Michele J. Borisuk, *Pedro J. del Nido, Gerald R. Marx, Christopher W. Baird

Boston Children's Hospital & Harvard Medical School, Boston, MA

Invited Discussant: *Jonathan M. Chen

14. Ultra Long Term Outcomes in Adult Survivors of Tetralogy of Fallot and the Effect of Pulmonary Valve Replacement

Richard Dobson[1], Mark Danton[1], Nicola Walker[1], Nikolaos Tzemos[2], Hamish Walker[1]

[1]Scottish Adult Congenital Cardiac Service, Glasgow, United Kingdom; [2]University of Glasgow, Glasgow, United Kingdom

Invited Discussant: *Bahaaldin Alsoufi

15. Long-Term Mortality After the Fontan Operation: Twenty Years of Experience at a Single Center

Tacy E. Downing[1], Kiona Y. Allen[1], Andrew C. Glatz[1], Lindsay S. Rogers[2], Chitra Ravishankar[1], Jack Rychik[1], Stephanie Fuller[1], Lisa M. Montenegro[1], James M. Steven[1], *Thomas L. Spray[1], Susan C. Nicolson[1], *J. William Gaynor[1], David J. Goldberg[1]

[1]The Children's Hospital of Philadephia, Philadelphia, PA; [2]Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Invited Discussant: *James K. Kirklin

16. Long-Term Outcomes After First-Onset Arrhythmia in Fontan Physiology

Thomas A. Carins[1], Ajay J. Iyengar[1], Ashley Nisbet[2], Victoria Forsdick[3], Tom Gentles[4], Dorothy Radford[5], Robert Justo[6], David S. Celermajer[7], Andrew Bullock[8], David Winlaw[9], Gavin Wheaton[10], Leeanne Grigg[2], Yves d'Udekem[11]

[1]The University of Melbourne, Parkville, VIC, Australia; [2]The Royal Melbourne Hospital, Parkville, VIC, Australia; [3]The University of Notre Dame, Darlinghurst, Sydney, Australia; [4]Starship Children's Hospital, Auckland, New Zealand; [5]The Prince Charles Hospital, Chermside, Brisbane, QLD, Australia; [6]Mater Children's Hospital, Brisbane, QLD, Australia; [7]Royal Prince Alfred Hospital, Sydney, Australia; [8]Princess Margaret Hospital for Children, Subiaco, WA, Australia; [9]Children's Hospital at Westmead, Sydney, NSW, Australia; [10]Women's & Children's Hospital, Adelaide, SA, Australia; [11]The Royal Children's Hospital, Parkville, VIC, Australia

Invited Discussant:

3:20 PM – 3:55 PM COFFEE BREAK/VISIT EXHIBITS

Moderators: *Emile A. Bacha and *Mark S. Bleiweis

17. The Impact of Non-Cardiac and Genetic Abnormalities on Outcomes Following Neonatal Congenital Heart Surgery

*Bahaaldin Alsoufi, Shriprasad Deshpande, William Mahle, Scott Gillespie, *Brian Kogon, Kevin Maher, *Kirk Kanter

Emory University, Atlanta, GA

Invited Discussant: *Peter J. Gruber

18. Health-Related Quality of Life in Adult Survivors After the Fontan Operation

*James K. Kirklin

University of Alabama at Birmingham, Birmingham, AL

Invited Discussant: *Charles B. Huddleston

19. Aortic Dilatation Is Not Associated with Aortic Valvulopathy in Patients with Bicuspid Aortic Valve

Byron K. Yip, Colleen Clennon, Adin-Cristian Andrei, S. Chris Malaisrie

Northwestern University, Chicago, IL

Invited Discussant: *Duke E. Cameron

5:00 PM ADJOURN

*AATS Member

2:00 PM **GENERAL THORACIC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 608, WSCC

8 minute presentation, 12 minute discussion

Moderators: *David J. Sugarbaker and *Jay M. Lee

20. Multimodality Therapy for Locally Advanced Thymomas: A Cohort Study of Prognostic Factors from a European Multicentric Database

Giovanni Leuzzi[1], *Gaetano Rocco[2], Enrico Ruffini[3], Isabella Sperduti[1], *Frank Detterbeck[4], *Walter Weder[5], *Federico Venuta[6], *Dirk Van Raemdonck[7], *Pascal Thomas[8], Francesco Facciolo[1], ESTS Thymic Working Group[10]

[1]Regina Elena National Cancer Institute – IFO, Rome, Italy; [2]National Cancer Institute, Pascale Foundation, Naples, Italy; [3]University of Torino, Torino, Italy; [4]Yale University, New Haven, CT; [5]University Hospital, Zurich, Switzerland; [6] Sapienza University of Rome, Rome, Italy; [7]University Hospitals Leuven, Leuven, Belgium; [8]Aix-Marseille University, Marseille, France; [10]European Society of Thoracic Surgeons, Exeter, United Kingdom

Invited Discussant: *Frank C. Deterbeck

21. The Impact of Adjuvant Chemotherapy in Pulmonary Large Cell Neuroendocrine Carcinoma: Results of an International Multi-Institutional Propensity Score-Adjusted Cohort Study on Behalf of the European Society of Thoracic Surgeons Neuroendocrine Tumors Working

Pier Luigi Filosso[1], Francesco Guerrera[1], Andrea Evangelista[2], Claudia Galassi[2], Stefan Welter[3], *Erino Angelo Rendina[4], William Travis[5], Eric Lim[6], Inderpal Sarkaria[7], *Pascal Alexandre Thomas[8]

[1]University of Torino Italy, Torino, Italy; [2]San Giovanni Battista Hospital, Torino, Italy; [3]Ruhrlandklinik Essen, Essen, Germany; [4]Sapienza University of Rome, Rome, Italy; [5]Memorial Sloan Kettering Cancer Center, New York, NY; [6]Royal Brompton Hospital, London, United Kingdom; [7]University of Pittsburgh, Pittsburgh, PA; [8]Aix-Marseille, Marseille, France

Invited Discussant: *Sidharta P. Gangadharan

22. Validation Study of the Proposed IASLC/ITMIG Staging Revisions of the Thymic Carcinoma Using Data from 287 Patients

Yang Zhao, Heng Zhao

Shanghai Chest Hospital, Shanghai, China

Invited Discussant: *Stephen D. Cassivi

23. Routine VTE Screening After Pneumonectomy: You Must Look to Find

Siva Raja, Jahanzaib Idrees, Jiayan He, *Eugene H. Blackstone, *David P. Mason, Daniel Raymond, *Thomas Rice, *Sudish C. Murthy

Cleveland Clinic, Cleveland, OH

Invited Discussant: *Keith S. Naunheim

3:20 PM – 3:55 PM COFFEE BREAK/VISIT EXHIBITS

DEEP DIVE SESSION IN THE EXHIBIT HALL AATS CT Theater 2
FEATURING: *Not for Credit*

23. Routine VTE Screening After Pneumonectomy: You Must Look to Find

P33. The Incidence and Burden of Venous Thromboembolism After Major Lung Resection: A Prospective Cohort Analysis

P34. Caprini Risk Assessment for Postoperative Venous Thromboembolism in Surgical Lung Cancer Patients

Moderated by *Keith S. Naunheim and *Sidharta P. Gangadharan

24. Giving Induction Radiation in Addition to Chemotherapy Is Not Associated with Improved Survival of NSCLC Patients with Operable Mediastinal Nodal

Chi-Fu Jeffrey Yang[1], Brian Gulack[1], Lin Gu[1], Paul Speicher[1], Xiaofei Wang[1], *Thomas D'Amico[1], *Mark Berry[2], Matthew Hartwig[1]

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

Invited Discussant: *David R. Jones

25. Accelerated Hemithoracic Radiation Followed by Extrapleural Pneumonectomy for Malignant Pleural Mesothelioma

*Marc De Perrot, Ronald Feld, Natasha Leighl, Andrew Hope, *Thomas K. Waddell, *Shaf Keshavjee, B.C. John Cho

Toronto General Hospital & Princess Margaret Hospital, Toronto, ON, Canada

Invited Discussant:

26. Is Surgical Resection Justified for Myasthenia Gravis? Long-Term Results in Over 1000 Cases

Andrew Kaufman, Justin Palatt, Mark Sivak, Peter Raimondi, Dong-Seok Lee, Andrea S. Wolf, Fouad Lajam, Faiz Bhora, *Raja Michael Flores

Icahn School of Medicine, Mount Sinai Health System, New York, NY

Invited Discussant: *Joshua R. Sonett

5:00 PM ADJOURN

*AATS Member

2:00 PM **PERIOPERATIVE CARE** Room 608, WSCC
SIMULTANEOUS SCIENTIFIC SESSION
8 minute presentation, 7 minute discussion

Moderators: *Glenn J. Whitman and Katherine J. Hoercher

27. Modified Perioperative Management Improves the Early Outcomes in Hemodialysis Patients Undergoing Cardiac Surgery
Hiroyuki Tsukui, Shogo Isomura, Chihiro Ueda, Shinka Miyamoto, Shizuko Iwasa, Satoshi Saito, Kenji Yamazaki
Tokyo Women's Medical University, Tokyo, Japan

Invited Discussant: *Vinod H. Thourani

28. Preoperative Anemia Versus Blood Transfusion: Which Is the Culprit for Worse Outcomes in Cardiac Surgery?
Damien J. LaPar[1], James M. Isbell[1], *Jeffrey Rich[2], *Alan M. Speir[3], Mohammed Quader[4], *Irving L. Kron[1], *John A. Kern[1], *Gorav Ailawadi[1]
[1]University of Virginia, Charlottesville, VA; [2]Mid-Atlantic Cardiothoracic Surgeons, Norfolk, VA; [3]INOVA Heart and Vascular Center, Falls Church, VA; [4]VCU, Richmond, VA

Invited Discussant: *Charles R. Bridges

29. Transcatheter Valve-In-Valve Therapy Using Six Different Devices In Four Anatomic Positions – Clinical Outcomes and Technical Consideration
Adam El-Gamel, Grant Parkinson, Zaw Lin, Nand Kejriwal, Nick Odom
Waikato Hospital, Hamilton, New Zealand

Invited Discussant:

30. How Detrimental Is Reopening for Bleeding After Cardiac Surgery? Analysis from 16,793 Cases
*Marc Ruel, Vincent Chan, Munir Boodhwani, Bernard McDonald, Xiaofang Ni, Gurinder Gill, Khanh Lam, Fraser Rubens, *Paul Hendry, Roy Masters, *Thierry Mesana
University of Ottawa, Ottawa, ON, Canada

Invited Discussant: *S. Chris Malaisrie

31. Use of Cumulative Data in Funnel Plots to Evaluate Performance Improvement in Cardiac Surgery
*James R. Edgerton[1], Morley A. Herbert[2], Baron L. Hamman[3], Syma L. Prince[4], W. Steves Ring[5]
[1]The Heart Hospital Baylor Plano, Plano, TX; [2]Medical City Dallas Hospital, Dallas, TX; [3]Texas Health Heart & Vascular Hospital, Arlington, TX; [4]CRSTI, Dallas, TX; [5] University of Texas Southwestern, Dallas, TX

Invited Discussant: *Harold L. Lazar

3:15 PM – 3:45 PM **COFFEE BREAK/VISIT EXHIBITS**

32. Postoperative Delirium Increases Both Operative and One Year Mortality in Patients Treated with Surgical or Transcatheter Aortic Valve Replacement
*Hersh Maniar, Brian Lindman, Michael Avidan, Krisztina Escallier, Eric Novac, Marci S. Damiano, John Lasala, *Jennifer Lawton, *Marc R. Moon, Spencer Melby, Nishath Quadar, *Michael Pasque, *Ralph J. Damiano, Jr., Alan Zajarias
Washington University, Saint Louis, MO

Invited Discussant: *Lars G. Svensson

33. A Novel Score to Estimate the Risk of Pneumonia After Cardiac Surgery
Arman Kilic, Rika Ohkuma, Joshua C. Grimm, J. Trent Magruder, Marc Sussman, Eric B. Schneider, *Glenn J.R. Whitman
Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: *Eugene H. Blackstone

34. Is Carotid Revascularization Necessary Before Cardiac Surgery?
Molly Schultheis, Siavash Saadat, Kiersten Frenchu, Jaya Kanduri, Joseph Romero, Victor Dombrovskiy, Aziz Ghaly, Anthony Lemaire, George Batsides, Saum Rahimi, Leonard Lee
Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ

Invited Discussant: Tom C. Nguyen

35. Preoperative Pulmonary Function Tests Consistently Predict Mortality After Surgical or Transcatheter Aortic Valve Replacement
Matthew C. Henn, Alan Zajarias, Brian R. Lindman, Jason W. Greenberg, Anna M. Wittenberg, Cassandra Lawler, Marci S. Damiano, Spencer J. Melby, Nishath Quader, John M. Lasala, *Marc R. Moon, *Jennifer S. Lawton, *Ralph J. Damiano, Jr., *Hersh S. Maniar
Washington University, St. Louis, MO

Invited Discussant: Todd Dewey

36. Use of Psoas Muscle Size As a Frailty Assessment Tool for Open and Transcatheter Aortic Valve Replacement
Raghavendra Paknikar, Jeffrey Friedman, David Cron, *G. Michael Deeb, Stanley Chetcuti, P. Michael Grossman, Stewart Wang, Michael Englesbe, *Himanshu J. Patel
University of Michigan Medical School, Ann Arbor, MI

Invited Discussant: *Wilson Y. Szeto

5:00 PM ADJOURN

*AATS Member

MONDAY EVENING, APRIL 27, 2015

5:00 PM **18TH ANNUAL C. WALTON LILLEHEI RESIDENT FORUM** Room 6B, WSCC

7 minute presentation, 5 minute discussion

Chairs: *Todd K. Rosengart and *Joseph B. Zwischenberger

L1. GRK2 Inhibition Reduces Post-Myocardial Infarction Cardiac Fibroblast Mediated Adverse Remodeling

Jennifer L. Philip[1], Xianyao Xu[1], Mei Han[1], Jinju Li[2], Abdur Razzaque[1], *Shahab A. Akhter[1]

[1]University of Wisconsin, Madison, WI; [2]University of Chicago, Chicago, IL

Invited Discussant: *Frank W. Sellke

L2. Ribosomal Dysfunction Results in Immunologic Susceptibility to Lung Cancer

Stephanie H. Chang, Ryuji Higashikubo, Saeed Arefanian, Andrew E. Gelman, *Daniel Kreisel, *Alexander S. Krupnick

Washington University, St. Louis, MO

Invited Discussant: *David H. Harpole

L3. Bone Marrow-Derived Mesenchymal Stem Cells Attenuate Right Ventricular Remodeling and Preserve Function in Neonatal Swine

Brody Wehman, Nicholas Pietris, Osama Siddiqui, Rachana Mishra, Sarah Murthi, *Bartley Griffith, *Sunjay Kaushal

University of Maryland, Baltimore, MD

Invited Discussant: *Richard D. Weisel

L4. Ex Vivo Lung Perfusion with Adenosine A2A Receptor Agonist Decreases Ischemia-Reperfusion Injury in Non-Heart-Beating Donor Lungs Subjected to Prolonged Cold Preservation

Cynthia E. Wagner, Nicolas H. Pope, Eric J. Charles, Mary E. Huerter, Ashish K. Sharma, Morgan D. Salmon, Benjamin T. Carter, Mark H. Stofer, *Christine L. Lau, Victor E. Laubach, *Irving L. Kron

University of Virginia, Charlottesville, VA

Invited Discussant: *Alexander S. Krupnick

L5. An Annexin V Homo-Dimer Protects Against Ischemia Reperfusion Induced Acute Lung Injury in Lung Transplantation

Kohei Hashimoto, Hyunhee Kim, Hisashi Oishi, Manyin Chen, Ilker Iskender, Jin Sakamoto, Akihiro Ohsumi, Zehong Guan, David M. Hwang, *Thomas K. Waddell, Marcelo Cypel, Mingyao Liu, *Shaf Keshavjee

University of Toronto, Toronto, ON, Canada

Invited Discussant: *Ashish S. Shah

L6. Beneficial Role of Antigen Commensalism in Mesothelin-Targeted T-Cell Therapy for Lung Adenocarcinoma

Adam Jason Bograd[1], Jonathan Villena-Vargas[2], Christos Colovos[2], Stefan Kachala[2], *David R. Jones[2], Michel Sadelain[2], *Prasad S. Adusumilli[2]

[1]New York University Medical Center, New York, NY; [2]Memorial Sloan-Kettering Cancer Center, New York, NY

Invited Discussant: *David J. Sugarbaker

L7. Impact of Aortic Annular Geometry on Aortic Valve Insufficiency: Insights from a Pre-Clinical, Ex-Vivo, Porcine Model

Talal Al-Atassi, Hadi Toeg, Benjamin Sohmer, Michel Labrosse, Munir Boodhwani

University of Ottawa, Ottawa, ON, Canada

Invited Discussant: *Joseph D. Schmoker

L8. Creation of a Novel Endosymbiotic System for Photon Powered Myocardium in the Ischemic Heart

Jeffrey E. Cohen[1], Andrew B. Goldstone[1], Yasuhiro Shudo[1], William L. Patrick[1], John W. MacArthur[2], Sergei A. Vinogradov[2], Tatiana V. Esipova[3], Bryan B. Edwards[1], Jay B. Patel[1], *Y. Joseph Woo[1]

[1]Stanford University, Stanford, CA; [2]University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Eugene A. Grossi

6:30 PM **ADJOURN**

5:00 PM **FUNCTIONAL MR: A SURGICAL DISEASE? NEW SURGICAL AND INTERVENTIONAL PARADIGMS FOR TREATMENT** Room 607, WSCC

The ***Functional MR: A Surgical Disease? New Surgical and Interventional Paradigms for Treatment*** session provides a deep dive into the contemporary management of functional mitral regurgitation. An interdisciplinary panel of experts will define the changing role of the surgeon in a landscape where an increasing percentage of functional MR cases can now be treated nonsurgically. A combination of case-based presentations, focused lectures, and engaging panel discussion will delve into the controversial debates surrounding the optimal treatment strategy for a variety of clinical presentations of mitral valve disease.

Moderators: *A. Marc Gillinov and *Mathew Williams

Panelists: Maurice E. Sarano, *Robert A. Dion, Brian K. Whisenant, Vinayak Bapat, Michael Robich, David Yaffee, and *Vinod Thourani

*AATS Member

5:00 PM – 5:10 PM
Does the Mitral Valve Really Matter in Functional MR and When Should We Treat?
Maurice E. Sarano, *Mayo Clinic*

5:10 PM – 5:20 PM
Which Operation Is Best for Severe Ischemic MR: Repair or Replace?
*Michael A. Acker, *University of Pennsylvania*

5:20 PM – 5:30 PM
Surgical Repair Techniques for Ischemic MR: Can This Teach Us About Future Percutaneous Options?
*Robert A. Dion, *Ziekenhuis Oost-Limburg*

5:30 PM – 5:40 PM
MitraClip Is the Ideal Treatment for Functional MR: Tips and Tricks
Brian K. Whisenant, *Intermountain Healthcare*

5:40 PM – 5:50 PM
Forget Complex Repair Techniques – the Future will Be in Transcatheter Mitral Valve Replacement
Vinayak Bapat, *Guys and St. Thomas' Hospital*

5:50 PM – 5:53 PM
Case Presentation: Moderate IMR in a Patient with CAD – Should We Treat the Mitral Valve?
Michael Robich, *Beth Israel Deaconess Medical Center*

5:53 PM – 6:03 PM
Panel Discussion

6:03 PM – 6:06 PM
Case Presentation: Functional MR That Must Be Addressed – but How?
David Yaffee, *NYU Langone Medical Center*

6:06 PM – 6:16 PM
Panel Discussion

6:16 PM – 6:19 PM
Case Presentation: High-Risk/End-Stage Patient with Functional MR: Should We Treat with Anything?
Steven R. DeBeer

6:19 PM – 6:30 PM
Panel Discussion

6:30 PM ADJOURN

5:00 PM **INTEGRATING ADVANCED IMAGING IN PLANNING INTERVENTIONS: A CASE-BASED INTERACTIVE EXPERT PANEL REVIEW,** *Supported by Siemens* Room 612, WSCC

Course Chair: *Juan B. Grau, *Valley Columbia Heart Center*

Course Co-Chair: *Mani Vannan, *Ohio State University*

5:00 PM – 5:30 PM

Degenerative Mitral Valve Disease: Approach to Mitral Valve Repair Through Imaging

*Michael A. Borger, *Columbia University*
Thilo Noack, *Heart Center Leipzig University*

5:30 PM – 6:00 PM

Chronic Aortic Insufficiency with Normal Leaflets: Relevant Imaging to Tailor AV Repair Options

*Gebrine El Khoury, *Université Catholique de Louvain*
Carols Ruiz, *University of Illinois at Chicago*

6:00 PM – 6:30 PM

Coronary Artery Disease: Implications of Preoperative Imaging and Functional Analysis of Areas Stenosis in Planning CABG/PCI

David Glineur, *Cliniques Universitaires Saint-Luc*
Giovanni Ferrari, *University of Pennyslvania*

6:30 PM **ADJOURN**

TUESDAY MORNING, APRIL 28, 2015

7:00 AM **CARDIAC SURGERY FORUM** Room 6B, WSCC
5 minute presentation, 5 minute discussion

Moderators: *Frederick Y. Chen and *Juan A. Crestanello

F1. Intraventricular Papillary Muscle Banding Is an Effective Technique to Repair Ischemic Mitral Regurgitation in Dilated Ventricles: Comparison with Annuloplasty in a Chronic Swine Model

Muralidhar Padala, Weiwei Shi, Rajnish Duara, Kanika Kalra, *Robert A. Guyton, *Vinod H. Thourani, Eric L. Sarin
Emory University, Atlanta, GA

Invited Discussant: *Robert A. Dion

*AATS Member

F2. Injectable Shear-Thinning Hydrogels Deliver Endothelial Progenitorcells, Enhance Cell Engraftment, Increase Vasculogenesis, and Stabilizeregional Ischemic Myocardium

Ann C. Gaffey, Minna H. Chen, Chantel M. Venkataraman, Alen Trubelja, Christopher B. Rodell, Patrick V. Dinh, John W. MacArthur, Jr., Renganaden V. Soopan, Jason A. Burdick, Pavan Atluri

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Terrence M. Yau

F3. Transesophageal Versus Transcranial Motor Evoked Potentials to Monitor Spinal Cord Ischemia

Kazumasa Tsuda, Norihiko Shiiya, Daisuke Takahashi, Kazuhiro Ohkura, Katsushi Yamashita, Yumi Kando Hamamatsu

University School of Medicine, Hamamatsu, Japan

Invited Discussant: *T. Brett Reece

F4. Inhibition of microRNA-29c Induces Cerebroprotection in a Rat Model of Prolonged Deep Hypothermic Circulatory Arrest by Targeting PGC-1α

Tianxiang Gu, Yongchao Wang, Enyi Shi

First Hospital of China Medical University, Shenyang, China

Invited Discussant: *Jennifer S. Lawton

Late-Breaking Clinical Trial

F5. Comparison of Procedural Outcomes and Early Safety by Surgical Approach after Isolated Rapid Deployment Aortic Valve Replacement

*Thorsten Wahlers[1], *Axel Haverich[2], *Michael Borger[3], *Malakh Shrestha[2], Alfred Kocher[4], Thomas Walther[5], Matthias Roth[5], Martin Misfeld[6], *Friedrich Mohr[6], Joerg Kempfert[5], Pascal Dohmen[6], Christoph Schmitz[7], Parwis Rahmanian[1], Dominik Wiedemann[4], Francis Duhay[8]

[1]University of Cologne, Cologne, Germany; [2]University of Hannover, Hannover, Germany; [3]Columbia University, New York, NY; [4]University of Vienna, Vienna, Austria; [5]Kerckhoff Klinik, Bad Nauheim, Germany; [6]University of Leipzig, Leipzig, Germany; [7]University of Munich, Munich, Germany; [8]Edwards Lifesciences LLC, Irvine, CA

Invited Discussant: Spencer J. Melby

F6. Small Platform Catheter-Based Left Ventricular Assist Device Support Suppresses Cardioprotective Beta-Arrestin-Mediated Signal Transduction

Keshava Rajagopal, Progyaparamita Saha, Isa Mohammed, Pablo G. Sanchez, Tieluo Li, Zhongjun J. Wu, *Bartley P. Griffith

University of Maryland, Baltimore, MD

Invited Discussant: *Mark S. Slaughter

F7. Differential Regulation of Intracellular Calcium Homeostas Is Between Sevoflurane Postconditioning and Delayed Remote Ischemic Preconditioning in an Isolated Rat Heart Model

Yang Yu, Lihuan Li

Fuwai Cardiovascular Hospital, Beijing, China

Invited Discussant: *Juan A. Crestanello

F8. Multidisciplinary Histological and Mechanichal Study of Aortic Aneurysm to Investigate Potential Parameters for Early Diagnosis of High Risk of Rupture

Pasquale Totaro[1], Alessandra Sbaffi[1], Anna Ferrara[2], Laura Viola[1], Simone Morganti[2], Eloisa Arbustini[1], Federico Auricchio[2], Alessandro Mazzola[1]

[1]IRCCS Foundation Hospital San Matteo, Pavia, Italy; [2]University of Pavia, Pavia, Italy

Invited Discussant: *Scott A. LeMaire

F9. Improvements in the Electrospun Polycarbonate-Urethane Vascular Graft by Effective Surface Modification

Xuefeng Qiu[1], Benjamin Li-Ping Lee[2], Wen Zhao[2], Dong Wang[2], Nianguo Dong[1], Song Li[2]

[1]Huazhong University, Wuhan, China; [2]University of California, Berkeley, CA

Invited Discussant: *Frederick Y. Chen

F10. Preventing Allogeneic Immune Rejection by Transplanting MHC-Homo Induced Pluripotent Stem Cell-Derived Cardiomyocytes to an MHC-Matched Non-Human Primate

Takuji Kawamura, Shigeru Miyagawa, Satsuki Fukushima, Shigeo Masuda, Noriyuki Kashiyama, Ai Kawamura, Atsuhiro Saito, Shohei Yoshida, Akira Maeda, Koichi Toda, Shuji Miyagawa, Yoshiki Sawa

Osaka University, Osaka, Japan

Invited Discussant: *Peter J. Gruber

8:40 AM **ADJOURN**

TUESDAY MORNING, APRIL 28, 2015

7:00 AM **GENERAL THORACIC SURGERY FORUM** Room 613, WSCC

5 minute presentation, 5 minute discussion

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

F11. CD8+ T Cells Contribute to Lung Cancer Progression in a PD-1 Dependent Fashion

Stephanie H. Chang, Saeed Arefanian, Ryuji Higashikubo, Andrew E. Gelman, *Daniel Kreisel, *Alexander S. Krupnick

Washington University, St. Louis, MO

Invited Discussant: Marc De Perrot

*AATS Member

F12. Repair of Large Tracheal Defects Using a Bioengineered Neotrachea in a Porcine Model

Adnan M. Al-Ayoubi, Sadiq S. Rehmani, Craig M. Forleiter, Michael Barsky, Ahmad Taweel, Catherine F. Sinclair, Robert S. Lebovics, *Raja M. Flores, Faiz Y. Bhora

Mount Sinai Hospital, New York, NY

Invited Discussant: *Thomas K. Waddell

F13. Pulmonary Venous Blood Sampling Significantly Increases the Yield of Circulating Tumor Cells in Early Stage Lung Cancer

Rishindra M. Reddy, Vasudha Murlidhar, Lili Zhao, Jennifer Zhuo, Nithya Ramnath, Jules Lin, *Andrew C. Chang, Phillip Carrott, William Lynch, *Mark B. Orringer, David G. Beer, Sunitha Nagrath

University of Michigan, Ann Arbor, MI

Invited Discussant: *Jessica S. Donington

F14. A Novel Large Animal Model of Acute Respiratory Distress Syndrome Induced by Mitochondrial Products

Pablo G. Sanchez, Chetan Pasrija, Matthew Mulligan, Diana L. Pratt, Mandheer Wadhwa, Keshava Rajagopal, Zhongjun Wu, *James S. Gammie, Si M. Pham, *Bartley P. Griffith

University of Maryland, Baltimore, MD

Invited Discussant: *Joseph B. Zwischenberger

F15. High Expression of HOXC6 and HOXC8 Predicts Poor Prognosis of Patients with Esophageal Squamous Cell Carcinoma (ESCC) and Promotes Tumorigenesis Through Their Positive Effect on Cell Proliferation

Keneng Chen, Lu-yan Shen

Key Laboratory of Carcinogenesis and Translational Research, Beijing, China

Invited Discussant:

F16. Intraoperative Molecular Imaging of Pre-Treated Mediastinal Tumors Is Feasible

Jane Keating, Elizabeth De Jesus, Jack Jiang, Ryan Judy, Sunil Singhal

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Yolonda L. Colson

F17. Rapamycin Prevents Bronchiolitis Obliterans Through Increasing Regulatory B Cells Infiltration in a Murine Tracheal Transplantation Model

Yunge Zhao, Jacob R. Gillen, Akshaya K. Meher, Jordan A. Burns, David A. Harris, *Irving L. Kron, *Christine L. Lau

University of Virginia, Charlottesville, VA

Invited Discussant: *Si Mai Pham

F18. AP-1 Inhibitor (SR11302) Inhibits Metastatic Lesion Formation in Ex Vivo 4D Lung Cancer Model

Dhruva K. Mishra, Min P. Kim

Houston Methodist, Houston, TX

Invited Discussant: *Prasad S. Adusumilli

F19. Therapeutic Implications and Prognostic Significance of c-Met in Esophageal Squamous Cell Cancer

*Ching Tzao[1], Chun-Ya Wang[2], Ban-Hen Chen[2], Guang-Huan Sun[2]

[1]Taipei Medical University, Taipei, Taiwan; [2]Tri-Service General Hospital, Taipei, Taiwan

Invited Discussant: *Nasser K. Altorki

F20. Lysyl-Like Oxidase 2 (LOXL2) Is an Oncogenic Driver of Malignancy Regulated by miR-145 in Tobacco-Associated Esophageal Adenocarcinomas

Shakirat Oyetunji, Sichuan Xi, Said Azoury, David Straughan, Julie Hong, Mary Zhang, *David Schrump

National Institute of Health, Bethesda, MD

Invited Discussant: *Dao M. Nguyen

8:40 AM **ADJOURN**

TUESDAY MORNING, APRIL 28, 2015

7:00 AM **ADULT CARDIAC EMERGING TECHNOLOGIES AND TECHNIQUES FORUM** Room 612, WSCC

5 minute presentation, 5 minute discussion

Moderators: *Y. Joseph Woo and *A. Marc Gillinov

Novel-Transcatheter Technologies

*Vinod H. Thourani, *Emory University*

T1. Early Clinical Results of Transapical Mitral Valve Replacement for Mitral Regurgitation

Anson Cheung[1], Robert Boone[1], Stephan Verheye[2], Moss Robert[1], Shmuel Banai[4], John Webb[1]

[1]St. Paul's Hospital, Vancouver, BC, Canada; [2]ZNA Middelheim Hospital, Antwerp, Belgium; [4]Tel Aviv Medical Center, Tel Aviv, Israel

T2. Xenoantigenicity of Porcine Decellularized Valves

Meghana R.K. Helder[1], Ryan Hennessy[1], Tyra Witt[1], Daniel B. Spoon[1], John M. Stulak[1], Robert D. Simari[2], Amir Lerman[1]

[1]Mayo Clinic, Rochester, MN; [2]University of Kansas School of Medicine, Kansas City, KS

T3. Less Invasive Surgical Treatment for Acute Type A Aortic Dissection Involving the Arch in High-Risk Patients: A Comparative Study of Hybrid Total Arch Repair and Conventional Total Arch Replacement

Qian Chang, Yan Li, Xiangyang Qian, Xiaogang Sun, Cuntao Yu

National Heart Center & Fuwai Hospital, Beijing, China

*AATS Member

T4. Five Years Clinical Outcome of Endoscopic Versus Open Radial Artery Harvesting: A Propensity-Score Analysis

Gianluigi Bisleri[1], Laura Giroletti[1], Tomasz Hrapkowicz[2], Martina Bertuletti[1], *Marian Zembala[2], Mario Arieti[3], *Claudio Muneretto[1]

[1]University of Brescia Medical School, Brescia, Italy; [2]Silesian Center for Heart Diseases, Zabrze, Poland; [3]Ospedale di Desenzano, Desenzano, Italy

T5. Point-of-View Video Streaming Promotes Enhanced Resident Surgeon Training and Assessment while Maintaining Quality Assurance and Patient Care

Andrew C.W. Baldwin, Hari R. Mallidi, *William E. Cohn, Goutham Dronavalli, Amit Parulekar, Steve K. Singh

Baylor College of Medicine, Houston, TX

T6. Enabling Minimally Invasive Atraumatic Repair of Intracardiac Septal Defects with Light

Assunta Fabozzo[1], Ellen T. Roche[2], Yuhan Lee[3], Panagiotis Polygerinos[2], Ingeborg Friehs[1], Lucia Schuster[2], Alejandra M. Casar Berezaluce[1], Alejandra Bueno[1], Nora Lang[1], Maria J.N. Pereira[3], Eric Feins[1], Steve Wassermann[4], Eoin D. O'Cearbhaill[3], Nikolay V. Vasilyev[1], David J. Money[2], Jeffrey M. Karp[3], Conor J. Walsh[2], *Pedro J. Del Nido[1]

[1]Boston Children's Hospital and Harvard Medical School, Boston, MA; [2]Wyss Institute and Harvard University, Cambridge, MA; [3]Brigham and Women's Hospital Harvard Medical School, Cambridge, MA; [4]Massachusetts Institute of Technology, Cambridge, MA

Cutting Edge Mechanical Circulatory Support Technology

*William E. Cohn, *Texas Heart Institute*

8:40 AM **ADJOURN**

7:00 AM **GENERAL THORACIC EMERGING TECHNOLOGIES AND TECHNIQUES FORUM** Room 603, WSCC

5 minute presentation, 5 minute discussion

Moderators: *Stephen R. DeMeester and *Shanda H. Blackmon

T7. Comparison of Microwave Ablation and Radiofrequency Ablation Therapy for Nonsurgical Lung Malignancies

Qiang Lu, Yongan Zhou, Lijun Huang, Xiaofei Li

Fourth Military Medical University, Xi'an, China

Interventional Management of Lung Cancer

*Hiran C. Fernando, *Boston Medical Center*

T8. Efficacy and Safety of Novel Modified Nuss Procedure for Pectus Excavatum with A New Steel Bar

Ju Mei, Guoqing Li, Zhaolei Jiang, Haibo Xiao, Mingsong Wang, Fengqing Hu, Xiao Xie Xinhua Hospital, Shanghai Jiaotong

University School of Medicine, Shanghai, China

T9. Easy and Safe Visualizing Method for Creating Intersubsegmental Plane by Bronchial Closure Using Slip-Knot in Thoracoscopic Lung Anatomical Subsegmentectomy

Hirohisa Kato, Hiroyuki Oizumi, Makoto Endoh, Jun Suzuki, Hikaru Watarai, Mitsuaki Sadahiro

Yamagata University, Yamagata-shi, Japan

T10. Near Infrared Image-Guided Lymphatic Mapping to Determine the Extent of an Adequate Lymphadenectomy in Early Stage Esophageal Cancer

Krista J. Hachey, Denis M. Gilmore, Katherine W. Armstrong, Sean E. Harris, Jon O. Wee, *Yolonda L. Colson

Brigham and Women's Hospital, Boston, MA

Image-Guided Thoracic Surgery

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

T11. Endobronchial Treatment for Pneumothorax with Ongoing Air Leak by Using Intra Bronchial Valve System

Eitan Podgaetz, *Rafael Santiago Andrade, Felix Daniel Zamora, Heidi Gibson, Erhan Huseyin Dincer

University of Minnesota, Minneapolis, MN

T12. Successful 3D Printing of a Biologic Trachea

Faiz Y. Bhora, Sadiq S. Rehmani, Adnan M. Al-Ayoubi, Michael Barsky, Craig M. Forleiter, Ahmad Tawee

Mount Sinai St.Luke's Hospital and Mount Sinai Roosevelt Hospital, New York, NY

T13. Single Port Video-Assisted Thoracoscopic Thymectomy

Hyun Koo Kim, Kook Nam Han, Hyun Joo Lee, Young Ho Choi

Korea University Guro Hospital, Seoul, Republic of Korea

T14. Pneumonectomy for Locally Advanced Non-Small-Cell Lung Cancer After Neoadjuvant Concurrent Chemo-Radiation Therapy

Kazunori Okabe, Hiroyuki Tao, Toshiki Tanaka, Tatsuro Hayashi, Koichi Yoshiyama, Masashi Furukawa, Kumiko Yoshida Yamaguchi

Ube Medical Center, Ube, Japan

8:40 AM ADJOURN

*AATS Member

TUESDAY MORNING, APRIL 28, 2015

7:00 AM **VIDEO SESSION** Room 608, WSCC
10 minute presentation

Moderators: *Song Wan,* Joseph S. Friedberg and *Kazuhiro Yasufuku

V1. A Novel Technique of Aortic Root Reconstruction for Extensive Endocarditis: The Pericardial Skirt Technique
Kiyoshi Doi Kyoto
Prefectural University, Kyoto, Japan

V2. Use of Fluorescence Imaging to Define the Intersegmental Plane During Robotic Segmentectomy
William Ragalie[1], Jonathan Spicer[2], *David C. Rice[2]
[1]Medical College of Wisconsin, Milwaukee, WI; [2]University of Texas, Houston, TX

V3. A Successful Case of Staged Fontan Operation for a Right Atrial Isomerism Patient with Pulmonary Atresia/MAPCAs, Complicated with Obstructed Supra-Cardiac Total Anomalous Pulmonary Venous Connection
Yujiro Ide, Masaya Murata, Maiko Tachi, Kisaburo Sakamoto
Mt. Fuji Shizuoka Children's Hospital, Shizuoka City, Japan

V4. Fluorescence-Guided Placement of an Endo-Aortic Balloon Occlusion Device for Totally Endoscopic Robotic Mitral Valve Repair
David W. Yaffee, Didier F. Loulmet, Ans G. Fakiha, *Eugene A. Grossi
New York University, New York, NY

V5. Laparoscopic Transdiaphragmatic Thymectomy
*Rafael Andrade, Eitan Podgaetz, Andrew Shaffer, Chad Engelhart
University of Minnesota, Minneapolis, MN

V6. New Technique for Reconstruction of the Sternum and Diaphragm in Pentalogy of Cantrell
Renato S. Assad, André Ivan Bradley Santos Dias, Rogério Teixeira Silva, Petronio Generoso Thomaz, Silvia Rejane Fontoura Herrera, Denise Pedreira, Ana Cristina Aliman, Maria Fernanda Silva Jardim, Edilson C. Ogeda, Monica Lipay, Teresa Maria Lopes Oliveira Uras
Hospital Samaritano São Paulo, São Paulo, Brazil

V7. Repair of Isolated Sinus of Valsalva Aneurysm Causing Right Ventricular Outflow Tract Obstruction
Walid K. Abu Saleh, Oday Al Jabbari, Alpesh Shah, Su Min Chang, Chun Lin, *Michael Reardon, Basel Ramlawi
Houston Methodist DeBakey Heart & Vascular Center, Houston, TX

V8. Robot Assisted First Rib Resection
Raghav Murthy, Derek Williams, Rachel Harrison, *Kemp Kernstine
Univertiy of Texas Southwestern, Dallas, TX

V9. Overlapping LV Plasty for AVSD with Progressive Severe Cardiac Dysfunction in Early Infancy
Mitsuru Sato, Sadahiro Sai, Tomoaki Kagatani, Akinobu Konishi Miyagi
Children's Hospital, Sendai, Japan

V10. Aortic Valve Reconstructions for Aortic Stenosis with Autologous Pericardium
Yoshito Inoue, Ryo Suzuki, Mio Kasai, Satoru Suzuki
Hiratsuka City Hospital, Hiratsuka, Kanagawa, Japan

8:40 AM **ADJOURN**

TUESDAY MORNING, APRIL 28, 2015

7:00 AM **VAD/ECMO SESSION** Room 607, WSCC
5 minute presentation, 5 minute discussion
Moderators: *Michael A. Acker and *Anelechi C. Anyanwu

37. Concomitant Aortic Valve Repair in Patients Undergoing Continuous-Flow Left Ventricular Assist Device Placement: A 10-year Experience and Clinical Implications
Shinichi Fukuhara, Koji Takeda, Jiho Han, Luilly Vargas, Boyangzi Kat Li, Melana Yuzefpolskaya, Donna M. Mancini, Paolo C. Colombo, Veli Topkara, *Paul A. Kurlansky, Hiroo Takayama, *Yoshifumi Naka
Columbia University, New York, NY
Invited Discussant: *R. Duane Davis, Jr.

38. A Novel and Validated Practical Risk Score to Predict the Need for Right Ventricular Assist Device at the Time of Continue-Flow Left Ventricular Assist Device Implantation
Steve K. Singh, Rohan M. Shah, Jatin Anand, *William E. Cohn, Leo Simpson, Andrew Civitello, Hari R. Mallidi
Baylor College of Medicine, Houston, TX
Invited Discussant: *Robert L. Kormos

39. Ipsilateral Lower Extremity Complications in Patients Undergoing Emergent Common Femoral Arteriovenous Extracorporeal Membrane Oxygenator therapy

Prashanth Vallabhajosyula[1], Matthew Kramer[1], Sofiane Lazar[1], *Wilson Y. Szeto[2], Pavan Atluri[1], J. Eduardo Rame[1], Joyce W. Wald[1], Kathryn Gray[1], Nimesh Desai[1], *Michael A. Acker[1]

[1]University of Pennsylvania, Philadelphia, PA; [2]Penn Presbyterian Hospital, Philadelphia, PA

Invited Discussant:

40. A Decade of Experience with Over 300 Continuous-Flow Left Ventricular Assist Devices at a Single Center

*Ranjit John, Peter Eckman, Chris Holley, Samit Roy, Laura Harvey, Kaustav Majumder, *Sara Shumway, *Kenneth Liao

University of Minnesota, Minneapolis, MN

Invited Discussant:

41. Risk Factors for Development of Tricuspid Regurgitation Post Heart Transplantation and Long-Term Outcome of Tricuspid Valve Surgery

Anja Claudia Baier, Eva Maria Delmo Walter, *Roland Hetzer

Deutsches Herzzentrum Berlin, Berlin, Germany

Invited Discussant: *Valluvan Jeevanandam

42. A Multi-Institutional Comparison of Adverse Events in Contemporary Continuous-Flow Left Ventricular Assist Devices: Do Significant Differences Exist?

John M. Stulak[1], Mary Elizabeth Davis[2], Nicholas Haglund[2], Shannon Dunlay[1], Jennifer Cowger[3], Palak Shah[4], *Francis Pagani[5], Keith Aaronson[5], Simon Maltais[2]

[1]Mayo Clinic, Rochester, MN; [2]Vanderbilt Heart and Vascular Institute, Nashville, TN; [3]St. Vincent's Hospital, Indianapolis, IN; [4]Inova Fairfax Hospital, Falls Church, VA; [5]University of Michigan, Ann Arbor, MI

Invited Discussant: *James K. Kirklin

43. Impact of Periportal Fibrosis Without Cirrhosis on Outcome Following Continuous Flow Left Ventricular Assist Device Implantation

Jonathan E. Sargent, Todd F. Dardas, Jason W. Smith, Richard K. Cheng, Sophia Carolina Masri, Kent R. Shively, Lauren M. Colyer, Nahush A. Mokadam

University of Washington, Seattle, WA

Invited Discussant: *Yoshifuma Naka

44. Severe Pulmonary Hypertension in Patients Undergoing Leftventricular Assist Device Insertion As Bridge to Transplant

Masaki Tsukashita, Hiroo Takayama, Koji Takeda, Paolo C. Colombo, Veli K. Topkara, Melana Yuzefpolskaya, Donna M. Mancini, *Yoshifumi Naka

New York Presbyterian Hospital/Columbia University, New York, NY

Invited Discussant:

45. Lung Transplantation and Concomitant Cardiac Surgery: Is It Justified?
Reshma M. Biniwale, *David Ross, Curtis Hunter, Jamil Aboulhosn, Oh-Jin Kwon, David Gjertson, *Abbas Ardehali
University of California, Los Angeles, CA

Invited Discussant: *Susan D. Moffat-Bruce

AATS Guidelines: Bridge to Transplant & Extracorporeal Lung Support
Marcelo Cypel, *Toronto General Hospital*

8:40 AM **ADJOURN**

TUESDAY MORNING, APRIL 28, 2015

8:45 AM **PLENARY SCIENTIFIC SESSION** Room 4E, WSCC
8 minute presentation, 12 minute discussion

Moderators: *Pedro J. del Nido and *Marc R. Moon

46. Long-Term Survival, Valve Durability, and Reoperation for Four Aortic Root Procedures
*Lars G. Svensson, Salia T. Pillai, Jeevanantham Rajeswaran, *Eric E. Roselli, *Gosta B. Pettersson, *A. Marc Gillinov, *Jose L. Navia, *Nicholas G. Smedira, *Joseph F. Sabik, III, *Bruce W. Lytle, *Eugene H. Blackstone
Cleveland Clinic, Cleveland, OH

Invited Discussant: *Tirone E. David

47. Long-Term Clinical Outcome and Performance of Pulmonary Valve Replacement with Bioprosthetic Valves in Patients with Congenital Heart Disease
Rio S. Nomoto[1], Lynn A. Sleeper[2], Michele J. Borisuk[1], Lisa Bergerson[1], *Pedro J. del Nido[1], *Frank A. Pigula[1], Sitaram Emani[1], Francis Fynn-Thompson[1], *John E. Mayer[1], Christopher W. Baird[1]
[1]Boston Children's Hospital & Harvard Medical School, Boston, MA; [2]Cytel, Inc., Cambridge, MA

Invited Discussant: *John W. Brown

48. Adjuvant Radiation Is Not Associated with Improved Survival in Patients with Positive Margins Following Lobectomy for Stage I & II Non-Small Cell Lung Cancer
Brian C. Gulack[1], Chi-Fu Jeffrey Yang[1], Paul J. Speicher[1], H. Volkan Kara[2], *Thomas A. D'Amico[1], *Mark F. Berry[3], Matthew G. Hartwig[1]
[1]Duke University, Durham, NC; [2]Marmara University, Istanbul, Turkey; [3]Stanford University, Stanford, CA

Invited Discussant: *Mark S. Allen

49. Should Asymptomatic Patients Discharged with Lower Hemoglobin Expect Worse Outcomes After Valve Surgery?

*Niv Ad, Sari Diana Holmes, *Alan M. Speir, Graciela Pritchard, Deborah J. Shuman, Linda Halpin

Inova Heart and Vascular Institute, Falls Church, VA

Invited Discussant: *Glenn J. Whitman

10:05 AM **COFFEE BREAK/VISIT EXHIBITS**

10:30 AM **AWARD PRESENTATIONS**

10:40 AM **PLENARY SCIENTIFIC SESSION**

Moderators: *Joseph S. Coselli and *Marc R. Moon

50. Resident Versus Attending Surgeon Patency and Clinical Outcomes in On- Versus Off-Pump Coronary Artery BypassSurgery

G. Hossein Almassi[1], Muath Bishawi[2], Annie Laurie Shroyer[3], Jacquelyn A. Quin[4], Brack Hattler[5], Todd H. Wagner[6], Joseph F. Collins[7], *Joseph C. Cleveland[8], *Frederick L. Grover[9], *Faisal G. Bakaeen[10]

[1]Medical College of Wisconsin, Milwaukee, WI; [2]Duke University, Durham, NC; [3]Northport Veterans Affairs Medical Center and Stony Brook University, Stony Brook, NY; [4]VA Boston Healthcare System, West Roxbury, MA; [5]Veteran Affairs Eastern Colorado Health Care System, Denver, CO; [6]Veterans Affairs Palo Alto Health Economics Resource Center, Menlo Park, CA; [7]Cooperative Studies Program Coordinating Center and VA Medical Center, Perry Point, MD; [8]University of Colorado, Aurora, CO; [9]University of Colorado, Denver, CO; [10]Baylor College of Medicine and Houston VA Medical Center, Houston, TX, Houston, TX

Invited Discussant: *John D. Puskas

51. Incidence and Implications of Postoperative Supraventricular Tachycardia Following Pulmonary Lobectomy

*Brendon M. Stiles[1], Gregory P. Giambrone[1], Xian Wu[1], Licia K. Gaber-Baylis[1], *Subroto Paul[1], Akshay U. Bhat[2], Ramin Zabih[2], Peter M. Fleischut*[1], *Nasser K. Altorki*[1]

[1]Weill Cornell Medical College, New York-Presbyterian Hospital, New York, NY; [2]Cornell University, Ithaca, NY

Invited Discussant: *Ara A. Vaporciyan

52. What Is a "Good" Result After Transcatheter Mitral Repair? Impact of 2+ Residual Mitral Regurgitation

Nicola Buzzatti[1], Michele De Bonis[1], Paolo Denti[1], Elisabetta Lapenna[1], Fabio Barili[2], Giovanna Di Giannuario[1], Giovanni La Canna[1], *Ottavio Alfieri[1]

[1]San Raffaele Scientific Institute, Milan, Italy; [2]Santa Croce e Carle Hospital, Cuneo, Italy

Invited Discussant: *Marc Ruel

11:40 AM	**HONORED GUEST LECTURE** ***Three Ideas About Changing Things*** Colonel Casey Haskins BLK SHP INNOVATIONS	*Not for Credit*
12:30 PM	**ADJOURN FOR LUNCH – VISIT EXHIBITS**	
12:45 PM	**MODERATED POSTER COMPETITIONS** 5 minute presentation	Exhibit Hall *Not for Credit*

ADULT CARDIAC MODERATED POSTER COMPETITION

Moderator: *Ralph J. Damiano, Jr.

P1. David Versus Goliath: Valve-Sparing Root Replacement Improves Outcomes Compared to Bentall Procedures in Patients with Aortic Root Dilatation

Maral Ouzounian, *Vivek Rao, Cedric Manlhiot, Nachum Abraham, Carolyn David, *Christopher M. Feindel, *Tirone E. David

University of Toronto, Toronto, ON, Canada

P2. Should We Repair Moderate to Severe Tricuspid Regurgitation During Reoperative Left Sided Valve Procedures?

Igor Gosev, Maroun Yammine, Marzia Leacche, Siobhan Mcgurk, Antony Norman, Julius I. Ejiofor, Vladimir Ivkovic, James D. Rawn, *John G. Byrne, *Lawrence H. Cohn

Brigham and Women's Hospital, Boston, MA

P3. Off-Pump Versus On-Pump Coronary Artery Bypass Grafting in Patients with Left Ventricular Dysfunction: Analysis of 918 Matched-Pairs

Chikara Ueki[1], Hiroaki Miyata[2], *Noboru Motomura[2], Genichi Sakaguchi[1], Takehide Akimoto[1], *Shinichi Takamoto[2]

[1]Shizuoka General Hospital, Shizuoka, Japan; [2]Japan Cardiovascular Surgery Database Organization, Tokyo, Japan

P4. Comparison of Clinical Efficacy Between Biatrial Epicardial Application of Drug-Releasing Adhesive Hydrogels to Prevent Postoperative Atrial Fibrillation

William Wang[1], Xiao Dong Feng[2], yunqing Mei[3], Xin Hiu Yuan[4]

[1]Scripps Memorial Hospital, La Jolla, CA; [2]Shanghai Eastern Hospital, Shanghai, China; [3]Shanghai Tongji Hospital, Shanghai, China; [4]Changzhi Peace Hospital, Changzhi, China

P5. Amiodarone After Surgical Ablation for Atrial Fibrillation – Is It Really Necessary? A Prospective Randomized Controlled Trial

Niv Ad, Sari Diana Holmes, Graciela Pritchard, Deborah J. Shuman, Casey E. Miller

Inova Heart and Vascular Institute, Falls Church, VA

*AATS Member

P6. Surgical Treatment of HOCM in Patients with Extreme Hypertrophy, Septal Myocardial Fibrosis and Ventricular Tachycardia
Konstantin Borisov
German-Russian Cardiac Clinic, Moscow, Russian Federation

P7. Ten-Year Follow Up After Prospectively Randomized Evaluation of Stentless Aortic Valve Versus Stented Aortic Valve Replacement
Adam El-Gamel
Waikato Hospitali, Hamilton, New Zealand

P8. Plenary Presentations and Public Citations from the American Association for Thoracic Surgery
Yusuke Terasaki[1], Matthew Smith[1], *Prasad Adusumilli[2], *Brendon M. Stiles[1]
[1]Weill Cornell Medical College, New York Presbyterian Hospital, New York, NY; [2]Memorial Sloan Kettering Cancer Center, New York, NY

P9. Does Grafting Coronary Arteries with Only Moderate Stenosis Affect Long-Term Mortality?
*Joseph F. Sabik, III, Gabriel Olivares, Sajjad Raza, Penny L. Houghtaling, *Eugene H. Blackstone
Cleveland Clinic, Cleveland, OH

P10. Surgical Outcomes of Jehovah's Witness Patients Requiring Complex Cardiac Surgery
Akiko Tanaka, Takeyoshi Ota, Zewditu Asfaw, David Onsager, Vassyl Lonchyna, *Valluvan Jeevanandam
University of Chicago, Chicago, IL

P11. Long-Term Clinical Outcomes of Mitral Valve Replacement with the Hancock II Bioprosthesis
Mitesh V. Badiwala, Carolyn M. David, Cedric Manlhiot, Lisa Garrard, *Tirone E. David, *Vivek Rao Peter Munk
University of Toronto, Toronto, ON, Canada

P12. Restoration of Sinus Rhythm and Atrial Transport Function After the Maze Procedure: Box-Lesion Versus U-Lesion Set
*Takashi Nitta, Yosuke Ishii, Masahiro Fujii, Yasuo Miyagi, Shun-ichiro Sakamoto, Atushi Hiromoto, Hajime Imura
Nippon Medical School, Tokyo, Japan

CONGENITAL HEART DISEASE MODERATED POSTER COMPETITION
Moderator: *Jennifer C. Hirsch-Romano

P13. Outcomes of Heart Transplantation in Children with Hypoplastic Left Heart Syndrome Previously Palliated with the Norwood Procedure
*Bahaaldin Alsoufi[1], William Mahle[1], Cedric Manlhiot[2], Shriprasad Deshpande[1], *Brian Kogon[1], Brian McCrindle[2], *Kirk Kanter[1]
[1]Emory University, Atlanta, GA; [2]University of Toronto, Toronto, ON, Canada

P14. Burden of Potentially Pathologic Copy Number Variants Is Higher in Children with Isolated Congenital Heart Disease and Significantly Impairs Covariate-Adjusted Long-Term Survival

Daniel Seung Kim[1], Jerry H. Kim[1], Amber A. Burt[1], David R. Crosslin[1], Nancy Burnham[2], Donna M. McDonald-McGinn[2], Elaine H. Zackai[5], Susan C. Nicolson[2], *Thomas L. Spray[2], Ian B. Stanaway[1], Deborah A. Nickerson[1], Patrick J. Heagerty[1], Hakon Hakonarson[2], Gail P. Jarvik[1], J. William Gaynor[2]

[1]University of Washington, Seattle, WA; [2]Children's Hospital of Philadelphia, Philadelphia, PA

P15. Intramural Coronary Arteries Are Not a Risk for Mortality in the Arterial Switch Operation

Tyson A. Fricke, Anne Eva Bulstra, Phillip S. Naimo, Yves d'Udekem, Christian P. Brizard, *Igor E. Konstantinov

Royal Children's Hospital, Melbourne, Australia

P16. The Surgical Treatment of Atrial Isomerism: Single Center Experience of 353 Cases

*Hajime Ichikawa, Koji Kagisaki, *Toshikatsu Yagihara, Takaya Hoashi

National Cerebral and Cardiovascular Center, Suita, Japan

P17. The Impact of Age at Cavo-Pulmonary Shunt (Stage II) on Outcome After the Norwood Procedure. Importance of Elective Versus Non-Elective Intervention.

Intisar Ulhaq, Adrian Crucean, John Stickley, David Barron, Timothy Jones, Natasha Khan, William James Brawn

Birmingham Children's Hospital, Birmingham, United Kingdom

P18. More Than Repair the Valve – Effect of Cone Reconstruction on Right Ventricle Remodeling in Patients with Ebstein Anomaly: A CMR Study

Qi An, Da Zhu, Xiao Li

West China Hospital, Chengdu, China

P19. Mild to Moderate Residual LVOTO May Stop or Reverse the Progression of Systemic Right Ventricle Remodeling Process in Adult CCTGA Patients After Physiological Repair

Fucheng Xiao, Jianping Xu, Hansong Sun Peking

Union Medical College and Chinese Academy of Medical Sciences, Beijing, China

P20. What Is the Procedure Impact on Ventricular Outflow Tract Hemodynamics and Reintervention in Patients with Complex Transposition?

Mohammed K. Al-Jughiman, Maryam Al-Omair, Luc Mertens, *Christopher A. Caldarone, *Glen Van Arsdell

Hospital for Sick Children, Toronto, ON, Canada

*AATS Member

P21. Increasing Complexity of Heart Transplantation in Patients with Congenital Heart Disease

William Y. Shi[1], Pankaj Saxena[2], Matthew S. Yong[1], Silvana Marasco[2], *David McGiffin[2], Anne Shipp[1], Robert G. Weintraub[1], Yves d'Udekem[1], Christian P. Brizard[1], *Igor E. Konstantinov[1]

[1]Royal Children's Hospital, Parkville, Australia; [2]Alfred Hospital, Prahran, Australia

P22. Bicuspid Aortic Valve Morphology: Does the Pattern of Leaflet Fusion Determine the Success of the Ross Procedure?

Mark Ruzmetov, Randall S. Fortuna, Jitendra J. Shah, Dale M. Geiss, Karl F. Welke

Children's Hospital of Illinois, Peoria, IL

P23. Durable Ventricular Assist Device Support for End-Stage Heart Failure: An Extended Role in Pediatric and Congenital Population

Ed Peng, Neil Wrightson, Massimo Griselli, Richard Kirk, Tanveer Butt, John J. O'Sullivan, Guy A. MacGowan, David Crossland, Stephan Schueler, Asif Hasan

Freeman Hospital, Newcastle Upon Tyne, United Kingdom

P24. Improving Outcomes with the Comprehensive Stage 2 Procedure After an initial Hybrid Stage 1 Palliation

*Mark E. Galantowicz, Andrew R. Yates

Nationwide Children's Hospital, Columbus, OH

GENERAL THORACIC MODERATED POSTER COMPETITION

Moderator: *Michael J. Liptay

P25. Early Initiation of Oral Feeding Following Thoracolaparoscopic Esophagectomy for Cancer: Interim Results from a Randomized Controlled Trial

Yin Li, Hai-bo Sun, Xian-ben Liu, Zong-fei Wang, Rui-xiang Zhang, Jian-jun Qin, Yan Zheng, Xian-kai Chen, Zhao Wu, Chang-sen Leng, Jun-wei Zhu Henan

Zhengzhou University, Zhengzhou, China

P26. Outcome of the Joint Council of Thoracic Surgery Education's Early Review Course Project

*Mark Allen[1], *John Calhoon[2], *David Fullereton[3], *Richard Shemin[4], *Keith Naunheim[5], *Edward Verrier[6], John Doty[7], *Douglas Mathisen[8]

[1]Mayo Clinic, Rochester, MN; [2]University of Texas Health Science Center, San Antonio, TX; [3]University of Colorado, Denver, CO; [4]UCLA, Los Angeles, CA; [5]St. Louis University Health Sciences Center, St. Louis, MO; [6]University of Washington, Seattle, WA; [7]Intermountain Medical Center, Murray, UT; [8] Massachusetts General Hospital, Boston, MA

P27. A Gene Expression Profile Based Test to Predict Neoadjuvant Chemoradiation Response in Esophageal Adenocarcinoma Patients

Weiwei Shan[1], Jennifer Mitchell[2], Natalie Lassen[1], Clare E. Johnson[1], John F. Stone[2], Derek J. Maetzold[1], Robert W. Cook[1], Sunil S. Badve[3], Kenneth S. Kessler[3], Romil Saxena[3]

[1]Castle Biosciences, Friendswood, TX; [2]St. Joseph's Hospital and Medical Center, Phoenix, AZ; [3]Indiana University, Indianapolis, IN

P28. Metformin Exposure Is Associated with Improved Survival in Early-Stage Non-Small Cell Lung Cancer Patients

Robert A. Medairos, Christopher W. Seder, James Clark, Simon Holoubek, John Kubasiak, Ravi Pithadia, Fatima Hamid, Gary W. Chmielewski, *William H. Warren, Sanjib Basu, Jeffrey Borgia, *Michael J. Liptay

Rush University, Chicago, IL

P29. Should Lobectomy Be Performed When Unsuspected pN2 Disease Is Found at the Time of Planned Lung Cancer Resection? A National Cancer Data Base Analysis

Chi-Fu Jeffrey Yang[1], Brian G. Gulack[1], Michael Mulvihill[1], Volkan Kara[1], *Thomas D'Amico[1], Matthew Hartwig[1], *Mark Berry[2]

[1]Duke University, Durham, NC; [2]Stanford University, Stanford, NC

P30. Does Neoadjuvant Chemoradiation Followed by Pneumonectomy Provide Better Long-Term Survival in Patients with NSCLC?

Cengiz Gebitekin[1], *Alper Toker[2], *Walter Weder[3], Ahmet Sami Bayram[1], Berker Özkan[2], Isabelle Opitz[3], Hüseyin Melek[1], Stephane Collaud[3], Adalet Demir[2]

[1]Uludag University, Bursa, Turkey; [2]Istanbul University, Istanbul, Turkey; [3]University Hospital, Zurich, Switzerland

P31. Prophylactic Mass Ligation of the Thoracic Duct During Esophagectomy Is Associated with a Higher Rate of Chylothorax Than Explicit Identification and Ligation of the Thoracic Duct

Yifan Zheng, Abraham Lebenthal, Jon O. Wee, *Scott J. Swanson, Ciaran J. McNamee, *Steven J. Mentzer, *Michael T. Jaklitsch, *Raphael Bueno

Brigham and Women's Hospital, Boston, MA

P32. Pulmonary Function Changes After VATS Lobectomy Versus Limited Resection for Early Stage Lung Cancers

Zhitao Gu, Wentao Fang, Teng Mao, Chunyu Ji

Shanghai Chest Hospital, Shanghai, China

*AATS Member

P33. The Incidence and Burden of Venous Thromboembolism After Major Lung Resection: A Prospective Cohort Analysis

Yaron Shargall[1], Wael C. Hanna[1], Colin Schieman[1], Christian J. Finley[1], Laura Schneider[1], Terri Schnurr[1], John Agzarian[1], Dennis Nguyen-Do[1], Yury Peysakhovich[1], *Thomas K. Waddell[2], *Marc de Perrot[2], Lori-Ann Linkins[1], Mark Crowther[1], James Douketis[1]

[1]McMaster University, Hamilton, ON, Canada; [2]University of Toronto, Toronto, ON, Canada

P34. Caprini Risk Assessment for Postoperative Venous Thromboembolism in Surgical Lung Cancer Patients

Krista J. Hachey, Philip D. Hewes, Liam P. Porter, Doug G. Ridyard, Pamela Rosenkranz, David McAneny, *Hiran C. Fernando, *Virginia R. Litle

Boston University, Boston, MA

P35. Long-Term Survival Advantage of Double Lung Transplantation in Patients with Secondary Pulmonary Hypertension

Joshua C. Grimm, J. Trent Magruder, Vicente Valero, III, Arman Kilic, Leann L. Silhan, Pali D. Shah, Christian A. Merlo, *Ashish S. Shah

Johns Hopkins University, Baltimore, MD

P36. Perforated Esophageal Intervention Focus Study: A Multi Center Study of Contemporary Treatment

Rob Rice[1], Joseph J. DuBose[1], Kamal Khalil[1], Jonathon Spicer[1], Luigi Bonavina[2], Stefano Siboni[3], Xian Luo-Owen[4], Sebron Harrison[5], Chad Ball[6], John Bini[7], Dan Fortes[8], Gary Vercruysse[9], David Skarupa[10], Charles Miller[1]

[1]University of Texas, Houston, TX; [2]University of Milan, Milan, Italy; [3]University of Southern California, Los Angeles, CA; [4]Loma Linda University, Loma Linda, CA; [5]University of Mississippi, Mississippi, MS; [6]University of Calgary, Calgary, AB, Canada; [7]Miami Valley Hospital, Dayton, OH; [8]University of Texas, Austin, TX; [9]University of Arizona, Houston, TX; [10]University of Florida, Jacksonville, FL

TUESDAY AFTERNOON, APRIL 28, 2015

2:00 PM **ADULT CARDIAC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 4E, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Thoralf M. Sundt, III and *Jose L. Pomar

AATS Guidelines: Ischemic Mitral Valve Regurgitation

*Irving L. Kron, *University of Virginia*

53. Multiple Arterial Bypass Grafting Should Be Routine

Robert F. Tranbaugh, David J. Lucido, Kamellia R. Dimitrova, Darryl M. Hoffman, Charles M. Geller, *John D. Puskas

Mount Sinai Beth Israel, New York, NY

Invited Discussant: *G. Hossein Almassi

54. Are All Forms of Total Arterial Revascularisation Equal? A Comparison of Single Versus Bilateral Internal Thoracic Artery Grafting Strategies

William Y. Shi[1], Philip A. Hayward[2], *James Tatoulis[3], John A. Fuller[4], Alexander Rosalion[5], *Brian F. Buxton[1]

[1]University of Melbourne, Melbourne, Australia; [2]Austin Hospital, Melbourne, Australia; [3]Royal Melbourne Hospital, Melbourne, Australia; [4]Epworth Hospital Richmond, Melbourne, Australia; [5]St. Vincent's Hospital, Melbourne, Australia

Invited Discussant: *Clifford W. Barlow

55. Complete Revascularization Improves Survival in Octogenarians

Spencer J. Melby, *Hersh S. Maniar, *Jennifer S. Lawton, *Michael K. Pasque, Akinobu Itoh, Keki R. Balsara, *Ralph J. Damiano, Jr., *Marc R. Moon

Washington University, Saint Louis, MO

Invited Discussant: *A. Pieter Kappetein

3:20 PM – 3:55 PM COFFEE BREAK

56. Full Myocardial Revascularization Purely with Bilateral Internal Thoracic Arteries: Effects on Late Survival, Analysis of 3757 Patients

*Daniel O. Navia, Juan Espinoza, Mariano Vrancic, Fernando Piccinini, Mariano Camporrotondo, Mariano Benzadon, Juan Camou, Alberto Dorsa

Instituto Cardiovascular de Buenos Aires, Buenos Aires, Argentina

Invited Discussant: *Michael E. Halkos

57. Non-Selective Carotid Artery Ultrasound Screening in Patients Undergoing Coronary Artery Bypass Grafting: Is It Necessary?

Khalil Masabni, *Joseph F. Sabik, III, Sajjad Raza, Theresa A. Carnes, Hemantha Koduri, Mehdi H. Shishehbor, Heather L. Gornik, *Eugene H. Blackstone

Cleveland Clinic, Cleveland, OH

Invited Discussant: *Thomas E. MacGillivray

58. A 20-Year Experience with Isolated Pericardiectomy: Analysis of Indications and Outcomes

Erin A. Gillaspie, John M. Stulak, *Richard C. Daly, Kevin L. Greason, *Lyle D. Joyce, Jae Oh, *Rakesh M. Suri, *Hartzell V. Schaff, *Joseph A. Dearani

Mayo Clinic, Rochester, MN

Invited Discussant: *Joseph F. Sabik, III

*AATS Member

59. Early and Late Surgical Outcomes of Infective Endocarditis Among Intravenous Drug Abusers: Results from Two Large Academic Centers

Joon Bum Kim[1], Julius I. Ejiofor[2], Maroun Yammine[2], Sandra B. Nelson[1], Arthur Y. Kim[1], Serguei I. Melnitchouk[1], James D. Rawn[2], Marzia Leacche[2], *John G. Byrne[2], *Thoralf M. Sundt, III[1]

[1]Massachusetts General Hospital, Harvard Medical School, Boston, MA; [2]Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Gosta B. Pettersson

Late-Breaking Clinical Trial

LB2. Neurologic Event-Risk and -Extent Are Equivalent for TAVR and SAVR in High Risk Patients: A Neurological Sub-Study of the US Pivotal Randomized Trial of a Self-Expanding Prosthesis

*Thomas G. Gleason[1], Jeffrey J. Popma[2], *John Conte[3], *G. Michael Deeb[4], *G. Chad Hughes, Jr.[5], *Michael J. Reardon[6], *David H. Adams[7]

[1]University of Pittsburgh, Pittsburgh, PA; 2Beth Israel Deaconess Medical Center, Boston, MA; [3]Johns Hopkins University, Baltimore, MD; [4]University of Michigan, Ann Arbor, MI; [5]Duke University, Durham, NC; [6]Houston Methodist Debakey Heart & Vascular Center, Houston, TX; [7]Mount Sinai Medical Center, New York, NY

Invited Discussant:

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

TUESDAY AFTERNOON, APRIL 28, 2015

2:00 PM **CONGENITAL HEART DISEASE SIMULTANEOUS SCIENTIFIC SESSION** Room 6A, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Jonathan M. Chen and *Charles B. Huddleston

60. Hybrid Therapy for the Hypoplastic Left Heart Syndrome – Myth, Alternative or Standard?

Can Yerebakan, Klaus Valeske, Hatem Elmontaser, Matthias Mueller, Juergen Bauer, Josef Thul, Dietmar Schranz, Hakan Akintuerk

Pediatric Heart Center Giessen, Giessen, Germany

Invited Discussant: *Mark E. Galantouitz

61. Selective Management Strategy for Neonates with Interrupted Aortic Arch Mitigates Future Left Ventricular Outflow Tract Obstruction Risk

*Bahaaldin Alsoufi, Brian Schlosser, Ritu Sachdeva, William Border, William Mahle, *Brian Kogon, *Kirk Kanter

Emory University, Atlanta, GA

Invited Discussant: *Ralph S. Mosca

62. Impact of Pacing on Left Ventricular Function in L-Transposition of the Great Arteries

Sophie C. Hofferberth, Mark E. Alexander, Douglas Y. Mah, Victor Baustista-Hernandez, *Pedro J. del Nido, Francis Fynn-Thompson

Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Henry M. Spotnitz

63. Comparison Between Two Surgical Techniques to Repair Total Anomalous Pulmonary Venous Connection at a Single Institute: 81 Cases with Sutureless Technique Versus 98 Cases with Traditional Technique

Yiqun Ding, Yanqiu Ou, Cheng Zhang, Jimei Chen, Jianzheng Cen, Shusheng Wen, Gang Xu, Jian Zhuang

Guangdong General Hospital, Guangzhou, China

Invited Discussant: *Christopher A. Caldarone

64. Characterization and Outcomes of Severe Primary Multi-Vessel Pulmonary Vein Stenosis in Low-Birth Weight Infants

Ashley Dickens, Kimberley Gauvereau, Sanjay P. Prabhu, Christina Ireland, Michele J. Borisuk, Kathy Jenkins, Christopher W. Baird

Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Emile A. Bacha

3:40 PM – 4:15 PM COFFEE BREAK

Moderators: *E. Dean McKenzie and *Michael E. Mitchell

65. Pre-Operative Predictors of Survival After Repair of Pulmonary Vein Stenosis

Mauro Lo Rito, Tamadhir Gazzaz, Travis Wilder, *Glen S. Van Arsdell, Osami Honjo, Shi-Joon Yoo, *Christopher A. Caldarone

Hospital for Sick Children, Toronto, ON, Canada

Invited Discussant: *Francois G. Lacour-Gayet

66. Improvement of Cardiopulmonary Exercise Capacity After Pulmonary Valve Replacement and Its Predictors in Patients with Pulmonary Regurgitation After Repair of Tetralogy of Fallot

Yu Rim Shin, Jong Keun Kim, Hong Ju Shin, Young-Hwan Park, Han Ki Park

Yonsei University Severance Hospital, Seoul, Republic of Korea

Invited Discussant: *E. Dean McKenzie

67. Intermediate-Term Neuro-Developmental Outcomes After Neonatal Cardiac Surgery: Role of Cortical Iso-Electric Activity

Michael Swartz, Laurie Seltzer, Jennifer Kwon, James Burchfiel, Jill M. Cholette, Dawn Sweeney, Cecilia Meagher, Ron Angona, Ronnie Guillet, George M. Alfieris

University of Rochester, Rochester, NY

Invited Discussant: *J. William Gaynor

DEEP DIVE SESSION FEATURING:

2. Late Survival and Right Ventricular Performance in 332 Matched Children: Classic Norwood-BT Shunt Versus Norwood-Sano Modification

Moderated by *Jonathan M. Chen

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

TUESDAY AFTERNOON, APRIL 28, 2015

2:00 PM **GENERAL THORACIC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 6C, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Thomas K. Waddell and *Yolonda L. Colson

68. Unexpected Readmission After Lung Cancer Surgery: A Benign Event?

Varun Puri, Aalok Patel, *Traves D. Crabtree, Jennifer M. Bell, *A. Sasha Krupnick, Stephen Broderick, *Daniel Kreisel, *G. Alexander Patterson, *Bryan F. Meyers

Washington University, Saint Louis, MO

Invited Discussant: *Alessandro Brunelli

69. Complexity of Case Mix Is an Independent Predictor of Mortlaity After Esophagectomy in a Nationwide Inpatient Sample Data Analysis

Matthew L. Inra, Elizabeth B. Habermann, Kristine M. Thomsen, *Mark S. Allen, *Stephen D. Cassivi, *Francis C. Nichols, K. Robert Shen, *Dennis Wigle, *Shanda H. Blackmon

Mayo Clinic, Rochester, MN

Invited Discussant: Nabil Rizk

70. Development of a Nomogram for Predicting Outcomes After Sublobar Resection for lung cancer; an Analysis from ACOSOG Z4032 (Alliance), a Randomized Trial

Michael Kent[1], Sumithra Mandrekar[2], *Rodney Landreneau[3], *Francis Nichols[2], Nathan Foster[2], Thomas Dipetrillo[4], *Brian Meyers[5], Dwight Heron[6], *David Jones[7], Angelina Tan[2], Sandra Starnes[8], *Joe Putnam[9], *Hiran Fernando[10]

[1]Beth Israel Deaconess Medical Center, Boston, MA; [2]Mayo Clinic, Rochester, MA; [3]Ochsner Medical Center, New Orleans, LA; [4]Rhode Island Hospital, Providence, RI; [5]Washington University, St. Louis, MO; [6]University of Pittsburgh, Pittsburgh, PA; [7]Memorial Sloan Kettering Cancer Center, New York, NY; [8]University of Cincinnati, Cincinnati, OH; [9]Vanderbilt University, Nashville, TN; [10]Boston University, Boston, MA

Invited Discussant:

71. Esophageal Perforation in Europe – A Multinational Study Using the Pittsburgh Esophageal Perforation Severity Scoring System

Michael Schweigert[1], Hugo Santos Sousa[2], Steve Eubanks[3], Norbert Solymosi[3], Aleksandar Yankulov[4], Marta Jiménez Fernández[5], Rory Beattie[6], Attila Dubecz[7], Charlotte Rabl[8], Rudolf J. Stadlhuber[8], Dietmar Ofner[8], Jim McGuigan[6], Helmut Witzigmann[1], Hubert J. Stein[7]

[1]Städtisches Klinikum Dresden Friedrichstadt, Dresden, Germany; [2]Hospital São João, Porto, Portugal; [3]Szent István University, Budapest, Hungary; [4]Medical University of Plovdiv, Plovdiv, Bulgaria; [5]Hospital Universitario de la Princesa, Madrid, Spain; [6]Royal Victoria Hospital, Belfast, United Kingdom; [7]Klinikum Nuremberg, Nürnberg, Germany; [8]Paracelsus Medical University, Salzburg, Austria

Invited Discussant: *Shanda H. Blackmon

72. Baseline Measure of Health-Related Quality of Life Predicts Overall Survival in Esophageal Cancer Patients

Biniam Kidane, Joanne Sulman, Wei Xu, Qin Quinn Kong, Rebecca Wong, Jennifer J. Knox, *Gail E. Darling

University of Toronto, Toronto, ON, Canada

Invited Discussant: *Thoms J. Watson

3:40 PM – 4:15 PM COFFEE BREAK

73. The Effect of Surgeon Volume on Procedure Selection in Non-Small Cell Lung Cancer Surgery

Ivana Camposilvan, Noori Aktar-Danesh, Laura Schneider, Colin Schieman, Wael C. Hanna, Yaron Shargall, Christian J. Finley

McMaster University, Hamilton, ON, Canada

Invited Discussant:

74. The Integrated Comprehensive Care Program: A Novel Home Care Initiative After Major Thoracic Surgery

Yaron Shargall[1], Wael C. Hanna[1], Colin Schieman[1], Christian J. Finley[1], Laura Schneider[1], Anna Tran[2], Carolyn Gosse[2], James M. Bowen[1], Gord Blackhouse[1], Kevin Smith[2]

[1]McMaster University, Hamilton, ON, Canada; [2]St. Joseph's Healthcare Hamilton, Hamilton, ON, Canada

Invited Discussant: *Mark Onaitis

AATS Guidelines: Management of Empyema

*K. Robert Shen, *Mayo Clinic*

*AATS Member

Late-Breaking Clinical Trial

LB3. Lung Cancer Screening by Quantitative Analysis of Exhaled Carbonyl Compounds

Erin M. Schumer, Victor H. van Berkel, Jaimin R. Trivedi, Mingxiao Li, Xiao-An Fu, Michael Bousamra, II

University of Louisville, Louisville, KY

Invited Discussant:

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

TUESDAY AFTERNOON, APRIL 28, 2015

2:00 PM **AORTIC/ENDOVASCULAR SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 612, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Scott A. LeMaire and *Allan S. Stewart

75. Long Term Comparison of Aortic Root Operations for Marfan Syndrome: Bentall Versus Valve-Sparing Techniques

Joel Price, J. Trent Magruder, Allen Young, Joshua Grimm, Nishant D. Patel, Diane Alejo, *Luca A. Vricella, *Duke E. Cameron

Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: *John A. Kern

76. Open Repair of Ruptured Descending Thoracic and Thoracoabdominal Aortic Aneurysms in 100 Consecutive Cases

Mario F.L. Gaudino, Christopher Lau, Monica Munjal, *Leonard N. Girardi

Weill Cornell Medical College, New York, NY

Invited Discussant: *Abe DeAnda, Jr.

77. Total Aortic Arch Replacement with the Thoraflex Hybrid Frozen Elephant Trunk Prosthesis: Report on the First 100 Patients in a Single Center

*Malakh Shrestha, Heike Krueger, Klaus Tim Kaufeld, Erik Beckmann, Nurbol Koigeldiyev, Felix Fleissner, Julia Umminger, *Axel Haverich, Andreas Martens

Hannover Medical School, Hannover, Germany

Invited Discussant: *Friedhelm Beyersdof

78. Total Aortic Arch Replacement: Predictors of Adverse Outcomes for Hybrid Arch Exclusion Versus Traditional Open Repair in 319 Patients

Ourania Preventza[1], Andrea Garcia[1], *Denton Arthur Cooley[2], Ricky Haywood-Watson[1], Kiki Simpson3, *Faisal Ghazi Bakaeen[3], Lorraine Cornwell[3], Shuab Omer[3], Kim Insua de la Cruz[1], *Joseph S. Coselli[1]

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

Invited Discussant: *Joseph E. Bavaria

3:20 PM – 3:50 PM **COFFEE BREAK**

6 minute presentation, 7 minute discussion

79. Does Moderate Hypothermia Really Carry Less Bleeding Risk Than Deep Hypothermia for Circulatory Arrest? A Propensity-Matched Comparison in Hemiarch Replacement

Jeffrey E. Keenan, Hanghang Wang, Brian C. Gulack, Asvin M. Ganapathi, Nicholas D. Andersen, Brian R. Englum, Jerrold H. Levy, Ian J. Welsby, *G. Chad Hughes

Duke University, Durham, NC

Invited Discussant: *Edward P. Chen

80. Aortic Dissection with Arch Entry Tear: Surgical Experience in 104 Patients During a 12-Year Period

Wei Zhang[1], Wei-Guo Ma[2], Long-Fei Wang[1], Jun Zheng[1], Bulat A. Ziganshin[2], Paris Charilaou[2], Xu-Dong Pan[1], Yong-Min Liu[1], Jun-Ming Zhu[1], Qian Chang[4], *Li-Zhong Sun[1], *John A. Elefteriades[2]

[1]Capital Medical University, Beijing, China; [2]Yale University, New Haven, CT; [3]Chinese Academy of Medical Sciences, Beijing, China

Invited Discussant: *John S. Ikonomidis

81. Remodeling of the Remnant Aorta After Acute Type A Aortic Dissection Surgery; Are Young Patients More Likely to Develop Adverse Aortic Remodeling of the Remnant Aorta Over Time?

Jihoon Kim[1], Suk Jung Choo[1], Sun Kyun Ro[2], Joon Bum Kim[1], Sung-Ho Jung[1], Cheol Hyun Chung[1], *Jae Won Lee[1]

[1]Asan Medical Center, Seoul, Republic of Korea; [2]Hanyang University Guri Hospital, Guri-si, Republic of Korea

Invited Discussant: *Anthony Estrera

82. Prophylactic First Stage Elephant Trunk for Moderately Dilated Descending Aorta in Patients with Predominantly Proximal Disease

Jahanzaib Idrees, *Eric E. Roselli, Ke Feng, Charles M. Wojnarski, Edward G. Soltesz, Douglas R. Johnston, *Joseph F. Sabik, III, *Lars G. Svensson

Cleveland Clinic, Cleveland, OH

Invited Discussant: *G. Chad Hughes

83. Long-Term Benefits of Surgical Pulmonary Embolectomy for Acute Pulmonary Embolus on RightVentricular Function

William B. Keeling, Bradley G. Leshnower, *Robert A. Guyton, *Michael E. Halkos, *Vinod H. Thourani, Omar M. Lattouf

Emory University, Atlanta, GA

Invited Discussant: Rune Waaverstad

84. Long-Term Follow-Up of Aortic Intramural Hematomas and Penetrating Ulcers

Alan S. Chou, Bulat Ziganshin, Paris Charilaou, Maryann Tranquilli, *John A. Elefteriades

Yale University, New Haven, CT

Invited Discussant: *Kenji Minatoya

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

WEDNESDAY MORNING, APRIL 29, 2015

7:00 AM **ADULT CARDIAC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 6B, WSCC

5 minute presentation, 6 minute discussion

Moderators: *Vinod H. Thourani and *Jennifer S. Lawton

In Case You Missed It!

Listen to a summary of the 95th Annual Meeting scientific programming from the adult cardiac surgeon perspective.

*John S. Ikonomidis, *University of South Carolina*

85. Insights into Flow Hemodynamics in Externally Stented Vein Grafts

*David Paul Taggart[1], Tomer Meirson[2], Idit Avrahami[3], Carlo Di Mario[4], Carolyn Webb[4], Keith M. Channon[1], Niket Patel[5], Eyal Orion[5]

[1]University of Oxford, Oxford, United Kingdom; [2]Afeka Academic College of Engineering, Tel Aviv, Israel; [3]Ariel University, Ariel, Israel; [4]Royal Brompton Hospital, London, United; [5]Vascular Graft Solutions, Tel Aviv, Israel

Invited Discussant: *James I. Fann

86. The Rise of New Technologies for Aortic Valve Stenosis: A Propensity-Score Analysis from Two Multicenter Registries Comparing Sutureless and Trans-Catheter Aortic Valve Replacement

Augusto D'Onofrio[1], Antonino S. Rubino[2], Stefano Salizzoni[3], Laura Besola[1], Claudia Filippini[3], *Ottavio Alfieri[4], Antonio Colombo[4], Marco Agrifoglio[5], Theodor Fischlein[6], Filippo Rapetto[7], Giuseppe Tarantini[1], Magnus Dalén[8], Davide Gabbieri[9], Bart Meuris[10], Carlo Savini[11], Aniello Pappalardo[12], Marco Luigi Aiello[13], Fausto Biancari[14], *Ugolino Livi[15], Pier Luigi Stefàno[16], Mauro Cassese[17], Bruno Borrello[18], Mauro Rinaldi[3], Carmelo Mignosa[2], *Gino Gerosa[1]

[1]University of Padova, Padova, Italy; [2]University of Catania, Catania, Italy; [3]Università di Torino, Molinette, Turin, Italy; [4]San Raffaele Hospital, Milan, Italy; [5]University of Milan, Milan, Italy; [6]Klinikum Nürnberg, Nürnberg, Germany; [7]IRCCS San Martino-IST, Genova, Italy; [8]Karolinska Institutet, Karolinska University Hospital, Stockholm, Sweden; [9]Hesperia Hospital, Modena, Italy; [10]University Hospital Gasthuisberg, Leuven, Belgium; [11]AOU S. Orsola, Bologna, Italy; [12]Ospedali Riuniti Trieste, Trieste, Italy; [13]IRCCS Policlinico S. Matteo, Pavia, Italy; [14]Oulu University Hospital, Oulu, Finland; [15]AOU S. Maria Misericordia, Udine, Italy; [16]Azienda Ospedaliero-Universitaria Careggi, Firenze, Firenze, Italy; [17]Clinica S. Maria, Bari, Italy; [18]Ospedale Maggiore, Parma, Italy

Invited Discussant: *Hersch Maniar

87. First North American Single Centre Experience with the Enable Sutureless Aortic Bioprosthesis in a High-Risk Surgical Cohort

Benoit de Varennes, Kevin Lachapelle, Renzo Cecere, Isabel Szczepkowski, Jean Buithieu

McGill University, Montreal, QC, Canada

Invited Discussant: *Thomas G. Gleason

Late Breaking Clinical Trial

88. First Large Cohort with a Sutureless Aortic Valve: The 1 Year Follow-Up of 628 Consecutive Patients from an International Multicenter Prospective Trial

*Axel Haverich[1], Bart Meuris[2], Theodor J.M. Fischlein[3], Kavous Hakim-Meibodi[4], Martin Misfeld[5], *Thierry P. Carrel[6], Marian Zembala[7], Sara Gaggianesi[8], Francesco Madonna[9], François Laborde[10]

[1]Hannover Medical School, Hannover, Germany; [2]U.Z. Gasthuisberg, Leuven, Belgium; [3]Hannover Medical School, Nuremberg, Germany; [4]Ruhr-Universität Bochum, Bad Oeynhausen, Germany; [5]University of Leipzig, Leipzig, Germany; [6]Inselspital, University Hospital, Bern, Switzerland; [7]Silesian Center for Heart Diseases, Zabrze (Silesia), Poland; [8]Sorin Group Italia S.r.l., Saluggia (VC), Italy; [9]Hopital Cardiologique Du Haut-Leveque, Pessac, France; [10]Institut Mutualiste Montsouris, Paris, France

Invited Discussant: *John S. Ikonomidis

Innovation in Cardiac Surgery
*Craig R. Smith, *Columbia University*

89. Robotic Repair of Simple Versus Complex Degenerative Mitral Valve Disease: Clinical and Echocardiographic Outcomes During Mid-Term Follow-Up

*Rakesh M. Suri[1], Amit Taggarse[1], *Harold Burkhart[2], Maurice Enriquez-Sarano[1], Hector Michelena[1], William Mauermann[1], Vuyisile Nkomo[1], Sunil Mankad[1], Zhuo Li[1], Rick Nishimura[1], *Richard Daly[1]

[1]Mayo Clinic, Rochester Minnesota, MN; [2]University of Oklahoma, Oklahoma City, OK

Invited Discussant:

90. Minimalist Transcatheter Aortic Valve Replacement: The New Standard for Surgeons and Cardiologists Using Transfemoral Access?

Hanna Alaoja Jensen, Jose Francisco Condado, Vasilis Babaliaros, Jose Binongo, Bradley G. Leshnower, Stamatios Lerakis, Eric Sarin, Chandan Devireddy, Kreton Mavromatis, Amjadullah Q. Syed, James P. Stewart, Brian Kaebnik, Ayaz Rahman, Amy Simone, Patricia Keegan, *Robert A. Guyton, Peter C. Block, *Vinod H. Thourani

Emory University, Atlanta, GA

Invited Discussant: *Michael J. Reardon

*AATS Member

91. Anterior Mitral Valve Leaflet Augmentation Repair in Type III Mitral Regurgitation: Lessons Learned

Thomas M. Kelley, Jr.[1], James McCarthy[2], Nels D. Carroll[2], Mohammed Kashem[2], G. William Moser[2], *Yoshiya Toyoda[2], Grayson H. Wheatley, III[2], *Larry Kaiser[2], *T. Sloane Guy[2], He Wang[1]

[1]Dwight D. Eisenhower Army Medical Center, Augusta, GA; [2]Temple University, Philadelphia, PA

Invited Discussant: *Ralph J. Damiano

92. Transapical Off-Pump Mitral Valve Repair with Neochord Implantation: Clinical and Echocardiographic Results of 3 Months Follow-Up

Colli Andrea, Fabio Zucchetta, Erica Manzan, Eleonora Bizzotto, Besola Laura, Cristiano Sarais, Roberto Bellu, Demetrio Pittarello, Dario Gregori, Gino Gersosa

University of Padua, Padua, Italy

Invited Discussant: *Gorav Ailawadi

93. Trends in U.S. Extracorporeal Membrane Oxygenation Utilization and Outcomes: 2002-2012

Fenton H. McCarthy, Katherine McDermott, Dawei Xie, Jacob Gutsche, Ashley C. Hoedt, *Wilson Y. Szeto, *Michael A. Acker, Nimesh D. Desai

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Matthew Bacchetta

AATS Guidelines: Sternal Wound Infection

*Harold L. Lazar, *Boston Medical Center*

WEDNESDAY MORNING, APRIL 29, 2015

7:00 AM **CONGENITAL HEART DISEASE SIMULTANEOUS SCIENTIFIC SESSION** Room 612, WSCC

5 minute presentation, 6 minute discussion

Moderators: *Duke E. Cameron and *Andrew J. Lodge

In Case You Missed It!

Listen to a summary of the 95th Annual Meeting scientific programming from the congenital surgeon perspective.

*Marshall L. Jacobs, *Johns Hopkins University*

94. Late Incidence of Endocarditis and Conduit Failure in Patients Undergoing Placement of Right Ventricular to Pulmonary Arterial Conduits with Bovine Jugular Grafts

Carlos M. Mery, Francisco Guzman-Pruneda, Matthew D. Terwelp, Luis E. DeLeon, Iki Adachi, *Jeffrey S. Heinle, *E. Dean McKenzie, *Charles D. Fraser, Jr.

Texas Children's Hospital, Houston, TX

Invited Discussant:

95. Pulmonary Artery Flow Studies Are Useful and Valid in Intraoperative Decision-Making for Patients Undergoing Repair of Pulmonary Atresia with Ventricular Septal Defect and Major Aortopulmonary Collateral Arteries

Jiaquan Zhu, Atsuko Kato, Arezou Saedi, Devin Chetan, Rachel Parker, *John G. Coles, *Christopher A. Caldarone, *Glen S. Van Arsdell, Osami Honjo

Hospital for Sick Children, Toronto, ON, Canada

Invited Discussant:

96. The Modification of Right Ventricle to Pulmonary Artery Conduit for Norwood Procedure Reduces the Number of Unintended Shunt-Related Events

Tomasz M. Mroczek, Rafal Zurek, Aleksandra Morka, Jerzy Jarosz, Katarzyna Szymanska, Janusz H. Skalski

Jagiellonian University, Krakow, Poland

Invited Discussant: *Minoo N. Kavarana

97. Right Ventricular Outflow Tract Reconstruction with a Polytetrafluoroethylene Monocusp Valve: A Twenty-Year Experience

*John Brown, Mohineesh Kumar, *Mark Rodefeld, *Mark Turrentine

Indiana University, Indianapolis, IN

Invited Discussant: *James A. Quintessenza

On Building a Heart: Lessons from Man and Nature

*Duke E. Cameron, *Johns Hopkins Hospital*

Moderators: *Bahaaldin Alsoufi and *J. William Gaynor

98. Repair of Parachute and Hammock Valves in Infants and Children and Its Long-Term Outcome

Eva Maria Delmo Walter, Henryk Siniawski, Takeshi Komoda, *Roland Hetzer

Deutsches Herzzentrum Berlin, Berlin, Germany

Invited Discussant: *Emre Belli

99. Preliminary Experience in the Use of an Extracellular Matrix As a Tube Graft: Word of Caution

Narutoshi Hibino, Patrick McConnell, *Toshiharu Shinoka, *Mark Galantowicz

Nationwide Children's Hospital, Columbus, OH

Invited Discussant: *David L. Morales

100. Neo-Aortic Valve Regurgitation After Arterial Switch: Outcomes from a Single Center

Kai Ma, Shoujun Li, *Shengshou Hu, Zhongdong Hua, Keming Yang, Jun Yan, Hao Zhang, Qiuming Chen, Sen Zhang

Fuwai Hospital, Beijing, China

Invited Discussant:

101. Anatomic Variability of the Thoracic Duct in Pediatric Patients with Complex Congenital Heart Disease

Ji Hyun Bang, Chun Soo Park, Jeong-Jun Park, Tae-Jin Yun

Asan Medical Center, Seoul, Republic of Korea

Invited Discussant:

102. Double Outlet Right Ventricle with Non-Committed Ventricular Septal Defect

Olivier Villemain[1], Damien Bonnet[1], Mathieu Vergnat[2], Magalie Ladouceur[1], Virginie Lambert[1], Zakaria Jalal[1], Pascal Vouhé[1], *Emré Belli[2]

[1]Université Paris Descartes, Sorbonne Paris Cité, Paris, France; [2]Université Paris Sud, Le Plessis Robinson, France

Invited Discussant: *Jennifer C. Hirsch-Romano

WEDNESDAY MORNING, APRIL 29, 2015

7:00 AM **GENERAL THORACIC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 608, WSCC

5 minute presentation, 6 minute discussion

Moderators: *Jessica S. Donington and *Sudish C. Murthy

In Case You Missed It!

Listen to a summary of the 95th Annual Meeting scientific programming from the general thoracic surgeon perspective.

*Sudish C. Murth, *Cleveland Clinic*

103. The Use of High-Risk Donors Decreases One-Year Survival in High-Risk Lung Recipients: A Review of the United Network of Organ Sharing Database

Matthew Mulligan, Pablo G. Sanchez, Charles F. Evans, Sina Rahimpour, Irina Timofte, Keshava Rajagopal, Aldo T. Iacono, June Kim, *James S. Gammie, *Bartley P. Griffith, *Si M. Pham

University of Maryland, Baltimore, MD

Invited Discussant:

104. Safety, Efficacy, and Durability of Lung Volume Reduction Surgery: A 10-Year Experience

Mark E. Ginsburg, Byron M. Thomashow, William M. Bulman, Patricia A. Jellen, Beth A. Whippo, Cody Chiuzan, Dan Bai, *Joshua Sonett

Columbia University, New York, NY

Invited Discussant: *Malcom M. DeCamp

105. Predictors of Prolonged Air Leak After Lung Resection

Sonam Maghera[1], Elham Sabri[2], Sudhir Sundaresan[2], Patrick James Villeneuve[2], Andrew Seely[2], Farid Shamji[2], Donna Maziak[2], Sebastien Gilbert[2]

[1]University of Ottawa, Ottawa, ON, Canada; [2]Ottawa Hospital, Ottawa, ON, Canada

Invited Discussant: *Philip A. Linden

106. Proportion of Newly Diagnosed Non-Small Cell Lung Cancer Patients That Would Have Been Eligible for Lung Cancer Screening

Geena Wu, Leanne Goldstein, Jae Y. Kim, Dan J. Raz

City of Hope National Medical Center, Duarte, CA

Invited Discussant: *Raja M. Flores

Artificial Lung and Ambulatory ECMO

*Joseph B. Zwischenberger, *University of Kentucky*

107. Is Costly Surveillance Indicated for Indolent Causes of Cancer? The Carcinoid Story

Christopher Bariana, Siva Raja, Daniel P. Raymond, *Eugene H. Blackstone, *Sudish C. Murthy

Cleveland Clinic, Cleveland, OH

Invited Discussant: *John C. Wain

108. A Propensity-Matched Study of Lobectomy Versus Segmentectomy for Radiologically Pure Solid Small-Sized Non-Small Cell Lung Cancer

Terumoto Koike[1], Seijiro Sato[1], Takehisa Hashimoto[1], Tadashi Aoki[2], Teruaki Koike[2], Katsuo Yoshiya[2], Shin-chi Toyabe[1], Masanori Tsuchida[1]

[1]Niigata University, Niigata, Japan; [2]Niigata Cancer Center Hospital, Niigata, Japan

Invited Discussant: *Matthew J. Schuchert

109. In the Modern Era, Single Lung Transplantation from Diabetic Donors Is Associated with Increased Mortality

Vishnu Ambur, Sharven Taghavi, Senthil Nathan Jayarajan, Sagar Kadakia, Huaqing Zhao, Akira Shiose, Grayson Wheatley, III, *Thomas Sloane Guy, *Yoshiya Toyoda

Temple University, Philadelphia, PA

Invited Discussant: *David P. Mason

110. Black Patients Die Earlier After Surgery for Esophageal Cancer

Andrea S. Wolf[1], Emanuela Taioli[2], Marlene Camacho-Rivera[2], Andrew Kaufman[1], Dong-Seok Lee[1], Faiz Bhora[1], *Raja Flores[1]

[1]Mount Sinai Medical Center, New York, NY; [2]North Shore/LIJ/Hofstra School of Medicine, New York, NY

Invited Discussant:

*AATS Member

111. Locally Advanced Esophageal Cancer: What Becomes of Five Year Survivors?

Galal R. Ghaly, *Brendon M. Stiles, Mohamed Kamel, Abu Nasar, *Jeffrey Port, *Paul C. Lee, *Subroto Paul, *Nasser K. Altorki

Weill Cornell Medical College, New York, NY

Invited Discussant: *Steven R. DeMeester

112. Post-Induction PET Mediastinal Activity Does Not Predict Persistent Nodal Disease or Overall Survival in Patients with Stage IIIA-N2 Lung Cancer

R. Taylor Ripley, Kei Suzuki, Camelia S. Sima, *Manjit Bains, *Prasad Adusumilli, James Huang, David J. Finley, *Bernard J. Park, *Robert J. Downey, *Nabil P. Rizk, *Valerie W. Rusch, *David R. Jones

Memorial Sloan-Kettering Cancer Center, New York, NY

Invited Discussant: *Arjun Pennathur

WEDNESDAY MORNING, APRIL 29, 2015

9:45 AM **ADULT CARDIAC MASTERS OF SURGERY VIDEO SESSION** Room 6B, WSCC

Moderator: *Thoralf M. Sundt, III

Panelists: *Tirone E. David, *Lars G. Svensson, *Friedrich Mohr, *A. Pieter Kappetein

9:45 AM – 10:05 AM
Aortic Root Valve-Sparing Procedure
*D. Craig Miller, *Stanford University*

10:05 AM – 10:25 AM
Complex MV Repair
*David H. Adams, *Mount Sinai Medical Center*

10:25 AM – 10:45 AM
Complex Aortic Case
*Joseph S. Coselli, *Baylor College of Medicine*

10:45 AM – 11:05 AM
Complex Arterial Revascularization
*John D. Puskas, *Mount Sinai Beth Israel*

9:45 AM **CONGENITAL MASTERS OF SURGERY VIDEO SESSION** Room 612, WSCC

Moderators: *Jonathan M. Chen and *Pirooz Eghtesady

9:45 AM – 10:05 AM
Starnes Procedure
*Vaughn A. Starnes, *Keck School of Medicine*

10:05 AM – 10:25 AM
Mitral Valve Replacement in Infants with Stent Mounted Valve
Sitaram Emani, *Boston Children's Hospital*

10:25 AM – 10:45 AM
Pulmonary-Aorto Fistula (Pott's Shunt) for Pulmonary Hypertension
*Emre Belli, *Institut Jacques Cartier*

10:45 AM – 11:05 AM
Circumflex Aorta
*Carl L. Backer, *Lurie Children's Hospital*

11:05 AM– 11:15 AM
Discussion

9:45 AM **GENERAL THORACIC MASTERS OF SURGERY VIDEO SESSION** Room 608, WSCC

Moderator: *Scott J. Swanson

Panelists: *Thomas A. D'Amico, *David J. Sugarbaker, *David R. Jones

9:45 AM – 10:01 AM
VATS Pancoast
*Robert J. McKenna, *Cedars Sinai Medical Center*

10:01 AM – 10:17 AM
Robotic Bronchial Sleeve
*Robert J. Cerfolio, *University of Alabama*

10:17 AM – 10:33 AM
Minimally Invasive Esophagectomy
*James D. Luketich, *University of Pittsburgh*

10:33 AM – 10:49 AM
VATS Pneumonectomy
*Todd L. Demmy, *Roswell Park Cancer Institute*

10:49 AM – 11:11 AM
When It Doesn't Go As Expected: Intra-Op VATS Repairs
*Shanda H. Blackmon, *Mayo Clinic*

*AATS Member

SATURDAY, APRIL 25, 2015

4:00 PM **ADVANCED TECHNIQUES FOR STATE OF THE ART CORONARY BYPASS SURGERY SESSION** Room 6A, WSCC

Course Chair: *John D. Puskas, *Icahn School of Medicine at Mount Sinai*

Course Co-Chairs: *David P. Taggart, *University of Oxford*
*Joseph F. Sabik, *Cleveland Clinic Foundation*

See full schedule on page 28.

MONDAY, APRIL 27, 2015

6:30 AM **Maintenance of Certification Information Breakfast** Room 6E, WSCC *Not for Credit*

7:20 AM **Business Session,** *AATS Members Only*

7:30 AM **PLENARY SCIENTIFIC SESSION** Room 4E, WSCC
8 minute presentation, 12 minute discussion

Moderators: *Pedro J. del Nido and *Marc R. Moon

1. Outcomes of 3264 Thoracoabdominal Aortic Aneurysm Repairs

*Joseph S. Coselli, Ourania Preventza, Kim I. de la Cruz, *Denton A. Cooley, Matt D. Price, Susan Y. Green, Courtney C. Nalty, *Todd K. Rosengart, *Scott A. LeMaire

Baylor College of Medicine, Texas Heart Institute, Houston, TX

Invited Discussant: *Nicholas T. Kouchoukos

OBJECTIVE: Since the pioneering era of E. Stanley Crawford, our multimodal strategy for thoracoabdominal aortic aneurysm (TAAA) repair has evolved. We sought to describe our series of 3264 TAAA repairs and identify predictors of early death and other adverse postoperative outcomes.

METHODS: We analyzed data regarding 3,264 open TAAA repairs performed between October 1986 and June 2014. Median patient age was 67 years (IQR 59–73, range: 12–92 years). Of the repairs, 159 (4.9%) involved acute or subacute aortic dissection, and 1014 (31.1%) involved chronic dissection. There were 710 (21.8%) emergent or urgent repairs and 167 (5.1%) ruptured aneurysms. Intercostal or lumbar artery reattachment was used in 1648 (50.5%) repairs, left heart bypass (LHB) in 1,456 (44.6%), cold renal perfusion in

1,896 (58.1%), cerebrospinal fluid drainage (CSFD) in 1,468 (45.0%), and visceral vessel procedure in 1,326 (40.6%). Hypothermic circulatory arrest (HCA) was reserved for highly complex repair (n = 47, 1.4%). Of the 1,047 most extensive (i.e., Crawford extent II) repairs (32.1%), intercostal/lumbar artery reattachment was done in 924 (88.3%), LHB in 855 (81.7%), and CSFD in 640 (61.1%). Multivariable analysis was used to identify predictors of operative (30-day or in-hospital) mortality and adverse event, a composite outcome comprising operative death and permanent (present at discharge) spinal cord deficit, renal failure, or stroke.

RESULTS: The operative mortality rate was 7.0% (n = 229); adverse event occurred after 463 repairs (14.2%). Predictors of operative death were rupture (OR = 3.11; p < .001), renal insufficiency (OR = 2.22; p = .01), symptoms (OR = 1.73; p = .001), procedures targeting visceral vessels (OR = 1.38; p = .03), increasing age (OR = 1.05/year; p < .001), and increasing clamp time (OR = 1.01/minute; p = .002). Extent IV repair was inversely associated with death (OR = .62; p = .03). Predictors of adverse event were the use of HCA (OR = 3.08; p = .004), renal insufficiency (OR = 2.65; p < .001), rupture (OR = 2.58; p < .001), extent II repair (OR = 1.64; p < .001), visceral vessel procedures (OR = 1.46; p < .001), urgent or emergent repair (OR = 1.37; p = .02), increasing age (OR = 1.05/y; p < .001), and increasing clamp time (OR = 1.01/minute; p < .001). At discharge, 185 patients (5.7%) had renal failure, 71 (2.2%) had stroke, and 173 (5.3%) had paraplegia or paraparesis. Repair failure, primarily pseudoaneurysm (n = 38) or patch aneurysm (n = 27), occurred after 95 (2.9%) repairs. Outcomes differed by extent of repair (see Table); risk was greatest in extent II repair. Actuarial survival was 63.5 ± 0.9% at 5 y, 37.1 ± 1.0% at 10 years, and 10.5 ± 1.1% at 20 years. Freedom from repair failure was 97.8 ± 0.3% at 5 years, 95.4 ± 0.6% at 10 y, and 90.8 ± 1.8% at 20 years.

Table: Early Outcomes of 3,264 Thoracoabdominal Aortic Aneurysm Repairs by Crawford Extent of Repair

Outcome	Extent I Repair (n = 907)	Extent II Repair (n = 1047)	Extent III Repair (n = 652)	Extent IV Repair (n = 658)
Operative death	51 (5.6%)	91 (8.7%)	52 (8.0%)	35 (5.3%)
Adverse event*	95 (10.5%)	198 (18.9%)	105 (16.1%)	65 (9.9%)
Paraplegia/paraparesis at discharge	29 (3.2%)	84 (8.0%)	44 (6.7%)	16 (2.4%)
Renal failure at discharge	29 (3.2%)	78 (7.4%)	42 (6.4%)	36 (5.5%)
Stroke at discharge	20 (2.2%)	36 (3.4%)	6 (0.9%)	9 (1.4%)

*Adverse event is a composite outcome comprising operative death and permanent (present at discharge) spinal cord deficit, renal failure, or stroke.

*AATS Member

CONCLUSIONS: Open TAAA repair produces respectable early outcomes. Preoperative and intraoperative factors influence risk. After repair, patients have acceptable long-term survival, and late repair failure is uncommon.

2. Late Survival and Right Ventricular Performance in 332 Matched Children: Classic Norwood-BT Shunt Versus Norwood-Sano Modification

Travis J. Wilder[1], Brian W. McCrindle[2], *Eugene H. Blackstone[3], Rajeswaran Jeevanantham[3], *William G. Williams[1], *William M. DeCampli[4], *Jeffery P. Jacobs[5], *Marshall L. Jacobs[6], Tara Karamlou[7], *Paul M. Kirshbom[8], *Gary K. Lofland[1], Alistair B. Phillips[9], *Gerhard Ziemer[10], Edward J. Hickey[2]

[1]*Congenital Heart Surgeons Society Data Center, Toronto, ON, Canada;* [2]*The Hospital for Sick Children, Toronto, ON, Canada;* [3]*The Cleveland Clinic, Cleveland, OH;* [4]*Arnold Palmer Hospital for Children University of Central Florida College, Orlando, FL;* [5]*All Children's Hospital, Saint Petersburg, FL;* [6]*Johns Hopkins, Newtown Square, PA;* [7]*University of California, San Francisco School of Medicine, San Francisco, CA;* [8]*Yale University, New Haven, CT;* [9]*Cedars Sinai Medical Center, Los Angeles, CA;* [10]*University of Chicago Medical Center, Chicago, IL*

Invited Discussant: *Richard G. Ohye

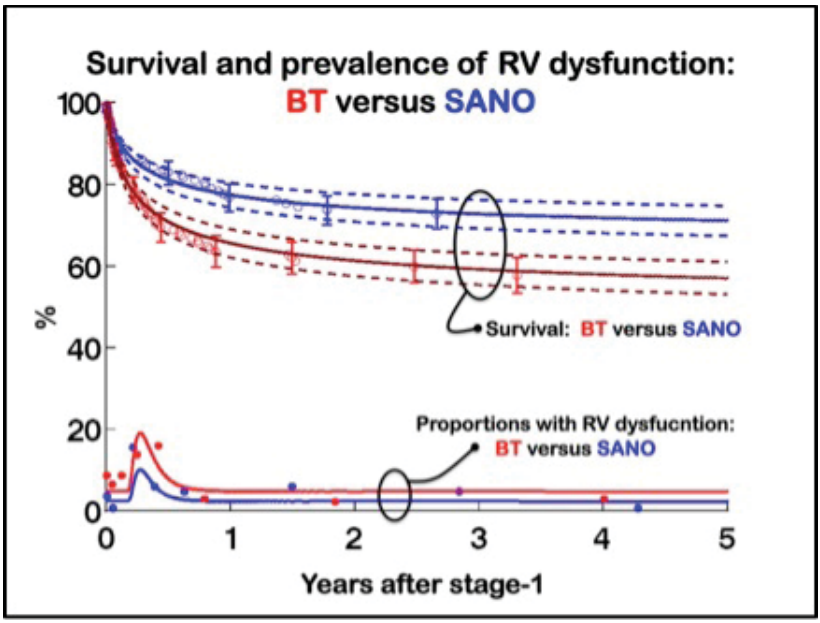
OBJECTIVE: Early survival advantages of Norwood with Sano shunt (SANO) over Norwood-BT shunt (BT) are confounded by concerns surrounding delayed RV dysfunction after SANO. In children with HLHS, we compared trends in long-term RV dysfunction and tricuspid regurgitation (TR) between these strategies, and incorporated survival differences.

METHODS: In an inception cohort of neonates with HLHS (2005 to 2014; 21 institutions) managed by Norwood palliation, propensity-matching resulted in 166 SANO paired with 166 BT (c-statistic .72, 11 baseline morphologic and demographic variables). Reports of 3,030 post-Norwood echoes were used to grade RV dysfunction and TR. Nonlinear mixed model regression characterized the time-related risk of ≥ *moderate RV dysfunction* and ≥ *moderate TR* via multiphase parametric models. These, and parametric survival models, were used to compare SANO versus BT.

RESULTS: Prevalence of RV dysfunction reached ~12% in the initial 6 months after Norwood, and was a strong risk factor for early death ($P < .0001$). However, RV dysfunction was almost twice as likely in these initial 6 months after BT versus SANO (18% versus 10%; $P = .05$). In late survivors, RV function was preserved in >95% after either strategy, but with a tendency towards reduced RV dysfunction after SANO versus BT (~2% versus ~5%; $P = .06$) (see Figure).

TR was also more prevalent (~20%) in the early 6–12 months after Norwood, but TR during this early time period was not different between BT and SANO. Early TR after Norwood was not a good predictor of death ($P = .43$) in either group. Late after Norwood, TR persisted with a prevalence of ~12% overall, and SANO had a lower prevalence versus BT ($P < .01$).

Propensity-adjusted survival was significantly worse with BT (65% versus 78% at 1 year; $P < .01$) throughout follow-up with no evidence of convergence as late as 5 years (see Figure; 114 still at risk at 3 years).



CONCLUSIONS: For comparable neonates with HLHS undergoing Norwood operation, SANO offers better late (>3 year) survival, less late TR, and, perhaps less late RV dysfunction than BT. These results from a research registry differ from randomized comparisons between the two strategies.

*AATS Member

3. Randomized Trial of Digital Versus Analog Pleural Drainage in Patients with or Without a Pulmonary Air Leak After Lung Resection

Sebastien Gilbert[1], Anna L. McGuire[2], Ramzi Addas[1], Sonam Maghera[2], Andrew J.E. Seely[1], Donna E. Maziak[1], Patrick J. Villeneuve[1], Farid M. Shamji[1], *Sudhir Sundaresan[1]

[1]University of Ottawa, Ottawa, ON, Canada; [2]University of British Columbia, Vancouver, BC, Canada

Invited Discussant: *Robert J. Cerfolio

OBJECTIVE: With capabilities for continuous monitoring and recording, digital pleural drainage devices are a promising tool in standardizing care for a parenchymal air leak after lung resection. It remains unknown whether or not this technology can benefit all patients or primarily those who have a postoperative air leak. The objective of this trial was to examine the impact of a digital pleural drainage device on time to chest tube removal and length of stay stratified according to the presence or absence of an air leak after lung resection.

METHODS: Single-center, randomized, controlled, open-label, parallel-group trial. Presence or absence of an air leak on postoperative day 1 following elective pulmonary resection was assessed by 2 independent, blinded observers. Patients were then randomized to a standard, water-sealed, pleural drainage device (analog) or to a digital device (digital). (Figure 1) Chest drains were managed according to a set protocol which included fluid output ≤250 mL/24 hours and absence of air leak as removal criteria. Primary outcomes include duration of chest tube drainage and hospital stay and are expressed as median time intervals with 25%–75% interquartile range.

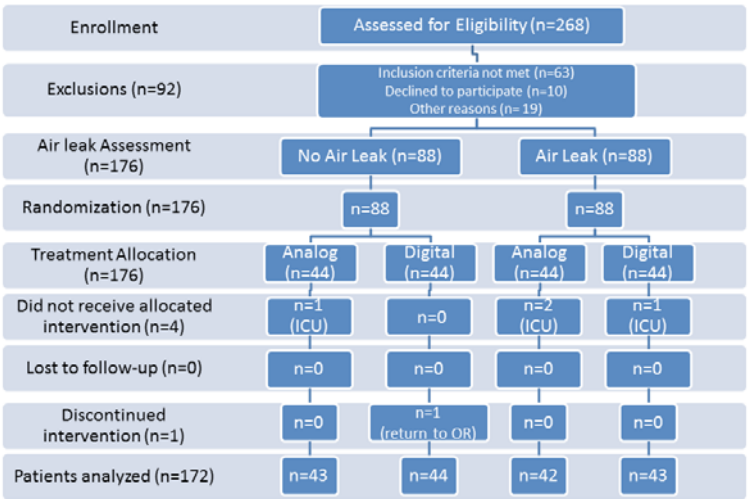
RESULTS: From April 2012 to June 2014, 268 patients were enrolled and 92 patients were excluded, leaving 176 patients eligible for randomization. Of these, 172 (97.7%) were analyzed. In both air leak groups (no air leak = 87; air leak = 85), patient factors and operative details were comparable between analog and digital patients except for a higher median FEV1% in digital drainage patients with no air leak. (See Table). In patients with no air leak, the median duration of chest tube drainage (analog = 3.0 days [2.9–4.9]; digital = 2.9 days [2.2–3.9] ; p = 0.05) and length of stay (analog = 4.3 days [3.3–5.2]; digital = 4.0 days [3.2–5.1]; p = 0.09) were not statistically different between digital and analog randomization groups. In patients with an air leak, the same findings were observed for median duration of chest tube drainage (analog = 5.6 days [4.0–8.9]; digital = 4.9 days [3.1–6.4] ; p = 0.11) and length of stay (analog = 6.2 days [5.2–9.1]; digital = 6.2 days [4.3–8.1; p = 0.36). Chest tube clamping trials were significantly reduced in digital device patients with an air leak (23.3% [10/43] vs 50% [21/42]; p = 0.01) and in those without an air leak (2.3% [1/44] vs 16.3% [7/43]; p = 0.03).

Table: Patient Characteristics and Operative Data

	Group 2: Air Leak Absent			Group 2: Air Leak Present		
Factors (*Median [25%–75%])	**Analog**	**Digital**	**p-Value**	**Analog**	**Digital**	**p-Value**
Age*	67 (61–71)	69 (59–76)	0.72	68 (60–75)	68 (60–72)	0.44
Male Gender	41%	23%	0.08	50%	33%	0.10
FEV1%*	81 (66–92)	72 (67–88)	0.01	76 (68–93)	78 (66–91)	0.51
DLCO%*	77 (69–87)	72 (67–88)	0.51	75 (62–85)	69 (60–80)	0.48
Lobectomy	82%	68%	0.22	88%	72%	0.10
VATS Approach	72%	77%	0.62	69%	63%	0.54
Pleural Adhesions	9%	16%	0.35	26%	33%	0.10
Use of Lung Sealants	9%	7%	0.49	3%	14%	0.06

Figure 1. CONSORT Diagram illustrating flow of patients during the trial.

(ICU = Intensive Care Unit transfer; OR = Operating Room)



CONCLUSIONS: After stratification of patients according to the presence or absence of an air leak on the first postoperative day, the introduction of new pleural drainage technology did not significantly reduce the duration of chest tube drainage or hospital stay. There was probably less uncertainty regarding the persistence and magnitude of an air leak over time with digital pleural space monitoring as reflected by the significant reduction in the clinical need for chest tube clamping trials. (ClinicalTrials.gov: NCT01775657)

*AATS Member

4. Positive Impact of Concomitant Tricuspid Annuloplasty on Tricuspid Regurgitation, Right Ventricular Function, and Pulmonary Artery Hypertension After Degenerative Mitral Repair

*Joanna Chikwe, Shinobu Itagaki, *Anelechi Anyanwu, *David H. Adams
The Icahn School of Medicine at Mount Sinai, New York, NY

Invited Discussant: *A. Marc Gillinov

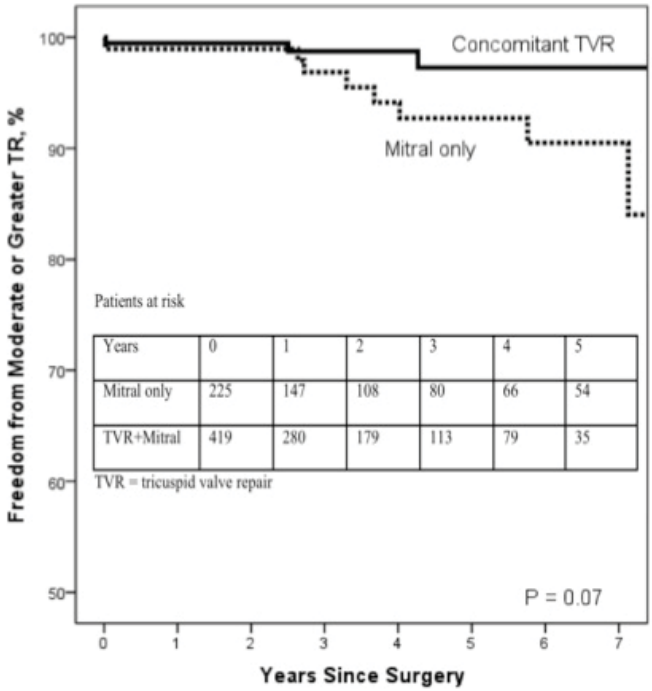
OBJECTIVE: For patients undergoing mitral valve repair, the indications for and results of concomitant tricuspid repair are controversial. This study was designed to evaluate the outcomes of a strategy of routine concomitant tricuspid annuloplasty for moderate tricuspid regurgitation or tricuspid annular dilation in patients undergoing degenerative mitral valve surgery.

METHODS: Outcomes of 645 consecutive patients (mean age 57 ± 13 years) undergoing primary repair of degenerative mitral regurgitation between 2003 and 2011, of whom 419 (65%) underwent concomitant tricuspid annuloplasty for moderate tricuspid regurgitation and/or tricuspid annular dilatation, were retrospectively analyzed with longitudinal echocardiographic follow-up.

RESULTS: The tricuspid repair patients were significantly older (median age 59.2 years; range: 19–90 years vs. 52.3 years; range: 16–84 years), with worse baseline right and left ventricular function, higher pulmonary artery pressures, and more than twice as likely to have a history of atrial fibrillation than isolated mitral repair patients (all $P < 0.001$). No significant difference in 30-day mortality, morbidity or permanent pacemaker requirement between the treatment groups was observed. Freedom from moderate tricuspid regurgitation at 7 years was 97 ± 2% in tricuspid repair patients, compared to 91 ± 3% in isolated mitral repair patients ($P = 0.07$) (Figure 1). In multivariate analysis tricuspid annuloplasty was independently associated with freedom from late moderate tricuspid regurgitation (HR, 0.26; 95% CI [0.07–0.94]; $p = 0.04$), and was an independent predictor for recovery of right ventricular function (HR, 1.4; 95% CI [1.06–1.96]; $P = 0.02$). Baseline pulmonary artery systolic pressures were significantly worse in tricuspid annuloplasty patients ($p < 0.001$), but improved post-operatively so that at mid-term follow-up pulmonary artery pressures in tricuspid repair patients were as low as in patients who underwent mitral repair only ($P = 0.97$).

CONCLUSIONS: In patients with moderate tricuspid regurgitation or tricuspid annular dilatation undergoing degenerative mitral repair, concomitant tricuspid ring annuloplasty is safe, highly effective and associated with improved right-sided remodeling in long-term follow-up. Importantly, tricuspid repair achieved superior freedom from tricuspid regurgitation, and improvements in right ventricular function and pulmonary artery hypertension in patients with worse baseline risk factors, compared to mitral repair only. Moderate tricuspid regurgitation or tricuspid annular dilatation should be routinely treated at the time of degenerative mitral valve repair.

Figure 1: Freedom from moderate or greater tricuspid regurgitation according to whether patient received concomitant tricuspid annuloplasty (solid line) or nor (dashed line)



8:50 AM **AWARD PRESENTATIONS**

9:05 AM **INTERMISSION – VISIT EXHIBITS/COFFEE BREAK**

9:45 AM **BASIC SCIENCE LECTURE**
Biologically Inspired Engineering: The Next Technology Wave
Donald E. Ingber, MD, PhD
Wyss Institute for Biologically Inspired Engineering

*AATS Member

10:25 AM PLENARY SCIENTIFIC SESSION

Moderators: *Joseph S. Coselli and *Marc R. Moon

5. Transcoronary Infusion of Cardiac Progenitor Cells in Hypoplastic Left Heart Syndrome: 2.5-Year Follow-Up of the TICAP Trial

*Shunji Sano, Shuta Ishigami, Takuya Goto, Daiki Ousaka, Suguru Tarui, Michihiro Okuyama, Sadahiko Arai, Kenji Baba, Shingo Kasahara, Shinichi Otsuki, Hidemasa Oh

Okayama University, Okayama, Japan

Invited Discussant: *John E. Mayer

OBJECTIVE: Hypoplastic left heart syndrome (HLHS) is one of the severe malformations in congenital heart diseases. Initial results of TICAP phase 1 study (NCT01273857) conducted in our hospital have shown that intracoronary infusion of cardiosphere-derived cells (CDCs) following staged palliation was feasible and safe to treat the patients with HLHS; however, the long-term safety and clinical outcomes remain elusive, as is the question whether any prognostic significance may provide independent information to predict the functional benefits in CDC recipients.

METHODS: This trial is a prospective controlled study. Fourteen consecutive patients with HLHS who are undergoing staged-2 or -3 surgical palliations were enrolled between January 2011, and January 2012. Seven patients assigned to receive intracoronary CDCs infusion 1 month after the cardiac surgery followed by 7 patients allocated to a control group with standard care alone. The primary endpoint was to assess the procedural feasibility and safety and the secondary endpoint was to evaluate the cardiac function and heart failure status from the baseline through long-term follow-up.

RESULTS: No complications were reported within 30 months after CDC infusion. Endpoint analysis was assessed by echocardiogram and showed that right ventricular ejection fraction (RVEF) in CDC-treated group increased markedly during the follow-up period (baseline: 46.9 ± 4.6 % vs. 30 months: 54.1 ± 2.3%; P = 0.0006). Absolute changes in RVEF were greater in the CDC-treated group than in controls at 30 months (+7.2 ± 4.8% vs. +2.7 ± 2.2%; P = 0.04). Similarly, fractional area change calculated by echocardiogram was higher in the CDCs than in controls (39.2 ± 2.2% vs. 33.9 ± 4.5%; P = 0.02). These cardiac function improvements in long-term resulted in decrease in BNP levels (P = 0.02) and lower incidence of unintended coil occlusion for collaterals (P = 0.03) at 30 months after CDC transfer compared with controls. In addition, continuous somatic growth (weight-for-age z score: WAZ) was evident in CDC-treated group through 30 months observation rather than controls (P = 0.00004). As independent predictors of treatment responsiveness, absolute changes in RVEF at 30 months were negatively correlated with age, WAZ, and RVEF at CDC infusion (age: r = −0.77; P = 0.045; WAZ: r = −0.97; p = 0.005; EF: r = −0.88; P = 0.008).

CONCLUSIONS: Intracoronary CDC infusion after staged procedure improves RVEF in patients with HLHS and that persists during 30 months of follow-up. This therapeutic strategy may merit somatic growth enhancement and reduce the incidence of heart failure as well as further collateral intervention after palliations. A randomized phase 2 trial (PERSEUS: NCT01829750) is ongoing in our hospital to verify the therapeutic efficacy as to determine the prognostic values and risk stratification in patients with single ventricle physiology.

*AATS Member

6. A Multicenter Propensity-Score Analysis of 991 Patients with Severe Aortic Stenosis and Intermediate-High Risk Profile: Conventional Surgery Versus Sutureless Valves Versus TAVR

*Claudio Muneretto[1], *Ottavio Alfieri[2], Michele De Bonis[3], Roberto Di Bartolomeo[4], Gianluigi Bisleri[1], Carlo Savini[4], Gianluca Folesani[4], Lorenzo Di Bacco[1], Manfredo Rambaldini[5], Juan Pablo Maureira[6], Francois Laborde[7], Maurizio Tespili[8], Alberto Repossini[1], Thierry A. Folliguet[9]

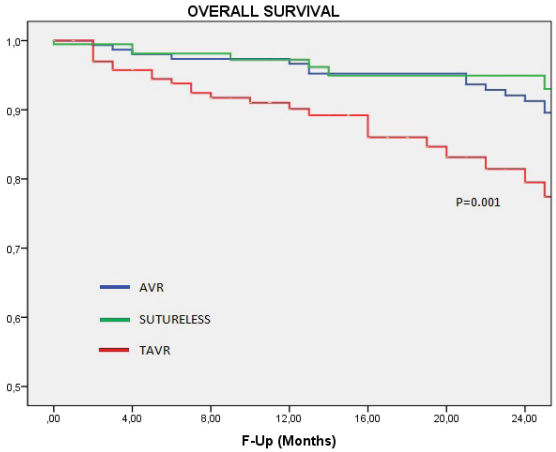
[1]University of Brescia Medical School, Brescia, Italy; [2]Università Vita-Salute San Raffaele, Milano, Italy; [3]San Raffaele University Hospital, Milan, Italy; [4]University of Bologna, Bologna, Italy; [5]Azienda Ospedaliera Carlo Poma, Mantova, Italy; [6]CHU de Nancy, Nancy, France; [7]Institut Mutualiste Montsouris, Parigi, France; [8]Ospedale di Seriate, Seriate, Italy; [9]Centre Hospital-Universitaire Brabois ILCV, Vandoeuvre les Nancy, France

Invited Discussant: *Friedrich W. Mohr

OBJECTIVE: The use of transcatheter aortic valve replacement (TAVR) has been validated in patients at extremely high-risk or contraindicated to conventional cardiac surgery and more recently there has been a trend to extend TAVR also in patients with intermediate-high risk profile. Aim of this study was to investigate the clinical outcomes of patients with severe aortic stenosis and intermediate-high risk treated either by means of conventional surgery (sAVR), sutureless valves implantation or TAVR in a multicenter evaluation.

METHODS: Among 991 consecutive patients with severe aortic stenosis and intermediate-high risk profile (STS-PROM > 4 and Logistic Euroscore I > 10), a propensity-score analysis was performed based on the therapeutical strategy: sAVR (Group 1, G1, n = 204), sutureless valves (Group 2, G2, n = 204), and TAVR (Group 3, G3, n = 204). Propensity matching criteria were: STS-PROM, Logistic Euroscore I, age, LVEF, BMI, gender, diabetes, COPD, peripheral vascular disease, chronic renal failure, previous cerebrovascular accidents. Primary end-points were short-term (30 days) mortality as well as overall survival at 24 months follow-up; secondary end-point was survival free from a composite end-point of MACCEs (defined as cardiac-related mortality, myocardial infarction, cerebrovascular accidents and major haemorrhagic events) and periprosthetic regurgitation >2.

RESULTS: Reported 30-days mortality was significantly higher in TAVR group (G1 = 3.4% vs. G2 = 5.8% vs. G3 = 9.8%; p = 0.005) as well as post-procedural PM implantation (G1 = 3.9% vs. G2 = 9.8% vs. G3 = 14.7%; p < 0.001) and peripheral vascular complications (G1 = 0% vs. G2 = 0% vs. G3 = 9.8%; p < 0.001). At 24 months follow-up, overall survival (G1 = 91.3 ± 2.4% vs. G2 = 94.9 ± 2.1% vs G3 = 79.5% ± 4.3%; p = 0.001), and the survival free from the composite end-point of MACCEs and periprosthetic regurgitation (G1 = 92.6 ± 2.3% vs. G2 = 96 ± 1.8% vs. G3 = 77.1 ± 4.2%; p < 0.001) were significantly better in patients undergoing sAVR and sutureless valves than those undergoing TAVR. Multivariate Cox regression analysis identified TAVR as independent risk factor for overall mortality (OR = 2.5; CI [1.1–4-2]; p = 0.018).



CONCLUSIONS: The use of TAVR in patients with intermediate-high risk profile was associated with a significant higher incidence of perioperative complications (as postoperative PM implantation and peripheral vessels complications). TAVR significantly decreased survival at short and mid term when compared to conventional surgery and sutureless valves. TAVR approach in this specific subset of patients should be carefully evaluated in further independent prospective randomized trials.

11:05 AM **NEW MEMBER INDUCTION**

11:25 AM **PRESIDENTIAL ADDRESS**
Technological Innovation in Cardiothoracic Surgery: A Pragmatists Approach
***Pedro J. del Nido,** *Boston Children's Hospital*

12:15 PM **ADJOURN FOR LUNCH – VISIT EXHIBITS**

12:30 PM **ETHICS FORUM LUNCH** Room 613, WSCC
Separate Registration Required
Should a Physician Inform an Innocent Contact About HIV Exposure, Against State Law?
Moderator: *Robert M. Sade
Pro: *Richard I. Whyte
Con: Steve F. O'Neill

12:30 PM **PREPARING YOURSELF FOR AN ACADEMIC CAREER LUNCHEON** Room 6E, WSCC *Not for Credit*
Residents, Fellows, and Medical Students Only

*AATS Member

2:00 PM **ADULT CARDIAC SURGERY** Room 6B, WSCC
SIMULTANEOUS SCIENTIFIC SESSION *Not for Credit*
8 minute presentation, 12 minute discussion

Moderators: *John D. Puskas and *Leonard N. Girardi

7. Appropriate Patient Selection or Healthcare Rationing? Lessons from Surgical Aortic Valve Replacement in the PARTNER-I Trial

*Eugene H. Blackstone[1], *Wilson Y. Szeto[2], *Lars G. Svensson[1], Jeevanantham Rajeswaran[1], John Ehrlinger[1], *Rakesh M. Suri[3], *Craig R. Smith[4], *Michael Mack[5], *D. Craig Miller[6], *Patrick M. McCarthy[7], *Joseph E. Bavaria[8], *Lawrence H. Cohn[9], Paul J. Corso[10], *Robert A. Guyton[11], *Vinod H. Thourani[11], *Bruce W. Lytle[1], *Mathew R. Williams[12], John G. Webb[13], Samir Kapadia[1], E. Murat Tuzcu[1], *David J. Cohen[14], *Hartzell V. Schaff[3], Martin B. Leon[4]

[1]Cleveland Clinic, Cleveland, OH; [2]University of Pennsylvania Medical Center, Philadelphia, PA; [3]Mayo Clinic, Rochester, MN; [4]New York-Presbyterian Hospital, Columbia University, New York, NY; [5]Baylor Health Care System, Plano, TX; [6]Stanford University, Palo Alto, CA; [7]Northwestern Memorial Hospital, Chicago, IL; [8]University of Pennsylvania, Philadelphia, PA; [9]Brigham and Women's Hospital, Boston, MA; [10]Washington Hospital Center, Washington, DC; [11]Emory University Hospital, Atlanta, GA; [12]NYU Langone Medical Center, New York, NY; [13]St. Paul's Hospital, Vancouver, BC, Canada; [14]Saint Luke's Cardiovascular Consultants, Kansas City, MO;

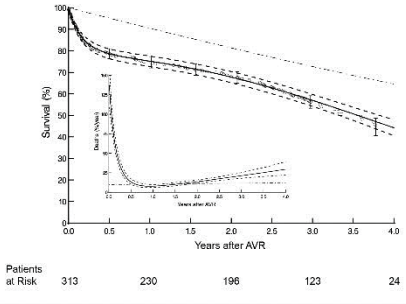
Invited Discussant: *David A. Fullerton

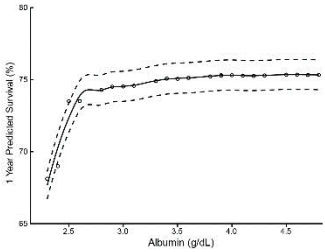
OBJECTIVES: The surgical aortic valve replacement (AVR) arm of the PARTNER-I trial of transcatheter AVR (TAVR) for severe aortic stenosis provided the unique opportunity to ask: 1) Are outcomes after surgical AVR in an elderly, high-surgical-risk population accurately predicted by contemporary Society of Thoracic Surgeons (STS) benchmarks? 2) Is their intermediate-term survival commensurate with that of the general population? 3) Is there an identifiable subset of patients whose risk after surgical AVR is higher than patients deemed inoperable (PARTNER-IB)?

METHODS: From May 2007 to October 2009, 699 high-surgical-risk patients, age 84 ± 6.3 years, were enrolled in PARTNER-IA; 351 were randomized to surgery and 313 underwent surgical AVR by experienced surgeons at 22 selected sites. Median follow-up was 2.8 years. Procedural morbidities were compared with contemporary STS benchmarks, intermediate-term survival referenced to a matched US population, and risk-adjusted survival with survival of PARTNER-IB standard therapy inoperable patients.

RESULTS: Operative mortality occurred in 33 patients (10.5%) (expected 29 [9.3%]; $P = .4$), stroke in 8 (2.6%) (expected 11 [3.5%]; $p = .4$), renal failure in 18 (5.8%) (expected 37.5 [12%]; $P = .0008$), sternal wound infection in 2 (0.64%) (expected 1.03 [0.33%]; $P = .3$), and prolonged length of stay in 83 (26%) (expected 56 [18%]; $P = < .0001$), but calibration of observed events across the spectrum of expected risk was poor. One, 2, 3, and 4-year survival was 75%, 68%, 57%, and 44%, respectively, substantially lower than the 90%, 81%, 73%, and 65% in the matched United States population (see Figure),

but higher than the 53%, 33%, 22%, and 14% in PARTNER-IB. Risk factors for death included smaller body mass index, lower albumin (see Figure), history of cancer, longer aortic clamp time, and severe prosthesis-patient mismatch. Only the 10% of patients with a poor risk profile based on preoperative comorbidity had estimated 1-year survival less than that of standard therapy patients.





CONCLUSIONS: 1) Despite surgical AVR being performed in institutions whose results generally outpace national benchmarks, PARTNER-IA patients experienced average early results and prolonged hospitalization, suggesting that contemporary benchmarks poorly discriminate across high-risk profiles; 2) Unlike past surgical series, in which survival of elderly patients was commensurate with a matched United States population, PARTNER-IA patients had worse survival, suggesting they were a less highly selected population; and 3) After a period of higher early mortality, most PARTNER-IA patients experienced better mid-term survival than inoperable PARTNER-IB patients, suggesting that PARTNER selection criteria for surgical AVR, with a few caveats, may be more appropriate for improving survival than previous practice.

*AATS Member

8. Prosthesis-Patient Mismatch in High Risk Patients with Severe Aortic Stenosis in a Randomized Trial of a Self-Expanding Prosthesis

George L. Zorn, III[1], Stephen H. Little[2], Peter Tadros[1], *G. Michael Deeb[3], John Heiser[4], Jeffrey J. Popma[5], *David H. Adams[6], *Michael J. Reardon[2]

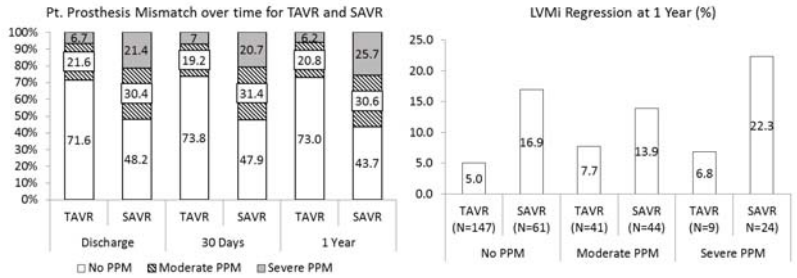
[1]University of Kansas, Kansas City, KS; [2]Houston Methodist DeBakey Heart and Vascular Center, Houston, TX; [3]University of Michigan, Ann Arbor, MI; [4]Spectrum Health Hospitals, Grand Rapids, MI; [5]Beth Israel Deaconess Medical Center, Boston, MA; [6]Mount Sinai Medical Center, New York, NY

Invited Discussant: *Craig R. Smith

OBJECTIVE: To compare the incidence of prosthesis-patient mismatch (PPM) between transcatheter aortic valve replacement (TAVR) using a self-expanding prosthesis and surgical aortic valve replacement (SAVR) in the high-risk arm of the CoreValve US Pivotal Trial. We will also evaluate the impact of PPM on left ventricular mass (LVM) regression.

METHODS: This was a prospective randomized multicenter investigation evaluating the safety and efficacy of self-expanding TAVR in patients at increased surgical risk with symptomatic severe aortic stenosis. Patients were randomized 1:1 to TAVR or SAVR. Postoperative PPM was defined by the effective orifice area index (EOAi) as follows; no PPM (EOAi > 0.85 cm^2/m^2), moderate PPM (0.65 cm^2/m^2 < EOAi ≤ 0.85 cm^2/m^2), severe PPM (EOAi ≤0.65 cm^2/m^2). Physiologic and clinical variables were analyzed in the implanted TAVR arm (n = 389) and SAVR arm (n = 353). LVM index (LVMi) and LVMi regression were analyzed at baseline and 1 year.

RESULTS: The incidence of any PPM in the SAVR group at 1 year was 56.3% (25.7% severe) versus 27.0% (6.2% severe) in the TAVR group (p < 0.001). At 1 year, PPM was absent in 73.0% of TAVR patients and 43.7% of SAVR patients. LVMi regression was observed in both TAVR and SAVR treatment groups, with a greater magnitude of regression in the SAVR treatment arm.



CONCLUSIONS: In patients at increased surgical risk and with severe aortic stenosis, PPM is more common and more severe in patients treated with SAVR than those treated with TAVR. However, at 1 year, LVMi regression was observed in both TAVR and SAVR treatment groups.

9. Transcatheter Valve-in-Valve Therapy Using Five Different Devices in Four Anatomic Positions – Clinical Outcomes and Technical Considerations

Lenard Conradi, Miriam Silaschi, Moritz Seiffert, Edith Lubos, Stefan Blankenberg, *Hermann Reichenspurner

Ulrich Schaefer, Hendrik Treede University Heart Center Hamburg, Hamburg, Germany

Invited Discussant: Vinayak Bapat

OBJECTIVES: Transcatheter valve-in-valve implantation (ViV) is emerging as a novel option for treatment of deteriorated bioprostheses. We report our cumulative experience using five different types of transcatheter heart valves (THV) in all four anatomic positions with an emphasis on technical considerations.

METHODS: Sixty consecutive patients (74.4 ± 13.6 years, 53.3% male (32/60), logEuroSCORE I 27.9 ± 19.9%, STS Score 9.2 ± 7.6%) receiving ViV procedures from 2008 through 2014 at our center were included for analysis. Data were prospectively gathered and retrospectively analyzed.

RESULTS: ViV implantation was performed in aortic (n = 42), mitral (n = 14), tricuspid (n = 2) and pulmonary (n = 2) positions. THV used were Edwards Sapien/Sapien XT/Sapien 3 (n = 36), Medtronic CoreValve/CoreValve Evolut (n = 18), St. Jude Portico (n = 2), JenaValve (n = 2) and Medtronic Engager (n = 2). Mean interval from index procedure to ViV was 8.7 ± 5.5 years. Access was transapical in 60.0% (n = 36) and endovascular in 40% (n = 24). ViV was successful in 96.7% (58/60), in two cases of aortic ViV distal embolization of THV required implantation of a sequential valve. Overall all-cause 30-day mortality was 8.3% (5/60) and it was 4.8% (2/42) in the aortic position. No periprocedural strokes were observed. Paravalvular leakage was ≤ grade I in all cases. After aortic ViV, resultant gradients were max/mean 34.2 ± 11.6 / 17.9 ± 6.6 mmHg and effective orifice area (EOA) was 1.4 ± 0.3 cm^2. Corresponding values after mitral ViV were gradient max/mean 16.5 ± 6.0 / 7.0 ± 3.4 mmHg and EOA 2.1 ± 0.5 cm^2.

CONCLUSIONS: ViV can be performed in all anatomic positions with acceptable hemodynamic and clinical outcome in this high-risk patient population. Different types of THV are needed to provide optimal care. Meticulous planning, considering aortic root anatomy as well as technical specifications of deteriorated surgical valves is mandatory. In the light of increasing use of surgical bioprostheses, growing importance of ViV can be anticipated for the future.

*AATS Member

3:00 PM – 3:35 PM COFFEE BREAK/VISIT EXHIBITS

DEEP DIVE SESSION IN THE EXHIBIT HALL AATS CT Theater 2
TAVR vs. SAVR *Not for Credit*

Moderated by *Vinod H. Thourani

6. A Multicenter Propensity-score Analysis of 991 Patients with Severe Aortic Stenosis and Intermediate-high Risk Profile: Conventional Surgery versus Sutureless Valves versus TAVR

7. Appropriate Patient Selection or Healthcare Rationing? Lessons from Surgical Aortic Valve Replacement in the PARTNER-I Trial

8. Prosthesis-Patient Mismatch in High Risk Patients with Severe Aortic Stenosis in a Randomized Trial of a Self-Expanding Prosthesis

9. Transcatheter Valve-in-Valve Therapy Using Five Different Devices in Four Anatomic Positions – Clinical Outcomes and Technical Considerations

10. Implications of Lesion Complexity on Process and Outcomes of Mitral Valve Repair for Degenerative Mitral Regurgitation

*Anelechi C. Anyanwu, Shinobu Itagaki, *Joanna Chikwe, Ahmed El-Eshmawi, *David H. Adams

Mount Sinai Medical Center, New York, NY

Invited Discussant: *Y. Joseph Woo

OBJECTIVES: Guidelines and publications on process and outcomes of valve repair for degenerative disease generally group patients as a single cohort. It is well appreciated that degenerative valve repairs vary in complexity, depending on lesions encountered, but this has not been subject of much formal study. This study aims to create a lesion complexity score to allow stratification of valve repairs, and to evaluate the impact of complexity on operative process and outcomes.

METHODS: We retrospectively analyzed data on 645 consecutive mitral valve operations for degenerative disease. We developed a lesion score (see Table) and graded valves based on intraoperative valve analysis. We categorized valves into four complexity groups based on the total lesion score: Lesion score 1: Simple (N = 244); 2–4: Intermediate (N = 254); 5–7: Complex (N = 124); and 8 or more Super-Complex (N = 23). Results were compared in these four groups. The mean patient follow-up was 3.7 years.

Lesion Score (Total Count = Score)	
P1 Involvement	1
P2 Involvement	1
P3 Involvement	1
A1 Involvement	2
A2 Involvement	2
A3 Involvement	2
Commissural Involvement	2
Any leaflet restriction	2
Papillary muscle or leaflet calcification	2
Annular calcification	3

RESULTS: Mitral Valve Repair was completed successfully in 644 patients. Basic demographics were similar in the four groups. The lesion score correlated with surrogates of technical complexity of repair: cardiopulmonary bypass time increased with lesion complexity (median times in mins: Simple 144, Intermediate 160, Complex 183, Super-Complex 203; $P < 0.001$), and median number of repair techniques used was directly related to lesion complexity (Simple 2, Intermediate 3, Complex 4, Super-Complex 6; $P < 0.001$). Barlow's etiology was more prevalent in the Complex (64%) and Super-Complex (65%) groups compared to Simple (9%) and Intermediate (36%). Incidence of concurrent tricuspid valve repair (62–70%) was similar among the groups. Hospital mortality was 0.6% and major morbidity 6.2% for entire

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cohort – this did not differ significantly among the groups. Mid-term patient survival was similar in all groups (8 year survival: Simple 96 ± 2%; Intermediate 90 ± 5%; Complex 99 ± 1%; Super-Complex 100%; P = 0.64). Freedom from moderate or greater mitral regurgitation was also similar at 8 years, though there seemed a trend towards less freedom from regurgitation in the Simple (92 ± 3%) compared to the Intermediate (96 ± 2%), Complex (100%) and Super-Complex (100%) groups; P = 0.18).

CONCLUSIONS: We developed a simple lesion scoring system that predicts technical complexity of mitral valve repair. Despite longer and more technically involved repairs, we observed extremely high repair rates and excellent results in patients with complex lesions. Lesion scoring can facilitate preoperative planning if applied echocardiographically; where the lesion score is high, the surgeon should be facile with a blend of repair techniques and be prepared to commit to a longer operative time to effect a durable repair. Our observation of a paradoxical trend towards more recurrent mitral regurgitation in less complex repair subsets requires further investigation.

11. A Contemporary Analysis of Pulmonary Hypertension in Patients Undergoing Mitral Valve Surgery: Is This a Risk Factor?

Daniel H. Enter, Anthony Zaki, Brett Duncan, Jane Kruse, Andrei Adin-Cristian, Carrie Li, Travis Abicht, Hyde Russell, Sukit Chris Malaisrie, Sanjiv Shah, James Thomas, *Patrick McCarthy

Northwestern University, Chicago, IL

Invited Discussant: *James S. Gammie

OBJECTIVE: Severe pulmonary hypertension (pHtn) has historically been considered a risk factor for 30-day mortality in cardiac surgery patients. Among mitral valve (MV) surgery patients, we sought to determine if severe pHtn is an independent short- or long-term mortality risk factor and whether concomitant tricuspid valve (TV) surgery incurs additional mortality risks among MV surgery patients with pHtn.

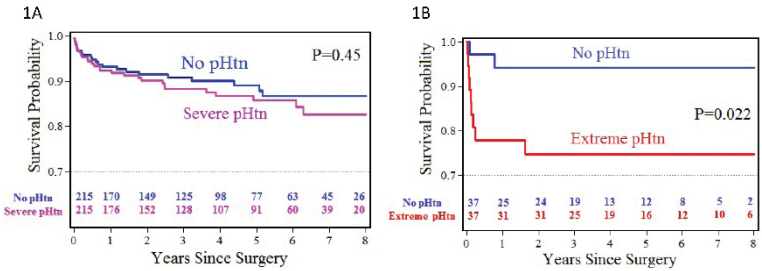
METHODS: Analysis was performed on our prospectively-collected institutional database to evaluate preoperative pulmonary artery pressures in patients undergoing mitral valve (MV) operations (n = 1,571) from April 2004 to December 2013. Preoperative pulmonary artery systolic pressures were assessed by echocardiography or right heart catheterization. Patients were stratified by pulmonary artery pressures into no (<35 mmHg), moderate (35–49 mmHg), severe (50–79 mmHg), and extreme (≥80 mmHg) pHtn groups. Mortality data was collected from the database and the social security death index. Patients were propensity score (PS) matched according to major risk factors and operative characteristics, resulting in 215 patients with severe pHtn and 215 patients without pHtn. Additionally, all patients with pHtn underwent PS-matching by concomitant tricuspid valve (TV) surgery (pHtn MV without TV surgery = 192 patients; pHtn MV with TV surgery = 192 patients). Kaplan-Meier survival curves were compared using the log-rank test.

RESULTS: Before PS-matching, patients with severe pHtn had more co-morbidities including older age, higher incidence of prior myocardial infarction, cerebrovascular disease, diabetes, and higher NYHA class. Patients with severe pHtn had higher 30 d (4% pHtn vs 1% no pHtn; $p < 0.02$) and late mortality (74% severe pHtn vs 93% no pHtn survival at 5 years; $p < 0.001$). In PS-matched groups, severe pHtn was not a risk factor for 30-day mortality (3% each; $p = 1.0$) or late mortality (86% severe vs 89% no pHtn survival at 5 years, Figure 1A; $p = 0.4$). Postoperative hospital length of stay (LOS) was similar (median 7 days; $p = 0.24$), as were 30 d readmission rates (17% severe vs 15% no pHtn; $p = 0.7$).

Among all PS-matched pHtn patients undergoing MV surgery, concomitant TV surgery did not increase 30 d mortality risk (4.7% TV vs. 4.2% no TV; $p = 0.8$); or late mortality (77% survival each at 5 years; $p = 0.97$). Postoperative LOS was not significantly different (median 8 days TV vs. 7.5 days no TV; $p = 0.9$).

*AATS Member

Figure 1: Propensity Score-Matched Survival for Severe (50-79mmHg) vs No Pulmonary Hypertension (1A) and Extreme (≥ 80 mmHg) vs No Pulmonary Hypertension (1B) in MV Surgery



For extreme pHtn, after PS-matching there was a difference in late survival (75% extreme vs. 94% no pHtn at 5 years, Figure 1B; $p < 0.03$) and a trend in 30-day mortality (11% extreme vs. 3% no pHtn; $p = 0.16$).

CONCLUSION: Early and late mortality in mitral valve surgery are unaffected by severe pHtn or the addition of tricuspid valve surgery, yet extreme pHtn remains a long-term risk factor. Severe pHtn (50–79 mmHg) should not cause, in and of itself, a patient to be turned down for surgery, and a tricuspid operation can be added without hesitation.

12. Long-Term Outcomes of the Cox-Maze IV Procedure for Atrial Fibrillation

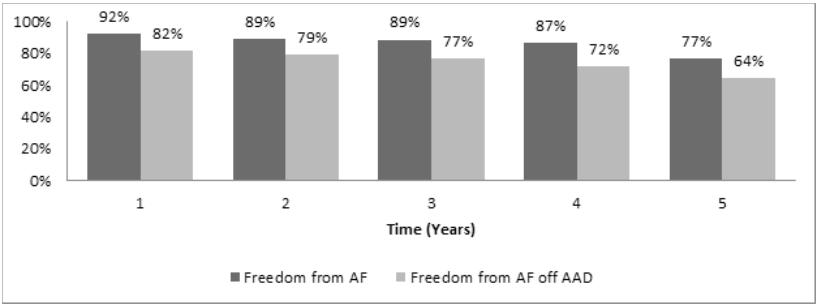
Matthew C. Henn, Timothy S. Lancaster, Jacob R. Miller, Laurie A. Sinn, Richard B. Schuessler, Spencer J. Melby, Hersh S. Maniar, *Ralph J. Damiano, Jr.
Washington University, St. Louis, MO

Invited Discussant: *Richard Lee

OBJECTIVE: Atrial fibrillation (AF) is the most common cardiac arrhythmia and is often refractory to medical management. Early and midterm results have established the Cox-Maze IV procedure (CMPIV) as the gold standard for surgical ablation, however long-term outcomes using current consensus definitions of treatment failure have yet to be reported. In order to compare to reported outcomes of catheter-based ablation, we report our institutional outcomes of patients who underwent left-sided or biatrial CMPIV at five years of follow-up.

METHODS: Between January 2002 and September 2014, data were collected prospectively on 576 patients with AF who underwent a CMPIV (n = 532) or left-sided CMP (n = 44). Preoperative and perioperative variables were evaluated as well as long-term outcomes. Freedom from AF and freedom from antiarrhythmic drugs (AADs) at 1, 2, 3, 4, and 5 years were evaluated by electrocardiogram or prolonged monitoring. Long-term freedom from AF and AADs were then compared between those patients with paroxysmal AF (n = 236) and those with persistent or long-standing persistent AF (n = 340), as well as between those undergoing stand-alone CMP (n = 168) and those receiving concomitant procedures (n = 408).

RESULTS: Follow-up at any time point was 85%. Median ICU length of stay was 3 days while median hospital length of stay was 9 days. Thirty-day mortality was 3% (17/576). Overall freedom from AF at 5 years was 77% (83/108) (see Figure). At five years follow-up, there was no difference between the paroxysmal AF and persistent/long-standing persistent AF groups in either freedom from AF (76% [37/49] vs. 78% [46/59]; p = 1.00) or freedom from AADs (65% [31/48] vs. 64% [37/58]; p = 0.30). There also was no difference between the stand-alone and concomitant CMP groups in freedom from AF (73% [19/26] vs. 78% [64/82]; p = 0.60) or freedom from AADs (54% [13/24] vs. 67% [55/82]; p = 0.33) at five years. The left-sided CMP in highly selected patients had similar late results.



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CONCLUSIONS: Outcomes of the CMPIV are good at long-term follow-up using stringent, consensus-based definitions for failure with the majority of patients having prolonged monitoring. Long-term success was not affected by the type of preoperative AF or the addition of concomitant procedures. Results of the CMPIV remain superior to those reported for catheter ablation and other forms of surgical AF ablation, especially for patients with persistent or long-standing AF.

Late-Breaking Clinical Trial

LB1. European Prospective Multicenter Study of Hybrid Thoracoscopic and Transcatheter Ablation of Persistent Atrial Fibrillation: The Historic – AF Trial

*Claudio Muneretto[1], Gianluigi Bisleri[1], Gianluca Polvani[2], Antonio Curnis[1], Luca Bontempi[1], Fabrizio Rosati[1], Elisa Merati[2], Gaetano Fassini[2], Massimo Moltrasio[2], Claudio Tondo[2], Ralf Krakor[3]

[1]University of Brescia, Brescia, Italy; [2]University of Milan, Milan; [3]THG Staedtisches Klinikum, Dortmund, Germany

Invited Discussant: *Niv Ad

5:00 PM ADJOURN

2:00 PM **CONGENITAL HEART DISEASE SIMULTANEOUS SCIENTIFIC SESSION** Room 6A, WSCC

Moderators: *Carl L. Backer and *Pirooz Eghtesady

13. Outcomes Following Simple and Complex (Damus-Kaye-Stansel Takedown) Ross Operations in 58 Consecutive Pediatric Patients

Alejandra Bueno, David Zurakowski, Suyog A. Mokashi, Vijayakumar Raju, Michele J. Borisuk, *Pedro J. del Nido, Gerald R. Marx, Christopher W. Baird
Boston Children's Hospital & Harvard Medical School, Boston, MA

Invited Discussant: *Jonathan M. Chen

INTRODUCTION: The Ross operation has acceptable outcomes in selected pediatric patients with a biventricular circulation. However, there are little data concerning outcomes of the Ross operation in patients with uni-ventricular circulation undergoing biventricular conversion. The purpose of this study was to review the outcomes before and after Ross operations, including patients undergoing biventricular conversion with Damus-Kaye-Stansel (DKS) takedown.

METHODS: A retrospective review was performed on 58 consecutive patients who underwent simple and complex Ross operations at a single institution from March 2000 to March 2014, including eight patients who underwent biventricular conversion with Ross operation and DKS takedown ± reversal of cavopulmonary connection (complex). Clinical data were collected from medical records and a single reviewer independently measured pre-operative, discharge and follow-up indexed echocardiographic data. Outcome variables included mortality, surgical or catheter-based re-interventions and echocardiographic measurements of pulmonary valve (PV) annulus, aortic root (AoR), ascending aorta (AA) and aortic regurgitation (AR) vena contracta. Statistical analysis included t-tests, repeated-measures ANOVA and Kaplan-Meier curves with 95% confidence intervals according to Greenwood's formula.

RESULTS: The cohort of 58 patients (44 males) had a median age of 4.5 years (IQR: 1–12.7 years) and median weight of 16.4 kg (IQR: 7.6–42.7 kg). Median follow-up was 2.5 yrs (IQR: 8 months to 4.5 years). Simple and complex patients having DKS takedown and biventricular conversion had similar results for all outcome variables. In the simple group, there were two deaths (both within 12 months), two late neo-aortic valve-sparring root replacements and 10 right ventricular outflow tract (RVOT) re-interventions. In the complex group, there was one death; no neo-aortic valve or AoR re-interventions and two had RVOT re-interventions (see Figure). In both groups, there were no differences between pre- and late follow-up AoR and AA dimensions and no correlations were found between pre-operative PV annulus sizes ($p = 0.19$), late AR ($p = 0.25$), late AoR ($p = 0.26$) or AA *z*-scores ($p = 0.91$). Additionally, there were no differences between simple and complex groups in the distribution of late AR categories (none, mild, moderate, severe) ($p = 0.54$, chi-square test). 83% of all patients had either no AR (20%) or mild AR (63%) and 17% (8 simple, 1 complex) had moderate or severe AR.

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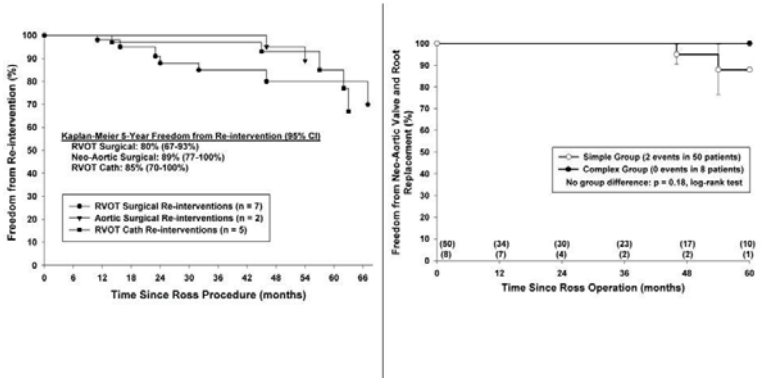


CONCLUSIONS: The Ross procedure has good similar short-term results in simple and complex patients and should be considered in those undergoing Ross operation with biventricular conversion and DKS takedown. Moreover, native PV size should not be a contraindication for Ross procedure.

14. Ultra Long Term Outcomes in Adult Survivors of Tetralogy of Fallot and the Effect of Pulmonary Valve Replacement

Richard Dobson[1], Mark Danton[1], Nicola Walker[1], Nikolaos Tzemos[2], Hamish Walker[1]
[1]*Scottish Adult Congenital Cardiac Service, Glasgow, United Kingdom;* [2]*University of Glasgow, Glasgow, United Kingdom*

Invited Discussant: *Bahaaldin Alsoufi

OBJECTIVE: To define the long-term outcomes of adult survivors of surgical repair of tetralogy of Fallot with respect to, 1.) survival, functional capacity and adverse events, and, 2.) the effect of pulmonary valve replacement (PVR) on clinical and functional outcome.

METHODS: Retrospective cohort analysis of 376 adult survivors (16 years or greater) of repaired tetralogy of Fallot (age at repair 5.3 ± 7.3 years) enrolled through a national adult congenital cardiac database. Male:female 59:41, and mean age at last follow up was 34.3 ± 12.4 years. 6,838 patient-years were available for analysis.

RESULTS: At 40-year follow-up from date of repair, freedom from death was 83%, atrial arrhythmia 60%, ventricular arrhythmia 73%, pacemaker/ICD insertion 70%, and surgical/percutaneous reintervention 27%.

In a multivariate model the risk of death was increased by older age at repair (HR, 1.11; $p = 0.006$), atrial arrhythmia by older age at repair (HR, 1.10; $p \leq 0.001$), device insertion by the presence of a genetic syndrome (HR, 4.75; $p = 0.001$), and reintervention by any non-classical form of tetralogy of Fallot (HR, 2.66; $p = 0.003$) and transannular patch repair (HR, 1.71; $p = 0.002$). 330 (86.9%) patients were NYHA class 1. There was no difference in the distribution of social deprivation scores compared to the general population ($p = 0.51$). 29/154 female patients (19%) had one or more successful pregnancy.

Mean QRS duration was 147 ± 25 ms. Each ms increase raised the risk of all-cause mortality in a univariate model (HR, 1.07; $p = 0.002$).

There were 130 (34.7%) patients with moderate or greater pulmonary regurgitation (PR) at latest follow-up, with mean PR fraction 25 ± 17%.

181 patients (48%) underwent cardiac MRI with mean RV EDVi 126 ± 35 ml/m^2, RV ESVi 68 ± 27 ml/m^2, and RV ejection fraction 47 ± 9%.

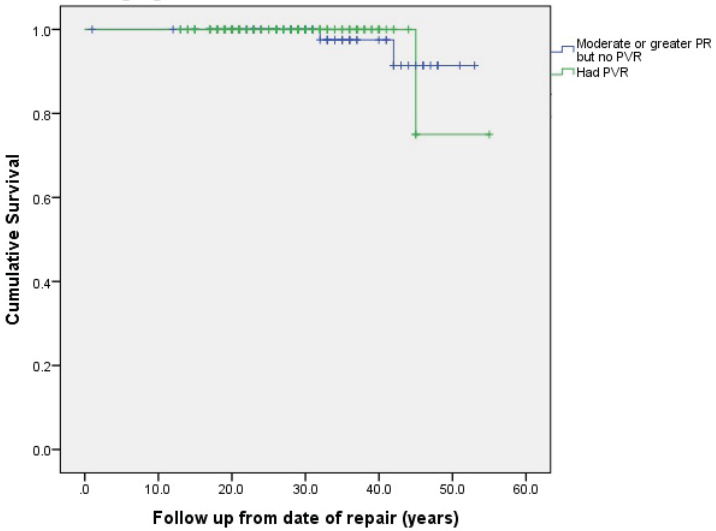
169 (45%) patients had a cardiopulmonary exercise test. Mean VO_2max was 23 ± 7.4 ml/kg/m^2. This correlated with RV ejection fraction ($p = 0.002$), but not RV EDVi ($p = 0.197$) or PR fraction ($p = 0.244$).

163 (43%) patients underwent repeat intervention. 150 PVRs were performed in 138 (37%) patients. Of these 18 were implanted percutaneously. Other procedures included 24 balloon pulmonary angioplasties, 15 redo repairs, 9 RVOT reconstructions, 8 tricuspid valve repair/replacements, 1 Bentall and 1 aortic valve replacement.

*AATS Member

PVR was not shown to confer a survival benefit in patients with moderate or greater pulmonary regurgitation (p = 0.925) (see Figure). However, following PVR a significant reduction in RV volumes was observed (mean RV EDVi 156ml/m^2 vs. 110 ml/m^2; p = 0.001) and the VE/VCO_2 slope improved (34.9 vs. 32.3; p = 0.046).

Fig 1: Comparison of survival curves for those with significant pulmonary regurgitation who underwent PVR and those who did not



CONCLUSIONS: In adult patients with repaired tetralogy of Fallot long-term survival remains excellent. However morbidity, arrhythmias and repeat intervention are frequent. Pulmonary valve replacement did not improve survival but improved exercise efficiency and normalised RV volume parameters.

15. Long-Term Mortality After the Fontan Operation: Twenty Years of Experience at a Single Center

Tacy E. Downing[1], Kiona Y. Allen[1], Andrew C. Glatz[1], Lindsay S. Rogers[2], Chitra Ravishankar[1], Jack Rychik[1], Stephanie Fuller[1], Lisa M. Montenegro[1], James M. Steven[1], *Thomas L. Spray[1], Susan C. Nicolson[1], *J. William Gaynor[1], David J. Goldberg[1]

[1]The Children's Hospital of Philadephia, Philadelphia, PA; [2]Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Invited Discussant: *James K. Kirklin

OBJECTIVE: To describe short and long-term mortality outcomes and identify risk factors in a modern cohort of patients with single ventricle physiology palliated with the Fontan operation.

METHODS: All patients who underwent a first Fontan operation at a single institution between 1992 and 2009 were retrospectively reviewed. Demographic and clinical variables were abstracted from the medical record. For patients lost to follow-up, vital status was ascertained using the National Center for Health Statistics' National Death Index. Multivariate logistic regression was used to identify covariates independently associated with early mortality (<1 year post-Fontan), and Cox regression was used to analyze late mortality. Because pre-Fontan catheterization data were available in only 79% of patients, subset analyses were performed to include hemodynamic parameters.

RESULTS: A total of 774 patients met inclusion criteria, with a median age at Fontan of 2.3 years (range: 0.9–38.4). The most common anatomic diagnosis was hypoplastic left heart syndrome (381, 50%), and 89 (12%) had a common atrioventricular valve (AVV). Fontan type was divided nearly equally between lateral tunnel (409) and extracardiac (365), and 90% (693) were fenestrated.

Vital status on or after 1/1/2012 was ascertained for 768 or 99.2% of patients, representing 7,548 patient-years of follow-up and a median follow-up of 8.8 years. 76 patients died during the study period, 37 within one year of Fontan. At 20 years post-Fontan, the Kaplan-Meier survival estimate was 77% (95% CI [65–86%]) for the entire cohort (see Figure). For patients surviving to one year, the conditional survival estimate was 81% (95% CI [68–90%]) at 20 years.

Multivariate regression results are summarized in the figure that follows. Fontan prior to 1996, post-operative pleural drainage >14 days, and longer aortic cross-clamp time were all independently associated with early mortality. Distinct risk factors for late mortality included post-Fontan ICU stay >1 week, common AV valve, and presence of ≥ mild AV valve regurgitation prior to Fontan. In a subset analysis of the 609 patients with pre-Fontan hemodynamic data, pulmonary artery pressure >15 mm Hg was independently associated with both early (OR, 6.8; 95% CI [2.9–16]; $p < 0.001$), and late mortality (HR, 3.1; 95% CI [1.3–7.3]; $p < 0.009$). Hypoplastic left heart syndrome, morphology of systemic ventricle, Fontan type and presence of fenestration were not independently associated with either early or late mortality.

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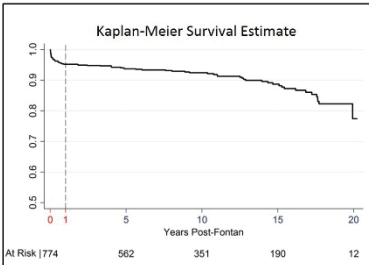

Risk Factors for Early Mortality[1]

	Odds Ratio (95% CI)	P-value
Pleural Drainage > 14 days	7.1 (3.4 – 14.9)	<0.001
Fontan prior to 1996	4.5 (2.1 – 9.7)	<0.001
Cross-Clamp (per 10 min)	1.3 (1.02 – 1.6)	0.03

Risk Factors for Late Mortality[2]

	Hazard Ratio (95% CI)	P-value
ICU stay > 1 week	4.6 (2.3 – 9.2)	<0.001
Common AV Valve	2.7 (1.1 – 6.4)	0.02
AVVR pre-Fontan	2.1 (1.0 – 4.1)	0.04

[1]Multivariate logistic regression, [2]Multivariate Cox regression. AV – atrioventricular ; AVVR – atrioventricular valve regurgitation.

CONCLUSIONS: In our single center experience, the 20-year survival estimate following Fontan operation is 77%. Risk factors for early and late post-Fontan mortality differ. Prolonged post-operative pleural drainage was associated with early mortality, but did not predict late mortality if patients survived to one year. Elevated pre-Fontan pulmonary artery pressure was associated with early and late mortality.

16. Long-Term Outcomes After First-Onset Arrhythmia in Fontan Physiology

Thomas A. Carins[1], Ajay J. Iyengar[1], Ashley Nisbet[2], Victoria Forsdick[3], Tom Gentles[4], Dorothy Radford[5], Robert Justo[6], David S. Celermajer[7], Andrew Bullock[8], David Winlaw[9], Gavin Wheaton[10], Leeanne Grigg[2], Yves d'Udekem[11]

[1]The University of Melbourne, Parkville, VIC, Australia; [2]The Royal Melbourne Hospital, Parkville, VIC, Australia; [3]The University of Notre Dame, Darlinghurst, Sydney, Australia; [4]Starship Children's Hospital, Auckland, New Zealand; [5]The Prince Charles Hospital, Chermside, Brisbane, QLD, Australia; [6]Mater Children's Hospital, Brisbane, QLD, Australia; [7]Royal Prince Alfred Hospital, Sydney, Australia; [8]Princess Margaret Hospital for Children, Subiaco, WA, Australia; [9]Children's Hospital at Westmead, Sydney, NSW, Australia; [10]Women's & Children's Hospital, Adelaide, SA, Australia; [11]The Royal Children's Hospital, Parkville, VIC, Australia

Invited Discussant:

OBJECTIVES: To determine long-term outcomes of patients with a Fontan circulation after first onset of arrhythmias.

METHODS: Out of the 1336 patients of Australia and New Zealand who have undergone a Fontan operation, 213 were identified to have tachyarrhythmias (176) and bradyarrhythmias (80; 72 pacemakers): 111 atrio-pulmonary connections, 49 lateral tunnel and 53 extra-cardiac conduits.

RESULTS: Twenty-three years freedom from tachyarrhythmias and bradyarrhythmias in the entire population were respectively 62% (95% CI [54–69]) and 86% (95% CI [82–90]). Detailed description of the time-course of the tachyarrhthmias was available for 172 patients. A single episode was observed in 27 (16%) of patients with no recurrence after a mean of 11.4 ± 2.5 years. Cardioversion was used in 51% (90/177) and radiofrequency ablation in 33% (58/177).

After a mean of 6.9 ± 1.3 years after a first onset of tachy- or bradyarrhythmias, 43 patients died; 12 underwent a heart transplantation and 43 a Fontan conversion; 13 had protein loosing enteropathy; 20 had a thromboembolism and 3 were in NYHA class III/IV. Twenty years survival after a first onset of tachy- and brady-arrhythmias were respectively 71% (95% CI [60–80]) and 81% (95% CI [68–89]). Their 5-, 10-, and 20-year freedom from all adverse events after tachy- and brady-arrhythmias were respectively 78% (95% CI [70–84]), 60% (95% CI [51–68]), 32% (95% CI [21–43]), 80% (95% CI [67–88]), 62% (95% CI [47–73]), and 45% (95% CI [30–59]). No differences in outcomes were noted between the 3 forms of Fontan. Five years after cardioversion and radiofrequency ablation, freedom from all adverse events were respectively 70% (95% CI [58–80]) and 74% (95% CI [56–86]). During follow-up, 86 patients were noted by echocardiography to undergo a progressive deterioration of their systolic function. Ten years freedom from decreased systolic function were 55% (95% CI [45–65]) after tachyarrhythmias and 60% (95% CI [46–72]) after bradyarrhythmias (see Figure). Freedom from all adverse events and decreased ventricular function after 5, 10, and 20 years were respectively for tachy- and bradyarrhythmias 64% (95% CI [56–72]), 43% (95% CI [35–52]), 14% (95% CI [6–25]) and 59% (95% CI [46–71]), 41% (95% CI [28–54]), 18% (95% CI [8–32]).

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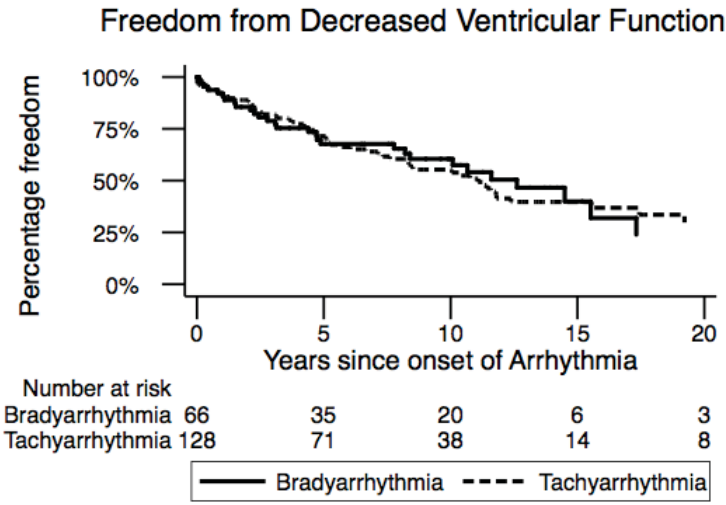

CONCLUSION: After a first onset of arrhythmia, patients who have undergone a Fontan procedure see a progressive deterioration of their ventricular function. Current conservative treatment with medications, cardioversion and ablation therapies provides symptomatic relief to close to three quarters of the patients for five years.

3:20 PM – 3:55 PM **COFFEE BREAK/VISIT EXHIBITS**

Moderators: *Emile A. Bacha and *Mark S. Bleiweis

17. The Impact of Non-Cardiac and Genetic Abnormalities on Outcomes Following Neonatal Congenital Heart Surgery

*Bahaaldin Alsoufi, Shriprasad Deshpande, William Mahle, Scott Gillespie, *Brian Kogon, Kevin Maher, *Kirk Kanter

Emory University, Atlanta, GA

Invited Discussant: *Peter J. Gruber

OBJECTIVE: Significant non-cardiac and genetic abnormalities (NC/GA) are common in neonates with congenital heart defects. We sought to examine the current era effect of those abnormalities on early and late outcomes following cardiac surgery.

METHODS: From 2002–12, 1538 neonates ≤ 30 days old underwent repair (n = 859, 56%) or palliation (n = 677, 44%) of congenital heart defects. Regression models examined the effect of NC/GA on operative results, resource utilization and late outcomes.

RESULTS: Neonates with NC/GA (n = 312, 20.3%) had higher incidence of prematurity (21.4% vs. 12.5%; $p < 0.001$) and low weight ≤2.5 Kg (24.4% vs. 12.3%; $p < 0.001$) than neonates without NC/GA (n = 1,226, 79.7%). Although the incidence of single ventricle was comparable (33.7% vs. 31.0%; $p = 0.37$), neonates with NC/GA underwent more palliation (52.2% vs. 42.0%; $p = 0.001$) and subsequently had higher percentage of STAT risk category 4 & 5 procedures (78.2% vs. 66.2%; $p < 0.001$).

Adjusted logistic regression models that included the disparate patient and operative variables showed that the presence of NC/GA was associated with increased unplanned reoperation (OR, 1.7; 95% CI [1.1–2.7]); $p = 0.03$) and hospital mortality (OR, 2.2; 95% CI [1.3–3.6]; $p = 0.002$). NC/GA neonates had longer mean mechanical ventilation requirement (6.3 vs. 4.0 days; $p < 0.001$), intensive care unit stay (10.5 vs. 6.3 days; $p < 0.001$), and hospital stay (18.3 vs. 10.8 days; $p < 0.001$). Adjusted linear regression models continued to show significant association between NC/GA and increased post-operative mechanical ventilation duration, intensive care unit and hospital stays ($p < 0.001$ each).

Adjusted hazard analysis showed that the presence of NC/GA was associated with diminished late survival (HR, 2.4; 95% CI [1.9–3.1]; $p < 0.001$) and that was evident in all subgroups of patients ($p < 0.001$ each, as shown in the figure).

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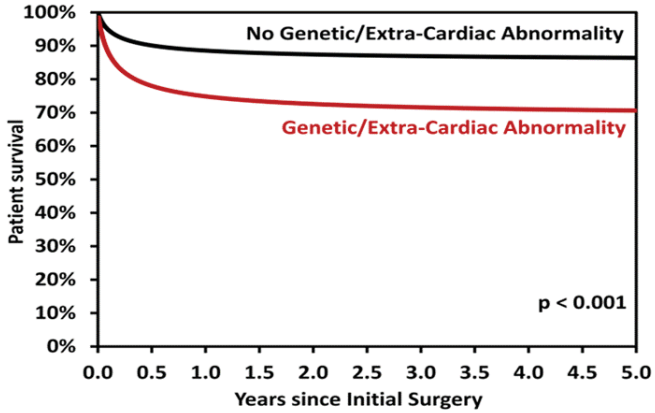

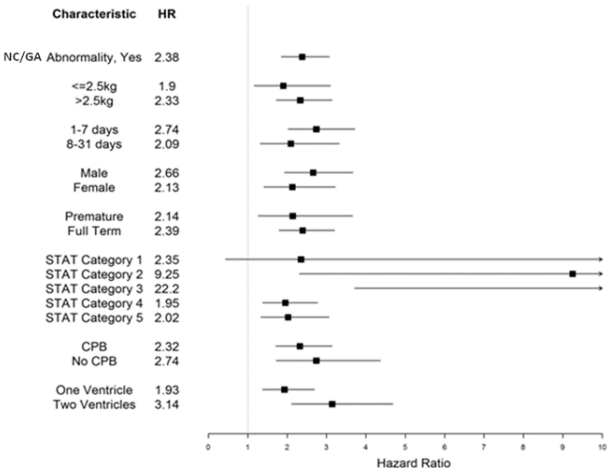

CONCLUSIONS: Neonates with NC/GA commonly have associated risk factors for morbidity and mortality such as prematurity and low weight. After adjusting for those factors, the presence of NC/GA continues to have significant association with increased unplanned reoperation, early mortality risk and resource utilization after palliative and corrective cardiac surgery. Importantly, the hazard of death in those patients continues beyond the peri-operative period for at least one year. Our findings show that the presence of NC/GA should be emphasized during parent counseling and decision making; and underscore the need to explore strategies to improve outcomes for this high risk population that must address peri-operative care, outpatient surveillance and management.

18. Health-Related Quality of Life in Adult Survivors After the Fontan Operation

*James K. Kirklin

University of Alabama at Birmingham, Birmingham, AL

Invited Discussant: *Charles B. Huddleston

OBJECTIVE: There is a growing population of survivors of single ventricle congenital anomalies after these children undergo staged reconstructive Fontan procedures, but limited information is available about the quality of life (QOL) among adult Fontan survivors. The objective of this cross sectional study was to assess the QOL outcomes on long term Fontan survivors and compare them with the general population and with heart transplant recipients.

METHODS: Quality of life was ascertained using the Short Form-36 (SF-36) survey on adult Fontan survivors (19 years or older), as well as pediatric heart transplant recipients who were adults at the time of the survey. The eight components of health related QOL were determined and compared to United States Norms. Follow-up was based on QOL survey completion date of 7/15/14.

RESULTS: Sixty surviving patients, currently 19 years or older, had undergone Fontan operations at UAB between January 1988 and December 2011. The study group consisted of 49 Fontan patients who responded to the QOL survey (82% response rate); 13 Heart transplant survivors met the eligibility criteria for comparison (QOL survey response rate 100%). Duration of follow-up for the Fontan study group averaged 18 years (range: 3–24 years) and for the heart transplant patients 13 years (range: 3–23 years). The overall QOL scores among responders in regard to physical functioning, general health, vitality, social functioning, and emotional/mental health of Fontan population were comparable with that of healthy United States population. The Fontan group had a trend towards diminished role-physical health ($p = 0.02$), while bodily pains among Fontan patients were significantly higher as compared to normative data ($p < 0.01$). There were no significant difference in any of the 8 subjective measures of health related QOL between Fontan and heart transplant recipients.

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QOL Domains	(A) Fontan Patients (n = 49)	(B) General population	(C) Heart Transplant Patients (n = 13)	p-Value (A < B)*	p-Value (A < C)
1. Physical functioning	49.6 ± 7.2	50 ± 10	50.7 ± 7.4	0.7	NS
2. Role-physical	45.6 ± 12.7	50 ± 10	45.4 ± 13.4	0.02	NS
3. Role-emotional	48.8 ± 13.7	50 ± 10	47.6 ± 13.3	0.5	NS
4. Social functioning	51.8 ± 8.1	50 ± 10	54 ± 5.2	0.1	NS
5. Mental health	50.1 ± 9.5	50 ± 10	52.8 ± 6.1	0.9	NS
6.Energy/vitality	49.8 ± 9.6	50 ± 10	50 ± 8.2	0.9	NS
7. Bodily pain	56.4 ± 7.9	50 ± 10	54.6 ± 10.8	<0.01*	NS
8. General health	48.3 ± 10.3	50 ± 10	47.7 ± 12	0.2	NS

*One sample t-test was performed to assess the level of significance between the difference in means of sample population and general population; NS = non-significant.

CONCLUSIONS: Surviving patients after a Fontan procedure for treatment of single ventricle enjoy, on average for nearly 2 decades, functional and health-related QOL (6 of 8 domains) outcomes that are similar to the general population and heart transplant recipients. This generally favorable extended life-satisfaction period (average of 18 years) should be considered when informing patients and families of expectations with the Fontan pathway versus certain higher risk procedures when both the Fontan and 2-ventricle options are considered.

19. Aortic Dilatation Is Not Associated with Aortic Valvulopathy in Patients with Bicuspid Aortic Valve

Byron K. Yip, Colleen Clennon, Adin-Cristian Andrei, S. Chris Malaisrie
Northwestern University, Chicago, IL

Invited Discussant: *Duke E. Cameron

OBJECTIVE: Bicuspid aortic valve (BAV) is associated with a markedly increased risk for aortic dilatation leading to aneurysm and dissection. The aim of this study is to determine the influence of aortic valvulopathy on ascending aortic dimensions measured using cardiac magnetic resonance imaging (cMRI) in a cohort of BAV patients at our institution.

METHODS: From October 2003 to November 2013, 732 BAV patients received care at our institution. In an IRB-approved retrospective chart review, 375 (mean age 47 ± 14 years, male gender 69%) were identified as having undergone cMRI with evaluation of the aorta performed at our institution. No patients in this group had a history of intervention involving the aortic valve or aorta at the time of earliest cMRI from which dimensions were obtained nor any concomitant connective tissue or other congenital heart disease. Distributions of ascending aortic diameter (aAoD) were compared between patients with aortic stenosis (AS) (n = 163) and without AS (n = 212); with aortic insufficiency (AI) (n = 263) and without AI (n = 112); and with AS or AI (AS/AI) (n = 316) and without AS/AI (n = 59). Aortic valvulopathy (AoV), or AS and AI, were defined as present if indicated as mild or greater in severity.

RESULTS: Mean aAoD in this BAV cohort was 3.9 ± 0.6 cm (median 4.0 cm; range: 2.4–6.3 cm) in those with AoV and 3.8 ± 0.6 cm (median 3.7 cm; range: 2.3–4.8 cm) in those without AoV. Since aAoD was not normally distributed in this BAV cohort, non-parametric group comparisons using Wilcoxon's rank-sum test were performed. There were no significant differences between groups by AS, AI or AS/AI (Figure 1A). The box plots presented reveal no associative relationship between aAoD and AS or AI severity grading (Figure 1B).

CONCLUSIONS: No association was found between degree of aortic dilatation and degree of aortic stenosis or insufficiency in this BAV cohort. Thus, the development of BAV-associated valvulopathy may not affect the progression of aortopathy. Similarities in mean, median, and standard deviation values across the groups without AoV, however, may inform future studies aimed at developing novel quantitative tools to enhance and standardize early clinical decision-making for BAV patients.

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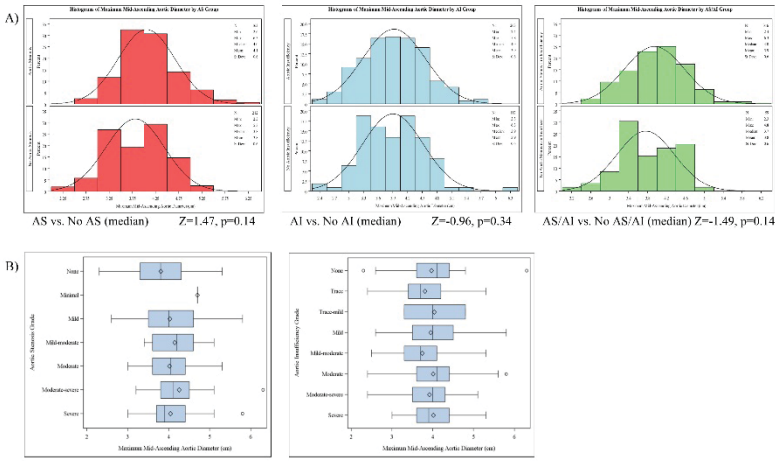

Figure 1. A) Distribution curves and median comparisons of ascending aortic diameter (aAoD) with descriptive statistics for comparison groups by AS, AI or AS/AI and B) box plots of aAoD measurements stratified by AS and AI severity grade.

5:00 PM ADJOURN

2:00 PM **GENERAL THORACIC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 608, WSCC

8 minute presentation, 12 minute discussion

Moderators: *David J. Sugarbaker and *Jay M. Lee

20. Multimodality Therapy for Locally Advanced Thymomas: A Cohort Study of Prognostic Factors from a European Multicentric Database

Giovanni Leuzzi[1], *Gaetano Rocco[2], Enrico Ruffini[3], Isabella Sperduti[1], *Frank Detterbeck[4], *Walter Weder[5], *Federico Venuta[6], *Dirk Van Raemdonck[7], *Pascal Thomas[8], Francesco Facciolo[1], ESTS Thymic Working Group[10]

[1]Regina Elena National Cancer Institute – IFO, Rome, Italy; [2]National Cancer Institute, Pascale Foundation, Naples, Italy; [3]University of Torino, Torino, Italy; [4]Yale University, New Haven, CT; [5]University Hospital, Zurich, Switzerland; [6] Sapienza University of Rome, Rome, Italy; [7]University Hospitals Leuven, Leuven, Belgium; [8]Aix-Marseille University, Marseille, France; [10]European Society of Thoracic Surgeons, Exeter, United Kingdom

Invited Discussant: *Frank C. Deterbeck

OBJECTIVE: The management of locally advanced thymomas (LATs) is controversial and, so far, no specific oncological strategies have been recommended. To investigate this issue, a retrospective analysis of the database developed by the European Society of Thoracic Surgeons (ESTS) was performed.

METHODS: From January 1990 to January 2010, clinico-pathological, surgical and oncological features were retrospectively reviewed in a cohort of 370 Masaoka-Koga stage III thymomas (WHO Classification A to B3) collected from 38 institutions. A multivariate Cox proportional hazard model was developed using stepwise regression, in order to identify independent predictors of outcomes. Cancer-specific (CSS) and Relapse-free survival (RFS) were calculated by the Kaplan-Meier method from the date of surgery until relapse or death. The log-rank and Tarone-Ware tests were used to assess differences between subgroups.

RESULTS: Induction and adjuvant therapy were administered to 88 (23.8%) and 245 (66.2%) patients, respectively. In the total sample, 5- and 10-year CSS and RFS rates were 88.4% and 80.0%, and, 83.3% and 71.5%, respectively. Patients receiving induction therapy had similar 5-year CSS and RFS compared to those undergoing primary surgery (85.0% vs. 88.3%; p = 0.82; 77.9% vs. 84.0%; p = 0.31). At multivariate analysis, independent predictors of CSS were completeness of resection (HR, 2.15; 95% CI [1.16–4.00]) and adjuvant therapy (HR, 2.44; 95% CI [1.32–4.48]). Pathologic microscopic invasion (according to T classification of the IASLC/ITMIG TNM staging proposal) was the strongest predictive factor of relapse (HR, 2.49; 95% CI [1.19–5.21]). When

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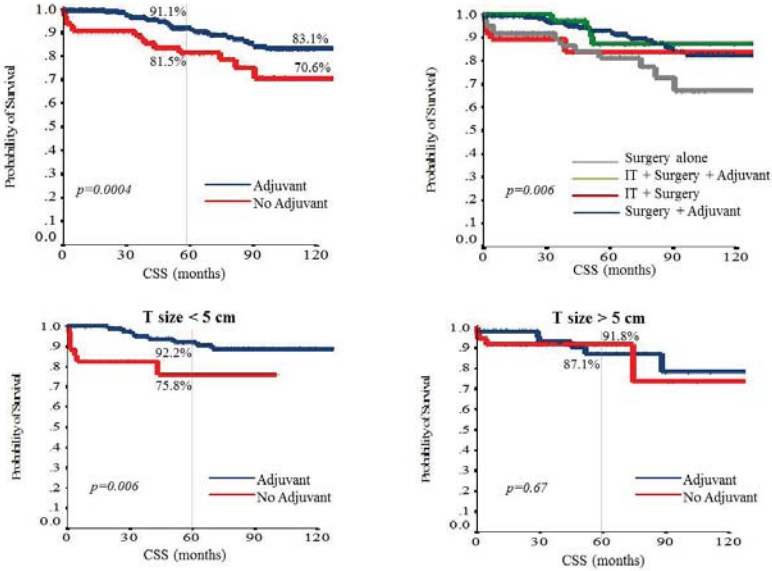
CSS was adjusted for T classification, adjuvant therapy confirmed a significant survival advantage. On the other hand, for thymomas larger than 5 cm, stratifying for tumor size and adjuvant therapy did not affect 5-year CSS (87.1% vs. 91.8%; p = 0.67; see Figure).



CONCLUSIONS: The results of the present study indicate that induction therapy does not affect survival and recurrence rate in LATs. Based on the reported survival advantages, adjuvant therapy should be administered whenever possible, especially for tumors smaller than 5 cm. Further prospective studies are needed to confirm this preliminary data.

21. The Impact of Adjuvant Chemotherapy in Pulmonary Large Cell Neuroendocrine Carcinoma: Results of an International Multi-Institutional Propensity Score-Adjusted Cohort Study on Behalf of the European Society of Thoracic Surgeons Neuroendocrine Tumors Working

Pier Luigi Filosso[1], Francesco Guerrera[1], Andrea Evangelista[2], Claudia Galassi[2], Stefan Welter[3], *Erino Angelo Rendina[4], William Travis[5], Eric Lim[6], Inderpal Sarkaria[7], *Pascal Alexandre Thomas[8]

[1]University of Torino Italy, Torino, Italy; [2]San Giovanni Battista Hospital, Torino, Italy; [3]Ruhrlandklinik Essen, Essen, Germany; [4]Sapienza University of Rome, Rome, Italy; [5]Memorial Sloan Kettering Cancer Center, New York, NY; [6]Royal Brompton Hospital, London, United Kingdom; [7]University of Pittsburgh, Pittsburgh, PA; [8]Aix-Marseille, Marseille, France

Invited Discussant: *Sidharta P. Gangadharan

OBJECTIVE: Large Cell Neuroendocrine Carcinomas (LCNEC) of the lung are rare neoplasms with very aggressive biological behavior. The usefulness of adjuvant chemotherapy (ACT) is still debated, since these tumors do not seem completely responsive to chemo/radiotherapy. Tumor recurrences or metastases are, in fact, very frequent even in cases of early-stage neoplasms in which postoperative treatment has been administered. Due to their rarity, there is a lack of controlled clinical trials concerning the most effective LCNEC treatment. The objective of the present study is to evaluate the impact of ACT in resected LCNECs.

METHODS: This is a retrospective cohort study including LCNEC patients operated between 1992 and 2012, in 17 institutions worldwide. Overall survival (OS) from date of resection was estimated by the Kaplan-Meier method. Propensity Score (PS) for the likelihood of having been submitted to ACT was estimated based on the following characteristics: age, gender, previous malignancy, ECOG Performance Score (ECOG-PS), TNM stage, and year of surgery. Crude, PS-adjusted and multivariable-adjusted OS comparisons stratified by administration of ACT or no ACT were performed using the Cox regression model.

RESULTS: Two-hundred thirty-four patients were included in the final analysis: 67 (29%) received ACT. The median follow-up (FU) was 38 months; FU completeness was 88%. At the end of the study, 133 patients died (36 in the ACT group). Patients receiving ACT treatment showed slightly worse survival (3-year OS 47% vs. 51%; see Figure). PS-adjusted analyses demonstrated no evidence of ACT protective effect on OS (ACT YES vs. NO Hazard Ratio (HR): 1.10, 95% CI [0.70–1.72]; P = 0.673, see Table). Sensitive analysis performed using multivariable Cox model showed similar results (ACT YES vs. NO HR: 0.97; 95% CI [0.61–1.53]; P = 0.899). Age and advanced TNM stages were significant negative predictors.

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Figure 1: Overall Survival according to the administration of adjuvant Chemotherapy

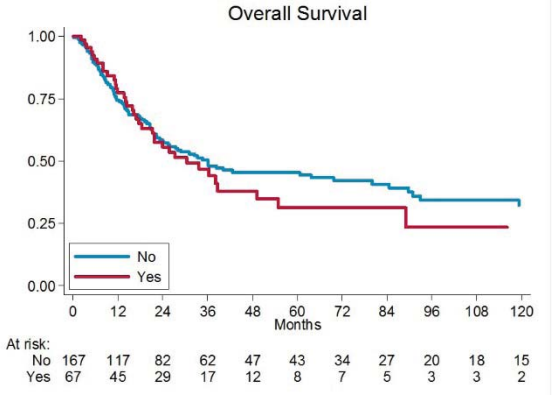


Table: Mortality Hazard According Adjuvant CT Administration. Cox Model with Shared Frailty

	HR (95% CI)	p-Value
Adjuvant Chemoterapy YES vs. NO (Crude)	1.17 (0.77–1.77)	0.472
Adjuvant Chemoterapy YES vs. NO (Propensity Score adjusted)* *Propensity Score includes: age, gender, Previous Malignancy, ECOG PS, pTNM, Year of surgery	1.10 (0.7–1.72)	0.673
Adjuvant chemoterapy YES vs. NO (adjusted for the below factors)	0.97 (0.61–1.53)	0.899
Age (per 1 year increase)	1.02 (1.00–1.05)	0.034
Male gender	1.02 (0.69–1.52)	0.912
ECOG PS ≥2	1.31 (0.77–2.24)	0.317
TNM II vs. I	1.30 (0.84–2)	0.234
TNM III vs. I	2.67 (1.66–4.32)	< 0.001
TNM IV vs. I	1.03 (0.36–2.97)	0.950
Year of Surgery 1999–2005 vs. 1992–1998	0.72 (0.42–1.22)	0.223
Years of surgery: 2006–2012 vs. 1992–1998	0.55 (0.32–0.94)	0.029

CONCLUSION: The results of our study, based on one of the largest LCNECs series reported, did not show a significant impact of ACT on survival. Further prospective clinical trials are needed to confirm these findings.

22. Validation Study of the Proposed IASLC/ITMIG Staging Revisions of the Thymic Carcinoma Using Data from 287 Patients

Yang Zhao, Heng Zhao
Shanghai Chest Hospital, Shanghai, China

Invited Discussant: *Stephen D. Cassivi

OBJECTIVE: In 2014, the IASLC/ITMIG launched a worldwide TNM staging project to inform the next edition (8th) of thymic tumors. The objective of the current study was to validate the proposed new staging system based on the largest single-institution experience.

METHODS: From February 2003 to April 2014, 287 consecutive patients were enrolled in this study with pathologiclly confirmed thymic carcinoma in Shanghai Chest Hospital. Clinical and pathologic data were retrospectively reviewed. Survival analysis was performed using the Kaplan-Meier and log rank tests. External validity was addressed by visually assessing the similarity of curves generated based on the staging system of Masaoka-Koga system and the proposed TNM ones.

RESULTS: The 5-year overall survival (OS) rate and the disease-free survival (DFS) rate were 63.0% and 43.4%, respectively. The 4-tiered survival curves of OS were demonstrated with both significant statistically (see Figure). In the comparisons of Masaoka-Koga staging system with proposed TNM ones, the calculate p values of adjacent groups were 0.629 and 0.630 between stage I and II on OS, 0.021 and 0.063 between stage II and III on OS, 0.001 and 0.004 between III and IV, 0.290 and 0.168 between stage I and II on DFS, 0.007 and 0.115 between stage II and III on DFS, and both <0.001 between III and IV on DFS.

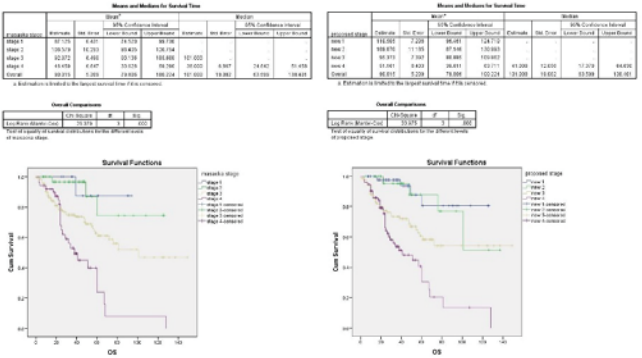


TABLE . Cox Proportional Hazards Regression Models for Masaoka-Koga and Proposed Clinical Stage

	HR for Comparison		*p*	
Comparisons	Masaoka-Koga system	Proposed TNM system	Masaoka-Koga system	Proposed TNM system
OS: Stage of all 4-tiered	2.416	2.130	<0.001	<0.001
OS: Stage I vs. II	1.754	1.409	0.629	0.630
OS: Stage II vs. III	3.957	2.677	0.021	0.063
OS: Stage III vs. IV	2.210	1.986	0.001	0.004
DFS: Stage of all 4-tiered	2.557	2.146	<0.001	<0.001
DFS: Stage I vs. II	3.087	1.958	0.290	0.168
DFS: Stage II vs. III	2.703	1.769	0.007	0.115
DFS: Stage III vs. IV	2.522	2.413	<0.001	<0.001

OS, overall survival; DFS, disease-free survival; HR, hazard ratio

*AATS Member

CONCLUSIONS: The new proposed TNM staging system failed to show priority on predicting clinical course compared with the traditional Masaoka-Koga clinical staging system, and the later should be respected until overwhelming evidence to support such changes in thymic carcinoma patients.

3:20 PM – 3:55 PM COFFEE BREAK/VISIT EXHIBITS

23. Routine VTE Screening After Pneumonectomy: You Must Look to Find

Siva Raja, Jahanzaib Idrees, Jiayan He, *Eugene H. Blackstone, *David P. Mason, Daniel Raymond, *Thomas Rice, *Sudish C. Murthy

Cleveland Clinic, Cleveland, OH

Invited Discussant: *Keith S. Naunheim

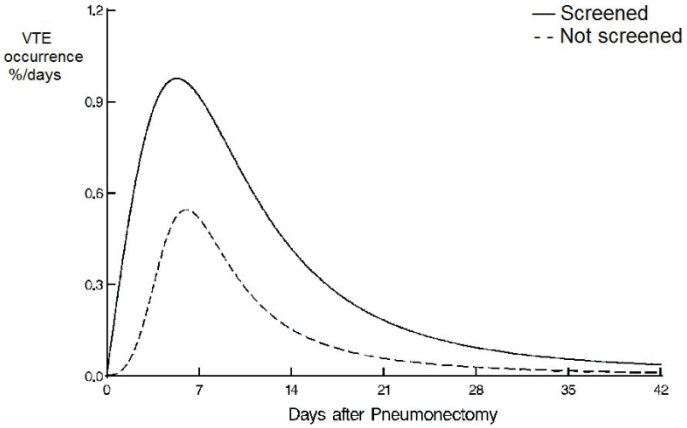
OBJECTIVES: Symptomatic venous thromboembolism (VTE) after pneumonectomy is associated with a worse prognosis. We describe a new care pathway protocol of pneumonectomy patients undergoing asymptomatic lower extremity VTE screening to determine whether this strategy increased detection and decreased mortality and morbidity from VTE in this high-risk population.

METHODS: One hundred and twelve patients underwent a pneumonectomy from 2006 through 2012 and were enrolled in a care pathway that included a routine post-operative lower extremity VTE screen just prior to expected discharge. Patient data was abstracted from the hospital's submission to the STS General Thoracic Surgery database. These data were contrasted with a prior cohort of 336 patients who underwent pneumonectomy without routine VTE screening.

RESULTS: Twenty out of 112 patients had VTE after pneumonectomy. Ten (50%) patients out of 20 were asymptomatic but had a VTE detected on the screen in hospital prior to discharge. Three of these 10 patients were observed, of whom 2 had progression of their VTE requiring anticoagulation. Fourteen (70%) patients had a VTE diagnosed within 30 days. The percentage in-hospital VTE in the screened cohort (8.9%) was significantly higher than those not screened (3.0%) ($p = 0.008$). Similarly, VTE within 30 days in the screened cohort (13%) was significantly higher than those unscreened (5.1%) ($p = 0.007$). The time-varying instantaneous risk of the first VTE in both the screened and unscreened population showed a similar profile consisting of an early peaking of risk followed by a constant risk (Figure). In both cohorts a peak was observed at approximately 6 days after pneumonectomy, around the day of discharge (see Figure) and plateauing after 30 days. The presence of a VTE portended a worse long term survival with a hazard ratio of 2.1 ($p = 0.08$).

CONCLUSION: The diagnosis of VTE after pneumonectomy is nearly three times higher when patients are screened compared to those who are tested following the development of symptoms. Although the risk appears to peak at 6 days, there is an increased risk up to 30 days questioning the need for additional screening or longer prophylaxis. Asymptomatic DVT that are observed have a high rate of progression. Care pathways after pneumonectomy that involve screening for VTE identify patients who require additional therapy and thereby might decrease the mortality and morbidity in this high risk population.

*AATS Member



3:20 PM – 3:55 PM COFFEE BREAK/VISIT EXHIBITS

DEEP DIVE SESSION IN THE EXHIBIT HALL AATS CT Theater 2
FEATURING: *Not for Credit*

23. Routine VTE Screening After Pneumonectomy: You Must Look to Find

P33. The Incidence and Burden of Venous Thromboembolism After Major Lung Resection: A Prospective Cohort Analysis

P34. Caprini Risk Assessment for Postoperative Venous Thromboembolism in Surgical Lung Cancer Patients

Moderated by *Keith S. Naunheim and *Sidharta P. Gangadharan

24. Giving Induction Radiation in Addition to Chemotherapy Is Not Associated with Improved Survival of NSCLC Patients with Operable Mediastinal Nodal

Chi-Fu Jeffrey Yang[1], Brian Gulack[1], Lin Gu[1], Paul Speicher[1], Xiaofei Wang[1], *Thomas D'Amico[1], *Mark Berry[2], Matthew Hartwig[1]

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

Invited Discussant: *David R. Jones

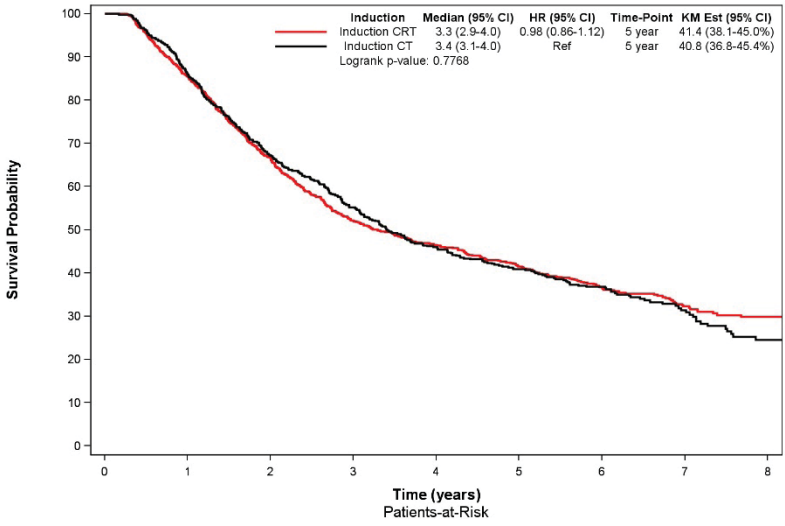
OBJECTIVE: Radiotherapy is commonly used in induction regimens for patients with operable stage IIIA (N2) non-small cell lung cancer (NSCLC) though evidence has not shown benefit over induction chemotherapy (IC) alone. We compared outcomes between IC and induction chemoradiation (ICR) using the National Cancer Database (NCDB).

METHODS: Induction radiation use and survival of patients with clinical stage IIIA-N2 NSCLC in the NCDB who received induction chemotherapy followed by lobectomy or pneumonectomy from 2003 to 2006 were assessed using logistic regression, Kaplan-Meier and Cox proportional hazard analysis.

RESULTS: In the study period, 1,362 patients met inclusion criteria: 834 (61.2%) ICR and 528 (38.8%) IC. Surgical resection was lobectomy in 81.6% (n = 1,111) and pneumonectomy in 18.4% (n = 251). Pneumonectomy was performed more often after ICR than after IC alone (20.1% vs. 15.7%; p = 0.04). Patient characteristics that predicted radiation use were younger age (adjusted odds ratio [aOR], 0.97 per year; 95% CI [0.96–0.99]; p < 0.0001), T2 (aOR, 1.47; 95% CI [1.12–1.92]; p = 0.005) and T3 (aOR, 2.25; 95% CI [1.52–3.35]; p < 0.0001) over T1 tumor status, and treatment at a non-academic institution community center (aOR, 2.00; 95% CI [1.25–3.21]; p = 0.004) and comprehensive center (aOR, 1.72; 95% CI [1.36–2.18]; p < 0.0001). Adjuvant chemotherapy use was uncommon in the entire cohort (3.5%; n = 47) and did not differ between IC and ICR patients (p = 0.95). Adjuvant radiation was used more commonly in the IC group than the ICR group (38.4% vs. 3.0%; p < 0.001). Down-staging from N2 to N0 was more common with ICR compared to IC (70% vs. 58%; p < 0.0001), but in univariate analysis patients in the ICR group had similar 5-year survival when compared to patients in the IC group (40.8% vs. 41.4%; p = 0.41, see Figure). In multivariable analysis, ICR did not improve survival over IC alone (HR, 1.02; 95% CI [0.89–1.18]; p = 0.72).

CONCLUSIONS: In this NCDB analysis, ICR was used in the majority of patients who had induction therapy prior to surgical resection of clinical stage IIIA-N2 NSCLC but did not improve survival compared to IC. The use of induction radiation for stage IIIA-N2 NSCLC should be reexamined in the context of a randomized trial so that patients are not exposed to risks of radiation without benefit.

*AATS Member


Induction Median (95% CI) HR (95% CI) Time-Point KM Est (95% CI)
Induction CRT 3.3 (2.9-4.0) 0.98 (0.86-1.12) 5 year 41.4 (38.1-45.0%)
Induction CT 3.4 (3.1-4.0) Ref 5 year 40.8 (36.8-45.4%)
Logrank p-value: 0.7768
Survival Probability
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8
Time (years)
Patients-at-Risk
Induction CRT – 834 698 533 406 356 299 205 110 49
Induction CT – 528 445 341 278 227 188 130 62 29

25. Accelerated Hemithoracic Radiation Followed by Extrapleural Pneumonectomy for Malignant Pleural Mesothelioma

*Marc De Perrot, Ronald Feld, Natasha Leighl, Andrew Hope, *Thomas K. Waddell, *Shaf Keshavjee, B.C. John Cho

Toronto General Hospital & Princess Margaret Hospital, Toronto, ON, Canada

Invited Discussant:

OBJECTIVE: The optimal multimodality approach for patients with resectable malignant pleural mesothelioma (MPM) remains controversial. We developed a new protocol of accelerated induction hemithoracic intensity modulated radiation therapy (IMRT) followed by extrapleural pneumonectomy (EPP) to deliver optimal radiation to the whole tumor bed in a short period of time. EPP is performed approximately one week after completion of radiation to limit the risk of pneumonitis. An initial phase I study demonstrated the feasibility of this protocol. Herewith, we reviewed our updated experience in a prospective single-arm phase II trial.

METHODS: Each patient received 25 Gy of radiation in 5 daily fractions over 1 week delivered to the entire ipsilateral hemithorax by IMRT with concomitant boost of 5 Gy to volumes at high risk based on CT and PET scan findings followed by EPP 6 ± 2 days after the end of the radiation. Adjuvant chemotherapy was offered to patients with ypN2 disease. Predefined entry criteria were clinical T1-3N0M0, histology proven, previously untreated MPM, staged with PET-CT scan. Treatment-related adverse events were reported using CTCAE(v.4).

RESULTS: A total of 62 patients were included in the protocol between November 2008 and October 2014 (Table). Access to the protocol was extended to 6 patients with clinical N2 on PET (n = 2), T4 on CT (n = 2) or who had received prior chemotherapy for MPM (n = 2). One patient (with extended access to the protocol) died in hospital after EPP for a total operative mortality of 1.6% and 2 died after discharged from hospital for an overall treatment related mortality (grade 5 toxicity) of 4.8%. A total of 24 patients (39%) developed grade 3+ complications (see Table). The rate of grade 3+ complications decreased from 60% to 29% between the first 20 patients and the latest 42 patients ($p = 0.02$). On final pathology, 94% of the patients were stage III or IV, and 56% had ypN1 (n = 3) or ypN2 disease (n = 32). The median survival for all patients as an intention-to-treat analysis was 36 months. Among patients who met the predefined entry criteria, the median survival and disease free survival was 51 and 47 months respectively in epithelial subtypes, compared to 10 and 8 months in biphasic subtypes ($p = 0.001$). After a median follow-up of 36 months, disease free survival reached 65% at 3 years in patients with epithelial ypT3-4N0M0 (compared to 43% in epithelial ypN+ patients; $p = 0.02$). Among 30 patients (48%) who developed recurrence, the predominant sites of recurrence were the contralateral chest (53%) and abdomen (47%). Ipsilateral chest recurrence occurred in only 8 patients (13%).

*AATS Member

Patient Characteristics (n = 62)	
Age (year)	63 ± 8
Male gender	52 (84%)
Epithelial histology subtype	44 (71%)
Right side tumor	45 (73%)
Main grade 3+ complications	
Atrial fibrillation	12 (19%)
Empyema (without bronchopleural fistula)	4 (6%)
Pulmonary emboli	3 (5%)
Hemothorax	2 (3%)
Chylothorax	2 (3%)

CONCLUSIONS: Accelerated hemithoracic IMRT followed by EPP has become our preferred approach for resectable MPM. This protocol can be delivered safely and is relatively well tolerated. The results have been encouraging, particularly in patients with epithelial subtype in the presence of ypN0 disease.

26. Is Surgical Resection Justified for Myasthenia Gravis? Long-Term Results in Over 1000 Cases

Andrew Kaufman, Justin Palatt, Mark Sivak, Peter Raimondi, Dong-Seok Lee, Andrea S. Wolf, Fouad Lajam, Faiz Bhora, *Raja Michael Flores
Icahn School of Medicine, Mount Sinai Health System, New York, NY

Invited Discussant: *Joshua R. Sonett

OBJECTIVE: The efficacy of thymectomy as the optimal surgical technique in the treatment of Myasthenia Gravis remains controversial. Long-term outcomes are lacking and remission rates are based on small populations. Therefore, we reviewed our institutional experience of thymectomy for myasthenia gravis focusing on long-term outcomes, the rate of complete stable remission (CSR), improvement in symptoms, after transcervical (TC), trans-sternal (TS), thoracotomy (TH), and VATS (V) thymectomy.

METHODS: A retrospective review of a prospectively maintained database of 3,000 patients diagnosed with Myasthenia Gravis from 1941 to 2013 was performed. Only patients who underwent thymectomy with complete data including: age, sex, date of onset of symptoms, date of surgery, Osserman classification before and after surgery, and the date and status at last follow-up were included in the analysis. Complete Stable Remission was defined as asymptomatic and off all medications for at least one year after surgery. Patients who underwent trans-sternal, transcervical, thoracotomy, and VATS thymectomy were included in the analysis. Data was analyzed using logistic regression and the Kaplan-Meier estimate.

Table: Logistic Regression with Remission as the Dichotomous Variable

Variable	N (%)	Odds Ratio	95% CI	*p*
Sex				
F	653 (65.2)	Ref		
M	349 (34.8)	1.240	.888–1.83	0.190
Thymoma				
No	826 (83.7)	Ref		
Yes	161 (16.3)	0.387	.195–.767	0.006
Technique				
Transcervical	743 (74.2)	Ref		
Transsternal	200 (20.0)	0.753	.453–1.25	0.274
Thoracotomy	43 (4.29)	1.290	.487–3.45	0.604
VATS	16 (1.60)	0.685	0.150–3.13	0.625
Osserman Class				
I	73 (7.29)	Ref		
II	776 (77.5)	1.220	.631–2.38	0.550
III	120 (12.0)	0.955	.420–2.17	0.913
IV	33 (3.30)	0.358	.073–1.74	0.203

*AATS Member

RESULTS: A total of 1,003 thymectomy patients met the inclusion criteria. A total of 35.5% (n = 356) derived a benefit from surgery. The overall rate of CSR was 19% (n = 192) and an additional 16% (n = 164) symptomatically improved requiring decreased medications after thymectomy. 58% (n = 580) of patients were stable after resection and 7% (n = 67) developed progressive disease. A multivariate analysis comparing preoperative variables demonstrated that the presence of thymoma significantly decreased the rate of CSR ($p < .006$). Preoperative Osserman classification and surgical technique showed no significant impact on the rate of CSR.

CONCLUSIONS: Thymectomy provides long-term complete stable remission in 19% of patients. Larger prospective studies are needed to ascertain not only the benefits but also the potential harm to patients who undergo surgery without response.

5:00 PM ADJOURN

2:00 PM **PERIOPERATIVE CARE** Room 608, WSCC
SIMULTANEOUS SCIENTIFIC SESSION
8 minute presentation, 7 minute discussion

Moderators: *Glenn J. Whitman and Katherine J. Hoercher

27. Modified Perioperative Management Improves the Early Outcomes in Hemodialysis Patients Undergoing Cardiac Surgery

Hiroyuki Tsukui, Shogo Isomura, Chihiro Ueda, Shinka Miyamoto, Shizuko Iwasa, Satoshi Saito, Kenji Yamazaki
Tokyo Women's Medical University, Tokyo, Japan

Invited Discussant: *Vinod H. Thourani

OBJECTIVE: To evaluate whether our modified perioperative management improves the early outcomes compared to previous management in hemodialysis (HD) patients undergoing cardiac surgery.

METHODS: Modified perioperative management for HD patients was started in 2013. One week before surgery, medications for hyperphosphatemia were discontinued to prevent postoperative constipation or ileus. In addition, low fiber diet and medications for defecation were introduced. After surgery, alprostadil alfadex (120 microgram/day) was infused continuously to maintain organ perfusion. Because aggressive fluid removal has risks of organ ischemia, ileus, cholecystitis, or pancreatitis, continuous HD was used routinely for several days from postoperative day 1, and then regular intermittent HD was introduced. Most of the patients took 7 to 10 days to reach the target dry weight after surgery. Bilateral thoracic chest tubes were routinely placed for anticipated pleural effusion, and left until the volume of pleural effusion reduced to less than 1 ml/kg/day to prevent atelectasis or pneumonia. A total of 100 consecutive HD patients undergoing cardiac surgery between January 2008 and September 2014 were divided into two groups (Group M: modified management, 35 patients vs. Group P: previous management, 65 patients) and the outcomes were compared.

RESULTS: There were no significant differences between the two groups in terms of preoperative status or surgical procedures except for operation time (Group M: 308 minutes vs. Group P: 367 minutes; $p = 0.02$) (see Table). There was no hospital death in Group M, whereas 8 patients (12.3%) died in Group P (sepsis: 2, ileus: 2, heart failure: 1, pancreatitis: 1, gastrointestinal bleeding: 1, and lung bleeding: 1) ($p = 0.048$). In terms of postoperative complications, the rate of reexploration for bleeding was significantly lower in Group M compared to Group P (0% vs. 15.4%; $p = 0.013$). No statistical differences were observed, however, the lower complication rates were found in Group M; superficial wound infection (Group M: 5.7% vs. Group P: 7.7%), mediastinitis (Group M: 2.9% vs. Group P: 10.8%), pneumonia (Group M: 5.7% vs. Group P: 9.2%), sepsis (Group M: 2.9% vs. Group P: 6.2%), ileus (Group M: 5.7% vs. Group P: 10.8%), pancreatitis (Group M: 0% vs. Group P: 3.1%),

cholecystitis (Group M: 0% vs. Group P: 3.1%), and respiratory failure requiring tracheotomy (Group M: 0% vs. Group P: 7.7%). In Group M, the lengths of intubation period (Group M: 21.8 hours vs. Group P: 162.2 hours; p = 0.034) and hospital stay (Group M: 21.8 days vs. Group P: 42.0 days; p = 0.025) were significantly shortened.

	Group M		Group P		p value
Number of Patients	35		65		
Gender (Male)	25	71.4%	54	83.1%	
Age	60.4	(42-78)	62.5	(37-78)	ns
Hemodialysis duration (years)	12.0	(0.1-34)	8.5	(0.1-36)	ns
Hypertension	31	88.6%	55	84.6%	ns
Diabetes	20	57.1%	39	60.0%	ns
Diabetic nephropathy	19	54.3%	33	50.8%	ns
Peripheral artery disease	8	22.9%	15	23.1%	ns
Emergent case	1	2.9%	4	6.2%	ns
Previous cardiac surgery	1	2.9%	1	1.5%	ns
Infectious endocarditis	0	0.0%	1	1.5%	ns
LVEF (%)	44.5		46.2		ns
EuroSCORE Additive (points)	7.1		6.9		ns
EuroSCORE Predicted mortality (%)	11.68		10.58		ns
Surgical procedures					
On pump beating CABG	15	42.9%	31	47.7%	
Off pump CABG	6	17.1%	5	7.7%	
AVR	5	14.3%	10	15.4%	
AVR+CABG	3	8.6%	5	7.7%	
AVR+Maze	0	0.0%	4	6.2%	
MVP+CABG	0	0.0%	2	3.1%	
MVR+TAP	2	5.7%	0	0.0%	
MVP+TAP+CABG	2	5.7%	0	0.0%	
Others	2	5.7%	8	12.3%	

AVR: aortic valve replacement, MVP: mitral valve plasty, MVR: mitral valve replacement, TAP: tricuspid annular plasty

CONCLUSIONS: Modified perioperative management improved early mortality and morbidity, and shortened the length of intubation period and hospital stay in HD patients undergoing cardiac surgery.

28. Preoperative Anemia Versus Blood Transfusion: Which Is the Culprit for Worse Outcomes in Cardiac Surgery?

Damien J. LaPar[1], James M. Isbell[1], *Jeffrey Rich[2], *Alan M. Speir[3], Mohammed Quader[4], *Irving L. Kron[1], *John A. Kern[1], *Gorav Ailawadi[1]

[1]University of Virginia, Charlottesville, VA; [2]Mid-Atlantic Cardiothoracic Surgeons, Norfolk, VA; [3]INOVA Heart and Vascular Center, Falls Church, VA; [4]VCU, Richmond, VA

Invited Discussant: *Charles R. Bridges

OBJECTIVES: Reducing blood product utilization after cardiac surgery has become a focus of perioperative care as studies suggest improved outcomes. However, the relative impact of preoperative anemia versus packed red blood cell (PRBC) transfusion on outcomes remains poorly understood. The purpose of this study was to investigate the relative association between preoperative hematocrit (Hct) level versus PRBC transfusion on postoperative outcomes after coronary artery bypass grafting (CABG).

METHODS: Patient records from 17 cardiac surgery centers were evaluated for primary, isolated CABG operations (1/2007–6/2014). Multiple logistic regression modeling, with smoothing spline functions, was utilized to estimate the relationship between baseline preoperative Hct level as well as PRBC transfusion and the likelihood for postoperative mortality and morbidity, adjusted for baseline patient risk. Model performance characteristics and likelihood ratios (LR) were compared to determine relative strength of association between Hct level versus PRBC transfusion and primary outcomes.

RESULTS: A total of 21,641 patients (average patient age = 64 ± 10 years, 27% female) were evaluated. Median preoperative hematocrit was 39% (29%, 46%) and STS PROM was 1.8% (0.3%, 5.8%). Postoperative events included: PRBC transfusion (38%), renal failure (3.1%), stroke (1.4%), and operative mortality (2.2%). As expected, a strong association was observed between preoperative Hct and the likelihood for PRBC transfusion (LR: 1,228; $p < 0.001$). After risk-adjustment, PRBC transfusion (not Hct level) demonstrated stronger associations with postoperative mortality (LR: 116; $p < 0.001$), renal failure (LR: 250; $p < 0.001$) and stroke (LR: 63; $p < 0.001$. Decreasing preoperative Hct was associated with an increased probability of mortality (LR: 10; $p < 0.007$) and renal failure (LR:69; $p < 0.001$), Interestingly, preoperative anemia compared to a Hct level of 40% was associated with up to a 66% increase in the probability of PRBC transfusion, 50% increase in renal failure, and a 43% increase in mortality (see Table).

Table: Impact of Preoperative Hematocrit Level on the Risk-Adjusted Probability of Postoperative Morbidity and Mortality After CABG

Postoperative Outcome	Preoperative Hematocrit (20%)	Preoperative Hematocrit (30%)	Preoperative Hematocrit (40%)
PRBC Transfusion	60%	40%	20%
Renal Failure	5%	4%	2.5%
Mortality	1.75%	1.3%	1.0%

*AATS Member

CONCLUSIONS: Packed red blood cell transfusion appears more closely associated with risk-adjusted morbidity and mortality compared to the preoperative hematocrit level alone, supporting efforts to reduce unnecessary PRBC transfusions. Preoperative anemia does independently increase the risk of postoperative morbidity and mortality. These data suggest that preoperative hematocrit levels should be included in the STS risk calculators. Finally, efforts to optimize preoperative hematocrit should be investigated as a potentially modifiable risk factor for mortality and morbidity.

29. Transcatheter Valve-In-Valve Therapy Using Six Different Devices In Four Anatomic Positions – Clinical Outcomes and Technical Consideration

Adam El-Gamel, Grant Parkinson, Zaw Lin, Nand Kejriwal, Nick Odom
Waikato Hospital, Hamilton, New Zealand

Invited Discussant:

OBJECTIVE: The quality of traditional de-airing in heart surgery did not improve until transesophageal echo (TEE) became the norm during cardiac surgery. Irrespective of duteous removal of all detectable air, emboli continue to be an unresolved problem. Air embolism may lead to severe left or commonly right ventricular dysfunction, arrhythmias, and transient or permanent neurologic deficits. The quality improvement resulting from using TEE came at the cost of an increase in the time necessary for complete de-airing. The randomness and quick advent of air embolism makes their management challenging. Our study evaluated a new technology using a novel system flooding the surgical field with humidified CO_2.

METHODS: Elective valve surgery patients were selected prospectively and consecutively for the study. Patients were assigned alternately to a control group (120 patients) and a study group (120 patients). Intraoperative TEE were performed, TEE images were reviewed by cardiac anesthetist and graded from 0 to 4, dependent on the density of the bubbles.

De-airing Technique

Study group. The method consists of flooding the surgical fields with warm humidified carbon dioxide through a novel (CO_2 humidification system) and no manual handling of the heart. the manual de-airing technique has been used in the control group. This involves routine measures such as heart dislocation and puncture of left-ventricular apex, heart ventricles massage to remove air. After completion of the surgical procedure, the aortic root was de aired, and the aortic crossclamp was released. The heart was defibrillated to sinus or pacemaker-induced rhythm. Good cardiac contraction and normal central hemodynamics were established.

*AATS Member

	Humidified CO2 used	Not used	P value
Deair time	2min	16 min	0.04
RV dysfunction	1%	12%	0.001
LV Dysfunction	0%	6%	0.01
Pulmonary hypertension	0%	8%	0.02
Delirium Seizures	1%	5%	0.01
Temp differ	n	n	

RESULTS: 76% of CO_2 group had no bubbles versus 30% in the manual group with P value < 0.003, de airing time in the CO_2 group with only 2 minutes versus 16 minutes ns in the control group p < 0.04, there was 2% of clinical symptoms due to air embolism in the study group versus 29% in the control group.

CONCLUSIONS: The use of humidified CO_2 field flooding has been observed to be associated with a significantly lower count of intracardiac air bubbles, improved morbidity in patients undergoing open heart surgery and moderate saving in theatre time and resources.

30. How Detrimental Is Reopening for Bleeding After Cardiac Surgery? Analysis from 16,793 Cases

*Marc Ruel, Vincent Chan, Munir Boodhwani, Bernard McDonald, Xiaofang Ni, Gurinder Gill, Khanh Lam, Fraser Rubens, *Paul Hendry, Roy Masters, *Thierry Mesana

University of Ottawa, Ottawa, ON, Canada

Invited Discussant: *S. Chris Malaisrie

OBJECTIVE: To establish the risk factors and impact of reopening for bleeding (RfB) in a large modern cardiac surgical cohort.

METHODS: At a tertiary referral center, baseline, index procedural, reopening, outcome and readmission characteristics of 16,793 consecutive adult cardiac surgical patients were prospectively entered into a dedicated clinical database. Data were validated and cross-referenced to separate data sources for accuracy. Determinants of RfB, as well as its independent impact on outcomes and readmission, were examined by using multivariable regression models supplemented with bootstrap simulations.

RESULTS: Mean age was 65.9 ± 12.1 years, and 11,991 (71.4%) patients were male. Reopening after the index operation occurred in 710 (4.2%) patients and of these, 661 (3.9%) were RfB. Perioperative mortality was 458/16,132 (2.8%) in those who did not undergo RfB and 81/661 (12.0%) in those who had RfB, corresponding to a 4.1 ± 0.5 odds ratio (P < .001) independent of other mortality risk factors (see Table). Hospital length of stay was greatly increased by RfB (median 12 versus 7 days in patients who did not have RfB; P < .001) to an extent beyond any other predictor including postoperative atrial fibrillation (median increase by 2 days; P < .001). RfB also was independently associated with new onset postoperative atrial fibrillation (36.3% versus 26.0% in non-RfB patients; P = .001). Risk factors for RfB were tricuspid valve repair (OR, 2.6 ± 0.4; p < .001), on-pump versus off-pump CABG (1.7 ± 0.4; p = .013), emergency status, cardiopulmonary bypass (CPB) duration, low body surface area, and low CPB hematocrit (1.15 ± 0.7 per 0.10 decrease; p = .025). RfB was not predicted by age, creatinine level, or preoperative hematocrit, and RfB did not increase the incidence of hospital readmission.

Table: Determinants of Perioperative Mortality (N = 16,793)

Risk factor	OR	SE	p-Value	95% CI
Reopening for bleeding	4.1	0.5	<.001	3.2–5.3
Mitral repair	0.6	0.1	.007	0.4–0.9
Age (per year)	1.04	0.004	<.001	1.03–1.05
Emergency	4.3	0.8	<.001	3.1–6.2
Tricuspid repair	1.9	0.4	.001	1.3–2.8
Atrial fibrillation	1.3	0.2	0.2	0.9–1.8
Creatinine (preop; per umol/L)	1.002	.0006	.001	1.001–1.003
CPB time (per min)	1.01	0.002	<.001	1.01–1.02
OPCAB (vs CABG)	0.99	1.02	1.0	0.12–7.6

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CONCLUSIONS: Reopening for bleeding is a lethal, morbid, and costly complication of cardiac surgery, with an independent detrimental effect that surpasses any other known potentially modifiable risk factor in this large cohort. All efforts should be made to minimize the incidence and burden of RfB, including further research on transfusion management during CPB.

31. Use of Cumulative Data in Funnel Plots to Evaluate Performance Improvement in Cardiac Surgery

*James R. Edgerton[1], Morley A. Herbert[2], Baron L. Hamman[3], Syma L. Prince[4], W. Steves Ring[5]

[1]The Heart Hospital Baylor Plano, Plano, TX; [2]Medical City Dallas Hospital, Dallas, TX; [3]Texas Health Heart & Vascular Hospital, Arlington, TX; [4]CRSTI, Dallas, TX; [5] University of Texas Southwestern, Dallas, TX

Invited Discussant: *Harold L. Lazar

OBJECTIVE: Assessing program outcomes over time is the first step to quality improvement but requires a readily obtainable and easily understandable assessment tool. Looking at a center's performance annually may not reveal a trend in any program because annual volumes can be insufficient for statistical significance. Assessing cumulative performance may reveal a more meaningful trend towards improvement.

METHODS: STS Adult Cardiac Database was voluntarily compiled by 26 hospitals from a large metropolitan area containing data on 26,634 cardiac surgical procedures including 13,379 isolated CABG (January 2009 to December 2013). The observed to expected (O/E) mortality ratio for isolated CABG procedures was calculated for each hospital and plotted against the surgical case volume over a five year period. A funnel plot was created about the STS national O/E of 1.0 with upper and lower 95% CI. Comparison of O/E ratio permits performance to be categorized: above average (O/E < 1.0), below average (O/E > 1.0 within 95% CI), or outlier (O/E outside 95% CI). By graphing the cumulative annual performance of individual programs, the slope of the curve can reveal performance improvement (negative slope) or not (flat or positive slope).

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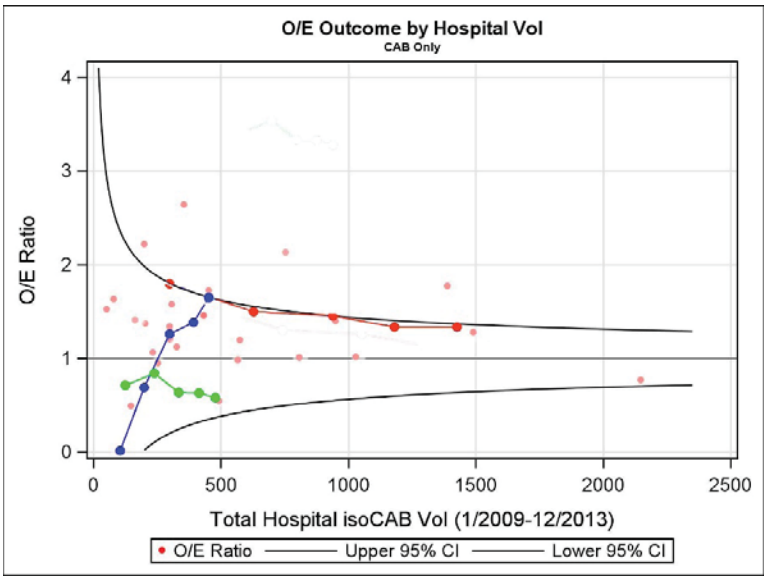

RESULTS: Cumulative plots of mortality O/E vs. surgical volume for four hospitals are presented. Hospital 1 (red) starts with above average performance but declines progressively over 5 years (positive slope), a trend leading it to below average performance. Hospital 2 (blue) starts below average but has progressively better results improving to the top 2.5% of performers. Hospital 3 (light blue) starts as a below average performer, but becomes an outlier with increased volumes although the O/E changes only slightly. Hospital 4 (green) starts excellent and maintains its status as its increased volumes leads to top 2.5% performance. Results from any one year rarely have enough case volume to get a good idea of performance.

CONCLUSIONS: Funnel plots are easily constructed and provide an understandable tool for assessing performance of individual centers. By superimposing a single center's yearly cumulative trend over the STS (total) funnel plot, we can determine if quality improvement processes in place are working (downward trend) or need to be revised (flat or upward trend). The traditional method of looking only at each individual yearly outcome will not show if a program is trending towards remaining inside the funnel, or towards becoming an outlier. This information is critical to assess the effectiveness of quality improvement processes.

3:15 PM – 3:45 PM COFFEE BREAK/VISIT EXHIBITS

32. Postoperative Delirium Increases Both Operative and One Year Mortality in Patients Treated with Surgical or Transcatheter Aortic Valve Replacement

*Hersh Maniar, Brian Lindman, Michael Avidan, Krisztina Escallier, Eric Novac, Marci S. Damiano, John Lasala, *Jennifer Lawton, *Marc R. Moon, Spencer Melby, Nishath Quadar, *Michael Pasque, *Ralph J. Damiano, Jr., Alan Zajarias
Washington University, Saint Louis, MO

Invited Discussant: *Lars G. Svensson

OBJECTIVE: Delirium is an acute and fluctuating neurological disorder that reflects a change from baseline cognition and is characterized by the cardinal features of inattention and disorganized thinking. Postoperative delirium occurs commonly after cardiac surgery and has been associated with adverse outcomes. The purpose of this study was to determine the incidence and clinical significance of delirium in patients with aortic stenosis (AS) undergoing surgical aortic valve replacement (SAVR) or transcatheter aortic valve replacement (TAVR).

METHODS: Between 2008 and 2013, 427 patients who underwent TAVR (n = 168) or SAVR (n = 259) were screened postoperatively for delirium twice daily while on the intensive care unit (ICU) using the Confusion Assessment Method for the ICU (CAM-ICU). The CAM-ICU is known to be sensitive (80%) and specific (96%) for delirium in this setting. A positive CAM-ICU evaluation identified patients with delirium. The incidence of delirium in both treatment groups was determined and its association with perioperative morbidity and 30 day and 1 year mortality was evaluated by univariable and multivariable analyses.

RESULTS: Postoperative delirium occurred in 135 patients (32%) and its incidence was similar between SAVR (33% [86/259]) and TAVR groups (29%, [49/168]) ($p = 0.40$). Among patients treated with SAVR, higher age ($p = 0.01$) and an intubation time greater than 24 hours ($p < 0.05$) were independently associated with delirium. Among patients treated with TAVR, chronic systemic steroid use ($p = 0.03$), non-transfemoral TAVR ($p < 0.05$) and the development of acute kidney injury ($p = 0.04$) were independently associated with delirium. The presence of postoperative delirium was associated with a significant increase in mortality at 30 days (7% vs. 1%; $p < 0.001$) and at 1 year (21% vs. 8%; $p < 0.001$). After adjustment for age, sex, STS score, and AVR type, delirium remained significantly associated with mortality over the first year after valve replacement (adjusted HR, 3.02; 95% CI [1.75–5.23]; $p < 0.001$). The increased mortality associated with delirium was observed in both the TAVR and SAVR treatment groups (see Figure). Delirium was also associated with a longer initial ICU stay (70 vs. 27 hours), a need for ICU readmission (10% [14/135] vs. 2% [6/292]), and a longer hospital length of stay (8 vs. 6 days) ($p < 0.001$ for all).

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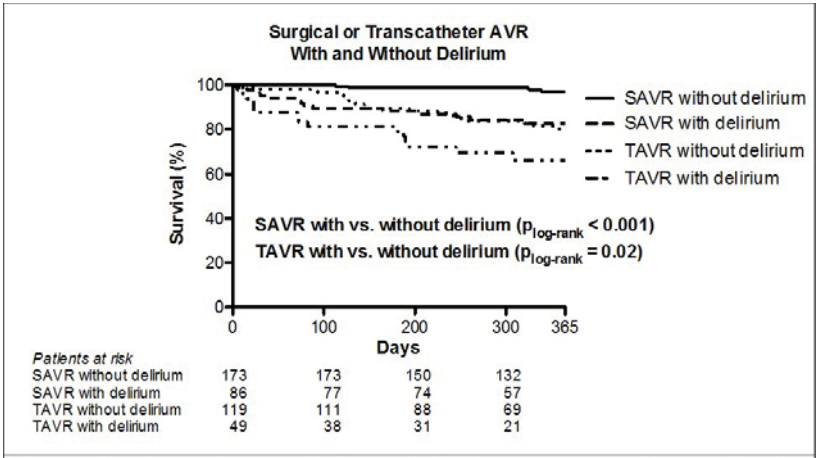

Figure. Time-to-event curves for 1-year death from any cause. One-year time-to-event curves are shown for death from any cause in SAVR and TAVR treated patients with and without delirium. Within each treatment group, patients with and without delirium were compared with the use of the log-rank test.

CONCLUSIONS: Delirium occurs commonly after surgical and transcatheter AVR and is associated with increased mortality and resource utilization. The characteristics associated with postoperative delirium differ depending on the procedure performed. Further studies are needed to elucidate risk factors for delirium after aortic valve replacement, and to test interventions that may decrease its incidence.

33. A Novel Score to Estimate the Risk of Pneumonia After Cardiac Surgery

Arman Kilic, Rika Ohkuma, Joshua C. Grimm, J. Trent Magruder, Marc Sussman, Eric B. Schneider, *Glenn J.R. Whitman

Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: *Eugene H. Blackstone

OBJECTIVE: The purpose of this study was to derive and validate a risk score for pneumonia (PNA) after cardiac surgery.

METHODS: Adults undergoing cardiac surgery between 2005–2012 were identified in a prospectively collected single institution database. The primary outcome was postoperative PNA, diagnosed by positive sputum cultures, transtracheal fluid, bronchial washings, and/or clinical findings consistent with PNA. Patients were randomly assigned to training and validation sets in a 3:1 ratio. A multivariable model was constructed incorporating univariate pre- and intraoperative predictors of PNA in the training set. Points were assigned to significant risk factors in the multivariable model based on their associated odds ratios, and a composite score was generated by summing individual risk points. The predictive capability of the composite score was then evaluated in the validation set using logistic regression, weighted regression, and area under receiver operating characteristic curve analysis (c-index). This risk score for PNA was also compared to the Society of Thoracic Surgeons (STS) prolonged ventilation model in predicting PNA.

RESULTS: 6,222 patients were identified and randomly assigned to training (75%; n = 4,666) and validation (25%; n = 1,556) sets. The overall rate of postoperative PNA was 4.5% (n = 282). A 22-point score incorporating 6 risk factors was generated: age > 65 years (3 points), mild, moderate, or severe chronic lung disease (4, 6, or 7 points, respectively), peripheral vascular disease (3 points), cardiopulmonary bypass time > 100 minutes (3 points), intraoperative red blood cell transfusion (2 points), and pre- or intraoperative intra-aortic balloon pump implantation (4 points). The model used to generate the score in the training set was robust in predicting PNA ($c = 0.72$; $p < 0.001$). Predicted rates of PNA increased exponentially with increasing risk score, ranging from 1.2% (score = 0) to 55% (score = 22) (see Figure). In the validation set, the score was predictive of PNA (OR, 1.32; $p < 0.001$). Patients with a score greater than 5 were over 3-fold more likely to develop PNA than patients with a score of 5 or less in the validation set (OR, 3.20; $p = 0.02$). In weighted regression analysis, there was a strong correlation between predicted rates of PNA based on the training set and actual rates of PNA in the validation set stratified by risk score ($r = 0.75$; $p < 0.001$). The composite score outperformed the STS prolonged ventilation model in predicting PNA in the validation cohort (c-index 0.74 versus 0.71, respectively).

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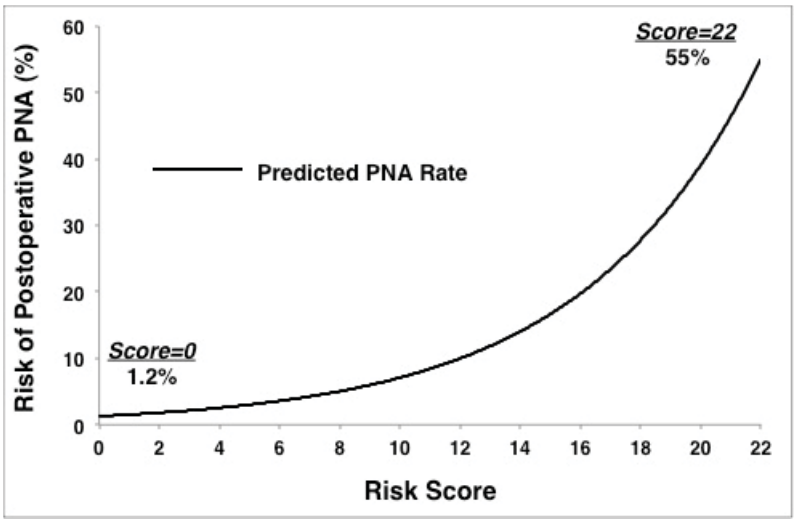

CONCLUSIONS: This 22-point risk score incorporating 6 pre- and intraoperative variables is strongly predictive of postoperative PNA after cardiac surgery. The composite score has utility in tailoring perioperative management and in targeting diagnostic and preventative interventions.

34. Is Carotid Revascularization Necessary Before Cardiac Surgery?

Molly Schultheis, Siavash Saadat, Kiersten Frenchu, Jaya Kanduri, Joseph Romero, Victor Dombrovskiy, Aziz Ghaly, Anthony Lemaire, George Batsides, Saum Rahimi, Leonard Lee

Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ

Invited Discussant: Tom C. Nguyen

OBJECTIVE: Debate over revascularization of asymptomatic carotid stenosis prior to cardiac surgery is ongoing. In this study, we analyze cardiac surgery outcomes in patients with asymptomatic carotid stenosis at a single university affiliated hospital.

METHODS: A total of 1,781 patients had cardiac surgery from January 2012 to June 2013; 1,357 with preoperative screening carotid duplex were included. Patient demographics, comorbidities, degree of stenosis, postoperative complications and mortality were evaluated. Chi-square and logistic regression analysis were performed using SAS 9.4 software (SAS Institute, NC).

RESULTS: Asymptomatic stenosis was found in 403/1,357 patients (29.7%; 355 moderate, 48 severe). Patients with stenosis, compared to those without, were older (71.7 ± 11 years vs. 66.3 ± 12 years; $P < 0.01$). Females were more likely to have stenosis (OR, 1.7; 95% CI [1.4–2.2]); however, patients were predominantly male in both groups. There were no significant differences in rates of mortality and postoperative complications, including stroke and transient ischemic attack (TIA) (see Table 1). Postoperative TIA occurred in 3/1,357 (0.2%); only one had moderate stenosis. In-hospital stroke occurred in 21/1,357 (1.5%) patients; stroke rates were 2.3% (8/355) with moderate stenosis and 2.1% (1/48) severe stenosis. There were 59/1,357 (4.3%) deaths; patients with stenosis had a mortality rate of 4.2% (17/403); however, no postoperative stroke lead to death. Multivariable logistic regression analysis with adjustment for age, gender, race, comorbidities and postoperative complications did not show a significant impact of carotid stenosis on postoperative mortality and development of stroke after cardiac surgery.

Table: Postoperative Complications in Patients With and Without Carotid Stenosis

Complications	Patients with Stenosis (Number, %)	Patients without Stenosis (Number, %)	p-Value
Acute Renal Failure	23 (5.7%)	52 (5.4%)	0.85
Atrial Fibrillation	85 (21.1%)	192 (20.1%)	0.69
Prolonged ventilation	57 (14.1%)	131 (13.7%)	0.84
Dialysis	13 (3.2%)	27 (2.8%)	0.69
Pneumonia	202 (50.1%)	454 (47.6%)	0.39
Stroke	9 (2.2%)	12 (1.3%)	0.23
TIA	1 (0.25%)	2 (0.21%)	1.0
Death	17 (4.2%)	42 (4.4%)	0.88
TOTAL	403	954	

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CONCLUSIONS: This study suggests patients with asymptomatic carotid stenosis undergoing cardiac surgery are not at increased risk of postoperative complications and mortality; thus, prophylactic carotid revascularization may not be indicated.

35. Preoperative Pulmonary Function Tests Consistently Predict Mortality After Surgical or Transcatheter Aortic Valve Replacement

Matthew C. Henn, Alan Zajarias, Brian R. Lindman, Jason W. Greenberg, Anna M. Wittenberg, Cassandra Lawler, Marci S. Damiano, Spencer J. Melby, Nishath Quader, John M. Lasala, *Marc R. Moon, *Jennifer S. Lawton, *Ralph J. Damiano, Jr., *Hersh S. Maniar

Washington University, St. Louis, MO

Invited Discussant: Todd Dewey

OBJECTIVE: In patients with aortic stenosis (AS) evaluated for aortic valve replacement (AVR), the STS risk score is significantly influenced by the presence and severity of lung disease, which is predominantly determined by pulmonary function test (PFT) results. Despite this, many centers only obtain PFTs in patients with suspected lung disease. There is also debate regarding how to interpret PFT results in patients with AS and concomitant heart failure. The purpose of this study was to, 1) determine the prevalence of lung disease as determined by PFTs in patients with and without a suspicion of lung disease; 2) evaluate the association between lung disease and mortality in patients undergoing surgical AVR (SAVR) or transcatheter AVR (TAVR); and 3) determine the consistency of this relationship in specific sub-groups.

METHODS: Between 2008 and 2013, 535 patients with preoperative PFTs underwent AVR (TAVR [n = 246], SAVR [n = 207], and SAVR+CABG [n = 82]). The presence and severity of lung disease was determined according to the STS definition. A suspicion for lung disease was defined as a history of smoking, bronchodilator or inhaled steroid use, or supplemental oxygen use. A multivariable Cox proportional hazards model was utilized to evaluate the association between lung disease and 1 year all-cause mortality.

RESULTS: There were 65% (349/535) of patients with suspected lung disease. Among these patients, 73% (255/349) had some degree of lung disease, including moderate in 18% (63/349) and severe in 31% (107/349). In the 35% (186/535) of patients without suspected lung disease, lung disease was less prevalent (41%, 76/186), but was moderate in 13% (24/186) and severe in 8% (15/186) of patients. Among all patients, 1 year mortality was 12%, 17%, 22%, and 31% in those with no, mild, moderate, or severe lung disease, respectively (log-rank $p < 0.001$). After adjustment for age, sex, BMI, diabetes, prior infarct, NYHA class, atrial fibrillation, smoking, glomerular filtration rate, left ventricular ejection fraction, and AVR type, moderate/severe lung disease was associated with increased 1-year mortality (adjusted HR, 2.07; 95% CI [1.30–3.29]; $p = 0.002$). Notably, there was no interaction between lung disease severity and smoking history, suspicion of lung disease, NYHA class, or AVR type with respect to 1-year mortality ($p > 0.10$ for all interactions).

CONCLUSIONS: Even when lung disease is not suspected, PFTs are abnormal in many patients referred for AVR. Moderate or severe lung disease, diagnosed predominantly by PFTs, is an independent predictor of mortality after SAVR or TAVR regardless of smoking history, suspicion for lung disease, severity of heart failure, or AVR type. Collectively, these findings suggest that PFTs should be a routine part of the risk stratification of patients considered for AVR and that a PFT-guided diagnosis of lung disease has consistent prognostic significance.

*AATS Member

36. Use of Psoas Muscle Size As a Frailty Assessment Tool for Open and Transcatheter Aortic Valve Replacement

Raghavendra Paknikar, Jeffrey Friedman, David Cron, *G. Michael Deeb, Stanley Chetcuti, P. Michael Grossman, Stewart Wang, Michael Englesbe, *Himanshu J. Patel

University of Michigan Medical School, Ann Arbor, MI

Invited Discussant: *Wilson Y. Szeto

BACKGROUND: Identification of an objective frailty assessment tool for patients with aortic stenosis is critical in determining optimal treatment choice, either open (SAVR) or catheter based (TAVR) therapy. Sarcopenia, assessed by total psoas muscle size, has previously been validated as a morphomic measure of frailty in general and vascular surgical procedures. This study evaluates sarcopenia as a frailty assessment tool for patients undergoing either SAVR or TAVR.

METHODS: 295 patients (mean age = 74.4; 65.4% male, 2011–2013) underwent SAVR ± CABG (N = 156) or TAVR ± PCI (N = 139). Mean preoperative Society of Thoracic Surgeons (STS) risk score was 4.66%. Comorbidities are listed in the table that follows. Preoperative CT scans were used to calculate gender-standardized total psoas muscle area (TPA), as a validated measure of sarcopenia. Outcomes evaluated included, 1) a composite early poor outcome (30-day death, stroke, dialysis, prolonged ventilation, infection and reoperation); 2) late survival; and, 3) high resource utilization (defined as length of stay >14 days, ICU length of stay >7 days, or hospital readmission within 30 days). Because treatment type was included as a variable potentially affecting these outcomes, propensity score adjustment was used to account for baseline treatment group differences and the probability for undergoing TAVR.

RESULTS: For the entire cohort, early poor outcome was independently predicted by preoperative STS major morbidity and mortality risk score (OR, 91.1; $p = 0.02$), BMI (OR, 1.13; $p < 0.001$), smoker status (OR, 4.97; $p = 0.031$), and TPA (OR, 0.52; $p = 0.024$). By Cox regression analysis, independent predictors of late survival included MI within 21 days (HR, 7.2; $p = 0.01$), and TPA (HR, 0.47; $p = 0.006$). When analyzing high resource utilization, only female gender (OR, 0.52; $p = 0.04$) and TPA (OR, 0.56; $p = 0.001$) were independent predictors. Further analysis separating the entire cohort into treatment type groups showed that TPA was an independent predictor for high resource utilization after SAVR (OR, 0.48; $p = 0.009$) but not after TAVR ($p = 0.392$). In SAVR patients, those with TPA size less than the 50th percentile had a risk adjusted high resource utilization rate of 31.4%, compared to 18.2% of patients with a TPA size greater than the median.

Table 1:

Variable	Mean: Open AVR ± SD	Mean: TAVR ± SD	P-Value
Age	70.4 ± 13.76	78.96 ± 8.92	<0.001
BMI	30.57 ± 6.01	29.58 ± 7.14	0.1985
STS Mortality Risk Score	3 ± 3%	6 ± 5%	<0.001
STS Major Morb. and Mort. Risk Score	18 ± 10%	29 ± 11%	<0.001
Gender Standardized TPA	0.25 ± 1.05	-0.29 ± 0.85	<0.001
Female	31%	38%	0.270
Diabetes	26%	44%	0.002
Hypertension	76%	80%	0.404
Peripheral Vascular Disease	11%	30%	<0.001
Cerebrovascular Disease	13%	33%	<0.001
Prior Cerebrovascular Accident	4%	12%	0.019
Previous CABG	10%	43%	<0.001
Previous Valve	9%	11%	0.696
Previous PCI	20%	38%	0.001
Myocardial Infarction Within 21d	2%	1%	1.000
Left Main Disease	4%	12%	0.018
Current and/or Recent Smoker	9%	4%	0.094
Infectious Endocarditis	5%	1%	0.039
Liver Disease	3%	4%	0.761
Immunosuppressive Treatment	4%	12%	0.009
Re-Operative Incidence	21%	53%	<0.001
Urgent Status	16%	10%	0.168
Chronic Lung Disease: Severe	2%	12%	0.001
NYHA: Class 4	3%	18%	<0.001
Ejection Fraction	60.41 ± 12.02	55.63 ± 15.24	0.0031
Hematocrit	38.23 ± 5.75	36.32 ± 5.89	0.0053
Serum Albumin	4.24 ± 0.42	3.96 ± 0.41	<0.001
Serum Creatinine	1.13 ± 0.85	1.4 ± 0.97	0.0128

Outcome	Open AVR	TAVR	P-Value
30d or in-hospital Mortality	0%	3.60%	0.022
Stroke	1.28%	4.32%	0.154
Renal Failure	0%	2.16%	0.1
Prolonged Ventilation	7.10%	4.32%	0.454
Infection	3.85	0.72%	0.125
Reoperation	N/A	N/A	----
Major Morbidity and 30d Mortality	8.33%	8.63%	1
High Resource Utilization	26.20%	19.00%	0.169
Crude Late Mortality	3.20%	15.10%	<0.001

CONCLUSION: Use of CT scan derived measurement of psoas muscle size as an objective frailty assessment tool predicts early morbidity and mortality, high resource utilization, as well as late survival after treatment for aortic stenosis. The correlation observed between sarcopenia and resource utilization after SAVR versus TAVR suggests this simple and reproducible risk assessment tool may also help further define the cohort of patients who optimally benefits from catheter-based therapy.

5:00 PM ADJOURN

*AATS Member

5:00 PM **18TH ANNUAL C. WALTON LILLEHEI RESIDENT FORUM** Room 6B, WSCC

7 minute presentation, 5 minute discussion

Chairs: *Todd K. Rosengart and *Joseph B. Zwischenberger

L1. GRK2 Inhibition Reduces Post-Myocardial Infarction Cardiac Fibroblast Mediated Adverse Remodeling

Jennifer L. Philip[1], Xianyao Xu[1], Mei Han[1], Jinju Li[2], Abdur Razzaque[1], *Shahab A. Akhter[1]

[1]*University of Wisconsin, Madison, WI;* [2]*University of Chicago, Chicago, IL*

Invited Discussant: *Frank W. Sellke

OBJECTIVES: Remote (non-infarct) territory fibrosis is a significant cause of post-infarction heart failure (HF). We have previously shown that increased G protein-coupled receptor kinase-2 (GRK2) activity in adult human cardiac fibroblasts (CF) isolated from failing hearts is an important mechanism of cardiac fibrosis through uncoupling β-adrenergic receptor (β-AR) signaling. This study investigates the potential therapeutic role of GRK2 inhibition on CF biology in vivo.

METHODS: Adult male rats underwent LAD ligation to induce post-MI HF. Left ventricular (LV) function was assessed by echocardiography. Myocardial fibrosis was quantitated by histologic staining. LV CF were isolated and cultured. GRK2 was inhibited by intra-coronary adenoviral-mediated delivery of a GRK2 inhibitor (Ad-GRK2ct) immediately following LAD ligation (n = 11). Control rats received a null adenovirus (n = 10). Animals were studied at baseline and 12 weeks post-MI and adenoviral delivery.

RESULTS: There was a significant decline in LV function at 12 weeks post-MI (Fractional shortening: 0.35 ± 0.01 vs. 0.52 ± 0.01; $p < 0.01$). Remote territory fibrosis was increased at 12 weeks post-MI compared to control (12 ± 1% vs. 2 ± 1% fibrosis; $p < 0.05$) consistent with adverse remodeling. Additionally, collagen synthesis was significantly upregulated in isolated CF 12 weeks post-MI compared to control CF (3,559 ± 760 vs. 1,029 ± 45 cmp/mg protein; $p < 0.02$). At 12 weeks post-MI, GRK2 activity was increased 1.4-fold ($p < 0.01$). There was a 42% decrease in intracellular cAMP ($p < 0.05$) and loss of β-agonist (isoproterenol)-stimulated inhibition of collagen synthesis characteristic of normal CF, indicating uncoupling of β-AR signaling post-MI. Intra-coronary delivery of Ad-GRK2ct following MI inhibited post-MI LV dysfunction versus Ad-Null as measured by improved fractional shortening (0.42 ± 0.01 vs. 0.30 ± 0.02; $p < 0.01$) and ejection fraction (72 ± 1% vs. 57 ± 2%; $p < 0.03$). Ad-GRK2ct also decreased peri-infarct and remote territory fibrosis by 60% ($p < 0.03$). Consistent with these findings, Ad-GRK2ct resulted in decreased α-SMA, collagen I, and collagen III expression in CF isolated 12 wks post-MI vs. Ad-Null ($p < 0.04$) providing evidence of decreased post-MI CF activation and transformation to myofibroblasts with Ad-GRK2ct.

Table: Left Ventricular Function and Fibrosis

	Fractional Shortening	Ejection Fraction (%)	Infarct Fibrotic Area (%)	Remote Territory Fibrosis (%)
Control (n = 4)	0.53 ± 0.01	80 ± 0.03	0.7 ± 0.1	1.8 ± 0.5
12-wk Post-MI + Ad-Null (n = 4)	0.30 ± 0.02*	57 ± 0.03*	11.4 ± 1.3*	12.0 ± 0.7*
12-wk Post-MI + Ad-GRK2ct (n = 5)	0.42 ± 0.01**	72 ± 0.01**	4.2 ± 0.7**	3.9 ± 0.3**

*p < 0.03 vs. Control; **p < 0.04 vs. Post-MI + Ad-Null

CONCLUSIONS: Uncoupling of β-adrenergic signaling in CF via increased GRK2 appears to be a key mechanism of post-MI fibrosis and remodeling. Targeted inhibition of GRK2 and restoration of β-adrenergic signaling/cAMP production in CF may represent a novel therapeutic approach to prevent pathological fibrosis and maladaptive remodeling.

*AATS Member

L2. Ribosomal Dysfunction Results in Immunologic Susceptibility to Lung Cancer

Stephanie H. Chang, Ryuji Higashikubo, Saeed Arefanian, Andrew E. Gelman, *Daniel Kreisel, *Alexander S. Krupnick

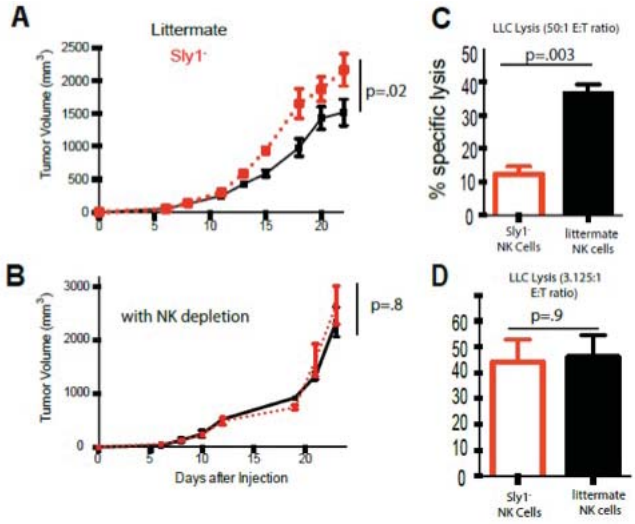
Washington University, St. Louis, MO

Invited Discussant: *David H. Harpole

OBJECTIVE: Inherited differences in function of natural killer cells (NK) result in lung cancer susceptibility or resistance. Our objective is to investigate the immunologic mechanisms responsible for differences in NK function.

METHODS: Genome wide expression analysis was performed on NK cells from lung cancer resistant (B6 and C3H) and lung cancer susceptible (A/J and 129) strains of mice. Flow cytometric analysis of lungs and spleens was performed to study the phenotype of NK cells using commercially available antibodies (from Ebioscience). NK function was examined ex vivo by plate-bound antibody stimulation and lysis of the Lewis lung carcinoma (LLC) cell line using ^{51}Cr release. In vivo tumor immune response was evaluated by LLC injection into the flank.

RESULTS: Genome wide expression analysis demonstrated that higher levels of Sly1, an adaptor protein, correlate with lung cancer resistance. In humans, NK cells from those with high Sly1 levels produced more TNF-α when stimulated by the lung cancer cell line A549 (correlation coefficient = 0.85; $p < 0.0005$). Phenotypic analysis revealed that Sly1 knockout ($Sly1^-$) NK cells had lower levels of activating receptors NKG2D, Nkp46 as well as perforin, granzyme, and signaling adaptor molecules such as JAK, STAT and AKT, when compared to wild type NK cells (data not shown). LLC injected into the flank grew more rapidly in $Sly1^-$ mice in an NK-dependent fashion (Figure 1A and B) and $Sly1^-$ NK cells demonstrated lower levels of LLC lysis in vitro (Figure 1C). NK cell activation with interleukin-2 (IL-2) abrogated all differences in surface receptor expression and tumor lytic capacity (Figure 1D). Based on these findings, we assumed that this adaptor protein contributed to the stability and function of a regulatory or transcription factor important to NK development and maturation. To investigate this further, we co-immunoprecipitated Sly1 and identified binding partners by mass spectrometry. Only ribosomal proteins co-precipitated with Sly1. To evaluate this in greater detail, wild-type NK cells were lysed and fractionated on a sucrose density gradient with ribosome analysis using A_{254} measurements. Western blot analysis confirmed that Sly1 localized solely to the ribosomal fraction.



1: LLC tumor growth in Sly1- and wild type mice in the presence (A) or absence NK cells. LLC lysis in vitro with freshly isolated (C) or IL2 stimulated (D) NK cells.

CONCLUSIONS: It has been postulated that ribosomal disorders are either embryonic lethal or result in severe life threatening diseases such as fragile X syndrome or Diamond-Blackfin anemia. We now demonstrate for the first time that a ribosomal-associated protein plays a role in immunosurveillance for lung cancer and variation in the expression levels contribute to lung cancer resistance or susceptibility. We also demonstrate that IL-2 treatment can reverse Sly1-medated immunosuppression opening a therapeutic approach for those at risk.

*AATS Member

L3. Bone Marrow-Derived Mesenchymal Stem Cells Attenuate Right Ventricular Remodeling and Preserve Function in Neonatal Swine

Brody Wehman, Nicholas Pietris, Osama Siddiqui, Rachana Mishra, Sarah Murthi, *Bartley Griffith, *Sunjay Kaushal

University of Maryland, Baltimore, MD

Invited Discussant: *Richard D. Weisel

OBJECTIVE: Pressure overload causes the progression of right ventricular dysfunction in congenital heart disease patients for which there are limited therapeutic options. Bone marrow-derived mesenchymal stem cells (MSCs) have shown encouraging results in the recovery of ischemic cardiomyopathy in animal models and clinical Phase I trials, yet have not been explored in right ventricular dysfunction. We utilized a neonatal swine model of RV pressure overload to test the hypothesis that injection of MSCs promotes recovery of RV function.

METHODS: Immunosuppressed piglets (6–9 kg) underwent pulmonary artery banding (PAB) to induce physiologically calibrated acute right ventricular dysfunction. Thirty minutes later human MSCs (1 million cells, n = 5) or placebo (n = 5) were injected intramyocardially into the RV free wall. Serial transthoracic echocardiography monitored RV functional indices including 2-D myocardial strain analysis. Pigs were euthanized four weeks after MSC injection, and explanted RV specimens examined by histology.

RESULTS: Elevation in RV:systemic pressure ratio was highly consistent (pre-banding, 0.35 ± 0.01 vs. post-banding, 0.76 ± 0.01), indicating a similar rise in RV pressure work across both groups. Four weeks post-injection, the MSC treated myocardium had a smaller increase in RV end-diastolic area, end-systolic area and tricuspid vena contracta width, increased RV ejection fraction and improved myocardial strain mechanics relative to placebo (see Table). RV hypertrophic changes were more pronounced in the placebo group, as evidenced by greater wall thickness on echocardiography (5.5 ± 0.1 mm vs. 4.3 ± 0.3 mm; $p = 0.008$) and cardiomyocyte cross-sectional area (by wheat germ agglutinin staining) (363.1 ± 38.3 μm^2 vs. 171.4 ± 6.3 μm^2; $p = 0.001$). Four weeks post-injection, few MSCs were retained in RV myocardium (0.34 ± 0.1 cells/mm^2). However, the MSCs group demonstrated reduced RV free wall fibrosis by Masson's trichrome staining (8.8 ± 2.5% vs.1.4 ± 0.3%; $p = 0.009$), enhanced neovessel formation (3.4 ± 0.4 vessels/mm^2 vs. 8.0 ± 0.7 vessels/mm^2; $p < 0.0001$) and increased proliferation of cycling $Ki67^+$ cardiomyocytes (0.89 ± 0.6 cells/mm^2 vs. 5.5 ± 0.6 cells/mm^2; $p = 0.0009$) and $Ki67^+$ endothelial cells (0.07 ± 0.03 cells/mm^2 vs. 0.55 ± 0.03 cells/mm^2; $p < 0.0001$).

Table: Echocardiographic Measurements Pre- and 4 Weeks Post-Banding.

Parameter	Pre-Banding	4 Weeks Post-Banding: Placebo (n = 5)	4 Weeks Post-Banding: MSCs (n = 5)	p-Value
End-systolic area (cm^2)	1.9 ± 2.0	12.1 ± 2.8	3.9 ± 0.9	0.02
End-diastolic area (cm^2)	4.1 ± 0.3	16.9 ± 3.7	7.2 ± 1.2	0.03
Right ventricular ejection fraction (%)	52.5 ± 0.5	29.9 ± 4.7	47.7 ± 3.4	0.01
Tricuspid vena contracta width (mm)	n/a	4.4 ± 0.4	2.9 ± 0.2	0.01
Global longitudinal strain (%)	−19.3 ± 0.7	−13.1 ± 0.6	−16.1 ± 0.6	0.002
Strain rate (s^{-1})	−1.3 ± 0.1	−0.97 ± 0.1	−1.4 ± 0.1	0.004

CONCLUSIONS: MSCs enhance myocyte turnover and neovessel formation, attenuate adverse cardiac remodeling by decreasing cardiomyocyte hypertrophy and fibrosis, and preserve RV function in an acute RV pressure overload model. While the mechanisms driving MSC-mediated positive remodeling require further exploration, these encouraging results provide the initial efficacy data of MSC treatment in congenital cardiac pressure overload lesions.

*AATS Member

L4. Ex Vivo Lung Perfusion with Adenosine A2A Receptor Agonist Decreases Ischemia-Reperfusion Injury in Non-Heart-Beating Donor Lungs Subjected to Prolonged Cold Preservation

Cynthia E. Wagner, Nicolas H. Pope, Eric J. Charles, Mary E. Huerter, Ashish K. Sharma, Morgan D. Salmon, Benjamin T. Carter, Mark H. Stofer, *Christine L. Lau, Victor E. Laubach, *Irving L. Kron

University of Virginia, Charlottesville, VA

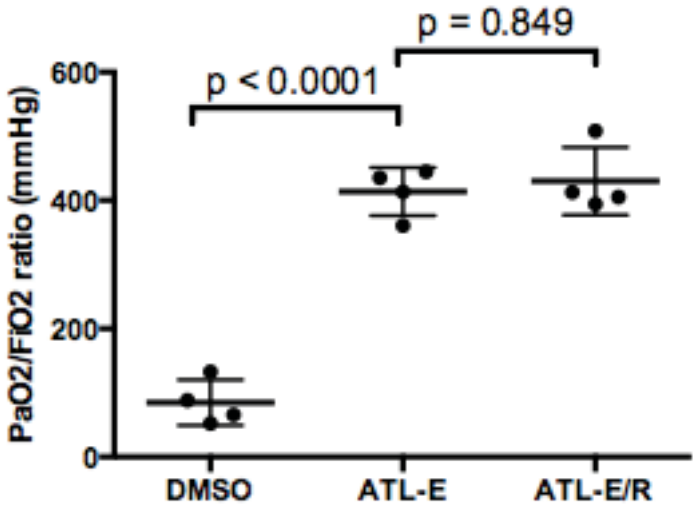
Invited Discussant: *Alexander S. Krupnick

OBJECTIVE: Ex vivo lung perfusion (EVLP) has been successful in the assessment and rehabilitation of marginal donor lungs in animal studies and clinical trials, and may be particularly useful in the evaluation of non-heart-beating donor (NHBD) lungs. EVLP also represents a unique platform for targeted drug delivery in the treatment of injured donor lungs. We sought to determine if ischemia-reperfusion injury (IRI) would be attenuated after transplantation of NHBD lungs subjected to prolonged cold preservation and treated with an adenosine A2A receptor (A2AR) agonist during EVLP.

METHODS: Porcine NHBD lungs were preserved at 4°C for 12 hours before undergoing normothermic EVLP with Steen solution for 4 hours. Left lungs were then transplanted and allowed to undergo reperfusion for 4 hours. Three groups (n = 4 transplants per group) were randomized according to treatment with the A2AR agonist ATL-1223 or vehicle control (dimethyl sulfoxide; DMSO): one group received an infusion of ATL-1223 during EVLP and reperfusion (ATL-E/R), one group received an infusion of ATL-1223 during EVLP and a DMSO infusion during reperfusion (ATL-E), and one group received an infusion of DMSO during EVLP and reperfusion (DMSO). After 4 hours of reperfusion, final PaO_2/FiO_2 ratios of the transplanted left lungs were determined from samples obtained from the superior and inferior pulmonary veins. Left lungs were then explanted for further analysis.

RESULTS: Initial donor PaO_2/FiO_2 ratios were not significantly different among groups. Final PaO_2/FiO_2 ratios in the ATL-E group (mean: 413.6 mmHg) were not significantly different from final PaO_2/FiO_2 ratios in the ATL-E/R group (mean: 430.1 mmHg), and were significantly higher than final PaO_2/FiO_2 ratios in the DMSO control group (mean: 84.8 mmHg) (Figure 1). However, there was no significant difference among groups in pulmonary artery pressure or peak airway pressure during EVLP, or in final wet-to-dry weight ratios as a measure of pulmonary edema.

Figure 1. Final PaO2/FiO2 ratio of transplanted left lung



CONCLUSIONS: Postoperative PaO_2/FiO_2 ratios >400 mmHg after transplantation of NHBD lungs subjected to prolonged 12-hour cold preservation are possible following treatment with an A2AR agonist administered during EVLP in a preclinical porcine model. Administration of ATL-1223 during EVLP alone was effective in decreasing IRI after transplant, suggesting that IRI is initiated by the donor lung and may be attenuated with inactivation of resident innate immune cells during EVLP. This strategy avoids potential side effects associated with systemic drug delivery in the recipient. These findings have important implications in augmenting the available donor lung pool and decreasing geographic restrictions during procurement, and may significantly impact the number of patients with end-stage lung disease awaiting transplantation.

*AATS Member

L5. An Annexin V Homo-Dimer Protects Against Ischemia Reperfusion Induced Acute Lung Injury in Lung Transplantation

Kohei Hashimoto, Hyunhee Kim, Hisashi Oishi, Manyin Chen, Ilker Iskender, Jin Sakamoto, Akihiro Ohsumi, Zehong Guan, David M. Hwang, *Thomas K. Waddell, Marcelo Cypel, Mingyao Liu, *Shaf Keshavjee

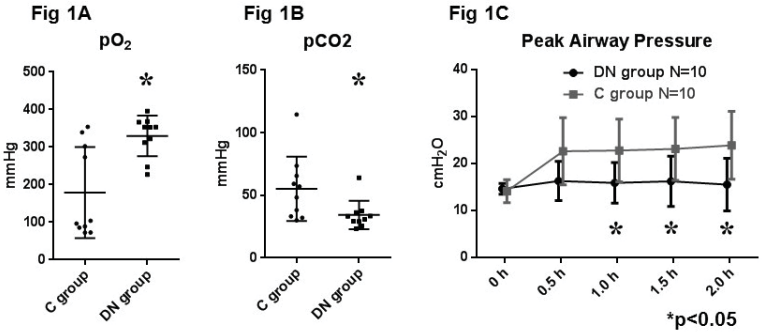
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Ashish S. Shah

OBJECTIVE: A homo-dimer of recombinant annexin V, diannexin, shields phosphatidylserine on the reperfused endothelium, inhibits leukocyte and platelet recruitment, and hence potentially reduces ischemia reperfusion injury. We hypothesized that diannexin ameliorates ischemia reperfusion induced acute lung injury in lung transplantation. This hypothesis was tested with a rat syngeneic single lung transplant model.

METHODS: Following 12 hours of cold ischemia, the left lung was transplanted. Rats were randomly assigned to receive diannexin (DN group; n = 10) or normal saline as a control (C group; n = 10). Diannexin (1,000 μg/kg) was administered to the donor lung in the pulmonary flush solution (low potassium dextran) and to the recipient intravenously at 5 minutes after reperfusion, in a blinded fashion. During the reperfusion period, the graft was separately ventilated from the recipient lung using a separate ventilator, in order to facilitate accurate measurement of isolated physiological function of the transplanted graft. In addition to analysis of pulmonary mechanics, gas exchange analysis was performed in the blood via pulmonary vein of the graft at 2 hours after reperfusion. Lung and plasma samples were collected after 2 hours of reperfusion.

RESULTS: The transplanted grafts in the DN group performed significantly better in gas exchange ability, pO_2 (C: 179 ± 121 vs. DN: 330 ± 54 mmHg; p = 0.007) (Figure 1A), pCO_2 (C: 55.1 ± 26 vs. DN: 34.2±11 mmHg; p = 0.04) (Figure 1B) and peak airway pressure (C: 20.5±8.5 vs. DN: 12.0 ± 7.9 cmH_2O; p = 0.035) (Figure 1C) after 2 hours of reperfusion. Lung edema, measured by the wet to dry ratio (C: 8.7 ± 2.2 vs. DN: 7.1 ± 1.1) (p = 0.05), and histological alveolar fibrin deposition score (p = 0.04) were significantly reduced in the DN group. Diannexin was observed in the treated transplanted graft, but not in the contralateral recipient lung. Caspase cleaved cytokeratin 18, an epithelial cell death marker, in the peripheral blood was significantly reduced in the DN group (C: 2.2 ± 0.5 vs. DN: 1.6 ± 0.5 ng/ml; p = 0.013). Furthermore, gene expression levels of key inflammatory cytokines in the transplanted graft, including IL-6 (p = 0.04) and macrophage inflammatory protein (MIP-2) (p = 0.03) were significantly decreased in the DN group.



CONCLUSIONS: Diannexin reduces ischemia reperfusion injury in a lung transplant animal model by reducing the activity of cell death pathway as well as inflammation and alveolar injury.

*AATS Member

L6. Beneficial Role of Antigen Commensalism in Mesothelin-Targeted T-Cell Therapy for Lung Adenocarcinoma

Adam Jason Bograd[1], Jonathan Villena-Vargas[2], Christos Colovos[2], Stefan Kachala[2], *David R. Jones[2], Michel Sadelain[2], *Prasad S. Adusumilli[2]

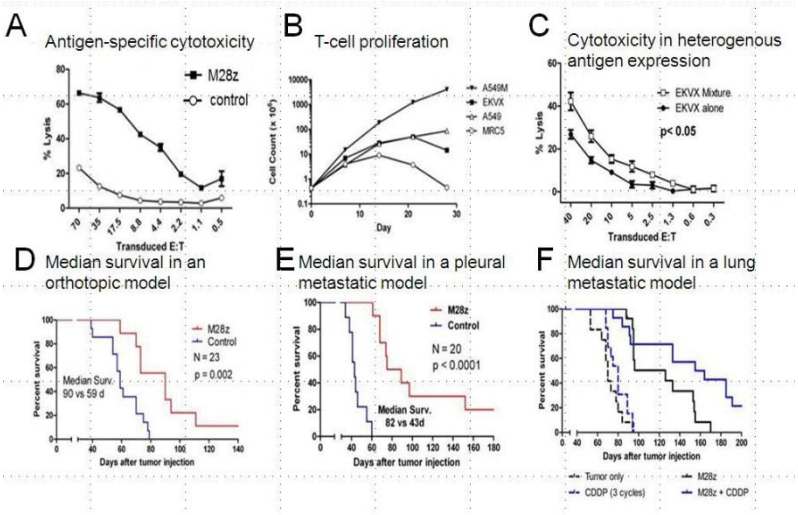
[1]New York University Medical Center, New York, NY; [2]Memorial Sloan-Kettering Cancer Center, New York, NY

Invited Discussant: *David J. Sugarbaker

OBJECTIVE: Recent success in cancer-antigen targeted T-cell therapy for hematologic malignancies is often attributed to near-uniform antigen expression on the surface of tumor cells. While publications from our group provide strong rationale for targeting mesothelin in lung adenocarcinoma [LADC] (a cancer-cell surface antigen that imparts aggressiveness in LADC patients), mesothelin expression on LADC tumors is heterogenous. The purpose of this study is to investigate mesothelin-targeted T-cell therapy efficacy in a heterogenous antigen-expressing LADC tumor microenvironment, thereby mimicking a phase I clinical trial (immuno-inhibitory factor expressing, therapy-resistant LADC in immune-privileged metastatic sites).

METHODS: Using human T cells retrovirally transduced to express mesothelin-targeted chimeric antigen receptors, or CARs (M28z), we evaluated T-cell cytotoxicity, proliferation, cytokine-release, and phenotype against TGF-β-expressing LADC cells, with varied or no mesothelin expression. In vivo antitumor efficacy was assessed in SCID-bg mice bearing established homogenous or heterogeneous lung tumors by use of three clinically relevant models (orthotopic, pleural, and intravenous).

RESULTS: M28z T cells exhibited mesothelin-specific cytolytic activity, effector cytokine secretion, and T-cell proliferation against LADC cells with uniformly high (H1299M, A549M) and low (A549, EKVX) mesothelin expression; effector responses were in proportion to mesothelin expression (Figures A and B). In the presence of LADC cells expressing a high-level of mesothelin, targeted T cells lysed an additional 5%–15% of LADC cells expressing a low-level of mesothelin ($p < 0.05$), with no off-target cytotoxicity (Figure C). In vivo, among SCID-bg mice bearing an established orthotopic lung tumor, mice that received a single low dose of intravenous M28z T cells demonstrated a survival advantage over those that received control T cells (median survival [MS], 90 vs. 59 days; $p < 0.002$; Figure D). Among SCID-bg mice with pleural disease and malignant pleural effusions, those that received a single low dose of intrapleural M28z T cells had prolonged survival (MS 82 vs. 43 days; $p < 0.0001$), with tumor eradication and long-term survival in 20% of mice compared to control (Figure E). In a clinically relevant scenario of LADC with a heterogeneous antigen tumor microenvironment, administering intravenous M28z T cells following cisplatin therapy, significantly improved survival, compared with cisplatin or M28z treatment alone (MS 160 vs. 80 vs. 126 days, respectively; $p < 0.05$) (Figure F).



CONCLUSIONS: In clinically relevant LADC models, we have demonstrated the beneficial role of antigen commensalism in the solid tumor microenvironment. Our data provide strong scientific support for our upcoming mesothelin-targeted T cell therapy clinical trial for LADC.

*AATS Member

L7. Impact of Aortic Annular Geometry on Aortic Valve Insufficiency: Insights from a Pre-Clinical, Ex-Vivo, Porcine Model

Talal Al-Atassi, Hadi Toeg, Benjamin Sohmer, Michel Labrosse, Munir Boodhwani
University of Ottawa, Ottawa, ON, Canada

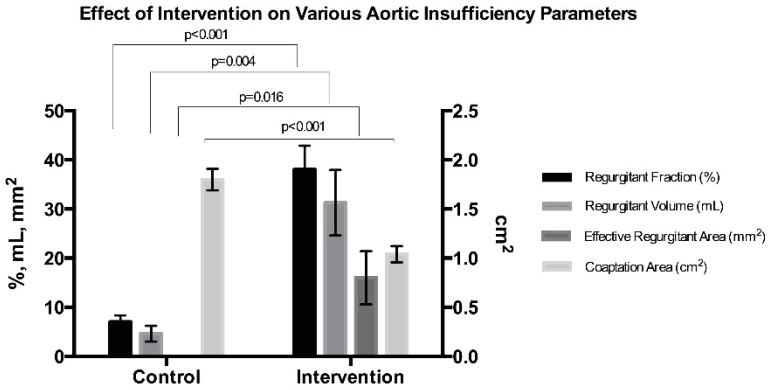
Invited Discussant: *Joseph D. Schmoker

OBJECTIVE: Advances in understanding the patho-anatomy of aortic insufficiency (AI) are limited significantly by the lack of a pre-clinical model of AI. We sought to create a clinically relevant, porcine model of AI in a left heart simulator, combined with 3D echocardiography, and finite element (FE) modeling of the aortic valve (AV). We further examined the effect of anatomic changes in the functional aortic annulus on cusp anatomy, function and AI.

METHODS: Fresh porcine aortic roots were harvested, measured, then mounted and analyzed on a left heart simulator before (control, n = 8) or after intervention (intervention, n = 8). Aortic root intervention consisted of 3 vertical incisions at the sinotubular junction (STJ) level and incorporation of 3 diamond-shaped patches into the defects, symmetrically enlarging the STJ. Patch sizes were pre-determined to create a graded increase in STJ diameter. Hemodynamic parameters including heart rate, stroke volume, regurgitant volume (RegV) and fraction (RegF), cardiac output, and pressure were obtained. A high-speed video camera evaluated leaflet motion and effective reguritant area (ERA). Echocardiographic (3D) images of the porcine root and AV were obtained to assess AV function, AI, and leaflet coaptation. Finite element models of the AV and root were constructed to corroborate relationships between root geometry and AI, and determine the impact on cusp stress.

RESULTS: The intervention group had a significant increase in STJ diameter by a mean of 55 ± 4% from baseline (range: 38%-66%). The ratio of the STJ to ventriculo-aortic junction (VAJ) diameter (STJ/VAJ) was significantly higher in the intervention compared to the control group (1.89 ± 0.16 vs. 1.47 ± 0.04; p = 0.02). Increase in STJ size resulted in significant AI (Figure 1A) as assessed by RegV (28 ± 7 mL vs. 5 ± 2 mL; p = 0.004), RegF (36 ± 5% vs. 7 ± 1%; p < 0.001), and ERA (15 ± 5 mm^2 vs. 0 mm^2; p = 0.016). Echocardiographically assessed coaptation surface area (Figure A) was significantly lower in the intervention group (1.03 ± 0.11 cm2 vs. 1.80 ± 0.08 cm^2; p < 0.001). Furthermore, we found a linear correlation (Figure B) between an increase in STJ/VAJ ratio and RegF (R2 = 0.65; p = 0.003). The FE models demonstrated a similar linear relationship between increasing STJ diameter and AI with an STJ diameter increase of 4–12%, 20–45%, and >50% corresponding to mild, moderate, and severe AI, respectively. A positive linear correlation was observed between end-diastolic cusp stresses and STJ diameters (R2 = 0.96).

A



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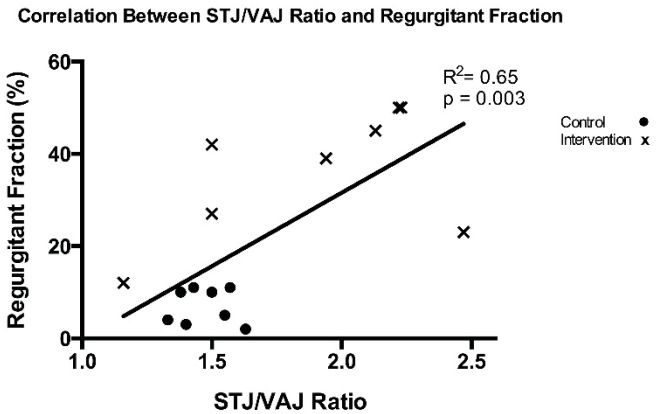


CONCLUSIONS: In a pre-clinical, porcine, left heart simulator model, we observed that increased STJ diameter and specifically STJ/VAJ ratio reduces cusp coaptation area and is linearly related to AI severity. These findings have potential implications for planning AV repair procedures. This model provides new insights into AI mechanisms, and may be used to evaluate novel interventions for AV repair.

*AATS Member

L8. Creation of a Novel Endosymbiotic System for Photon Powered Myocardium in the Ischemic Heart

Jeffrey E. Cohen[1], Andrew B. Goldstone[1], Yasuhiro Shudo[1], William L. Patrick[1], John W. MacArthur[2], Sergei A. Vinogradov[2], Tatiana V. Esipova[3], Bryan B. Edwards[1], Jay B. Patel[1], *Y. Joseph Woo[1]

[1]Stanford University, Stanford, CA; [2]University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Eugene A. Grossi

OBJECTIVES: Current strategies for managing myocardial ischemia are sometimes unable to sufficiently restore myocardial energetics and ventricular function. This study's goal was to develop a completely novel method of enhancing bioenergetics in the setting of myocardial ischemia by implementing a photosynthetic system. The hypothesis is that targeted delivery of a photosynthetic agent to a region of myocardial ischemia will enable light to fuel cardiomyocytes and local oxygen production to enhance ventricular function.

METHODS: Male Wistar rats at 10 weeks old were utilized for the ischemia model. The rats were anesthetized, intubated, and underwent sternotomy followed by placement of an LV catheter and aortic flow probe. Baseline intramyocardial O_2 tension was assessed along with myocardial metabolic activity via thermal imaging. The LAD was then ligated 2 mm below the left atrial appendage, and after 10 minutes animals were randomized (n = 5/group) to receive saline injection or 5 x 10^6 photosynthetic *Synechococcus elongatus* (SE) directly to the ischemic myocardium (IM). Hemodynamic, O_2, and thermal data were collected at multiple time points with consistent photon exposure.

RESULTS: Baseline intramyocardial O_2 assessment revealed no difference between groups. At 10 minutes after injection, the treatment group demonstrated augmented oxygenation as a percentage of baseline in the IM compared to control (37.5 ± 8.0% vs. 10.8 ± 2.1%; $p = 0.01$). Ultra-sensitive thermal imaging of the IM at 20 minutes post-injection, revealed significantly elevated myocardial temperature as a percent of baseline in SE compared to control (98.1 ± 1.0% vs. 95.5 ± 0.4%; $p = 0.04$). Hemodynamic assessment at 45 minutes post-injection demonstrated enhanced max dP/dt (5,344 ± 542 mmHg/s vs. 2,912 ± 258 mmHg/s; $p < 0.01$) and cardiac output (26 ± 2 mL/min vs. 17 ± 3 mL/min; $p = 0.04$) in SE compared to control.

CONCLUSION: Targeted intramyocardial delivery of a photosynthetic agent to ischemic territory enables localized oxygen production, enhanced metabolic activity, and augmented ventricular function in a rat model of acute myocardial ischemia. This strategy of utilizing light as a fuel source for myocardium represents a completely novel approach to the treatment of cardiac ischemia.

6:30 PM ADJOURN

5:00 PM **FUNCTIONAL MR: A SURGICAL DISEASE? NEW SURGICAL AND INTERVENTIONAL PARADIGMS FOR TREATMENT** Room 607, WSCC

Moderators: *A. Marc Gillinov and *Mathew Williams

Panelists: Maurice E. Sarano, *Robert A. Dion, Brian K. Whisenant, Vinayak Bapat, Michael Robich, David Yaffee, and *Vinod Thourani

See full schedule on page 41.

5:00 PM **INTEGRATING ADVANCED IMAGING IN PLANNING INTERVENTIONS: A CASE-BASED INTERACTIVE EXPERT PANEL REVIEW,** *Supported by Siemens* Room 612, WSCC

Course Chair: *Juan B. Grau, *Valley Columbia Heart Center*

Course Co-Chair: *Mani Vannan, *Ohio State University*

See full schedule on page 43.

6:30 PM **ADJOURN**

*AATS Member

TUESDAY MORNING, APRIL 28, 2015

7:00 AM **CARDIAC SURGERY FORUM** Room 6B, WSCC
5 minute presentation, 5 minute discussion

Moderators: *Frederick Y. Chen and *Juan A. Crestanello

F1. Intraventricular Papillary Muscle Banding Is an Effective Technique to Repair Ischemic Mitral Regurgitation in Dilated Ventricles: Comparison with Annuloplasty in a Chronic Swine Model

Muralidhar Padala, Weiwei Shi, Rajnish Duara, Kanika Kalra, *Robert A. Guyton, *Vinod H. Thourani, Eric L. Sarin
Emory University, Atlanta, GA

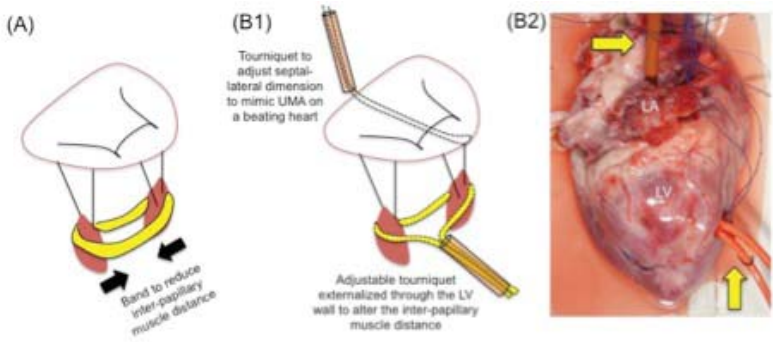
Invited Discussant: *Robert A. Dion

OBJECTIVE: Intra-ventricular papillary muscle banding (PMB), is a new mitral repair technique for ischemic mitral regurgitation (IMR), which reduces lateral distance between the two muscles to relieve leaflet tethering (Figure A). In this two phase study, we compared the hemodynamic efficacy of PMB against undersized mitral annuloplasty (UMA) and the combination of PMB and UMA, in a chronic swine IMR model.

METHODS: In phase 1 of this study, six swine were induced with chronic IMR via percutaneous infarction of the postero-lateral wall of the left ventricle (LV), and followed to 6 weeks to develop >2+ IMR. At 6 weeks, via a left atriotomy (on-pump) an adjustable PMB externalized through the LV wall, and an adjustable UMA suture externalized through the anterior annulus were implanted (Figure B1 and B2). The animals were weaned from bypass, and physiological swine hemodynamics of 90/65 mmHg were achieved at 75 bpm. PMB was done such that 50% reduction in the lateral distance between the muscles was achieved, and UMA reduced septal-lateral annular dimension to 28 mm ring size. In phase 2 of this study, fifteen swine were induced with chronic IMR and at 6 weeks post-infarction, the animals were randomized to PMB, UMA or PMB+UMA. On-pump mitral repair was performed and the animals followed to 2 months after surgery. Epicardial echocardiography was performed to assess mitral valve function, with IMR severity and tenting area recorded. P-V loops with pre-load reduction were recorded to assess left ventricular function at the time of surgery and at the time of euthanasia.

RESULTS: Table 1 that follows summarizes valve function after each repair, with PMB reducing MR grade from 3.67 ± 0.52 to 0.33 ± 0.52 ($p < 0.05$), which was significantly better than the persistent MR grade of 1.5 ± 0.55 after UMA ($p < 0.05$). PMB+UMA achieved the best results overall, but increased transmitral gradient. Similar trends in tenting area were seen, with PMB reducing the tenting area better than UMA, but the combination demonstrating the best

reduction in tenting area. Chronic reduction in MR sustained with the PMB, while the persistent MR after surgery with UMA, remained through the chronic period.



(C)

	Pre-surgery	PMB	UMA	PMB+UMA
MR Grade	3.67±0.52	0.33±0.52*	1.5±0.55*#	0.0±0.0*#^
Tenting area (sq mm)	125±24.1	82±14*	110.6±28#	58±13*#^

* p<0.05 compared to pre-surgery
# p<0.05 compared to PMB
^ p<0.05
compared to UMA

Figure: (A) Schematic depiction of the papillary muscle band encircling the two muscles in the ventricle, which can be adjusted to obtain a desired distance between the two muscles; (B1) A trans-annular septal-lateral suture was used to mimic adjustable undersizing annuloplasty while a papillary muscle band externalized through the LV wall was used to mimic adjustable PM banding; (B2) A photograph of one of the explanted hearts with the annular and papillary muscle torniquets. (C) Table depicting changes in MR grade and tenting area with the different surgical techniques

CONCLUSIONS: PMB alone or concomitant with UMA is an effective technique to repair IMR in this model, with good hemodynamic efficacy and better coaptation geometry compared to UMA.

*AATS Member

F2. Injectable Shear-Thinning Hydrogels Deliver Endothelial Progenitorcells, Enhance Cell Engraftment, Increase Vasculogenesis, and Stabilizeregional Ischemic Myocardium

Ann C. Gaffey, Minna H. Chen, Chantel M. Venkataraman, Alen Trubelja, Christopher B. Rodell, Patrick V. Dinh, John W. MacArthur, Jr., Renganaden V. Soopan, Jason A. Burdick, Pavan Atluri

University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Terrence M. Yau

OBJECTIVES: Both expansion and clinical applicability of cell based therapy for ischemic heart disease has been limited due to low cell retention (<1%), lack of a translatable delivery mechanism, and poor targeting to ischemic myocardium. We have developed a novel injectable shear-thinning hyaluronic acid hydrogel (STG) and endothelial progenitor cell construct (STG-EPC) to overcome these barriers. The self-assembly of the STG is based on interactions of adamantine and β-cyclodextrin modified hyaluronic acid with further polymerization of the STG-EPC construct in vivo within the ischemic myocardium. This directed therapy to the ischemic myocardial borderzone enables direct cell suspension delivery and stabilization of infarcted myocardium to minimize adverse remodeling. We hypothesize that this system provides an easy clinically translatable therapy for robust vasculogenesis and myocardial stabilization.

METHODS: EPCs (DiLDL+ VEGFR2+ CD34+) were harvested from adult male Wistar Rats, cultured, and then suspended in the tissue engineered STG. In vitro viability was quantified using a fluorescent live-dead stain of EPCs obtained from transgenic rats expressing enhanced green fluorescent protein+ (eGFP+). STG-EPC construct was injected at the borderzone of the ischemic rat myocardium in a model of acute myocardial infarction (left anterior descending coronary artery ligation). The migration of the eGFP+ EPCs from the construct to ischemic myocardium was analyzed using confocal microscopy. Vasculogenesis, myocardial remodeling, and hemodynamic function were analyzed in 4 groups: control (PBS injection), intramyocardial injection of EPCs (IC), empty STG injection (STG), and treatment with shear thinning gel-EPC construct (STG-EPC). Hemodynamics and geometry were quantified using echocardiography and Doppler flow analysis.

RESULTS: EPCs demonstrated viability within the STG. A marked increase of EPC incorporation within the treated myocardium was noted one-week post implant as compared to IC (17.2 + 0.83 cells/ HPF vs. 3.5 cells + 1.3 cells/HPF; $P = 0.0002$). A statistically significant increase in vasculogenesis was noted with therapy of the shear thinning gel-EPC construct as compared to control ($P = 0.0001$), IC ($P < 0.0001$), and empty gel ($P < 0.0001$). Significant improvements in ventricular function, scar fraction, and geometry were noted after STG-EPC treatment compared to the control (see Table).

	Control (n = 10)	IC (700,000 Cells/Rat) (n = 9)	STG (n = 6)	STG- EPC (700,000 Cells/rat) (n = 6)
Ejection Fraction (%)	39 + 3.2	47 + 4.4 (p = 0.16)	48 + 1.7 (p = 0.036)	64 + 3.0 (p = 0.0001)
Left Ventricle Scar Fraction Four Weeks Post Coronary Ligation (%)	38.4 + 1.9	38.9 + 4.3 (p = 0.94)	29.2 + 1.5 (p = 0.0015)	10.5 + 2.0 (p < 0.0001)
Ventricle Vascular Density (vessels/HPF)	6.0 + 0.8	6.1 + 0.8 (p = 0.95)	5.6 + 0.8 (p = 0.82)	17.5 + 2.4 (p = 0.04)
Left Ventricle End Systolic Diameter (mm)	26.4 + 3.4	20.0 + 1.0 (p = 0.026)	17.6 + 3.4 (p = 0.19)	14.0 + 0.9 (p = 0.0039)

p-value in comparison to control; EPC = endothelial progenitor cell; IC = injection of EPCs; STG = shear-thinning hydrogel; STG-EPC = shear-thinning hydrogel with endothelial progenitor cells

CONCLUSIONS: This novel injectable shear-thinning hyaluronic acid hydrogel seeded with endothelial progenitor cells demonstrates enhanced cell retention, cell delivery, and vasculogenesis. This therapy limits adverse myocardial remodeling with preservation of contractility.

*AATS Member

F3. Transesophageal Versus Transcranial Motor Evoked Potentials to Monitor Spinal Cord Ischemia

Kazumasa Tsuda, Norihiko Shiiya, Daisuke Takahashi, Kazuhiro Ohkura, Katsushi Yamashita, Yumi Kando Hamamatsu

University School of Medicine, Hamamatsu, Japan

Invited Discussant: *T. Brett Reece

OBJECTIVE: Although transcranial (TC-) motor evoked potential (MEP) is quick and sensitive to detect spinal cord ischemia during aortic surgery, low specificity due to instability has always been a problem. We have previously reported that transesophageal (TE-) MEP is feasible and more stable than TC-MEP because of the technical ease and the use of supramaximal stimulation intensity. This study aimed to investigate the efficacy of TE-MEP to monitor spinal cord ischemia.

METHODS: Twelve adult beagle dogs were anesthetized with intravenous propofol and remifentanil without muscle relaxants. To induce spinal cord ischemia, the aorta was balloon-occluded at 9/10th thoracic vertebra level via a femoral artery under fluoroscopic control, and arterial blood pressure was recorded at the contralateral femoral artery and left internal carotid artery. TE- and TC-MEPs were recorded at bilateral forelimbs, external anal sphincters, and hindlimbs. In the 11 animals that showed decrease in MEP amplitudes of anal sphincters and hindlimbs, balloon occlusion was maintained for 10 minutes (n = 6) or 40 minutes (n = 5) after disappearance of hindlimb MEPs. Neurological function was evaluated according to the Tarlov score at 24 and 48 hours postoperatively, and animals with paralysis were sacrificed at 48 hours. The explanted spinal cords were histopathologically evaluated.

RESULTS: Baseline amplitudes were similar between TE- and TC-MEP (316 ± 228 vs. 271 ± 224 μV at anal sphincter; p = 0.215; 8.7 ± 2.2 vs. 7.8 ± 2.4 mV at hindlimbs; p = 0.055). Time to MEP disappearance was shorter in TE-MEP than in TC-MEP at anal sphincter (7.9 ± 3.1 vs. 8.6 ± 3.5 min; p = 0.024) but was similar at hindlimbs (5.5 ± 1.9 vs. 7.6 ± 3.4 min; p = 0.113). In 10-minutes occlusion group, time to MEP recovery (>75% of control) at hindlimbs was 12–28 minutes in TE-MEPs and 18–38 minutes in TC-MEPs, and was shorter in TE-MEPs (17.3 ± 5.6 vs. 27.0 ± 7.5 min; p = 0.001). Anal sphincter potentials did not recover to >75% in both methods. There was no spinal cord dysfunction in these animals. In the 40-minute occlusion group, hindlimb MEPs did not reappear in three dogs, and they were completely paraplegic (Tarlov grade 0) throughout the postoperative period. Among the two remaining dogs, one showed delayed (after 39 minutes for TE-MEP and 60 minutes for TC-MEPs) and inconsistent (50–75%) re-appearance of both TE- and TC-MEPs. This dog developed paraparesis (Tarlov grade 3) that became evident at 48 hours. In another dog, TE-MEPs of hindlimbs remained less than 20%, while TC-MEPs showed recovery (>75%) at 30 minutes and thereafter. This dog developed progressive paraplegia that became Tarlov grade 0 at 48 hours.

CONCLUSIONS: Transesophageal MEP seems superior to transcranial MEP in terms of its prognostic value. Prompt recovery (>75% of baseline within 30 minutes) of hindlimb TE-MEP amplitude was associated with good neurological outcome.

F4. Inhibition of microRNA-29c Induces Cerebroprotection in a Rat Model of Prolonged Deep Hypothermic Circulatory Arrest by Targeting PGC-1α

Tianxiang Gu, Yongchao Wang, Enyi Shi

First Hospital of China Medical University, Shenyang, China

Invited Discussant: *Jennifer S. Lawton

OBJECTIVE: Cardiopulmonary bypass (CPB) and deep hypothermic circulatory arrest (DHCA) are required for the repair of complex pediatric and adult congenital cardiac and aortic arch lesions. Neurological deficit induced by prolonged DHCA remains a major complication. Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is involved in the reactive oxygen species (ROS) and mitochondria biogenesis in cerebral ischemia. MicroRNA-29c has been shown to be an endogenous regulator of PGC-1α. In the current study, we sought to investigate the cerebroprotection of a novel microRNA mechanism by targeting PGC-1α in a rat model of prolonged DHCA.

METHODS: Right carotid artery and jugular vein of male Sprague-Dawley rats were cumulated for CPB. When the body was cooled to a pericranial temperature of 18°C, circulation arrest was accomplished by draining the venous blood to a reservoir. After 60 minutes of DHCA, CPB was reinstituted and the rats were rewarmed. All animals were divided into 4 groups randomly (n = 8 for each group). The sham group received the surgical procedure without CPB and DHCA; DHCA group suffered from CPB and DHCA; DHCA + vehicle group received intracerebroventricular administration of lentiviral vector before CPB and DHCA; DHCA + anti-microRNA-29c group received intracerebroventricular administration of lentiviral vector containing anti-microRNA-29c before CPB and DHCA. Neurological function was evaluated by the modified hole board test for 14 postoperative days. Then the animals were sacrificed and the brain tissues were harvested for histological examination. Neuron apoptosis was assessed by the expression of Caspase-3 using western blot. In a parallel protocol, 6 rats of each group were sacrificed just after the weaning of CPB. Expressions of microRNA-29c and PGC-1α were measured by RT-PCR and western blot respectively. Malondialdehyde (MDA) levels of the brain were measured using a Malondialdehyde Assay Kit.

RESULTS: Expression of Micro-29c was elevated after CPB and DHCA in the hippocampus. Pretreatment with anti-micro-RNA29c significantly decrease the expression of micro-RNA29c and increase the expression of PGC-1α in the hippocampus ($p < 0.01$, vs. DHCA group or DHCA + vehicle group, respectively).The level of MDA in the hippocampus was much lower in the DHCA + anti-microRNA-29c group ($p < 0.01$, vs. DHCA group or DHCA + vehicle group, respectively). The neurological functions were markedly protected in rats received anti-microRNA-29c as evidenced by improved long-term motor function and cognitive performance. In DHCA+anti-microRNA-29c group, histological scores of the hippocampus were much better and the level of caspase-3 in the hippocampus was much lower ($p < 0.01$, vs. DHCA group or DHCA + vehicle group, respectively).

CONCLUSIONS: Inhibition of microRNA-29c attenuates neurological injuries induced by prolonged DHCA by targeting PGC-1α.

*AATS Member

Late-Breaking Clinical Trial

F5. Comparison of Procedural Outcomes and Early Safety by Surgical Approach after Isolated Rapid Deployment Aortic Valve Replacement

*Thorsten Wahlers[1], *Axel Haverich[2], *Michael Borger[3], *Malakh Shrestha[2], Alfred Kocher[4], Thomas Walther[5], Matthias Roth[5], Martin Misfeld[6], *Friedrich Mohr[6], Joerg Kempfert[5], Pascal Dohmen[6], Christoph Schmitz[7], Parwis Rahmanian[1], Dominik Wiedemann[4], Francis Duhay[8]

[1]University of Cologne, Cologne, Germany; [2]University of Hannover, Hannover, Germany; [3]Columbia University, New York, NY; [4]University of Vienna, Vienna, Austria; [5]Kerckhoff Klinik, Bad Nauheim, Germany; [6]University of Leipzig, Leipzig, Germany; [7]University of Munich, Munich, Germany; [8]Edwards Lifesciences LLC, Irvine, CA

Invited Discussant: Spencer J. Melby

F6. Small Platform Catheter-Based Left Ventricular Assist Device Support Suppresses Cardioprotective Beta-Arrestin-Mediated Signal Transduction

Keshava Rajagopal, Progyaparamita Saha, Isa Mohammed, Pablo G. Sanchez, Tieluo Li, Zhongjun J. Wu, *Bartley P. Griffith

University of Maryland, Baltimore, MD

Invited Discussant: *Mark S. Slaughter

OBJECTIVES: Left ventricular (LV) assist device (LVAD) support reduces pathological mechanical loading and resultant adverse effects on individual cardiomyocyte and regional/global ventricular function. However, LVAD support also may inhibit adaptive, beneficial responses to pathological mechanical loading. Pathological mechanical loading dysregulates signal transduction through G protein-coupled receptors (GPCRs), central regulators of cardiac function that are the targets of most heart failure medical therapies. Canonical GPCR signaling through G proteins is deleterious. However, GPCR signaling through beta-arrestins has been shown to be cardioprotective, and may be adaptively induced in response to mechanical loading. We examined the effects of pathological LV mechanical loading and LV dysfunction, as well as treatment via LVAD support, on cardioprotective beta-arrestin-mediated signaling.

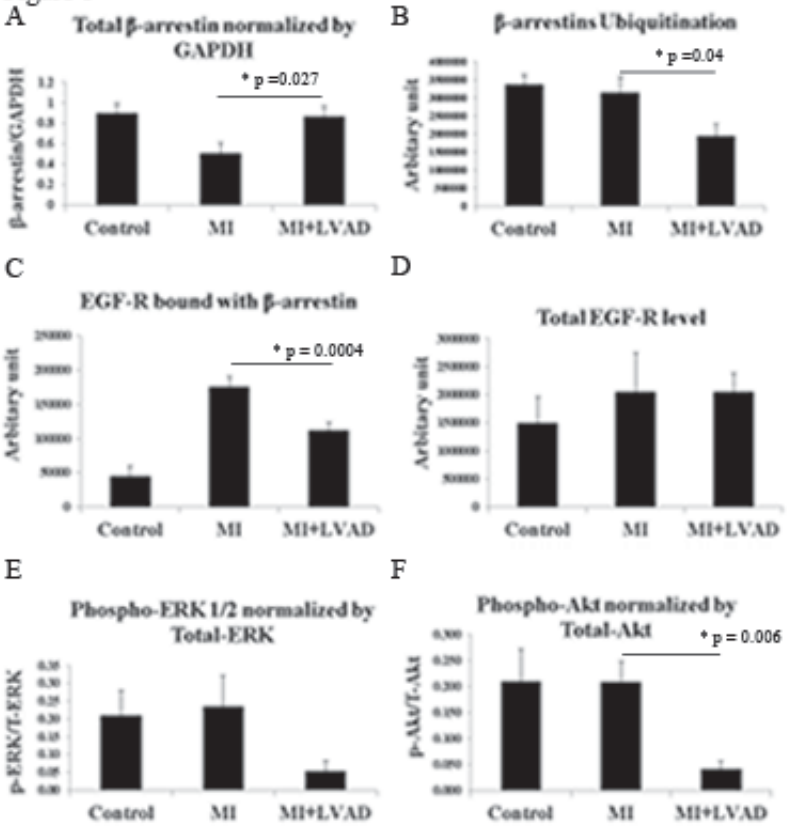
METHODS: An ovine model of myocardial infarction (MI)-induced LV dysfunction was employed. Sheep underwent either sham thoracotomy, ligation of the mid-left anterior descending coronary artery to produce large-territory MI, or MI with placement of a small platform catheter-based LVAD. LVAD support was continued for 2 weeks. Animals were maintained for a total of 12 weeks. Myocardial specimens were harvested and analyzed.

RESULTS: As shown in Figure 1, MI induced activation of beta-arrestins. This was evidenced by beta-arrestin ubiquitination, which reduces overall beta-arrestin levels. In addition, increased interactions between the EGF receptor (a key regulator of load-mediated signal transduction, "mechanotransduction")

and beta-arrestins were observed. LVAD support consistently inhibited these responses to MI ($p < 0.05$). In addition, LVAD support inhibited activation of cardioprotective signaling effectors Akt ($p < 0.05$), and to a lesser extent, ERK1/2 ($p = NS$).

CONCLUSIONS: In this clinically relevant model of acute MI with HF supported by a catheter-based LVAD, LVAD support inhibited cardioprotective beta-arrestin-mediated signaling. These findings may have implications for the optimal extent and duration of mechanical unloading, and adjunctive medical therapies.

Figure 1



*AATS Member

F7. Differential Regulation of Intracellular Calcium Homeostas Is Between Sevoflurane Postconditioning and Delayed Remote Ischemic Preconditioning in an Isolated Rat Heart Model

Yang Yu, Lihuan Li

Fuwai Cardiovascular Hospital, Beijing, China

Invited Discussant: *Juan A. Crestanello

OBJECTIVE: Intracellular calcium homeostasis, mainly regulated by L-type Ca2+ channel (LTCCs), ryanodine receptor2 (RyR2), and Na+/Ca2+ exchanger isoform 1 (NCX1), is an important protective mechanism during myocardial ischemia-reperfusion (I/R) injury. Both sevoflurane postconditioning (SevoPoC) and remote ischemic preconditioning (RIPC) have been shown to protect the heart against I/R injury. In this study, we explored the effect of SevoPoC and delayed RIPC (DRIPC) on the intracellular calcium homeostasis in an isolated rat heart model.

METHODS: After 30-minute balanced perfusion, isolated hearts were subjected to 30-minute ischemia followed by 60-minute reperfusion. The effect of SevoPoC (3% v/v) and DRIPC (4 cycles of 5-minute occlusion and 5-minute reflow at unilateral hind limb once at the day before heart isolation) were observed. Myocardial infarct size was estimated using TTC staining. Cardiac Troponin I level and heart function were measured. The protein and messenger RNA (mRNA) levels of LTCCs, RyR2, and NCX1 were determined.

RESULTS: Both SevoPoC and DRIPC improved the recovery of myocardial function, and reduced cTnI release after I/R injury. The decrease in infarct size was more significant in the SevoPoC group than that in the DRIPC group (16.50% ± 4.54% vs. 22.34% ± 4.02%; $p < 0$ .001). SevoPoC, but not DRIPC significantly inhibited the activity of NCX1 (0.32 ± 0.16 in the SevoPoC group vs. 0.59 ± 0.09 in the I/RI group; $p = 0.05$). No statistical differences were observed in the expression of LTCCs and RyR2. However, this effect was not confirmed in the mRNA level. No statistical differences between SevoPoC and DRIPC were observed in both protein and mRNA levels of LTCCs and RyR2.

CONCLUSIONS: SevoPoC and DRIPC can confer similar cardioprotection. However, the involved mechanisms on the regulation of intracellular calcium homeostasis may be different, especially in the deactivation of NCX1.

A
TC
I/RI
SevoPoC
DRIPC
RyR2
NCX1
LTCCs
β-actin
565kDa
108kDa
105kDa
42kDa
B
NCX1 expression
Relative Intensity
C
RyR2 expression
Relative Intensity
D
LTCCs expression
Relative Intensity

*AATS Member

F8. Multidisciplinary Histological and Mechanichal Study of Aortic Aneurysm to Investigate Potential Parameters for Early Diagnosis of High Risk of Rupture

Pasquale Totaro[1], Alessandra Sbaffi[1], Anna Ferrara[2], Laura Viola[1], Simone Morganti[2], Eloisa Arbustini[1], Federico Auricchio[2], Alessandro Mazzola[1]

[1]IRCCS Foundation Hospital San Matteo, Pavia, Italy; [2]University of Pavia, Pavia, Italy

Invited Discussant: *Scott A. LeMaire

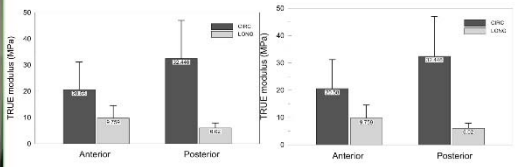
INTRODUCTION: The potential for advanced criteria for optimal decision making process in patient presenting with ascending aorta aneurysm has been extensively investigated. So far, however, many patients are referred while in the so called "grey zone" for surgical indication. In this multidisciplinary study in patients with ascending aorta aneurysm, we have compared preoperative parameters with mechanical and histological tests on operative aortic specimens to investigate potential early diagnostic signs of increased risk of complications.

MATERIALS AND METHODS: Forty patients undergoing surgery for AAA were enrolled. In all patients preoperative diagnosis was completed with transthoracic cardiac echo (TTE) and cardiosyncronized high definition CT scan with 3D and volume rendering reconstruction. Aortic distensibility (AD) was calculated based both TTE and CT measurement, according previously reported formulae. At operation different regions of native aorta were identified and then several specimens were sent for histological and mechanical tests. Histological evaluation included numerical quantification (scored 0 to 4) of each type of abnormalities with a total abnormality score (HATS) scored 0 to 16. Mechanical tests using uniaxial testing device (Figure 1A) measured three differents parameters : Peek strein (PS), Peek stress (Pss), and maximum elastic modules (MEM). All parameters were obtained either testing a circumferential force either a longitudinal force. Preoperative parameters were statistically correlated to such findings.

RESULTS: A total number of 198 tests were performed. 137 specimens were from the anterior surface and 61 from posterior. Circumferential force was applied in 116 and longitudinal in 82. First important finding was the different mechanical test response in different regions of the aorta. Posterior wall of the aorta had a significantly higher elastic modulus especially with a circumferential force (Figure 1B). Patient age (>55) and maximum diameter of native aorta (>5cm) correlated to a significantly reduced Peek Strein (Figure 1C). Histological abnormality also were correlated either with preoperative parameters (including AD) either with impaired mechanical properties (Figure 1D).

1A

1B



	Age >55	Age ≤ 55	p
MEM (MPa)	8.94±7.04	8.75±4.93	0.93
Pss (MPa)	0.72±0.38	1.18±0.53	***0.022***
PS (mm/mm)	0.38±0.28	0.58±0.07	***0.040***

1C

	Diameter >5 cm	Diameter ≤ 5 cm	p
MEM (MPa)	10.07±6.75	7.11±4.01	0.19
Pss (MPa)	0.96±0.57	0.97±0.45	0.97
PS (mm/mm)	0.40±0.21	0.60±0.16	***0.001***

1D

	HATS > 6	HATS ≤ 6	p
MEM (MPa)	9.15±6.92	8.57±5.06	0.82
Pss (MPa)	0.71±0.37	1.18±0.53	***0.0205***
PS (mm/mm)	0.33±0.18	0.62±0.14	***0.0005***
Diameter (mm)	54±4	49±2	***0,004962***
AD (TTE)	0,75±0,26	1,22±0,42	***0,00392***

CONCLUSIONS: A strong correlation exists between anagraphic data, histological abnormalities and mechanical properties of the aortic wall in patients presenting with ascending aorta aneurysm. The current cut off (in terms of maximum diameter) for surgical indication is surely correlated to significant abnormalities in terms of histological and mechanical characteristics. However other factors seem to be also relevant in reducing the elasticity of the aorta, especially in the posterior wall, increasing the risk of rupture. Finally aortic distensibility calculated either with TTE or CT could be useful in further optimize preoperative decision making process.

*AATS Member

F9. Improvements in the Electrospun Polycarbonate-Urethane Vascular Graft by Effective Surface Modification

Xuefeng Qiu[1], Benjamin Li-Ping Lee[2], Wen Zhao[2], Dong Wang[2], Nianguo Dong[1], Song Li[2]

[1]*Huazhong University, Wuhan, China;* [2]*University of California, Berkeley, CA*

Invited Discussant: *Frederick Y. Chen

OBJECTIVE: To explore an effective surface modification method for the electrospun polycarbonate-urethane (PCU) vascular grafts to improve endothelialization as well as graft patency.

METHODS: We selected three common surface modification techniques from an array of options, and investigated which of them is the most effective modification method. Specifically, we utilized aminolysis with 1-Ethyl-3-[3-dimethylaminopropyl]carbodiimide hydrochloride (EDC) chemistry as a chemical immobilization, polydopamine coating as a passive adsorption, and plasma treatment paired with end-point immobilization to ultimately conjugate heparin on the graft surface. The most effective modification was determined with respect to the heparin density as well as the antithrombogenic activity of the immobilized heparin. Then, we proceeded with these optimized PCU grafts immobilized with heparin for short-term in vivo studies, focusing on the performance of heparin-modified electrospun PCU grafts on endothelialization as well as graft patency.

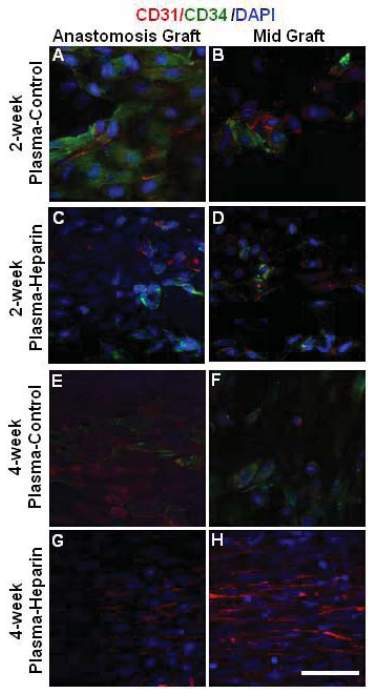


Figure1. *En face* immunostaining of PCU plasma-control and plasma-heparin grafts after 2 and 4 weeks *in vivo*. *En face* immunostaining for CD31 (red) with CD34 (green) of patent (A, B) 2-week plasma-control, (C, D) 2-week plasma-heparin, (E, F) 4-week plasma-control, and (G, H) 4-week plasma- heparin grafts was performed. Representative images were taken from the anastomosis-graft and mid-graft regions of each graft. Cell nuclei were stained using DAPI (blue). Scale bar = 50 μm.

RESULTS: Immediately after heparin conjugation at day 0, control (untreated) grafts had an insignificant amount of heparin (2.531 μg/cm^3) compared to the heparin density on aminolysis-heparin (27.320 ± 10.968 μg/cm^3), polydopamine (PD)-heparin (28.400 ± 26.763 μg/cm^3), and plasma-heparin (47.740 ± 14.451 μg/cm^3) grafts. At day 0, control grafts exhibited a baseline activity level of 0.835 ± 0.372 NIH U/cm^3, compared to aminolysis-heparin (7.989 ± 0.094 NIH U/cm^3), PD-heparin (8.370 ± 0.283 NIH U/cm^3), and plasma-heparin (8.151 ± 0.408 NIH U/cm^3) grafts. In terms of graft performance, at 2 weeks, approximately 71% (5 of 7) of plasma-control grafts remained patent, whereas 86% (6 of 7) of plasma-heparin grafts were patent. However, after 4 weeks, plasma-control grafts exhibited approximately 29% (2 of 7) patency, compared to 86% (6 of 7) patency of plasma-heparin grafts. More importantly, we observed a more complete endothelialization of the luminal surface with a more aligned, well-organized monolayer of endothelial cells.

CONCLUSIONS: We confirmed in vitro that the combination of plasma treatment and end-point immobilization of heparin exhibited the highest surface density and correspondingly the highest antithrombogenic activity of heparin molecules. It demonstrates that the end-point immobilized heparin drastically improved the performance of the vascular grafts with respect to patency as well as early stages of endothelialization.

*AATS Member

F10. Preventing Allogeneic Immune Rejection by Transplanting MHC-Homo Induced Pluripotent Stem Cell-Derived Cardiomyocytes to an MHC-Matched Non-Human Primate

Takuji Kawamura, Shigeru Miyagawa, Satsuki Fukushima, Shigeo Masuda, Noriyuki Kashiyama, Ai Kawamura, Atsuhiro Saito, Shohei Yoshida, Akira Maeda, Koichi Toda, Shuji Miyagawa, Yoshiki Sawa

Osaka University, Osaka, Japan

Invited Discussant: *Peter J. Gruber

OBJECTIVE: Derivatives of allogeneic, "ready-made" induced pluripotent stem cell (iPSC), in which safety and efficacy were already established, are promising in prompt application of iPSC-based regeneration therapy for cardiac diseases, although host immune response against the allogenicity is a concern. Major histocompatibility complex (MHC)-matched allogeneic implantation (MMAI) using "ready-made" iPSC with homozygous MHC haplotypes is theoretically useful in diminishing the immune rejection in allogeneic iPSC-based therapy. We thus explored efficacy of or appropriate immunosuppression in adjunct with this MMAI therapy using a non-human primate, Macaca fascicularis model.

METHODS: IPSCs constitutively expressing GFP were established from Macaca fascicularis with homozygous MHC haplotypes, in which all alleles constituting MHC genes were homozygous, named "HT1" (HT1-homo-MCiPSC). Cardiomyogenic differentiation was induced for the HT1-homo-MCiPSCs in vitro by using the established protocol, displaying that expression of Nkx2.5, myosin heavy chain and cardiac troponin T was markedly high as assessed by RT-PCR and that more than 80% of the cells were positive for troponin T as assessed by flow cytometry. The derivatives were then subcutaneously transplanted to the Macaca fascicularis with heterozygous HT1 as MMAI model with a daily intake of tacrolimus (TAC), mycophenolate mofetil (MMF) and prednisolone (PSL) (Group 1), TAC only (Group 2) and no immunesuppressants (Group 3), and to the Macaca fascicularis with no alleles that constituted HT1 as MHC-mismatched allogeneic transplantation (MmMAI) model with TAC, MMF and PSL (Group 4).

RESULTS: Relative GFP intensity, as assessed by stereomicroscope, of the transplanted cell-clusters at 2 weeks against that immediately after the transplantation was the markedly higher in the Group 1 (1.41), compared to the other groups, such as the Group 2 (0.97), the Group 3 (0.77) or the Group 4 (0.81). The GFP intensity was preserved at one month (1.26) and two months (1.33) in the Group 1, whereas it was markedly diminished in the Group 3 (0.33) and in the Group 4 (0.39) at one month after the transplantation. Histologically, CD3 or CD4-positive T cells were abundantly infiltrated into the graft of the Group 3 and 4 at one month, whereas these cells were rarely present in the Group 1 at one and two months. Expression of interleukin-2 receptor in the graft of the Group 3 and 4 was more than three times higher as compared to that of Group 1 as assessed by RT-PCR.

CONCLUSIONS: MMAI of cardiomyogenically differentiated MHC-homo-iPSCs was effective for the engraftment of the iPSC-derivatives in MHC-hetero non-human primate, while addition of immunosuppressant therapy enhanced the engraftment. MmMAI of iPSC-derivatives were involved in immune rejection despite full immunosuppressant therapy.

8:40 AM ADJOURN

*AATS Member

7:00 AM **GENERAL THORACIC SURGERY FORUM** Room 613, WSCC
5 minute presentation, 5 minute discussion

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

F11. CD8+ T Cells Contribute to Lung Cancer Progression in a PD-1 Dependent Fashion

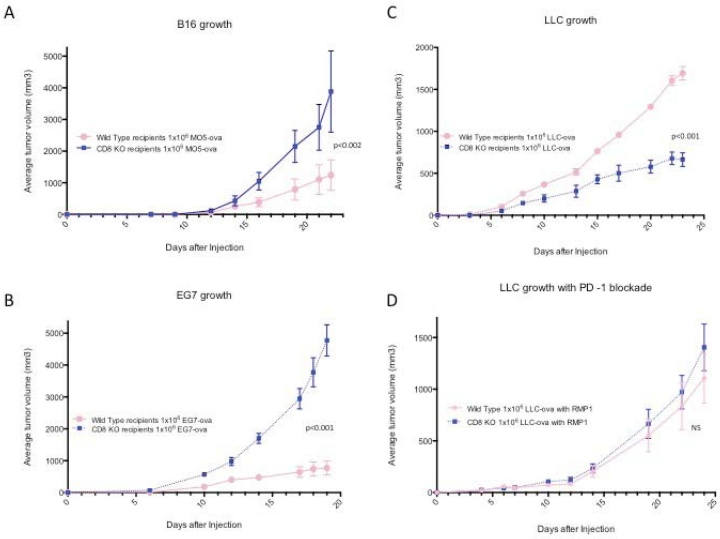
Stephanie H. Chang, Saeed Arefanian, Ryuji Higashikubo, Andrew E. Gelman, *Daniel Kreisel, *Alexander S. Krupnick
Washington University, St. Louis, MO

Invited Discussant: Marc De Perrot

OBJECTIVE: Data from our laboratory, as well as others, has put into question the role of the adaptive immune system in lung cancer development. Our objective was to investigate the role of CD8+ T lymphocytes, in controlling the growth of lung cancer in vivo.

METHODS: C57BL/6 wild type (B6) and C57BL/6 CD8 deficient (B6 CD8-/-) mice were injected through the flank with 3-methylcholantherene (3-MCA) to initiate the development of fibrosarcoma, or systemic urethane, thereby inducing the development of lung adenocarcinoma. For other experiments, B6 or B6 CD8-/- mice were injected in the flank with tumor cells (B16 melanoma; EG7 thymoma, and LLC Lewis lung carcinoma) expressing the ovalbumin model tumor associated antigen. Tumor growth was measured with calipers three times per week. For one experiment, mice were treated with anti-Programmed Cell Death 1 (PD-1) blocking antibody RMP1 (BioXCell). Surface phenotype of immunologic markers of in vitro expanded tumor cells (B16, EG7, and LLC) was evaluated by flow cytometry.

RESULTS: Consistent with the previously described role of CD8+ T cells in immunoregulation of solid tumors, B6CD8-/- mice treated with 3-MCA had a higher tumor burden compared to B6 (518.3 ± 120.8 mm^3 vs. 204.4 ± 64.36 mm^3; $p < 0.05$). To further study the role of CD8+ T cells in tumor growth, we used tumor cell line transplantation. Similar to the primary carcinogenesis model, B16 melanoma and EG7 thymoma tumor cell lines grew faster in B6 CD8-/- compared to B6 mice (Figure 1A, 1B). In direct contrast, lung cancer burden was lower in urethane-treated B6 CD8-/- compared to B6 mice (0.6628 ± 0.13 mm^3 vs. 1.717 ± 0.23 mm^3; $p < 0.001$). Additionally, in tumor line transplantation, LLC grew faster in the presence of CD8+ T cells (Figure 1C). Flow cytometric analysis revealed higher levels of surface Programmed Cell Death Ligand 1 in the LLC lung cancer cell line compared to B16 and EG7. To evaluate if PD-1, which is expressed on CD8+ T cells, could be contributing to CD8+ T cell-mediated tolerance, we treated B6 and B6 CD8-/- mice with the PD-1 blocking antibody RMP1. In contrast to mice treated with control IgG, LLC tumor-bearing mice treated with RMP1 demonstrated tumor growth patterns similar to that of B16 and EG7 with lower tumor burden in wild-type CD8+ T cell-sufficient mice compared to B6 CD8-/- mice (Figure 1D).



CONCLUSIONS: We have previously demonstrated that, unlike the case for other solid tumors, T lymphocytes play a negligible role in controlling the growth of lung cancer. We now demonstrate, for the first time, that CD8+ T cells may have a specific tolerogenic role in promoting lung cancer-growth and, in a paradoxical fashion, facilitate acceptance of lung cancer in a PD-1 dependent fashion. Our data provide a unique explanation for lung cancer-specific immune avoidance and provide further impetus for clinical trials of PD-1 inhibitors for this disease.

*AATS Member

F12. Repair of Large Tracheal Defects Using a Bioengineered Neotrachea in a Porcine Model

Adnan M. Al-Ayoubi, Sadiq S. Rehmani, Craig M. Forleiter, Michael Barsky, Ahmad Taweel, Catherine F. Sinclair, Robert S. Lebovics, *Raja M. Flores, Faiz Y. Bhora

Mount Sinai Hospital, New York, NY

Invited Discussant: *Thomas K. Waddell

OBJECTIVE: Repair of large tracheal defects is surgically challenging. Despite recent advances in regenerative medicine, the ideal tracheal substitute remains elusive. In this study, we describe the use of a bioengineered neotrachea for repair of large anterior tracheal defects in a porcine model. We further determine chondrogenesis, neovascularization and epithelialization of the graft.

METHODS: Acellular bovine dermis (collagen I and III) was fashioned as a semi-cylinder. Male-derived human mesenchymal stem cells (hMSCs, 2.0 x 10^6 cells) were seeded on the matrix to create the bioengineered neotrachea, and incubated in a bioreactor 1 week prior to implantation. Growth media were supplemented with chondrogenic differentiation factors. Controls consisted of acellular dermis alone. An anterolateral 4 cm x 3 cm defect was surgically created in the cervical trachea of 4 weeks old (~40 lbs) female Yorkshire pigs. The neotrachea (n = 5) or control (n = 2) was used to close the defect. No immunosuppressive therapy or endoluminal stents were utilized. Low dose steroids were given on POD #0 to decrease airway edema. Broad spectrum antibiotics were given for two weeks. Bronchoscopy was performed monthly to monitor the airway. Euthanasia and tissue extraction was performed at 3 months post-operatively.

RESULTS: There was no operative or perioperative mortality. Survival ranged from 7 days (n = 3) to more than 3 months (n = 4) with substantial animal growth (>200% weight). Early death (day 7) was attributed to infection and sepsis. Antibiotics regimen were adjusted accordingly with improved survival (>3 months). Bronchoscopy showed patent airway, slight remodeling (<30% stenosis) and integration of the graft with the native trachea. On histology, epithelialization of the lumen and neovascularization was observed in both the neotrachea and control. Chondrogenesis was seen only in the neotrachea which was more rigid than control. The neocartilage was less mature and less organized compared to native cartilage. SRY immunostain was positive in the neotrachea but not control or native trachea, demonstrating the male origin of the chondrocytes (male-derived hMSCs).

CONCLUSIONS: We demonstrate the feasibility of the bioengineered neotrachea for repair of large anterior tracheal defects with chondrogenesis, neovascularization and epithelialization. Importantly, the neotrachea sustained the fast and substantial animal growth, potentially expanding its use to include pediatric as well as adult patients.

F13. Pulmonary Venous Blood Sampling Significantly Increases the Yield of Circulating Tumor Cells in Early Stage Lung Cancer

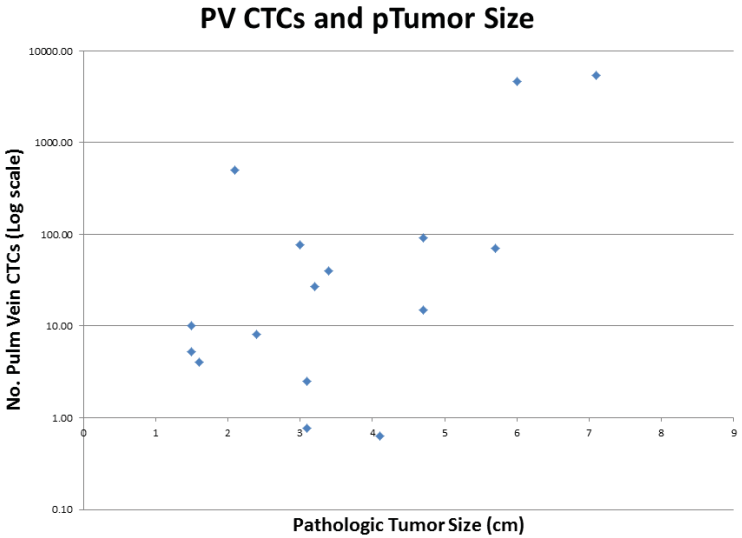
Rishindra M. Reddy, Vasudha Murlidhar, Lili Zhao, Jennifer Zhuo, Nithya Ramnath, Jules Lin, *Andrew C. Chang, Phillip Carrott, William Lynch, *Mark B. Orringer, David G. Beer, Sunitha Nagrath

University of Michigan, Ann Arbor, MI

Invited Discussant: *Jessica S. Donington

OBJECTIVE: Improving early detection of lung cancer is critical to improving lung cancer survival. Reproducible detection of circulating tumor cells (CTCs) is limited both by the low yield of CTCs (1–10 CTC per 7.5 ml of blood) and by the difficulty characterizing these rare cells. We hypothesize that CTCs are present in the blood of patients with early stage lung cancer and that evaluating pulmonary vein (PV) blood using microfluidic chip technology yields a significant number of CTCs.

METHODS: Patients undergoing pulmonary resection for lung cancer were consented for peripheral and pulmonary vein sampling. PV blood was drawn after the draining vein was mobilized during surgery. Blood samples were analyzed at 5 ml/hr on microfluidic chips using EpCAM-based capture. CTC concentrations are reported as CTCs (N)/7.5 ml of blood.



RESULTS: Thirty-two patients with primary lung cancer were evaluated. Only 20 patients had clinically significant CTCs detected at any time point (62.5%). The mean CTCs from peripheral vein sources at pre-op, intra-op, and post-op time-points were 1.98, 3.05, and 1.00, respectively. The PV average was 543.54 ($p < 0.01$; range: 0.0–5,422.50). When PV CTCs were present, the number of

CTCs correlated with pathologic tumor size ($p = 0.0236$) (see Figure). The number of PV CTCs did not correlate with any other clinical feature (smoking status, pre- or post-op stage). The presence of PV CTCs correlated with pre-operative bronchoscopic biopsies performed, compared to CT guided ($p = 0.0311$). Six patients had evidence of CTC clusters, or "microemboli."

CONCLUSIONS: With a single vein draining the entire tumor basin, lung cancers are unique among solid organ tumors. Reproducible and high yield isolation of CTCs from pulmonary venous drainage may facilitate future studies of CTCs as a possible biomarker in the diagnosis and treatment of lung cancer patients.

F14. A Novel Large Animal Model of Acute Respiratory Distress Syndrome Induced by Mitochondrial Products

Pablo G. Sanchez, Chetan Pasrija, Matthew Mulligan, Diana L. Pratt, Mandheer Wadhwa, Keshava Rajagopal, Zhongjun Wu, *James S. Gammie, Si M. Pham, *Bartley P. Griffith

University of Maryland, Baltimore, MD

Invited Discussant: *Joseph B. Zwischenberger

OBJECTIVE: Extensive tissue injury after surgery, trauma or transplantation often results in a systemic inflammatory response syndrome (SIRS) even in the absence of infection. Acute respiratory distress syndrome (ARDS) resulting from SIRS has a mortality rate ranging from 40–60%. It has recently been demonstrated that mitochondrial products released to the circulation after cell injury activate neutrophils through mechanisms that are very similar to those used by microbes, generating a state that is clinically indistinguishable from sepsis. We have developed a novel large animal model of SIRS-induced ARDS using disrupted mitochondrial products (DAMPs).

METHODS: Five pigs (30–40 kg) received an intravenous (IV) dose of DAMPs and were maintained under general anesthesia for up to six hours. These animals were compared to a control group (anesthesia only) and a well-established model of sepsis induced ARDS by lipopolysaccharide (LPS) IV administration.

RESULTS: Animals in the DAMPs group developed clinical signs of SIRS after IV administration of mitochondrial products. At 6 hours of injection the heart rate and the temperature were significantly higher in the DAMPs group when compared to the controls (204 ± 12.3 bpm and 41.2 ± 1.2°C vs. 100 ± 12.7 bpm and 37.8 ± 0.5°C). These variables were not significantly different between the DAMPs and LPS group, 178 ± 18 bpm and 41.6 ± 0.5°C (Figure A-B). Lung oxygenation capacity (PO_2/FiO_2) was significantly lower at hour 6 in the DAMPs (187 ± 39 mmHg) and LPS groups (176 ± 49 mmHg) when compared to the control group (494 ± 45 mmHg) (Figure C). Furthermore, mean histological lung injury scores were significantly higher in DAMPs group (64.63) when compared to controls (13.53), but not the LPS group (53.60). Lung injury in the DAMPs and LPS groups was associated with higher IL-6 levels when compared to the control group (166 ± 17, 158 ± 23, and 60 ± 11 pg/mg, respectively). However, the difference was not significant between the DAMPs and LPS groups. In addition we observed increased neutrophil infiltration, in the DAMPs and LPS groups which correlated with an increased MMP-8 protein expression in lung tissue when compared to the control group (0.25, 0.22, and 0.1, respectively).

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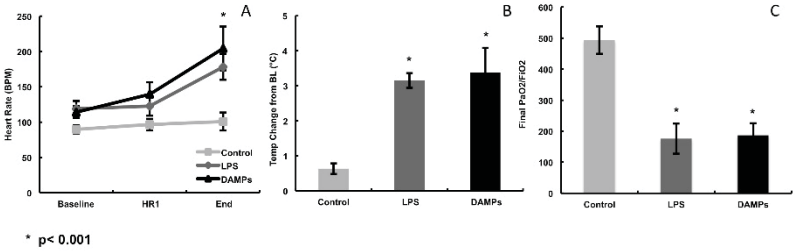


CONCLUSION: Our data demonstrates that the release of mitochondrial products to the circulation leads to SIRS-induced ARDS, which is clinically, histologically and molecularly indistinguishable from sepsis. We believe this new and clinically relevant large animal model will facilitate the development and the translation of therapies for the treatment of SIRS-induced ARDS.

F15. High Expression of HOXC6 and HOXC8 Predicts Poor Prognosis of Patients with Esophageal Squamous Cell Carcinoma (ESCC) and Promotes Tumorigenesis through Their Positive Effect on Cell Proliferation

Keneng Chen, Lu-yan Shen

Key Laboratory of Carcinogenesis and Translational Research, Beijing, China

Invited Discussant:

OBJECTIVES: Previously, HOXC6 and HOXC8 were found upregulated in ESCC tissues but not in paired noncancerous mucosa at mRNA level, which were regulators of cell growth and differentiation as well as involved in development of normal esophagus. This recurrence of expression in cancer tissues drives us to consider whether the gain of expression reflect the gain of function. This study is to explore their functional significance and causal effect in carcinogenesis.

METHODS: Immunohistochemistry were performed to examine the expression of HOXC6/HOCX8 at protein level. Then, univariate survival analysis and multivariate analysis were carried out to investigate the significance of HOXC6/HOXC8 in prognosis of patients. To explore the functional roles of HOXC6/HOXC8 in oncogenesis, we established stable cell strain with knockdown of these two genes using RNA interference. Based on the cell culture model, in vitro experiments, the cell viability and clonogenic ability of ESCC cells were detected by CCK8 assay and soft agar colony formation assay. Cell cycle progression and apoptosis were assessed by flow cytometry. Then, in vivo tumorigenesis was investigated in xenograft model.

RESULTS: HOXC6/HOXC8 proteins mainly were localized in cytoplasm, and 39.9% and 38.4% cases have high expression for these two genes, respectively. Their high expression was positively correlated with TNM stage. Univariate survival analysis showed that the median survival time of patients with high expression of HOXC6/HOXC8 was markedly shorter than that of patients with low expression (35 ms vs. 70.1 ms; p = 0.007 for HOXC6; 30.3 ms vs. 110.4 ms; p = 0.005 for HOXC8). Multivariate analysis showed that high HOXC6/HOXC8 expression was another independent poor predictor (HR, 1.341; 95% CI [0.895–2.010]; p = 0.045 and HR, 1.657; 95% CI [1.146–2.395]; p = 0.007, respectively) in addition to TNM stage. In vitro experiment revealed that knockdown of HOXC6/HOXC8 obviously inhibited cell proliferation through decreasing cell viability, reducing colony formation, inducing cell cycle arrest in G1 phase and enhancing apoptosis. Moreover, tumor growth was notably inhibited in HOXC8 knockdown xenograft model.

CONCLUSION: High expression of HOXC6/HOXC8 was independent poor predictor of prognosis of ESCC patients, and might promote tumorigenesis as a consequence of their positive effects on cell proliferation.

*AATS Member

F16. Intraoperative Molecular Imaging of Pre-Treated Mediastinal Tumors Is Feasible

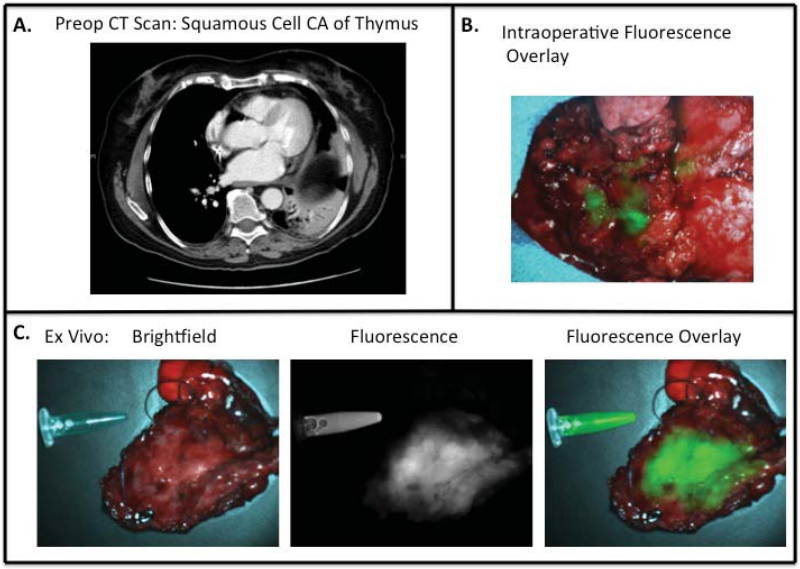
Jane Keating, Elizabeth De Jesus, Jack Jiang, Ryan Judy, Sunil Singhal
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Yolonda L. Colson

OBJECTIVE: Intraoperative near infrared (NIR) molecular imaging is an emerging technology to identify margins and lymph nodes during resection of primary mediastinal tumors. Many patients undergo preoperative chemotherapy for mediastinal tumors, and the feasibility of intraoperative molecular imaging has not been evaluated in this scenario. The goal of this study was to determine whether neoadjuvant chemotherapy would alter the efficacy of NIR intraoperative molecular imaging.

METHODS: EL-4 thymomas were established in the flanks of C57/bl6 mice (n = 40). Mice were randomized to weekly intraperitoneal cisplatin treatment versus control carrier. After 3 weeks, all mice were injected with a fluorescent NIR contrast agent, indocyanine green (ICG), 24 hours prior to surgery. Prior to resection, flank tumors were imaged in vivo. Tumors were excised and the wound bed was re-imaged for residual tumor cells. Signal to background ratios (SBR) were generated using digital imaging software. Follow up IRB approved clinical studies were performed in 8 human patients with mediastinal masses. Four of the 8 patients had preoperative chemotherapy. ICG was given the day prior to surgery. The tumor was imaged in vivo and after resection, and the tumor bed was inspected for residual disease. All imaging data was correlated with pathological analysis.

RESULTS: EL-4 tumors were identified by NIR imaging in all 40 mice regardless of chemotherapy status. At the time of imaging, tumor size of the treatment-naïve and chemotherapy cohort was 536 ± 42 mm^3 versus 374 ± 69 mm^3 ($p < 0.01$), respectively. The mean in vivo SBR of the treatment-naïve and chemotherapy groups was not different ($p = 0.899$): 3.22 ± 0.276 (IQR, 3.08–3.30) vs. 3.23 ± 0.243 (IQR, 3.08–3.40). In the human study, the four patients receiving preoperative chemotherapy did not have a significant difference in vivo SBR when compared to the remaining patients (3.23 ± 0.243 [range: 3.09–3.60] vs. 3.15 ± 0.404 [range: 2.78–3.66]; $p = 0.723$). In one treatment-naïve patient and 2 pre-treated patients, intraoperative molecular imaging identified residual tumor cells in the wound bed after surgery. Ex vivo, the tumor cell viability varied from 65–90% in the treatment-naïve group and 55–85% in the pre-treated patient cohort, and tumor pathology included 2 invasive thymomas, 2 thymic carcinomas, a Hodgkin lymphoma, ganglioneuroma, synovial cell tumor and a liposarcoma.



CONCLUSIONS: NIR intraoperative molecular imaging can identify mediastinal tumors. In animal models and a pilot human study, neoadjuvant chemotherapy likely does not affect the mediastinal tumor fluorescence. Our findings suggest that intraoperative molecular imaging may have an acceptable indication in pre-treated solid tumors.

*AATS Member

F17. Rapamycin Prevents Bronchiolitis Obliterans Through Increasing Regulatory B Cells Infiltration in a Murine Tracheal Transplantation Model

Yunge Zhao, Jacob R. Gillen, Akshaya K. Meher, Jordan A. Burns, David A. Harris, *Irving L. Kron, *Christine L. Lau

University of Virginia, Charlottesville, VA

Invited Discussant: *Si Mai Pham

OBJECTIVE: B cells are generally considered to be positive regulators of the immune response because of their capability to produce antibodies. However, the recent findings showed that a subset of B cells, regulatory B cell, can also negatively regulate the immune response by producing regulatory cytokines, such as IL-10. We have reported that mTOR inhibition prevented luminal obliteration through inhibition of fibrocyes and promotion of epithelial progenitor cells in a mouse heterotopic tracheal transplantation (HTT) model. The purpose of this study is to further explore whether Bregs associates with BO development post treatment of rapamycin in a murine HTT model.

METHODS: An established HTT model with MHC class I- and class II-mismatch was utilized. Tracheas from Balb/c were transplanted into C57BL/6 recipients. Three study groups were examined: Rapamycin (10 mg/kg/day) treatment group (n = 8), Rapamycin (5 mg/kg/day) treatment group (n = 8) and DMSO group (n = 8). The treatment was from day 0 to day 14. Isografts are used as control group. Tracheas were collected on Days 14, 28, and 42 post-transplantation. The luminal obliteration was evaluated by HE staining and picrosirius red staining. The cellular infiltration, secretion of IL-10 and TGF-β were accessed by immunohistochemistry with specific antibodies. The positive signals were analyzed by densitometric analysis. Cytokines and TGF-β were further confirmed using Bio-Plex Pro-mouse cytokine analysis.

RESULTS: The results revealed that intraperitoneal injection of rapamycin (5 or 10 mg/kg/day) for 14 days after tracheal transplantation significantly reduced luminal obliteration on days 28 when compared with DMSO control group (97.78% ± 3.63% vs. 3.02% ± 2.14%; $P < 0.001$). It was notable that injection of rapamycin markedly induced B220+ B cells infiltration into the allografts when compared with DMSO controls on Days 14, 28, and 42. Further analysis revealed that the majority of the infiltrated B cells were Breg cells, which were defined as B220+IgM+IgG- IL-10+B cells (on Day 28, 35.83 ± 0.75 vs. 14.57 ± 0.69; $P < 0.001$). Rapamycin treatment inhibited IL-1 beta, IL-6, IL-13, and IL-17 days 7 and 14. Furthermore, rapamycin also greatly increased IL-10, IL-4 and TGF-β production on day 28. In addition, rapamycin treatment significantly increased Tregs in filtration in the allografts when compared with DMSO treatment group on D28 (9.88 ± 0.2718 vs. 1.71 ± 0; $P = 0.003$).

CONCLUSIONS: mTOR inhibition decreases BO development via inhibition of pro-inflammatory cytokines and increasing Breg cell infiltration, which subsequently produce anti-inflammatory cytokines (IL-4 and IL-10) and upregulate Treg cells. The role of B cells in BO development following mTOR inhibition post lung transplantation need to be further elucidated.

F18. AP-1 Inhibitor (SR11302) Inhibits Metastatic Lesion Formation in Ex Vivo 4D Lung Cancer Model

Dhruva K. Mishra, Min P. Kim

Houston Methodist, Houston, TX

Invited Discussant: *Prasad S. Adusumilli

OBJECTIVE: Activator protein (AP) −1 is a transcription factor that plays an important role in cell differentiation, proliferation, and apoptosis. An analysis of tumor cells grown on the ex vivo 4D lung cancer model shows an increase in the components of AP-1, c-Fos and c-Jun in circulating tumor cells (CTC) compared to the primary tumor. Our aim is to determine whether the AP-1 inhibitor inhibits metastatic lesion formation in the 4D model.

METHODS: The human lung cancer cell lines A549, H1299, or H460 were grown in the ex vivo 4D lung cancer model with or without AP-1 inhibitor (SR11302, 1uM). We compared the primary tumor's size, the number of CTCs, and the number of cells per high power field in the metastatic lesion between the 4D models treated with or without AP-1 inhibitor. We also placed CTCs isolated from the 4D model treated with or without AP-1 inhibitor on a petri dish and determined the number of viable cells after 4 days. For our control group, we treated the parental tumor cells on petri dish with or without AP-1 inhibitor and determined the viable cells after 4 days.

RESULTS: There were no differences in the primary tumor size for A549, H1299, or H460 cells grown on the 4D model treated with or without AP-1 inhibitor. The 4D model seeded with H1299 cells treated with AP-1 inhibitor had fewer CTC than the untreated control group. However, the 4D model seeded with H460 or A549 cells treated with AP-1 inhibitor had more CTC than the untreated control group. There were significantly fewer tumor cells per high power field in the metastatic lesion of the 4D model seeded with H460 ($p = 0.009$), A549 ($p = 0.01$), or H1299 ($p = 0.02$) cells treated with AP-1 inhibitor than the respective untreated control. Furthermore, the CTC from the 4D model seeded with H460 ($p = 0.04$), A549 ($p = 0.008$), or H1299 ($p = 0.01$) cells treated with AP-1 inhibitor had significantly fewer viable tumor cells after being cultured in a petri dish for 4 days than the respective untreated control group. However, the parental H460 ($p = 0.87$), A549 ($p = 0.93$) or H1299 ($p = 0.25$) cells grown on a petri dish treated with AP-1 inhibitor had no difference in the number of tumor cells compared to the untreated control group after 4 days.

CONCLUSIONS: The AP-1 inhibitor, SR11302, inhibits metastatic lesion formation in the ex vivo 4D lung cancer model without having an effect on primary tumor growth. This is due to the presence of an independent yet common pathway among three cell lines involving AP-1 that is crucial for the survival of CTCs in the vasculature. The ex vivo 4D model may provide a tool to better understand the complex process of cancer metastasis.

F19. Therapeutic Implications and Prognostic Significance of c-Met in Esophageal Squamous Cell Cancer

*Ching Tzao[1], Chun-Ya Wang[2], Ban-Hen Chen[2], Guang-Huan Sun[2]

[1]Taipei Medical University, Taipei, Taiwan; [2]Tri-Service General Hospital, Taipei, Taiwan

Invited Discussant: *Nasser K. Altorki

OBJECTIVE: c-MET is a receptor tyrosine kinase (RTK) that has been shown to be overexpressed and may serve as a potential therapeutic target in a variety of human cancers. We aimed to study if c-Met expression correlates with patients' outcome with therapeutic implications in esophageal squamous cell cancer (ESCC).

METHODS: Expression of c-Met was analyzed by immunohistochemistry in tumors from 97 resected ESCC with correlative analysis with clinicopathologic variables. Cytotoxicity (MTT), cell migration, and assays for cell cycle and apoptosis were conducted in KYSE-510 and KYSE-170 ESCC cell lines in response to two c-Met inhibitors, SU11274 and PHA665752. Expression of cell cycle regulators, cyclin A and B1, tumor suppressors including Rb, p53 p21 and p27, and intrinsic apoptotic factors were determined by immunoblotting. Mice inoculated with KYSE 170 ESCC cell line were used to test effects of c-Met inhibitors in vivo.

RESULTS: Expression of c-Met within resected ESCC correlated positively with T status ($p = 0.008$), N status ($p < 0.001$), M status ($p = 0.048$) and stage ($p < 0.001$). Patients with low expression of c-Met showed better survival compared to those with high expression ($p = 0.0001$). SU11274 and PHA665752 significantly inhibited viability and migration of KYSE-170 and 510-ESCC cells with decreased expression of phosphorylated c-Met (p-c-Met). When treated with c-Met inhibitors, p27and p53 was upregulated with a concomitant decrease in cyclin-dependent kinase 6 (Cdk6) in KYSE-170 cells, whereas cyclin A and B1 were decreased in KYSE-170 cells with an induction of G1 or G2 cell cycle arrest. Apoptosis was induced by c -Met inhibitors with upregulation of pro-apoptic factors, Bcl-2-associated X protein (BAX) and BCL2- interacting killer (BIK) in KYSE-170 cells. Growth was significantly suppressed in murine tumors of KYSE-170 when treated with c-Met inhibitors with decreased expression in p-c-Met.

CONCLUSIONS: c-Met expression may serve as a predictor for poor prognosis in resected ESCC. c-Met inhibitors, SU11274 and PHA665752 had significant anticancer effects in ESCC cell lines in vitro and in vivo, suggesting that c-Met may serve as a potential therapeutic target for ESCC.

F20. Lysyl-Like Oxidase 2 (LOXL2) Is an Oncogenic Driver of Malignancy Regulated by miR-145 in Tobacco-Associated Esophageal Adenocarcinomas

Shakirat Oyetunji, Sichuan Xi, Said Azoury, David Straughan, Julie Hong, Mary Zhang, *David Schrump

National Institute of Health, Bethesda, MD

Invited Discussant: *Dao M. Nguyen

OBJECTIVE: Although recently implicated in the pathogenesis of esophageal adenocarcinomas (EAC), the mechanisms by which cigarette smoke mediates initiation and progression of these malignancies have not been fully elucidated. In this study, a novel in-vitro model system was used to examine the effects of cigarette smoke on microRNA (miR) expression during tobacco-induced esophageal adenocarcinogenesis.

METHODS: Immortalized esophageal squamous and Barrett's epithelia (Het-1A; CP-A, CP-C, respectively), and EAC lines (NCI-EsC1, NCI-EsC2, NCI-EsC3, OE-19, and OE-33) were cultured with or without cigarette smoke condensate (CSC) under relevant exposure conditions. Micro-array and qRT-PCR techniques were used to identify miRs consistently modulated by CSC in cell lines, with correlative analysis of EAC specimens/paired normal esophageal tissues. RNA crosslink immunoprecipitation, luciferase reporter assays, MTS, and xenograft experiments were performed to identify targets and characterize phenotypic effects of differentially expressed miRs.

RESULTS: Sixty miRs were significantly induced, whereas twenty-one were repressed following 5-day CSC exposure. Sixteen of the induced miRs are oncomirs, including miR-21 and miR-372, previously shown to be up regulated in esophageal cancers. Fourteen of the repressed miRs are tumor suppressors, including miR-487b and miR-217, which are epigenetically repressed in lung and esophageal cancers and silenced in normal respiratory and esophageal epithelia by cigarette smoke. miR-145, previously shown to be repressed in esophageal squamous cell cancers, was down-regulated in immortalized esophageal squamous and Barrett's epithelia, and EAC lines by CSC in a time and dose dependent manner. Endogenous levels of miR-145 were significantly lower in EAC lines/primary tumors compared to immortalized cells/normal mucosa ($p < 0.003$). Lysyl-like oxidase 2 (LOXL2), an oncogene not previously implicated in EAC, was identified as a novel, direct target of miR-145. CSC mediated repression of miR-145 coincided with up-regulation of LOXL2 expression in immortalized esophageal epithelia and EAC cells. Furthermore, repression of mir-145 coincided with over-expression of LOXL2 in EAC specimens, particularly those from smokers. Over-expression of LOXL2 significantly enhanced proliferation, invasion and migration of EAC in-vitro, and significantly increased tumorigenicity of EAC in athymic nude mice ($p = 0.006$); these findings were recapitulated with stable knock-down of miR-145 in EAC cells ($p = 0.011$; Figure 1).

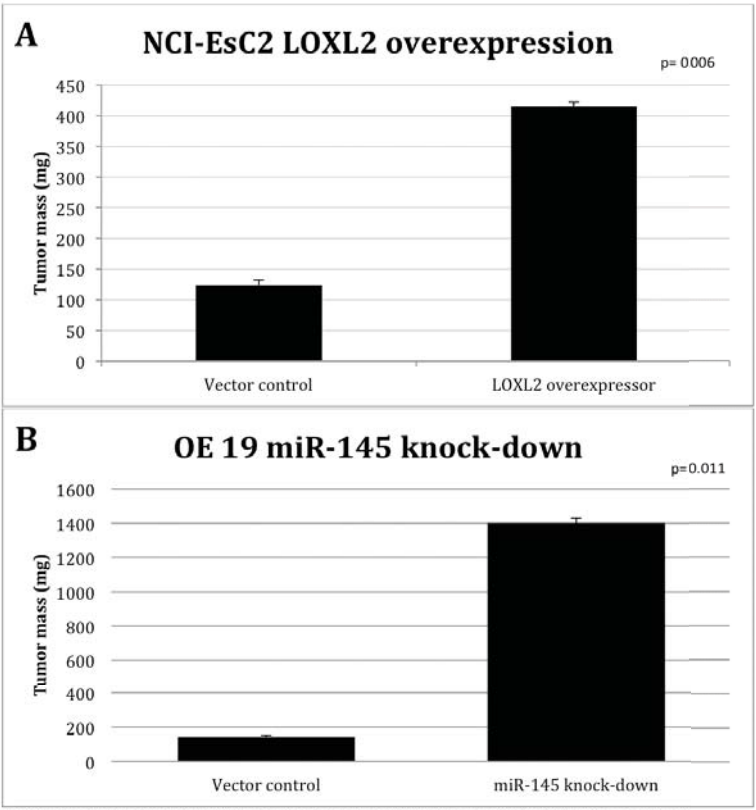


Figure 1. Increased tumorigenicity of EAC following overexpression of LOXL2(A) or knock-down of miR-145(B)

CONCLUSIONS: Repression of miR-145 up-regulates a novel oncogenic driver of malignancy during tobacco-associated esophageal adenocarcinogenesis. These findings warrant further efforts to target aberrant LOXL-2 expression by reactivation of mir-145, or direct inhibition of LOXL2 expression/activity for treatment of EAC.

8:40 AM ADJOURN

7:00 AM **ADULT CARDIAC EMERGING TECHNOLOGIES AND TECHNIQUES FORUM** Room 612, WSCC

5 minute presentation, 5 minute discussion

Moderators: *Y. Joseph Woo and *A. Marc Gillinov

Novel-Transcatheter Technologies

*Vinod H. Thourani, *Emory University*

T1. Early Clinical Results of Transapical Mitral Valve Replacement for Mitral Regurgitation

Anson Cheung[1], Robert Boone[1], Stephan Verheye[2], Moss Robert[1], Shmuel Banai[4], John Webb[1]

[1]St. Paul's Hospital, Vancouver, BC, Canada; [2]ZNA Middelheim Hospital, Antwerp, Belgium; [4]Tel Aviv Medical Center, Tel Aviv, Israel

OBJECTIVE: Mitral valve surgery remains the treatment of choice for mitral regurgitation (MR). However surgical risk remains high in the elderly, patients with comorbidities and poor left ventricular function. Transcatheter mitral valve replacement (TMVR) technology has been developed and may offer an alternative therapeutic option for these high-risk patients with severe symptomatic MR.

METHODS: The Tiara valve is a self-expanding, trileaflet, anatomical D-shaped mitral prosthesis for trans-apical implantation. Extensive preclinical experiments have been reported. Three patients with symptomatic MR were assessed by the Heart Team and deemed too high risk for conventional MV surgery and anatomically suboptimal for MitraClip. Canadian Special Access permission and patient consent were obtained. TMVR was carried out transapically via a left mini-thoracotomy under transesophageal and fluoroscopic guidance. Patients' demographics and baseline echo data are presented in Table 1.

RESULTS: Tiara valves were implanted uneventfully in all patients without any cardiopulmonary support. All patients were extubated in the hybrid operating room and no transfusions were required. Patients' outcomes are shown in Table 2. Echocardiograms demonstrated excellent prosthetic valve function with a low transvalvular gradient and no left ventricular outflow tract obstruction. There was trivial paravalvular leak (PVL) in the first patient at 48 hours which was completely resolved in subsequent studies and no PVL was detected in the other patients.

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Table 1:

#	Age/Gender	Etiology	NYHA	Comorbidities	STS (%)
1	73/M	Ischemic	4	CRI (HD), pulm fibrosis (DLCO-22%), CRT-D	47.7
2	61/F	Ischemic	3–4	Liver cirrhosis, CKD	5
3	39/M	Dilated	3	CKD, MitraClip abandoned	2.4

#	LVEDD (mm)	Vena Contracta (cm)	ERO (cm^2)	MR Grade	SPAP (mmHg)	LVEF (%)
1	76	0.64	0.59	Severe	65	15–20
2	62	0.80	0.62	Severe	45	25
3	94	0.62	0.70	Severe	60	20

Table 2:

Patient	LOS (days)	Days post Implant	MR Grade	Clinical Status
1	38	69 (expired)	Trivial	End-stage heart and renal failure. Palliative care. Expired
2	5	240	None	NYHA III, improvement in 6MWT
3	4	37	None	NYHA II

CONCLUSIONS: Transapical transcatheter mitral valve replacement is technically feasible and can be performed safely. Early prosthesis hemodynamic performance is excellent. Early clinical outcomes in these extreme risk patients were acceptable. TMVR may play an important role in the treatment of MR.

T2. Xenoantigenicity of Porcine Decellularized Valves

Meghana R.K. Helder[1], Ryan Hennessy[1], Tyra Witt[1], Daniel B. Spoon[1], John M. Stulak[1], Robert D. Simari[2], Amir Lerman[1]

[1]Mayo Clinic, Rochester, MN; [2]University of Kansas School of Medicine, Kansas City, KS

OBJECTIVE: The xenoantigenicity of porcine bioprosthetic valves has been implicated as one of the etiologies leading to calcification and subsequent valve failure. Decellularization has been touted to have the potential to erase the antigenicity of valves. We hypothesized that decellularization does not fully remove the antigenic nature of porcine heart valves.

METHODS: Porcine aortic valves were decellularized with 1% sodium dodecyl sulfate for 4 days. Frozen sections of decellularized cusps were stained with M86 antibody for α-gal epitope and analyzed using confocal microscopy (controls: positive – fresh non-decellularized cusps, negative – human valve cusps from autopsy). To test for non α-gal antigens, decellularized valves were implanted into the pulmonary position of 3 juvenile sheep (30–40 kg, 3–4 months of age), as sheep do not react to α-gal antigens. Sheep serum was obtained preoperatively, 1 week postoperatively, 1 month, and 2 months post implantation. Fresh frozen sections of sterilized decellularized porcine valve cusps were incubated with sheep serum. Both rabbit anti-sheep IgM:FITC (AbD Serotec) and donkey anti-sheep IgG:Alexa Fluor 594 (Life Technologies) were utilized as secondary antibodies. Our negative experimental controls utilized decellularized and sterilized sheep aortic valve cusps instead of porcine cusps. All samples were analyzed with confocal microscopy. Sheep C1q in the serum was quantified at different time points using an ELISA kit (Biotang, Inc.) and known standards of C1q.

RESULTS: Non-decellularized and decellularized porcine and porcine aortic valve cusps harbored α-gal epitopes. Human aortic valve cusps showed no evidence of α-gal epitopes. Testing of the sheep serum at different time points showed evidence of anti-porcine antibodies. Preoperatively, there was no staining of IgG or IgM anti-pig antibodies on the decellularized valves. However by 1 week time, anti-pig IgM antibodies were clearly visible on the valves. By 1 month postoperatively, anti-pig IgG antibodies were also evident. Sheep C1q serum concentrations also increased at the different time points. Preoperatively, C1q in the sheep serum was 2.5 ± 0.8 IU/mL. At 1 week, the concentrations rose to 4.6 ± 1.3 IU/mL and reached their peak at 1 month (6.4 ± 1.6 IU/mL). There was a statistically significant difference between preoperative concentrations and concentrations at 1 week ($p = 0.01$), 1 month ($p < 0.0001$), and 2 months ($p = 0.002$); 1 week and 1 month concentrations were also different ($p = 0.03$).

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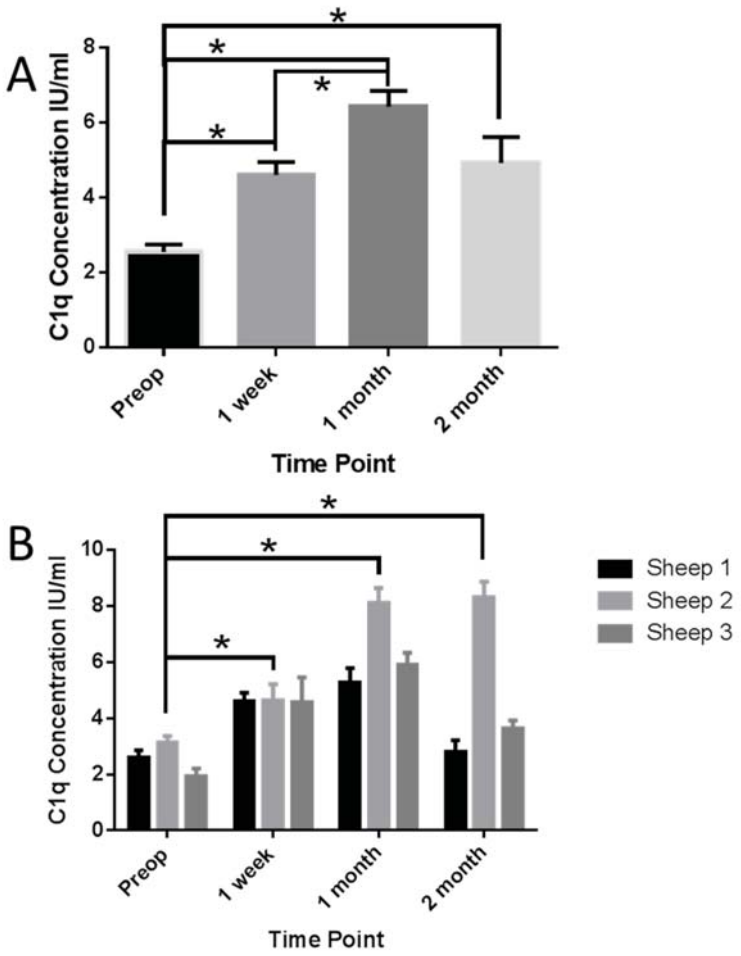

CONCLUSIONS: Decellularization with 1% sodium dodecyl sulfate does not eliminate α-gal or non α-gal antigens. Other forms of antigen removal must be sought as decellularization alone will likely not defer immune mediated calcification of porcine valves. Evaluation of any new commercial decellularized porcine valves should include antigen testing prior to implantation.

T3. Less Invasive Surgical Treatment for Acute Type A Aortic Dissection Involving the Arch in High-Risk Patients: A Comparative Study of Hybrid Total Arch Repair and Conventional Total Arch Replacement

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

OBJECTIVE: Acute type A aortic dissection (ATAAD) involving the aortic arch is an inherently lethal condition, and the optimal surgical strategy remains controversial. Conventional total arch replacement plus stented elephant trunk (C-TAR + SET) with deep hypothermic circulatory arrest (DHCA) has been the standard surgical option at our institution. In selected high-risk patients, we have attempted less invasive hybrid total arch repair (Hybrid-TAR) involving supraaortic bypass and endovascular stent-graft placement without DHCA. We review the early and long-term outcomes to clarify the impact of the hybrid procedure.

METHODS: From November 2009 to December 2013, patients with ATAAD undergoing surgical repair at our institution were prospectively entered into a database. Data were extracted for ATAAD patients with arch involvement: group (A) Hybrid-TAR (n = 50); group (B) C-TAR + SET (n = 136). The operative technique of Hybrid-TAR includes (Figure 1): 1 Ascending aortic replacement with a 4-branch Dacron graft (creating a Dacron ascending zone 0); 2 Three branches connected to the supraaortic arteries (arch debranching and supraaortic bypass); 3 Antegrade guidewire positioning and deployment of an endograft via the branch of the Dacron graft into the arch and the descending aorta. The early and long-term data were investigated. Early outcomes of interest were in-hospital mortality, postoperative morbidities and length of ICU stay. Long-term survival was evaluated with Cox regression and propensity score analysis. Computed tomography angiography was used to evaluate the fate of descending aorta after repair.

RESULTS: Patients in Hybrid-TAR group were significantly older (p = 0.01) and had a higher EuroSCORE (p = 0.01). Univariate analysis for early outcomes showed significant benefits from Hybrid-TAR for pulmonary complications (8.0% vs. 14.7%; p = 0.009), renal failure (8.0% vs. 12.5%; p = 0.03), and length of ICU stay. After adjusted for baseline characteristics and propensity analysis, there was still a benefit of Hybrid-TAR. During follow-up, Kaplan-Meier event-free survival analysis for long-term outcomes showed that death occurred more frequently in Hybrid-TAR group (p = 0.026). However, Cox regression and propensity analysis showed that total mortality was similar in the two groups (HR, 1.45; 95% CI [0.89 to 1.78]). The observation of complete thrombosis formation of false lumen at the level of the left inferior pulmonary was also similar between the two groups (89.4% vs. 84.9%; p = 0.14).

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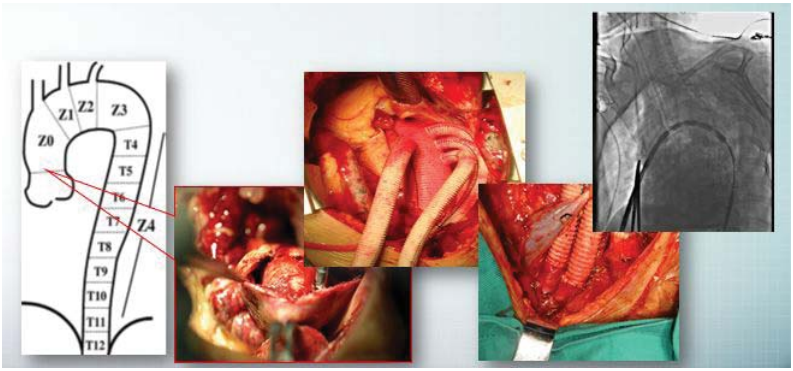

CONCLUSIONS: The early and long-term outcomes of Hybrid-TAR demonstrated the superiority of the combination of the surgical and interventional approaches while avoiding the weaknesses associated with DHCA for high-risk patients with ATAAD involving the arch. This procedure has the potential to be an alternative for conventional total arch replacement for high-risk patients.

T4. Five Years Clinical Outcome of Endoscopic Versus Open Radial Artery Harvesting: A Propensity-Score Analysis

Gianluigi Bisleri[1], Laura Giroletti[1], Tomasz Hrapkowicz[2], Martina Bertuletti[1], *Marian Zembala[2], Mario Arieti[3], *Claudio Muneretto[1]

[1]University of Brescia Medical School, Brescia, Italy; [2]Silesian Center for Heart Diseases, Zabrze, Poland; [3]Ospedale di Desenzano, Desenzano, Italy

OBJECTIVE: During the past decade there has been an increased interest towards endoscopic radial artery harvesting (ERAH) techniques as an alternative to the conventional approach in order to reduce pain and wound complications. Nevertheless, concerns have been raised about the potential detrimental effects of the endoscopic technique in terms of conduit damage and worse late clinical outcomes when compared to the conventional "open" technique.

METHODS: From January 2001 to August 2014, 470 patients underwent CABG with the use of a radial artery (RA) conduit: 420 patients were matched according to parameters such as age, sex, diabetes, peripheral artery disease, number of diseased coronary vessels and target anastomotic site (for the RA) and assigned either to Group 1 (G1, open technique, n = 82) or Group 2 (G2, endoscopic approach, n = 82) according to the harvesting technique. Endoscopic harvesting was performed via a reusable retractor and a disposable vessel sealing system (with impedance-controlled bipolar radiofrequency). Primary end-point was cardiac related mortality while secondary end-point was the survival free from major cardiac and cerebrovascular adverse events (MACCEs: defined as cardiac related death, myocardial infarction, need of PTCA reintervention, need for redo surgery and stroke). Moreover, hand/forearm sensory discomfort (including pain assessment: VAS score, paresthesia, and dysesthesia) and forearm wound healing (Hollander scale) were also assessed.

RESULTS: No conversion occurred to the open technique in G2. No patients in either group showed hand ischemia; wound infection occurred only in the open group (G1 = 7.3% vs. G2 = 0%; p = 0.007). Wound healing (Hollander scale) was considerably better in the endoscopic group (G1 = 3.3 vs. G2 = 4.7; p < 0.001) as well as neurological(sensory) complications, also at the latest follow-up(G1 = 19.5% vs. G2 = 6%; p < 0.001). Pain (VAS score) was significantly reduced with the endoscopic technique (G1 = 3.2 vs. G2 = 1.2; p = 0.003). At 5-year follow-up, freedom from cardiac related mortality (G1 = 96.3 ± 2.1% vs. G2 = 98.1 ± 1.8%; p = 0.448) as well as survival free from MACCEs (G1 = 93.9 ± 2.6% vs. G2 = 93 ± 3.4%; p = 0.996) was similar among the groups.

CONCLUSIONS: Endoscopic radial artery harvesting allows for incremental benefits at short term in terms of improved cosmesis, reduced wound and neurological complications without yielding detrimental effects in terms of graft related events at 5-year follow-up.

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T5. Point-of-View Video Streaming Promotes Enhanced Resident Surgeon Training and Assessment while Maintaining Quality Assurance and Patient Care

Andrew C.W. Baldwin, Hari R. Mallidi, *William E. Cohn, Goutham Dronavalli, Amit Parulekar, Steve K. Singh

Baylor College of Medicine, Houston, TX

OBJECTIVE: Surgical residency training has traditionally relied on self-study combined with intraoperative evaluation and feedback. As work-hour restrictions have limited the extent of the latter, contemporary advances in surgical education have focused on skills lab exercises and virtual models. Our aim was to evaluate the feasibility and educational potential of a novel point-of-view technology (Google Glass™) to improve resident training, performance, and assessment intra-operatively.

METHODS: A single resident surgeon was trained to use the Explorer Edition Google Glass (Google Inc., Mountain View, CA), a wearable 'smart' camera chosen for its heads-up display, hands-free capability, and wireless connectivity. Intraoperative use focused on the integration of heads-up software and live video streaming. Surgical checklists for selected procedures were uploaded to a secure Google Drive™ folder and accessed by the Glass™ headset display to validate case-specific milestones. Video streaming was enabled using Livestream™ software (Livestream, Brooklyn, NY), broadcast to a secure website accessible via desktop and smartphone displays. Primary outcomes consisted of technological feasibility, adherence to methodology, application to resident training and patient safety and quality assurance. Informed consent was ensured prior to use of the device.

RESULTS: Ten consecutive procedures were performed: left internal mammary harvest (3), femoral vessel exposure and cannulation (3), donor heart procurement (2) and donor lung procurement (2). The method of use proved feasible, with proper adherence in all cases. Hands-free voice commands allowed for sterile manipulation of both the camera and heads-up checklist display. In each case, a supervising physician was able to successfully observe the video feed and provide real time communication of feedback. All recorded media was stored for retrospective individual and peer review and the compilation of a multimedia database, establishing the feasibility of practical and high-fidelity performance assessments. No complications occurred during the course of the series, and patient safety and quality assurance was maintained.

CONCLUSION: This is the first reported clinical application of wearable technology to provide both real-time video streaming and live-action checklist confirmation for the purpose of enhanced resident training and quality assurance. Intraoperative use of Glass™ is feasible, safe and capable of expanding opportunities for resident training and education. In addition to the potential for improved feedback, postoperative review suggested the utility of maintaining a compendium of procedures as a form of virtual case log. Further research is warranted to explore applications of this technology and to assess metrics of improved resident performance.

T6. Enabling Minimally Invasive Atraumatic Repair of Intracardiac Septal Defects with Light

Assunta Fabozzo[1], Ellen T. Roche[2], Yuhan Lee[3], Panagiotis Polygerinos[2], Ingeborg Friehs[1], Lucia Schuster[2], Alejandra M. Casar Berezaluce[1], Alejandra Bueno[1], Nora Lang[1], Maria J.N. Pereira[3], Eric Feins[1], Steve Wassermann[4], Eoin D. O'Cearbhaill[3], Nikolay V. Vasilyev[1], David J. Money[2], Jeffrey M. Karp[3], Conor J. Walsh[2], *Pedro J. Del Nido[1]

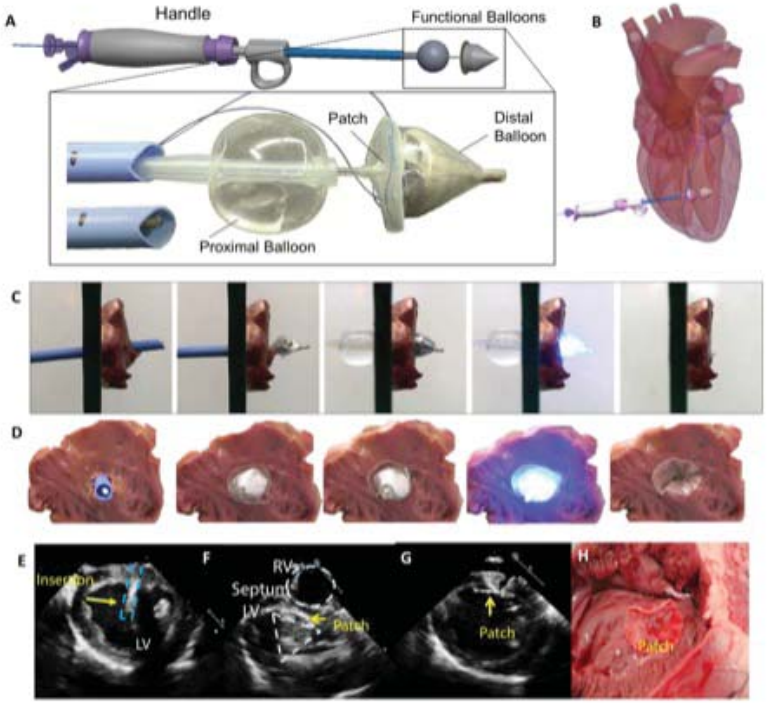
[1]Boston Children's Hospital and Harvard Medical School, Boston, MA; [2]Wyss Institute and Harvard University, Cambridge, MA; [3]Brigham and Women's Hospital Harvard Medical School, Cambridge, MA; [4]Massachusetts Institute of Technology, Cambridge, MA

OBJECTIVE: To develop a catheter-based device that enables closure of cardiac defects minimally invasively with an elastic biodegradable patch and hydrophobic light-activated adhesive (HLAA), based on poly(glycerol sebacate). This novel technology can overcome limitations of current therapies, being less invasive than suture-based surgical techniques and avoiding tissue erosion and conduction block associated with metallic occluder devices.

METHODS: A catheter-based device was prototyped with the following components (Figures A and B); a dual shaft delivery system, a distal inflatable balloon (coated with 150 nm of aluminum for UV light reflection) for glue activation, a single lumen nylon shaft for distal balloon inflation and optical fiber insertion, an optical fiber and a UV light source, an outer distal balloon for patch deployment and a proximal balloon for device stabilization on the septum. The device was tested on a portion of septum for ex vivo trans-cardiac patch delivery (n = 3; Figure 1 C through D). HLAA is activated by UV light and its adhesion strength under various pre-loads was evaluated by pull-off testing (n = 3). Burst pressure experiments were conducted with the patch adhered to fresh cardiac tissue (n = 5) to determine the optimal defect/patch size ratio and patch location (left vs right side of the septum). Subsequently device feasibility and efficacy were evaluated in an ex vivo porcine heart at physiological pressures (n = 3). Finally, proof-of-concept in vivo experiments were performed in pigs (n = 3) to further evaluate procedural feasibility and defect repair. Echocardiography was used to measure septal defect diameter before and after patch implantation.

RESULTS: Ex vivo experiments (Figures C and D) demonstrated successful adhesion to septum after patch delivery and glue activation. The adhesive strength of HLAA on endocardium was measured at 2.1 ± 0.41 N/cm^2. In vitro burst pressures of 300 mmHg and 50 mmHg for patch placement on the left and right side of the septum respectively, with a patch/defect ratio of 2:1. The procedure was successfully performed in a pressurized ex vivo heart. Finally, proof-of-concept of device functionality was successfully demonstrated in vivo in a large animal model under 2D and 3D echo guidance (Figures E through H), with a reduction of defect diameter from 6.4 mm to 1.6 mm.

*AATS Member



CONCLUSIONS: We have designed a light-reflecting catheter-based device for trans-cardiac closure of septal defects that delivers a UV-light activated adhesive for atraumatic attachment of an elastic patch to the endocardium, eliminating the need for sutures or double disc designs for patch attachment. The use of a biocompatible and biodegradable material as a scaffold for patch endothelialization minimizes local tissue damage. This system has potential to reduce operative times and invasiveness of surgery, prevent tissue erosion and consequently should improve procedural outcomes.

Cutting Edge Mechanical Circulatory Support Technology

*William E. Cohn, *Texas Heart Institute*

8:40 AM ADJOURN

7:00 AM **GENERAL THORACIC EMERGING TECHNOLOGIES AND TECHNIQUES FORUM** Room 603, WSCC

5 minute presentation, 5 minute discussion

Moderators: *Stephen R. DeMeester and *Shanda H. Blackmon

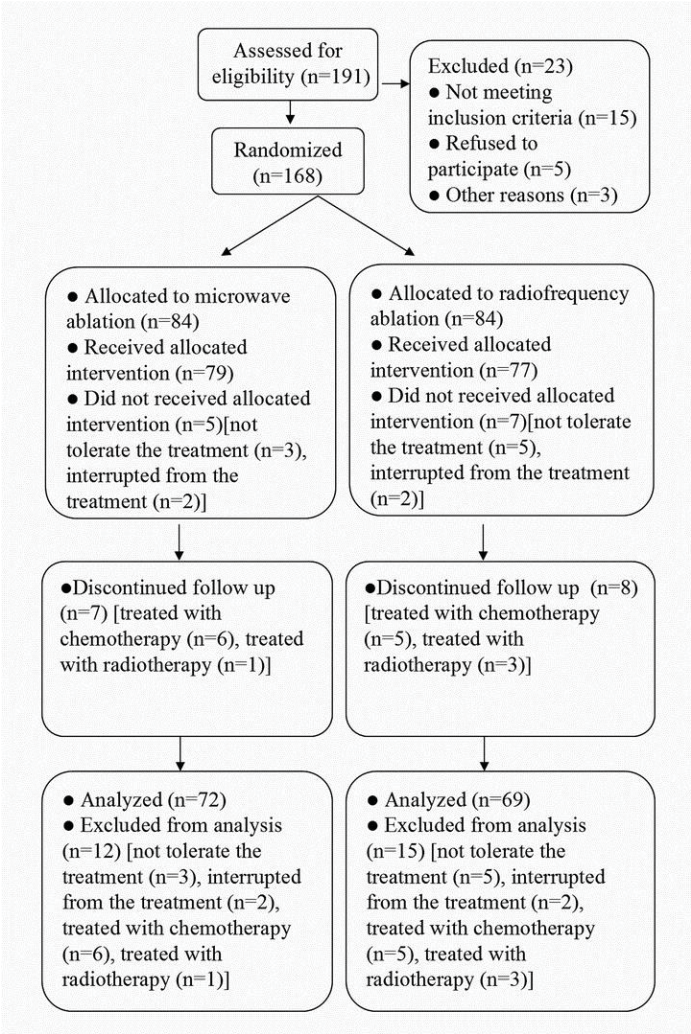
T7. Comparison of Microwave Ablation and Radiofrequency Ablation Therapy for Nonsurgical Lung Malignancies

Qiang Lu, Yongan Zhou, Lijun Huang, Xiaofei Li
Fourth Military Medical University, Xi'an, China

OBJECTIVE: To evaluate the curative efficacy and safety in treating inoperable malignant lung masses with radiofrequency ablation (RFA) and microwave ablation (MWA).

METHODS: Patients with medically inoperable or refused surgery were treated in this study, which comprised 100 patients with NSCLC and 41 patients with inoperable metastases from other tumors. The total patient population was equally divided into two treatment groups using a computer generated randomization scheme (Figure 1). The correlation between tumor diameter and local progression after ablation and 5-year survival rates were compared for the two therapies.

RESULTS: The study was conducted between 1 May 2007 and 1 May 2009. Informed consent was obtained from all patients prior to any procedure being undertaken. All 141 patients who were entered onto the study and completed therapy had undergo CT-guided RFA and MWA for malignant lung masses. The results showed that pneumothorax was the most frequent complication and occurred in 29 patients (20.57%) after ablation. Neither needle track implantation was found nor did patient death occur in these patients within 30 days. Local progression rate of tumor masses within 5 years reached to 28.50% (N = 53) in total. Significant difference was found with tumor diameters >3 cm between MWA and RFA group for local progression (RR = 0.176; p = 0.029). During the observed period, the overall median survival of MWA and RFA were 20.000 ± 2.690 months and 23.000 ± 2.373 months respectively. No significant difference was found between MWA and RFA for the survival rates.



CONCLUSIONS: MWA and RFA provide satisfactory alternative methods for managing nonsurgical lung malignancies. Complications associated with both thermal ablative modalities were generally self-limiting. MWA was associated with a lower risk of local progression than RFA and might be more effective in treating larger lung tumors.

Interventional Management of Lung Cancer

*Hiran C. Fernando, *Boston Medical Center*

T8. Efficacy and Safety of Novel Modified Nuss Procedure for Pectus Excavatum with A New Steel Bar

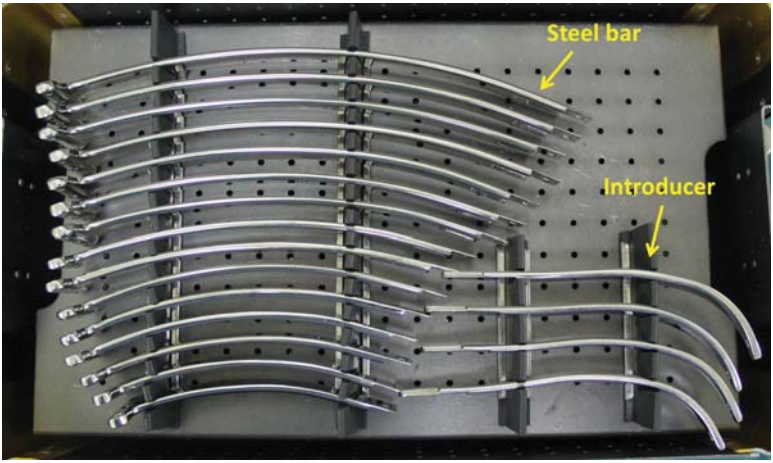
Ju Mei, Guoqing Li, Zhaolei Jiang, Haibo Xiao, Mingsong Wang, Fengqing Hu, Xiao Xie Xinhua Hospital, Shanghai Jiaotong

University School of Medicine, Shanghai, China

OBJECTIVE: This new steel bar was produced according to the normal structure of human anterior chest wall. One end of the steel bar was fused with a bar stabilizer, and the other end was designed to connect with the introducer or stabilizer. The steel bars were divided into large size and small size by the different length, thickness and width. The small size was used for children, and the large size was used for adolescent or adult. The aim of this study was to examine the efficacy and safety of this novel modified Nuss procedure for pectus excavatum with the new steel bar.

METHODS: From July 2010 to July 2011, 147 patients with pectus excavatum underwent this novel modified Nuss procedure. There were 118 male and 29 female patients. Patients' age ranged from 3 to 35 years old (mean: 10.35 ± 6.72 years; median 9 years). 102 patients had symmetric pectus excavatum, 35 patients had asymmetric pectus excavatum, and 10 patients had recurrent pectus excavatum. Mean CT index was 4.83 ± 1.41 (range: 3.38–15.23). The procedure was performed with the new steel bar through bilateral thoracic minimally invasive incision under the guidance of thoracoscope. A 5 mm diameter thoracoscope was inserted into the right thoracic cavity via the right 6th~8th intercostal space on the middle axillary through a trocar to guide and monitor the procedure. Bilateral vertical skin incisions with the length about 1.5–2.5 cm were made near the middle axillary line. For patients with recurrent pectus excavatum, a small vertical subxiphoid anterior chest wall incision was crested to bluntly dissect the retrosternal adhesions. The bar was installed or removed by pushing and pulling without turning over. It was removed between 1.5 to 4 years after placement depending on the growth.

RESULTS: Mean operation time was 25.25 ± 2.37 minutes for the primary pectus excavatum and 63.76 ± 29.15 minutes for the recurrent. Blood loss was less than 10 ml for the primary and 115~290 ml for the recurrent. Mean postoperative hospital stay was 4.85 ± 0.22 days. There was no perioperative death or cardiac perforation. At a mean follow-up time of 35.8 ± 5.2 months, wound infection occurred in 5 patients (3.4%). Follow-up chest X-ray showed that steel bar was in the original position in 132 patients (89.8%). Only 3 patients (2.0%) with bar displacement required reoperation. During the follow up, 134 patients had bar removal. Of the 134 cases, the initial orthopedic and functional results were excellent in 121 patients (90.3%), good in 13 patients (9.7%). No patient had recurrence. Compared with preoperative CT index, postoperative CT index was significantly decreased after the bar removal (4.87 ± 1.72 vs. 2.67 ± 0.18; $p < 0.01$; median 4.54 vs 2.59; $n = 134$).



CONCLUSION: This novel modified Nuss procedure with the new steel bar was a safe, effective and convenient treatment for pectus excavatum.

T9. Easy and Safe Visualizing Method for Creating Intersubsegmental Plane by Bronchial Closure Using Slip-Knot in Thoracoscopic Lung Anatomical Subsegmentectomy

Hirohisa Kato, Hiroyuki Oizumi, Makoto Endoh, Jun Suzuki, Hikaru Watarai, Mitsuaki Sadahiro

Yamagata University, Yamagata-shi, Japan

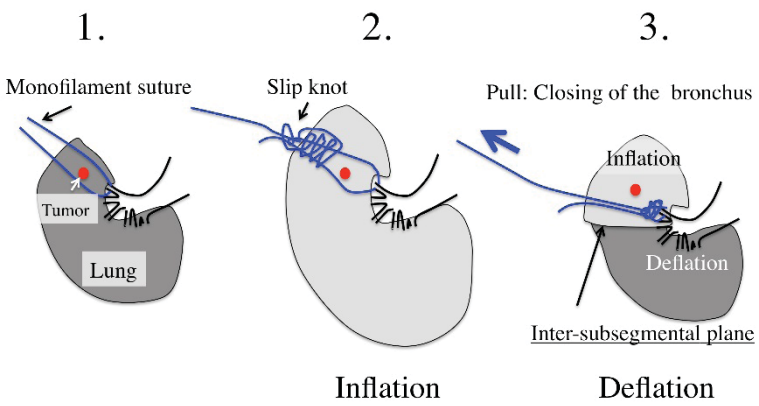
OBJECTIVE: The visualization of an inter-segmental and inter-subsegmental plane is a key process in segmentectomy and subsegmentectomy. Therefore, several previous reports have documented various methods for delineating the inter-segmental plane for a segmentectomy. However, it is difficult to delineate an inter-subsegmental plane in thoracoscopic surgery using conventional methods (i.e., selective air supply using a bronchoscope or injection of dye using a needle into the target subsegmental bronchus) because subsegmental bronchi are very thin and the working space is limited in thoracoscopic surgery. In order to carry out thoracoscopic subsegmentectomy for small-sized lung cancers, it is necessary to overcome difficulties of creating the inter-subsegmental plane. We therefore thought up a method for creating an inter-subsegmental plane during thoracoscopic subsegmentectomy and examined the usefulness of this technique.

METHODS: The target subsegmental bronchus is threaded with a monofilament suture before bilateral lung inflation. The monofilament suture is pulled to close the bronchus after inflation using a slip-knot. The inflation-deflation line becomes visible (see Figure). The parenchyma is then dissected along the inter-subsegmental line using an energy device.

Between 2008 and 2014, 56 patients underwent thoracoscopic subsegmentectomy and segmentectomy combined with adjacent subsegmentectomy. From 2010 onward, the method was used in 39 patients (uni-subsegmentectomy, 17; bi-subsegmentectomy, 7; tri-subsegmentectomy, 3; segmentectomy combined with adjacent subsegmentectomy, 12). We carried out a retrospective assessment of the targeted bronchial size, tumor size, pathological diagnosis, accuracy in sufficient surgical margins, operation time, bleeding volume, chest tube duration, and post-operative hospital stay.

RESULTS: Fifty-six subsegmental bronchi were closed by this method. The mean bronchial size was 4.6 mm (range: 3.0–7.2 mm), and the mean tumor size was 18 mm (range: 5–35 mm). Tumors were removed completely in all cases. A total of 33 patients were diagnosed with lung cancer, 9 had metastatic lung tumors, and 2 had benign tumors. The ratio of accurate creation of an inter-subsegmental line was 86.4% (6 cases needed additional resection). The mean surgical time was 168 minutes (range: 71_275 minutes), and the median bleeding volume was 10 mL (0–400 mL). Surgical duration and bleeding volume were both reduced significantly after introduction of this method. The median chest tube duration was 1 day, while median post-operative hospital stay was 7 days. No complications or recurrences occurred during a mean follow-up period of 20.4 months.

Figure



CONCLUSIONS: Our visualizing method for creating an inter-subsegmental plane by bronchial closure using Slip-knot was very useful and safely enabled a reliable procedure in thoracoscopic subsegmentectomy.

T10. Near Infrared Image-Guided Lymphatic Mapping to Determine the Extent of an Adequate Lymphadenectomy in Early Stage Esophageal Cancer

Krista J. Hachey, Denis M. Gilmore, Katherine W. Armstrong, Sean E. Harris, Jon O. Wee, *Yolonda L. Colson

Brigham and Women's Hospital, Boston, MA

OBJECTIVE: To evaluate an intraoperative, minimally invasive NIR image-guided approach to lymphatic mapping in esophageal cancer patients for safety and feasibility. Esophageal cancer is an aggressive malignancy with locoregional recurrence rates ranging from 14–34%. Thus, extensive lymph node (LN) dissection is recommended to remove occult disease. While the bulk of harvested LNs are local (on the esophageal specimen), no techniques are available to determine which regional LNs (off the esophagus) are most critical for an adequate lymphadenectomy (LAD). We hypothesize that NIR identification of regional LNs at greatest risk for metastases for focused histologic analysis has significant potential to assist in a targeted LAD and improve clinical outcomes in esophageal cancer. Here we present the results of our first-in-human pilot trial for safety and feasibility using this technology.

METHODS: Ten patients with early stage T1-T3 GE junction esophageal cancer underwent NIR lymphatic mapping following peritumoral injection of Indocyanine Green (ICG). Standard assessment for staging and minimally invasive surgical resection including LAD was performed. ICG was injected submucosally around the tumor via endoscopy, prior to esophagectomy. NIR imaging was performed in situ and on specimens ex vivo (see Figure).

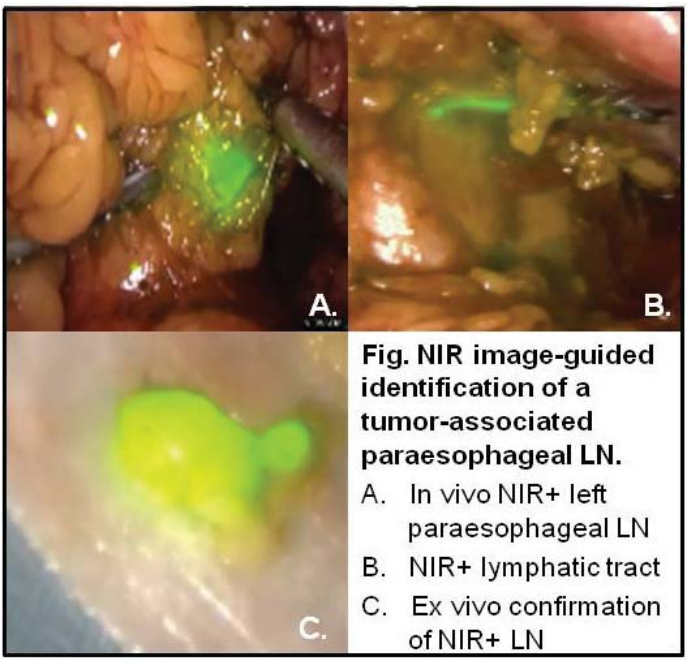


Fig. NIR image-guided identification of a tumor-associated paraesophageal LN.

A. In vivo NIR+ left paraesophageal LN
B. NIR+ lymphatic tract
C. Ex vivo confirmation of NIR+ LN

*AATS Member

RESULTS: The mean number of LNs resected for T1 and T2/T3 lesions were 21.5 (range: 18–25) and 29 (range: 22–40) respectively. Pathologic LNs were identified in 5 cases: all were local LNs removed en bloc with the esophageal specimen. NIR imaging was successfully performed in all patients, without adverse events. NIR imaging revealed 2-6 NIR+ tumor-draining regional LNs per patient in diverse locations including the pericardial, left gastric, paraesophageal and celiac axis stations (n = 6). Analysis of NIR+ regional LNs was reflective of the overall regional nodal status with no additional disease identified in other regional LNs.

CONCLUSIONS: This is the first study to examine lymphatic mapping of regional LNs in esophageal cancer using intraoperative, minimally invasive, NIR imaging. This study establishes that NIR lymphatic mapping is feasible and safe in esophageal cancer and that specific tumor-draining regional LNs can be identified. We hypothesize that, if successful, rapid intraoperative staging of NIR+ regional LNs may permit a "targeted LAD" approach and assist in determining whether a more extensive LAD is necessary, depending on the disease status of those identified LNs. The absence of disease in any regional nodes in this trial, even in the presence of positive peri-tumoral local nodes, suggests that directed assessment of regional nodal status may provide additional prognostic information in addition to the current nodal staging system and merits further study. This early success will provide the groundwork for an NIR lymphatic mapping protocol during esophagectomy.

Image-Guided Thoracic Surgery

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

T11. Endobronchial Treatment for Pneumothorax with Ongoing Air Leak by Using Intra Bronchial Valve System

Eitan Podgaetz, *Rafael Santiago Andrade, Felix Daniel Zamora, Heidi Gibson, Erhan Huseyin Dincer

University of Minnesota, Minneapolis, MN

BACKGROUND: Alveolopleural and bronchopleural air-leaks are one of the most common complications following pulmonary resection and iatrogenic or spontaneous pneumothorax, especially in patients with underlying lung disease. Prolonged air-leak is defined as an ongoing air-leak for more than 5 days after diagnosis. In selected patients with prolonged air-leaks, IBV treatment is minimally invasive, has the potential to shorten the duration of the air-leak, to reduce hospital stay and costs and to improve quality of life.

OBJECTIVE: The objective of this study is to analyze our experience with intrabronchial valve sytem (IBV) to manage patients with prolonged air-leaks, and to evaluate the safety and effectiveness of IBV in patients with prolonged air-leaks.

METHODS: We performed an Institutional Review Board-approved retrospective analysis of our experience from Nov/2013 to Oct/2014. We report our results as median with range.

RESULTS: We treated a total of 11 patients (6 females, 55%) with a median age of 60 (range: 38–90). The etiologies of pneumothorax and air-leak were iatrogenic in 5 patients, post-surgical in 2, secondary spontaneous in 2, and traumatic in 1. We placed IBVs in the desired airways in all patients without valve migration. All 11 patients were initially treated with tube thoracostomy without success. Median time from detection of air-leak to IBV placement was 10.5 days (5–16). After endobronchial valve placement all patients had successful resolution of the air-leak and removal of chest tube at a median of 2.7 days (range: 1–8 days). MEDIAN time from IBV placement to discharge from the hospital was 4.4 days (range: 1–13 days). Five patients have had the IBV removed without incident between 4 to 6 weeks after implantation.

CONCLUSION: In our limited experience, the use of IBV to treat patients with for prolonged air-leaks from various etiologies is safe and effective. Further evaluation of our experience will allow us to establish clear patient selection criteria, to develop a specific valve-removal protocol, and to calculate cost-effectiveness of IBV management of patients with prolonged air-leaks. We believe IBV management of prolonged air-leaks is a promising approach for this challenging patient population.

*AATS Member

T12. Successful 3D Printing of a Biologic Trachea

Faiz Y. Bhora, Sadiq S. Rehmani, Adnan M. Al-Ayoubi, Michael Barsky, Craig M. Forleiter, Ahmad Tawee

Mount Sinai St.Luke's Hospital and Mount Sinai Roosevelt Hospital, New York, NY

OBJECTIVE: Organ and tissue engineering is likened to the holy grail of medicine. 3D bioprinting is a novel tool that has significant potential for biomedical applications. Here we describe the utility of 3D printing technology to produce a tracheal scaffold based on accurate anatomic measurements using a biocompatible polymer capable of sustaining stem cells growth.

METHODS: Neck and Chest CT scans of an adult male volunteer were obtained and 3D reconstruction of the trachea and main bronchi was performed. The airways were isolated from the surrounding anatomy and transformed to a stereolithography (.STL) file, readable by the 3D printer. We used a fused-deposition modeling (FDM) printer to extrude the final shape. Polycaprolactone (PCL), a biocompatible and slowly degradable polymer was used as the biological "ink" to produce the scaffold. To assess the capability of the polymer to sustain stem cells growth, a separate mesh with an external lattice network of 500 micron diameter openings was designed, forming a modular repository for the stem cells. The polymer was pretreated with fibronectin to enhance cellular attachment. Mesenchymal stem cells were subsequently seeded on the lattice network and incubated in a bioreactor to initiate chondrogenesis. Cellular growth and survival was tracked using the DEAD/LIVE assay for four weeks.

RESULTS: The 3D printed biologic trachea was produced with high fidelity to the anatomic shape and wall thickness. Fluorescent microscopy showed successful growth of the mesenchymal stem cells maintaining >95% survival after four weeks of in vitro growth.

CONCLUSIONS: 3D bioprinting is a promising tool with great potential for advancing regenerative medicine. We report the first 3D printed biologic trachea using a biocompatible polymer capable of sustaining mesenchymal stem cells growth. Further in vivo experiments are warranted to establish the translational benefits of 3D bioprinting.

T13. Single Port Video-Assisted Thoracoscopic Thymectomy

Hyun Koo Kim, Kook Nam Han, Hyun Joo Lee, Young Ho Choi
Korea University Guro Hospital, Seoul, Republic of Korea

OBJECTIVE: Single port approach has been introduced in video-assisted thoracoscopic surgery (VATS) recently. We started single port VATS thymectomy through transthoracic approach for the first time and evaluated the feasibility and safety of this procedure.

METHODS: Twenty-three patients (10 men, 13 women; age, 56.4 ± 13.0 years) with thymic disease underwent single port VATS thymectomy from April 2010 to July 2014. An incision of around 2.5~4 cm was made at the 5 or 6th intercostal space at right, left or both sides. A single flexible port was placed to access the thoracic cavity and CO2 gas was insufflated. 5 mm sized thoracoscope, articulating gasper and sealing device were introduced through port channels.

RESULTS: Ten patients with thymic cyst were operated by right (8 patients) or left sided (2 patients) single port VATS approach. Eleven patients with stage I (6 patients) or II (5 patients) thymoma were operated by right sided (4 patients) or left sided (2 patients) or bilateral approach (5 patients). One patient with atypical carcinoid tumor was operated by bilateral approach; one with thymolipoma by right-sided approach. The operation time was 100.5 ± 54.6 minutes (range: 45–240), and no one needed additional port or open conversion. The chest tube was removed on average at postoperative day 2.6 ± 1.3 days (range: 2–5) and patients were discharged from the hospital without complications on average at postoperative day 3.5 ± 1.3 days (range: 3–6). During the follow-up period of 18.3 ± 13.3 months (range: 1.7–53.7), there were no recurrences and mortality except one patients with pleural recurrence.

CONCLUSIONS: These data demonstrate that single port VATS thymectomy is a technically feasible and safe procedure. Further work and development of a specific single port VATS thymectomy are needed to refine the use and advantages of this procedure.

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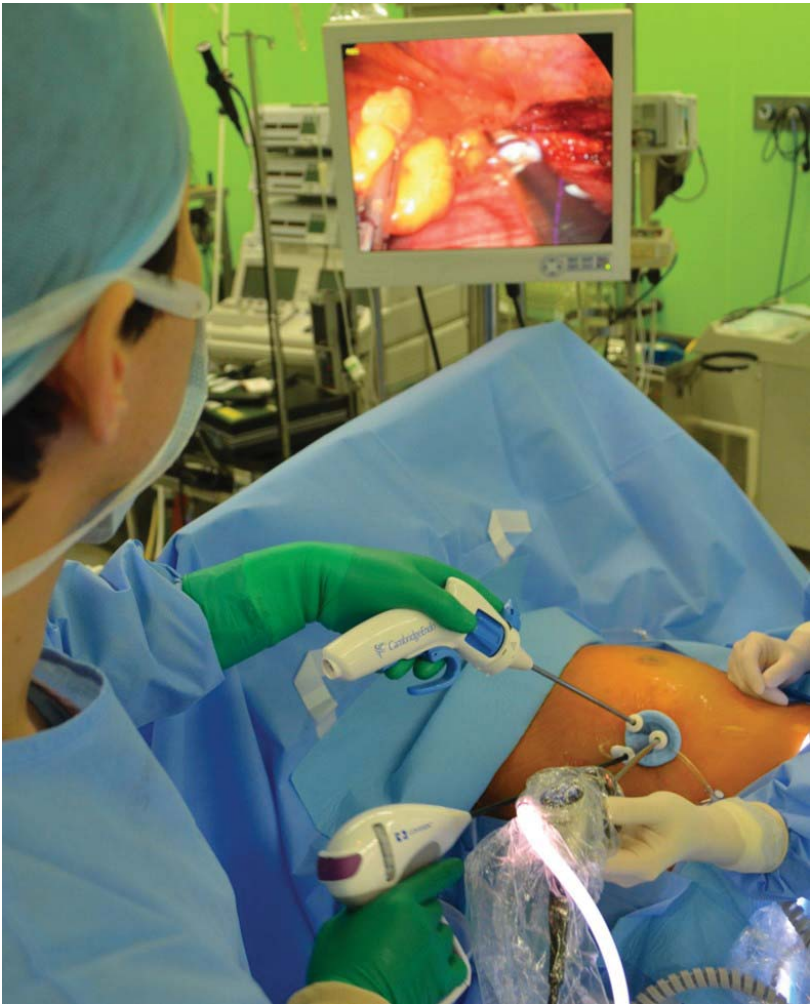


T14. Pneumonectomy for Locally Advanced Non-Small-Cell Lung Cancer After Neoadjuvant Concurrent Chemo-Radiation Therapy

Kazunori Okabe, Hiroyuki Tao, Toshiki Tanaka, Tatsuro Hayashi, Koichi Yoshiyama, Masashi Furukawa, Kumiko Yoshida Yamaguchi
Ube Medical Center, Ube, Japan

OBJECTIVE: The prognosis of locally advanced non-small-cell lung cancer is still poor. A new and highly effective treatment strategy is necessary to improve it.

Pneumonectomy after neoadjuvant concurrent chemo-radiation therapy for locally advanced non-small-cell lung cancer in our hospital was retrospectively reviewed.

METHODS: Retrospective analyses were performed for 16 consecutive patients who underwent pneumonectomy after neoadjuvant concurrent chemo-radiation therapy over the last 7 years. Our standard neoadjuvant chemo-radiation therapy consisted of cisplatin 40 mg/m^2 and docetaxel hydrate 40 mg/m^2 given on days 1, 8, 29, and 36 plus concurrent irradiation of 46 Gy (2 Gy/day) to the tumor, hilum, and mediastinum. Pneumonectomy was performed between 4 and 6 weeks after completion of the radiotherapy. No adjuvant treatment was given until recurrent lesion was found. The median age was 59 (41–70). There were 3 females and 13 males. Adenocarcinoma was present in 7, squamous cell carcinoma in 6, adenosquamous cell carcinoma in 1, large cell neuroendocrine carcinoma in 1, and atypical carcinoid which was preoperatively diagnosed as squamous cell carcinoma in 1. The pretreatment stage was IIIB in 6, IIIA in 8, IIA in 1, and IB in 1. The left side was involved in 13 and the right side in 3. The pretreatment very high tumor marker levels in blood were as follows: CEA 336.6 ng/ml, 104.8 ng/ml, 33.3 ng/ml, CYFRA 20.1 ng/ml, 11.2 ng/ml, and SCC 10.4 ng/ml, 8.5 ng/ml.

RESULTS: The median pneumonectomy time was 4 hours and 35 minutes (2 hours 35 minutes to 7 hours 30 minutes). The median bleeding amount was 175 g (60–560 g). Intrapericardial pneumonectomy was performed in 7 patients. All 16 cases were R0 resection. The first right bronchial stump was buttressed by the omentum, and the other right stumps and the left stumps were buttressed by the intercostal muscle. A pathologically complete response was obtained in 6 (38%) patients. The post operative stage was CR in 6, IIIB in 1, IIIA in 2, IIA in 3, IB in 1, and IA in 3. All abnormal blood tumor marker levels went down to normal after the treatment. At a median follow-up period of 3 years 4 months (1 year to 7 years 9 months), all patients were alive in excellent condition. Only two patients had recurrent tumors. There were already five 5-year-survivors whose pretreatment stages were IIIB in 4 and IIIA in 1. Toxicity was manageable, and no serious complication was noted. The mortality rate was 0%.

CONCLUSIONS: Pneumonectomy after neoadjuvant concurrent chemo-radiation therapy for locally advanced non-small-cell lung cancer is feasible and highly effective. This combined modality treatment strategy may greatly improve the prognosis of locally advanced non-small-cell lung cancer.

8:40 AM ADJOURN

*AATS Member

7:00 AM **VIDEO SESSION** Room 608, WSCC
10 minute presentation
Moderators: *Song Wan,* Joseph S. Friedberg, *Kazuhiro Yasufuku

V1. A Novel Technique of Aortic Root Reconstruction for Extensive Endocarditis: The Pericardial Skirt Technique

Kiyoshi Doi Kyoto
Prefectural University, Kyoto, Japan

BACKGROUND: Aortic valve endocarditis associated with aortic annulus destruction is a challenging condition. Successful treatment of this condition requires complete debridement of the necrotic and infected tissue that would result in extensive defects of aortic annulus.

In such cases, implantation of a valved conduit is necessary for aortic root reconstruction. Because obtaining complete adaptation between the conduit and the destroyed annulus is difficult, reconstruction of a severely destroyed aortic root involves the risk of catastrophic bleeding from the proximal anastomosis.

In the present report, we describe a technique for aortic root reconstruction that involves the use of a valved conduit with a bovine pericardial skirt at the proximal end. The skirt facilitated excellent fitting with the irregular and fragile annular plane following complete debridement.

CASE VIDEO SUMMARY: Once complete debridement in the aortic root was achieved, an appropriately sized valved conduit was selected. We used a stentless valve or a composite graft consisting of a stented tissue valve sewn onto a polyester tube graft. A doughnut-shaped bovine pericardial sheet was sewn around the proximal end of the valved conduit with 4-0 polypropylene continuous sutures. Thereafter, the valved conduit attached with the pericardial sheet (skirt) was secured to the destructed aortic annulus using a double-layered suture technique. The first row of sutures involved interrupted 2-0 braided polyester horizontal mattress sutures with pledgets that were placed through the remaining annulus or directly onto the left ventricular muscle and through the pericardial skirt. These interrupted sutures were usually tied over another pledget to prevent bleeding from the needle holes. For the second row of sutures, the pericardial skirt was appropriately trimmed, and continuous sutures with 4-0 polypropylene were placed through the skirt and surrounding tissue including the left ventricular/left atrial wall and remnant of the Valsalva sinus.

The technique was indicated only when more than half of the aortic annulus was destroyed (left ventricular-aortic discontinuity). In other cases annular reconstruction (simple closure of the abscess cavity) was performed using a bovine pericardial patch. Thus far, we have performed our proposed technique

in 3 patients.The stentless valve and composite graft has been used as a valved conduit in 2 patients and 1 patient, respectively. No instances of severe bleeding from the proximal suture line of the conduit have been noted in any of these cases. However, 1 patient died 5 days after the surgery due to heart failure. The other 2 patients remain well at 28 months and 40 months after surgery.

CONCLUSION: We believe that the simple technique described herein can be used to prevent bleeding from the proximal anastomosis during the reconstruction of a severely destroyed aortic root.

*AATS Member

V2. Use of Fluorescence Imaging to Define the Intersegmental Plane During Robotic Segmentectomy

William Ragalie[1], Jonathan Spicer[2], *David C. Rice[2]

[1]Medical College of Wisconsin, Milwaukee, WI; [2]University of Texas, Houston, TX

OBJECTIVE: Anatomic segmentectomy is an alternative to lobectomy in patients with lung malignancy and borderline pulmonary function or for patients with small (≤2 cm) primary lung cancers or isolated metastases. Robotic assisted surgery not only enables extremely accurate dissection of the segmental bronchi and vessels, but allows use of near infrared fluorescence to delineate the borders of the anatomic intersegmental plane.

CASE VIDEO SUMMARY: We present the case of a 55 year old male with a solitary metastatic lesion of a peripheral nerve sheath tumor in the right superior segment of the upper lobe. He underwent robotic assisted thoracoscopic segmentectomy. Intraoperatively, after division of the superior segmental artery, vein, and bronchus, indocyanine green was injected intravenously. Under near infrared fluorescence, this delineated the true anatomical parenchymal division between the superior segment and basilar segments and defined the plane for parenchymal transection. The patient had a small air leak that resolved spontaneously. His chest tube was removed on postoperative day two and he was discharged after radiograph demonstrated adequate expansion of the lung.

CONCLUSIONS: Use of near infrared fluorescence and intravenous indocyanine green is a unique feature of robotic assisted thoracoscopic surgery which enhances the anatomical planes encountered during anatomic segmentectomy. Delineation of the true parenchymal division between segments may decrease the incidence of prolonged air leak following segmentectomy.

V3. A Successful Case of Staged Fontan Operation for a Right Atrial Isomerism Patient with Pulmonary Atresia/MAPCAs, Complicated with Obstructed Supra-Cardiac Total Anomalous Pulmonary Venous Connection

Yujiro Ide, Masaya Murata, Maiko Tachi, Kisaburo Sakamoto
Mt. Fuji Shizuoka Children's Hospital, Shizuoka City, Japan

OBJECTIVE: Fontan completion for a patient with single ventricle, pulmonary atresia, and major aortopulmonary collaterals (MAPCAs) is still challenging. An accurate diagnosis and evaluation of MAPCAs and central pulmonary artery (cPA) are mandatory. We present a successful case of staged Fontan operation for a right atrial isomerism (RAI) patient with pulmonary atresia (PA)/MAPCAs, complicated with obstructed supra-cardiac total anomalous pulmonary venous connection (TAPVC), and introduce a novel method of intraoperative pulmonary angiography.

CASE VIDEO SUMMARY: A baby boy was delivered at 41 weeks of gestation with body weight 2836 g. He was referred to our hospital on day10 because of poor feeding and cyanosis. Echocardiography revealed single atrium, single right ventricle, RAI, PA/MAPCAs, bilateral superior vena cava, and supra-cardiac TAPVC. His pulmonary vein drained into the right SVC from its behind with stenosis of 11mmHg of pressure gradient. An angiogram was performed to obtain more accurate diagnosis of arborization of MAPCAs and it showed 3 MAPCAs originating from the descending aorta. Although there was no antegrade pulmonary blood flow from the single ventricle, he had a small central pulmonary artery(cPA) which seemed to communicate with all 3 MAPCAs within the lungs. Our concern was whether this small cPA could supply his lung segments sufficiently or not. So we planned intraoperative pulmonary angiography to clarify the distribution of cPA and communication between cPA and MAPCAs.

On day15, he underwent the first palliation with a body weight of 3.26 kg. After median full sternotomy, we put a small cannula directly into the main pulmonary artery(mPA) and injected contrast medium through it. It immediately revealed an adequate size of cPA which covered whole lung segments and clarified good communication with 3MAPCAs. So we decided to ligate the 3 MAPCAs on its root(Unifocalization) and put a modified Blalock-Taussig shunt to enhance the native PA growth, as well as obstructed TAPVC repair.

Although he required patch angioplasty for cPA stenosis at 8 months old, he underwent bilateral bidirectional Glenn shunt and cPA plasty at 14 months old, followed by fenestrated Fontan operation at 27 months of age using an intra-extracardiac conduit(to avoid the compression of repaired PV chamber). His postoperative PA pressure was about 10 mmHg and SpO2 was around 90%. Now he is in a good clinical condition 1 year after Fontan completion.

CONCLUSIONS: We successfully achieved fenestrated Fontan for single ventricle with PA/MAPCAs after staged palliation. Direct PA-graphy is useful to demonstrate central PA and communication with MAPCAs, which was uncertain by regular angiography. Pulmonary vascular bed can be reconstructed sufficiently to allow for cavopulmonary connections even in a patient who underwent unifocalization of MAPCAs.

V4. Fluorescence-Guided Placement of an Endo-Aortic Balloon Occlusion Device for Totally Endoscopic Robotic Mitral Valve Repair

David W. Yaffee, Didier F. Loulmet, Ans G. Fakiha, *Eugene A. Grossi
New York University, New York, NY

OBJECTIVE: Endo-aortic balloon occlusion (endo-balloon) replaces both the external aortic cross clamp and the aortic root line during totally endoscopic robotic mitral valve repair (TERMR). Used in 4000 patients annually this technique has the advantage of eliminating the clutter of a physical cross clamp in the surgical field and avoids the need to puncture the ascending aorta for cardioplegia, venting, and de-airing, simplifying the totally endoscopic procedure. Determining the position of the endo-balloon is indirect, using both limited transesophageal echocardiographic views and differential extremity hemodynamic monitoring, without the need for X-ray fluoroscopy. However, once the left atrium is opened to expose the mitral valve the echocardiographic window is lost, making it impossible to confirm or change the position of the endo-balloon using echocardiographic guidance. We sought to determine if the endo-balloon filled with the fluorescent dye indocyanine green (ICG) could be directly visualized using the fluoroscopic feature of the endoscope and whether this would facilitate placement and positioning of the endo-balloon.

CASE VIDEO SUMMARY: The endo-balloon is inserted through a side-port of the femoral arterial cannula and advanced into the ascending aorta over a guide wire using echocardiographic guidance. The balloon is inflated with an aqueous solution of ICG and albumin. The protein-bound ICG is excited by a near-infrared laser and fluoresces between ~750-950 nm allowing it to be clearly visualized as a green band through the aortic wall using the robotic fluoroscopic camera. The ICG-albumin solution is contained within the endo-balloon with no direct administration to the patient. We performed TERMR using ICG-inflated endo-balloons in 16 cases. The fluorescent endo-balloon was easily visualized and allowed the precise evaluation of balloon position in all cases.

This video demonstrates:

1) extended pericardiotomy with complete opening of the superior pericardium to provide visualization of the aortic root and ascending aorta

2) of echocardiographic visualization of the aorta when the left atrium is opened

3) easy visualization of the ICG-filled endo-balloon transilluminating the aortic wall using the fluoroscopic camera

4) quick and accurate repositioning of the ICG-filled endo-balloon under direct vision without echocardiographic guidance.

CONCLUSIONS: Inflation of the endo-balloon with the fluorescent dye ICG during TERMR allows for fast and accurate positioning and continuous real-time monitoring of endo-balloon location. This is particularly important when the left atrium is open and the echocardiographic window is lost. This technique simplifies the use of the endo-balloon and removes the uncertainty in its placement and positioning, obviating the need for X-ray fluoroscopy.

V5. Laparoscopic Transdiaphragmatic Thymectomy

*Rafael Andrade, Eitan Podgaetz, Andrew Shaffer, Chad Engelhart
University of Minnesota, Minneapolis, MN

OBJECTIVES: To describe the surgical steps of laparoscopic transdiaphragmatic thymectomy as a potential alternative for patients with non-thymomatous myasthenia gravis.

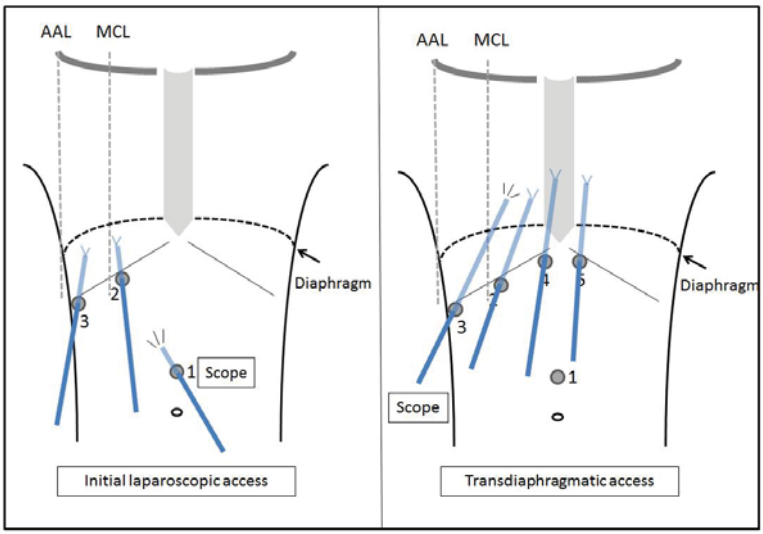
CASE VIDEO SUMMARY

PATIENT: A 39-year-old male with non-thymomatous myasthenia gravis.

PROCEDURE: Anesthesia and position:

We use general anesthesia with a single-lumen endotracheal tube. We place the patient supine, arms abducted, and flex the operating table to mildly extend the spine.

Initial laparoscopic access (the figure depicts port placement): We place one 12 mm supraumbilical port (port 1) and insufflate with CO2 to 15 mmHg, we then place 2 right subcostal 5 mm ports (ports 2, 3). We use electrocautery to make two small, peripheral diaphragmatic openings.



THORACIC ACCESS: We introduce the two right subcostal ports (ports 2, 3) into the chest cavity. Once the two subcostal ports are in the right chest, a 45° scope provides good visualization. Upon entering the chest, we deflate the abdominal cavity and insufflate the chest cavity with CO2 at 8–12 mmHg. Under direct vision, we place a right-sided 12 mm subxyphoid port (port 4) directly into the chest cavity. As the thymic dissection approaches the left pleural space, we place a left-sided 5 mm subxyphoid port (port 5).

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DISSECTION: The four intrathoracic ports (ports 2–5) provide visualization and access to the entire anterior mediastinum from phrenic-to-phrenic and from diaphragm-to-inlet. The dissection is akin to a routine thoracoscopic thymectomy. We remove the specimen with a bag through the right-sided 12 mm subxyphoid port site. We place 2 chest drains via the subxyphoid ports and remove the subxyphoid ports.

Final laparoscopic step: We pull the 2 right subcostal ports back into the abdomen, place the scope through the supraumbilical port, and repair the diaphragmatic openings with #2 non-absorbable pledgeted "U" stitches.

POST-OPERATIVE COURSE: We removed pleural drains on postoperative day (POD) 2 and discharged the patient on POD 3. He required transient nasogastric tube decompression for gastric distension. The patient stopped narcotic pain medications on POD 4.

CONCLUSIONS: Laparoscopic transdiaphragmatic thymectomy is a new procedure that provides appropriate access to the anterior mediastinum while avoiding intercostal incisions; this approach appears to be safe in a properly selected patient. The laparoscopic transdiaphragmatic access to the chest may represent a novel, less invasive option to perform thoracic surgery. However, further experience is warranted to clearly define patient selection criteria and technical limitations that will minimize the risk for complications.

V6. New Technique for Reconstruction of the Sternum and Diaphragm in Pentalogy of Cantrell

Renato S. Assad, André Ivan Bradley Santos Dias, Rogério Teixeira Silva, Petronio Generoso Thomaz, Silvia Rejane Fontoura Herrera, Denise Pedreira, Ana Cristina Aliman, Maria Fernanda Silva Jardim, Edilson C. Ogeda, Monica Lipay, Teresa Maria Lopes Oliveira Uras

Hospital Samaritano São Paulo, São Paulo, Brazil

OBJECTIVE: Pentalogy of Cantrell (PC) is a rare anomaly (6 per million live births). It consists of five anomalies: A deficiency of the anterior diaphragm, a midline supraumbilical abdominal w all defect, a defect in the diaphragmatic pericardium, congenital intracardiac abnormalities, and a defect of the lower sternum. We describe a new technique for reconstruction of the sternum and diaphragm in a case of complete PC.

CASE VIDEO SUMMARY: A prenatal ultrasound in a 24-year-old showed a fetus with ectopia cordis, ventricular septal defect (VSD), small right ventricle (RV) and a large omphalocele with evisceration of the heart and the liver. At 39-week gestational age, a girl was delivered by c-section (birth weight: 3,530 g). Wall defect was extending from the umbilicus to the upper third of the body of the sternum. There was a large omphalocele with evisceration of the heart, liver and intestines; on palpation the manubrium was intact. An echocardiogram confirmed a small RV, a large VSD (7.2 mm) and patent ductus arteriosus (PDA, 2.2 mm). CT scan revealed a deficiency of the anterior diaphragm, a midline supraumbilical abdominal wall defect, a defect in the diaphragmatic pericardium, congenital intracardiac abnormalities (VSD and small RV), and absent lower 2/3 of sternum. On the 9th day of life, she was submitted to surgical correction. A multidisciplinary team attempted to repair the sternal, diaphragmatic, pericardial and abdominal defects at the same time. The heart was situated directly under the skin, not protected by the ribs or the hypoplastic sternum. The anterior diaphragm was absent and a peritoneal-pericardial connection was found. The surgery was aimed to enclose the ectopic heart within pleural spaces by wide opening of both pleural cavities. PDA was ligated and a new central tendon of diaphragm was formed with rotation of the autologous pericardium and suture to the diaphragm border to separate thoracic from abdominal cavities. To protect the heart, the lower sternal wall was reconstructed with a custom made prosthesis made of Polymethyl methacrylate (PMMA), sutured to the ribs. Omphalocele wall was resected and the anterior abdominal wall defect (8 cm x 6 cm) was closed with a biologic graft (Surgisis Biodesign) to protect abdominal organs.

CONCLUSIONS: The use of PMMA for sternal reconstruction allowed for a mechanical protection to the heart and stability of the chest wall. Enclosure of the heart in the thoracic compartment was achieved with autologous pericardium with no hemodynamic impairment. When prenatal diagnosis of PC is suspected, a multidisciplinary approach is essential. A prenatal medical team consisting of a gynecologist, a neonatologist, a pediatric cardiologist, a geneticist, and a cardiovascular and pediatric surgeons should use their expertise in choosing the best approach to this severe disorder. This strategy may improve surgical outcomes of this rare malformation.

V7. Repair of Isolated Sinus of Valsalva Aneurysm Causing Right Ventricular Outflow Tract Obstruction

Walid K. Abu Saleh, Oday Al Jabbari, Alpesh Shah, Su Min Chang, Chun Lin, *Michael Reardon, Basel Ramlawi

Houston Methodist DeBakey Heart & Vascular Center, Houston, TX

OBJECTIVE: Isolated single sinus of Valsalva aneurysms are rare with an incidence of <1% of congenital heart disease repairs. We present a case of a 64 year old male presenting with right-sided heart failure symptoms caused by severely dilated right sub-coronary sinus of valsalva aneurysm causing right ventricular outflow tract obstruction.

METHODS: The surgical technique involved midline sternotomy, cardiopulmonary bypass with ascending aorta and bicaval cannulation. The defect was approached from the aortic root via transverse aortotomy as well as through a right ventriculotomy through the outflow tract (RVOT). The right ventricle was significantly enlarged on visual inspection. The right ventricular outflow tract (RVOT) obstruction was evident which was compressed by the aortic sinus aneurysm. We proceeded to open the ascending aorta and exposed the aortic valve. Inspection revealed a healthy tricuspid aortic valve with a large defect underneath the right coronary artery as advertised. The defect within the right sinus of Valsalva measured approximately 3 to 5 cm in diameter. Visualization of the aneurysm through a right atriotomy and tricuspid valve was not satisfactory. Resection of the aneurysm was carried through the sub-pulmonic RVOT incision and was oversewn using pledgeted 4-0 prolene sutures in a continuous fashion. The right ventricular outflow tract was enlarged with bovine pericardium. The aorta was inspected and 5 cm circular bovine pericardial patch was used to close the sinus of Valsalva aneurysm in a sub-coronary manner using running 5-0 prolene.

RESULTS: Appropriate CT angiography and cardiac MRI imaging were performed to assess the location of the aneurysm and cardiac function. We had a successful repair of a rare non-ruptured aneurysm of the right sinus of valsalva (7.6 cm x 5.5 cm) with RVOT compression through patch repair of the sub coronary sinus, resection of the aneurysm from the RVOT, and patch enlargement of the RVOT.

CONCLUSIONS: Sinus of valsalva aneurysm may present with right sided heart failure symptoms. Primary surgical repair is feasible with good short term outcomes once the right ventricular pressure overload has been corrected.

V8. Robot Assisted First Rib Resection

Raghav Murthy, Derek Williams, Rachel Harrison, *Kemp Kernstine
Univertiy of Texas Southwestern, Dallas, TX

OBJECTIVE: To discuss and demonstrate the technique of robot assisted 1st rib resection.

METHODS: The video discusses the case of a 24 year old female who presented with a right upper extremity DVT. She was treated with Coumadin for 4 repair for the same. Examination of the right upper extremity and neck was normal with no neurovascular abnormalities. Chest x-ray did not reveal a cervical rib. Dynamic venography of the right upper extremity in the adducted position revealed flow through the axillary and the subclavian vein into the SVC. In the abducted position there was an abrupt cut off of flow within the subclavian vein at the level of the first rib confirming a diagnosis of Paget-Schrotter syndrome. This explained effort thrombosis in her upper extremity as she was a yoga instructor. PFT's were non prohibitive. She was taken to the operating room for a robot assisted first rib resection. After single lung ventilation, she was placed in the left lateral decubitus position. The camera port was placed in the mid axillary line in the 5th ICS. The working ports were placed in the 4th ICS in the anterior and posterior axillary lines. An additional assistant port is placed for suction. Care is taken to identify the SVC, azygous vein, sympathetic chain, subclavian artery and vein. The borders of the first rib are defined. The goal of this operation is to decompress the vein which requires removal of the medial 2/3^{rds} of the 1st rib. The superior and inferior borders of the rib are dissected. Hook cautery is used to divide the attachments of the scalene muscles. The first rib is the thinnest between the area of the artery and vein. The rib is transected in this area with a kerrison bone cutter. Medially it is disarticulated at the osteocartilagenous junction. The specimen is removed through a port site. Extensive venolysis is performed. Multilevel Marcaine intercostal nerve block is performed. Chest tubes are placed and the port sites closed.

RESULTS: The patient was discharged on POD 1 with no complications. At follow up she has been asymptomatic and has resumed yoga.

CONCLUSIONS: Robot assisted 1st rib resection is a feasible operation for the surgical management of Paget-Schrotter syndrome. The main advantage of the robotic approach is minimal manipulation of the brachial plexus and thus minimal neurologic morbidity.

*AATS Member

V9. Overlapping LV Plasty for AVSD with Progressive Severe Cardiac Dysfunction in Early Infancy

Mitsuru Sato, Sadahiro Sai, Tomoaki Kagatani, Akinobu Konishi Miyagi
Children's Hospital, Sendai, Japan

BACKGROUND: Left ventriculoplasty (LV plasty)has been widely applied for patients with dilated cardiomyopathy or ischemic cardiomicyopathy in adult, but rarely done in pediatric patient, especially infant.

OBJECTIVE: We sought the efficacy of overlapping LV plasty for early infant case with progressive severe cardiac dysfunction.

CASE VIDEO SUMMARY: He has already been diagnosed complete AVSD (Rastelli type C) with PS by fetal UCG. The follow up echoes showed exacerbation of LV contraction, LV dilatation, and AV valve regurgitation (AVVR). He was born at 36 w 5 d by Caesarean section and his birth weight was 3078 g. Immediately after birth, severe cyanosis immerged and persisted, then mechanical respiratory support started. UCG showed severe AVVR and moderate pulmonary stenosis (PS) with severe reduced LV function with less than 30% of EF. Hemodynamics deteriorated in spite of intensive medical treatments. So common AV valve (CAVV) plasty such as edge to edge repair to stabilize cardiac function was performed urgently at 7 days old. However, AVVR, LV dilatation, and LV contraction gradually got worse. We thought that dyssynchrony associated with dilated LV might be harmful against circulation, so LV volume reduction therapy could be effective. Because the pathogenesis of progressive dysfunction and dilatation only on the left sided ventricle was unknown, overlapping LV plasty technique was chosen so that myocardial resection was not necessary.

Overlapping LV palsty and re-CAVV repair was planned at 2 months old. Under general anesthesia, a 5cm long incision was made along the left anterior descending artery in the enlarged LV free wall. Approximation between bilateral papillary muscles was carried out with several mattress sutures. Then, the left free wall margin was sutured to the lower two-thirds of septal wall in continuous fashion to keep adequate subaortic space using 14Fr urethral balloon catheter keeping 50% of normal LVEDV. Next the right side margin was sutured to the epicardium of anterolateral free wall to cover. Regarding AVVR, several edge to edge suture were placed on left and right side of CAVV.

Postoperative UCG showed clearly diminished LV volume, and relatively synchronized contraction between RV and LV. Although moderate AVVR still remained general hemodynamic status improved to large extent. Considering ventricular dimension and balance between RV and LV, single ventricular repair was suitable for this case. Now, the patient waits for Glenn and re-re-CAVV repair as next surgical treatment.

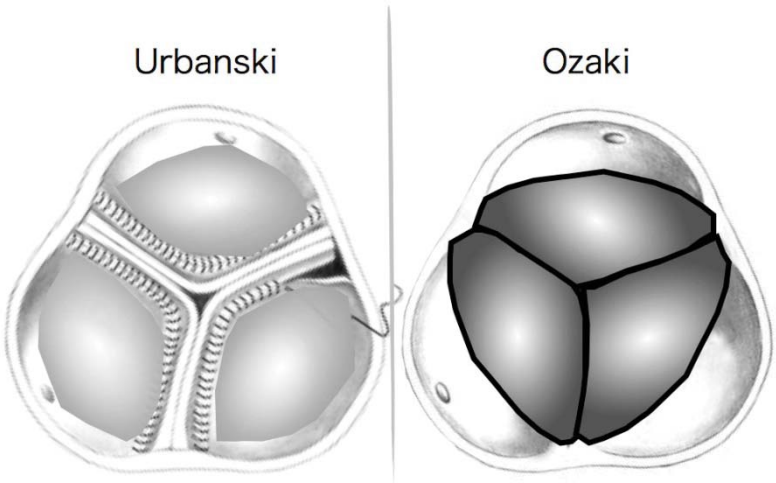
CONCLUSIONS: In a view of protection from of further LV dilatation, and of preservation of potential viable myocardium, we would think that overlapping LV plasty was useful option in this particular early infant case with the progressive severe cardiac dysfunction.

V10. Aortic Valve Reconstructions for Aortic Stenosis with Autologous Pericardium

Yoshito Inoue, Ryo Suzuki, Mio Kasai, Satoru Suzuki
Hiratsuka City Hospital, Hiratsuka, Kanagawa, Japan

OBJECTIVE: Aortic stenosis (AS) is not considered to be suitable for reconstructive repair techniques. However, no ideal prosthesis is available for small aortic annulus. Autologous pericardial reconstruction allows full size restoration of their native annuli. Two novel techniques of aortic valve leaflet reconstruction were performed and compared.

METHODS: Ninteen AS patients with small aortic annulus <20 mm were treated with aortic valve reconstruction between 2012–2014. Three cases with trileaflet AS with uncalcified cusp free-margins were treated with (1) native cups frame preservation (Leaflet edge preserving pericardial replacement; Urbanski procedure), and 16 cases with heavily calcified AS were treated with (2) complete valve reconstruction (Ozaki procedure). Mean age was 76.3 ± 4.3 (5 men, 11 women). There were no differences concerning preoperative max/mean transvalvular pressure gradient (PG; 77.6 ± 35.3/44.9 ± 22.7 mmHg), aortic valve orifice area (AVA; 0.66 ± 0.2 cm^2) and NYHA class between 2 groups.



RESULTS: Sufficient AVA were obtained by both procedures without postoperative aortic insufficiency. Mean postoperative PG and AVA were (1) 8.1 ± 2.8 mmHg, 1.56 ± 0.3 cm^2, and (2) 9.1 ± 3.4 mmHg, 1.53 ± 0.2 cm^2 respectively. (1) In Urbanski procedure. indication seemed suitable to pure aortic stenosis with non-calcified valve edge. It required longer cross-clamp time

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(204.7 ± 22.3 min) due to longer suture line. Valve size was adjusted to effective hight (eH) 8 mm. (2) In contrast, Ozaki procedure could be performed to any type of AS. It could be performed with shorter cross-clamp time (187 ± 73.4 min). Large coaptation length were created by the special valve sizing template (8–22 mm).

CONCLUSIONS: Aortic valve leaflet reconstruction techniques allow full size restoration of the native aortic valve orifice. Since there is no concern for PPM and anticoagulation, these techniques provide ideal options for AS with small aortic annulus.

8:40 AM ADJOURN

7:00 AM **VAD/ECMO SESSION** Room 607, WSCC

5 minute presentation, 5 minute discussion

Moderators: *Michael A. Acker and *Anelechi C. Anyanwu

37. Concomitant Aortic Valve Repair in Patients Undergoing Continuous-Flow Left Ventricular Assist Device Placement: A 10-year Experience and Clinical Implications

Shinichi Fukuhara, Koji Takeda, Jiho Han, Luilly Vargas, Boyangzi Kat Li, Melana Yuzefpolskaya, Donna M. Mancini, Paolo C. Colombo, Veli Topkara, *Paul A. Kurlansky, Hiroo Takayama, *Yoshifumi Naka

Columbia University, New York, NY

Invited Discussant: *R. Duane Davis, Jr.

OBJECTIVE: Aortic insufficiency (AI) after continuous-flow left ventricular assist device (CF-LVAD) implantation is known to affect device performance and patient outcomes. However, the management of pre-existing AI in patients undergoing CF-LVAD remains unclear. Central closure of the aortic valve (AV) has been a commonly practiced strategy, although the efficacy and durability of this technique has not been extensively described.

METHODS: From March 2004 to May 2014, a total of 340 patients received CF-LVAD (89 [26.2%] as destination therapy [DT]). Those who underwent concurrent AV replacement/AV closure, or those with previous AV procedures were excluded from the analysis. Outcomes were compared between patients with central AV closure (n = 57 [16.8%]; Group A) and without AV procedure (n = 283 [83.2%]; Group B).

RESULTS: The mean follow-up period was 2.3 ± 2.0 years. Patients in Group A were older (65.1 ± 8.3 vs. 54.9 ± 14.1 years old; $p < 0.001$), more likely DT (47.4 vs. 21.9%; $p < 0.001$), had a greater cardiopulmonary bypass (112.3 ± 44.2 vs. 90.7 ± 48.1 minutes; $p < 0.001$) and aortic cross-clamp time (23.3 ± 9.9 vs. 1.6 ± 8.1 minutes; $p = 0.002$), and more often received intraoperative transfusions than did patients in Group B. Twenty-three (40.4%) patients had significant pre-device AI, defined as greater than mild AI, consists of 9 (15.8%) mild to moderate, 11 (19.3%) moderate, 3 (5.3%) severe in Group A, while none did Group B ($p < 0.001$). During follow-up period, moderate or greater AI occurred in 5 (8.8%) in Group A and 26 (9.2%) patients in Group B ($p = 0.92$). Kaplan-Meier analysis revealed overall freedom from significant AI was 75.4 ± 7.4% and 78.0 ± 3.3% at 1 year ($p = 0.82$), and 66.2 ± 9.9% and 59.9 ± 5.2% at 2 years ($p = 0.85$) in Group A and B, respectively. There was no difference in the on-device survival rate at 2 years between groups (78.9% vs.84.8%; $p = 0.37$). Subgroup analysis of freedom from significant AI inclusive of DT patients demonstrated 77.1 ± 9.1% and 71.4 ± 6.6% at 1 year ($p = 0.81$) and 77.1 ± 9.1% and 41.6 ± 8.2% at 2 years ($p = 0.084$) in Group A and B, respectively (see Figure). No subjects in Group A developed significant AI beyond 1 year after device placement, whereas 41.7% of significant AI in Group B occurred between 1 and 2 post-device years.

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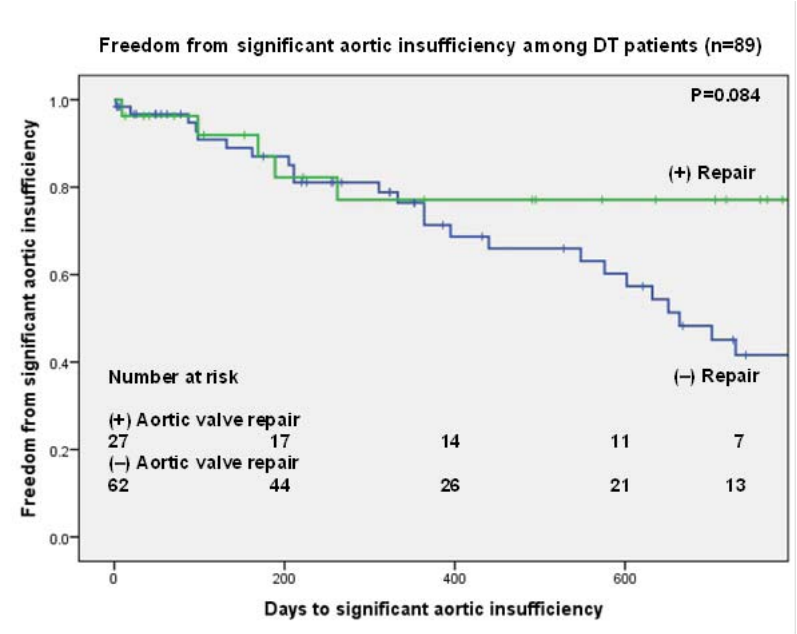

CONCLUSIONS: Despite the severity of pre-device AI, the prevalence of significant AI in CF-LVAD-supported patients who underwent concomitant central valve closure was comparable to those without pre-existing significant AI/central valve closure. In addition, the efficacy of central valve closure appears more pronounced among DT patients, possibly due to more prolonged device duration with less censoring events in the subgroup. Central AV closure may be an effective and durable strategy addressing pre-device AI, especially in patients requiring longstanding device support as DT.

38. A Novel and Validated Practical Risk Score to Predict the Need for Right Ventricular Assist Device at the Time of Continue-Flow Left Ventricular Assist Device Implantation

Steve K. Singh, Rohan M. Shah, Jatin Anand, *William E. Cohn, Leo Simpson, Andrew Civitello, Hari R. Mallidi

Baylor College of Medicine, Houston, TX

Invited Discussant: *Robert L. Kormos

OBJECTIVE: The unplanned requirement of a right ventricular assist device (RVAD) at the time of left ventricular assist device (LVAD) implant is well described to portend high early mortality and morbidity. Predictive tools of RVAD after LVAD have been based on univariate analysis of small sample sizes that preclude meaningful multivariable regression models. Current predictive tools also include both older pulsatile with new generation continuous flow (CF) LVADs. We aimed to review the largest single-center experience with new generation CF LVADs, to develop a validated, portable and clinically relevant risk score that accurately predicts the need for RVAD after LVAD implant.

METHODS: A retrospective review of all patients (n = 462) implanted with a CF LVAD at a single center (1999 to 2013). Patients were stratified by unplanned implant of RVAD at the time of CF LVAD. Demographics, pre-operative and operative data, baseline echocardiographic and right heart catheterization data, perioperative outcomes, early and late survival were gathered. Univariate, survival and multivariable regression analysis were performed. The odds ratios (OR) of the resulting independent predictors of RVAD were used to create an additive score predicting the likelihood of requiring an RVAD. This was internally validated within multiple subsets of our population using Bootstrapping techniques; a receiver-operating curve (ROC) was created to determine the predictive value of the risk score.

RESULTS: We identified 462 patients; 42 (9.1%) requiring an RVAD. Mean follow-up was 2.5 ± 2.4 years (maximum 13.3 years). Survival was significantly worse in the RVAD cohort (30-day: 93% vs. 31%; 1-year: 80% vs. 10%). RVAD was an independent predictor of mortality (OR, 19; 95% CI [5–60]; $p < 0.001$). Patient characteristics, baseline hemodynamics, operative characteristics and clinical outcomes comparing the RVAD and no RVAD cohorts are summarized in the table that follows. Multivariable regression analysis found pre-operative variables which were significant independent predictors of unplanned RVAD at CF LVAD implantation to include: any tricuspid regurgitation (TR) (OR, 3), renal replacement therapy (OR 4), albumin (low, <3.5 g/dL) (OR, 2), previous sternotomy (OR, 2), vaso-pressor requirement (OR, 2) and small LV cavity size (<6 cm, OR 2). A composite risk score using these variables' odds ratios, given the acronym TRAPPS, was analyzed within multiple subsets of our sample using Bootstrapping techniques, with a resulting ROC curve c-statistic of 0.70.

CONCLUSIONS: This is the largest single-center series of patients with contemporary CF LVADs and long term follow-up. Unplanned RVAD at time of CF LVAD implant purports very poor survival. The TRAPPS score is a novel, validated, simple additive odds ratio, which is portable and able to predict unplanned RVAD at the time of LVAD implant with good statistical accuracy.

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Table Pre-Operative Characteristics

	CF LVAD Only (n = 420)	CF LVAD + RVAD (n = 42)
Age (years)	54 ± 14	54 ± 15
Male	324 (77%)	30 (71%)
BMI (kg/m^2)	28 ± 6	26 ± 6
Renal replacement therapy	20 (5%)*	9 (21%)*
Albumin (g/dL)	3.7 ± 1.4*	3.2 ± 0.5*
INTERMACS 1 or 2	213 (53%)*	31 (77%)*
Inotropic support	355 (84%)*	41 (98%)*
Vasopressor support	57 (14%)*	12 (29%)*
Ischemic etiology	173 (41%)	20 (48%)
Bridge-to-transplant	246 (59%)	26 (62%)
Echocardiography & Hemodynamics		
Cardiac Index (L/min/m^2)	1.9 ± 0.6	1.9 ± 0.6
PCWP (mmHg)	25 ± 10	23 ± 9
CVP (mmHg)	12 ± 7	14 ± 9
PVR (Wood's Units)	3.5 ± 2.7	4.4 + 2.7
LV end diastolic dimension (cm)	6.7 ± 1.1*	6.1 ± 1.3*
TR (mod-sev)	170 (43%)*	24 (60%)*
MR (mod-sev)	228 (57%)	25 (63%)
RV depression	283 (72%)	32 (86%)
Operative Device		
Heartmate II	296 (70%)	29 (69%)
Jarvik	60 (14%)	9 (21%)
HeartWare	61 (15%)	4 (10%)
Other	3 (1%)	0 (0%)
Cardiopulmonary Bypass (min)	84 ± 48*	128 ± 66*
Previous Sternotomy	144 (34%)*	21 (50%)*
Operative approach		
Sternotomy	363 (86%)	35 (83%)
Thoracotomy	35 (8%)	6 (14%)
Subcostal/other	19 (5%)	1 (2%)

*$P < 0.05$

39. Ipsilateral Lower Extremity Complications in Patients Undergoing Emergent Common Femoral Arteriovenous Extracorporeal Membrane Oxygenator therapy

Prashanth Vallabhajosyula[1], Matthew Kramer[1], Sofiane Lazar[1], *Wilson Y. Szeto[2], Pavan Atluri[1], J. Eduardo Rame[1], Joyce W. Wald[1], Kathryn Gray[1], Nimesh Desai[1], *Michael A. Acker[1]

[1]University of Pennsylvania, Philadelphia, PA; [2]Penn Presbyterian Hospital, Philadelphia, PA

Invited Discussant:

OBJECTIVE: Patients in cardiogenic shock/distress undergoing emergent peripheral arteriovenous extracorporeal membrane oxygenator (AV ECMO) support via cannulation of the femoral artery and vein were evaluated for lower extremity (LE) complications based on the type of ipsilateral limb perfusion strategy utilized–percutaneous superficial femoral artery cannulation (PSFA group), versus open SFA cannulation (Open SFA group), versus no SFA cannulation (No SFA group).

METHODS: In a retrospective review from 2008 to 2013, 105 out of 250 underwent emergent AV ECMO via femoral cannulation. For ipsilateral LE perfusion, patients either underwent no further SFA cannulation (n = 35), percutaneous antegrade SFA cannulation (n = 23), or open cut-down antegrade SFA cannulation (n = 47). Percutaneous SFA cannulation was performed via ultrasound guidance, over Seldinger technique. A 7-French SFA cannula was connected to the arterial inflow of ECMO circuit. Lower extremity complications in the 3 groups were assessed.

RESULTS: Overall, mean age was 50 +16 years, 63% (n = 67) were male, with body mass index of 30+8. 92 patients (88%) had primary cardiac emergency, and 13 patients (12%) had cardiopulmonary emergency for primary cause. 30-day/in-hospital mortality was 65% (n = 68), with overall LE complication rate of 13% (n = 14). LE complications were highest in the PSFA group (n = 6; 26%), followed by No SFA group (n = 7; 20%). There was one complication in the Open SFA group (2%). In two group comparisons, Open SFA group had significantly lower

LE complication rate than No SFA (p = 0.01) and Percutaneous SFA group (p = 0.004). There was no difference between No SFA and Percutaneous SFA groups (p = 0.7). In the No SFA group, 2 patients required emergent thromboembolectomy, 3 required fasciotomy, and 2 patients required emergent ipsilateral SFA cannula placement. In the PSFA group, 2 patients required SFA thromboembolectomy with primary SFA repair, one required fasciotomy, one needed a below knee amputation, one had open SFA cannula revision, and one patient developed loss of distal signals from multiorgan failure. In the Open SFA group, one patient developed loss of signals from multiorgan failure.

CONCLUSION: No ipsilateral SFA perfusion strategy in peripheral AV ECMO is associated with a high LE complication rate. Ultrasound guided percutaneous SFA cannulation is also associated with high limb ischemia complications, unlike open SFA cannulation. Percutaneous cannulation should be performed under fluoroscopic guidance with angiographic confirmation of LE arterial run-off. Open SFA approach remains a safe alternative to the other strategies.

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40. A Decade of Experience with Over 300 Continuous-Flow Left Ventricular Assist Devices at a Single Center

*Ranjit John, Peter Eckman, Chris Holley, Samit Roy, Laura Harvey, Kaustav Majumder, *Sara Shumway, *Kenneth Liao

University of Minnesota, Minneapolis, MN

Invited Discussant:

OBJECTIVES: Despite previously unseen risks of pump thrombus and GI bleeding, continuous-flow (CF) LVADs have drastically revolutionized the landscape of mechanical circulatory support for heart failure. With clinical trials embarking on the next generation of LVADs, our objective was to review our long term experience with this current generation of LVADs.

METHODS: We evaluated 278 consecutive patients receiving 302 axial-flow LVADs at a single center between June 2005 and October 2014. Patients were divided into 3 groups: Group 1, first 100 patients, Group 2, second 100 patients, Group 3, last 78 patients. Time to event analysis including Kaplan-Meier analysis, was used to examine differences in survival between groups. Secondary outcomes, including stroke, GI bleed, device thrombus, and transplant were analyzed using one-way ANOVA.

RESULTS: Total follow up time was 489.4 patient years with median follow up of 436 days. Mean age of patients was 57 years, with 81.8% males and 62% with ischemic etiology. 212 (76.3%) patients were bridge-to-transplant (BTT) and 66 (23.7%) were destination therapy (DT). Mortality in the total cohort was 106/278 (38.1%). Overall survival at 30 days, 6 months, 1 year, and 2 years was 94%, 83%, 74%, and 63%, respectively. 1 and 2 year survival was 77% and 65% in BTT patients and 65% and 54% in DT patients. 30-day, 6-month and 1-year survival was 93%, 78%, and 60% in Group 1, 93%, 88%, and 86% in Group 2, and 94%, 85%, and 75% in Group 3 ($p = 0.0006$). The table that follows shows comparison of demographics, survival and major complications between the 3 groups. There was a significant increase in LVAD use as DT, reduced driveline infections, increased pump thrombus, reduced frequency of transplantation and improved survival with later groups (Groups 2 and 3) versus early group (Group 1).

Table:

Baseline (Presented as n [%] or Mean ± SD)	Group 1 (n = 100)	Group 2 (n = 100)	Group 3 (n = 78)	p-Value
BTT	81 (81.0)	81 (81.0)	50 (64.1)	0.012
Postop Hospitalization (days)	21 ± 16	18 ± 11	18 ± 10	0.18
Male	72 (72.7)	83 (83.8)	70 (90.9)	0.007
Age (Years)	56 ± 14	56 ± 15	60 ± 14	0.11
BMI	28.7 ± 6.3	28.6 ± 5.2	30.3 ± 10.6	0.28
INTERMACS Score Mean	3.8 ± 1.7	4.2 ± 1.6	3.3 ± 1.4	0.001
Prior CABG	27 (27.6)	35 (35.0)	23 (29.9)	0.51
Outcomes (presented as n [%] or mean ± SD)				
Stroke	13 (14.0)	14 (14.1)	13 (18.3)	0.70
GI bleed	21 (22.3)	30 (30.3)	18 (24.3)	0.42
Driveline infection	27 (28.7)	26 (26.3)	6 (8.2)	0.003
Pump Thrombus	3 (3.0)	14 (14.0)	12 (15.4)	0.010
% Undergoing transplant	51 (51.0)	22 (22.0)	1 (1.4)	<0.001
Days to transplant	376 ± 311 (n = 50)	495 ± 257 (n = 20)	304 (n = 1)	0.30
Survival (presented as mean survival [95%CI])				
30 days	0.93 [0.86–0.97]	0.93 [0.86–0.97]	0.95 [0.87–0.98]	0.006
6 months	0.78 [0.68–0.85]	0.88 [0.80–0.93]	0.84 [0.74–0.91]	
1 year	0.60 [0.49–0.70]	0.86 [0.77–0.91]	0.75 [0.63–0.84]	
2 year	0.45 [0.33–0.56]	0.74 [0.64–0.82]	0.73 [0.60–0.82]	

CONCLUSIONS: While CF-VADS have favorably influenced the outcomes of patients with end-stage heart failure, major complications still limit their survival. Improving host/blood-pump compatibility, better anticoagulation strategies as well as totally implantable pumps may further reduce complications, improve survival and allow LVADs to be a true long-term alternative to heart transplantation.

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41. Risk Factors for Development of Tricuspid Regurgitation Post Heart Transplantation and Long-Term Outcome of Tricuspid Valve Surgery

Anja Claudia Baier, Eva Maria Delmo Walter, *Roland Hetzer

Deutsches Herzzentrum Berlin, Berlin, Germany

Invited Discussant: *Valluvan Jeevanandam

OBJECTIVES: This report aims to determine factors which promote the development of tricuspid regurgitation (TR) after heart transplantation. Likewise, it aims to evaluate outcome of tricuspid valve surgery for post-transplant TR.

METHODS: Between 1989 and 2013, 1,804 patients underwent heart transplantation for end-stage heart failure. Among them, 31 heart transplant patients were operated for severe tricuspid regurgitation, of whom 30 were analyzed retrospectively as to potential risk factors for development of TR and compared with another 30 patients matched for gender, transplantation age and underlying cardiac diseases with no or having only mild TR.

RESULTS: Post-transplant patients with TR had all undergone biatrial anastomosis technique during orthotopic heart transplantation, had a significant higher number of biopsies (p = 0.003) and frequent episodes of severe rejections (p = 0.003). One, 5 and 10 years after transplantation, their bilirubin values were higher and right ventricular ejection fraction lower, with more ascites and peripheral edema, they were in a higher NYHA Functional class and had more mitral regurgitation. Presence of diabetes, hypertension or renal insufficiency did not contribute to the development of TR. Patients who underwent tricuspid valve surgery were found to have leaflet destruction and chordal rupture (n = 20; 67%) from repeated myocardial biopsies, annular dilatation (n = 5; 17%) or both (n = 5; 17%). Valve replacement was done in 15 (biological = 7, mechanical = 8) patients. Tricuspid valve repair was performed in another 15 patients (modified De Vega´s annuloplasty = 8; Kay Wooler annuloplasty = 1, Cosgrove Edwards ring implantation = 1, double orifice valve technique = 3, leaflet reconstruction = 2). Hospital mortality was 20% and one patient had to be retransplanted during the first postoperative day due to cardiac failure. Deaths were due to postoperative cardiac failure in 2, myocardial infarction in 1 and sepsis in 3 patients. Duration of follow-up was a mean of 6.4 years, range: 0.8–20.2 years. Median postoperative survival was 3.46 years with 7 patients still alive. A repeat mechanical valve replacement was performed in a patient after 2.48 years and survived 7.5 months afterwards. There was improvement in NYHA Functional Class (n = 20; 67%), kidney function (n = 1; 3.3%) after tricuspid valve surgery. Renal failure was intermittently progressive in 13 patients and was permanent in 8 patients requiring dialysis.

CONCLUSION: Repeated myocardial biopsies and increased frequency of rejections are risk factors for development of post-transplant tricuspid regurgitation. Tricuspid valve surgery improves hemodynamic conditions but with deteriorating kidney function and considerable mortality.

42. A Multi-Institutional Comparison of Adverse Events in Contemporary Continuous-Flow Left Ventricular Assist Devices: Do Significant Differences Exist?

John M. Stulak[1], Mary Elizabeth Davis[2], Nicholas Haglund[2], Shannon Dunlay[1], Jennifer Cowger[3], Palak Shah[4], *Francis Pagani[5], Keith Aaronson[5], Simon Maltais[2]
[1]Mayo Clinic, Rochester, MN; [2]Vanderbilt Heart and Vascular Institute, Nashville, TN; [3]St. Vincent's Hospital, Indianapolis, IN; [4]Inova Fairfax Hospital, Falls Church, VA; [5]University of Michigan, Ann Arbor, MI

Invited Discussant: *James K. Kirklin

OBJECTIVE: Few large, multi-institutional studies have specifically examined differences in the incidence and timing of adverse events observed in the contemporary era of patients implanted with continuous flow left ventricular assist devices (CF-LVAD). We review the experience from the Mechanical Circulatory Support Research Network registry.

METHODS: From May 2004 to September 2014, 734 pt (591 males, median age 59 years) underwent primary CF-LVAD implantation at our institutions. HeartMate II was implanted in 560 pt (76%) and Heart Ware HVAD in 174 (24%). Patients implanted with HeartMate II were more often destination therapy (47% vs. 20%; $p < 0.01$), lower preoperative creatinine (1.2 vs. 1.3; $p = 0.01$), and had less median preoperative right ventricular dysfunction (mild vs. moderate; $p < 0.01$). Ischemic etiology (50% vs. 47%; $p = 0.52$), prior sternotomy (30% vs. 33%; $p = 0.51$), and median INTERMACS profile (3 vs. 3; $p = 0.7$) were similar.

RESULTS: Early mortality was similar between groups (HMII: 7.3% vs. HVAD: 7.5%; $p = 0.95$) while length of hospital stay was longer after HMII (20 vs. 16 days; $p < 0.01$). Early renal failure requiring dialysis (HMII: 11% vs. 11%; $p = 0.96$) and RV failure requiring temporary RVAD (HMII: 4.8% vs. HVAD: 3.4%; $p = 0.45$) were similar. Follow-up was available in 100% of early survivors for a median of 1 year (maximum 10 years) and a total of 1,120 patient-years of support (HMII: 940 patient-years [median:1.1 years, max.:5.3 years] and HVAD: 180 patient-years [median: 0.6 year, max.: 10.4 years]). The timing and incidence of first adverse events are summarized in the following table.

Variable	Overall	HeartMate II	HVAD	p-value
Time to 1st Event (mos.)				
GI bleed	2.4	2.7	1.5	0.09
Stroke	5.8	6.3	4.5	0.17
Pump Thrombus	5.6	5	6.3	0.5
Driveline Infection	10.4	1.6	13.5	*0.044*
Incidence (event/pt-yr)				
Stroke	0.14	0.11	0.26	*0.05*
Pump Thrombus	0.12	0.1	0.2	0.09
Driveline Infection	0.09	0.12	0.056	0.051

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CONCLUSIONS: In this pooled analysis from the MCS Research Network, patients treated with HeartMate II experienced driveline infections earlier than those with HVAD, and had a trend toward a higher driveline infection incidence. Conversely, patients treated with HVAD had a trend toward a higher incidence of stroke. Understanding these differences can significantly enhance preoperative counseling, as well as postoperative monitoring of patients.

43. Impact of Periportal Fibrosis Without Cirrhosis on Outcome Following Continuous Flow Left Ventricular Assist Device Implantation

Jonathan E. Sargent, Todd F. Dardas, Jason W. Smith, Richard K. Cheng, Sophia Carolina Masri, Kent R. Shively, Lauren M. Colyer, Nahush A. Mokadam
University of Washington, Seattle, WA

Invited Discussant: *Yoshifuma Naka

OBJECTIVE: The severity of congestive hepatopathy is frequently evaluated among patients with advanced heart failure (HF) during work-up for Left Ventricular Assist Device (LVAD) implantation, but the interpretation of liver biopsy findings are of unclear prognostic significance in advanced HF. This study investigated whether hepatic fibrosis is associated with post-LVAD mortality or intensive care unit length of stay (ICU LOS) following LVAD implantation.

METHODS: A total of 189 patients with continuous flow LVAD devices implanted at our center between July 2005 and August 2013 were studied. Liver biopsy was performed on 14 patients with abnormal liver function tests and/or abdominal imaging. The effects of fibrosis on overall survival and ICU LOS were modeled using Cox proportional hazards regression and linear regression, respectively. Adjustments were made for age, INTERMACS class, performance of a biopsy and modified MELD (modMELD) score. The modMELD score replaces INR with albumin to eliminate the effects of anti-coagulation.

RESULTS: Ninety patients received heart transplants and 52 died over the course of follow-up. Twelve of the 14 patients biopsied had periportal fibrosis without cirrhosis and 2 had normal liver architecture. The median modMELD score for biopsied patients was 14.61 (IQR 12.41, 16.30) and for those without biopsy was 16.64 (IQR 13.52, 19.20). The higher modMELD scores were due to higher creatinine values in the non-biopsied patients (1.4 ± 0.8 vs. 1.1 ± 0.5). One-year survival for the groups with and without fibrosis was 92 ± 8% and 82 ± 3%, respectively. The presence of periportal fibrosis was not associated with mortality (HR, 0.86; p = 0.83); nor was the performance of a biopsy (HR, 0.76; p = 0.70). Only progressive age (HR 1.03/year; p = 0.017) was associated with mortality in the multivariable model. The average ICU LOS for this cohort was 9.7 days and was not statistically different between the two groups (p = 0.55).

Table: Risks Factors for Survival

Variable	HR	Standard Error	p-Value
Periportal Fibrosis on Liver Biopsy	0.816	0.597	0.781
Liver Biopsy Obtained	0.759	0.551	0.704
modMELD	0.949	0.304	0.870
INTERMACS	1.019	0.113	0.863
Age	1.031	0.013	0.017

CONCLUSIONS: The presence of periportal fibrosis did not affect survival or ICU LOS in patients undergoing LVAD implantation. This suggests that carefully selected advanced heart failure patients with hepatic fibrosis without cirrhosis may achieve acceptable outcomes with LVAD implantation.

*AATS Member

44. Severe Pulmonary Hypertension in Patients Undergoing Leftventricular Assist Device Insertion As Bridge to Transplant

Masaki Tsukashita, Hiroo Takayama, Koji Takeda, Paolo C. Colombo, Veli K. Topkara, Melana Yuzefpolskaya, Donna M. Mancini, *Yoshifumi Naka

New York Presbyterian Hospital/Columbia University, New York, NY

Invited Discussant:

OBJECTIVE: End-stage heart failure is often associated with pulmonary hypertension (pHTN). Although orthotopic heart transplantation (OHT) is an ultimate treatment of end-stage heart failure, severe pHTN is considered to be one of contraindications for OHT in many transplant facilities. Left ventricular assist device (LVAD) improves pHTN by reducing left ventricular end-diastolic pressure and may be able to transform candidacy of OHT. However, this has not been elucidated yet. The aim of this study is to investigate how severe pHTN affects the outcome in patients who undergo LVAD insertion for bridge-to-transplant (BTT).

METHODS: Between March 2004 and December 2013, 248 patients underwent continuous-flow LVAD insertion as BTT. Pre-LVAD right heart catheterization data was available for analysis in 222 patients. Patients were divided to three groups based on pre-LVAD PVR: low PVR (lPVR, ≤ 3 Wood units) (n = 106), medium PVR (mPVR, 3 < PVR < 5) (n = 76), high PVR (hPVR, ≥ 5) (n = 40). Post-LVAD and post-OHT outcomes were compared between groups.

RESULTS: Seventy-two patients in lPVR (67.9%), 48 patients in mPVR (61.8 %), and 29 patients in lPVR (72.5%) reached OHT ($p = 0.46$).

PVR significantly dropped from 7.05 ± 2.18 to 3.05 ± 1.76 (p = 0.007) after LVAD implantation. In-hospital mortality after OHT was significantly higher in hPVR group (20.7%, 4.3%, and 6.9%, hPVR, mPVR, and lPVR, respectively; $p = 0.036$). The leading cause of mortality in hPVR group was primary graft dysfunction (4/6, 66.7%). However, survival rate at 3 years after OHT was similar between the groups (83.8%, 72.8%, and 78.2%, hPVR, mPVR, and lPVR, respectively; $p = 0.5$). Multivariate Cox-regression analysis demonstrated that hPVR is a significant risk factor for early mortality (HR, 10.2; 95% CI [1.81–57.02]; $p = 0.008$) but not for late mortality.

CONCLUSIONS: LVAD support can significantly reduce PVR enough to transform OHT candidacy even in patients with severe pHTN. Although severe pHTN before LVAD support has negative impact on early mortality, comparable long-term survival to that in patients with low PVR can be expected.

45. Lung Transplantation and Concomitant Cardiac Surgery: Is It Justified?

Reshma M. Biniwale, *David Ross, Curtis Hunter, Jamil Aboulhosn, Oh-Jin Kwon, David Gjertson, *Abbas Ardehali

University of California, Los Angeles, CA

Invited Discussant: *Susan D. Moffat-Bruce

OBJECTIVE: Increasing numbers of lung transplant (OLT) candidates have cardiac conditions that affect their survival after transplantation. The purpose of this report is to determine if patients who undergo concomitant corrective cardiac surgery (CCS) and OLT have different clinical outcomes, when compared to a matched cohort of isolated OLT recipients.

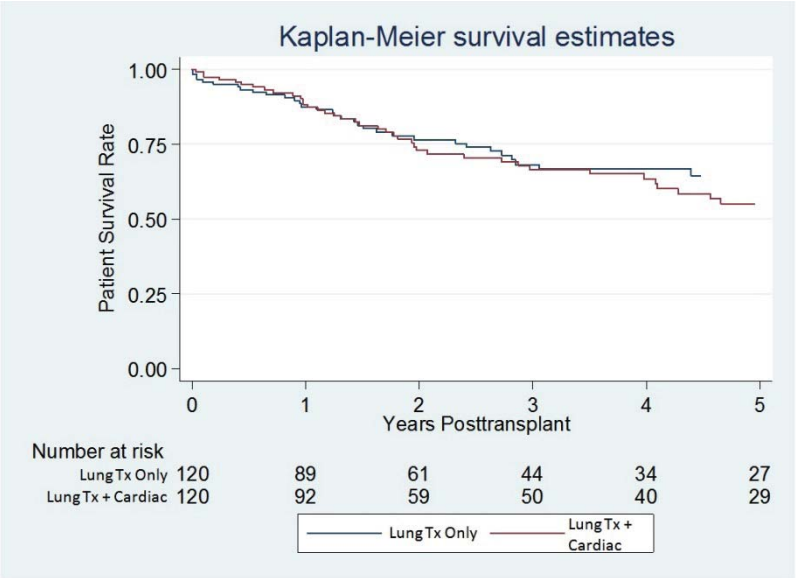
METHODS: The clinical records of all OLT recipients who had undergone a concomitant cardiac surgical procedure from December 2000 to January 2014 were reviewed. This group was matched to a cohort of isolated OLT recipients based on age, Lung Allocation Score, diagnosis, type of procedure and era. The following clinical endpoints were compared: Survival, PGD grade III at 72 hours, ICU and hospital length of stay, and composite adverse cardiac events (incidence of post-operative atrial fibrillation, myocardial infarction, need for redo cardiac intervention, or congestive heart failure requiring hospital admission).

RESULTS: During this period, 120 patients underwent lung transplantation and concomitant cardiac surgical procedures (OLT + cardiac). The concomitant cardiac procedures included: coronary artery bypass grafting (CABG n = 22), PFO repair (n = 66), valve repair/replacement (n = 35), and others (n = 17). The survival curves for the 2 groups are shown in Figure 1. There was no statistical difference in the survival of the 2 groups up to 5 years. There was no statistically significant difference in the incidence of PGD grade III at 72 hours, ICU stay, ventilator time, hospital stay, and the incidence of composite adverse cardiac events within 30 days (P = 0.06). The difference in the readmission rates for cardiac events was not statistically significant (P = 0.339). The difference in the total donor organ ischemia times between the 2 groups, was not statistically significant (P = 0.086). Mean ischemia time for no CCS is 304.84 minutes and for CCS 323.08 minutes.

Table: Concomitant Cardiac Surgical Procedures in Lung Transplant Recipients

Patent foramen ovale repair	64
Atrial septal defect repair	2
CABG	22
Tricuspid valve repair	31
Mitral valve repair	2
Aortic valve repair	2
Repair of ascending aortic aneurysm	1
Modified MAZE procedure	15
Others (pulmonic valve repair)	1
Multiple procedures	19

*AATS Member



CONCLUSIONS: OLT candidates who undergo concomitant cardiac surgical procedures and lung transplantation have similar early and mid-term clinical outcomes, when compared to isolated OLT recipients. Because this report is the largest published experience, offering lung transplantation and corrective cardiac surgery to selected patients remains justified.

AATS Guidelines: Bridge to Transplant & Extracorporeal Lung Support

Marcelo Cypel, *Toronto General Hospital*

8:40 AM ADJOURN

8:45 AM **PLENARY SCIENTIFIC SESSION** Room 4E, WSCC
8 minute presentation, 12 minute discussion

Moderators: *Pedro J. del Nido and *Marc R. Moon

46. Long-Term Survival, Valve Durability, and Reoperation for Four Aortic Root Procedures

*Lars G. Svensson, Salia T. Pillai, Jeevanantham Rajeswaran, *Eric E. Roselli, *Gosta B. Pettersson, *A. Marc Gillinov, *Jose L. Navia, *Nicholas G. Smedira, *Joseph F. Sabik, III, *Bruce W. Lytle, *Eugene H. Blackstone
Cleveland Clinic, Cleveland, OH

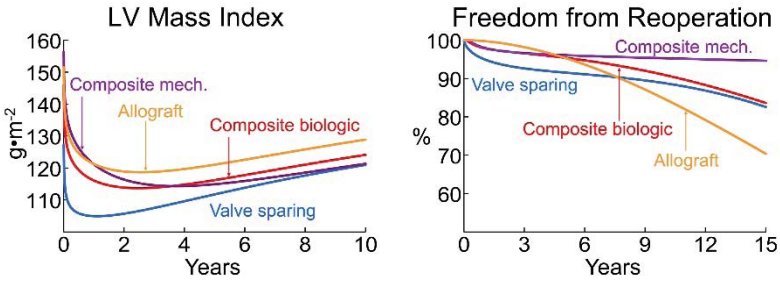
Invited Discussant: *Tirone E. David

OBJECTIVE: Aortic valve-preserving and root-sparing procedures have become established as alternatives to aortic root replacement by allografts or Bentall procedures for aortic aneurysms involving the root, but comparative safety, effectiveness, and durability of these alternative procedures are unavailable. Therefore, we evaluated short- and long-term results of aortic root procedures using 4 surgical strategies.

METHODS: From January 1995 to January 2011, 957 patients underwent aortic root procedures for aneurysms using 4 different approaches: 1) valve-sparing root preservation, including remodeling and reimplantation techniques (n = 261), 2) composite graft replacement with a biological valve (n = 297) or 3) mechanical valve (n = 156), or 4) allograft with coronary reimplantation (n = 243).

RESULTS: There were 7 in-hospital deaths (0.73%) and 13 (1.4%) in-hospital strokes, with no in-hospital deaths after valve-sparing procedures. Composite grafts exhibited higher mean gradients than either allografts or valve-sparing procedures, but the latter 2 exhibited more aortic regurgitation (19% and 24% at 10 years for allograft and valve-sparing operations vs. 2.7% and 7.1% for biologic and mechanical composite grafting). Valve-sparing root preservation was associated with the largest reduction in left ventricular mass and remodeling (see Figure) and allograft replacement the smallest. Valve-sparing root preservation was associated with the highest early-phase risk of reoperation and allograft replacement the lowest (see Figure). Nonetheless, by contrast, patients who received allografts had the highest risk of late reoperation ($P < .05$) and the composite mechanical group and valve preservation the lowest. Patients who received a composite bioprosthesis had the highest late mortality (57% at 15 years vs. 14% to 26% for the remaining procedures); however, they were substantially older with more comorbidities ($P < .0001$).

*AATS Member



CONCLUSIONS: These 4 aortic root procedures provide excellent survival and good durability. Valve preservation and allograft procedures have the lowest gradients with better ventricular remodeling, but more late regurgitation and likely less risk of valve-related complications, such as bleeding, hemorrhage, and endocarditis. Despite the early risk of reoperation tradeoff, we recommend valve-preserving procedures for young patients when possible. Composite bioprostheses are the preferable approach for the elderly.

47. Long-Term Clinical Outcome and Performance of Pulmonary Valve Replacement with Bioprosthetic Valves in Patients with Congenital Heart Disease

Rio S. Nomoto[1], Lynn A. Sleeper[2], Michele J. Borisuk[1], Lisa Bergerson[1], *Pedro J. del Nido[1], *Frank A. Pigula[1], Sitaram Emani[1], Francis Fynn-Thompson[1], *John E. Mayer[1], Christopher W. Baird[1]

[1]Boston Children's Hospital & Harvard Medical School, Boston, MA; [2]Cytel, Inc., Cambridge, MA

Invited Discussant: *John W. Brown

BACKGROUND: Survival of children with congenital heart disease (CHD) has improved significantly and as a result increasing numbers of patients undergo pulmonary valve replacement (PVR). There are limited reports of mid- and long-term outcomes. The goal of this single center series was to assess differences in clinical outcomes by PVR type and to identify independent predictors of outcomes following surgical bioprosthetic PVR.

METHODS: Surgical and follow-up data were retrospectively collected from medical records and follow-up from referring cardiologists in patients undergoing PVR from 1996 to 2014. Outcome measures analyzed with Kaplan-Meier estimation and Cox proportional hazards regression were, 1) time to re-intervention (surgical or catheter-based PVR) in 634 patients and, 2) the composite of time to re-intervention or structural valve deterioration (SVD: at least moderate pulmonary stenosis [PS] or regurgitation on echo) in 474 patients.

RESULTS: Patient age was 20.8 ± 13.7 years (IQR, 11.6–27.1; 51% < 18 years) with BSA 1.50 ± 0.51 m^2. Diagnosis was Tetralogy of Fallot in 434 (68%) and 59% were male. Mean (±SD) and median follow-up was 3.6 ± 3.2 and 2.9 years (IQR, 1.0–5.3), respectively. Valve types included Sorin Mitroflow, 316 (50%; mean age 19 years); Carpentier-Edwards (CE) Magna/Magna Ease, 223 (35%; age 23 years); CE Perimount, 72 (11%; age 25 years); and Porcine, 23 (4%; age 14 years). Re-intervention occurred in 7% (44/634) and re-intervention/SVD occurred in 23% (109/474). Crude 5-year re-intervention and re-intervention/SVD rates were Sorin Mitroflow, 18% and 44%; CE Magna/Magna Ease, 2% and 8%; CE Perimount, 0% and 3%; and Porcine, 0% and 8%, respectively. Neither outcome was associated with gender, valve insertion method, or procedures performed concurrently with valve placement. Independent risk factors for re-intervention/SVD after controlling for age (hazard ratio [HR] 0.90 per 3-year increase; p = .009; Figure 1B) were valve type (p < .0001) and labeled valve size (HR 1.12 per mm decrease; p = .017). CE Perimount valves and Sorin Mitroflow valves were associated with the longest and shortest time to re-intervention/SVD, respectively (HR 12.2; Figure 1A). The association of valve type and outcome did not depend on patient age (interaction p = 0.75).

*AATS Member

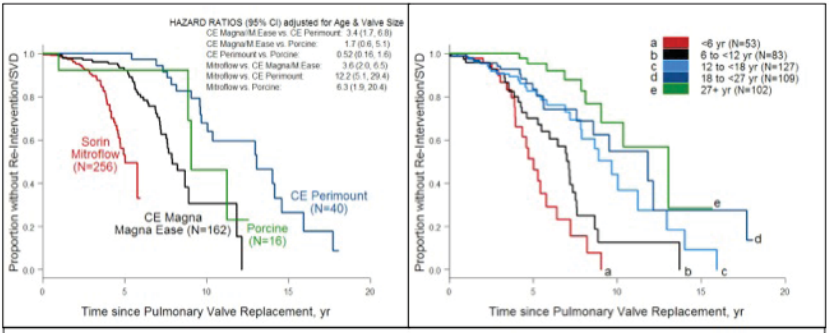


Figure 1. Unadjusted Kaplan-Meier Curves of Time to Pulmonary Valve Re-Intervention or Structural Valve Deterioration on Echocardiogram, 110 events in 474 cases, (a) considering valve type; and (b) considering age.

CONCLUSIONS: Bioprosthetic PVR in patients with CHD has excellent short and mid-term outcomes. Younger patients had more re-interventions and SVD. However, independent of age, different valve types had different rates of re-intervention and SVD. These differences may be important in valve selection and follow-up.

48. Adjuvant Radiation Is Not Associated with Improved Survival in Patients with Positive Margins Following Lobectomy for Stage I & II Non-Small Cell Lung Cancer

Brian C. Gulack[1], Chi-Fu Jeffrey Yang[1], Paul J. Speicher[1], H. Volkan Kara[2], *Thomas A. D'Amico[1], *Mark F. Berry[3], Matthew G. Hartwig[1]

[1]Duke University, Durham, NC; [2]Marmara University, Istanbul, Turkey; [3]Stanford University, Stanford, CA

Invited Discussant: *Mark S. Allen

OBJECTIVES: Treatment recommendations for patients with positive margins following lobectomy for non-small cell lung cancer (NSCLC) include re-resection and adjuvant radiation therapy. However, evidence demonstrating a benefit to adjuvant radiation is currently lacking. We analyzed patients with positive margins following lobectomy for stage I and II NSCLC in the National Cancer Data Base (NCDB) to test the hypothesis that adjuvant radiation therapy improves survival.

METHODS: Patients in the NCDB who underwent a lobectomy without known induction therapy for stage I or II NSCLC from 1998–2006 were grouped by margin status (negative vs positive) and compared with regards to treatment and outcomes. Patients who died within 30 days of surgery were removed prior to analysis. The group of patients with positive margins was then analyzed in order to determine the effect of adjuvant radiation on outcomes using Kaplan-Meier analysis and Cox proportional hazards modeling. Patients with upstaged disease were removed prior to this analysis. To explore the potential benefits of re-resection, outcomes of patients with positive margins after lobectomy who underwent adjuvant radiation were compared to a matched control group of patients who were treated with pneumonectomy without adjuvant radiation.

RESULTS: A total of 50,010 patients met study criteria, of which 1,959 (3.9%) had positive margins following lobectomy. Positive margins were associated with a significantly increased risk of death following adjustment (HR, 1.67; 95% CI [1.55–1.81]). Of the 1,598 patients with positive margins who had stage I or II disease on pathologic examination, adjuvant radiation was used in 587 (38.2%) patients. Patients who underwent adjuvant radiation were significantly younger (median age: 67 vs. 70; $p < 0.001$), were more likely to have larger tumors (5 cm or greater: 32.4% [181/559] vs. 24.2% [223/920]; $p < 0.001$), and were more likely to have stage II disease on pathologic examination (62.9% [307/488] vs. 37.0% [311/840]; $p < 0.001$). In multivariable analysis, adjuvant radiation did not significantly impact survival (HR, 1.11; 95% CI [0.91–1.36]). Patients who underwent lobectomy and received adjuvant radiation were then matched 1:1 to patients who underwent pneumonectomy for Stage I or II NSCLC and did not receive adjuvant radiation. In the matched cohort, patients who underwent pneumonectomy had significantly improved survival compared to patients who underwent lobectomy followed by adjuvant radiation, (HR, 0.72; 95% CI [0.58–0.89]).

CONCLUSIONS: Survival when positive margins are present after lobectomy for early-stage non-small cell lung cancer is poor, and it is not improved by adjuvant radiation. Surgeons should strongly consider re-resection to achieve negative margins, even when a pneumonectomy is required.

49. Should Asymptomatic Patients Discharged with Lower Hemoglobin Expect Worse Outcomes After Valve Surgery?

*Niv Ad, Sari Diana Holmes, *Alan M. Speir, Graciela Pritchard, Deborah J. Shuman, Linda Halpin

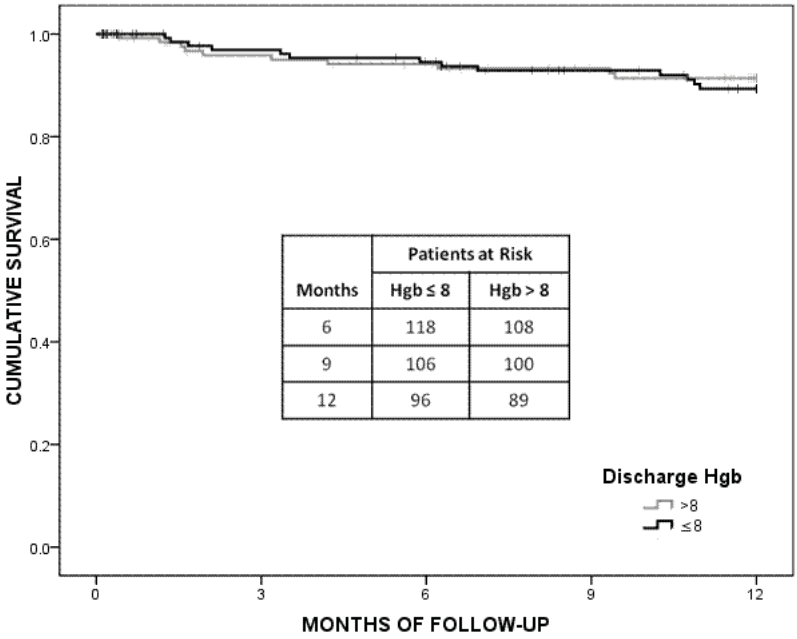
Inova Heart and Vascular Institute, Falls Church, VA

Invited Discussant: *Glenn J. Whitman

OBJECTIVE: Blood transfusion has been associated with increased morbidity and cost in cardiac surgery patients. The decision to transfuse patients after cardiac surgery is often based primarily on low hemoglobin (Hgb) levels, even when patients are asymptomatic. In 2008 our center implemented a blood transfusion protocol to standardize indications across the service line. Under this protocol, less than 20% of our valve patients are transfused and anemic patients are being discharged if they are asymptomatic. The purpose of this study was to determine whether patients discharged with lower Hgb levels are at increased risk for perioperative and 1-year mortality.

METHODS: A total of 1,107 valve-only surgical procedures were performed at our institute between 2008 and mid-2014. From these patients, those who were discharged from the hospital and had complete Hgb data (N = 1,044) were assigned to two groups: Hgb ≤8 g/dL (n = 153) and Hgb > 8 g/dL (n = 891). Perioperative outcome measures per STS, 1-year survival, and health-related quality of life (HRQL) with SF-12 were captured prospectively. Propensity score matching was conducted between Hgb groups and 152 pairs of patients were in the final matched sample. Analyses were then conducted with the propensity score matched sample.

RESULTS: This sample consisted of 918 single-valve, 114 double-valve, and 12 triple-valve surgeries, including 514 mitral valve, 593 aortic valve, 72 tricuspid valve, and 3 pulmonic valve procedures. Discharge Hgb as a continuous variable was not predictive of 1-year survival (HR, 0.87; P = 0.36) or incidence of readmission <30 days (OR, 0.92; P = 0.31) in the full sample after adjustment for covariates from the propensity score model. After matching, the two groups were balanced on all preoperative and intraoperative characteristics. Incidence of blood product transfusion during the hospital course was also similar between the matched groups. There were no differences between the matched Hgb ≤8 and Hgb >8 groups in 30-day mortality (0% vs. 0.7%; P > 0.99), incidence of readmission (14% vs. 16%; P = 0.52), or 1-year mortality (9% vs. 7%; P = 0.52). Cumulative 1-year survival was similar between matched patients discharged with Hgb ≤8 and Hgb >8 (89.3% vs. 91.4%; p = 0.67; Figure). In a subset of patients with HRQL scores presurgery and at 6 months postsurgery (n = 78), the matched Hgb ≤8 and Hgb > 8 groups had similar physical (28% vs. 18% increase; F = 1.25; P = 0.27) and mental (7% vs. 6% increase; F = 0.01; P = 0.94) HRQL improvements.



CONCLUSIONS: The results of this study suggest that low discharge Hgb is not associated with inferior outcomes, including survival, readmission, and HRQL. Reduction in blood transfusions to correct anemia in asymptomatic patients before discharge may have a positive impact on outcomes for patients after valve surgery.

10:05 AM COFFEE BREAK/VISIT EXHIBITS

10:30 AM AWARD PRESENTATIONS

*AATS Member

10:40 AM PLENARY SCIENTIFIC SESSION

Moderators: *Joseph S. Coselli and *Marc R. Moon

50. Resident Versus Attending Surgeon Patency and Clinical Outcomes in On- Versus Off-Pump Coronary Artery BypassSurgery

G. Hossein Almassi[1], Muath Bishawi[2], Annie Laurie Shroyer[3], Jacquelyn A. Quin[4], Brack Hattler[5], Todd H. Wagner[6], Joseph F. Collins[7], *Joseph C. Cleveland[8], *Frederick L. Grover[9], *Faisal G. Bakaeen[10]

[1]Medical College of Wisconsin, Milwaukee, WI; [2]Duke University, Durham, NC; [3]Northport Veterans Affairs Medical Center and Stony Brook University, Stony Brook, NY; [4]VA Boston Healthcare System, West Roxbury, MA; [5]Veteran Affairs Eastern Colorado Health Care System, Denver, CO; [6]Veterans Affairs Palo Alto Health Economics Resource Center, Menlo Park, CA; [7]Cooperative Studies Program Coordinating Center and VA Medical Center, Perry Point, MD; [8]University of Colorado, Aurora, CO; [9]University of Colorado, Denver, CO; [10]Baylor College of Medicine and Houston VA Medical Center, Houston, TX, Houston, TX

Invited Discussant: *John D. Puskas

OBJECTIVE: The impact of using residents in the role of primary surgeon (performing the majority of distal anastomoses) versus first assistant surgeon during on and off pump coronary artery bypass grafting (CABG) is unknown; thus, resident outcomes were compared to attending surgeon outcomes.

METHODS: In the Randomized On/Off Bypass trial (ROOBY) centers with residents participating, 1,272 patients were assessed for post-CABG outcomes including 1-year graft patency. Secondary study endpoints included short-term and 1-year clinical outcomes. Univariate and multivariate analyses were performed.

RESULTS: Residents were the primary surgeon in 493/633 (77.8%) on-pump and in 431/ 639 (67.4%) off-pump patients, $p < 0.001$; corresponding to 79.2% and 67.3% of distal coronary anastomoses in on-pump and off-pump groups, respectively ($p = 0.013$). There were no differences in the patient characteristics between residents versus attending surgeons.

Intraoperative conversion rate was not different for off-pump group between the residents and attending surgeons; however, the attendings had a higher on-pump conversion rate versus residents (8.6% vs. 3.2%; $p = 0.006$). Short-term mortality and morbidity were not different for residents vs. attending surgeons; similarly, the 1-year patency for the internal mammary artery and the saphenous venous grafts were not different (see Table).

Table:

	On Pump Resident Patient N (%)	On Pump Attending Patient N (%)	On Pump p-Value	Off Pump Resident Patient N (%)	Off Pump Attending Patient N (%)	Off Pump p-Value
LIMA graft patency	262/270 (97)	69/73 (94.5)	0.402	225/239 (94.1)	113/121 (93.4)	0.412
SVG graft patency	404/507 (79.7)	115/139 (82.7)	0.677	326/441 (73.9)	174/223 (78)	0.185
Early adverse composite outcome*	24/493 (4.9)	10/140 (7.1)	0.292	27/431 (6.3)	10/208 (4.8)	0.460
1-year death (all cause)	12/493 (2.4)	4/140 (2.9)	0.778	17/431 (3.9)	5/208 (2.4)	0.317
Late adverse composite outcome**	32/493 (6.5)	8/140 (5.7)	0.739	44/431 (10.2)	19/208 (9.1)	0.770
Non-fatal acute myocardial infarction***	8/493 (1.6)	2/140 (1.4)	0.871	5/431 (1.2)	4/208 (1.9)	0.443
Repeat revascularization ***	16/493 (3.2)	4/140 (2.9)	0.817	25/431 (5.8)	11/208 (5.3)	0.793

*The early primary adverse composite outcome is based on at least one of the following events occurring: 30-day operative mortality or major peri-operative morbidity (i.e., renal failure requiring dialysis, stroke, reoperation, new mechanical support, cardiac arrest, or coma).
**The late adverse composite outcome is based on at least one of the following events occurring: death from any cause at 1-year, a non-fatal acute myocardial infarction (occurring between 30 days post-operatively and 1-year follow-up) or a repeat revascularization procedure (occurring between 30-days post-operatively and 1-year follow-up).
***These two late adverse outcomes were evaluated from the time of 30-days post-surgery up until 1-year follow-up.

CONCLUSION: In the ROOBY trial, residents were the primary surgeon for a lower proportion of off-pump patients vs. on-pump patients. No differences were found in short-term and 1-year outcomes or the graft patency. With appropriate case selection and supervision, ROOBY documented that residents performed new surgical techniques with similar outcomes to the attending surgeons.

*AATS Member

51. Incidence and Implications of Postoperative Supraventricular Tachycardia Following Pulmonary Lobectomy

*Brendon M. Stiles[1], Gregory P. Giambrone[1], Xian Wu[1], Licia K. Gaber-Baylis[1], *Subroto Paul[1], Akshay U. Bhat[2], Ramin Zabih[2], Peter M. Fleischut*[1], *Nasser K. Altorki*[1]

[1]*Weill Cornell Medical College, New York-Presbyterian Hospital, New York, NY;* [2]*Cornell University, Ithaca, NY*

Invited Discussant: *Ara A. Vaporciyan

OBJECTIVE: The AATS recently published guidelines for the prevention and management of atrial fibrillation following thoracic surgery. As such, we sought to determine the rate of supraventricular tachycardia (SVT) in patients undergoing pulmonary lobectomy (with and without other complications) and to identify the incidence of stroke, mortality, and readmission, as well as determine the relationship of SVT to length of stay (LOS).

METHODS: Analyzing the State Inpatient Databases, Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality database, we reviewed all lobectomies performed (2009–2011) on patients >18 years of age in California, Florida, and New York. We determined the incidence of new-onset SVT and whether the event was isolated or associated with other complications, and used unique identifiers to determine 90-day readmission rates and diagnoses. The following comparator groups were created: 1) No SVT, uncomplicated course; 2) No SVT, but other complications; 3) Isolated SVT, otherwise uncomplicated course; 4) SVT, with other complications. Stroke rates were analyzed independently from other complications. Multivariable regression analysis (MVA) was used to determine factors associated with SVT and stroke.

RESULTS: Among 20,727 lobectomies performed, 2,455 (11.8%) patients had postoperative SVT, including 1,119 (5.4%) with isolated SVT and 1,336 (6.4%) with SVT with other complications. Clinical predictors of SVT by MVA included age ≥75 (OR, 6.4; CI [5.2–8.0]), male gender (OR, 1.4; CI [1.3–1.6]), COPD (OR, 1.3; CI [1.2–1.4]), CHF (OR, 1.5; CI [1.2–1.9]), and thoracotomy (OR, 1.2; CI [1.1–1.3]). By MVA, SVT increased the odds of stroke (OR, 2.29; CI [1.4–3.7]). As shown in the table that follows, the stroke rate was <1% in patients with isolated SVT and 1.5% in patients with SVT with other complications. Patients with isolated SVT had increased length of stay (LOS), increased readmission, and a marginal increase in stroke rate when compared to patients with an uncomplicated course, but no difference was identified for in-hospital mortality or readmission with stroke (see Table). Patients with SVT with other complications had increased LOS and an increased frequency of stroke, mortality, and readmission when compared to other groups.

Table: Clinical Impact of Postoperative SVT

	No SVT/ Uncomplicated Course (n = 12,086)	Isolated SVT, No Other Complications (n = 1,119)	p-Value	No SVT, Other Complications (n = 6,186)	SVT, with Other Complications (n = 1,336)	p-Value
Postoperative stroke	22 (0.2%)	<11 (<1.0%)*	<0.05*	47 (0.8%)	20 (1.5%)	0.009
In-hospital mortality	26 (0.2%)	<11 (<1.0%)*	>0.70*	229 (3.7%)	103 (7.7%)	<0.001
Median length of stay (Q1;Q3)	5 (4;6)	6 (5;8)	<0.001)	7 (5;12)	10 (7;16)	<0.001
90-day readmission	1,811 (16.7%)	205 (20.2%)	0.004	1,209 (22.2%)	309 (27.1%)	<0.001
90-day readmission with stroke	122 (1.1%)	11 (1.1%)	0.917	74 (1.4%)	25 (2.2%)	0.036

*The HCUP Data Use Agreement prohibits the reporting of fewer than 11 observations. Sample size and p-values are masked to prevent identification.

CONCLUSIONS: Postoperative SVT is common in patients undergoing pulmonary lobectomy and is associated with increased stroke, prolonged LOS, and increased readmission. Isolated SVT was not found to increase mortality, although patients with SVT with other complications had a higher frequency of death. Comparative studies are needed to determine whether strict adherence to recently published guidelines will decrease the rate of stroke, readmission, and death following new onset SVT in thoracic surgical patients.

*AATS Member

52. What Is a "Good" Result After Transcatheter Mitral Repair? Impact of 2+ Residual Mitral Regurgitation

Nicola Buzzatti[1], Michele De Bonis[1], Paolo Denti[1], Elisabetta Lapenna[1], Fabio Barili[2], Giovanna Di Giannuario[1], Giovanni La Canna[1], *Ottavio Alfieri[1]

[1]San Raffaele Scientific Institute, Milan, Italy; [2]Santa Croce e Carle Hospital, Cuneo, Italy

Invited Discussant: *Marc Ruel

OBJECTIVE: Transcatheter mitral repair for mitral regurgitation (MR) is associated with variable degrees of residual MR. The objective of this study was to evaluate the impact of acute 2+ residual MR after MitraClip procedure.

METHODS: All patients submitted to MitraClip repair at our Institution underwent a standardized in-hospital and follow-up prospective data collection pathway. We assessed the outcomes of 140 patients treated with MitraClip between October 2008 to March 2014 who had acute residual MR≤2+ and who accomplished follow-up at our dedicated echocardiographic outpatient clinic.

RESULTS: Baseline patients characteristics included mean age 72.3 ± 10.2 years, median STS mortality 8.3 (3.4–17.2), NYHA class III-IV in 111 (79.3%) patients. Functional (FMR) and degenerative (DMR) regurgitation were present in 100 (71.4%) and 40 (28.6%) cases, respectively.

Acute residual 2+ MR was observed in 22 (22%) FMR and 12 (30%) DMR patients; p = 0.31. Only 2 deaths occurred at 30 days, both in the FMR group. Overall actuarial survival was 66 ± 5.6% at 51 months.

In FMR, freedom from cardiac death was 82.8 ± 5.1% at 50 months. Residual 2+ MR (HR, 5.9; CI [1.2–30.1]; p = 0.033), baseline higher EDD (HR, 1.5; CI [1.2–1.8]; p = 0.001) and NYHA class (HR, 3.6; CI [1.2–10.2]; p = 0.016) were found to be independent preditors of increased cardiac death at multivariate Cox regression model. Freedom from 3-4+ recurrent MR was 65 ± 7.3% at 50 months, independent predictors at multivariate analysis being residual 2+ MR (HR, 3.8; CI [1.5–9.9]; p = 0.006), baseline higher sPAP (HR, 1.045; CI [1.0–1.1]; p = 0.003) and the presence of restricted posterior leaflet motion (HR, 4.5; CI [1.4–14.3]; p = 0.01). Residual 2+ MR was also associated with more frequent NYHA III-IV at follow-up (p = 0.0002).

In DMR, freedom from cardiac death was 97.3 ± 2.7% at 38 months (2 cardiac deaths). Freedom from 3-4+ MR was 71.7 ± 8.3% at 36 months, residual 2+ MR being the only predictor of MR recurrence (HR, 8.4; CI [2.1–33.2]; p = 0.002). Only 2 DMR patients (5%) were found to be in NYHA class III at follow-up.

CONCLUSIONS: Residual 2+ MR after MitraClip repair was associated with increased cardiac mortality and worse NYHA functional class in FMR patients; moreover it predicted increased recurrent 3-4+ MR at follow-up in both the FMR and DMR settings.

11:40 AM **HONORED GUEST LECTURE** *Not for Credit*
Three Ideas About Changing Things
Colonel Casey Haskins
BLK SHP INNOVATIONS

12:30 PM **ADJOURN FOR LUNCH – VISIT EXHIBITS**

*AATS Member

ADULT CARDIAC MODERATED POSTER COMPETITION

Moderator: *Ralph J. Damiano, Jr.

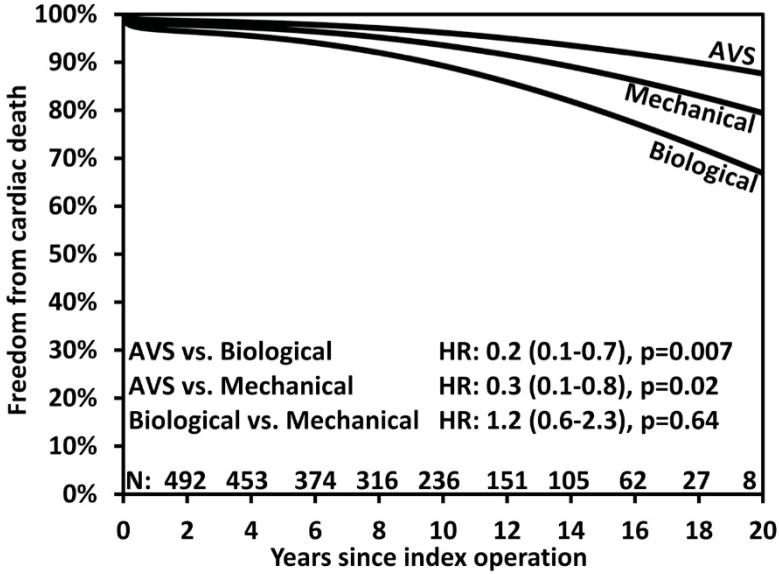
P1. David Versus Goliath: Valve-Sparing Root Replacement Improves Outcomes Compared to Bentall Procedures in Patients with Aortic Root Dilatation

Maral Ouzounian, *Vivek Rao, Cedric Manlhiot, Nachum Abraham, Carolyn David, *Christopher M. Feindel, *Tirone E. David
University of Toronto, Toronto, ON, Canada

OBJECTIVE: We sought to compare the early and long-term outcomes of patients undergoing aortic valve sparing (AVS) vs. Bentall procedures for aortic root dilatation.

METHODS: From January 1990 to December 2010, 1,187 patients underwent elective aortic root replacement procedures (AVS, n = 282; Bentall with a biological prosthesis [b-Bentall], n = 562; Bentall with a mechanical prosthesis [m-Bentall], n = 343) at a single institution. Patients were matched into 186 triads based on age, year of surgery, and stage of heart failure. Mean age was 49.8 ± 13.2 years and 80.2% were male. Mean follow-up duration was 9.0 ± 5.2 years.

RESULTS: Patients undergoing AVS in the matched cohort had lower rates of previous cardiac surgery (4.9% vs. 12.4% vs. 36.2%; $p < 0.001$) and ejection fraction <40% (8.1% vs. 9.3% vs. 13.0%; $p = 0.02$) than those undergoing b-Bentall or m-Bentall procedures, respectively. They also had higher rates of Marfan syndrome (41.3% vs. 3.5% vs. 9.0%; $p < 0.001$) and lower rates of bicuspid aortic valve (7.5% vs. 67.6% vs. 51.7%; $p < 0.001$). Rates of in-hospital mortality were similar between the three matched groups (AVS: 0.5%, b-Bentall: 2.2%, m-Bentall 1.1%; $p = 0.36$), as were rates of stroke, myocardial infarction, atrial fibrillation, renal failure, and reoperations (p = NS). Overall survival at 5, 10, and 15 years was similar between the three groups (AVS: 93.9 ± 1.8, 91.1 ± 2.4, 80.9 ± 4.3, respectively; b-Bentall: 92.3 ± 2.1, 85.7 ± 3.1, 83.1 ± 3.5; m-Bentall: 95.1 ± 1.7, 89.7 ± 2.7, 79.4 ± 5.3; $p = 0.58$). However, as shown in the adjusted survival curves in Figure 1, freedom from cardiac death was greatest in the AVS group. Furthermore, long-term results of AVS appeared to be favorable with respect to anticoagulant-related hemorrhage (AVS: 3.2%, b-Bentall: 3.3%, m-Bentall: 17.8%; $p < 0.001$), structural valve deterioration (AVS: 0%, b-Bentall: 6.5%, m-Bentall: 0%; $p = 0.001$), and freedom from reoperations (AVS: 93.5%, b-Bentall: 86.5%; m-Bentall: 96.8%; $p = 0.001$).



CONCLUSIONS: In the most comprehensive analysis performed to date of the surgical management of aortic root dilatation, early post-operative outcomes and overall long-term survival were similar between AVS, b-Bentall and m-Bentall. However, AVS procedures were associated with improved long-term freedom from cardiac death. Furthermore, patients undergoing AVS experienced improved anticoagulant-related hemorrhage compared to patients undergoing m-Bentall procedures, and improved freedom from reoperations as compared to patients undergoing b-Bentall procedures. If the aortic valve can be spared, AVS procedures should be considered for patients undergoing aortic root replacement.

*AATS Member

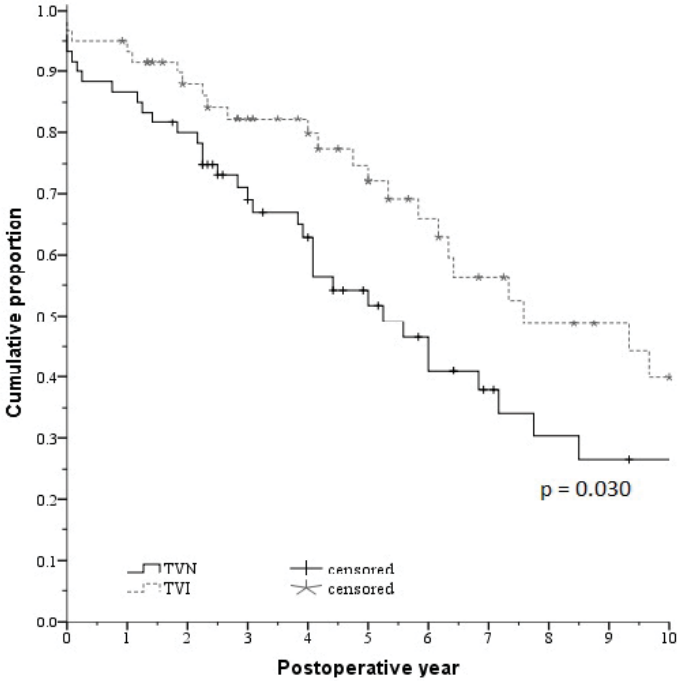
P2. Should We Repair Moderate to Severe Tricuspid Regurgitation During Reoperative Left Sided Valve Procedures?

Igor Gosev, Maroun Yammine, Marzia Leacche, Siobhan Mcgurk, Antony Norman, Julius I. Ejiofor, Vladimir Ivkovic, James D. Rawn, *John G. Byrne, *Lawrence H. Cohn
Brigham and Women's Hospital, Boston, MA

OBJECTIVE: Debate still exists as to whether the increased risks posed by tricuspid valve (TV) surgery is warranted in patients with moderate to severe tricuspid regurgitation (TR) during reoperative left heart valve surgery. The current study compares early and mid-term outcomes for patients with and without concomitant TV surgery.

METHODS: We identified 200 patients with moderate-to-severe TV regurgitation undergoing reoperative left sided valve procedures between January 2002 and April 2014; of these 75 had tricuspid valve interventions (TVI) and 125 had no tricuspid procedure performed (TVN). Subgroup analyses were performed on propensity matched case (TVI) and control (TVN) groups (n = 60 in each). Outcomes included NYHA class, echo findings and mortality.

RESULTS: TVI patients were younger (66 ± 15 vs 72 ± 13 years; $p < 0.001$) with fewer octogenarians (11/75 vs. 38/125; p = .02); the proportion of women was similar (p = 0.24). TVI patients presented with more cardiogenic shock (6/75, vs. 0/125; $p < 0.001$) required more frequent preoperative IABP support (5/75 vs. 0/125; p = 0.14), and had lover preoperative ejection fraction (47% ± 14% vs. 51% ± 15%; $p < 0.13$). TVI patients were more likely to undergo mitral valve surgery (60/75 vs. 69/125; $p < 0.001$) and had longer median cross-clamp times (207 minutes vs. 158 minutes; $p < 0.001$). Operative mortality was 5/75 (7%) for TVI patients vs. 12/125 (10%) for TVN (p = 0.60). Median follow-up was 4.4 years (25th–75th percentile = 2.4–6.5). Kaplan-Meier analyses showed no differences between groups in survival (p = 0.76) or TR (p = 0.30) but among TVI patients, there was a trend towards increased risk of TR in patients with valve repair alone versus annuloplasty (p = 0.15). Propensity matching yielded a TVI case cohort of 60 patients (80% retention) and 60 control TVN patients. The groups were balanced with regard to age (TVI = 67 ± 13 vs. TVN 68 ± 14 years; p = .67), renal insufficiency (TVI = 7 vs. TVN = 8; p = 1.0), cardiogenic shock (2 vs. 0; p = 0.50), and mitral valve surgery (15 in each; p = 1.0). Operative mortality was 3/60 for TVI versus 10/60 for TVN (p = 0.27). At follow-up, 12 TVI and 16 TVN patients were in NYHA class III/IV (p = 0.52). Analysis of the cumulative incidence of the composite risks of valve reoperation, TR or mortality showed that the TVI group experienced significantly improved outcomes compared to TVN (mean: 6 years, 95% CI [4.8–7.2 years] vs. 8 years, 95% CI [6.7–9.3 years] for TVI; p = 0.030) (see Figure).



N at risk

Year	0	2	4	6	8	10
TVI	60	44	28	16	8	4
TVN	60	45	33	20	12	7

CONCLUSION: In this series of reoperative left side valve surgery, tricuspid valve intervention was more often used for patients with higher operative risk, yielding results similar to no intervention. However, a risk-adjusted comparison revealed that TVI was associated with improved midterm outcomes. Our data also suggest that annuloplasty may yield better results than TV repair alone.

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P3. Off-Pump Versus On-Pump Coronary Artery Bypass Grafting in Patients with Left Ventricular Dysfunction: Analysis of 918 Matched-Pairs

Chikara Ueki[1], Hiroaki Miyata[2], *Noboru Motomura[2], Genichi Sakaguchi[1], Takehide Akimoto[1], *Shinichi Takamoto[2]

[1]Shizuoka General Hospital, Shizuoka, Japan; [2]Japan Cardiovascular Surgery Database Organization, Tokyo, Japan

OBJECTIVE: Although several single-center trials reported the clinical outcomes of coronary artery bypass grafting (CABG) for patients with left ventricular dysfunction, the benefit of off-pump CABG in this high risk cohort is still unclear because of limited sample size and potential selection bias of single-center trials. The aim of this study was to evaluate the impact of the off-pump technique in patients with low ejection fraction on mortality and morbidity using data from the Japan Cardiovascular Surgery Database (JCVSD).

METHODS: We analyzed 2,187 patients with an ejection fraction of less than 0.30 who underwent primary, non-emergent, isolated CABG between 2008 and 2012, as reported in the JCVSD. These patients were divided into those who underwent on-pump CABG (ONCAB, n = 1,134 [51.1%]) and off-pump CABG (OPCAB, n = 1,053 [48.9%]). OPCAB patients who were converted to ONCAB were counted as intended OPCAB and were included in the OPCAB group. A propensity score matching with 20 preoperative variables was performed and the early mortality and morbidity were compared between matched groups.

RESULTS: Propensity score matching created 918 pairs from each group. Of the 918 patients in the OPCAB group, conversion to ONCAB occurred in 67 (7.3%). The OPCAB group showed fewer distal anastomoses (3.21 vs. 3.34; P = 0.019), more frequent use of bilateral internal thoracic artery (37.9% vs. 21.0%; P < 0.001) and shorter operation time (322.5 minutes vs. 375.4 minutes; P < 0.001) than the ONCAB group. Compared with ONCAB, OPCAB was associated with a significantly lower incidence of 30-day death (n = 16 [1.7%] vs. 34 [3.7%]; P = 0.01), operative death (n = 30 [3.3%] vs. 56 [6.1%]; P = 0.006), reoperation for bleeding (n = 8 [0.9%] vs. 32]3.5%]; P < 0.001), prolonged-ventilation (n = 75 [8.2%] vs. 123 [13.4%]; P < 0.001), prolonged ICU stay (equal and more than 8days) (n = 111 [12.1%] vs. 159 [17.3%]; P = 0.002) and blood transfusion (n = 75 [8.2%] vs. 123 [13.4%]; P < 0.001). There was no significant difference in the incidence of stroke (OPCAB 1.5% vs. ONCAB 2.1%; p = 0.38), renal failure (OPCAB 6.1% vs. ONCAB 7.4%; P = 0.26), postoperative dialysis (OPCAB 3.1% vs. ONCAB 4.4%; P = 0.14), and postoperative atrial fibrillation (OPCAB 12.4% vs. ONCAB 13.0%; P = 0.73) between the 2 groups.

CONCLUSIONS: Despite slightly fewer total grafts per patient than ONCAB, OPCAB is associated with significantly reduced early mortality and morbidity in patients undergoing coronary artery bypass grafting with an ejection fraction of less than 0.30.

P4. Comparison of Clinical Efficacy Between Biatrial Epicardial Application of Drug-Releasing Adhesive Hydrogels to Prevent Postoperative Atrial Fibrillation

William Wang[1], Xiao Dong Feng[2], yunqing Mei[3], Xin Hiu Yuan[4]

[1]Scripps Memorial Hospital, La Jolla, CA; [2]Shanghai Eastern Hospital, Shanghai, China; [3]Shanghai Tongji Hospital, Shanghai, China; [4]Changzhi Peace Hospital, Changzhi, China

OBJECTIVE: Postoperative atrial fibrillation (POAF) is the most frequent complication arising after cardiac surgery, occurring in 40% of cases. Considerable experimental and clinical evidence suggest that POAF is "multi-factorial." Facilitating factors can be classified as acute factors caused by the surgical intervention (inflammation) and chronic factors related to structural heart disease. The treatment of POAF with epicardial amiodrone/corticosteroid hydrogel delivery can increase efficacy and reduce side effects. To further evaluate whether amiodrone hydrogel is superior to corticosteroid hydrogel or to placebo, we performed a randomized prospective study on 150 patients with coronary rtery bypass graft to compare the effectiveness with different epicardial drug approaches in the postoperative period.

METHODS: After institutional review board approval, 150 patients, from January 2012 to July 2014, who had undergone cardiac surgery, were randomized to three equal groups. Group I received poly-based hydrogel with amiodarone and group II received poly-based hydrogel with triamcinolone. Both of hydrogels were sprayed diffusely over the biatrial epicardium. The control group underwent the procedure without the spray. Continuous telemetry monitored for POAF, and amiodarone or triamcinolone levels in the atria, plasma, and tissue were measured postoperatively. Daily electrocardiographic parameters were measured until postoperative day 14.

RESULTS: The incidence of POAF was significantly less in the group I, with 4 of 50 patients (8%) incurring atrial fibrillation compared with 11 of 50 patients (22%) in group II and 13 of 50 (26%) patients in the control group ($P < .01$). The mean amiodarone and triamcinolone concentrations in the atria (12.06 ± 3.1/1.5 ± 0.7) were significantly greater than those in the extracardiac tissues (1.32 ± 0.9/0.2 ± 0.4; $P < .01$). The plasma amiodarone and triamcinolone levels remained below the detection limit (<8 μg/mL and < 0.2 μg/ml) during the 14 days of follow-up. Bradycardia was observed less in the control group (93 ± 18) than in the study group I (76 ± 29; $P < .01$).

CONCLUSIONS: Epicardial application of amiodarone-releasing adhesive hydrogel is a less invasive, well-tolerated, quick, and effective therapeutic option for preventing POAF with minimal risk of extracardiac adverse side effects. However, there was no clinical evidence that epicardial corticosteroid prevented postoperative AF.

P5. Amiodarone After Surgical Ablation for Atrial Fibrillation – Is It Really Necessary? A Prospective Randomized Controlled Trial

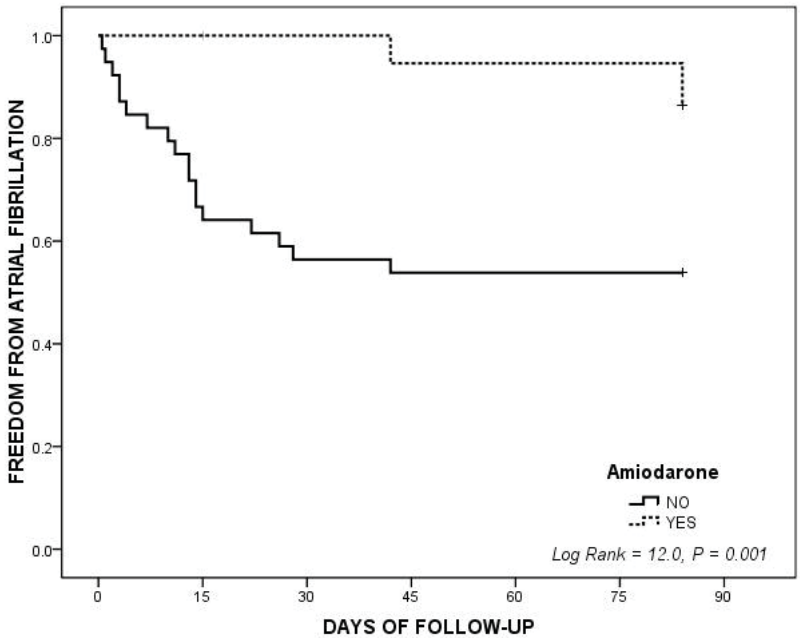
Niv Ad, Sari Diana Holmes, Graciela Pritchard, Deborah J. Shuman, Casey E. Miller

Inova Heart and Vascular Institute, Falls Church, VA

OBJECTIVE: Prophylactic antiarrhythmic treatment is a well-established practice after catheter ablation for atrial fibrillation (AF) but is controversial in patients who have had surgical ablation. To clarify the need for prophylactic treatment after surgical ablation for AF, we conducted a prospective randomized controlled trial to determine whether amiodarone treatment after surgical ablation is effective in reducing the risk of early recurrence of atrial arrhythmia (AA).

METHODS: Eighty-one patients were randomized to receive (n = 40) or to not receive (n = 41) amiodarone following surgical ablation. Rhythm status was ascertained via 72-hour Holter monitoring at 6 and 12 weeks after surgery using HRS guidelines. Four patients were lost to follow-up for rhythm status. Primary outcome was defined as recurrence of AA at 6- or 12-week follow-up or crossover from the no-amiodarone to the amiodarone group at any time during follow-up due to AA. Data were analyzed with an intention-to-treat approach.

RESULTS: Following randomization, no significant differences were found between the two treatment groups in preoperative patient characteristics, including age (64.0 vs. 63.5 years; P = 0.84), proportion of females (28% vs. 27%; P = 0.95), ejection fraction (54.6% vs. 55.5%; P = 0.70), and Euro SCORE II (2.5% vs. 3.0%; P = 0.40). There were also no differences between the amiodarone and no-amiodarone groups on traditional predictors for failure of surgical ablation, including left atrium size (5.0 vs. 5.1 cm; P = 0.80), duration of AF (46.1 vs. 36.3 months; p = 0.44), proportion with long-standing persistent AF (45% vs. 32%; P = 0.22), and minimally invasive approach (35% vs. 27%; P = 0.43). The primary outcome occurred in 46% of the no-amiodarone group (18 of 39) and 13% of the amiodarone group (5 of 38; P = 0.002). Cumulative freedom from the primary outcome was significantly greater in the amiodarone group than in the no-amiodarone group (86.5% vs. 53.8%, log rank = 12.0; P = 0.001; see Figure). Amiodarone was discontinued in 13 patients in the amiodarone group for side effects, bradycardia, or noncompliance.



CONCLUSIONS: In this prospective randomized study it was demonstrated that the use of prophylactic amiodarone was effective in reducing early recurrence of atrial arrhythmia without substantial associated morbidity. These results are consistent with findings regarding catheter ablation for AF and should lead to a recommendation for prophylactic amiodarone or other class I or III antiarrhythmic treatment in all patients following surgical ablation for AF. Close monitoring of patients for side effects and discontinuation of amiodarone by 3 months for patients in sinus rhythm is warranted.

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P6. Surgical Treatment of HOCM in Patients with Extreme Hypertrophy, Septal Myocardial Fibrosis and Ventricular Tachycardia

Konstantin Borisov

German-Russian Cardiac Clinic, Moscow, Russian Federation

OBJECTIVE: In patients with hypertrophic cardiomyopathy myocardial fibrosis is an independent predictor of adverse outcome.A new technique of HOCM surgical correction in patients with extreme hypertrophy and septal myocardial fibrosis has been proposed.

METHODS: The excision of the asymmetrical hypertrophied area of the interventricular septum (IVS) causing obstruction was performed from the conal part of the right ventricle corresponding to the zone of obstruction of the left ventricle (LV). This excision was carried out on the right side of the IVS and not trough the whole IVS thickness. The areas of septal myocardial fibrosis were removed corresponding to the zone of delayed enhancement (DE) imaging. Myocardial fibrosis was detected by cardiovascular magnetic resonance (with DE imaging). Twelve HOCM patients with extreme hypertrophy (NYHA Class 3,1), myocardial fibrosis and episodes of ventricular tachycardia (VT) underwent this procedure. Five patients had biventricular obstruction.The follow-up period was 39Â ± 9 months.

RESULTS: Ten patients were free of symptoms (NYHA class 1) and two patients had only mild limitations. The mean echocardiographic gradient in LV decreased from 89.9Â ± 2.6 to 9,1Ã‘Â ± 2.2 mmHg, the mean value of gradient in right ventricular outflow tract was reduced from 43.4Â ± 5.2 to 4.3Â ± 1.3 mmHg. Echocardiographically determined septal thickness was reduced from 34.7Â ± 3.1 to 15.6Â ± 2.1 mm. Sinus rhythm without block of His bundle right branch was noted in all patients after surgery. VT was not registered. None of the patients needed implantation of cardioverter-defibrillator.

CONCLUSIONS: This novel technique of HOCM surgical correction provides the precise removal of the areas of septal fibrosis and effective elimination of biventricular obstruction in patients with extreme hypertrophy who can not be treated with the current surgical tecnhniques.The approach avoids mechanical damage to the heart conduction system.

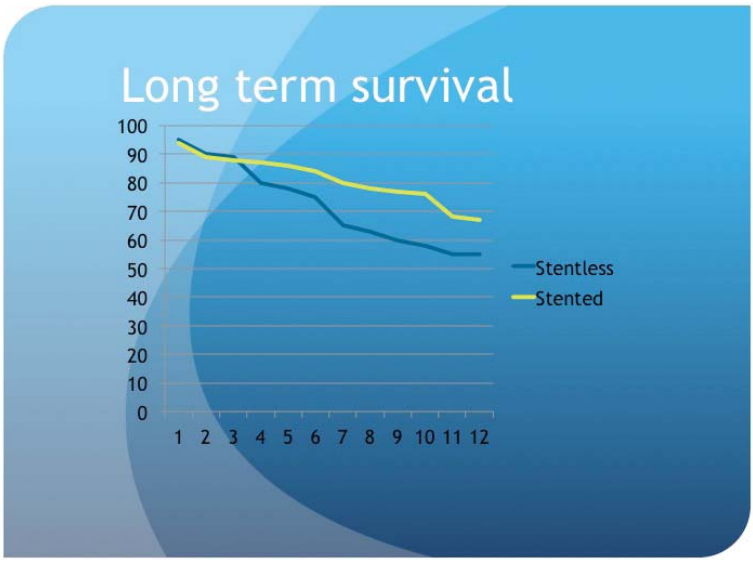
P7. Ten-Year Follow Up After Prospectively Randomized Evaluation of Stentless Aortic Valve Versus Stented Aortic Valve Replacement

Adam El-Gamel

Waikato Hospitali, Hamilton, New Zealand

Stentless aortic valve replacement (SAVR) became a common surgical procedure to treat aortic valve disease, as it presumed to provid larger orifice area and improved hemodynamics The aim of this prospectively randomized study was to analyze the long-term clinical results after stentless versus conventional aortic valve replacement (AVR).

METHODS: Between January 1998 and January 2000, a total of 200 patients was prospectively included into the study. Of these patients, 100 received a stentless aortic valve (SAV), and 100 stented bioprosthesis (AVR). In these patient groups, 94% and 95%, respectively, had an aortic stenosis, and the mean ages were 67 ± 7 and 69 ± 4 years, respectively. There were no significant inter-group differences in left ventricular function, preoperative pressure gradient, or NYHA functional status, and the aortic annulus diameter indices were comparable and measured with Hagar dilator.



RESULTS: The 10-year follow up was 98% complete. At time of discharge,no operative mortality , maximum pressure gradients across the stentless valve (13 ± 7 mmHg) were comparable to maximum pressure gradient across the stented valve (15 ± 6 mmHg; p = NS) so as the calculated effective orifice area for both. At 1 year, gradients increased in both groups, but were not significantly higher between both valves). At follow up the mean NYHA class was 1.2 ± 0.8 after SAV versus 1.9 ± 0.7 after AVR the left ventricular ejection fraction was 55 ± 11% versus 52 ± 8%, and the maximum aortic valve pressure

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gradient 20 ± 9.2 mmHg versus 18 ± 6.8 mmHg (p = NS). 70% of suviving pateints were statsified with their improvement; however, a regression of left ventricular hypertrophy occurred in all patients after the procedure no difference again between the groups. The 10-year survival was 59 ± 4.2% (SAV) versus 68 ± 5.2% (AVR) (p = NS).

CONCLUSION: A good functional and hemodynamic outcome was observed at 10 years after all AVR. Stentless AVR was not associated with improved survival or hemodymnics, stented valve have excellent outcomes compared to stenless valve with the advavtage of easier implantation.

P8. Plenary Presentations and Public Citations from the American Association for Thoracic Surgery

Yusuke Terasaki[1], Matthew Smith[1], *Prasad Adusumilli[2], *Brendon M. Stiles[1]
[1]*Weill Cornell Medical College, New York Presbyterian Hospital, New York, NY;*
[2]*Memorial Sloan Kettering Cancer Center, New York, NY*

OBJECTIVE: The plenary scientific session of the American Association for Thoracic Surgery is an international forum for presentation of the most important clinical research performed by cardiothoracic surgeons. We sought to examine the impact of this work by determining how frequently the published manuscripts from the session were cited and sought to identify the most cited publications of the past 25 years from the plenary session.

METHODS: We reviewed the AATS programs from 1989 to 2014 (http://aats.org/annualmeeting/Program-Books/) and identified the corresponding publications in The Journal of Thoracic And Cardiovascular Surgery (JTCVS) from all abstracts presented Monday morning in the plenary scientific session. Papers were classified as cardiac, thoracic, or congenital. References were then evaluated for subsequent citations in ISI web of science (ISI: http://wokinfo.com/), Scopus (S: http://www.scopus.com/), and Google scholar (GS: http://scholar.google.com). We determined the mean/median of total citations and of citations/year. As a comparator, we evaluated citation numbers in ISI from contemporary JTCVS articles published in issues containing the top three cited plenary session articles in each subspecialty.

RESULTS: Among 109 total published plenary papers, the median number of citations in ISI, S, and GS was 51, 60, and 85 respectively. The median total number of citations in ISI was 55 for cardiac papers (n = 55), 61.5 for thoracic papers (n = 32), and 40 for congenital papers (n = 22), higher than citations for contemporary non-plenary cardiac (median: 22; n = 55; $P < 0.001$), thoracic (median: 31.5, n = 8; $P = 0.32$), and congenital (median: 15.5; n = 24; $P = 0.013$) papers published in JTCVS. The median number of citations per year since publication for plenary publications was 5.86, 5.35, and 3.33, respectively for each subspecialty. The three most cited papers (total) in each subspecialty since publication are listed in the following table.

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Table: The Three Most Cited Papers in Each Subspecialty Since Publication

Subspecialty	Title	Year	Institution	Number of Citations (ISI)	Citations/ Year Since Publication
Adult Cardiac	Two internal thoracic artery grafts are better than one	1998	Cleveland Clinic	452	28.3
Adult Cardiac	Off-pump coronary artery bypass grafting provides complete revascularization with reduced myocardial injury, transfusion requirements, and length of stay: A prospective randomized comparison of two hundred unselected patients undergoing off-pump versus conventional coronary artery bypass grafting	2002	Emory University	325	27.1
Adult Cardiac	The "first generation" of endovascular stent-grafts for patients with aneurysms of the descending thoracic aorta	1994	Stanford University	313	19.6
Thoracic	Postintubation tracheal stenosis: Treatment and results	1994	Mass General Hospital	189	9.45
Thoracic	Data from The Society of Thoracic Surgeons General Thoracic Surgery database: The surgical management of primary lung tumors	2007	STS Database	171	24.4
Thoracic	Eliminating the cervical esophagogastric anastomotic leak with a side-to-side stapled anastomosis	1999	University of Michigan	164	10.9
Congenital	The influence of hemodilution on outcome after hypothermic cardiopulmonary bypass: results of a randomized trial in infants	2002	Boston Children's Hospital	166	13.8
Congenital	Brain maturation is delayed in infants with complex congenital heart defects	2008	CHOP	94	15.7
Congenital	Predictors of outcome after the Fontan operation: Is hypoplastic left heart syndrome still a risk factor	2001	CHOP	79	6.08

CONCULSION: The plenary scientific session of the AATS provides a forum for the presentation and discussion of the most significant clinical research in field of cardiothoracic surgery. Publications corresponding to the presentations are highly cited and include some of the seminal studies in our field in the last 25 years.

P9. Does Grafting Coronary Arteries with Only Moderate Stenosis Affect Long-Term Mortality?

*Joseph F. Sabik, III, Gabriel Olivares, Sajjad Raza, Penny L. Houghtaling, *Eugene H. Blackstone

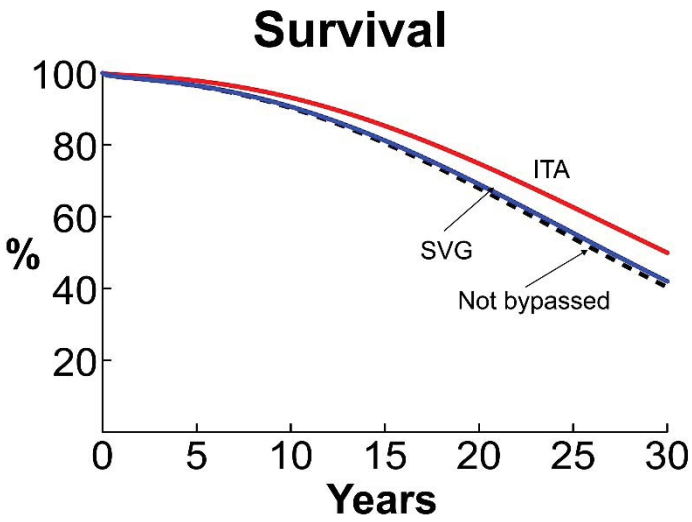
Cleveland Clinic, Cleveland, OH

OBJECTIVES: Fractional flow reserve (FFR), a technique that evaluates the potential of a coronary artery stenosis to induce myocardial ischemia, is being advocated to identify which coronary stenoses should be addressed by revascularization and which should not. Although an FFR-guided approach yields better PCI outcomes than the traditional angiographic-guided approach, its value in patients undergoing CABG is unknown. Most angiographically moderate coronary stenoses would not be identified by FFR as candidates for a revascularization procedure, yet traditionally, surgeons have attempted to bypass all such lesions. Therefore, in this era of FFR, we sought to determine whether grafting coronary arteries with moderate anatomic stenosis is associated with poorer long-term mortality than leaving them ungrafted.

METHODS: From 1972 to 2011, 55,567 patients underwent primary isolated CABG. Of these, 8,531 had a single coronary artery with moderate (50–69%) stenosis; it was bypassed in 6,598 patients (77%) and not bypassed in 1,933 (23%). These patients had bypasses to all other coronary arteries with severe (≥70%) stenoses. Moderate stenosis was present in the circumflex artery in 2,714 patients (32%), right coronary artery in 2,599 (30%), diagonals in 1,635 (19%), and left anterior descending in 1,583 (19%). Internal thoracic arteries (ITA) were used to graft moderately stenosed coronary arteries in 1,806 patients (27%) and saphenous vein (SV) grafts in 4,625 (70%). The study endpoint was all-cause mortality. Mean follow-up was 13 ± 9.7 years.

RESULTS: Unadjusted survival was similar for patients with and without a graft to the moderately stenosed coronary artery (p = .3). Unadjusted survival at 1, 5, 10, 20, and 30 years was 97%, 90%, 76%, 43%, and 18% in patients receiving no graft to moderately stenosed coronary arteries, 97%, 89%, 74%, 41%, and 18% in patients receiving SV grafts, and 98%, 93%, 82%, 51%, and 23% in patients receiving ITA grafts. After adjusting for patient characteristics, long-term mortality was similar for patients with and without a graft to the moderately stenosed coronary artery (p = .13). SV grafting vs. non-grafting of moderately stenosed coronary arteries was associated with similar long-term mortality (p = .2), whereas ITA grafting vs. non-grafting of such arteries was associated with 22% lower long-term mortality (HR, 0.78; 68% CLs, 0.74–0.82) (see Figure).

CONCLUSIONS: Grafting coronary arteries with angiographically moderate stenosis is not associated with higher long-term mortality. Instead, ITA grafting of such coronary arteries is associated with lower long-term mortality. Therefore, in patients with an indication for CABG, the FFR-guided approach may not be beneficial because the angiographic-guided approach does not seem to be harmful, and ITA grafting of moderately stenosed coronary arteries is beneficial.


Survival
100
80
60
40
20
%
ITA
SVG
Not bypassed
0
5
10
15
20
25
30
Years

P10. Surgical Outcomes of Jehovah's Witness Patients Requiring Complex Cardiac Surgery

Akiko Tanaka, Takeyoshi Ota, Zewditu Asfaw, David Onsager, Vassyl Lonchyna, *Valluvan Jeevanandam

University of Chicago, Chicago, IL

OBJECTIVE: We assessed surgical outcomes and predictors of mortality in all Jehovah's Witness (JW) patients undergoing cardiac surgery at our institution and evaluated the efficacy of our preoperative optimization protocol.

METHODS: From 1999 to 2014, of all 146 referred JW patients 141 underwent cardiac surgery (5 patients were not operated because of liver cirrhosis, 5th-time reoperation for transplant, and irreversible pulmonary hypertension). Patients with preoperative circulatory catastrophe who underwent salvage operations (N = 7) were excluded from the study. Twenty-four (18%) patients were reoperations and 22 (16%) required preoperative IABP due to hemodynamic instability. The operative procedures, all performed via sternotomy, included 54 CABG, 35 valve, 11 valve + CABG, 8 aortic, 11 VAD, 10 heart transplant and 5 congenital surgeries. Our current preoperative optimization for JW includes: 1) preoperative iron and/or vitamin (e.g., folic acid, vitamin B12) supplementation and subcutaneous erythropoietin targeting hemoglobin (Hb) > 12 g/dL, 2) discontinuing antiplatelet therapy for 5 days.

RESULTS: Ninety patients (67%) were Optimized and 44 patients (33%) were Unoptimized at the time of surgery. Surgical procedures and patient demographics in both groups were not significantly different. The mean Hb of entire cohort was: preoperative 12.7 ± 1.7 g/dL; intraoperative nadir 9.4 ± 2.3 g/dL; and discharge 9.7 ± 1.8 g/dL. No blood products were administered in any patient. There were 9 (6.7%) perioperative deaths – 2 (2.2%) in Optimized and 7 (15.9%) in Unoptimized patients (p = 0.003). Six deaths were affected by the restriction to blood product usage. The Youden index identified a preoperative Hb cutoff value of 11.7 g/dL for perioperative mortality (sensitivity 73.8%, specificity 76.8%). Univariate analysis revealed preoperative low creatinine clearance (<50ml/min) and suboptimal preoperative Hb (48H) (sensitivity 90.0%, specificity 73.6%) and Hb 11.7 g/dL for renal failure requiring hemodialysis (sensitivity 76.8%, specificity 75.0%).

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Patient Demographics

Variable	Overall N=134	Optimized N = 90	Unoptimized N = 44	P-value
Surgical Procedures				
CABG	54 (40%)	39 (43%)	15 (34%)	0.306
Valve	35 (26%)	23 (26%)	12 (27%)	0.831
Valve + CABG	11 (8%)	5 (6%)	6 (14%)	0.110
Aorta	8 (6%)	7 (8%)	1 (2%)	0.207
VAD	11 (9%)	5 (6%)	6 (14%)	0.110
Heart transplant	10 (7%)	6 (7%)	4 (9%)	0.616
Congenital	5 (4%)	5 (6%)	0 (0%)	0.111
Perioperative mortality	9 (7%)	2 (2%)	7 (16%)	0.003*

*: Statistically significant, CABG: coronary artery bypass, VAD: ventricular assist device

Cause of Perioperative Death

Cause of Death	N = 9
Low output syndrome	3
Arrhythmia	1
Donor graft failure	1
Sepsis	3
Anaphylactic shock	1

CONCLUSIONS: Preoperative Hb <12 g/dl and creatinine clearance <50 ml/min were independent predictors of perioperative mortality. Our JW optimization protocol was successful in reducing postoperative mortality and complications. With proper optimization and meticulous surgical technique, complex cardiac surgery without administration of any blood products, can be safely performed in JW patients with excellent outcomes.

P11. Long-Term Clinical Outcomes of Mitral Valve Replacement with the Hancock II Bioprosthesis

Mitesh V. Badiwala, Carolyn M. David, Cedric Manlhiot, Lisa Garrard, *Tirone E. David, *Vivek Rao Peter Munk

University of Toronto, Toronto, ON, Canada

OBJECTIVE: We have previously demonstrated that compared to other bioprosthetic valves, the Hancock II (HII) has superior durability in the aortic position. The purpose of this study is to evaluate the long-term outcomes of patients implanted with a HII in the mitral position at our institution.

METHODS: All patients who underwent mitral valve replacement with a HII prosthesis from January 2000 to December 2013 in a single institution were included in this study. Freedom from time dependent outcomes was modeled using non-parametric Kaplan-Meier method. Data are presented as mean ± SD or median with 5th and 95th percentiles.

RESULTS: A total of 636 consecutive patients underwent mitral valve replacement with a HII prosthesis during the study period. Median age was 73 years (51–83), and 508 (81 %) of patients were in NYHA class I or II before operation. Coronary artery bypass was required in 277 (44%) patients, aortic valve replacement in 149 (23%) and tricuspid valve repair in 109 (17%). Most patients underwent surgery for rheumatic (188, 30%) or myxomatous disease (181, 28%). Median ICU stay was 73 hours and hospital stay was 10 d. Reoperation for bleeding occurred in 60 (9%) patients and pacemaker insertion occurred in 107 (17%). In-hospital mortality was 7% (44 patients). Mean follow-up duration was 4.5 ± 3.6 years and extended from 0.8 to 14.5 years. At last follow-up, 366 (91%) of patients were in NYHA class I or II. Survival at 12 years was 38 ± 4%, however, only 2% had a valve-related death. Structural valve deterioration occurred in 8 (1%) of patients in the follow-up period. Thrombotic complication including stroke/TIA occurred in 7 (2%) of patients in the follow-up period. Freedom from anticoagulation-related hemorrhage at 12 years was 95 ± 2% and freedom from reoperation was 96 ± 1% at 12 years (see Figure). Factors associated with reoperation on univariable analysis were age (HR, 1.04/5 years; $p = 0.02$) and preoperative endocarditis (HR, 4.4; $p = 0.03$) Factors significantly associated with all-cause mortality on multivariable analysis were age (HR, 1.3/5 years; $p < 0.001$), CPB time (HR, 1.25/30 minutes; $p < 0.001$), mitral valve calcification (HR, 2.0; $p = 0.001$), smoking history (HR, 1.4; $p = 0.02$), LV ejection fraction (HR, 1.2/class; $p = 0.03$), preoperative syncope (HR, 2.5; $p = 0.03$), level of urgency (HR, 1.2/level; $p = 0.04$), preoperative COPD (HR, 1.7; $p = 0.05$), and any previous reoperation (HR, 1.4; $p = 0.06$).

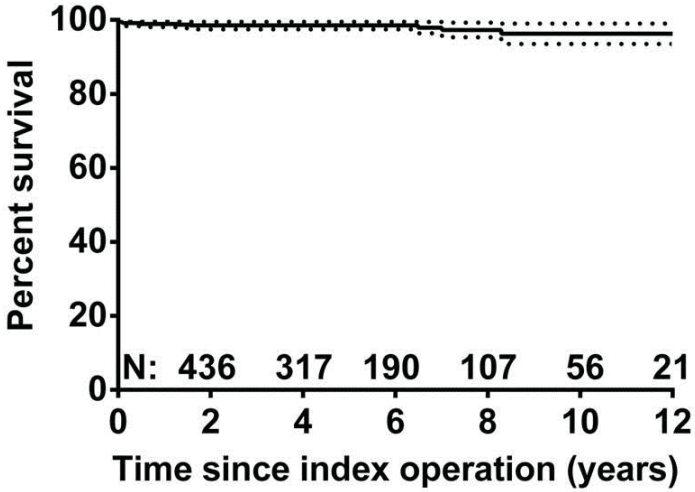


Figure 1. Freedom from Reoperation

CONCLUSIONS: Mitral valve replacement with the Hancock II prosthesis is associated with a low incidence of valve-related mortality and a high freedom from anticoagulation-related hemorrhage and reoperation at 12-year follow-up.

P12. Restoration of Sinus Rhythm and Atrial Transport Function After the Maze Procedure: Box-Lesion Versus U-Lesion Set

*Takashi Nitta, Yosuke Ishii, Masahiro Fujii, Yasuo Miyagi, Shun-ichiro Sakamoto, Atushi Hiromoto, Hajime Imura

Nippon Medical School, Tokyo, Japan

OBJECTIVE: Surgery for AF is performed to restore sinus rhythm and atrial transport function with the aim of prevention of thromboembolism. Box-lesion set that isolates the entire posterior LA including all four pulmonary veins has been shown to restore sinus rhythm in more patients than the U-lesion set in which the LA roof between the right and left superior pulmonary veins is not ablated to allow the activation to propagate into the posterior LA and to recruit this segment as a contractile atrial component. The purpose of the study was to examine if the preservation of the posterior LA results in a better postoperative LA transport function.

METHODS: Postoperative LA transport function was examined in 402 patients who underwent surgery for AF with Box-lesion or U-lesion set from August 1993 to October 2014. The patients who underwent pulmonary vein isolation alone or other simplified procedures were excluded from the study. Cardiac rhythm was examined by ECG and Holter monitoring and LA transport function was evaluated 20 ± 33 months postoperatively in patients who restored sinus rhythm. The LA transport function was quantified by the peak A/E: the ratio of peak flow velocities of the atrial filling wave to the early filling wave of the transmitral Doppler flow. Case-matching and multivariable regression modeling techniques were used to estimate the association of peak A/E with specific preoperative patient conditions and the lesion set of AF ablation. Factors used for propensity score matching were age, sex, paroxysmal or chronic AF, association of structural heart disease, and preoperative LA diameter and EF.

RESULTS: Multivariable logistic regression analysis revealed that increased LA diameter significantly decreased postoperative AF-free rate (OR, 18.4; $p = 0.03$). None of the other factors indicated above significantly influenced postoperative AF-free rate. Sinus rhythm resumed in 81.8% in the patients with Box-lesion, while 90.4% in U-lesion ($p = 0.15$). The postoperative peak A/E after the U-lesion set (0.52 ± 0.26) was higher than after the box-lesion set (0.39 ± 0.17), but did not reach statistically significant level ($p = 0.37$). This tendency became more evident in the patients with preoperative LA diameter <55 mm (U-lesion set: 0.55 ± 0.26 vs Box-lesion set: 0.41 ± 0.20; $p = 0.16$).

CONCLUSION: U-lesion set should be indicated in patients with a mild to moderately dilated LA to restore a superior LA transport function.

*AATS Member

CONGENITAL HEART DISEASE MODERATED POSTER COMPETITION

Moderator: *Jennifer C. Hirsch-Romano

P13. Outcomes of Heart Transplantation in Children with Hypoplastic Left Heart Syndrome Previously Palliated with the Norwood Procedure

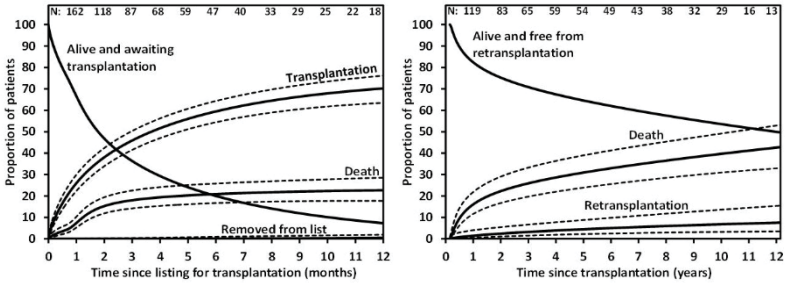
*Bahaaldin Alsoufi[1], William Mahle[1], Cedric Manlhiot[2], Shriprasad Deshpande[1], *Brian Kogon[1], Brian McCrindle[2], *Kirk Kanter[1]

[1]Emory University, Atlanta, GA; [2]University of Toronto, Toronto, ON, Canada

OBJECTIVE: Following the Norwood operation, unfavorable hemodynamic or anatomic factors might disqualify children with hypoplastic left heart syndrome (HLHS) from progressing through subsequent palliative surgeries or might cause late deterioration following Fontan completion; all necessitating enlistment to receive heart transplantation (HT). Those patients might have immune, clinical or anatomic risk factors that could preclude proper donor heart allocation, increase operative risk and diminish late survival following HT. Prior studies have shown that previously palliated HLHS patients had the worst outcomes following pediatric HT. We studied outcomes of HT in this patient cohort using the Pediatric Heart Transplant Study (PHTS) database.

METHODS: Between 1993 and 2013, 253 children with previously palliated HLHS were listed for HT. Competing risks analysis modeled events after listing (HT, death without HT), and after HT (death, retransplantation) and examined risk factors affecting outcomes.

RESULTS: Patients were listed at median age of 1.5 years (IQR, 0.4–4.2) and were in the following palliation stages: after Norwood (n = 89 [35%]), after Glenn (n = 96 [38%]), after Fontan (n = 68 [27%]). 188/253 (74%) were listed UNOS status I. Renal failure was present in 12 (5%). T-cell and B-cell panel reactive antibody (PRA) was >10% in 40% and 44%, respectively. Competing risks analysis showed that 2 years after listing, 23% of patients had died without HT, 74% had received HT, and 3% were alive without HT. [Figure a] Risk factors for death prior to HT were UNOS status 1 (HR, 4.3; $p < 0.001$), listing before Glenn (HR, 2.6; $p < 0.001$), younger age (HR, 2.8; $p = 0.004$), renal failure (HR, 3.0; $p = 0.02$) and mechanical circulatory support (HR, 2.0; $p = 0.03$). In the 188 HT recipients, competing risks analysis showed that 15 years following HT, 42% had died, 7% had received retransplantation, and 51% were alive without retransplantation. [Figure B] Risk factors for death following HT were black race (HR, 2.7; $p = 0.02$) and donor head trauma (HR, 1.8; $p = 0.02$). Following retransplantation, 3/8 (38%) died yielding an overall 15-year survival following HT of 54%.



CONCLUSIONS: HT is an acceptable strategy to salvage previously palliated HLHS patients who fail to progress at different palliation stages. Long term results are encouraging and comparable to published reports on HT in children with other forms of congenital heart disease. Nonetheless, waiting list mortality is high and is more elevated in younger children who are listed soon after Norwood. Efforts to decrease this waiting list mortality could include early mechanical support prior to organ dysfunction, and ABO incompatible HT to increase donor pool. In patients who received HT, survival was not affected by last palliation stage or by the presence of elevated PRA, reflecting advances in the current management strategies of sensitized patients undergoing HT.

*AATS Member

P14. Burden of Potentially Pathologic Copy Number Variants Is Higher in Children with Isolated Congenital Heart Disease and Significantly Impairs Covariate-Adjusted Long-Term Survival

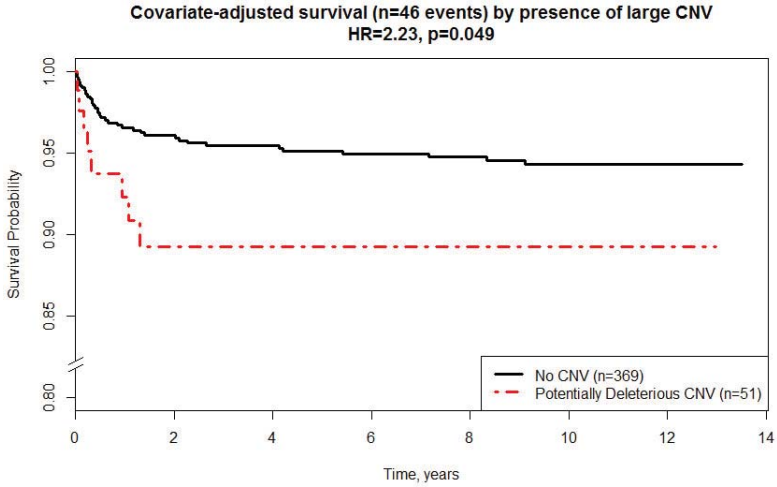
Daniel Seung Kim[1], Jerry H. Kim[1], Amber A. Burt[1], David R. Crosslin[1], Nancy Burnham[2], Donna M. McDonald-McGinn[2], Elaine H. Zackai[5], Susan C. Nicolson[2], *Thomas L. Spray[2], Ian B. Stanaway[1], Deborah A. Nickerson[1], Patrick J. Heagerty[1], Hakon Hakonarson[2], Gail P. Jarvik[1], J. William Gaynor[2]

[1]University of Washington, Seattle, WA; [2]Children's Hospital of Philadelphia, Philadelphia, PA

OBJECTIVE: Copy number variants (CNVs) are a common genomic polymorphism. Larger CNVs that duplicate or delete genes are rare, and potentially pathogenic. Prior work has found that large, gene-overlapping CNVs are enriched in children with congenital heart disease (CHD). In this work we sought to determine the frequency of large CNVs in children with isolated CHD and delineate the effect of these potentially pathogenic CNVs on long-term survival.

METHODS: This is an analysis of a previously described cohort of non-syndromic CHD patients who underwent cardiac surgery with cardiopulmonary bypass before 6 months of age (n = 419). Healthy pediatric controls (n = 500) were obtained from the Children's Hospital of Philadelphia (CHOP) site of the electronic Medical Records and Genetic Epidemiology (eMERGE) study. Illumina 550 K or greater GWAS chips were typed and analyzed at Center for Applied Genomics at CHOP for both cases and controls. CNVs were discovered through the GWASTools and PennCNV algorithms and subsequently screened for >95% overlap between the two calling methods, size (>300 kb), quality score (>100), overlap with a gene, and novelty (not present in a known, non-pathologic database of CNVs). Survival curves, adjusting for confounding covariates identified through *a priori* analyses, were calculated using Cox Proportional Hazards modeling to evaluate the joint effect of CNV burden and covariates on long-term survival.

RESULTS: Compared to eMERGE healthy pediatric controls, children with isolated CHD had a significantly higher burden of potentially pathogenic CNVs (51/419 [12.2%] vs. 25/500 [5.0%]; p = 0.00015). Presence of a large, potentially pathogenic CNV was associated with significantly decreased long-term survival (HR = 2.23; p = 0.049) after confounder adjustment (e.g., CHD severity, total bypass duration) in children with isolated CHD after surgical palliation (see Figure).



CONCLUSIONS: We confirm prior reports that children with CHD have a greater burden of rare CNVs, even after the exclusion of syndromic children (e.g., those with DiGeorge 22q11.2 deletion syndrome). Moreover, we report a novel finding that these large and rare CNVs are associated with an approximate 2-fold increased risk of death, after adjustment for other covariates. These data suggest that rare genetic variation is an important modifier of survival after surgery for CHD. Further understanding of these CNVs may lead to new prevention and treatment strategies.

*AATS Member

P15. Intramural Coronary Arteries Are Not a Risk for Mortality in the Arterial Switch Operation

Tyson A. Fricke, Anne Eva Bulstra, Phillip S. Naimo, Yves d'Udekem, Christian P. Brizard, *Igor E. Konstantinov

Royal Children's Hospital, Melbourne, Australia

OBJECTIVE: Intramural coronary arteries (IMCAs) may complicate coronary artery transfer during the arterial switch operation (ASO). IMCAs are often considered a risk factor for mortality following ASO. We sought to determine the long-term outcomes of 29 patients with IMCAs who underwent an ASO at a single institution.

METHODS: All patients who had IMCAs and underwent an ASO were identified from the hospital database and retrospectively reviewed.

RESULTS: From 1983 to 2009, 675 patients underwent an ASO at our institution for transposition of great arteries (d-TGA, n = 618) and Taussig-Bing anomaly (TBA, n = 57). Twenty nine (29/675 [4.3%]) had IMCAs. Most patients (28/29 [97%]) had d-TGA with intact ventricular septum (n = 21) or ventricular septal defect (n = 7). One (3%, 1/29) patient had TBA. Intramural course involved the left main coronary artery in 27 (27/29 [93%]) patients, the left anterior descending artery in 1 (1/29 [3.5%]) patient and the right coronary artery in 1 (1/29 [3.5%]) patient. Median age at operation was 9 days (range: 2 days to 447 days) and median weight at operation was 3.5 kilograms (range: 2.6 kilograms to 10 kilograms). There were no early deaths. Follow-up was 100% complete for 27 local patients. Mean follow-up was 14.6 years (median 15.4 years; range: 4.5 years to 25 years). There were no late deaths. No patient required reoperation on the coronary arteries or transcatheter coronary angioplasty. Freedom from reoperation was 93% at 10 years. There were 8 reoperations in 4 patients that occurred at a mean 9 years after surgery (range: 1 day to 14 years). One patient had 2 reoperations for supra-aortic stenosis and aortic-to-pulmonary artery fistula, one patient had mitral valve repair, one patient had 4 reoperations due to left pulmonary artery stenosis and one patient had a Bentall procedure and aortic valve replacement with mechanical prosthesis. No patient had more than mild aortic regurgitation at last follow-up. Seven patients had coronary angiograms at median 21 months (range: 14 months to 17 years) after ASO. All patients were asymptomatic at the time of angiogram. One patient had mild stenosis of the circumflex coronary artery demonstrated on a routine coronary angiogram 14 months postoperatively. This patient remained asymptomatic with a myocardial perfusion scan negative for inducible ischemia 16 years postoperatively. All 27 patients were in New York Heart Association Class 1 at last follow-up.

CONCLUSION: Patients with IMCAs were not at increased risk of death or coronary re-interventions and have good late outcomes after the ASO.

P16. The Surgical Treatment of Atrial Isomerism: Single Center Experience of 353 Cases

*Hajime Ichikawa, Koji Kagisaki, *Toshikatsu Yagihara, Takaya Hoashi
National Cerebral and Cardiovascular Center, Suita, Japan

OBJECTIVE: The surgical treatment of univentricular heart has improved by the successful treatment strategy to leads to single ventricular repair. However, the survival rate of the patients with atrial isomerism is inferior to that without. We have reviewed the 354 patients' charts in our center retrospectively and analyzed the long term outcome.

METHODS: From 1978 to 2013, patients with right atrial isomerism (RAI; n = 246) and left atrial isomerism (LAI; n = 108) are treated surgically. Univentricular repair was indicated in 263 patients, whereas only 91 patients were indicated for biventricular repair. Among them, 244 patients tolerated first surgical procedure and survived.

RESULTS: Operative death was seen 65 out of 246 in RAI and 10 out of 108 in LAI at first surgery. The outcome is analyzed by dividing the decades from 1978 to 1989, 1990 to 1999, and 2000 to present. The operative mortality decreased by time (17%, 7%, and 2%, respectively). The late mortalities to present date are 13%, 7%, and 2%, respectively. The mean ages at the initial surgical procedure are 1.59 years, 0.94 years, and 0.22 years, respectively. The choice of systemic to pulmonary shunt as an initial palliative surgery was decreased by decades (50, 33, and 23 %, respectively). Contrarily, the choice of bidirectional Glenn procedure increased (2, 10, and 17%). The ratio of TCPC completion was improved by decades (23%, 38%, and 51%, respectively). The average oxygen saturation after the first palliation was higher in the earliest decades and lowest in the recent decades. The significant risk factor for operative and late death is the TAPVC repair as the first palliative procedure and a severe common AV valve regurgitation. With these two factors, there was no improvement in the survival among three decades. The survival rate 20 years after initial surgical procedure was 60 % and 36 % in left and right isomerism, respectively. The 10 year survival was improved by decades (40, 53, and 64% in 1980s, 1990s, and after 2000, respectively [see Figure]).

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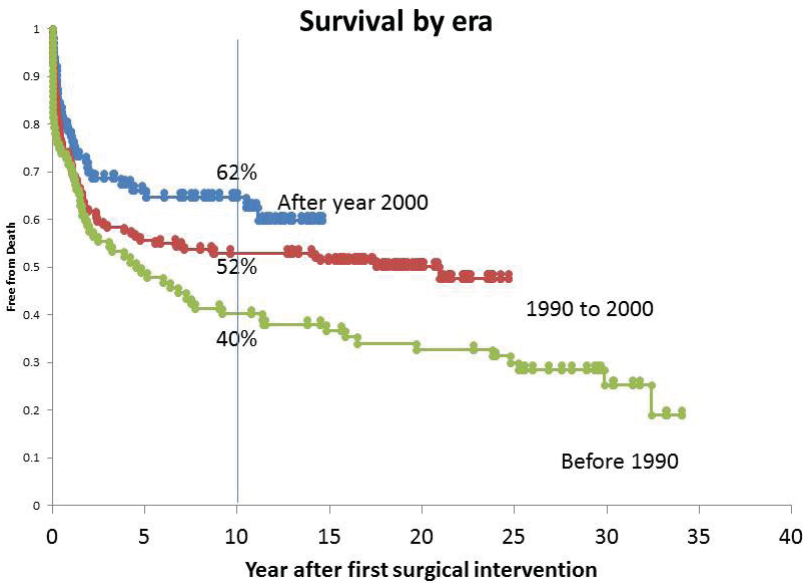

CONCLUSIONS: The outcome of the surgical treatment for atrial isomerism is still not satisfactory with high mortality. The low pulmonary blood flow strategy might improve the outcome possibly due to the prevention of high pulmonary vascular resistance and volume overload to the systemic ventricle to prevent AV valve regurgitation.

P17. The Impact of Age at Cavo-Pulmonary Shunt (Stage II) on Outcome After the Norwood Procedure. Importance of Elective Versus Non-Elective Intervention.

Intisar Ulhaq, Adrian Crucean, John Stickley, David Barron, Timothy Jones, Natasha Khan, William James Brawn

Birmingham Children's Hospital, Birmingham, United Kingdom

OBJECTIVE: The cavo-pulmonary shunt (CPS) is part of the staged strategy in univentricular heart palliation. Multiple studies have looked at the timing of this procedure highlighting the potential benefits of an early CPS especially in patients with hypoplastic left heart syndrome (HLHS). The experience with the CPS procedure in these particular patients is presented in this review.

METHODS: The study presents a retrospective analysis of 292 consecutive patients with dominant right ventricular morphology (HLHS and its variants) who have undergone CPS from 2002 to 2014. Variables analysed included age and weight at the time of CPS, atrio-ventricular(AV) valve function, ventricular function, interstage interventions, associated procedures, and the urgency of CPS (elective versus non-elective procedures based on clinical status and contemporary assessment of imaging data. End-points included length of hospital stay (LOS), freedom from death or transplantation, survival to the final stage of palliation (Fontan).

RESULTS: This is the largest series of its kind to date. The median patients' age at the time of CPS was 155 days (IQR, 125–182) and weight was 6 kg (IQR, 5.3–6.7). There were 54 (18.5%) CPS performed under 4 months of age and 59 (20.2%) were non-elective. The follow-up was complete in all patients. The overall 30-day mortality post CPS was 2.4% and 154 patients have reached the final stage (III) of palliation to date. There were no significant differences in outcomes between patients undergoing CPS before or after the age of 4 months or whether patients underwent interstage procedures or not. There were significantly worse outcomes for the patients undergoing a non-elective procedure (30-day mortality 7.3% versus 1.3% in the elective group; $p = 0.03$; median LOS 15 versus 10 days in the elective group). At least moderate or worse AV valve regurgitation was an additional risk factor for mortality in the non-elective group ($p = 0.01$) but ventricular function was not.

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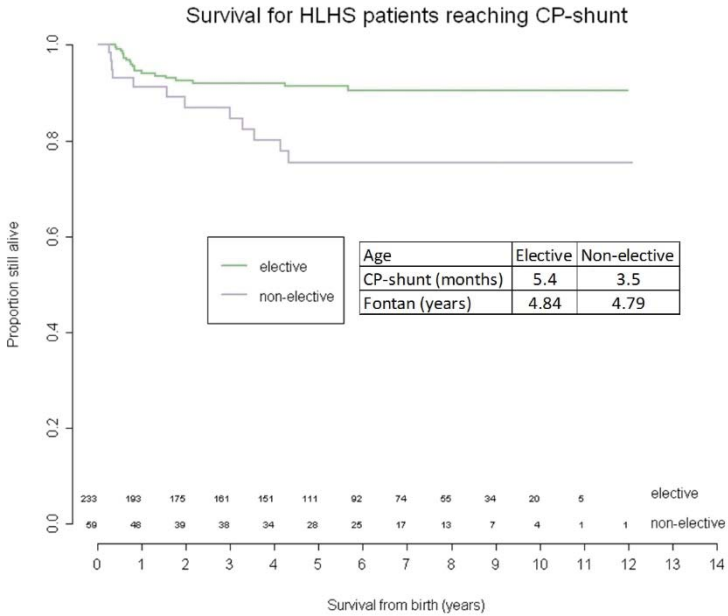

Figure: Significant survival difference between patients undergoing CPS in elective versus non-elective conditions (p-value = 0.03). Median age of patients at the time of CPS and stage III palliation is included.

CONCLUSIONS: Age at the time of stage II palliation did not affect outcome for patients with dominant right ventricular morphology. The CPS performed in non-elective settings yields worse outcomes irrespective of other variables that were traditionally found to be associated with poor prognosis. The function of the systemic AV valve only strengthens this association.

P18. More Than Repair the Valve – Effect of Cone Reconstruction on Right Ventricle Remodeling in Patients with Ebstein Anomaly: A CMR Study

Qi An, Da Zhu, Xiao Li

West China Hospital, Chengdu, China

OBJECTIVE: As a revolutionized procedure for Ebstein anomaly, cone reconstruction has yielded excellent results for valve repair. This study aims to determine the impact of cone reconstruction on right ventricle (RV) remodeling using cardiac magnetic resonance (CMR) technique.

METHODS: Patients with Ebstein anomaly were studied with CMR before and after cone reconstruction of tricuspid valve. Functional right ventricle (fRV) was traced manually on RV short axial planes, RV volume during end-systolic and end-diastolic phase as well as ejection fraction were than calculated. We also proposed the tricuspid annular movement synchronic index (TAMSI) to quantify the longitudinal movement pattern of tricuspid annuls during cardiac cycle. Three point at tricuspid annuls was chosen at four chamber and RV two chamber view of CMR indicating the anterior, posterior and septal leaflet, systolic excursion in reference to RV apex was then measured. TAMSI is defined as standard deviation of the systolic excursion divided by the average of the systolic excursion of at this three point.

RESULTS: During the study period, 17 patients were enrolled, with mean age 26 ± 12 years and mean follow-up time 6 ± 3 months. All patients survived without major complications except for one with a reoperation for valve repair. The atrialized right ventricle (aRV) was eliminated. The right ventricular end-diastolic volume was significantly reduced from 197.0 ± 64.3 ml/m2 to 154.7 ± 67.8 ml/m^2 ($p < 0.001$; Figures A and B), with slight elevation of EF% after cone reconstruction (from 35.8% ± 8.9% to 38.2% ± 8.7%; $p = 0.687$). The TAMSI was reduced from 0.562 ± 0.152 to 0.233 ± 0.137 ($p < 0.05$; Figures C through F), which indicated more coordinated movement of tricuspid annuls and a positive effect of cone construction on RV remodeling.

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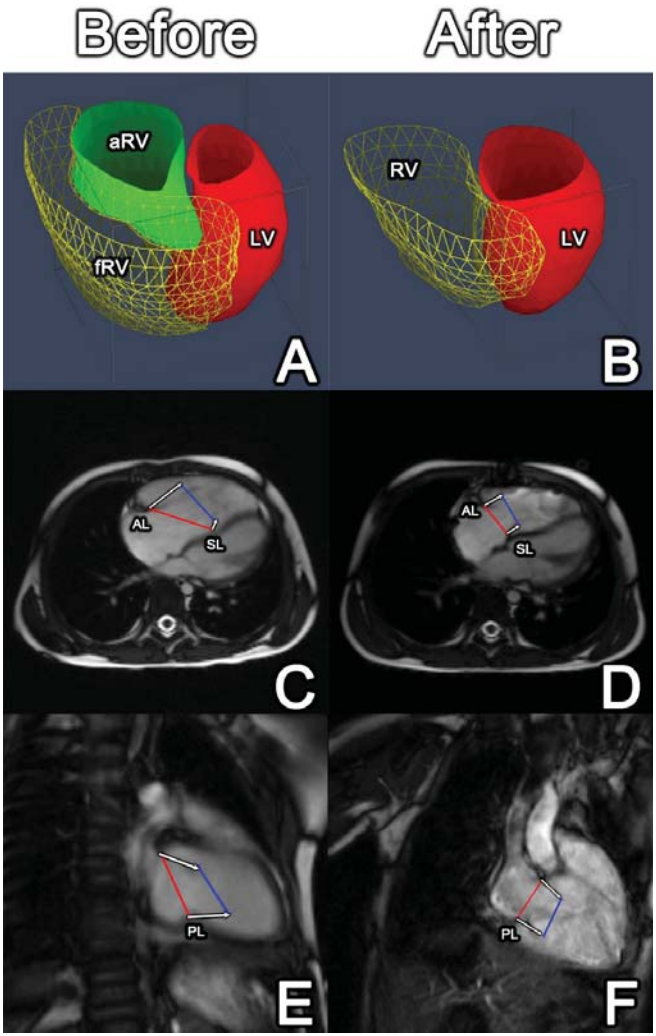


CONCLUSIONS: Cone reconstruction significantly decreases the volume of right ventricle while improves the longitudinal movement synchronicity of right ventricle during cardiac cycle. This remodeling effect of cone reconstruction of right ventricle may benefit clinical outcome after cone reconstruction.

P19. Mild to Moderate Residual LVOTO May Stop or Reverse the Progression of Systemic Right Ventricle Remodeling Process in Adult CCTGA Patients After Physiological Repair

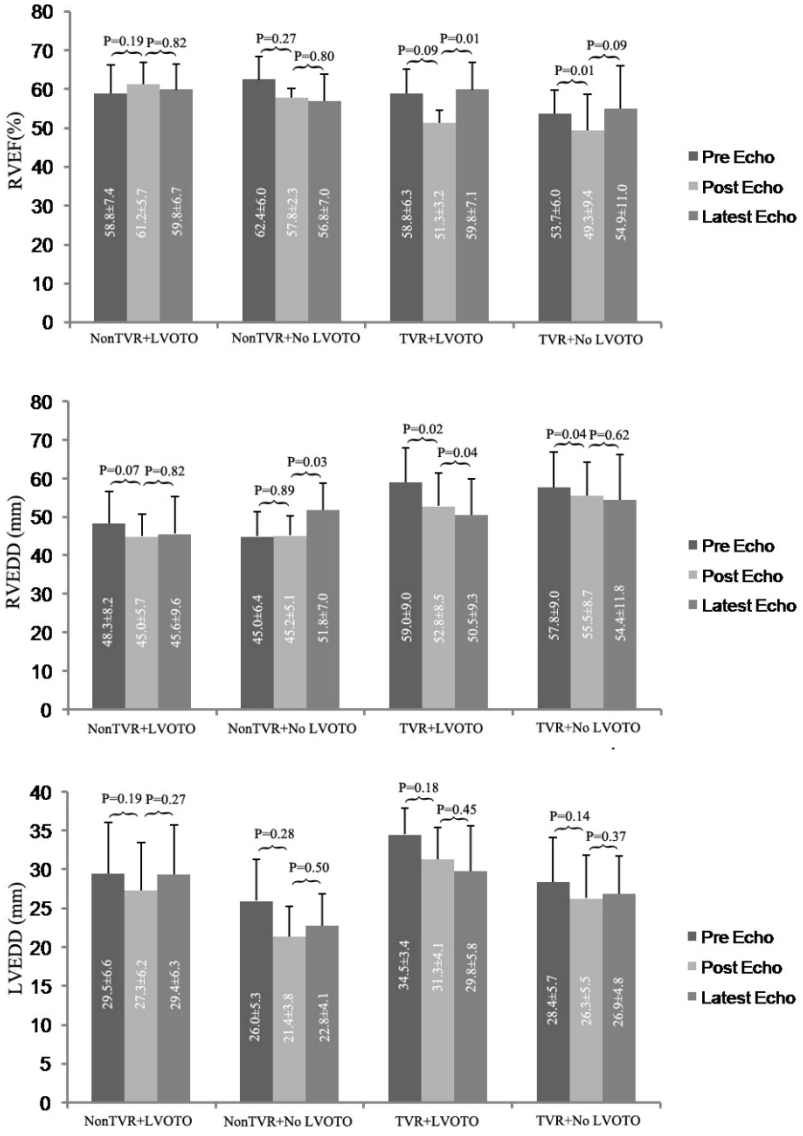
Fucheng Xiao, Jianping Xu, Hansong Sun Peking

Union Medical College and Chinese Academy of Medical Sciences, Beijing, China

OBJECTIVE: Left ventricular outflow tract obstruction (LVOTO) caused by pulmonary artery banding has been shown to retrain the sub-pulmonic left ventricle and to improve tricuspid regurgitation and morphological right ventricular dysfunction effectively in patients with congenitally corrected transposition of the great arteries (ccTGA). We aimed to evaluate the long-term effect of residual LVOTO in patients with ccTGA after physiological repair.

METHODS: Between January 2000 and August 2013, 47 consecutive adult ccTGA patients undergoing physiological repair were included. Residual LVOTO was defined as transpulmonary pressure gradient ≥15 mmHg. Patients were grouped into tricuspid valve replacement (TVR group) and non replacement group (NonTVR group). Based on the presence of residual LVOTO, those 2 groups were further divided into 4 subgroups, namely NonTVR+LVOTO subgroup (n = 13), NonTVR+No LVOTO subgroup (n = 5), TVR+LVOTO subgroup (n = 7) and TVR+No LVOTO subgroup (n = 22). Remodeling process of sub-aortic right ventricle after surgery, indicated by its ejection fraction (RVEF) and end diastolic diameter (RVEDD) were evaluated between postoperative and latest echocardiography in each subgroup. Late major adverse cardiac events (death, reintervention either surgical or percutaneous and recurrence of at least moderate tricuspid regurgitation or perivalvular leakage) were also analyzed.

RESULTS: There was 1 death and 7 surgically acquired complete heart blocks occurred during hospitalization. Mean echocardigrphic follow-up was 57.0 ± 39.4 months. In TVR+ LVOTO subgroup, RVEDD decreased significantly, from 52.8 ± 8.5 mm postoperatively to 50.5 ± 9.3 mm in latest echocardiography (P = 0.04), and RVEF increased dramatically from 51.3 ± 3.2% to 59.8 ± 7.1% (P = 0.01) whereas no significant improvement was observed in RVEDD and RVEF in TVR+No LVOTO subgroup (P = 0.62 and P = 0.09, respectively). In NonTVR group, RVEDD dilated progressively over time, from 45.2 ± 5.1 mm to 51.8 ± 7.0 mm in patients without LVOTO (P = 0.03) whereas it remained stable in patients with LVOTO (P = 0.82). However, RVEF did not differ significantly between postoperative and latest echocardiography in NonTVR group patients with or without LVOTO. The overall event free survival rate after physiological repair was 97.6%, 93.8%, 68.2%, and 45.5% at 12, 60, 120, and 143 months, respectively. In univariate analysis, residual LVOTO was associated with a trend toward being a significant protective factor against late adverse outcomes in NonTVR group but not in TVR group (OR = 0.15; P = 0.09 and OR = 3.82; P = 0.38, respectively).



CONCLUSIONS: Mild to moderate residual LVOTO may stop or even reverse the progression of right ventricular remodeling process and tend to decrease the long-term adverse outcomes in adult patients with ccTGA undergoing physiological repair.

P20. What Is the Procedure Impact on Ventricular Outflow Tract Hemodynamics and Reintervention in Patients with Complex Transposition?

Mohammed K. Al-Jughiman, Maryam Al-Omair, Luc Mertens, *Christopher A. Caldarone, *Glen Van Arsdell

Hospital for Sick Children, Toronto, ON, Canada

BACKGROUND: Over the past few decades, multiple surgical strategies have evolved in order to improve survival and ventricular outflow tract-related problems in patients with complex transposition and equivalents.

OBJECTIVE: We hypothesized that Nikaidoh procedure would produce better left ventricular outflow tract (LVOT) and right ventricular outflow tract (RVOT) hemodynamics and lower reintervention rates compared to the Rastelli and REV procedures.

METHOD: Over the past 32 years, 88 patients underwent repair with either Nikaidoh (n = 9 [10.2%]), Rastelli (n = 69 [78.4%]), or REV (n = 10 [11.4%]) ± atrial switch for either D-TGA (n = 54 [61.4%]), DORV (n = 12 [13.6%]), or CC-TGA (n = 22 [25%]). All had associated morphologic left ventricular outflow tract obstruction (LVOTO). Analysis was divided into eras; that is, first era 1982 to 1989 (n = 28 [31.8%]), second era 1990 to 1999 (n = 31 [35.2%]), and last era 2000 to 2013 (n = 29 [33%]).

RESULT: In the most recent era, freedom from LVOT reintervention at 10 years was 100%, 92.3%, and 100% after Nikaidoh, Rastelli, and REV respectively (P = 0.66). Freedom from RVOT reintervention at 10 years was 58.3%, 92.3%, and 66.7% after Nikaidoh, Rastelli, and REV respectively (P = 0.26). At 7 years, freedom from free PI was 41.7%, 53.2%, and 0.0% after Nikaidoh, Rastelli, and REV respectively (P = 0.014). In repeated measures analysis for the entire cohort (Figure 1A-B), Rastelli had a positive time relationship to increasing LVOT gradient with a slope of 0.47 (SE = 0.13; 95% CI [0.20–0.73]; P = 0.001), compared to −0.05 (SE = 0.07; 95% CI [−0.20–0.10]; P = 0.49) and 0.33 (SE = 0.24; 95% CI [−0.18–0.85]; P = 0.19) after Nikaidoh and REV respectively. There was no difference in LVOT mean gradient between groups; that is, 5.35, 11.50, and 7.17 in Nikaidoh, Rastelli, and REV, respectively (F = 2.26; p = 0.12). On RVOT, there was a positive time relationship to increasing gradient after Nikaidoh and Rastelli with a slope of 3.4 (SE = 1.09; 95% CI [0.96–5.83]; P = 0.01) and 0.89 (SE = 24; 95% CI [0.4–1.37]; P < 0.001) respectively, compared to 0.5 (SE = 0.69; 95% CI [−0.93–1.95]; P = 0.47) after REV. Mean RVOT gradient was also similar i.e. 28.79, 31.46, and 25.59 in Nikaidoh, Rastelli, and REV respectively (F = 1.05; P = 0.35).

In the most recent era, freedom from mortality at 10 years was 88.9%, 93.8%, and 100% after Nikaidoh, Rastelli, and REV, respectively (P = 0.79).

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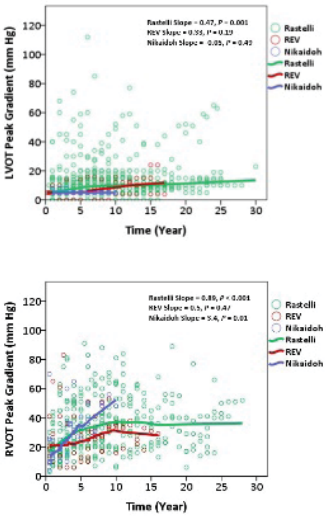


CONCLUSION: The Nikaidoh yielded the most favorable LVOT hemodynamics. No advantage was demonstrated for survival, RVOT hemodynamics, or reintervention in the current era with midterm follow up. The REV produced the least RVOT obstruction/reintervention but at a cost of free pulmonary insufficiency.

P21. Increasing Complexity of Heart Transplantation in Patients with Congenital Heart Disease

William Y. Shi[1], Pankaj Saxena[2], Matthew S. Yong[1], Silvana Marasco[2], *David McGiffin[2], Anne Shipp[1], Robert G. Weintraub[1], Yves d'Udekem[1], Christian P. Brizard[1], *Igor E. Konstantinov[1]

[1]Royal Children's Hospital, Parkville, Australia; [2]Alfred Hospital, Prahran, Australia

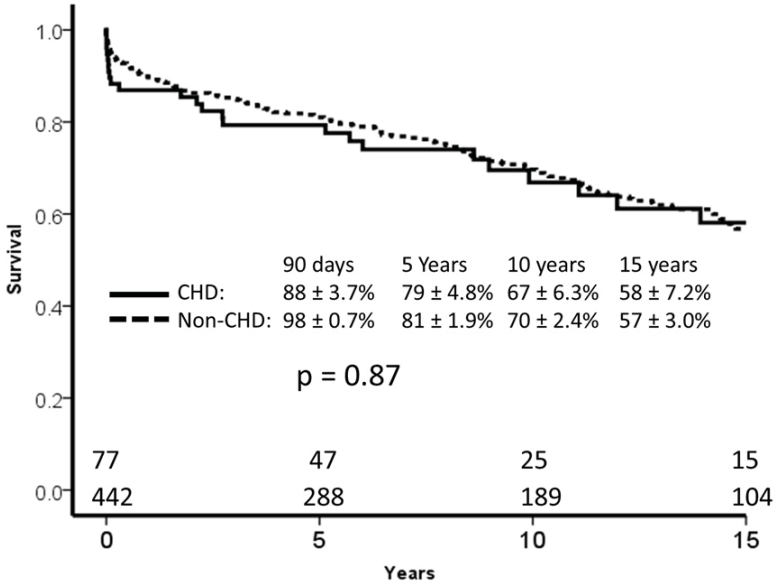
OBJECTIVES: Due to improved surgical results, there is a growing population of patients with repaired congenital heart disease (CHD) requiring heart transplantation.

METHODS: Retrospective review of outcomes of heart transplantation in patients with CHD (n = 77) was compared to age-matched patients without CHD (n = 442). Outcomes of early (1988 to 1999) and late (2000 to 2013) eras were compared.

RESULTS: From 1988 to 2013, 817 patients underwent orthotopic heart transplantation. Of these, 77 had CHD. There were 48 (62%) males and 29 (38%) females with a mean age of 18 ± 14 years (range: 16 days to 58 years). Most (70/77 [91%]) patients underwent a mean of 2.6 ± 1.3 (range: 1–6) cardiac operations prior to transplantation. Univentricular palliation was performed in 44 (57%) patients, 22 patients of whom had Fontan procedure. Seventeen (22%) patients required an additional procedure during transplantation (pulmonary artery reconstruction in 9, aorta arch replacement in 3, combined aortic and pulmonary reconstruction in 5).

Hospital mortality was 13% (10/77) with primary graft failure being the cause of death in 7 patients. There were no difference in mean age (early: 15 ± 14 years vs. late: 21 ± 15 years; p = 0.06), number of prior cardiac procedures (early: 2.1 ± 1.4 vs. late: 2.7 ± 1.4; p = 0.09), waiting time to transplantation (early: 279 ± 449 days vs. late: 202 ± 163 days; p = 0.33), proportion univentricular palliations (early: 53%, 20/38 vs. late: 59%, 23/39; p = 0.65) or hospital mortality (early: 16%, 6/38 vs. late: 10%, 4/39; p = 0.52) in patients with CHD during 2 time periods. However, recipients with CHD in the later era had longer mean cardiopulmonary bypass (CPB) time (early: 190 ± 70 minutes vs. late: 271 ± 114 minutes; p < 0.001), donor ischaemic times (early: 222 ± 98 minutes vs. late: 276 ± 102 minutes; p = 0.02) and more often required postoperative ECMO (early: 8%, 3/38 vs. late: 72%, 28/39; p = 0.036).

Patients (n = 442) without CHD (non-CHD) were used for comparison. The proportion of transplant recipients with CHD remained similar across the study period (early: 15% vs. late: 15%; p = 0.9). Univentricular physiology had no impact on survival. Recipients with CHD waited longer for transplantation (CHD: 240 ± 336 days vs. non-CHD: 152 ± 222; p = 0.028) and had longer mean CPB (CHD: 232 ± 103 minutes vs. non-CHD: 130 ± 52 minutes; p < 0.001) and cardiac ischaemia (CHD: 249 ± 103 minutes vs. non-CHD: 223 ± 92 minutes; p = 0.026) times, reflecting the need for complex intraoperative surgical preparation. CHD patients had greater 30-day mortality (CHD: 10%, 8/77 vs. non-CHD: 4%, 18/442; p = 0.04). However, long-term survival was similar in patients with and without CHD (see Figure). Survival adjusted for age and era was also similar.



CONCLUSIONS: Patients with CHD await heart transplantation longer, often require complex intraoperative surgical preparation and have higher early mortality. Long-term post-transplantation survival is similar in patients with and without CHD.

P22. Bicuspid Aortic Valve Morphology: Does the Pattern of Leaflet Fusion Determine the Success of the Ross Procedure?

Mark Ruzmetov, Randall S. Fortuna, Jitendra J. Shah, Dale M. Geiss, Karl F. Welke
Children's Hospital of Illinois, Peoria, IL

OBJECTIVES: In addition to being associated with aortopathy, bicuspid aortic valve (BAV) has been posed to be a risk factor for dilation of the pulmonary autograft in the aortic position. The aim of this study is to assess the association between the subtype of native aortic valve leaflet fusion (right and non-coronary leaflets [R/N] versus right and left leaflets [R/L]) and autograft dilatation and valve dysfunction after the Ross procedure.

METHODS: We performed a retrospective review of 43 patients with BAV who underwent a Ross procedure in our center from 1998 to 2012. Serial transthoracic echocardiography was used to measure changes in autograft and ascending aortic diameter over time. For each patient, the most recent echocardiogram or the last echocardiogram before intervention was reviewed. Moderate or greater aortic stenosis (AS) was defined as a valve gradient >3.5 m/s; aortic insufficiency (AI) was quantified using standard criteria. Aortic diameter was measured at 4 levels, and Z-values were computed. Aortic dilation was defined as a Z=value >3.

	R/L (n = 26)	R/N (n = 17)	p Value
Age at Ross procedure (years)	13.4+10.5	16.3+10.5	0.41
Pre-Ross Aortic Dilation (Z value > 3)	8(32%)	13(72%)	0.02
Pre-Ross Aortic Valve Gradient (mmHg)	75+19	78+25	0.64
Pre-Ross Aortic Insufficiency (grade)	3.2+0.8	3.1+0.7	0.98
Reduction of Ascending Aorta at Ross procedure	6(23%)	3(18%)	0.72
Follow-up time (years)	9.5+4.5	9.7+4.9	0.87
Aortic Insufficiency > moderate at follow-up	10(39%)	1(6%)	0.03
Aortic Dilation at Follow-up (Z-value > 3)	16(62%)	16(94%)	0.03
Surgical Intervention on Aortic Root/Valve	9(35%)	5(29%)	0.75

RESULTS: Mean age at the time of Ross procedure was 14.8 + 10.5 years (Table). R/L was the most prevalent native aortic valve subtype (R/L; n = 26 [61%] vs. R/N; n = 17 [49%]). Pre-Ross procedure, aortic dilation was more frequent in patients with R/N fusion (R/N, 72% vs. R/L, 32%; p = 0.02), whereas the initial aortic valve gradient and grade of AI did not differ between the subgroups. Patients had serial follow-up echocardiography performed for a mean of 9.6 + 4.3 years postoperatively. At follow-up, dilation of the autograft and ascending aorta was seen more often in patients with R/N leaflet fusion (R/N, 94% vs. R/L, 62%; p = 0.03). Conversely, the prevalence of more than moderate AI was significantly higher in patients with R/L leaflet fusion (R/L, 39% vs. R/N, 6%; p = 0.03). There was no significant difference between groups among numbers of late reintervention the aortic valve or root (R/L, 35% vs. R/N, 29%; p = 0.75); however the type of intervention varied by morphologic

subtype. Patients with R/L fusion underwent more aortic valve replacements while patients with R/N fusion underwent more valve sparing aortic root replacements.

CONCLUSIONS: Our study suggests that in young patients with BAV who undergo a Ross procedure, aortic valve morphology may be associated with autograft dilation and valve dysfunction. Patients with R/N leaflet fusion were more likely to have aortic root and ascending aortic dilation at follow-up, whereas patients with R/L fusion were more likely to have postoperative autograft insufficiency. This information may serve to guide patient and procedure selection for aortic valve replacement.

P23. Durable Ventricular Assist Device Support for End-Stage Heart Failure: An Extended Role in Pediatric and Congenital Population

Ed Peng, Neil Wrightson, Massimo Griselli, Richard Kirk, Tanveer Butt, John J. O'Sullivan, Guy A. MacGowan, David Crossland, Stephan Schueler, Asif Hasan
Freeman Hospital, Newcastle Upon Tyne, United Kingdom

OBJECTIVE: Mechanical circulatory support in pediatric population is currently limited to pulsatile mechanical device (Berlin Heart Excor®). In recent years, the use of left ventricular assist device (LVAD) has increased substantially in adults with end-stage acquired heart disease with the availability of durable, newer generation, continuous flow device. We examined the extended role of this newer generation device in the pediatric and congenital population.

METHODS: Between 2010 and 2014, 16 patients who received HVAD (Heartware Inc, Framingham, MA) were studied and divided into two groups: (I) Pediatric group [N = 7; mean age: 11.3; range: 3.7–17.0 years]: 6-cardiomyopathy and 1-post-transplant rejection (II) Adult group (N = 9; mean age: 34.8; range: 24.5–41.0 years): all with complex congenital heart disease. Two patients were bridged from VA-ECMO and concomitant valve surgery was required in 3. RV function was optimised by pre-operative protocol using aggressive diuretics with/out inodilator and with/out hemofiltration. Temporary RVAD support if necessary was provided by a short-term device via neck or groin cannulation and pulmonary artery return via a vascular graft.

RESULTS: Overall, mortality on HVAD was 19% (3), 7 (44%) were transplanted, 2 (13%) were explanted and 4 (25%) were waiting for transplant.

(I) In pediatric group: median length of support was 149 days (range: 17–638). The smallest patient to receive HVAD was 13.5 kg (age 3.7-year). Short term RVAD support was required in 3 patients but was successfully weaned off (range: 6–9 days) to LVAD support alone. The actuarial survival rate on HVAD was 100% at 30-day, 6-month, and 1-year on HVAD with no neurological event (0%). There was one death at day-638 from pneumonia/sepsis. 4 (57%) patients were transplanted and one pediatric HVAD was decommissioned following recovery from dilated cardiomyopathy (day-149).

(II) In adult group, median length of support was 269 days (range: 64–685). The actuarial survival rates were 89% (30-day), 89% (6-month) and 76% (1-year). 3 patients were transplanted and 2 patients died (due to sepsis). One adult HVAD was explanted due to recurrent gastrointestinal bleeding, but also with evidence of improved heart function. 4 (44%) adult patients developed neurological complication (1-hemorrhagic, 3-embolic) but regained near complete or complete neurological recovery in all of them.

CONCLUSION: Our early experience suggests that continuous flow, third generation device can provide durable support in the pediatric and congenital population with end-stage heart failure. Larger study is required to further assess the extended role of this device.

*AATS Member

P24. Improving Outcomes with the Comprehensive Stage 2 Procedure After an initial Hybrid Stage 1 Palliation

*Mark E. Galantowicz, Andrew R. Yates

Nationwide Children's Hospital, Columbus, OH

OBJECTIVE: The Hybrid Approach has emerged as an alternative surgical strategy for the management of hypoplastic left heart syndrome (HLHS). A Hybrid Stage 1 is followed by a Comprehensive Stage 2 (removal of PDA stent and PA bands, aortic & pulmonary artery (PA) reconstruction, Damus-Kaye-Stansel, atrial septectomy, Glenn). This is a challenging new procedure with very little published outcome data. We report our improving institutional experience.

METHODS: An IRB approved, retrospective review of prospectively collected data on all patients having a Comprehensive Stage 2 procedure between January 2002 to December 2013 including learning curve, high-risk, and standard-risk patients were separated into Group 1 (January 2002 to March 2010) n = 64, and Group 2 (3/2010 to 12/2013) n = 36. The grouping eras flank the implementation of a peri-operative management protocol based on a review of the mode of death in Group 1.

RESULTS: Group 1 mortality was 12/64 (19%) where the most common mode of death involved pulmonary artery thrombosis in at least 6, with urgent vs elective indication for surgery, as well as age at procedure being factors. Care modifications instituted in 3/2010 included no procedures on an emergent basis or age <3 months, use of a BT shunt if the SVC and/or PA were too small, completion angiogram of Glenn with low threshold for intra-operative stenting, and post-op anticoagulation for 6 weeks. Group 2 mortality was 1/36 (3%) secondary to a hospital acquired viral pneumonia. There was no incidence of PA thrombosis in Group 2. ECMO utilization fell from 6/64 in Group 1 to 0/36 in Group 2.

CONCLUSION: Despite the technical challenges of the Comprehensive Stage 2 procedure excellent outcomes are attainable. Experience coupled with an internal quality review drove implementation of a successful peri-operative management protocol.

Moderator: *Michael J. Liptay

P25. Early Initiation of Oral Feeding Following Thoracolaparoscopic Esophagectomy for Cancer: Interim Results from a Randomized Controlled Trial

Yin Li, Hai-bo Sun, Xian-ben Liu, Zong-fei Wang, Rui-xiang Zhang, Jian-jun Qin, Yan Zheng, Xian-kai Chen, Zhao Wu, Chang-sen Leng, Jun-wei Zhu Henan
Zhengzhou University, Zhengzhou, China

OBJECTIVE: Nil by mouth with enteral tube feeding for several days is widely practiced after resection and reconstruction of esophageal cancer. The aim of current study was to investigate the feasibility of no nasogastric intubation and early oral feeding at will after thoracolaparoscopic esophagectomy for patients with esophageal cancer. We report results from the preplanned interim analysis.

METHODS: We did a single-center, randomized controlled trial in Henan Cancer Hospital. Patients aged 18 years or older with esophageal squamous cell carcinoma who received thoracolaparoscopic esophagectomy were randomly allocated (1:1) to a group starting early oral feeding (EOF) on postoperative day (POD) 1 and another group that remained nil by mouth until 7 days after surgery (late oral feeding, LOF group). The primary study endpoint was postoperative complication and the secondary outcomes included length of postoperative stay, time to first flatus and bowel movement. Two hundred and eighty patients were planned to be included in this study and analysis was by intention-to-treat. This trial was registered on clinicaltrials.gov (ID code NCT01998230) before the start of the study.

RESULTS: Started from February 2014, 148 patients with thoracolaparoscopic esophagectomy were included in this study including 72 patients in EOF group and 76 patients in LOF group. There was no significant difference in baseline comparison between the two groups. One patient (1.4%) could not initiate oral intake on POD1 and 4 (5.6%) patients discontinued oral intake because of postoperative complications in EOF group. The rate of anastomotic leak was 2.8% (2/72) and 1.3% (0.612) in EOF group and LOF group respectively ($P = 0.612$). The rate of patients with complication is 22.2% (16/72) and 25.0% (19/76) in EOF group and LOF group respectively ($P = 0.691$). Compared with LOF group, time to first flatus (2.4 ± 0.8 days versus 3.3 ± 0.7 days; $P < 0.001$), bowel movement (2.7 ± 1.3 days versus 4.5 ± 0.9 days; $P < 0.001$) and length of postoperative stay (7.6 ± 2.2 days versus 11.7 ± 3.9 days; $P < 0.001$) was significantly shorter in the EOF group.

CONCLUSIONS: No nasogastric intubation and early oral feeding postoperatively in patients with thoracolaparoscopic esophagectomy is feasible and safe. Early oral feeding postoperatively in patients with thoracolaparoscopic esophagectomy could shorten postoperative length of stay and fasten postoperative bowel function recovery.

Key Words: Esophageal cancer, Thoracolaparoscopic esophagectomy, Early oral feeding.

*AATS Member

P26. Outcome of the Joint Council of Thoracic Surgery Education's Early Review Course Project

*Mark Allen[1], *John Calhoon[2], *David Fullereton[3], *Richard Shemin[4], *Keith Naunheim[5], *Edward Verrier[6], John Doty[7], *Douglas Mathisen[8]

[1]Mayo Clinic, Rochester, MN; [2]University of Texas Health Science Center, San Antonio, TX; [3]University of Colorado, Denver, CO; [4]UCLA, Los Angeles, CA; [5]St. Louis University Health Sciences Center, St. Louis, MO; [6]University of Washington, Seattle, WA; [7]Intermountain Medical Center, Murray, UT; [8] Massachusetts General Hospital, Boston, MA

OBJECTIVE: The JCTSE was formed in 2008 to improve cardiothoracic education. Resident learning has been a concern as reflected in declining passing rates on the ABTS examinations. The JCTSE piloted a program to determine if early exposure to cardiothoracic (CT) curriculum via participation in a board review course would improve learning. The purpose of this manuscript is to report the results of this project.

METHODS: Residents from the incoming classes of traditional 5-2 or 5-3 CT training programs were randomly selected to attend a 3-day board review course (University of Utah) in September of their first year. For the 2012 and 2013 classes of cardiothoracic residents, we asked all incoming residents to take the prior spring in-training examination (ITE) in July of their first year and then take the ITE in the spring of their first year. We combined the results of the incoming class of 2012 and 2013 and analyzed the results.

RESULTS: There were 171 residents that participated in either 2012 or 2013. There were 38 (78.9% men) who attended the board review course and 133 (79.7% men) who did not. Questionnaires completed by the program directors and the residents that took the review course showed a favorable opinion of the program. The number of correct answers on the ITE examination, the % correct and the percentile rank score increased more for the residents that took the review course, but was not statistically significant. When just the general thoracic surgery questions were analyzed, there was a statistically significant increase in the rank change between the residents that attended the review course and those that did not (8.4% increase vs. 2.0% decrease; $p = 0.042$). (See Table.)

CONCLUSIONS: This pilot study established for the first time the baseline level of knowledge of incoming residents assessed by the in-training exam. Participation in a board review type course early in the residency training program may increase learning by cardiothoracic residents. The program was view as favorable by both the participating residents and program directors. Cardiothoracic surgery residency programs should consider this activity to improve education.

Subject		Did not take review course	Did take review course	p value
		n=133	n=38	
All	# Correct Change	8.8 (±9.9)	11.5 (±9.0)	0.139
	% Correct Change	7.1 (±6.5)	8.8 (±5.7)	0.149
	Rank Change	-1.5 (±24.6)	5.4 (±23.6)	0.128
GTS	# Correct Change	6.0 (±5.8)	7.8 (±5.9)	0.108
	% Correct Change	8.5 (±7.5)	10.7 (±7.6)	0.11
	Rank Change*	-2.0 (±27.8)	8.4 (±26.2)	0.042
Cardiac	# Correct Change	5.9 (±7.2)	6.5 (±6.0)	0.613
	% Correct Change	6.9 (±9.8)	7.9 (±7.8)	0.588
	Rank Change	-0.5 (±27.0)	0.5 (±25.9)	0.839

*Statistically significant (student t-test)

*AATS Member

P27. A Gene Expression Profile Based Test to Predict Neoadjuvant Chemoradiation Response in Esophageal Adenocarcinoma Patients

Weiwei Shan[1], Jennifer Mitchell[2], Natalie Lassen[1], Clare E. Johnson[1], John F. Stone[2], Derek J. Maetzold[1], Robert W. Cook[1], Sunil S. Badve[3], Kenneth S. Kessler[3], Romil Saxena[3]

[1]Castle Biosciences, Friendswood, TX; [2]St. Joseph's Hospital and Medical Center, Phoenix, AZ; [3]Indiana University, Indianapolis, IN

OBJECTIVE: 1) To discover and develop GEP signature(s) able to predict EC patient's response to pre-operative CTRT using diagnostic biopsy tumor tissue; 2) To compare the accuracy of treatment response prediction determined by GEP analysis to that of a previously validated IHC-based assay.

METHODS: Sixteen formalin fixed and paraffin embedded (FFPE) EC biopsy specimens with known CTRT responsiveness were subject to macro-dissection. Tumor RNA was isolated, reverse-transcribed, and analyzed by RT-PCR analysis on high-throughput microfluidics cards for the expression of 96 candidate discriminant genes chosen from in silico analysis. Multiple linear and non-linear predictive models were compared using JMP GENOMICS SAS-based software to determine the optimal models for response prediction. Potential GEP signatures were evaluated by selected predictive models as well as hierarchical clustering for their ability to classify EC patients into CTRT responders and non-responders. The predictive accuracy of these GEP signatures was also compared with an IHC-based test that has been validated to discriminate EC patients with distinct responsiveness.

RESULTS: EC diagnostic biopsy tissue from 8 CTRT responders [Treatment Response Grade (TRG) 0–2] and 8 non-responders (TRG 3) was examined. Five control and 85 predictive genes were included in the analysis. Cross-validation analysis identified Radial Basis Machine (RBM) and Partial Least Squares (PLS) as highly accurate models for prediction of CTRT response. Two GEP signatures comprised of 10 and 18 genes, respectively, were capable of identifying responders and non-responders with 100% accuracy. Unsupervised hierarchical clustering analysis with the genetic signatures stratified the 16 EC cases into two distinct response groups. The GEP signatures demonstrated enhanced predictive capability compared to a validated IHC-based test previously reported to have greater than 90% accuracy and specificity in a cohort of 64 EC cases, which identified 5 of 8 non-responders and 7 of 8 responders in the current study.

CONCLUSIONS: Two GEP signatures were able to accurately distinguish CTRT responders from non-responders. In the reported study, the GEP based test identified treatment response with greater accuracy than a previously validated IHC response prediction test. The GEP assay offers an accurate and reliable method for prospective identification of EC patients who are not likely to respond to standard CTRT regimens.

P28. Metformin Exposure Is Associated with Improved Survival in Early-Stage Non-Small Cell Lung Cancer Patients

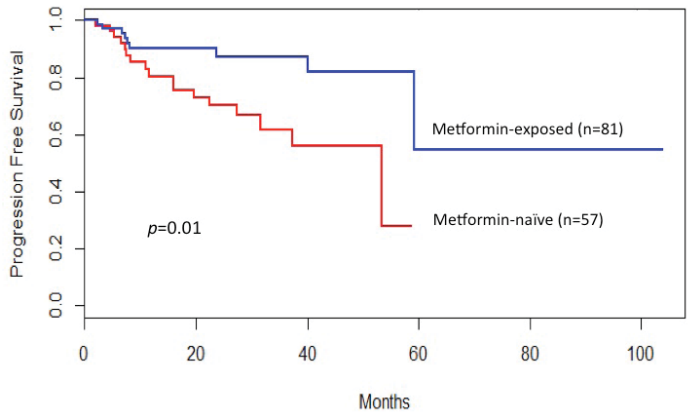
Robert A. Medairos, Christopher W. Seder, James Clark, Simon Holoubek, John Kubasiak, Ravi Pithadia, Fatima Hamid, Gary W. Chmielewski, *William H. Warren, Sanjib Basu, Jeffrey Borgia, *Michael J. Liptay

Rush University, Chicago, IL

OBJECTIVE: Evidence from epidemiological and translational studies suggest a therapeutic benefit for cancer patients treated with metformin; however, there are minimal data evaluating the effect of metformin therapy in patients with non-small cell lung cancer (NSCLC). The purpose of this study is to evaluate the association between metformin exposure and survival in NSCLC patients with type 2 diabetes (DM2).

METHODS: An institutional database was used to identify Stage I and II NSCLC patients with DM2 who underwent pulmonary resection between 2006 and 2013. Patients were divided into two cohorts: those with metformin exposure (n = 81) and those without metformin exposure (n = 57). Clinical and pathological characteristics were compared between cohorts. Progression-free survival and overall survival were calculated via Log-Rank method and a multivariate Cox proportional hazards analysis was performed.

RESULTS: A total of 138 stage I and II NSCLC patients who underwent surgical resection were identified for analysis. There were no differences in age, gender, body-mass index, histological subtype, stage, surgical procedure, or pack-years between the metformin and non-metformin cohorts. Progression free survival was greater for patients exposed to metformin than those not receiving metformin (Median not reached vs. 53.4 m, respectively; see Figure). No difference was observed in overall survival between the groups.



CONCLUSION: Metformin exposure in NSCLC patients with type 2 diabetes is associated with improved progression-free survival. These results suggest a potentially therapeutic role for metformin in the treatment of NSCLC patients.

TUESDAY, APRIL 28

*AATS Member

P29. Should Lobectomy Be Performed When Unsuspected pN2 Disease Is Found at the Time of Planned Lung Cancer Resection? A National Cancer Data Base Analysis

Chi-Fu Jeffrey Yang[1], Brian G. Gulack[1], Michael Mulvihill[1], Volkan Kara[1], *Thomas D'Amico[1], Matthew Hartwig[1], *Mark Berry[2]

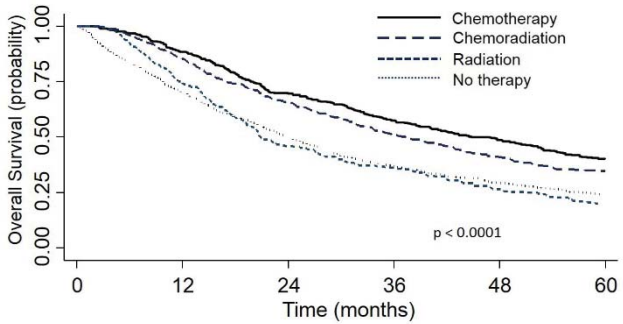
[1]*Duke University, Durham, NC;* [2]*Stanford University, Stanford, NC*

OBJECTIVE: Treatment with induction therapy prior to potential surgery for non-small cell lung cancer (NSCLC) patients who have pathologically confirmed N2 disease is well accepted. However, data on whether to continue with lung resection versus deferring in order to deliver induction treatment for patients found to have pN2 disease at the time of thoracotomy or thoracoscopy are more limited. This National Cancer Database (NCDB) analysis was performed to improve the level of evidence available to guide treatment in this clinical situation.

METHODS: Survival of patients with clinical T1-3, N0-1 NSCLC who had pathologic N2 disease after lobectomy without induction therapy from 1998 to 2006 in the NCDB was evaluated using Kaplan-Meier and Cox proportional hazard analysis, and compared using propensity-score matching to survival of "suspected" N2 disease patients (cT1-3 cN2) who were treated with chemotherapy with or without radiation followed by lobectomy.

RESULTS: Of 46,746 patients who underwent lobectomy as primary therapy for cT1-3 N0-1 NSCLC during the study period, 2,108 (4.5%) patients had pN2 disease. Adjuvant therapy after surgery was chemotherapy in 416 (20%), chemoradiation in 525 (25%), radiation in 308 (15%), and none in 859 (41%) patients. The 5-year overall survival of these patients was 29%; in subset analysis, 5-year survival was 40%, 34%, 19%, 24% for patients who underwent adjuvant chemotherapy, chemoradiation, radiation, and no adjuvant therapy, respectively. Compared to no adjuvant therapy, radiation treatment alone (HR, 1.04; 95% CI [0.78–1.38]; $p = 0.78$) did not impact survival while treatment with adjuvant chemotherapy (HR, 0.63; 95% CI [0.53–0.76]; $p < 0.001$) and chemoradiation (HR, 0.65; 95% CI [0.53–0.80]; $p < 0.001$) improved survival (figure). The overall 5-year survival of the entire unsuspected N2 cohort was worse than the suspected N2 group (29% vs. 40%; $p < 0.0001$), but in a propensity-matched analysis of 1,026 patients there was no difference in 5-year survival between suspected N2 patients and unsuspected pN2 patients that received adjuvant chemotherapy or chemoradiation (43% vs. 44%; $p = 0.63$).

Survival of Patients with Unsuspected pN2 Disease Stratified by Type of Adjuvant Therapy



No. at risk						
No therapy	859	573	397	290	230	176
Chemotherapy	416	359	277	227	189	148
Chemoradiation	525	439	328	253	201	165
Radiation	308	219	133	102	74	54

CONCLUSION: Although patients with unsuspected pN2 disease treated with primary surgical resection overall do worse than patients treated with induction therapy, proceeding with resection is reasonable if the patient is likely to be able to tolerate adjuvant chemotherapy with or without radiation.

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P30. Does Neoadjuvant Chemoradiation Followed by Pneumonectomy Provide Better Long-Term Survival in Patients with NSCLC?

Cengiz Gebitekin[1], *Alper Toker[2], *Walter Weder[3], Ahmet Sami Bayram[1], Berker Özkan[2], Isabelle Opitz[3], Hüseyin Melek[1], Stephane Collaud[3], Adalet Demir[2]

[1]Uludag University, Bursa, Turkey; [2]Istanbul University, Istanbul, Turkey; [3]University Hospital, Zurich, Switzerland

OBJECTIVE: Adding radiotherapy (RT) to neoadjuvant chemotherapy (ChT) increase downstaging ratio in patients with locally advanced NSCLC. However, early and late complications of radiotherapy may cause morbidity and mortality after especially pneumonectomy(PN). In this multicenter (three academic hospitals) prospective study, we aimed to show survival benefit of neoadjuvant chemoradiation followed by pneumonectomy in patients with NSCLC.

METHODS: All patients undergoing pneumonectomy after neoadjuvant treatment between 2000 and 2013 were prospectively entered into database and retrospectively reviewed. Patients with other malignancies, solitary brain or surrenal metastases, completion pneumonectomy or lost follow-up were excluded. In total; 140 patients were reviewed. All but 23 patients were male with a median age of 55.3 (range: 31–73). Neoadjuvant treatment was chemotherapy (ChT) in 100 (71.4%, group I) and chemoradiation (ChRT) in 40 patients (28.6%, group II). Chemotherapy consisted of 2–6 cycles, and radiotherapy involved administrating a dose of 45–66 Gy. Pneumonectomy was performed at least three weeks after ChT and 6–8 weeks after ChRT. Both groups were compared for morbidity, 90 days mortality and long-term survival.

RESULTS: Right PN was performed in 57 (40.7%) and the procedure was in a standard manner in 64 % of patients. The 90 days mortality was 5% (7 patients in group I, no mortality in group II). The mortality rate for right and left pneumonectomy was 3.6% (2/57 patients) and 6.4% (5/78 patients), respectively. Morbidity observed in 30.7% of patients (32% in group I, and 27.5% in group II). The incidence of post-PN bronchopleural fistula was 3.5% (3% in group I and 5% group II). The 5-year survival rate was 48% in group I and 50% in group II; $p = 0.7$. The difference was not found statistically significant.

CONCLUSIONS: This multicenter study confirmed that pneumonectomy after neoadjuvant chemoradiation therapy is a safe procedure with an acceptable morbidity, mortality and superior long-term survival rate. This study also revealed that adding radiotherapy to neoadjuvant ChT did not provide any long-term survival benefit after pneumonectomy for NSCLC.

P31. Prophylactic Mass Ligation of the Thoracic Duct During Esophagectomy Is Associated with a Higher Rate of Chylothorax Than Explicit Identification and Ligation of the Thoracic Duct

Yifan Zheng, Abraham Lebenthal, Jon O. Wee, *Scott J. Swanson, Ciaran J. McNamee, *Steven J. Mentzer, *Michael T. Jaklitsch, *Raphael Bueno
Brigham and Women's Hospital, Boston, MA

OBJECTIVE: Chylothorax after esophagectomy is an uncommon morbid complication requiring additional procedures and associated with increased length of hospital stay. It is unclear whether prophylactic thoracic duct ligation reduces the incidence of chylothorax. The thoracic duct may be ligated directly after identification or by mass ligation. The aim of this study was to determine if the method of ligation influences the incidence of post-esophagectomy chylothorax.

METHODS: The charts of all 829 patients undergoing esophagectomy at a single institution from July 1, 2001 to June 30, 2012 were reviewed for clinical data, the method of ligation of the thoracic duct, and whether sutures or surgical clips were used. The incidence of postoperative chylothoraces was evaluated as well as the method of treatment.

RESULTS: During the study period, 193 cases had prophylactic intraoperative ductal ligation: 56 with explicit identification and ligation of the thoracic duct, 136 with mass ligation, and one case with unknown method of thoracic duct ligation. The majority of the ligations were performed during open esophagectomy. Mass ligations were most commonly performed with surgical sutures while ductal ligation after identification was commonly performed with surgical clips. There were 31 cases (16.1%) of postoperative chylothorax versus 33 cases (5.2%) in the 636 operations without prophylactic thoracic duct ligation ($p < 0.0001$).

Of the cases with intraoperative ligation, 4 (7.1%) occurred in the explicit identification and ligation cohort while 27 chylothoraces (19.8%) occurred in the mass ligation cohort ($p = 0.0314$). Of the 31 cases with postoperative chylothoraces after prophylactic ligation, a majority had adenocarcinoma tumors located in the distal esophagus or gastroesophageal junction and the majority of the cases had received neoadjuvant therapy. The 33 cases of postoperative chylothoraces without prophylactic ligation had a similar stratification. (See Table.)

Of the 64 total cases of chylothorax, 28 cases were successfully treated by thoracic duct embolization and 20 were successfully treated by operative thoracic duct ligation. In 10 cases, thoracic duct embolization was attempted but unsuccessful and all were successfully treated with operative ligation. Six cases were managed with chest tube drainage and total parenteral nutrition. The use of each type of management was equally distributed between the cohort that received prophylactic ligation and the cohort that did not receive prophylactic ligation.

Table: Neoadjuvant Treatment and Diagnoses of Chylothorax Cases with and without Prophylactic Ligation

	Chylothorax with Prophylactic Ligation (N = 31)	Chylothorax without Prophylactic Ligation (N = 33)
Neoadjuvant therapy	20 (64.5%)	24 (72.7%)
Diagnosis		
Adenocarcinoma	24 (77.4%)	24 (72.7%)
Squamous cell carcinoma	5 (16.1%)	8 (24.2%)
Stricture	2 (6.5%)	0
Esophago-pleural fistula	0	1 (3.0%)
Location of Tumor		
Proximal	0	3 (9.1%)
Middle	2 (6.5%)	2 (6.1%)
Distal	14 (45.2%)	13 (39.4%)
Gastroesophageal junction	14 (45.2%)	14 (42.4%)
Not applicable	1 (3.2%)	0
Unknown	0	1 (3.0%)

CONCLUSIONS: Prophylactic intraoperative thoracic duct ligation appears to be associated with a higher rate of chylothorax. This may be due to the method used to ligate the thoracic duct. Explicit identification and ligation is significantly associated with a lower incidence of chylothorax than mass ligation.

P32. Pulmonary Function Changes After VATS Lobectomy Versus Limited Resection for Early Stage Lung Cancers

Zhitao Gu, Wentao Fang, Teng Mao, Chunyu Ji
Shanghai Chest Hospital, Shanghai, China

OBJECTIVE: Limited resections for early stage lung cancer have been of increasing interests recently. However, it is still unclear to what extent limited resection could preserve pulmonary function comparing to standard lobectomy, especially in the context of minimally invasive surgery. The purpose of this study was to evaluate postoperative changes of spirometry in patients undergoing VATS lobectomy or limited resections.

METHODS: Spirometry test was obtained prospectively before and 6 months after 75 VATS lobectomy, 34 VATS segmentectomy, 15 VATS wedge resection. Eleven VATS mediastinal procedures without lung resection were taken as control group.

RESULTS: Demographic characteristics and preoperative pulmonary function showed no differences among 4 groups. FVC loss after lobectomy was significantly greater than segmentectomy ($p = 0.046$), and much significantly greater than after wedge resection ($p = 0.002$). FEV1 loss after lobectomy was similar to segmentectomy ($p = 0.278$), both significantly greater than wedge resection ($p = 0.008$). DLCO loss was similar among the 4 groups ($p = 0.496$). There is no significant difference of any spirometry index between wedge resection and mediastinal procedures (FVC: $p = 0.856$; FEV1: $p = 0.665$; DLCO: $p = 0.07$). When compared by average value per segment resected, pulmonary function loss was significantly less after lobectomy than after segmentectomy in all spirometry indexes ($p < 0.001$). On average, pulmonary function loss would be 5% per segment for VATS lobectomy and 10% per segment for VATS segmentectomy.

Table: Patients Demographic and Postoperative Changes of Pulmonary Function

Variables	Lobectomy	Segmentectomy	Wedge Resection	Mediastinal Procedures
No.	75	34	15	11
Male/female	32/43	16/18	6/9	5/6
Age (years)	60.1	58.2	62.1	57.2
FVC loss	−0.58 L, −19.2%	−0.46 L, −15.0%	−0.15 L, −5.5%	−0.24 L, −4.7%
FEV1 loss	−0.52 L, −21.0%	−0.44 L, −18.4%	−0.19 L, −8.6%	−0.2 L, −6.6%
DLCO loss	−3.1 ml/mmHg/min, −16.0%	−2.7 ml/mmHg/min, −13.5%	−2.2 ml/mmHg/min, −11.2%	0.09 ml/mmHg/min, 1.86%

CONCLUSION: In minimal invasive surgery, wedge resection best preserves pulmonary function, with similar spirometry change with VATS procedures without lung resection. Compared with VATS lobectomy, VATS segmentectomy might help minimize loss of FVC but not FEV1 or DLCO. Pulmonary function loss per segment is doubled after VATS segmentectomy than after lobectomy. These results should be taken into account when deciding the extent of resection for patients with early stage lung cancer.

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P33. The Incidence and Burden of Venous Thromboembolism After Major Lung Resection: A Prospective Cohort Analysis

Yaron Shargall[1], Wael C. Hanna[1], Colin Schieman[1], Christian J. Finley[1], Laura Schneider[1], Terri Schnurr[1], John Agzarian[1], Dennis Nguyen-Do[1], Yury Peysakhovich[1], *Thomas K. Waddell[2], *Marc de Perrot[2], Lori-Ann Linkins[1], Mark Crowther[1], James Douketis[1]

[1]McMaster University, Hamilton, ON, Canada; [2]University of Toronto, Toronto, ON, Canada

OBJECTIVE: The incidence of post-operative Venous Thromboembolism (VTE), defined as Deep Vein Thrombosis (DVT) and Pulmonary Embolus (PE), in patients undergoing major oncological lung resections is largely unknown. Guidelines regarding VTE prophylaxis are based on data from other surgical specialties, and therefore considerable inconsistency in prophylaxis regime amongst thoracic surgeons and hematologists persists. This is the first prospective cohort analysis to assess the real incidence of post-operative VTE events after major lung resection.

METHODS: Between June 2013 and October 2014, patients undergoing anatomical or non-anatomical resections for primary or secondary lung malignancies in two tertiary centers were prospectively consented to undergo chest CT with PE protocol and a Doppler ultrasound of the lower limbs 30 ± 5 days after surgery. Patient demographics, pre-operative comorbidities, histology, staging, peri-operative complications and VTE-related outcomes were recorded up to 3 months post-operatively.

RESULTS: The study enrolled 132 patients. All patients received unfractionated Heparin and mechanical prophylaxis peri-operatively and until hospital discharge. Mean age was 67 years, 55% (73/132) female. Anatomical resections were undertaken in 70% (93/132) and non-anatomical resection in 30% (39/132) of cases. Pathology was primary lung cancer (82%, 108/132), metastatic disease to the lung (16/132 [12%]) or eventual benign disease (8/132 [6%]). Overall 30-day mortality was 0.76%. There were 17 events (13% incidence), including 12 PE (70%), 3 DVT (18%), one with both PE and DVT (6%) and one with massive Left Atrium thrombus originating from the pulmonary vein stump post lobectomy. The majority of PE events occurred at the operated lung, including 3 with large pulmonary artery stump thrombi extending to a major branch. Only 4 patients (23%) were acutely symptomatic at the time of diagnosis, two of whom presented with cardiogenic shock. One patient died secondary to a massive ipsilateral PE. The remaining patients were anticoagulated and are stable at last follow-up. Pre-operative comorbidities, previous malignancy, neo-adjuvant therapy, staging, extent and type (thoracoscopy vs open) of surgical procedure, site of surgery and peri-operative events were not found to be significantly different between the event and overall cohorts on both independent parametric and non-parametric analysis.

CONCLUSIONS: The incidence of post-operative post-discharge VTE after lung resection is significant despite guideline-directed in-hospital only VTE prophylaxis. There are no specific risk factors associated with the development of post discharge VTE, and most patients will not have suggestive symptomatology. Related morbidity and mortality from those events is not insignificant. More research into the role of post-discharge VTE prophylaxis is warranted.

P34. Caprini Risk Assessment for Postoperative Venous Thromboembolism in Surgical Lung Cancer Patients

Krista J. Hachey, Philip D. Hewes, Liam P. Porter, Doug G. Ridyard, Pamela Rosenkranz, David McAneny, *Hiran C. Fernando, *Virginia R. Litle

Boston University, Boston, MA

OBJECTIVE: The risk of dying from a postoperative venothromboembolic (VTE) event can reach 20% in patients after lung resection. The Caprini Risk Assessment Model (RAM) has been described by other specialties to calculate the risk of a post-operative VTE and guide recommendations for prophylactic anticoagulation after discharge. The RAM contains 42 variables including age, body mass index, prior VTE history, chemotherapy, laparoscopic and open surgery. Thoracoscopy is not a current variable. Our first aim was to determine whether the Caprini RAM could risk stratify patients undergoing lung resection for cancer. The second aim was to determine the impact of video-assisted thoracoscopic surgery (VATS) as a new variable for VTE prediction in this risk assessment model.

METHODS: Patients who underwent lung resection from 2005–2013, were evaluated. After excluding those with preoperative caval filter placement or on chronic anticoagulation, 232 patient medical records were reviewed to calculate the Caprini RAM score. We recorded all VTE (deep vein thrombosis or DVT; pulmonary emboli or PE) events as documented by history and radiograph reports. Subjects were placed into one of five risk groups based on a modified Caprini scoring system: lowest risk (score 0), low (1–2), moderate (3–4), high risk (5–8), or highest risk (>9). Surgical approach as minimally invasive (VATS; robotic) or open thoracotomy (primary intent or conversion) was recorded.

RESULTS: The overall 60-day postoperative VTE incidence was 5.17% (12/232). 50% (6/12) had pulmonary emboli (PE). The one death from a PE occurred in the patient with a high score of 16. The net VTE incidence by individual Caprini scores is shown in the Figure. The mean Caprini scores for the non-VTE and VTE groups were 8.07 (±2.84) and 11.83 (±3.74), respectively. The score distribution was significantly different by the Wilcoxon test ($p < 0.001$). Scores in the lowest to moderate, high and highest risk groups were associated with a VTE incidence of 0%, 1.67%, and 10.42%. As scores >9 are highest risk, the sensitivity, specificity and accuracy with a score cut off of 9 are 80%, 60.9% and 61.2%. Thirty percent (70/232) of the patients had minimally invasive approaches; however, 11/12 (92%) of the VTE occurred in the open cases. When the minimally invasive risk factor (RF) was included, there was no significant difference in the distribution of Caprini scores in the VTE vs. non-VTE groups ($P = 0.114$).

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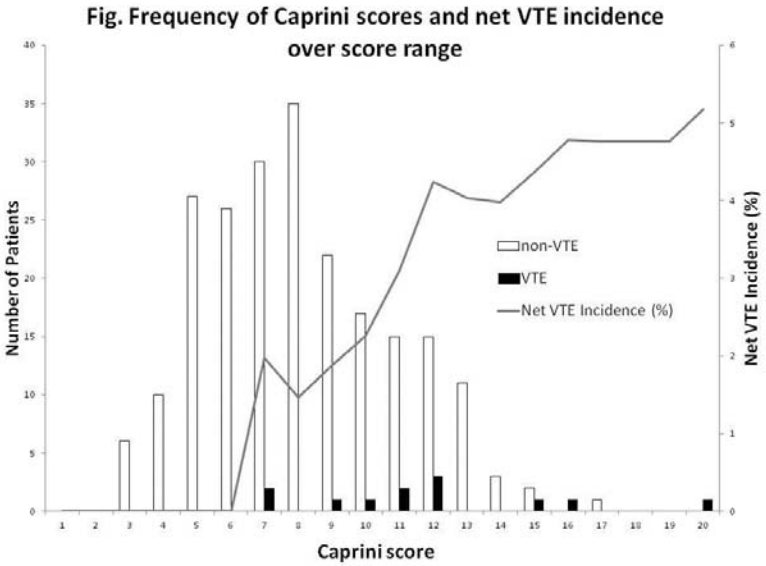

CONCLUSIONS: VTE incidence in lung resection patients is associated with increasing Caprini RAM scores. Patients in the highest risk group had a VTE incidence of 10.42% suggesting that this particular group may benefit from extended course anticoagulation for up to 30 days. Accounting for VATS as a novel RF did not improve risk stratification in this study, suggesting that the current RAM is adequate for assessment of patients.

P35. Long-Term Survival Advantage of Double Lung Transplantation in Patients with Secondary Pulmonary Hypertension

Joshua C. Grimm, J. Trent Magruder, Vicente Valero, III, Arman Kilic, Leann L. Silhan, Pali D. Shah, Christian A. Merlo, *Ashish S. Shah

Johns Hopkins University, Baltimore, MD

INTRODUCTION: The aim of this study was to determine if double lung transplantation (DLTx) offered a short- or long-term survival advantage over single lung transplantation (SLTx) in patients with idiopathic pulmonary fibrosis (IPF) or chronic obstructive pulmonary disease (COPD) and concomitant pulmonary hypertension.

METHODS: The United Network for Organ Sharing database was queried for adult patients (≥18 years of age) undergoing lung transplantation (LTx) for IPF or COPD between 2005 and 2012. Pulmonary hypertension was defined as a mean pulmonary artery pressure > 25 mmHg prior to LTx. Patients with missing values were excluded from analysis. Primary stratification by type of transplant (SLTx or DLTx) was performed. Recipient, donor and transplant related variables were compared between the two cohorts. Differences in short- (1-year) and long-term (5-year) survival were estimated using the Kaplan Meier method. Cox-regression models were constructed to determine the risk adjusted impact of transplant type on mortality. These findings were then validated with a propensity-matched analysis.

RESULTS: Of the 3,647 patients that met criteria for inclusion, 61.5% (2,242) underwent DLTx. This cohort had a greater median lung allocation score (41.3 [34.7, 56.4] vs. 37.9 [33.9, 47.4]; $p < 0.001$), worse functional performance (Karnofsky score 0–40: 31.6% vs. 21.9%; $p < 0.001$) and a greater percentage of patients mechanically ventilated (7.8% vs. 2.8%; $p < 0.001$), managed in the intensive care unit (9.5% vs. 4.5%; $p < 0.001$) and requiring extra-corporeal support (1.5% vs. 0.6%; $p = 0.01$) prior to LTx. While there was no observed difference in short-term survival (84.6% vs. 84.6%; $p = 0.95$), DLTx recipients experienced not only greater long-term survival (57.8% vs. 49.2%; $p = 0.002$) but also enhanced postoperative functional performance (Karnofsky score 80–100: 55.5% vs. 48.1%; $p = 0.003$). Furthermore, after risk-adjustment with a robust set of recipient and donor variables, DLTx was independently protective against 5-year mortality (HR: 0.85, 95% CI: 0.75–0.97, p-value = 0.02). This finding was substantiated in the propensity matched analysis (1-year: HR, 1.02; 95% CI [0.84–1.24]; $p = 0.85$; 5-year: HR, 0.85; 95% CI [0.74–0.97]; $p = 0.01$).

CONCLUSIONS: In the largest known study investigating the impact of SLTx or DLTx on outcomes in patients with non-pyogenic lung disease and pulmonary hypertension, we demonstrated improved long-term survival and functional performance in DLTx recipients.

P36. Perforated Esophageal Intervention Focus Study: A Multi Center Study of Contemporary Treatment

Rob Rice[1], Joseph J. DuBose[1], Kamal Khalil[1], Jonathon Spicer[1], Luigi Bonavina[2], Stefano Siboni[3], Xian Luo-Owen[4], Sebron Harrison[5], Chad Ball[6], John Bini[7], Dan Fortes[8], Gary Vercruysse[9], David Skarupa[10], Charles Miller[1]

[1]University of Texas, Houston, TX; [2]University of Milan, Milan, Italy; [3]University of Southern California, Los Angeles, CA; [4]Loma Linda University, Loma Linda, CA; [5]University of Mississippi, Mississippi, MS; [6]University of Calgary, Calgary, AB, Canada; [7]Miami Valley Hospital, Dayton, OH; [8]University of Texas, Austin, TX; [9]University of Arizona, Houston, TX; [10]University of Florida, Jacksonville, FL

OBJECTIVE: To examine contemporary practices utilized in the treatment of thoracic and thoracoabdominal esophageal perforation (EP) and determine the impact of initial management on subsequent outcome.

METHODS: A five- year multicenter retrospective review (2008 to 2013) of demographics, management and outcomes for EP patients was conducted. Outcomes following specific management approaches were compared. Logistic regression was utilized to identify independent predictors of mortality.

RESULTS: 199 EP patients from 8 centers in the US, Canada and Europe were identified. Mechanisms of EP included Boerhaave Syndrome (60, 30.1%), iatrogenic injury (65 [32.6%]) and penetrating trauma (25 [12.6%]). Mean time from initial symptoms to presentation was 26.6 hours. Diagnostic modalities employed included CT (142 [71.4%]), esophagram (90 [45.2%]) and endoscopy (41.2%). EP was isolated to the thoracic segment alone in 124 (62.3%), with 62 (31.2%) involving the abdominal esophagus. Mean perforation length was 2.5 cm. Observation alone was selected as initial management in 65 (32.7%), with only two failures. Thirty patients (15.1%) were treated with closed chest drainage (CCD) alone as initial management, 11 requiring additional procedures. Ten patients initially underwent diversion (cervical esophagostomy/gastrostomy) and CCD. No diversion patients developed sepsis, empyema or died during initial hospitalization. Open surgical repair (OSR) was initial management in 41 patients (20.6%), while 29 (14.6%) underwent esophageal stent (ES) coverage. Compared to OSR, ES patients were significantly more likely to have a history of COPD or malignancy and and die during initial hospitalization (0, 0% vs. 5, 17.2%). Overall, secondary intervention requirement for patients with EP was 33.7% (66), most commonly due to persistent pleural fluid collections (28, 14.1%) or recurrent leak (26, 13.1%). Complications were common, including sepsis (56, 28.1%), pneumonia (34, 17.1%) and multi-organ failure (MOF) (23, 11.6%). Mean ICU and hospital length of stays were 10.0 and 23.9 days, respectively. On logistic regression analysis, risk factors for MOF or death were history of myocardial infarction (OR 14; $p < 0.002$), heart rate > 100 (OR 6; $p < 0.0003$), thoracic esophageal involvement (OR 2.8; $p < 0.05$). Overall mortality was 15.1% (30), with open surgical repair associated with a 12-fold lower rate of adjusted mortality than other management approaches (OR 0.08; $p < 0.02$).

CONCLUSIONS: In contemporary practice, diagnostic and management approaches to EP vary. Observation appears safe for appropriately selected patients. Early diversion mitigates the risk for delayed adverse events. Early esophageal stenting is associated with a higher mortality than initial open surgical repair, although this finding may be related to patient selection and requires additional investigation.

*AATS Member

2:00 PM **ADULT CARDIAC SURGERY** Room 4E, WSCC
SIMULTANEOUS SCIENTIFIC SESSION
8 minute presentation, 12 minute discussion

Moderators: *Thoralf M. Sundt, III and *Jose L. Pomar

AATS Guidelines: Ischemic Mitral Valve Regurgitation
*Irving L. Kron, *University of Virginia*

53. Multiple Arterial Bypass Grafting Should Be Routine

Robert F. Tranbaugh, David J. Lucido, Kamellia R. Dimitrova, Darryl M. Hoffman, Charles M. Geller, *John D. Puskas
Mount Sinai Beth Israel, New York, NY

Invited Discussant: *G. Hossein Almassi

OBJECTIVE: Long-term survival after coronary artery bypass grafting (CABG) using the left internal thoracic artery (LITA) to bypass the LAD is significantly improved by adding a 2nd arterial graft using either the right internal thoracic artery or the radial artery (RA). However, approximately 90% of CABG patients in the United States receive a LITA and only saphenous vein (SV) grafts. We have reviewed our 19 year experience using a LITA-RA multiple arterial bypass grafting (MABG) strategy to estimate the reduction in deaths and the number of additional person years of life that could potentially be gained by nationwide adoption of routine MABG.

METHODS: We retrospectively reviewed our institution's 5,520 patients who underwent primary, isolated CABG from January, 1995 to June, 2014. Of these, 2,297 patients (average age, 59 years; 80% male, and 38% diabetic) underwent LITA-RA based MABG. We used propensity analysis of our LITA-RA and LITA-SV patients to calculate the potential reduction in mortality that could be saved based on a 20% and an 80% rate of multiple arterial grafting, compared to the national 10% rate, applied to a hypothetical sample of 200,000 similar patients.

RESULTS: Our overall MABG rate was 42% for the entire 19 year period and 81% for the most recent 2 years, compared to approximately 17% in New York State and 10% in the STS database in 2013. The table that follows shows the number of additional person-years of life for two rates (20% and 80%) of multiple arterial grafting compared to the current national 10% rate assuming 200,000 CABG procedures are performed in a similar population. A hypothetical 20% multiple arterial grafting rate would add 10,510 person-years, whereas an 80% rate would add 73,570 person-years of life over a 10-year period, compared to the present 10% multiple arterial grafting rate. During 10 years of follow-up, 12,320 fewer patients would die among each annual national cohort if an 80% rate of multiple arterial grafting were applied compared to the 10% rate.

Table: Additional Person-Years of Life for Two Rates (20% and 80%) of Arterial Grafting Compared to the Current National 10% Grafting Rate, Assuming 200,000 CABG Procedures.

	Time After CABG		
	1 Year	**3 Years**	**10 Years**
RA survival rate	0.983	0.939	0.831
SV survival rate	0.972	0.887	0.743
Patients at risk RA 10%	194,620	178,440	150,360
Patients at risk RA 20%	194,840	179,480	152,120
Patients at risk RA 80%	196,160	185,720	162,680
Incremental person-years @20% RA	220	1,040	1,760
Incremental person-years @80% RA	1,540	7,280	12,320
Cumulative person-years @20% RA	220	3,150	10,510
Cumulative person-years @80% RA	1,540	22,050	73,570

CONCLUSIONS: An achievable 80% rate of MABG has the potential to reduce mortality by over 12,000 lives and to add over 73,000 person years of life over the course of 10 years. The use of a second arterial graft during CABG should be routine in patients with the appropriate anatomy, age and clinical indications.

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54. Are All Forms of Total Arterial Revascularisation Equal? A Comparison of Single Versus Bilateral Internal Thoracic Artery Grafting Strategies

William Y. Shi[1], Philip A. Hayward[2], *James Tatoulis[3], John A. Fuller[4], Alexander Rosalion[5], *Brian F. Buxton[1]

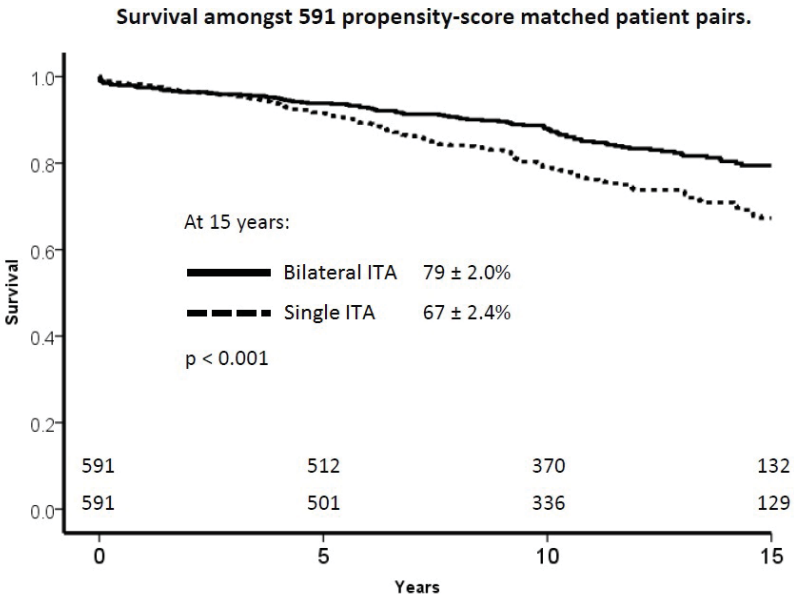
[1]University of Melbourne, Melbourne, Australia; [2]Austin Hospital, Melbourne, Australia; [3]Royal Melbourne Hospital, Melbourne, Australia; [4]Epworth Hospital Richmond, Melbourne, Australia; [5]St. Vincent's Hospital, Melbourne, Australia

Invited Discussant: *Clifford W. Barlow

OBJECTIVE: Total arterial revascularisation (TAR) with internal thoracic arteries (ITAs) and radial arteries (RA) is associated with improved long-term survival compared to the use of a single internal thoracic artery supplemented by veins. The optimal conduit choice and configuration in achieving TAR remains controversial, with uncertainty regarding the individual prognostic impact of ITAs and RAs. As such, amongst patients solely undergoing TAR, we compared long-term survival between patients receiving single versus bilateral ITAs.

METHODS: From 1995 to 2010, 2,821 patients at 8 centers with three-vessel coronary artery disease underwent primary isolated CABG with total arterial revascularisation using ITAs and RAs. Bilateral ITAs were used in 912 patients. In 380 cases, bilateral in-situ ITAs were grafted to the left coronary system. RAs were used in 848 (93%) bilateral ITA patients and 1,906 (99.8%) single ITA patients. Survival data was obtained using the National Death Index. Separate 1:1 propensity-score matched analyses were performed for, 1) bilateral ITA versus single ITA and, 2) bilateral ITA incorporating a free right ITA (RITA) versus single ITA and RA. Amongst the 912 patients with bilateral ITAs, those receiving an in-situ right ITA to the left coronary system were compared to those receiving a free RITA.

RESULTS: In the propensity-score matched analysis comparing bilateral versus single ITA (591 matched pairs), there were similar rates of 30-day mortality and deep sternal wound infection. Bilateral ITA was associated with improved 15-year survival (79 ± 2.0% vs. 67 ± 2.4%; $p < 0.001$). In the analysis between bilateral ITA incorporating a free RITA versus single ITA + RA (380 matched pairs), bilateral ITA use demonstrated comparable survival at 15 years (79 ± 2.4% vs. 67 ± 2.9%; $p = 0.09$). Amongst patients receiving BITAs, comparison between in-situ RITA versus free RITA recipients (206 matched pairs) revealed comparable 15-year survival (84 ± 3.1% vs. 79 ± 3.4%; $p = 0.13$).



CONCLUSIONS: The use of bilateral internal thoracic arteries as either an in-situ or free conduit is associated with improved survival and appears to offer a prognostic advantage over use of only a single ITA supplemented by radial arteries. All configurations of total arterial revascularisation are therefore not equivalent.

*AATS Member

55. Complete Revascularization Improves Survival in Octogenarians

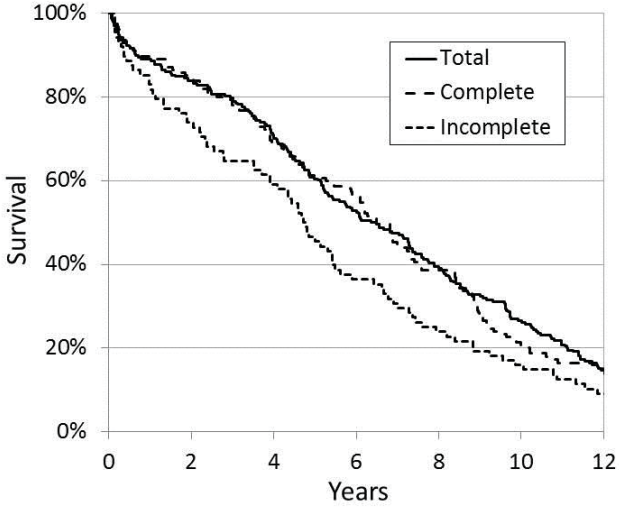
Spencer J. Melby, *Hersh S. Maniar, *Jennifer S. Lawton, *Michael K. Pasque, Akinobu Itoh, Keki R. Balsara, *Ralph J. Damiano, Jr., *Marc R. Moon
Washington University, Saint Louis, MO

Invited Discussant: *A. Pieter Kappetein

BACKGROUND: It is well established that completeness of revascularization is important in the general population of patients undergoing coronary artery bypass grafting (CABG). Little data exists on its' impact on long-term outcomes in patients 80 years of age or greater.

METHODS: From January of 1986 through May of 2004, 525 consecutive patients aged 84 ± 3 years old (range: 80–94) underwent CABG. Surviving patients were followed for a minimum of ten years. Outcome was stratified based on extent of revascularization, which was defined as either: total (bypass graft to every suitable diseased vessel, n = 239 [49%]), complete (bypass graft to each suitable region but not every diseased vessel, n = 156 [32%]), or incomplete (bypass not done to all suitable regions or vessels, n = 89 [18%]).

RESULTS: Total follow-up was 3,155 patient-years with mean follow-up of 73 ± 54 months and was 99% complete. Operative mortality was 41/525 or 8 ± 2% (±95% confidence interval) and was lower for elective 16/369 (4 ± 2%) than urgent/emergent (16 ± 6%; $p < 0.001$). There was a trend towards higher operative mortality with incomplete (13/102, 13 ± 6%) versus complete (13/169, 8 ± 4%) or total revascularization (15/254, 6 ± 3%; $p = 0.09$). Multivariate regression analysis identified six independent predictors of death at five years: age, cerebrovascular accident, COPD, myocardial infarction, congestive heart failure, and incomplete revascularization ($p < 0.02$ for all). For operative survivors, mean survival (Kaplan-Meier) was 6.9 years for total revascularization, 6.8 years with complete revascularization compared with 5.4 years with incomplete revascularization ($p < 0.008$; see Figure). For total, complete, and incomplete revascularization, survival at five years was 61% ± 3%, 61% ± 4%, 47% ± 5%; and at ten years survival was 27% ± 3%, 21% ± 3%, and 16% ± 4% ($p = 0.01$), respectively.



Total	240	201	170	127	99	64	34
Complete	156	133	108	88	61	33	20
Incomplete	88	66	54	33	22	15	9

CONCLUSIONS: Incomplete revascularization in patients older than 80 years is associated with decreased mid- and long-term survival when compared to total or complete revascularization. There was no additional survival benefit in this population when CABG was performed to every affected vessel versus every affected region of the heart. Completion of bypasses to all affected regions of the heart improved outcomes and should be undertaken when possible. Despite advanced age this population can experience good long-term survival, especially with adequate revascularization.

3:20 PM – 3:55 PM COFFEE BREAK

*AATS Member

56. Full Myocardial Revascularization Purely with Bilateral Internal Thoracic Arteries: Effects on Late Survival, Analysis of 3757 Patients

*Daniel O. Navia, Juan Espinoza, Mariano Vrancic, Fernando Piccinini, Mariano Camporrotondo, Mariano Benzadon, Juan Camou, Alberto Dorsa

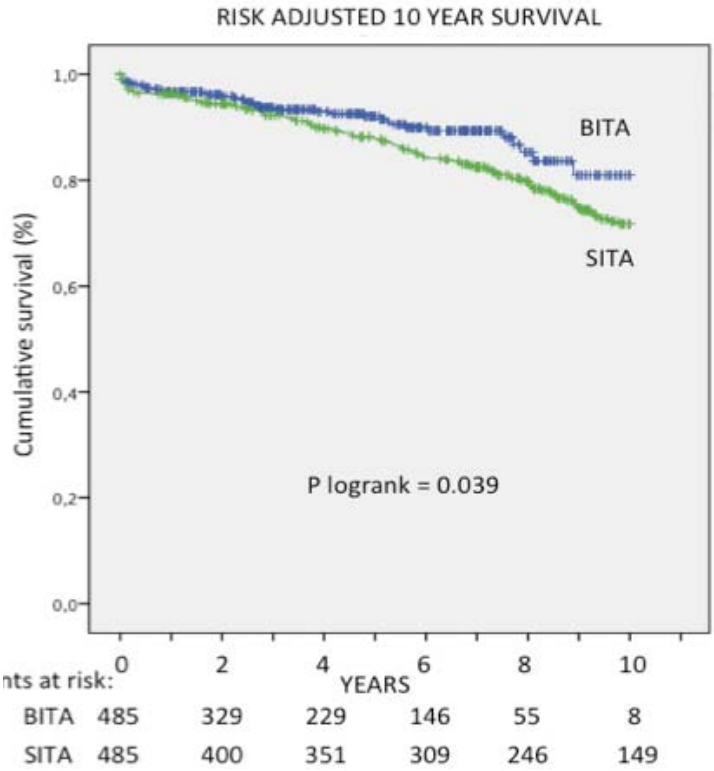
Instituto Cardiovascular de Buenos Aires, Buenos Aires, Argentina

Invited Discussant: *Michael E. Halkos

OBJECTIVE: Bilateral internal thoracic artery (BITA) grafting has been shown to improve long-term survival after coronary artery bypass grafting. We studied the long-term survival of using exclusive BITA versus single internal thoracic artery grafting (SITA) in a large population of patients with multi-vessels disease.

METHODS: Consecutive coronary artery bypass grafting surgeries performed at a single center between 1996 and 2014 were reviewed. Long-term survival and incidence of cardiac events was compared among patients receiving: Single Internal Thoracic Artery (SITA) plus other type of conduits (SVG and/or RA) (n: 1659) versus full myocardial revascularization with BITA alone (n: 2098). In BITA patients, LITA was grafted mainly to the LAD, while the RITA was used more commonly to graft the circumflex and the right coronary system as a Y grafts. A total of 485 pairs were matched using propensity scores. Cox proportional hazard models were generated to examine the association of arterial grafting with mortality.

RESULTS: Patients in the BITA group were more likely to be younger (BITA: 63.7 ± 9.1 vs. SITA: 65.0 ± 9.9; $p < 0.0001$), to be male but also to have more left ventricle dysfunction, hypertension, hypercholesterolemia, smoking habit, family history of coronary artery disease and to have more left main trunk disease. At 30 days, BITA patients experienced reduced unadjusted mortality (BITA: 1.2% versus SITA: 4.4%; $p < 0.0001$). At 10 years, BITA patients experienced superior unadjusted survival (BITA: 82.6 ± 1.8% vs. 76.1 ± 1.3%; $p = 0.001$). Cox regression analysis in the entire study cohort showed BITA to be associated with improved survival (HR, 0.71; 95% CI [0.58–0.87]; $p < 0.001$). In the propensity score adjusted analysis, BITA patients had similar hospital mortality (BITA: 1.6% vs. SITA: 2.9%; $p = 0.196$). BITA patients still showed improved survival at 10 years (BITA: 81.0 ± 4,1% vs. SITA: 71.8 ± 2.5%; $p = 0.039$).



CONCLUSION: This single center study suggests that using BITA, alone as a total arterial revascularization may be associated with improved long-term survival compared with use of only a single arterial graft plus other types of conduits. We postulate that total arterial revascularization may eventually be shown to yield a superior long-term clinical outcome.

*AATS Member

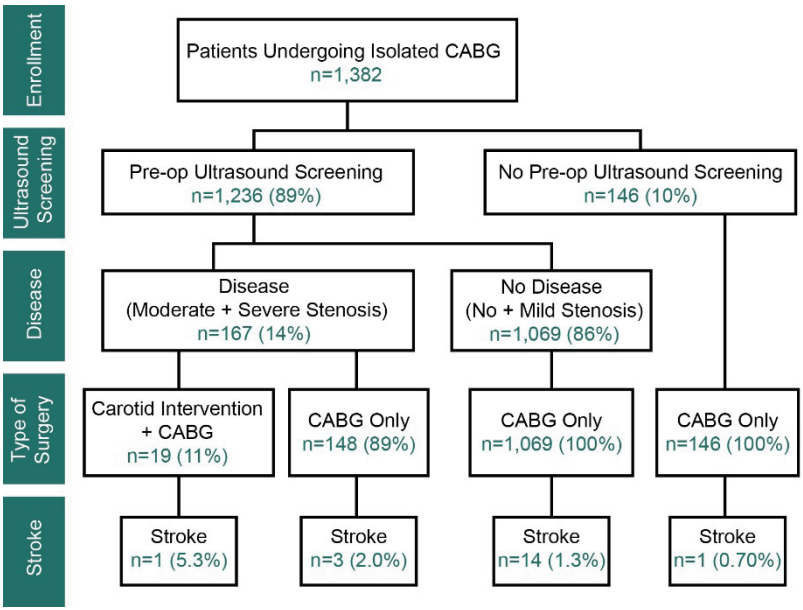
57. Non-Selective Carotid Artery Ultrasound Screening in Patients Undergoing Coronary Artery Bypass Grafting: Is It Necessary?

Khalil Masabni, *Joseph F. Sabik, III, Sajjad Raza, Theresa A. Carnes, Hemantha Koduri, Mehdi H. Shishehbor, Heather L. Gornik, *Eugene H. Blackstone
Cleveland Clinic, Cleveland, OH

Invited Discussant: *Thomas E. MacGillivray

OBJECTIVE: Despite decreasing risk of operative mortality after coronary artery bypass grafting (CABG), stroke remains a persistent risk. Some have suggested that routine preoperative carotid artery (CA) ultrasound may detect patients at risk of stroke and allow for intraoperative management changes, including performing CA revascularization. Therefore, we implemented a quality improvement protocol that included universal CA screening. Its purposes were to 1) determine how preoperative non-selective CA ultrasound screening altered the management of patients scheduled to undergo isolated CABG, and 2) evaluate neurologic outcomes of these patients.

METHODS: From March 2011 to September 2013, non-selective CA ultrasound screening was performed prospectively on 1,236 of 1,382 patients (89%) scheduled to undergo isolated CABG. CA stenosis was classified as none or mild (any 0%–59% stenosis), moderate (unilateral 60%–79% stenosis), or severe (bilateral 60%–79% stenosis or unilateral 80%–100% stenosis). Data on the management and neurologic outcome of these patients were obtained by medical records review.



RESULTS: Among the 1,236 patients, 1,069 (86%) had less than moderate CA stenosis and 167 (14%) had moderate or greater CA stenosis; 11% (n = 19) of the latter underwent combined CABG and carotid endarterectomy (CEA). Stroke occurred in 1.4% (19/1,382) of all patients, 1.3% (14/1,069) of those with less than moderate CA stenosis and 2.4% (4/167) of those with moderate or greater CA stenosis (P = .3). For patients with moderate or greater CA stenosis, stroke location was ipsilateral to a carotid stenosis in 1, contralateral in 1, and bilateral hemispheric in 2. In this group, stroke occurred in 5.3% (1/19) of those undergoing combined CEA-CABG and 2.0% (3/148) of those undergoing isolated CABG (P = .4; see Figure). Of the 19 strokes, 4 were present on awakening from anesthesia and 15 occurred postoperatively between days 2 and 14.

CONCLUSIONS: Preoperative CA screening and perioperative CA intervention did not result in a decreased occurrence of stroke. Given this observation, carotid disease might only be a marker of patients' diffuse atherosclerotic burden. Therefore, the value of preoperative carotid artery screening is questionable.

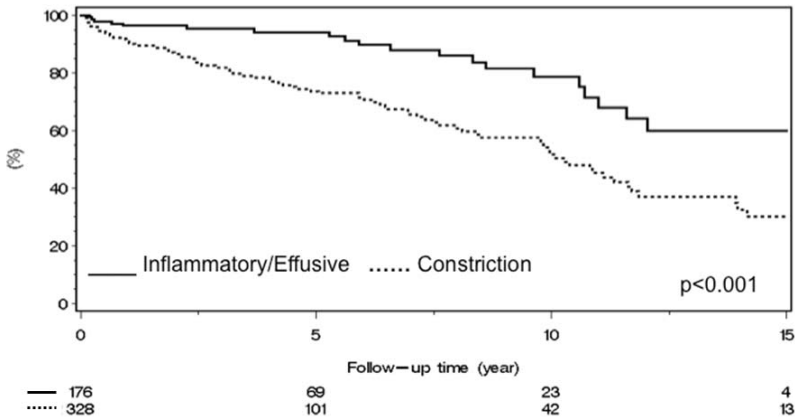
58. A 20-Year Experience with Isolated Pericardiectomy: Analysis of Indications and Outcomes

Erin A. Gillaspie, John M. Stulak, *Richard C. Daly, Kevin L. Greason, *Lyle D. Joyce, Jae Oh, *Rakesh M. Suri, *Hartzell V. Schaff, *Joseph A. Dearani
Mayo Clinic, Rochester, MN

Invited Discussant: *Joseph F. Sabik, III

OBJECTIVE: Outcome after pericardiectomy is dependent on many factors, but no large study has provided clarity on the effects of patient variables or cause of pericarditis on patient survival. We report early and late results from a 20-year experience with isolated pericardiectomy.

METHODS: From January 1993 to December 2013, 938 patients underwent pericardiectomy at our institution. After excluding patients with prior chest radiation and concomitant cardiac surgery, we identified a cohort of 521 who underwent isolated pericardiectomy. Median age at operation was 58 (range: 18–84) and 371 (71%) were male. Indications for pericardiectomy were inflammatory/effusive in 181 (35%) and constriction in 340 (65%). Prior cardiac surgery had been performed in 86 patients (17%). Median preoperative left ventricular ejection fraction was 60% (range: 24–80) and median NYHA Functional class was III (70% class III/IV).



RESULTS: Surgical approach was median sternotomy in 420 (81%), left thoracotomy in 71 (14%), and clamshell in 30 (5%). Extent of pericardial resection was radical in 418 (80%), subtotal in 74 (14%), and completion in 29 (6%). Cardiopulmonary bypass was utilized in 210 (40%). Overall mortality was 12/521 (2.3%); 2.2% for inflammatory/effusive versus 2.4% for constriction ($p = 0.91$). Not enough early deaths occurred to allow for a multivariate analysis, but univariate predictors of early death included lower left ventricular ejection fraction (HR, 1.09; $p = 0.03$) and preoperative renal insufficiency (HR, 10; $p < 0.001$). Median duration of late follow-up was 29 months (maximum, 20.5 years) and overall 5, 10 and 15-year survival was 81%, 60%, and 39%, respectively. Late survival according to surgical indication was higher in the effusive/

inflammatory group when compared to the constriction cohort ($p < 0.001$) (see Figure). Independent predictors of late mortality identified on multivariate analysis included older age (HR, 1.05; $p < 0.001$), congestive heart failure (HR, 1.57; $p = 0.02$), and chronic obstructive pulmonary disease (HR, 1.95; $p = 0.004$). At last follow-up, median NYHA Functional class was II (79% class I/II) ($p < 0.001$ vs. preoperative).

CONCLUSIONS: While early mortality after isolated pericardiectomy is low irrespective of the indication for surgery, late follow-up demonstrates better outcomes in the setting of inflammatory/effusive pericarditis compared to constriction. Importantly, the majority of patients demonstrated a significant improvement in NYHA functional class throughout follow-up.

*AATS Member

59. Early and Late Surgical Outcomes of Infective Endocarditis Among Intravenous Drug Abusers: Results from Two Large Academic Centers

Joon Bum Kim[1], Julius I. Ejiofor[2], Maroun Yammine[2], Sandra B. Nelson[1], Arthur Y. Kim[1], Serguei I. Melnitchouk[1], James D. Rawn[2], Marzia Leacche[2], *John G. Byrne[2], *Thoralf M. Sundt, III[1]

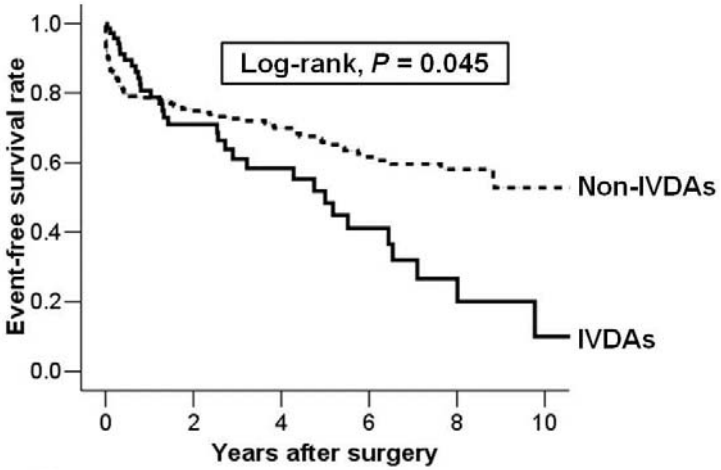
[1]Massachusetts General Hospital, Harvard Medical School, Boston, MA; [2]Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Gosta B. Pettersson

OBJECTIVES: Increasing numbers of intravenous drug abusers (IVDAs) with infective endocarditis (IE) are presenting for cardiac surgery. Their youth and risk of recidivism raises both ethical and economic concerns. In the interest of informing these decisions, we compared early and late outcomes of surgery for IE in IVDA and non-IVDA patients.

METHODS: Using the prospective databases of two closely associated urban tertiary academic centers, we identified 436 consecutive adult patients undergoing surgery for active IE between 2002 and 2014. Primary endpoints were death and valve-related events based on Society for Thoracic Surgeon definitions. Median follow-up time was 29.4 months (IQR, 4.7–72.6 months).

RESULTS: Overall, 78 patients (17.9%) were current IVDAs, with the proportion of IVDAs significantly increasing after 2012 (14.8% to 26.1%; P = 0.006). IVDAs were younger (35.9 ± 9.9 vs. 59.3 ± 14.1 years; P < 0.001) and had fewer cardiovascular risk factors (e.g., diabetes, P = 0.27; hypertension, P < 0.001; coronary diseases, P = 0.087; renal dysfunction, P < 0.001). They presented more frequently, however, with embolic events (46.2% vs. 29.9%; P = 0.006), large (≥10 mm) vegetations (70.5% vs. 49.8%; P < 0.001), and had right-sided (25.6% vs. 5.0%; P < 0.001) and multiple valvular involvement (82.1% vs. 73.1%; P < 0.001). Overall, valves were repaired in 45 (10.3%), replaced with mechanical prostheses in 99 (22.7%), bioprostheses in 206 (47.2%) or homografts in 86 (19.7%) without significant differences between IVDAs and non-IVDAs (P = 0.87). Major adverse events for the entire cohort during the follow-up period included death in 90 (20.6%), recurrence of IE in 34 (7.8%), valve reoperation in 35 (8.0%) and thromboembolism in 16 (3.7%). Early mortality was lower in IVDAs (3.8% vs. 13.7% in non-IVDAs; P = 0.012), but overall survival rates were not significantly different at 5 years (83.5 ± 5.0% in IVDAs and 79.1 ± 2.2% in non-IVDAs; P = 0.21). Freedom from valve-related complications, however, was significantly lower among IVDAs at 5 years, (52.5 ± 8.4% vs. 84.1 ± 3.1%; P < 0.001) mainly attributed to higher rates of reinfection (25.6% vs. 3.9%; P < 0.001) and reoperation (23.1% vs. 4.7%; P < 0.001). Overall event-free survival rates at 5 years were 48.3 ± 7.9% in IVDAs and 65.2 ± 3.3% in non-IVDAs (P = 0.047; see Figure). By multivariable analysis, independent predictors of the composite of death and valve-related complications were IVDA (P = 0.028), congestive heart failure (0.042), prosthetic IE (P = 0.002), multi-valve IE (P = 0.003) and renal dysfunction (P < 0.001).



Number at risk						
Non-IVDAs	358	145	98	67	33	6
IVDAs	78	33	20	11	4	1

CONCLUSIONS: The proportion of IVDAs among surgical patients with IE is increasing. Although IVDAs are young, with lower baseline cardiovascular risk burdens, long-term clinical outcomes are discouraging with a significant rate of reinfection. This information should be considered when making decisions regarding operative intervention on IE among IVDA.

Late-Breaking Clinical Trial

LB2. Neurologic Event-Risk and -Extent Are Equivalent for TAVR and SAVR in High Risk Patients: A Neurological Sub-Study of the US Pivotal Randomized Trial of a Self-Expanding Prosthesis

*Thomas G. Gleason[1], Jeffrey J. Popma[2], *John Conte[3], *G. Michael Deeb[4], *G. Chad Hughes, Jr.[5], *Michael J. Reardon[6], *David H. Adams[7]

[1]University of Pittsburgh, Pittsburgh, PA; 2Beth Israel Deaconess Medical Center, Boston, MA; [3]Johns Hopkins University, Baltimore, MD; [4]University of Michigan, Ann Arbor, MI; [5]Duke University, Durham, NC; [6]Houston Methodist Debakey Heart & Vascular Center, Houston, TX; [7]Mount Sinai Medical Center, New York, NY

Invited Discussant:

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

*AATS Member

2:00 PM **CONGENITAL HEART DISEASE SIMULTANEOUS SCIENTIFIC SESSION** Room 6A, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Jonathan M. Chen and *Charles B. Huddleston

60. Hybrid Therapy for the Hypoplastic Left Heart Syndrome – Myth, Alternative or Standard?

Can Yerebakan, Klaus Valeske, Hatem Elmontaser, Matthias Mueller, Juergen Bauer, Josef Thul, Dietmar Schranz, Hakan Akintuerk

Pediatric Heart Center Giessen, Giessen, Germany

Invited Discussant: *Mark E. Galantouitz

OBJECTIVE: The neonatal performance of the classical Norwood operation is still the standard treatment for patients with hypoplastic left heart syndrome (HLHS) worldwide. Alternative therapies such as the hybrid approach have only met acceptance as a niche therapy in most centers. We retrospectively evaluated our experience in hybrid treatment of the HLHS in a single center since June 1998.

METHODS: Patients with the diagnosis HLHS (n = 125) without exceptions were included into analysis who were treated with hybrid approach by one surgeon until October 2014. Hypoplastic left heart variants were excluded from this analysis. The different types of HLHS were distributed as follows: aortic and mitral atresia n = 38, 31%), aortic atresia and mitral stenosis (n = 43, 34%), aortic stenosis and mitral stenosis (n = 35, 28%), aortic stenosis and mitral atresia (n = 9, 7%). Median comprehensive aristotle score was 17.5 (14.5–27.5). Median weight was 3,200 g (1,210–7,050). All patients received an initial hybrid stage I procedure (surgical bilateral pulmonary artery banding and ductal stenting) with following comprehensive stage II operation, which included aortic arch reconstruction, bidirectional Glenn procedure, bilateral debanding of the pulmonary arteries and ductal stent removal at 4–6 months of age as indicated. Extracardiac total cavopulmonary anastomosis procedure completed the univentricular palliation.

RESULTS: Median follow-up time was 7.1 years (range: 1month to 15.6 years). Four early deaths occurred after hybrid stage I (3.2%). Out of the 121 survivors 3 patients received orthotopic heart transplantation (HTx). Seven patients did not survive until comprehensive stage II operation (5.1%). From these 4 patients received palliative care due to chromosomal defects after hybrid stage I. Comprehensive stage II operation was performed in 96 patients except 8 patients who are still awaiting stage II and 7 patients who received biventricular repair. Operative mortality after comprehensive stage II was observed in 5 cases (5.2%). Two patients underwent Htx. Interstage mortality after stage II comprised 5 patients (5.6%). Except 20 patients awaiting, Fontan/Kreutzer circulation was established in 62 patients without operative mortality and

two successful HTx thereafter. One patient died on the waiting list for HTx. Sixteen-year overall survival is 82% for the entire group. Survival beyond 10 years is 77.2% when patients who received biventricular repair and HTx are excluded from the cohort.

CONCLUSIONS: We adopted the hybrid approach as a standard treatment for all types of HLHS. Long-term results are highly satisfying in terms of mortality and morbidity in a complex group of unselected patients.

61. Selective Management Strategy for Neonates with Interrupted Aortic Arch Mitigates Future Left Ventricular Outflow Tract Obstruction Risk

*Bahaaldin Alsoufi, Brian Schlosser, Ritu Sachdeva, William Border, William Mahle, *Brian Kogon, *Kirk Kanter

Emory University, Atlanta, GA

OBJECTIVE: Following surgical repair of Interrupted aortic arch (IAA) and ventricular septal defect (VSD), left ventricular outflow tract obstruction (LVOTO) is a common complication that is associated with important morbidity and mortality, especially when early reoperation is required during infancy. Several anatomic factors that increase LVOTO risk have been identified and surgical strategies such as concomitant resection of the infundibular septum or LVOT bypass procedures (single stage Yasui or staged Norwood followed by Rastelli) have been proposed in those patients. We examined outcomes of our current selective management of neonates with IAA to address LVOTO risk.

METHODS: From 2002 to 2013, 77 neonates underwent IAA repair. Based on the presence of anatomic substrate for LVOTO, patients underwent standard IAA repair and VSD closure (n = 53 [69%]), concomitant infundibular resection (n = 7 [9%]), or LVOT bypass (n = 17 [22%], staged in 14). We analyzed anatomic and echocardiographic characteristics influencing procedure choice and explored reoperation risk and survival following IAA repair.

RESULTS: Median age at time of surgery was 7 days and median weight was 3.0 Kg; 41/77 (53%) had DiGeorge syndrome. Selected anatomic data is presented in the supplementary table. In comparison to neonates who had standard IAA repair and VSD closure, neonates who had infundibular resection or LVOT bypass had significantly smaller aortic valve and subaortic area and a trend for higher prevalence of type B IAA, aberrant right subclavian artery and bicuspid aortic valve. (See table) Overall freedom from LVOT reoperation was 94% and 76% at 1 and 8 years. Freedom from LVOT reoperation at 8 years was 80%, 43% and 88% for standard repair, infundibular resection and LVOT bypass, respectively (p = 0.004); 73% of LVOT reoperations were for discrete subaortic membrane resection. Overall 8-year survival was 86% and was not related to procedure type or LVOT reoperation. Eight-year freedom from arch and all-cause cardiac reoperation was 93% and 60%, respectively and was not related to procedure type. The majority of reoperations in the LVOT bypass group were for conduit change (67%).

Table: Anatomic and echocardiographic details of IAA patients who underwent various IAA repair strategies

	Standard IAA repair	Infundibular resection	LVOT bypass	P value
IAA type B	76%	100%	88%	0.11
Bicuspid aortic valve	59%	86%	88%	0.06
Aberrant right subclavian artery	42%	57%	71%	0.08
Aortic valve z score	-2.5	-3.8	-4.0	<0.001
Aortic valve annulus minus weight	2.1	1.0	0.9	<0.001
Aortic valve indexed cross sectional area (cm2/m2)	1.03	0.64	0.61	<0.001
LVOT diameter (cm)	0.44	0.32	0.34	0.004
LVOT indexed cross sectional area (cm2/m2)	0.79	0.41	0.44	0.006
Average LVOT / descending aorta ratio	0.70	0.44	0.50	<0.001
Ascending aorta z score	-1.2	-1.9	-1.8	0.015

CONCLUSIONS: This selective management strategy that is customized to the degree of aortic valve and subaortic area narrowing has mitigated and delayed LVOTO risk compared to published reports. With this tailored approach, most LVOT reoperations occur beyond infancy and are commonly related to the development of discrete subaortic membrane stenosis. Early and more complex LVOT reoperations, usually associated with higher morbidity and mortality, are required less often. The well established association between aortic valve and LVOT narrowing and increased LVOTO risk is neutralized with LVOT bypass procedures however reoperation for LVOTO continues to be the highest following infundibular resection.

*AATS Member

62. Impact of Pacing on Left Ventricular Function in L-Transposition of the Great Arteries

Sophie C. Hofferberth, Mark E. Alexander, Douglas Y. Mah, Victor Baustista-Hernandez, *Pedro J. del Nido, Francis Fynn-Thompson

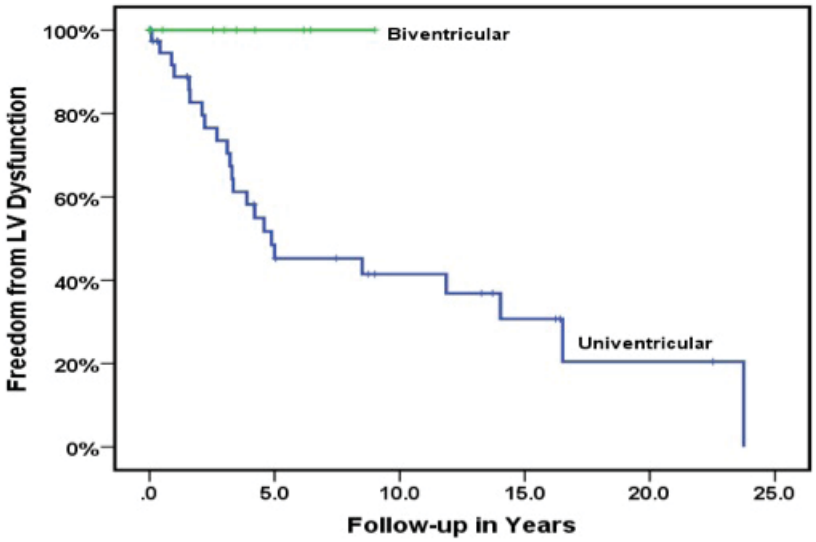
Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Henry M. Spotnitz

OBJECTIVE: Late onset left ventricular (LV) dysfunction is a significant problem for patients with congenitally corrected transposition of the great arteries (ccTGA), particularly in those who are pacemaker dependent. The impact of univentricular versus biventricular (cardiac resynchronization therapy, CRT) pacing on LV function remains poorly understood in patients with ccTGA. In this study we sought to investigate the impact of ventricular pacing on LV function and assess whether the use of CRT as a primary or secondary (upgrade) mode of pacing precludes the development of late onset LV dysfunction in patients with ccTGA.

METHODS: We performed a retrospective review of all patients with a diagnosis of ccTGA who underwent pacemaker insertion. From 1993 to 2014, a total of 53 patients were identified from the cardiology database and surgical records at our institution. The primary endpoint was moderate or severe LV dysfunction as measured by echocardiography at latest follow up.

RESULTS: Overall mortality was 7.5 % (n = 4), with 1 patient requiring transplantation and 3 late deaths occurring secondary to end-stage heart failure. Median follow-up was 3.7 years (range: 4 days to 22.5 years). Seventeen (32%) patients underwent pacemaker insertion for spontaneous heart block (n = 8) or had a pacemaker placed at the time of surgical intervention preparing for anatomical repair (Pulmonary artery banding, n = 8; or BT shunt; n = 1). Eight (15%) underwent pacemaker insertion at the time of anatomical repair, while 28 (53%) patients became pacemaker dependent post anatomical repair. Twenty-eight (53%) underwent univentricular pacing only, of these, 10 (36%) patients developed moderate or severe LV dysfunction at latest follow-up. Twenty-five (47%) patients received CRT, 14 (26%) underwent secondary upgrade from a prior dual-chamber system, and 11 (21%) received CRT as the primary mode of pacing. Eleven of the 14 (85%) patients undergoing secondary CRT had significant LV dysfunction at the time of pacer upgrade, with only 4 (36%) demonstrating persistent LV dysfunction at latest follow-up. Therefore, of the 42 (79%) patients who initially underwent univentricular pacing, 21 (50%) went on to develop significant LV dysfunction. This is in contrast to the 11 patients who underwent primary CRT, none of whom developed LV dysfunction (see Figure, log rank test; p = 0.043).



CONCLUSIONS: Late-onset LV dysfunction is a clinically significant complication associated with the use of univentricular pacing in patients with ccTGA. All patients with ccTGA who develop heart block should undergo primary CRT as this prevents the development of left ventricular dysfunction. Furthermore, pre-emptive placement of biventricular pacing leads at the time of anatomical repair or other permanent palliative procedure will facilitate subsequent CRT should pacing be needed in ccTGA.

*AATS Member

63. Comparison Between Two Surgical Techniques to Repair Total Anomalous Pulmonary Venous Connection at a Single Institute: 81 Cases with Sutureless Technique Versus 98 Cases with Traditional Technique

Yiqun Ding, Yanqiu Ou, Cheng Zhang, Jimei Chen, Jianzheng Cen, Shusheng Wen, Gang Xu, Jian Zhuang

Guangdong General Hospital, Guangzhou, China

Invited Discussant: *Christopher A. Caldarone

OBJECTIVE: Traditional surgical repair of total anomalous pulmonary venous connection (TAPVC) is associated with high mortality and morbidity, especially for patients with pulmonary venous obstruction. This study aims to compare the effect of two surgical techniques.

METHODS: From October 2007 to December 2013, 179 consecutive patients with TAPVC (Cardiac type was excluded) underwent biventricular surgical repair at our institute. Patients were allocated to 5 doctors, including 2 surgeons performing sutureless technique (Group 1, n = 81) and 3 surgeons performing traditional technique (Group 2, n = 98). All patients were divided into two categories: with/without preoperative pulmonary venous obstruction (PVO). Patient characteristics are summarized in the table that follows.

Table: Characteristics of Patients

	Preoperative PVO			Non-Preoperative PVO		
	Sutureless Group	Traditional Group	p-Value	Sutureless Group	Traditional Group	p-Value
Number	24	28		57	70	
Age,*days	12 (1~60)	13 (2~123)	0.997	90 (30~6570)	90 (30~14965)	0.840
Weight,* kg	3.26 (2.50~5.30)	3.29 (2.20~5.00)	0.774	4.60 (1.80~44.00)	5.35 (3.00~60.00)	0.164
TAPVC type			0.076			0.079
Supracardiac	11	16		52	53	
Infracardiac	11	6		2	5	
Mixed	2	6		3	12	

* Values are shown as median (range).

RESULTS: All patients were followed up from 7 days to 68.5 months.There were 23 deaths (4 in Group 1 [4/81, 4.9%], 19 in Group 2 [19/98, 19.4%]; P = 0.025). Postoperative PVO was present in 16 patients (2 in Group 1 [2/81, 2.5%], 14 in Group 2 [14/98, 14.3%]; P = 0.006). In the preoperative PVO category, the mortality of Group 1 and 2 were 12.5% (3/24) and 46.4% (13/28), respectively, P = 0.008. There was 1/24 (4.2%) patient in Group 1 present with mild PVO 18 days after the operation, the patient is symptomless, and being followed up. The survival rate and rate of free from PVO at 1 year were 87.5% (21/24) and 95.8% (23/24). There was 7/28 (25.0%) patients in Group 2 present with PVO at 1 to 7 months after the operations, with median as 3 months. 3 patients are symptomless and being followed up,

4 patients underwent reoperations, 75.0%(3/4) died. The survival rate and rate of free from PVO at 1 year were 53.6% (15/28) and 75.0% (21/28).In the non-preoperative PVO category, there were 1 and 6 deaths in Group 1 and 2, respectively, P = 0.199. There was 1/57 (1.8%) patient in Group 1 present with severe PVO 13 days after the operation, the patient underwent reoperation and survived. The survival rate and rate of free from PVO at 1 year were 98.2% (56/57) and 98.2% (56/57). There was 7/70 (10.0%) patients in Group 2 present with PVO 6 days to 8.74 months after the operations, with median as 1.5 months. 5 patients are being followed up, 2 patients underwent reoperations, 50.0%(1/2) died. The survival rate and rate of free from PVO at 1 year were 91.4% (64/70) and 90.0% (63/70).By using Cox's proportional hazard model, traditional technique was the risk factor for death (OR, 4.59; 95% CI [1.53–13.89]) and postoperative PVO (OR, 8.20; 95% CI: [1.70–40.00]) for patients with preoperative PVO when adjusted for preoperative PVO, mixed type, neonates and weight at operation.

CONCLUSIONS: For patients with supracardiac, infracardiac and mixed type of TAPVC with preoperative PVO, sutureless technique in primary repair can decrease mortality and morbidity significantly. For patients without preoperative PVO, both sutureless and traditional techniques show satisfactory results.

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64. Characterization and Outcomes of Severe Primary Multi-Vessel Pulmonary Vein Stenosis in Low-Birth Weight Infants

Ashley Dickens, Kimberley Gauvereau, Sanjay P. Prabhu, Christina Ireland, Michele J. Borisuk, Kathy Jenkins, Christopher W. Baird

Boston Children's Hospital, Harvard Medical School, Boston, MA

Invited Discussant: *Emile A. Bacha

BACKGROUND: Primary pulmonary vein stenosis (PVS) is generally the most aggressive form of the disease; infants are often born premature and develop signs and symptoms within weeks to months after birth and frequently do not survive. The aim of this study was to characterize primary PVS in young and pre-mature infants and evaluate outcomes following surgical intervention.

METHODS: Patients undergoing surgical repair for primary PVS from February 2008 to July 2014 at Boston Children's Hospital were identified. An aggressive modified "sutureless" surgical approach was used and additional consideration was given to modifying the relationship between the affected PVs and associated external structures. Outcome measures included mortality, re-intervention, degree of individual PV involvement and the relationship of externally related structures. Survival was determined by Kaplan-Meier analysis.

RESULTS: Twenty-five patients were identified with severe multi-vessel primary PVS. Median gestational age at birth was 34 weeks (25–40) and weight was 1.54 kg (0.39–4.22). Most patients underwent a pre-operative CT scan. Figure 1 shows direct relationships between the most affected PVs segments and external structures. The common findings included the following: right upper PV associated with the right pulmonary artery, left upper PV associated with the left bronchus and left lower PV associated with the descending aorta and left lung atelectasis. The right lower PV was generally unaffected. At operation, median age was 5.8 months (1–35) and weight was 4.9 kg (2.7–14). 92% had bilateral PV disease and 84% had involvement of three or more PV. The most common PV involved was RU (96%), LU (88%) and LL (80%) while the RL PV was involved least (44%). PV atresia was found in nearly half the patients (48%) and most commonly associated with the RU PV (28%) and LU PV (16%). All patients underwent post-operative catheterizations and 22 patients (88%) had interventions. The median number of catheterizations per patient was 3 (1–13). The median number of catheterizations with intervention per patient was 2.5 (1–12). No patients had PV re-operation. One patient died within 30 days following operation and 11 patients (44%) died in the follow-up period at a median follow-up of 0.8 years (13 days to 5.2 years). Eight patients were listed for lung transplantation: three patients were delisted, three patients died waiting and two patients were transplanted.

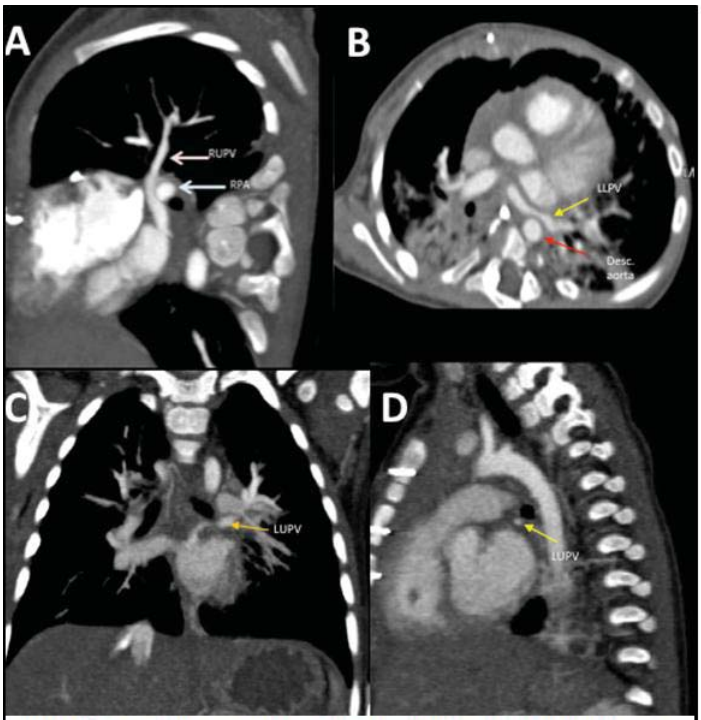


Figure1. External structures associated with stenotic segments of the pulmonary veins. (a) Enlarged right pulmonary artery compressing the right upper PV. (b) Atelectasis of the left lower lung causing rotational shift of the cardiac mass and compression of the left lower PV with posterior compression from the descending aorta. (c, d) Mediastinal shift causing a rotational ostial obstruction of the left upper PV. There is posterior compression from the left main bronchus seen on coronal and sagittal reformats.

CONCLUSIONS: Severe multi-vessel primary PVS is uniformly fatal if not intervened upon. Aggressive multi-modal medical, surgical and interventional approach has improved survival in these patients, but mortality remains high. Continued characterization of primary PVS including the role of external anatomic structures will help to identify these patients earlier to prevent progression and allow earlier intervention and continued improved survival.

3:40 PM – 4:15 PM COFFEE BREAK

*AATS Member

Moderators: *E. Dean McKenzie and *Michael E. Mitchell

65. Pre-Operative Predictors of Survival After Repair of Pulmonary Vein Stenosis

Mauro Lo Rito, Tamadhir Gazzaz, Travis Wilder, *Glen S. Van Arsdell, Osami Honjo, Shi-Joon Yoo, *Christopher A. Caldarone

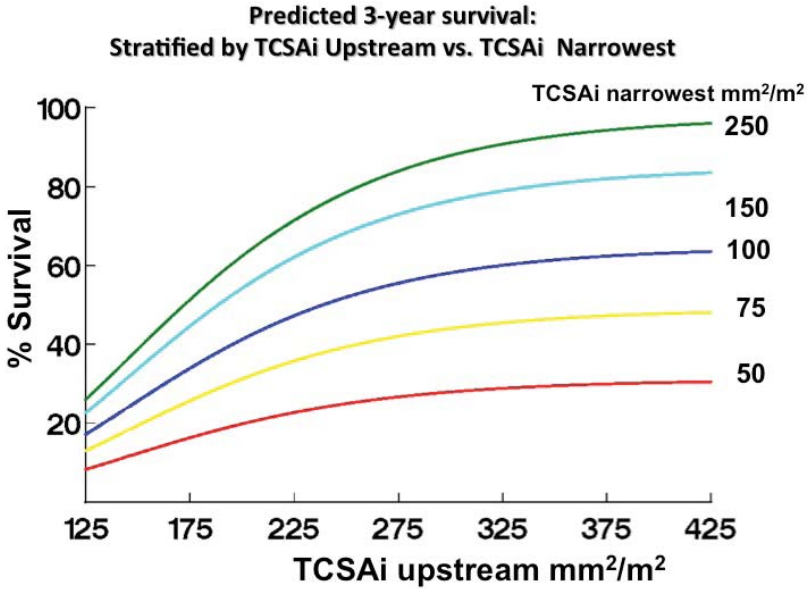
Hospital for Sick Children, Toronto, ON, Canada

Invited Discussant: *Francois G. Lacour-Gayet

OBJECTIVES: Pulmonary vein (PV) stenosis is associated with high mortality. CT/MRI imaging allows characterization of pulmonary vein pathology which may influence survival. We sought to develop a predictive model for survival after repair of PV stenosis.

METHODS: Patients who underwent repair of congenital or acquired PV stenosis (1990 to 2012) and preoperative CT/MRI were retrospectively reviewed. We measured short/long cross-sectional diameters of each PV at the left atrial junction (downstream), PV bifurcation (upstream), and at the narrowest point (maximum stenosis) and calculated total cross sectional area of PVs indexed for BSA (TCSAi). Survival after operation was evaluated with parametric multiphase risk-adjusted models. Univariate and multivariable analyses were used to identify relationships between PV dimensions and survival, and predictive nomograms were generated.

RESULTS: 145 patients underwent surgical repair of PV stenosis; 31 had preoperative imaging that met inclusion criteria. PV stenosis was congenital in 20 and acquired in 11. Surgical repair techniques included sutureless (n = 30) and pericardial patch reconstruction (n = 1). Follow-up duration is 4.28 ± 4.2 years. In-hospital mortality was 9.7% (3/31). Unadjusted 6-year freedom from death was 75 ± 7%, 69 ± 9% and 61 ± 10% at 1, 3 and 6 years respectively. Mean TCSAi downstream was 194 ± 109 mm^2/m^2, upstream was 302 ± 122 mm^2/m^2 and site of maximum stenosis was 170 ± 90 mm^2/m^2. Although nearly 2/3 patients has the site of maximal narrowing which was localized to the left atrial junction, 1/3 of patients had sites of maximal narrowing which were between the left atrial junction and the first branching point of the pulmonary vein. A smaller upstream TCSAi was associated with an increased risk of early mortality (p = 0.06) and the TCSAi at the site of maximal stenosis was associated with late risk of death (p = 0.02) (see Figure).



CONCLUSION: Although intuitive to many surgeons, the anatomic characteristics of pulmonary veins which are amenable (or not amenable) to surgical repair are not objectively defined. The severity of maximal stenosis (which is often surgically accessible at the left atrial junction and associated with late mortality) has a complex predictive relationship with the extent of progression of PV pathology upstream into the lung parenchyma (which is not surgically accessible). The TCSAi is an objective measurement which can help to inform surgical decision making and stratify patients for enrollment in clinical trials of agents directed at upstream pulmonary vein pathology.

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66. Improvement of Cardiopulmonary Exercise Capacity After Pulmonary Valve Replacement and Its Predictors in Patients with Pulmonary Regurgitation After Repair of Tetralogy of Fallot

Yu Rim Shin, Jong Keun Kim, Hong Ju Shin, Young-Hwan Park, Han Ki Park
Yonsei University Severance Hospital, Seoul, Republic of Korea

Invited Discussant: *E. Dean McKenzie

OBJECTIVE: Chronic pulmonary regurgitation in patients after repair of tetralogy of Fallot results in progressive right ventricular dilatation and dysfunction. However, the association of exercise capacity and the right ventricular dilatation has not been clarified. The purpose of this study is to evaluate the change of exercise capacity and its association with right ventricular volume in the patients who underwent pulmonary valve replacement (PVR) after repair of tetralogy of Fallot.

METHODS: Among the patients who underwent PVR after repair of tetralogy of Fallot from January 2005 to August 2013, 40 patients underwent cardiopulmonary exercise test as well as magnetic resonance imaging (MRI) preoperatively and 1 year postoperatively. The medical records were reviewed retrospectively.

RESULTS: The patients undergoing PVR had reduced preoperative cardiopulmonary exercise capacity (peak oxygen consumption, peak VO_2, 28.9 ± 5.8 ml/kg/min; percentage of predictive peak VO_2, 61.1 ± 10.5%). Preoperative peak VO2 had significant association with right ventricular end-diastolic volume index (RVEDVI) from preoperative MRI ($r = -0.46$; $p < 0.01$). After PVR, RVEDVI has decreased (173.1 ± 35.0 vs.110.7 ± 18.4 ml/m^2; $p < 0.01$) and right ventricular ejection fraction improved (48.9 ± 9.1 vs. 52.2 ± 7.5%; $p < 0.01$) on the MRI. On the postoperative cardiopulmonary exercise test, percentage of predicted peak VO2 showed significant improvement (61.1 ± 10.5 vs.66.2 ± 10.7%; $p = 0.03$). The ratio of minute ventilation to carbon dioxide production (VE/VCO_2) significantly improved (31.2 ± 6.8 vs.27.6 ± 3.3; $p = 0.02$), but the heart rate reserve showed no significant difference postoperatively. The postoperative peak oxygen consumption showed association with preoperative RVEDVI ($r = -0.33$; $p = 0.04$). On the risk factor analysis, moreover, preoperative RVEDVI larger than 160 ml/m^2 was a negative predictive factor for the improvement of exercise capacity in the patients with reduced preoperative peak VO_2 (OR, 0.10; 95% CI [0.014–0.838]; $p = 0.03$).

CONCLUSIONS: The overall exercise capacity showed significant improvement after PVR. The preoperative right ventricular volume had significant inverse correlation not only with the preoperative exercise capacity but also with the postoperative exercise performance. In the patients with larger RVEDVI more than 160 ml/m^2, the change of exercise capacity was less favorable after the PVR. The timely operation before severe dilatation of the right ventricle might be crucial in terms of exercise performance.

67. Intermediate-Term Neuro-Developmental Outcomes After Neonatal Cardiac Surgery: Role of Cortical Iso-Electric Activity

Michael Swartz, Laurie Seltzer, Jennifer Kwon, James Burchfiel, Jill M. Cholette, Dawn Sweeney, Cecilia Meagher, Ron Angona, Ronnie Guillet, George M. Alfieris
University of Rochester, Rochester, NY

Invited Discussant: *J. William Gaynor

OBJECTIVE: Neonates with congenital heart disease are at risk for adverse neuro-developmental outcomes following surgery. This multifactorial risk is likely related to fluctuations in blood pressure, flow, and temperature during cardiopulmonary bypass (CPB) and circulatory arrest. Electro-encephalograms (EEG's) reflect cortical brain activity, and may be useful as an intra-operative monitoring tool. We hypothesized that intra-operative EEG activity may provide insight into future neuro-developmental outcomes.

METHODS: Neonates requiring surgery had baseline and continuous intra-operative EEG and hemodynamic monitoring. EEG activity was classified as either, 1) appropriate for age, 2) moderate burst suppression, 3) severe burst suppression, or 4) iso-electric (absent brain activity for >3 minutes). Follow-up neuro-developmental outcomes were assessed using the Vineland Adaptive Behavior Scale (VABS), providing a composite score and scores in specific activities (i.e., daily living, socialization, and communication).

RESULTS: Twenty-one neonates requiring cardiac surgery had baseline EEG activity which was appropriate for age. All neonates developed moderate burst suppression with the induction of general anesthesia. This pattern was unchanged throughout the case in the absence of hypothermia <25°C. Eleven neonates (52%) developed severe burst suppression that progressed into iso-electric activity during the severe hypothermic period required for circulatory arrest. The duration of iso-electric activity was significantly greater than circulatory arrest times (103.1 ± 50 vs. 24.6 ± 16 minutes; $p < 0.001$), and the onset of iso-electricity occurred with severe hypothermia 23.1 ± 4°C. However, iso-electric activity was not influenced by mean arterial pressure, or CPB flow. At a mean follow-up at 5.6 ± 1.0 years, neonates who required severe hypothermia had lower VABS scores in all areas and significantly lower communication scores (43.4 ± 9 vs. 50.1 ± 5; $p = 0.05$) when compared to neonates not requiring severe hypothermia. Comparison of composite VABS scores demonstrated an inverse correlation with the duration of iso-electric activity ($R^2 = 0.4$; $p = 0.03$) but not circulatory arrest times ($R^2 = 0.001$; $p = 0.9$) (see Figure). Further, in the neonates that developed iso-electric activity, those with iso-electric times >90 minutes, had the lowest VABS scores (459 ± 34 vs. 301.2 ± 62; $p < 0.01$).

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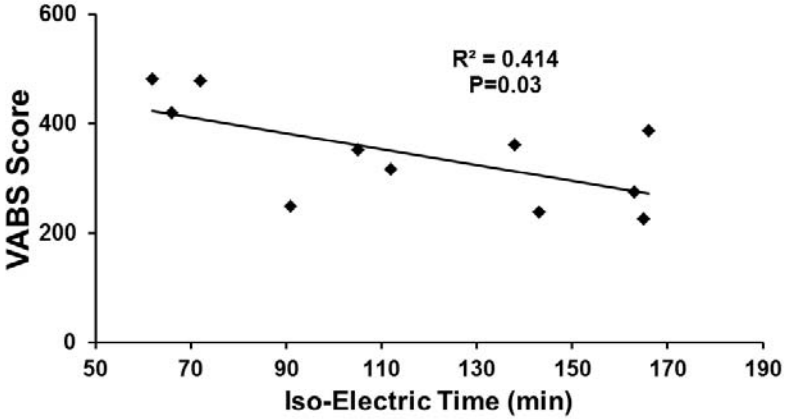
Figure 1.



CONCLUSIONS: The duration of cortical iso-electric activity associated with circulatory arrest is directly related to poor intermediate-term neuro-developmental outcomes, particularly if >90 minutes. Strategies which utilize moderate hypothermia, and continuous intra-operative EEG monitoring, may be useful during complex congenital heart surgery to predict risk.

DEEP DIVE SESSION FEATURING:

2. Late Survival and Right Ventricular Performance in 332 Matched Children: Classic Norwood-BT Shunt Versus Norwood-Sano Modification

Moderated by *Jonathan M. Chen

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

2:00 PM **GENERAL THORACIC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 6C, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Thomas K. Waddell and *Yolonda L. Colson

68. Unexpected Readmission After Lung Cancer Surgery: A Benign Event?

Varun Puri, Aalok Patel, *Traves D. Crabtree, Jennifer M. Bell, *A. Sasha Krupnick, Stephen Broderick, *Daniel Kreisel, *G. Alexander Patterson, *Bryan F. Meyers
Washington University, Saint Louis, MO

Invited Discussant: *Alessandro Brunelli

OBJECTIVE: To study incidence and predictors of unanticipated early readmission after lung resection for non-small cell lung cancer (NSCLC) and assess short- and long-term implications of unplanned readmission.

METHODS: Patients undergoing resection for clinical stage I-III NSCLC were abstracted from the participant user file of the National Cancer Database (NCDB). Individuals experiencing unplanned readmission within 30 days after surgery were identified. Regression models were fitted to identify predictors of 30-day readmission, and to study the association of unplanned readmission with 30-day and long-term survival.

RESULTS: Between 1998 and 2010, 129,893 patients underwent resection for stage I-III NSCLC. Of these, 5,624 (4.3%) were unexpectedly readmitted within 30-days of surgery. In univariate analysis, readmitted patients were older, more likely male, had lower annual income, and higher Charlson comorbidity score. Readmitted patients were also more likely to be treated at non-academic institutions, and had longer index hospitalization after surgery (7.3 vs. 9.0 days; $p < 0.001$). In a multivariate logistic regression model, increasing age (OR, 1.007; 1.004–1.10), male gender (OR, 1.17; 1.10–1.24), preoperative radiation (OR, 1.23; 1.08–1.39), and pneumonectomy (OR, 1.77; 1.56–2.00) were associated with unexpected readmissions. Annual income greater than $35,000 (OR, 0.94; 0.88–0.99), and treatment at an academic center (OR, 0.86; 0.81–0.92) were protective factors. Longer index hospitalization and higher Charlson comorbidity score were also independently predictive of readmission. The c statistic for the model was 0.6.

The 30-day mortality for readmitted patients was higher (3.9% vs. 2.8%), as was 90-day mortality (7.0% vs. 3.3%; both $p < 0.001$). In a multivariate cox proportional hazard model of overall long-term survival, increasing age, higher Charlson comorbidity score, male gender (HR, 1.34; 1.31–1.37), and higher pathologic stage (HR for stage III 1.81, 1.42–2.29) were associated with greater risk of mortality. Higher annual income, undergoing lobectomy (vs. wedge or pneumonectomy), and treatment at an academic facility (HR, 0.92; 0.90–0.94) were associated with better overall survival. Unplanned readmission was

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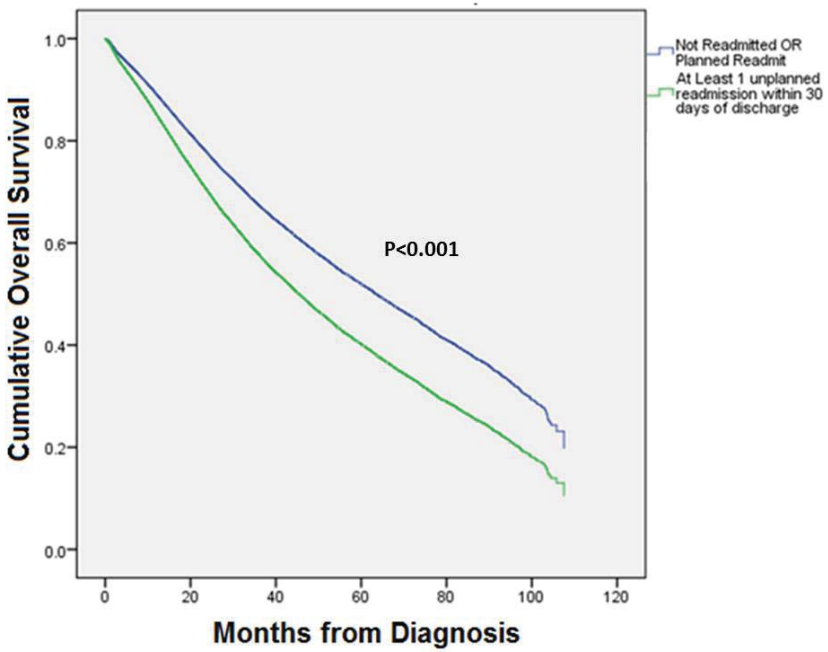
independently predictive of higher risk of long-term mortality (HR, 1.40; 1.34–1.47). The median survival for readmitted patients was significantly shorter (38.7 months vs. 58.5 months; $p < 0.001$).



CONCLUSIONS: Unplanned readmissions are common after pulmonary resection for NSCLC. Such events are independently predictive of a greater risk of short- and long-term mortality. With the renewed national focus on readmissions and potential financial disincentives with adverse outcomes, greater resource allocation is urgently needed to help identify patients at risk for readmission and develop measures to avoid the associated negative outcomes.

69. Complexity of Case Mix Is an Independent Predictor of Mortlaity After Esophagectomy in a Nationwide Inpatient Sample Data Analysis

Matthew L. Inra, Elizabeth B. Habermann, Kristine M. Thomsen, *Mark S. Allen, *Stephen D. Cassivi, *Francis C. Nichols, K. Robert Shen, *Dennis Wigle, *Shanda H. Blackmon

Mayo Clinic, Rochester, MN

Invited Discussant: Nabil Rizk

OBJECTIVE: There is tremendous variation in outcome after esophagectomy, and some advocate for regionalization to high-volume hospitals. We have yet to accurately describe those centers best able to perform esophagectomy. We hypothesized centers performing complex reconstruction would have improved outcomes following simple esophagectomy.

METHODS: Using the Nationwide Inpatient Sample (NIS) database from 2000 to 2011, we identified all patients age ≥18 undergoing esophagectomy and their hospitals. Hospitals were then classified into two categories: complex or non-complex based on performance of at least one complex reconstruction (non-gastric conduit) within the same year as the patient esophagectomy. High volume was based on leapfrog criteria of ≥13 cases per year. Hospital and patient characteristics were compared across hospital complexity categories using t-tests and chi-squares. Multivariable logistic regression analysis determined the effect of case mix on prolonged length of stay (LOS) (defined as ≥20 days, the 75th percentile) and in-hospital mortality following non-complex esophagectomy, adjusting for patient factors.

RESULTS: From 2000 to 2011, 11,211 esophagectomies were performed in 2,476 NIS-sampled hospitals. Approximately 18% of all NIS hospitals that performed non-complex esophagectomy also had complex esophageal reconstruction performed in the same year (n = 444). Complex hospitals tended to be high volume (27% [n = 120] vs. 2% [n = 49] of non-complex hospitals; $p < 0.001$), larger bed size (70% [n = 312] vs. 61% [n = 1,238]; $p < 0.001$), urban (96% [n = 426] vs. 90% [n = 1,825]; $p < 0.001$), and teaching (79% [n = 352] vs. 45% [n = 911]; $p < 0.001$). Independent predictors of in-hospital mortality included non-complex hospital ($p < 0.001$), age ≥70 versus 50–59 ($p < 0.001$), esophageal cancer ($p < 0.001$), emergency versus elective admission ($p < 0.001$), urgent versus elective admission ($p < 0.001$), and black versus white ($p = 0.008$). Independent predictors of prolonged LOS included non-complex hospital ($p < 0.001$), age ≥70 versus 50–59 ($p = 0.001$), esophageal cancer ($p = 0.012$), emergent versus elective admission ($p < 0.001$), urgent versus elective admission ($p < 0.001$), black versus white ($p < 0.001$), and Hispanic versus white ($p = 0.004$). When we stratified hospitals by volume and complexity, complexity of case mix did separately predict mortality within low volume hospitals, making it a separate discriminator ($p = 0.012$).

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Table: Multivariate Logistic Regression Analysis of Factors Predicting Mortality

Variable	Predictors of Mortality	OR (95% CI)	p-Value
Complex hospital	complex (vs. non-complex)	1.7 (1.4–2.0	<0.001
Age	50–59	(ref)	
	≥70	2.2 (1.8–2.8)	<0.001
Race	white	(ref)	
	black	1.5 (1.1–2.1	0.008
Esophageal cancer	yes (vs no)	1.4 (1.2–1.6)	<0.001
Admission type	elective	(ref)	
	urgent	2.5 (2.0–3.1)	<0.001
	emergent	3.4 (2.8–4.3)	<0.001

CONCLUSIONS: Volume remains the strongest predictor of esophagectomy outcome. Complexity is a novel independent predictor of mortality. Esophagectomies performed in hospitals that perform complex esophageal reconstruction have half the mortality compared to the non-complex hospitals.

70. Development of a Nomogram for Predicting Outcomes After Sublobar Resection for lung cancer; an Analysis from ACOSOG Z4032 (Alliance), a Randomized Trial

Michael Kent[1], Sumithra Mandrekar[2], *Rodney Landreneau[3], *Francis Nichols[2], Nathan Foster[2], Thomas Dipetrillo[4], *Brian Meyers[5], Dwight Heron[6], *David Jones[7], Angelina Tan[2], Sandra Starnes[8], *Joe Putnam[9], *Hiran Fernando[10]

[1]Beth Israel Deaconess Medical Center, Boston, MA; [2]Mayo Clinic, Rochester, MA; [3]Ochsner Medical Center, New Orleans, LA; [4]Rhode Island Hospital, Providence, RI; [5]Washington University, St. Louis, MO; [6]University of Pittsburgh, Pittsburgh, PA; [7]Memorial Sloan Kettering Cancer Center, New York, NY; [8]University of Cincinnati, Cincinnati, OH; [9]Vanderbilt University, Nashville, TN; [10]Boston University, Boston, MA

Invited Discussant:

OBJECTIVE: Individualized prediction of outcomes may help refine therapeutic decisions for patients with non-small cell lung cancer (NSCLC). We developed a nomogram using 23 clinical factors and outcomes from a randomized study of sublobar resection for NSCLC in high-risk operable patients. There were no differences in primary and secondary outcomes between the study arms, and were thus combined for this analysis.

METHODS: 23 clinical factors of interest (considered as continuous variables) were assessed in a univariable Cox Proportional Hazards model for significance at the 0.10 level for their impact on overall survival (OS), local recurrence-free survival (LRFS) and any recurrence-free survival (RFS). The final multivariable model was developed using a stepwise model selection approach ($p \leq 0.1$ for entering the model, and $p \leq 0.05$ for staying in the model). A nomogram with internal validation to guard against over fitting, based on the final model was developed for predicting the 5-year OS, LRFS and RFS outcomes.

RESULTS: 173 of 212 patients had complete data on all 23 risk factors. Median (range) follow-up was 4.94 (0.04–6.22) years. The 5-year OS, LRFS and RFS were 58.4%, 53.2%, and 47.4%, respectively. Age, baseline DLCO %, margin-tumor ratio and maximum tumor diameter were significant predictors for all outcomes in univariable analysis. In addition, histology (squamous vs. adenocarcinoma) was significant for OS, and race (white vs. others) was significant for RFS. Age, baseline DLCO % and maximum tumor diameter were significant predictors for OS, LRFS and RFS in the multivariable model. The nomogram for predicting 5-year OS is provided in the following figure.

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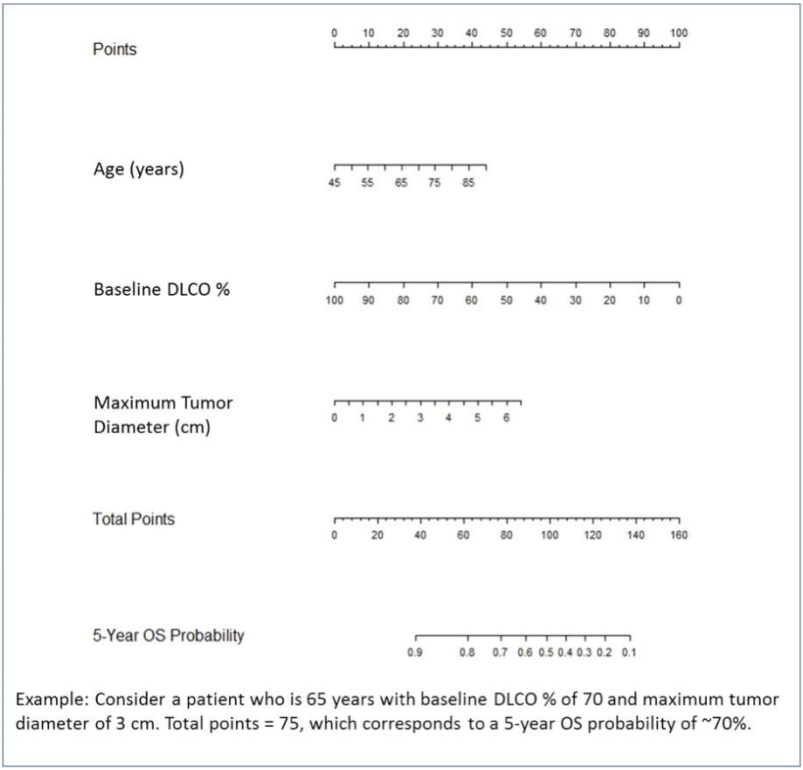


Example: Consider a patient who is 65 years with baseline DLCO % of 70 and maximum tumor diameter of 3 cm. Total points = 75, which corresponds to a 5-year OS probability of ~70%.

CONCLUSIONS: Age, baseline DLCO% and maximum tumor diameter significantly predicted outcomes after sublobar resection. Predictive nomograms using these data were developed and need further validation. Such nomograms may be helpful for treatment planning in early stage NSCLC.

71. Esophageal Perforation in Europe – A Multinational Study Using the Pittsburgh Esophageal Perforation Severity Scoring System

Michael Schweigert[1], Hugo Santos Sousa[2], Steve Eubanks[3], Norbert Solymosi[3], Aleksandar Yankulov[4], Marta Jiménez Fernández[5], Rory Beattie[6], Attila Dubecz[7], Charlotte Rabl[8], Rudolf J. Stadlhuber[8], Dietmar Ofner[8], Jim McGuigan[6], Helmut Witzigmann[1], Hubert J. Stein[7]

[1]Städtisches Klinikum Dresden Friedrichstadt, Dresden, Germany; [2]Hospital São João, Porto, Portugal; [3]Szent István University, Budapest, Hungary; [4]Medical University of Plovdiv, Plovdiv, Bulgaria; [5]Hospital Universitario de la Princesa, Madrid, Spain; [6]Royal Victoria Hospital, Belfast, United Kingdom; [7]Klinikum Nuremberg, Nürnberg, Germany; [8]Paracelsus Medical University, Salzburg, Austria

Invited Discussant: *Shanda H. Blackmon

OBJECTIVE: Esophageal perforation is a devastating condition. The Pittsburgh group has suggested a perforation severity score (PSS) for better decision-making in the management of esophageal perforation. Aim of this study was to analyse the usefulness of the Pittsburgh PSS in an independent European study population.

METHODS: In a retrospective study cases of esophageal perforation were collected from eight centres of esophageal surgery in Austria, Bulgaria, Germany, Spain and the United Kingdom. PSS was calculated for each patient and compared with the management, clinical course and outcome. The study-period was 1990 to 2013.

RESULTS: The study comprises a total of 175 patients. Mean age was 60.5 years. Etiology was spontaneous (Boerhaave), iatrogenic (instrumentation) and traumatic perforation in 87, 57, and 31 patients, respectively. Esophageal cancer was present in 28 patients whereas 112 patients had no prior esophageal disorder. Operative treatment (125) was more common than non-operative management (50). Mortality was 38/175 (21.7%) with no significant difference between operative and non-operative cases (8/50 vs. 30/125; OR, 0.61; 95% CI [0.22–1.50]; $p = 0.31$). The mean PSS was 6.64. PSS was significantly higher in patients with fatal outcome (10.79 vs. 5.49; $p < 0.001$). Moreover, significantly higher PSS was observed in operative cases (7.24 vs. 5.14; $p = 0.003$). Patients with PSS ≤ 9 had 20 times higher odds for survival than patients with PSS > 9 (OR, 19.48; 95% CI [7.61–54.60]; $p < 0.00001$). In accordance with the original study from Pittsburgh 3 subgroups were formed: PSS ≤ 2 (31); PSS 3–5 (51); PSS > 5 (93). Perforation-related morbidity, length of stay, frequency of operative treatment and mortality correlated significantly with the subgroups ($p < 0.01$). There was no mortality in subgroup 1 compared to 35/93 in subgroup 3 ($p < 0.001$). The frequency of non-operative management was 16/31 in subgroup 1 and 22/93 in subgroup 3 (OR, 3.40; 95% CI [1.34–8.77]; $p = 0.006$).

CONCLUSIONS: The Pittsburgh PSS reliably correlates with the seriousness of esophageal perforation. It is an useful tool to identify appropriate candidates for non-operative management of esophageal perforation.

*AATS Member

72. Baseline Measure of Health-Related Quality of Life Predicts Overall Survival in Esophageal Cancer Patients

Biniam Kidane, Joanne Sulman, Wei Xu, Qin Quinn Kong, Rebecca Wong, Jennifer J. Knox, *Gail E. Darling

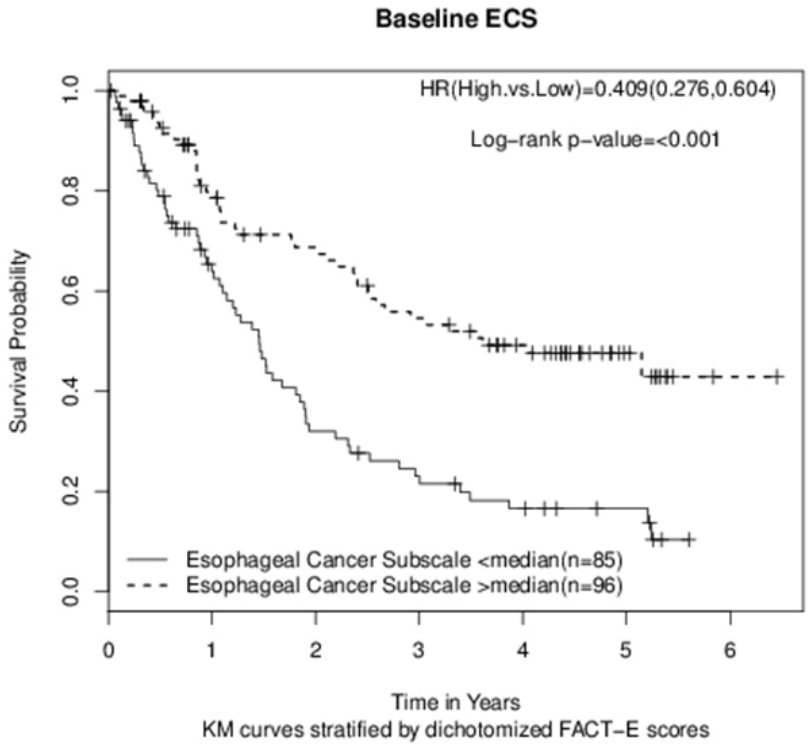
University of Toronto, Toronto, ON, Canada

Invited Discussant: *Thoms J. Watson

OBJECTIVE: Functional Assessment of Cancer Therapy-Esophagus (FACT-E) is a health-related quality of life (HRQOL) instrument validated in esophageal cancer patients. It is comprised of a general component (FACT-G) and an esophageal cancer subscale (ECS). Our objective was to determine if baseline FACT-E and ECS by itself predict overall survival in patients with Stage II-IV cancer of the gastroesophageal junction or thoracic esophagus.

METHODS: Data from 4 prospective, non-randomized studies in 3 large Canadian cancer centers were combined. These studies included consecutive eligible patients with clinical stage II-IV cancer of the gastroesophageal junction or thoracic esophagus who received chemotherapy with cisplatin, irinotecan and 50 Gy of radiation either as neoadjuvant or definitive therapy. In 1 of the 4 studies, adjuvant sunitinib was used. All patients completed FACT-E at baseline. The FACT-E and ECS scores were dichotomized to high and low HRQOL groups based on the median FACT-E and ECS scores. Cox regression analyses, controlling for age and treatment intent (curative versus palliative), were performed treating FACT-E and ECS as both continuous and dichotomous variables. Hazard ratios and associated Kaplan-Meier curves were produced.

RESULTS: There were 207 patients treated between 1996 and 2014.Mean age was 61+10.6 years. Approximately 68.6% (n = 142) had adenocarcinoma. Sixteen (7.7%) patients were treated with palliative intent. Twenty-eight (13.5%) patients started adjuvant sunitinib but only 14 (6.8%) completed 6 to 12 months of therapy. With >9 months of follow-up for all patients, 114 deaths were observed. Mean FACT-E and mean ECS scores were 78.2+17.5 and 45.4+12.9, respectively. When treated as continuous variables, baseline FACT-E and ECS significantly predicted overall survival with hazard ratios (HR) of 0.87 (95% CI [0.81–0.93]; $p < 0.001$) and 0.69 (95% CI [0.59–0.81]; $p < 0.001$), respectively. When treated as dichotomous variables, baseline FACT-E and ECS significantly predicted overall survival with hazard ratios (HR) of 0.56 (95% CI [0.38–0.83]; $p = 0.003$) and 0.41 (95% CI [0.28–0.60]; $p < 0.001$), respectively.



CONCLUSIONS: In patients with stage II-IV esophageal cancer being considered for chemoradiation therapy, higher baseline FACT-E and esophageal cancer subscale (ECS) appear to independently predict overall survival. This is the first study to report this prognostic effect of baseline HRQOL in esophageal cancer. ECS appears to be an even stronger predictor than FACT-E and is a focused, shorter questionnaire. It may be useful as a parsimonious prognostic tool to inform patient decision-making as well as patient selection criteria for studies.

3:40 PM – 4:15 PM COFFEE BREAK

*AATS Member

73. The Effect of Surgeon Volume on Procedure Selection in Non-Small Cell Lung Cancer Surgery

Ivana Camposilvan, Noori Aktar-Danesh, Laura Schneider, Colin Schieman, Wael C. Hanna, Yaron Shargall, Christian J. Finley

McMaster University, Hamilton, ON, Canada

Invited Discussant:

OBJECTIVE: Procedure selection by the surgeon can greatly impact patients' operative and long-term survival. This selection potentially reflects comfort with technically challenging surgeries. This study aims to examine surgeon choices for non-small cell lung cancer (NSCLC) and if surgeon volume predicts the type of procedure chosen, controlling for patient demographics, co-morbidity, year of surgery and institutional factors.

METHODS: Data was abstracted from an Ontario population-based linked database from 2004 to 2011. Patient demographics, co-morbidities, year of surgery, institutional and surgical factors were evaluated. Three-level random-effect multilevel regression analyses were performed to examine the role of factors influencing the operation patients received for NSCLC.

RESULTS: Of 8,070 patients who underwent surgical resection, 842, 6,212, and 1,002 underwent pneumonectomy, lobectomy, and wedge resection, respectively, of whom 4,070 (50.4%) were male. Resections were performed by 124 unique physicians and 45 institutions. The proportion of patients undergoing pneumonectomy fell from 14.8% in 2004 to 7.6% in 2011. Multilevel regression analysis showed physician volume, age, year of procedure, gender and Charlson index were predictive of performing a pneumonectomy. Adjusting for these variables, the results indicated that for each 10 unit increase in physician volume, the relative risk of performing a pneumonectomy decreased by 9.1% (95% CI [8.2–10.0]; $p = 0.04$).

CONCLUSIONS: While patient and temporal factors influence the type of resection a patient receives for NSCLC, surgeon volume is also a strong predictor. This study may be limited by minimal stage data, but the suggestion that a surgeon's total procedural volume for NSCLC significantly influences procedure selection has implications on how we deliver care to this patient population.

74. The Integrated Comprehensive Care Program: A Novel Home Care Initiative After Major Thoracic Surgery

Yaron Shargall[1], Wael C. Hanna[1], Colin Schieman[1], Christian J. Finley[1], Laura Schneider[1], Anna Tran[2], Carolyn Gosse[2], James M. Bowen[1], Gord Blackhouse[1], Kevin Smith[2]

[1]McMaster University, Hamilton, ON, Canada; [2]St. Joseph's Healthcare Hamilton, Hamilton, ON, Canada

Invited Discussant: *Mark Onaitis

OBJECTIVE: To evaluate and validate the effect of a novel Integrated Comprehensive Care (ICC) program, a health system integration initiative focused on coordinating home care and hospital-based clinical services for patients undergoing major thoracic surgery. The innovative post-discharge ICC was launched in 2012 and is consists of a local team of nurses, physiotherapists and dietitians. This team coordinates initial peri-operative needs assessment, arranges for home-based care planning and facilitates post-discharge home care, all while in direct communication with the hospital's clinical team. Previously, post-discharge home care was coordinated by provincial healthcare agencies.

METHODS: A retrospective case-control analysis of a prospective database was conducted to determine pre and post intervention impact of ICC. The intervention cohort (ICC) was composed of patients undergoing major thoracic surgical procedures between April 1, 2012 and March 31, 2013. The control cohort (CTRL) composed a similar cohort of patients operated during 2011 and 2012, prior to initiating ICC. Demographics, length of stay, Resource Intensity Weight (RIW), hospital costs, 30 and 60 day hospital re-admission and ER visits were collected and stratified by surgical procedure.

RESULTS: The ICC group included 331 patients, 47.6% males with median age of 67 (range: 13–90) undergoing anatomical (segmentectomy n = 38, lobectomy n = 185, bilobectomy/pneumonectomy n = 12) or sub-anatomical (single wedge n = 52, multiple n = 28) resections, and decortication for pleural empyema (n = 16). The control group included 335 patients, 57.5% males and median age 66 (range: 18–87) undergoing segmentectomy (n = 19), lobectomy (n = 187), bilobe/pneumonectomy (n = 12), single/multiple wedge (n = 69/40) and decortication (n = 8). While the evaluation did not reach statistical significance on some parameters, the clinical significance is substantial. Hospital stay was markedly shorter in the ICC cohort compared to CTRL for open (5.9 vs. 8 days) and VATS (5.2 vs. 6.4 days) lobectomy, wedge resections (3.5 vs. 5.2d) and decortication (7.3 vs. 10.9 days), with significant reduction in overall costs for the ICC group on each category. (See Table 1). Admissions to the ER within 60 days were significantly lower for the ICC group. Open lobectomy showed similar readmission rates between the groups but significantly fewer ER visits in the ICC group. All ICC patients rated the program as excellent (70%) or very good (30%). There were no adverse events related to the launching of the ICC program.

Table: Stratified Comparison of Key ICC and Control Outcomes

	LOS Days (SE)	p-Value	Total Cost (SE)	p-Value	60-Day Readmission Rate (%)	p-Value	60-day ER Utilization	p-Value
Open Sub-Anatomic: ICC (n = 43)	4.30 (0.27)	0.035	$11,220.22 ($587.34)	0.072	7.0%	0.145	9.3%	0.140
Open Sub-Anatomic: CTRL (n = 60)	6.41 (0.80)		$14,742.94 ($1582.18)		18.3%		26.7%	
Open Anatomic: ICC (n = 109)	6.82 (0.67)	0.283	$15,487.51 ($1517)	0.183	16.5%	0.601	18.3%	0.042
Open Anatomic: CTRL (n = 150)	8.51 (1.24)		$20,344.20 ($2889.45)		14.0%		30.0%	
VATS Sub-Anatomic: ICC (n = 72)	3.83 (0.44)	0.322	$8505.39 ($540.15)	0.007	8.30%	0.428	13.9%	0.097
VATS Sub-Anatomic: CTRL (n = 74)	4.39 (0.35)		$11,038.18 ($739.93)		13.50%		25.7%	
VATS Anatomic: ICC (n = 88)	5.20 (0.46)	0.144	$12,772.77 ($949.06)	0.074	4.50%	0.288	10.2%	0.048
VATS Anatomic: CTRL (n = 51)	6.43 (0.76)		$16,327.97 ($2015.04)		9.80%		23.5%	

p = 0.05; SE = Standard Error; ER = Emergency Department

CONCLUSION: A hospital-based, post-discharge, patient-centered program is simple, offers cost-savings, and results in shorter hospital stay, fewer readmission and ER visits and no adverse outcomes after major thoracic surgery, when compared to the control. More research will be conducted regarding implementation of an ICC program in other complex patient groups.

AATS Guidelines: Management of Empyema

*K. Robert Shen, *Mayo Clinic*

Late-Breaking Clinical Trial

LB3. Lung Cancer Screening by Quantitative Analysis of Exhaled Carbonyl Compounds

Erin M. Schumer, Victor H. van Berkel, Jaimin R. Trivedi, Mingxiao Li, Xiao-An Fu, Michael Bousamra, II

University of Louisville, Louisville, KY

Invited Discussant:

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

2:00 PM **AORTIC/ENDOVASCULAR SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 612, WSCC

8 minute presentation, 12 minute discussion

Moderators: *Scott A. LeMaire and *Allan S. Stewart

75. Long Term Comparison of Aortic Root Operations for Marfan Syndrome: Bentall Versus Valve-Sparing Techniques

Joel Price, J. Trent Magruder, Allen Young, Joshua Grimm, Nishant D. Patel, Diane Alejo, *Luca A. Vricella, *Duke E. Cameron

Johns Hopkins Hospital, Baltimore, MD

Invited Discussant: *John A. Kern

OBJECTIVES: Prophylactic aortic root replacement improves survival in Marfan syndrome patients with aortic root aneurysms, but the optimal procedure (Bentall vs. valve sparing aortic root replacement [VSRR]) remains undefined. Although several reports suggest the two procedures have similar operative and early results, there is little information on long term outcomes.

METHODS: Marfan syndrome patients who had Bentall or VSRR procedures at our institution between 1997 and 2013 were identified. Comprehensive follow-up information was obtained from hospital charts and telephone contact with patients and/or their physicians. Kaplan-Meier, Cox and propensity score analyses were performed for the outcomes of mortality, the composite endpoint of thromboembolic or hemorrhagic events, reoperation on the aortic valve or root, and endocarditis.

RESULTS: One hundred and sixty-five adult Marfan syndrome patients (age > 20 years) had either VSRR (n = 98; 69 reimplantation, 29 remodeling) or Bentall (n = 67) procedures. Bentall patients were older (median 37 vs. 36 years; p = 0.03), had larger median preoperative sinus diameter (5.5 cm vs. 5.0 cm; p = 0.003), more aortic dissections (25.4% vs. 4.1%; p < 0.001), higher incidence of moderate or severe aortic insufficiency (49.3% vs. 14.4%; p < 0.001) and more urgent or emergent operations (24.6% vs. 3.3%; p < 0.001). There were no hospital deaths. There were nine late deaths in over 17 years of follow-up (median 7.8 years). By Kaplan-Meier analysis, ten-year survival was 90.5% in Bentall patients and 96.3% in VSRR patients (p = 0.10). Composite thromboembolic and/or hemorrhagic events occurred in 19 patients (15 Bentall pts vs. 4 VSRR pts; log rank p < 0.001); eight patients required aortic valve or root reoperations (4 Bentall pts vs. 4 of VSRR pts; log rank p = 0.52) and four developed endocarditis (3 Bentall pts vs. 1 VSRR pt; log rank p = 0.14). Multivariable Cox proportional hazards analysis controlling for pre- and intraoperative characteristics revealed that VSRR was associated with fewer composite thromboembolic or hemorrhagic events (HR, 0.12; 95% CI [0.03–0.46]; p = 0.002), which was confirmed by a propensity score-adjusted regression analysis (HR, 0.16; 95% CI [0.03–0.85]; p = 0.03). Freedom from reoperation at ten years was 96.9% in the reimplantation group and 86.4% in the remodeling group

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(log rank p = 0.11). At latest echocardiographic followup, only one remodeling VSRR patient and no reimplantation patient had >2+ aortic regurgitation (log rank p = 0.32).

CONCLUSIONS: After prophylactic root replacement in Marfan syndrome, Bentall and valve sparing procedures have similar late survival, freedom from root reoperation, and freedom from endocarditis. However, valve sparing procedures result in significantly fewer thromboembolic and hemorrhagic events. These results support continued use of valve sparing procedures in Marfan syndrome.

76. Open Repair of Ruptured Descending Thoracic and Thoracoabdominal Aortic Aneurysms in 100 Consecutive Cases

Mario F.L. Gaudino, Christopher Lau, Monica Munjal, *Leonard N. Girardi
Weill Cornell Medical College, New York, NY

Invited Discussant: *Abe DeAnda, Jr.

OBJECTIVE: To evaluate the results of the open repair of ruptured thoracic and thoracoabdominal aortic aneurysms (RTAAA).

METHODS: From January 1997, one hundred consecutive open repairs of RTAAA were performed (43 thoracic and 57 thoracoabdominal); cases with traumatic rupture were not included in the analysis. These patients were compared to 575 contemporary cases that underwent repair of corresponding intact aneurysms. Logistic regression analysis was performed to identify independent determinants of in-hospital outcome.

RESULTS: Patients with RTAAA had higher incidence of smoking (94% vs. 73.6%), chronic pulmonary disease (60% vs. 37.6%), previous cerebrovascular accident (8% vs. 5.1%), peripheral vascular disease (38% vs. 25.6%), diabetes (17% vs. 7.7%), preoperative renal failure (59% vs. 25.5%) preoperative spinal cord injury (7% vs. 0.5%), and preoperative shock (27% vs. 0.2%; $p \leq .01$ for all variables; see Table). The rupture was located in the thoracic aorta in 90 cases and in the abdominal aorta in the others; 48% of the RTAAA cases had a extent I or II aneurysm vs. 53.7% of the control group ($p = .06$). Concomitant procedures were performed in 35% of the ruptured group and 30.1% of the non-ruptured ($p < .001$ for both). The clamp and sew technique was used in 69% of RTAAA patients and 64.3% of the others ($p = .22$) and circulatory arrest was used in 11% of cases of the ruptured group and 8.5% of the other ($p = .42$). Spinal drainage was used in 65% of RTAAA cases vs. 85.7% of the controls ($p < .001$); intercostal reimplantation was performed in 22% of cases in the ruptured group vs. 43.8% of the other and 11% of RTAAA patients had more than one intercostal reimplanted vs. 22.9% of the non-ruptured series ($p \leq .001$ for both). Cold renal perfusion was used in 15% of the RTAAA vs. 22.7% of the non-ruptured patients ($p = .21$). In-hospital mortality was 14% in the RTAAA group and in 4.2% in the non-ruptured series ($p = .01$); the incidence of postoperative myocardial infarction, need for tracheostomy and dialysis requiring new onset renal failure was 3%, 19%, 11% in the rupture group and 0.8%, 5.7% and 4.2% in the non-ruptured series ($p \leq .01$ for all variables). Spinal cord lesion occurred in 5% of cases in the RTAAA group vs. 2.4% of the other ($p = 0.16$) and left recurrent nerve injury occurred in 9% of the ruptured cases vs. 6.6% of the other ($p = .38$). Five-year survival was 62% for the RTAAA group and 74.1% for the other ($p = .01$). At logistic regression analysis procedure status, peripheral vascular and cardiac valvular disease and the need for concomitant procedure but not ruptured aneurism were found to predict in-hospital outcome.

CONCLUSION: Open repair of RTAAA can be performed with gratifying rate of salvage. Although renal failure and myocardial infraction occur with greater frequency, the outcomes are quite acceptable given the near certainty of death without treatment.

Table:

Variable	Ruptured Series N (%)	Non-Ruptured Series N (%)	p-Value
Preoperative data			
Patients	100	575	
Age	67.2 ± 14.3	64.3 ± 14.4	.06
Male	61 (61%)	336 (58.4%)	.63
Smoking	94 (94%)	423 (73.6%)	<.001
Previous coronary revascularization	20 (20%)	115 (20%)	1.0
Hypertension	97 (97%)	553 (96.2%)	.686
Chronic pulmonary disease	60 (60%)	216 (37.6%)	<.001
Previous stroke	8 (8%)	29 (5.1%)	<.001
Peripheral vascular disease	38 (38%)	147 (25.6%)	.01
Diabetes	17 (17%)	44 (7.7%)	.003
Family history of aneurism	1 (1%)	30 (5.2%)	.06
Renal failure	59 (59%)	147 (25.5%)	<.001
Previous heart surgery	38 (38%)	290 (50.4%)	.09
Spinal cord lesions	7 (7%)	3 (0.5%)	<.001
Extent 1 and 2	48 (48%)	309 (53.7%)	.06
Shock	27 (27%)	1 (0.2%)	<.001
Emergent	96 (96%)	115 (20%)	<.001
Intraoperative data			
Clamp and sew	69 (69%)	370 (64.3%)	.22
Circulatory arrest	11 (11%)	49 (8.5%)	.42
Spinal drainage	65 (65%)	493 (85.7%)	<.001
Intercostal reimplantation	22 (22%)	252 (43.8%)	<.001
> 1 intercostal reimplanted	11 (11%)	132 (22.9%)	.001
Concomitant procedures	35 (35%)	173 (30.1%)	<.001
Renal perfusion	15 (15%)	131 (22.8%)	.21
Postoperative data			
In-hospital death	14 (14%)	24 (4.2%)	.01
Myocardial infarction	3 (3%)	5 (0.8%)	.004
Stroke	0	5 (0.8%)	.86
Tracheostomy	19 (19%)	33 (5.7%)	<.001
Dialysis	11 (11%)	24 (4.2%)	.01
Spinal cord lesion	5 (5%)	14 (2.4%)	.16
Recurrent nerve lesion	9 (9%)	38 (6.6%)	.38
Revision for bleeding	2 (2%)	14 (2.4%)	.79
5-year survival	62 (62%)	426 (74.1%)	.01

77. Total Aortic Arch Replacement with the Thoraflex Hybrid Frozen Elephant Trunk Prosthesis: Report on the First 100 Patients in a Single Center

*Malakh Shrestha, Heike Krueger, Klaus Tim Kaufeld, Erik Beckmann, Nurbol Koigeldiyev, Felix Fleissner, Julia Umminger, *Axel Haverich, Andreas Martens
Hannover Medical School, Hannover, Germany

Invited Discussant: *Friedhelm Beyersdof

OBJECTIVE: Combined disease of the aortic arch and the proximal descending aorta remains a surgical challenge. The Thoraflex hybrid frozen elephant trunk graft consists of a 4-branched arch graft with a stent graft at the distal end allowing a total aortic arch replacement including the origins of the supra-aortic vessels combined with endoluminal treatment of the proximal descending aorta. The proximal part is a conventional gel coated woven polyester graft and the stented section is a self-expanding endo-prosthesis constructed of polyester with nitinol ring stents. We present the results of our first 100 patients.

METHODS: From 04/2010 to 10/2014, 100 patients (65 male; age 58.7 ± 13.6 years) were operated on (43 aneurysms, 57 dissections [38 acute]). Eleven patients Marfan Syndrome. Twenty-eight of these patients underwent re-do operations.

The stented portion of the FET is deployed through the opened aortic arch into the descending aorta during a short period of circulatory arrest. A sewing collar simplifies the "distal" anastomosis. The 4-branched graft segment allows to replace the aortic arch and supra aortic vessels individually.

RESULTS: The 30-day-mortality was 6% (n = 6). Of these, four patients had acute aortic dissections and one was a re-do arch procedure. Mean cardiopulmonary bypass time was 241.1 ± 60.9 minutes, aortic cross clamp time was 122.7 ± 62.0 minutes, and circulatory arrest time was 57.1 ± 35.5minutes. Aortic root surgery was necessary in forty (including 20 David procedures) patients, and CABG in twelve. The mechanical ventilation, ICU and hospital stay time were 3.5 ± 5.9 days, 8.4 ± 8.5 days, and 20.7 ± 13.0 days, respectively. The re-thoracotomy for bleeding, stroke and 30 day mortality rates were 13.0%, 10.0%, and 6.0%, respectively. In follow-up, 19 patients underwent further procedures in the downstream aorta. Seven of these were open surgical repair and the rest endovascular completion.

CONCLUSIONS: In patients with aortic aneurysms limited to the proximal descending aorta, Thoraflex FET potentially allows for a "single stage" therapy. In acute DeBakey type I aortic dissections, it may stabilize the dissecting membrane, favours false lumen thrombosis and favours true lumen expansion. The graft adds to the "frozen elephant trunk" concept for treating arch and descending aortic disease. Our experience with 100 patients demonstrates excellent early and mid-term. The Thoraflex Hybrid frozen elephant trunk prosthesis increases the armamentarium of the surgeon in the treatment of complex and diverse aortic arch pathology.

*AATS Member

78. Total Aortic Arch Replacement: Predictors of Adverse Outcomes for Hybrid Arch Exclusion Versus Traditional Open Repair in 319 Patients

Ourania Preventza[1], Andrea Garcia[1], *Denton Arthur Cooley[2], Ricky Haywood-Watson[1], Kiki Simpson3, *Faisal Ghazi Bakaeen[3], Lorraine Cornwell[3], Shuab Omer[3], Kim Insua de la Cruz[1], *Joseph S. Coselli[1]

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

Invited Discussant: *Joseph E. Bavaria

OBJECTIVE: To determine predictors of adverse outcomes in contemporary patients (pts) undergoing total aortic arch replacement (TAAR), we analyzed our experience in 319 cases.

METHODS: We performed multivariable model analysis using 16 variables to identify predictors of adverse outcomes (mortality, permanent neurologic events at hospital discharge, and permanent renal failure requiring hemodialysis) in 319 consecutive pts who underwent TAAR in the past 9 years. Two hundred seventy-four pts (85.9%) had traditional open repair, and 45 pts (14.1%) had hybrid total arch exclusion. Older age, female gender, preoperative coronary events, and chronic obstructive pulmonary disease were more frequent in the hybrid group ($P < 0.05$). The traditional group more often had a redo sternotomy, prior proximal aortic dissection, and ≥III NYHA status ($P < 0.05$).

RESULTS: Operative mortality was 9.7% (n = 31): 11.1% (n = 5) in the hybrid group and 9.5% (n = 26) in the traditional group ($P = 0.79$). Twenty-three pts (7.2%) had stroke with permanent neurologic deficit at discharge [traditional, 17 pts (6.2%) vs. hybrid, 6 pts (13.3%); $P = 0.11$], and 3 pts (traditional) had paraplegia ($P = 1.00$). Prior coronary disease and intervention ($P = 0.0098$), NYHA class ≥III ($P = 0.029$), and concomitant coronary artery bypass grafting (CABG) ($P = 0.0067$) independently predicted permanent adverse outcomes for the entire series. Concomitant CABG independently predicted permanent stroke ($P = 0.0006$). During the median follow-up period of 4.5 years (IQR, 3.9–4.9), the survival rate was 78.1% with no intergroup difference ($P = 0.12$).

CONCLUSION: In the current era, traditional or hybrid TAAR has acceptable results. Comparing these 2 heterogeneous different surgical treatment options is challenging. In choosing the optimal surgical method, an individualized approach offers the best results. Prior coronary events, NYHA class ≥III, and concomitant CABG predict adverse outcomes.

3:20 PM – 3:50 PM COFFEE BREAK

79. Does Moderate Hypothermia Really Carry Less Bleeding Risk Than Deep Hypothermia for Circulatory Arrest? A Propensity-Matched Comparison in Hemiarch Replacement

Jeffrey E. Keenan, Hanghang Wang, Brian C. Gulack, Asvin M. Ganapathi, Nicholas D. Andersen, Brian R. Englum, Jerrold H. Levy, Ian J. Welsby, *G. Chad Hughes

Duke University, Durham, NC

Invited Discussant: *Edward P. Chen

OBJECTIVE: Optimal temperature for hypothermic circulatory arrest (HCA) during aortic arch surgery remains undefined. Moderate HCA (MHCA) has been increasingly used during such procedures in part because, in comparison to deep HCA (DHCA), MHCA is posited to reduce hypothermia-induced coagulopathy. The purpose of this study was to determine if MHCA compared to DHCA reduced bleeding and perioperative transfusion requirements.

METHODS: Patients who underwent elective and non-elective aortic hemiarch replacement with HCA at our institution from 7/2005 to 8/2014 were identified and stratified into DHCA (minimum systemic temperature ≤20°C) and MHCA (minimum systemic temperature >20°C) subgroups. To allow for adjusted comparison, propensity matching was performed accounting the following covariates: age, gender, race, BMI, hypertension, tobacco use, diabetes, coronary artery disease, CHF, history of stroke, chronic renal insufficiency, connective tissue disease, ASA class, bicuspid aortic valve, type A aortic dissection, preoperative malperfusion or shock, aortic rupture, procedural status, concomitant root replacement, redo sternotomy, and preoperative hemoglobin level, platelet count, INR and partial thromboplastin time. The primary outcome was perioperative transfusion of allogeneic blood products on postoperative day zero. Secondary outcomes included postoperative hematologic laboratory values, reoperation for bleeding, and 30-day mortality and morbidity.

RESULTS: Over the study period, 571 patients underwent hemiarch replacement: 401 (70.2%) with DHCA and 170 (29.8%) with MHCA. After propensity matching, 155 patients remained in each group. The matched groups were not significantly different with respect to all covariates included in the propensity match. The median minimum systemic temperature was 17°C (IQR, 15.7–18.0°C) and 24°C (21.3–26.2°C) for the DHCA and MHCA groups, respectively. There were no significant differences between these groups in median units of red blood cells, plasma, or platelets transfused perioperatively (see Table). A higher proportion of the MHCA received cryoprecipitate, although the median number of cryoprecipitate units transfused was zero in both groups. Additionally, a higher proportion of MHCA patients received intraoperative factor VIIa (FVIIa). Although a higher proportion of DHCA patients had an elevated postoperative INR (≥1.2), the median INR was 1.1 for both groups. Other outcomes assessed were not significantly different between the groups.

Table: Outcomes after Propensity Matching

Outcome	Total (N=310)	DHCA (N=155)	MHCA (N=155)	p-value
RBC	2 (0, 4)	2 (0, 4)	2 (0, 4)	0.86
Plasma	6 (4, 8)	6 (4, 8)	4 (4, 8)	0.1
Platelet	2 (1, 3)	2 (1, 3)	2 (1.5, 3)	0.45
Cryoprecipitate	0 (0, 1)	0 (0, 1)	0 (0, 1)	0.02
≥1 unit cryoprecipitate	150 (41.9%)	60 (36.1%)	70 (44.5%)	0.003
Intraoperative Factor VIIa	87 (28%)	35 (22.6%)	52 (33.5%)	0.04
Postoperative Factor VIIa	13 (4.1%)	8 (5.2%)	5 (3.2%)	0.57
Postoperative Lab Values				
Hemoglobin	9.9 (9.3, 10.5)	9.9 (9.25, 10.5)	10.0 (9.4, 10.55)	0.23
Platelets	144.5 (120, 174.8)	140 (115, 176.5)	147 (127, 173)	0.08
INR	1.1 (1.0, 1.2)	1.1 (1.0, 1.2)	1.1 (0.9, 1.2)	0.03
INR ≥ 1.2	125 (41.2%)	72 (46.8%)	53 (35.6%)	0.048
Partial Thromboplastin Time	28.6 (26.2, 33)	28.7 (25.95, 37.0)	28.6 (21.3, 31.4)	0.26
Reoperation for Bleeding	10 (3.2%)	5 (3.2%)	5 (3.2%)	0.99
30-Day Mortality	8 (2.5%)	3 (1.9%)	5 (3.2%)	0.72
30-Day Composite Morbidity*	72 (23.2%)	37 (23.9%)	35 (22.6%)	0.89

Continuous variables are expressed as median values with quartile 1 and quartile 3 indicated in parentheses.
Comparisons were made between groups using one-way ANOVA or Wilcoxon rank sum test for continuous variables and Fisher's exact test or the chi-squared test for categorical variables.
*30-day composite morbidity comprises the following: acute renal failure, stroke, prolonged ventilation, deep sternal wound infection/mediastinitis, clinically significant bleeding, and reoperation.
RBC: red blood cells; INR: international normalized ratio

CONCLUSIONS: MHCA compared to DHCA during hemiarch replacement did not result in reduced perioperative transfusion requirement, reduced incidence of reoperation for bleeding, or clinically significant changes in postoperative hematologic lab values. These findings suggest that MHCA does not mitigate complications from hypothermia-induced coagulopathy in comparison to DHCA.

80. Aortic Dissection with Arch Entry Tear: Surgical Experience in 104 Patients During a 12-Year Period

Wei Zhang[1], Wei-Guo Ma[2], Long-Fei Wang[1], Jun Zheng[1], Bulat A. Ziganshin[2], Paris Charilaou[2], Xu-Dong Pan[1], Yong-Min Liu[1], Jun-Ming Zhu[1], Qian Chang[4], *Li-Zhong Sun[1], *John A. Elefteriades[2]

[1]*Capital Medical University, Beijing, China;* [2]*Yale University, New Haven, CT;* [3]*Chinese Academy of Medical Sciences, Beijing, China*

Invited Discussant: *John S. Ikonomidis

OBJECTIVE: Aortic dissection with arch entry tear is an unusual and complicated subtype of type A aortic dissection (TAAD). There is no consensus on the management. We evaluate the efficacy of the frozen elephant trunk and total arch replacement (FET + TAR) technique in this specific group of patients.

METHODS: Between April 2003 and November 2012, we performed FET + TAR for 832 patients with TAAD under moderate hypothermic circulatory arrest and selective antegrade cerebral perfusion. Among them, 104 (12.5%) had an arch entry tear diagnosed by preoperative computed tomography angiography or by surgical findings. The patients were 49.3 ± 9.3 years of age (range: 20–65) and significantly older than those with an entry tear located elsewhere (45.6 ± 10.8 years; $p < .001$). There were 84 males (80.8%). Hypertension was seen in 88 cases (84.6%) and Marfan syndrome in 1 (0.9%). All 104 cases were surgically repaired in the acute phase (4.6 ± 3.5 days from symptom onset). A Bentall operation was done in 10 (9.6%) cases with severe root dilation. Selective cerebral perfusion time was significantly longer in patients with arch entry tears (28 ± 11 vs. 24 ± 8 minutes; $p = .007$). Early outcomes and late survival were compared between patients with arch entry tears and without.

RESULTS: Operative mortality was 8.6% (9/104), which did not differ significantly from other TAAD patients (6.0%, 44/728; $p = .308$). The cause of death was multiorgan failure in 4 cases (3.8%), low cardiac output in 3 (2.9%), stroke in 1 (0.9%) and infection in 1 (0.9%). Early morbidity occurred in 10 (9.6%) cases, including renal failure in 4 (3.8%), spinal cord injury in 3 (2.9%), stroke in 2 (1.9%), limb ischemia in 2 (1.9%), reexploration for bleeding in 2 (1.9%) and recurrent laryngeal nerve injury in 1 (1.0%), which did not differ significantly from other TAAD patients. Univariate analysis found that longer cardiopulmonary bypass time was the sole predictor of early mortality after FET + TAR in TAAD patients with arch entry tear (193 ± 39 minutes in survivors vs 234 ± 90 in nonsurvivors; $p = .011$). Follow-up was complete in 100% (95/95) for 5.0 ± 2.6 years (range: 1.3–11.1). Late death occurred in 2 cases, 1 due to pneumonia (1.0%) at 1.3 years and the other (1.0%) due to recurring dissection in distal descending aorta at 2.8 years. At the latest follow-up, 96.8% of patients (93/95) were alive. Survival was 88.9% at 5 and 10 years, respectively (95% CI [80.7–93.8%]).

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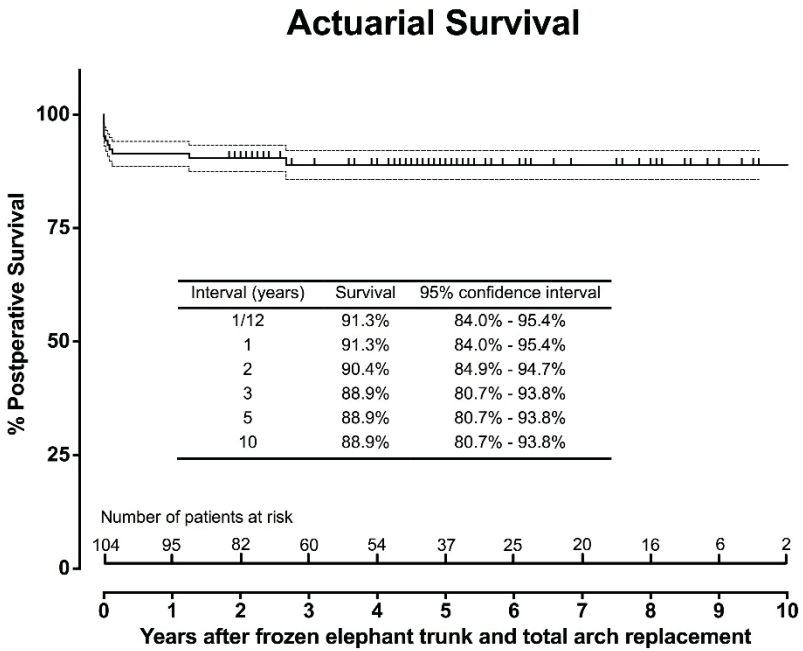

CONCLUSIONS: In this series, TAADs with arch entry tear presented and required surgery exclusively in the acute phase and in older patients. Surgical repair using FET + TAR was not associated with increased operative mortality and morbidity compared with other TAADs and could achieve satisfactory early and late survivals. These results argue favorably for use of the more extensive approach of frozen elephant trunk and total arch replacement in management of TAAD patients with arch entry tears.

81. Remodeling of the Remnant Aorta After Acute Type A Aortic Dissection Surgery; Are Young Patients More Likely to Develop Adverse Aortic Remodeling of the Remnant Aorta Over Time?

Jihoon Kim[1], Suk Jung Choo[1], Sun Kyun Ro[2], Joon Bum Kim[1], Sung-Ho Jung[1], Cheol Hyun Chung[1], *Jae Won Lee[1]

[1]Asan Medical Center, Seoul, Republic of Korea; [2]Hanyang University Guri Hospital, Guri-si, Republic of Korea

Invited Discussant: *Anthony Estrera

OBJECTIVE: Adverse aortic remodeling after acute type A aortic dissection appears more extensive in the younger age group than in patients of advanced age. To investigate this possibility, the dimensions of the remnant aorta proximal and distal to an ascending or hemiarch arch replacement for acute type A aortic dissection were analyzed according to age groups.

METHODS: From January 1999 to December 2013, 190 patients had undergone ascending and/or hemiarch aortic replacement for acute type A aortic dissection. Pre- and post-operative chest computed tomography (CT) were performed in 162 patients. Of these, 124 patients (76.5%) in whom the follow up was longer than one month were enrolled. The dimensions of the remnant aorta at the aortic sinus, arch, and the descending thoracic aorta level were serially assessed on follow up CT.

RESULTS: The patients were divided into two groups according to age; group A (age <50 years; n = 29) and group B (age ≥50 years; n = 95). Overall median CT follow-up was 1091.5 (IQR, 427.8–1982.3) days. In group A, the pre-operative and last follow up aortic measurements at the aortic sinus, arch, and descending thoracic aorta levels were each 41.8 ± 6.0 mm and 44.1 ± 7.3 mm, (p = 0.004), 36.5 ± 6.8 mm and 41.3 ± 8.6 mm, (p = 0.010), and 36.4 ± 6.6 mm to 43.0 ± 11.2 mm (p = 0.003), respectively. In group B, significant size increase from preop to last follow-up was observed only at the descending thoracic aorta level at 37.6 ± 4.8 mm and 40.6 ± 9.3 mm, (p = 0.002), whereas no significant changes were observed at the aortic sinus and the arch levels during the study period.

CONCLUSIONS: All index segments of the non-operated aorta in the younger age group patients showed significant enlargement from the preoperative dimensions. In the older patients only the descending thoracic aorta appeared to show significant enlargement. Therefore, the data suggest a more extensive pattern of adverse aortic remodeling in the relatively younger patients with dissection.

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82. Prophylactic First Stage Elephant Trunk for Moderately Dilated Descending Aorta in Patients with Predominantly Proximal Disease

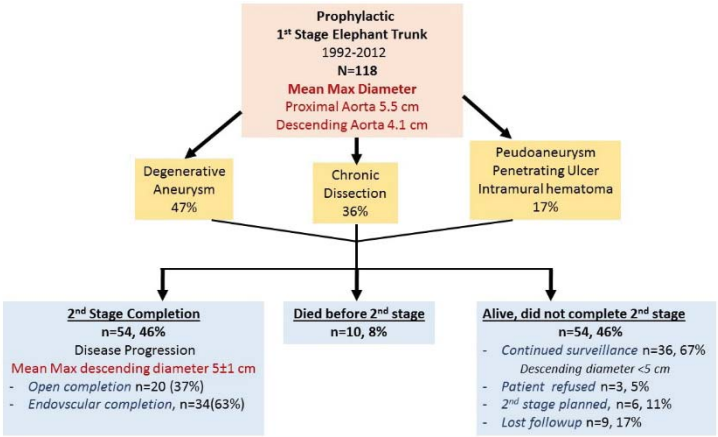
Jahanzaib Idrees, *Eric E. Roselli, Ke Feng, Charles M. Wojnarski, Edward G. Soltesz, Douglas R. Johnston, *Joseph F. Sabik, III, *Lars G. Svensson
Cleveland Clinic, Cleveland, OH

Invited Discussant: *G. Chad Hughes

OBJECTIVE: Staged Elephant trunk (ET) repair is a commonly performed procedure for extensive aortic disease. A significant proportion of patients with predominantly proximal aortic pathology often also have a moderately dilated descending aorta (<5 cm). These patients may develop progressive degeneration of descending aorta over time that can be treated with subsequent second stage completion using endovascular or open approach. Objectives were to characterize patients, determine subsequent completion rate after prophylactic 1st stage ET and assess outcomes.

METHODS: From 1992 to 2012, 572 patients underwent 1st stage ET for degenerative aneurysm and dissection. Among these 118 (20.6%) patients had predominantly *proximal* aortic disease (mean *ascending* or arch diameter: 5.5 ± 1 cm) with moderate dilation (defined as <5 cm) of descending aorta (mean maximum descending diameter: 4 ± 0.6 cm) and the 1st stage ET was performed as a prophylactic measure. Mean age was 63 ± 13 years. Aortic pathology included: Ascending or arch aneurysm (n = 56, 47%), chronic dissection (n = 42, 36%), Pseudoaneurysm (n = 9, 7.6%), penetrating ulcer (n = 9, 7.6%) and intramural hematoma (n = 2, 1.7%). Additionally, 12 (10%) patients had connective tissue disorder, 20 (17%) had giant cell aortitis and 9(7.6) had bicuspid aortic valve disease. The 1st stage ET was a redo in 44 (37%) patients, including 27(61%) who had previous type A dissection repair.

RESULTS: There was one hospital death (operative mortality 0.8%). This patient suffered post-operative MI and mesenteric ischemia resulting in sepsis and death. Other complications included: stroke (n = 7 [5.9%]), tracheostomy (n = 6 [5%]), renal dialysis (n = 4 [3.3%]) and re-operation for bleeding (n = 7 [5.9%]). Mean follow-up was 4 ± 3 years. Fifty-four (46%) patients completed the second stage ET (open: 20 [37%], endovascular: 34 [63%]) at median interval of 6 months (9 days to 10 years). Mean descending diameter had increased from 4.1 ± 0.6 cm to 5 ± 1 cm at the time of second stage completion. In 11 patients the second stage was performed for acute events including rupture or leak (n = 4), complicated dissection (n = 3), penetrating ulcer (n = 2), pseudocoarctation (n = 1) and rapid growth (n = 1). Of the 64 (54%) patients who did not complete the second stage, 10 died, 9 lost follow-up and 3 refused additional surgery. In 6 patients the second stage is planned. The remaining 36 patients are on continued surveillance as the descending diameter is <5 cm. Estimated survival at 1, 5 and 8 years was 94%, 92%, and 74%, respectively.



CONCLUSION: Prophylactic elephant trunk for moderately dilated descending aorta is an effective strategy for staged repair of progressive aortic degeneration, especially in patients with chronic dissection, connective tissue disorder and aortitis. This approach can also be beneficial in managing emergency distal aortic complications with endovascular elephant trunk completion.

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83. Long-Term Benefits of Surgical Pulmonary Embolectomy for Acute Pulmonary Embolus on RightVentricular Function

William B. Keeling, Bradley G. Leshnower, *Robert A. Guyton, *Michael E. Halkos, *Vinod H. Thourani, Omar M. Lattouf

Emory University, Atlanta, GA

Invited Discussant: Rune Waaverstad

OBJECTIVE: Surgical pulmonary embolectomy (SPE) has been utilized for the successful treatment of massive and submassive pulmonary emboli. The purpose of this study is to document the short- and long-term echocardiographic follow-up of right ventricular function after SPE for acute pulmonary embolus.

METHODS: A retrospective review of the local STS database of patients who underwent SPE for acute PE was conducted from 1998 to 2014 at a United States academic center. Patients with chronic thrombus were excluded. The institutional echocardiographic database was searched for follow-up studies to compare markers of right ventricular function. Unadjusted outcomes were described, and quantitative comparisons were made of short- and long-term echo data.

RESULTS: Forty-one patients were included for analysis. 34 patients (82.9%) suffered a submassive PE, whereas 7 (15.4%) suffered a massive PE and required preoperative inotropy. Mean cardiopulmonary bypass time was 65.1 ± 37.3 minutes, and 24 patients (58.5%) underwent procedures without aortic cross-clamping. No patient suffered in-hospital mortality, 30-day mortality, or a permanent neurological deficit. Twenty-one patients had echocardiography results available for follow-up. Perioperative echocardiographic data is detailed in the table that follows. Mean echocardiographic follow-up was 35 months in 10 patients. At long-term follow up, improvements in RV function observed postoperatively persisted. Only 2 patients had moderate RV dysfunction, and only one had worse than mild tricuspid regurgitation. Mean tricuspid valve regurgitant velocity was 2.5 ± 0.8 m/s, and mean pulmonary artery systolic pressure was 37.2 ± 14.2 mmHg.

Table: Perioperative Echocardiographic Data

	Preoperative Value	Postoperative Value	p-Value
≥ Moderate ventricular dysfunction	17/21 (81.0%)	9/19 (47.4%)	0.04
≥ Moderate tricuspid regurgitation	6/18 (33.3%)	1/18 (5.6%)	0.08
Pulmonary artery systolic pressure (mm/Hg)	51.2	36.6	0.04
Tricuspid valve regurgitant velocity (m/s)	3.1	2.7	0.36

CONCLUSIONS: SPE may represent optimal therapy for massive and submassive acute pulmonary emboli given the low morbidity and mortality rates. Echocardiographic follow-up shows preserved improvement in right ventricular function in the vast majority of patients.

84. Long-Term Follow-Up of Aortic Intramural Hematomas and Penetrating Ulcers

Alan S. Chou, Bulat Ziganshin, Paris Charilaou, Maryann Tranquilli, *John A. Elefteriades

Yale University, New Haven, CT

Invited Discussant: *Kenji Minatoya

OBJECTIVE: Acute aortic syndromes include typical aortic dissection and the variants forms of intramural hematoma (IMH) and penetrating atherosclerotic ulcer (PAU). While previous studies have primarily characterized acute and short-term follow-up, this current study evaluates long-term experience of patients with IMH and PAU, with focus on treatment efficacy, survival analysis, and radiological follow-up.

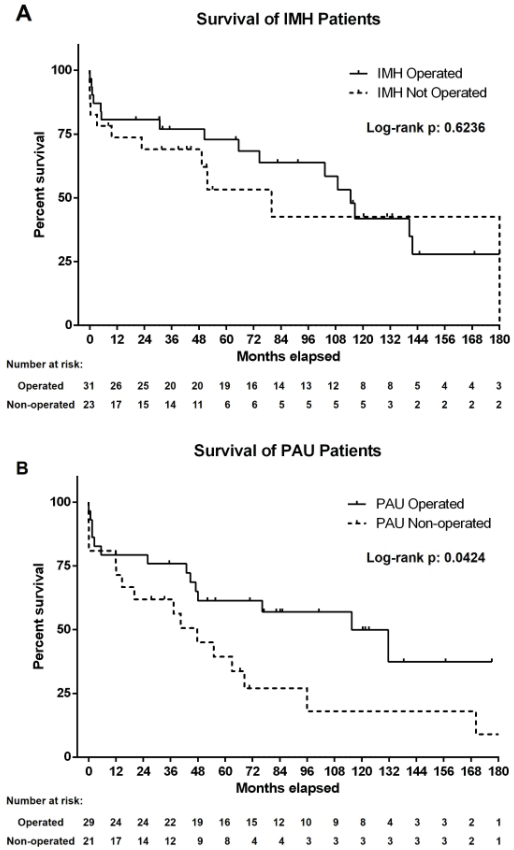
METHODS: Between 1996 and 2014, 104 patients (mean age 70.7 ± 10.4 years, range: 39–90, 45 males, [43.2%]) presenting with variant forms of acute aortic disease were treated at our institution, 54 with IMH (52%) and 50 (48%) with PAU. We reviewed medical records, radiological databases, the online Social Security Death Index, and other online mortality databases.

RESULTS: For IMH: Of 54 IMH patients (mean age: 70.6 ± 10.4 years; range: 41–88; 22 males [41%]), 12 (22%) had rupture or impending rupture upon admission, 31 (57%) patients underwent operative repair, and 47 (87%) patients survived to discharge. Follow-up imaging was available for 26 patients (48%), and mean follow-up time was 37.7 months. Of these, 4 (15%) patients showed resolution, 10 (38%) had no change, and 12 patients (46%) had worsening, with 5 (19%) converting to typical dissection. Long-term survival of IMH patients was 78%, 74%, 66%, and 42% at 1, 3, 5, and 10 years, respectively.

For PAU: Of 50 PAU patients (mean age 70.8 ± 10.5 years, range: 39–90, 23 males [46%]), 15 (30%) had rupture upon admission, 29 (58%) patients underwent operative repair, and 43 (86%) patients survived to discharge.

Follow-up imaging was available for 27 patients (54%), and mean follow-up time was 47.6 months. Of these, 3 (11%) patients showed resolution, 19 (70%) had no change, and 5 patients had worsening (19%). Long-term survival of PAU patients was 78%, 70%, 52%, and 37% at 1, 3, 5, and 10 years, respectively.

Early rupture rates are significantly higher than overall rupture rates for typical dissection (Type A [8%] or Type B [4%]). Overall survivals were 86%, 77%, 66%, and 39% at 1, 3, 5, and 10 years, respectively. Kaplan-Meier survival curves are shown for IMH (A) and PAU (B) patients. Operatively treated PAU patients had better long-term survival than patients treated medically ($p = 0.0424$). In the IMH group no such difference was observed ($p = 0.6236$).We also noted an elevated prevalence of isolated left vertebral artery: 12 IMH/PAU patients (11.5%), compared to a typical prevalence of 3.7%.



CONCLUSIONS: (1) Presentation. IMH and PAU are acute conditions of advanced age and predominate in females. (2) Rupture. Incidence of early rupture was significantly higher than for typical dissection. (3) Imaging follow-up. IMH patients demonstrated a significant proportion of worsening conditions. PAU patients rarely improved, but often remained stable. (4) Survival. Significant differences in survival are observed for operated and non-operated PAU patients.

5:35 PM **EXECUTIVE SESSION,** *AATS Members Only*

WEDNESDAY MORNING, APRIL 29, 2015

7:00 AM **ADULT CARDIAC SURGERY** Room 6B, WSCC
SIMULTANEOUS SCIENTIFIC SESSION
5 minute presentation, 6 minute discussion

Moderators: *Vinod H. Thourani and *Jennifer S. Lawton

In Case You Missed It!
Listen to a summary of the 95th Annual Meeting scientific programming from the adult cardiac surgeon perspective.

*John S. Ikonomidis, *University of South Carolina*

85. Insights into Flow Hemodynamics in Externally Stented Vein Grafts

*David Paul Taggart[1], Tomer Meirson[2], Idit Avrahami[3], Carlo Di Mario[4], Carolyn Webb[4], Keith M. Channon[1], Niket Patel[5], Eyal Orion[5]
[1]University of Oxford, Oxford, United Kingdom; [2]Afeka Academic College of Engineering, Tel Aviv, Israel; [3]Ariel University, Ariel, Israel; [4]Royal Brompton Hospital, London, United; [5]Vascular Graft Solutions, Tel Aviv, Israel

Invited Discussant: *James I. Fann

OBJECTIVE: Laminar flow pattern was shown to have a protective effect against the development of vessel wall injury. In contrast, areas with low and oscillatory wall shear stress are more prone to endothelial dysfunction, focal aggressive intimal hyperplasia and vascular disease. Mechanical external stents for saphenous vein grafts (SVG) have shown considerable promise in pre-clinical and clinical testing with significant reductions of lumen irregularity and proliferative intimal hyperplasia. The aim of the present study was to compare the flow pattern in externally stented and non-stented SVG and to analyze the relationship between different hemodynamic parameters and the development of intimal hyperplasia.

METHODS: 30 patients were randomized in a prospective, multi-center study, where each patient received both an externally stented and a non-stented SVG, acting as their own control. Computational fluid dynamics simulations were based on specific SVG geometries and flow rates derived from angiographies 1 year after CABG. Cross-sectional intimal area was measured every 10 mm along the entire SVG using Intra Vascular Ultra Sound (IVUS). Diffuse flow patterns were assessed using mean values of three hemodynamic parameters (HP): time averaged wall shear stress (TAWSS), oscillatory shear index (OSI) and relative residence time (RRT). To analyze and compare focal flow disturbances, the 80th, 90th, and 95th percentiles for OSI and RRT values, and for 20th, 10th, and 5th percentiles for TAWSS values, were calculated. For each SVG, mean value of every HP was analyzed with respect to the mean value of intimal area assessed by IVUS.

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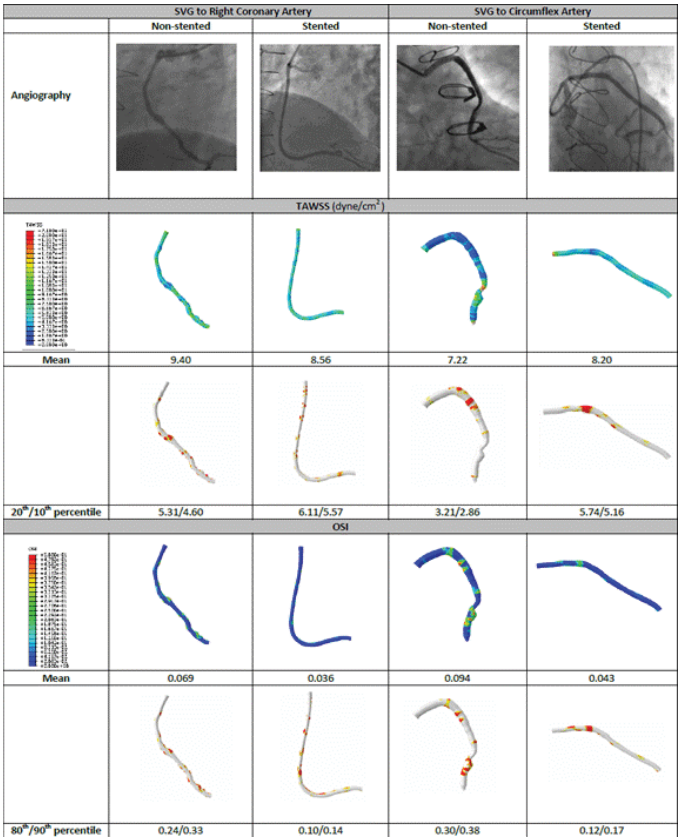
RESULTS: One-year follow-up angiography was completed in 29 patients (96.6%). All patent SVGs (n = 53 [76.8%]) were analyzed by QCA. TIMI flow and velocity could not be calculated for 3 non-stented SVGs and these grafts were excluded from the hemodynamic analysis. Average SVG diameter, TIMI velocity and flow at 12 months were similar in the stented and non-stented groups. Mean OSI was significantly lower in the stented versus non-stented SVG group (p = 0.009), whereas mean TAWSS and RRT did not differ significantly. Both OSI and RRT values were significantly lower in the stented group in all percentile levels (p = 0.003, p = 0.001, p < 0.001 for OSI80th, OSI90thand OSI95th percentiles, respectively; and p = 0.019, p = 0.011, p = 0.007 for RRT80th, RRT90th and RRT95th percentiles, respectively), whereas no significant difference was observed in TAWSS values. High OSI values were correlated with the development of intimal hyperplasia (p = 0.01).



CONCLUSIONS: External stenting results in improved hemodynamics in vein grafts 1 year after coronary artery bypass grafting and may affect the progression of intimal hyperplasia by improving lumen uniformity and oscillatory shear.

86. The Rise of New Technologies for Aortic Valve Stenosis: A Propensity-Score Analysis from Two Multicenter Registries Comparing Sutureless and Trans-Catheter Aortic Valve Replacement

Augusto D'Onofrio[1], Antonino S. Rubino[2], Stefano Salizzoni[3], Laura Besola[1], Claudia Filippini[3], *Ottavio Alfieri[4], Antonio Colombo[4], Marco Agrifoglio[5], Theodor Fischlein[6], Filippo Rapetto[7], Giuseppe Tarantini[1], Magnus Dalén[8], Davide Gabbieri[9], Bart Meuris[10], Carlo Savini[11], Aniello Pappalardo[12], Marco Luigi Aiello[13], Fausto Biancari[14], *Ugolino Livi[15], Pier Luigi Stefàno[16], Mauro Cassese[17], Bruno Borrello[18], Mauro Rinaldi[3], Carmelo Mignosa[2], *Gino Gerosa[1]

[1]University of Padova, Padova, Italy; [2]University of Catania, Catania, Italy; [3]Università di Torino, Molinette, Turin, Italy; [4]San Raffaele Hospital, Milan, Italy; [5]University of Milan, Milan, Italy; [6]Klinikum Nürnberg, Nürnberg, Germany; [7]IRCCS San Martino-IST, Genova, Italy; [8]Karolinska Institutet, Karolinska University Hospital, Stockholm, Sweden; [9]Hesperia Hospital, Modena, Italy; [10]University Hospital Gasthuisberg, Leuven, Belgium; [11]AOU S. Orsola, Bologna, Italy; [12]Ospedali Riuniti Trieste, Trieste, Italy; [13]IRCCS Policlinico S. Matteo, Pavia, Italy; [14]Oulu University Hospital, Oulu, Finland; [15]AOU S. Maria Misericordia, Udine, Italy; [16]Azienda Ospedaliero-Universitaria Careggi, Firenze, Firenze, Italy; [17]Clinica S. Maria, Bari, Italy; [18]Ospedale Maggiore, Parma, Italy

Invited Discussant: *Hersch Maniar

OBJECTIVE: Sutureless aortic valve replacement (SU-AVR) and trans-catheter aortic valve replacement (TAVR) are suitable alternatives to conventional surgery for patients suffering from severe symptomatic aortic valve stenosis (SSAS). Aim of this multicenter study was to compare early clinical outcomes of patients undergoing SU-AVR and TAVR.

METHODS: Data from the ITER registry (Italian Trans-catheter balloon Expandable Registry), that includes patients who underwent TAVR with Sapien/Sapien XT (Edwards Lifesciences, Irvine, CA, USA) bioprosthesis at 33 Italian centers between 2007 and 2012, and from a European Multicenter SU-AVR study-group that includes patients who underwent SU-AVR with Perceval bioprosthesis (Sorin Biomedica, Saluggia, Italy) at 6 European centers between 2010 and 2014, were analyzed. In order to reduce bias, a propensity score was calculated by estimating the likelihood of receiving SU-AVR using several preoperative covariates. The propensity score was used to adjust for observed confounding factors. Outcomes were defined according to VARC and VARC-2 definitions. A multivariate analysis, with and without propensity score adjustment, was carried out to evaluate the results of the two procedures in terms of thirty-day clinical outcomes.

RESULTS: A total of 2,177 patients were included in the analysis. Of these, 292 (13.4%) and 1885 (86.6%) underwent isolated SU-AVR and TAVR, respectively. TAVR patients were older (81.7 ± 6.2 vs. 76.8 ± 5.3 years; $p < 0.001$) and had a higher Logistic Euroscore (21.1 ± 13.6 vs. 9.5 ± 6.0; $p < 0.001$) as well as Euroscore II (7.3 ± 6.8 vs. 3.3 ± 3.1; $p < 0.001$). VARC mortality at 30-day was 2.1% and 7.1% in SU-AVR and TAVR patients, respectively ($p < 0.001$). At multivariate analysis before propensity-score adjustment, SU-AVR patients presented lower risk of mortality (OR, 0.27; 95% CI [0.12–0.63]; $p = 0.002$),

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better device success (OR, 9.71; 95% CI [3.58–26.3]; p < 0.001), lower risk of life-threatening or major bleeding (OR, 0.70; 95% CI [0.50–0.97]; p = 0.03) and lower risk of at least moderate (≥2+/3) aortic regurgitation (AR) (OR, 0.04; 95% CI [0.01–0.29]; p = 0.001). After propensity-score adjustment, there was still a trend towards lower mortality in SU-AVR patients although not statistically significant (OR, 0.41; 95% CI [0.16–1.06]; p = 0.06). Furthermore, device success (OR, 8.7; 95% CI [3.01–25.1]; p < 0.001) and risk of at least moderate AR (OR, 0.05; 95% CI [0.01–0.38]; p = 0.004) were still in favor of SU-AVR. On the other hand, SU-AVR patients had higher risk of permanent pacemaker implantation (OR, 2.31; 95% CI [1.29–4.13]; p = 0.005). (See Table.)

Table: Multivariate Analysis Before and After Propensity-Score Adjustment

Outcome as for VARC-2 Definition	OR [95% CI]	p-Value	OR-Adjusted [95% CI]	p-Value
30-day/in hospital mortality	0.27 [0.12–0.63]	0.002	0.41 [0.16–1.06]	0.06
Device success	9.71 [3.58–26.3]	<0.0001	8.70 [3.01–25.1]	<0.0001
Any stroke	0.74 [0.32–1.74]	0.49	0.90 [0.32–2.60]	0.85
Life-threatening or major bleeding	0.70 [0.50–0.97]	0.03	1.22 [0.80–1.87]	0.36
Pacemaker implant	1.50 [0.96–2.33]	0.08	2.31 [1.29–4.13]	0.005
Need for dialysis	0.74 [0.32–1.74]	0.49	1.60 [0.57–4.52]	0.37
Mild aortic regurgitation	0.03 [0.01–0.08]	<0.0001	0.04 [0.02–0.10]	<0.0001
≥moderate aortic regurgitation	0.04 [0.01–0.29]	0.001	0.05 [0.01–0.38]	0.004

CONCLUSIONS: According to our data, SU-AVR and TAVR are both reasonable alternative treatments in patients with SSAS. SU-AVR seems associated with better device success and is protective towards postoperative AR. Nevertheless, SU-AVR patients were more likely to receive permanent pacemaker implantation.

87. First North American Single Centre Experience with the Enable Sutureless Aortic Bioprosthesis in a High-Risk Surgical Cohort

Benoit de Varennes, Kevin Lachapelle, Renzo Cecere, Isabel Szczepkowski, Jean Buithieu

McGill University, Montreal, QC, Canada

Invited Discussant: *Thomas G. Gleason

OBJECTIVE: TAVI is performed using a sutureless valve and is increasingly used in patients at high surgical risk. Surgical sutureless valves have the potential for shorter cross-clamp and cardiopulmonary bypass times and could benefit increased risk patients who are not candidates for TAVI. The Enable valve is a stentless equine bioprosthesis housed in a Nitinol cage allowing the valve to fold and expand once implanted within the aortic annulus. The aim of this study was to evaluate the early clinical and echocardiographic results with the Enable sutureless aortic valve bioprosthesis.

METHODS: Patients with aortic stenosis thought to be at higher surgical risk (STS score > 4, 0 and/or need for combined procedures and/or patient frailty) were considered for Enable valve implantation.

RESULTS: Between August 2012 and October 2014, 63 patients underwent implantation of the Enable valve. Pre-operative NYHA functional status was the following: I (1), II (16), III (35), IV (11). 30 patients underwent isolated AVR. Combined procedures were AVR/CABG (26), AVR/MV repair (2), AVR/MV Repair/CABG (2) and AVR/Ascending aortic graft (3) Mean age was 78 ± 8 years. Predicted STS score was 8.06 ± 7.73 (0.94–41.30). Implant success was 100%. Mean cross-clamp time for isolated AVR was 44 ± 14 min. (30–91). 30-day mortality was 1.6% (1/63) and late mortality was 3.2% (2/62). No mortality was valve-related. Intra-operative need for revision was 6.3% (4/63). Early migration requiring re-operation occurred in 1.6% (1/63). The rate of complications was the following: Pacemaker 3.1% (2/63), Transient Ischemic Attack 1.6% (1/63), other thrombo-embolic events 0%, Bleeding 0%, and Endocarditis 0%. Mean follow-up was 10 ± 8 months. At latest follow-up, 61 patients were in NYHA class I and 1 patient was in class II. No patient developed moderate or severe aortic regurgitation in the follow-up period.

Table: Echocardiographic Results:

	Pre-op	Pre-Discharge	3–6 Months	1 Year
Aortic valve area (cm^2/m^2)	0.43 ± 0.12	1.08 ± 0.28	1.04 ± 0.27	1.08 ± 0.22
Peak gradient (mmHg)	73 ± 25	21 ± 6	19 ± 3	17 ± 7
Mean gradient (mmHg)	48 ± 16	12 ± 4	10 ± 2	9 ± 4
n	63	34	22	16

CONCLUSION: The Enable sutureless bioprosthesis is an acceptable alternative to conventional AVR in higher risk patients or patients requiring combined procedures. The possibility of intra-operative re-positioning of the valve is an advantage. The early hemodynamic performance appears favourable.

*AATS Member

Late Breaking Clinical Trial

88. First Large Cohort with a Sutureless Aortic Valve: The 1 Year Follow-Up of 628 Consecutive Patients from an International Multicenter Prospective Trial

*Axel Haverich[1], Bart Meuris[2], Theodor J.M. Fischlein[3], Kavous Hakim-Meibodi[4], Martin Misfeld[5], *Thierry P. Carrel[6], Marian Zembala[7], Sara Gaggianesi[8], Francesco Madonna[9], François Laborde[10]

[1]Hannover Medical School, Hannover, Germany; [2]U.Z. Gasthuisberg, Leuven, Belgium; [3]Hannover Medical School, Nuremberg, Germany; [4]Ruhr-Universität Bochum, Bad Oeynhausen, Germany; [5]University of Leipzig, Leipzig, Germany; [6]Inselspital, University Hospital, Bern, Switzerland; [7]Silesian Center for Heart Diseases, Zabrze (Silesia), Poland; [8]Sorin Group Italia S.r.l., Saluggia (VC), Italy; [9]Hopital Cardiologique Du Haut-Leveque, Pessac, France; [10]Institut Mutualiste Montsouris, Paris, France

Invited Discussant: *John S. Ikonomidis

Innovation in Cardiac Surgery
*Craig R. Smith, *Columbia University*

89. Robotic Repair of Simple Versus Complex Degenerative Mitral Valve Disease: Clinical and Echocardiographic Outcomes During Mid-Term Follow-Up

*Rakesh M. Suri[1], Amit Taggarse[1], *Harold Burkhart[2], Maurice Enriquez-Sarano[1], Hector Michelena[1], William Mauermann[1], Vuyisile Nkomo[1], Sunil Mankad[1], Zhuo Li[1], Rick Nishimura[1], *Richard Daly[1]

[1]Mayo Clinic, Rochester Minnesota, MN; [2]University of Oklahoma, Oklahoma City, OK

Invited Discussant:

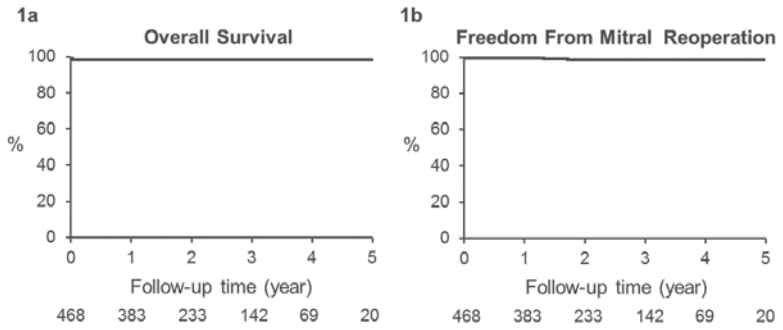
OBJECTIVE: Although robot-assisted repair of severe mitral valve regurgitation (MR) due to degenerative disease has been shown to be safe and effective early following surgery, mid-term clinical and echocardiographic outcomes based upon mitral valve leaflet prolapse complexity stratifications detailed in current heart valve guidelines are unknown.

METHODS: From January 2008 to October 2014, 483 patients underwent robotic mitral valve repair (plus concomitant maze/septal defect closure as indicated) for non-ischemic degenerative mitral valve prolapse. Exclusion criteria included coronary/peripheral vascular disease and prior cardiac operations. Mid-term outcomes among those who consented (469) were studied with particular emphasis upon the influence of leaflet prolapse complexity. Mean age was 56 ± 11 years, 346 (74%) were men, 434 (93%) had NYHA class I/II symptoms and mean EF was 65 ± 6%. Median clinical follow-up was 723 days and median echocardiographic follow-up was 389 days.

RESULTS: Simple pathology (posterior leaflet alone) was found in 280 (60%) while complex anatomy was addressed in 189(40%). Simple disease was repaired using posterior leaflet resection in 273/280 (98%), commissuroplasty in 43/280 (15%) and plication in 15/280 (5%). Complex pathology was

corrected using leaflet resection in 151/189 (80%), Gore-Tex neochords in 122/189 (65%) and plication in 55/189 (29%). All patients underwent posterior annuloplasty. Median aortic cross clamp time was 53 min., perfusion 76 min. and postoperative ventilation time was 0 hr. Repair was successful in all patients with no conversions. There was 1 early death and median length of hospital stay was 3 days. Following dismissal, 1 further death occurred leading to 1- and 5-year survival of 99.5% (2/469; Figure 1a). Four patients underwent mitral reoperation; with a 3-year freedom from reoperation of 99.2% and a linearized rate of 0.38% re-interventions per year. Freedom from reoperation at 5 years was 100% (0/280) for simple and 98.2% (3/189) for complex pathology (p = 0.29; Figure 1b). On review of 282 echocardiograms available at 1.10 ± 0.43 years after procedure, recurrent MR was: none-to-trivial in 214 (76%), mild in 57 (20%), moderate in 9 (3%) and >moderate in 2 (0.7%). There was no statistical difference in mid-term freedom from MR based upon initial leaflet prolapse category or complexity (p = 0.48). Ninety-nine percent of patients reported NYHA functional class I/II status at follow-up.

Figure 1



CONCLUSIONS: Mitral valve repair using robotic assistance is associated with excellent survival along with very low MR recurrence and reoperation risks during mid-term follow-up. The findings appear to be uniform amongst those undergoing correction of either simple or complex degenerative mitral valve disease pathology. These outcomes establish a standard against which future percutaneous repair in low-risk patients should be compared.

*AATS Member

90. Minimalist Transcatheter Aortic Valve Replacement: The New Standard for Surgeons and Cardiologists Using Transfemoral Access?

Hanna Alaoja Jensen, Jose Francisco Condado, Vasilis Babaliaros, Jose Binongo, Bradley G. Leshnower, Stamatios Lerakis, Eric Sarin, Chandan Devireddy, Kreton Mavromatis, Amjadullah Q. Syed, James P. Stewart, Brian Kaebnik, Ayaz Rahman, Amy Simone, Patricia Keegan, *Robert A. Guyton, Peter C. Block, *Vinod H. Thourani
Emory University, Atlanta, GA

Invited Discussant: *Michael J. Reardon

OBJECTIVE: Minimalist transcatheter aortic valve replacement (TAVR) utilizing transfemoral access under conscious sedation and transthoracic echocardiography is increasing in popularity. This relatively novel technique may necessitate a training period to achieve proficiency in performing a successful and safe procedure. Our goal was to evaluate our minimalist TAVR cohort with a specific characterization between our early, mid-term, and recent experience.

METHODS: We retrospectively reviewed 142 consecutive patients that underwent minimalist TAVR with surgeons and interventionists equally as primary operator at a United States academic institution between May 2012 and July 2014. Our institution had performed 300 TAVR procedures prior to implementation of the minimalist technique. Patient characteristics and early outcomes were compared using VARC-2 definitions among three groups: Group 1: the first 50 patients, Group 2: patients 51–100, and Group 3: patients 101–142.

RESULTS: Mean age for all patients was 82.8 ± 7.4 and similar among groups. The majority of patients were male (55.6%), and the median ejection fraction for all patients was 55% (IQR, 38.0–60.0%). The majority of patients were high risk surgical candidates with a median STS PROM for all patients of 10.0% and similar among groups (see Table). The overall major stroke rate was 3.5%, major vascular complications occurred in 2.1% of patients, and moderate paravalvular leak rate was 1.4%. For morbidity, there were no differences among our 3 Groups (see Table). Although the mortality was increased in Group 3 (7.1%) compared to Group 1 (2.0%) and Group 2 (0%), this was not statistically significant.

	All	Group 1 (n=50)	Group 2 (n=50)	Group 3 (n=42)	p-value
Preoperative					
Age (mean±SD, years)	82.8±7.4	81.4±8.6	82.9±7.0	84.4±6.2	0.15
STS Predicted Risk of Mortality (median, interquartile range), %)	10.0 (7.4-13.5)	10.0 (7.2-13.2)	9.4 (7.9-13.5)	10.5 (7.9-14.5)	0.79
Postoperative					
Stroke					
Minor stroke (n, %)	2 (1.4)	1 (2.0)	1 (2.0)	0 (0.0)	0.49
Major stroke (n, %)	5 (3.5)	1 (2.0)	3 (6.0)	1 (2.4)	0.51
Vascular complications					
Major (n, %)	3 (2.1)	0 (0.0)	1 (2.0)	2 (4.8)	0.28
Paravalvular leak (n, %)					
None (n, %)	95 (66.9)	30 (60.0)	33 (66.0)	32 (76.2)	0.22
Mild (n, %)	45 (31.7)	18 (36.0)	17 (34.0)	10 (23.8)	
Moderate (n, %)	2 (1.4)	2 (4.0)	0 (0)	0 (0)	
Readmission (n, %)	12 (8.5)	5 (10)	5 (10)	2 (4.8)	0.59
30-day mortality (n, %)	4 (2.8)	1 (2.0)	0 (0)	3 (7.1)	0.40

STS = Society of Thoracic Surgeons.

CONCLUSIONS: In a high-volume TAVR center, transition to a minimalist approachfor transfemoral TAVR is feasible with acceptable outcomes and a diminutive procedural learning curve. We advocate for TAVR centers to actively pursue the minimalist technique with equal representation by cardiologists and surgeons.

*AATS Member

91. Anterior Mitral Valve Leaflet Augmentation Repair in Type III Mitral Regurgitation: Lessons Learned

Thomas M. Kelley, Jr.[1], James McCarthy[2], Nels D. Carroll[2], Mohammed Kashem[2], G. William Moser[2], *Yoshiya Toyoda[2], Grayson H. Wheatley, III[2], *Larry Kaiser[2], *T. Sloane Guy[2], He Wang[1]

[1]Dwight D. Eisenhower Army Medical Center, Augusta, GA; [2]Temple University, Philadelphia, PA

Invited Discussant: *Ralph J. Damiano

OBJECTIVE: To evaluate the intermediate term durability of extracellular matrix (ECM) in the treatment of Type III mitral regurgitation (MR) utilizing an anterior mitral leaflet (AML) augmentation procedure.

METHODS: A single-site chart review and data collection was conducted on patients who underwent AML augmentation with ECM. Cases were performed with the da Vinci surgical robot or through a median sternotomy. All were done for Type III (MR). Robotic access was accomplished in a totally endoscopic fashion with 5 ports ranging from 8–15 mm through the right thorax. Median follow-up was 10.6 months (range: 1 to 23 months). Reoperation through a sternotomy was performed on patients with recurrence of symptoms and evidence of severe MR on echocardiography who opted for surgical management. Explanted patches at our institution were examined histologically.

RESULTS: Between August 2012 and April 2013, 25 patients (9 males [36%], mean age 63.3 ± 12.2 years) underwent AML augmentation with ECM. 22 (88%) were performed robotically. 2 (8%) patients died of non-cardiac related causes after 30 days. 8 (32%) had recurrence of symptoms and demonstrated severe MR with ballooning or rupture of the AML graft on echocardiography. Average time to recurrence was 219 ± 100 days. 7 (28%) of these 8 patients underwent reoperation, of which 5 had valve replacement and 2 had repair of the augmentation. One patient elected for medical management.Intraoperative findings revealed 1 (4%) patch with a central perforation of the ECM, 5 (20%) with significant enlargement of the ECM patch and 1 (4%) with a small area of dehiscence from the suture line. Patients who underwent repair of the augmentation demonstrated recurrence of severe MR. Univariate risk analysis demonstrated no correlation of age, sex, incidence of comorbid conditions such as diabetes, COPD and hypertension, LVEF, surgical approach or annuloplasty band size with patch failure. A lower body mass index was demonstrated to be the only risk factor associated with recurrence (28.1 vs. 34.5 p = .039). Histological study of the 3 available explants demonstrated intense chronic and acute inflammation with abundant eosinophils, plasma cells macrophages and multinucleated giant cells. Granulation tissue with rich vasculogenesis was prominent. No significant calcification was identified. These findings were primarily present at the periphery of the ECM. The surviving 15 (60%) patients in functional graft cohort demonstrated normal mitral leaflet motion and function, with no more than mild MR.

CONCLUSIONS: For Type III MR, use of large patch augmentation with ECM had a 32% recurrence rate of MR with evidence of graft dysfunction. A suitable biomaterial is required to develop this surgical technique and enable predictable, long term success. More study and development of ECMs is warranted to enhance the development of this novel mitral valve reconstructive option.

92. Transapical Off-Pump Mitral Valve Repair with Neochord Implantation: Clinical and Echocardiographic Results of 3 Months Follow-Up

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

Invited Discussant: *Gorav Ailawadi

OBJECTIVE: The transapical off-pump mitral valve intervention with neochord implantation (TOP-MINI) is a recently established procedure to treat degenerative mitral valve regurgitation (MR). This study aimed to assess its efficacy at 6 month follow-up in a consecutive cohort of patient treated at our institution.

METHODS: A total of 36 patients underwent TOP-MINI. All patients were followed up to 3 months with clinical and Echocardiographic examination.

RESULTS: A total of 37 procedures were performed; median age was 73 years (IQR, 59, 78) and median Euroscore-II 1.8% (IQR, 0.7, 2.8%). Thirty-three patients (93.5%) presented a posterior leaflet disease, 3 patients had an anterior leaflet disease (8.1%) and 1 patient had anterior and posterior leaflet disease (2.7%). Three neochordae were implanted in 13 patients (35.1%), 4 in 16 (43.2%), 5 in 7 (19%), 6 in 1 (2.7%). Acute procedural success was achieved in all patients.

Thirty-two patients competed the 30-day follow-up period, MR was absent in 14 patients (43.7%), grade 1+ in 9 patients (28.1%), grade 2+ in 6 patients (18.8%). 3 patients (9.4%) presented a recurrence of MR > 2+ after 30 days due to chordal rupture and underwent successful reintervention with conventional surgery. At 3 months follow-up MR was absent in 12 patients (41.3%), grade 1+ in 9 patients (31.1%), grade 2+ in 8 patients (27.6%). At 6 months major adverse events included only one acute myocardial infarction (2.7%) successfully treated percutaneously, 1 sepsis (2.7%) and one death (2.7%) in very high-risk surgical candidate. Random Forests analysis evidenced that the most important predictors of residual MR were preoperative pulmonary hypertension, Euroscore, age, NYHA class, gender and anatomical type (RF classification error rate of about 18.8%).

Echocardiographic data showed a reduction in the MV annular dimensions from baseline to 3 months follow-up [Anteroposterior diameter from 36 mm (IQR, 31, 40) to 33 mm (IQR, 30, 36); mediolateral diameter from 35 mm (32, 38) to 35 mm (IQR 31, 39)]. Ejection fraction was 59% at baseline (IQR, 50, 64), and 58% at 3 months (IQR, 48, 66). Median LVEDV indexed were 66 ml/mq (IQR, 52,73) at baseline, 78 ml/mq (IQR, 67, 89) at 1 month and 72 ml/mq (59, 83) at 3 months. At baseline median LA indexed volumes was 41 ml/mq (IQR, 35, 57), and at 3 months was 32 ml/mq (IQR, 28, 49).

CONCLUSIONS: The MR correction obtained with the TOP-MINI procedure provides a significant acute reduction of MR together with an improvement of ventricular volumes and cardiac function. Those improvements are maintained at 3 months after procedure.

*AATS Member

93. Trends in U.S. Extracorporeal Membrane Oxygenation Utilization and Outcomes: 2002-2012

Fenton H. McCarthy, Katherine McDermott, Dawei Xie, Jacob Gutsche, Ashley C. Hoedt, *Wilson Y. Szeto, *Michael A. Acker, Nimesh D. Desai
University of Pennsylvania, Philadelphia, PA

Invited Discussant: *Matthew Bacchetta

OBJECTIVE: This study evaluates national trends over time in the volume, outcomes, and clinical presentation of critically ill adult patients undergoing extracorporeal membrane oxygenation (ECMO) in US hospitals.

METHODS: All adult discharges in the Nationwide Inpatient Sample database during the years 2002 through 2012 that included extracorporeal membrane oxygenation were used to estimate the total number of US ECMO hospitalizations (n = 12,407). Procedural and diagnostic codes were used to group patients by indication for ECMO use, and trends in volume and outcomes were analyzed for the entire adult ECMO population and by primary indication for ECMO use. Patients were divided into six mutually-exclusive groups by apparent primary indication for ECMO: post-cardiotomy, heart transplant, lung transplant, cardiogenic shock, respiratory failure, and cardiopulmonary failure. A Mann-Kendall test for trend was used to examine trends over time, and means and frequencies were calculated using SAS software statistical techniques for survey data.

RESULTS: Overall ECMO use increased significantly over the period from 2002 to 2012 ($p = 0.003$), while in-hospital mortality rate has fluctuated without a significant difference in trend over time (see Figure). There was an inflection point in ECCMO utilization occurring around 2007 (see Figure). Dividing the study period into pre and post 2007, no significant trend was observed in overall ECMO use from 2002 to 2007, but use did demonstrate a statistically significant increase from 2007 to 2012 ($p = 0.0028$). Highest in-hospital mortality rates were found in the post cardiotomy (57.2%) and respiratory failure (59.2%) groups. Lung and heart transplant groups had the lowest in-hospital mortality rates (44.10% and 45.31%, respectively). The proportion of total ECMO use represented by post-cardiotomy patients decreased over the study period from 56.9% of all ECMO admissions in 2002 to 37.9% in 2012 ($p = 0.026$), and the percent of patients undergoing ECMO due to cardiopulmonary failure increased from 3.9% to 11.1% ($p = 0.026$). No other groups exhibited a significant trend.

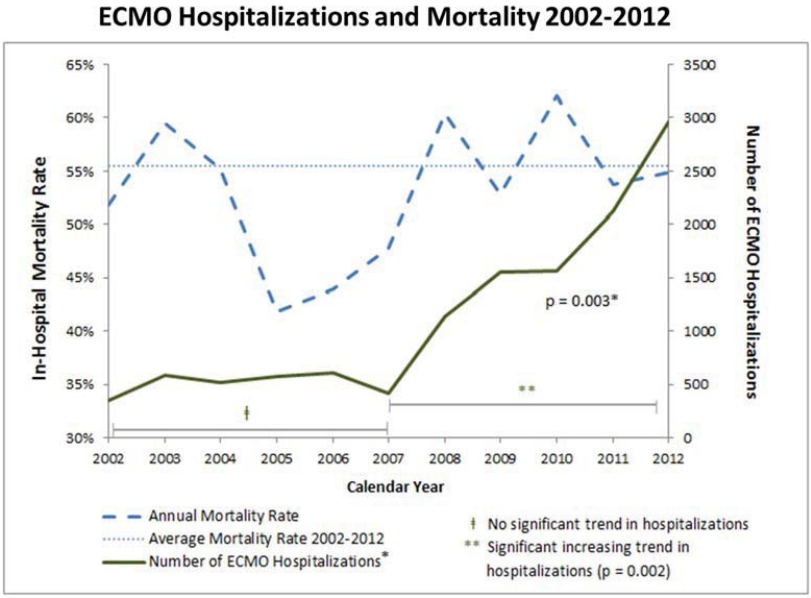


Figure: In-Hospital Mortality Rate and Hospitalization of Extracorporeal Membrane Oxygenation in the United States.

CONCLUSIONS: These results demonstrate an increase in ECMO use in the US between 2002 and 2012, driven primarily by rising national ECMO utilization beginning in 2007. Mortality rates remained high but stable during this time period. Though there were shifts in relative ECMO use among patient groups, absolute ECMO use increased for all indications over the study period. Mortality rates during this period did not show a significant trend.

AATS Guidelines: Sternal Wound Infection

*Harold L. Lazar, *Boston Medical Center*

*AATS Member

7:00 AM **CONGENITAL HEART DISEASE SIMULTANEOUS SCIENTIFIC SESSION** Room 612, WSCC

5 minute presentation, 6 minute discussion

Moderators: *Duke E. Cameron and *Andrew J. Lodge

In Case You Missed It!

Listen to a summary of the 95th Annual Meeting scientific programming from the congenital surgeon perspective.

*Marshall L. Jacobs, *Johns Hopkins University*

94. Late Incidence of Endocarditis and Conduit Failure in Patients Undergoing Placement of Right Ventricular to Pulmonary Arterial Conduits with Bovine Jugular Grafts

Carlos M. Mery, Francisco Guzman-Pruneda, Matthew D. Terwelp, Luis E. DeLeon, Iki Adachi, *Jeffrey S. Heinle, *E. Dean McKenzie, *Charles D. Fraser, Jr.

Texas Children's Hospital, Houston, TX

Invited Discussant:

OBJECTIVE: Bovine jugular grafts (BJG) have been frequently used as right ventricular to pulmonary arterial (RV-PA) conduits. We have anecdotally observed several patients developing late endocarditis in the setting of a BJG after this procedure. The goal of this study was to analyze the long-term results of BJG's as RV-PA conduits in terms of endocarditis and failure risk.

METHODS: All BJG RV-PA conduits placed at our institution from 2001 to 2014 were included. Freedom from endocarditis, freedom from conduit replacement (surgical or interventional), and freedom from reintervention (surgical or interventional) were calculated for each conduit. Univariate analyses were performed using Kaplan-Meier curves and log-rank tests. Multivariate analyses were performed using Cox proportional hazard models including statistically significant and/or clinically relevant variables.

RESULTS: 245 conduits were placed in 223 patients (103 [46%] females, 61 [27%] with genetic syndromes). BJG's were inserted in 65 (27%) neonates/infants, 98 (40%) patients 1–5 years, and 82 (33%) patients >5 years. Median conduit size was 16 mm (12–22 mm) with 125 (51%) conduits ≤16 mm in size. Diagnoses included pulmonary atresia or tetralogy of Fallot (88 [36%]), tetralogy of Fallot s/p simple repair (26 [11%]), truncus arteriosus (64 [26%]), and other (67 [27%]). 117 (48%) conduits were replacements of prior RV-PA conduits (89 [76%] homograft, 21 [18%] bovine jugular, 7 [6%] others). Median follow-up for non-replaced conduits was 4 years (3 days to 14 years). During the study period, endocarditis complicated 14 (6%) of the conduits at a median time of 7 years after implantation (34 days to 10 years); only 2 during the first year after implantation. 12 conduits were replaced and 2 were managed medically. Actuarial 5- and 10-year freedom from endocarditis was 94% and 76%, respectively (see Figure). Actuarial freedom from replacement

(5-year: 80%, 10-year: 46%) and freedom from reintervention (5-year: 76%, 10-year: 33%) can be seen in the figure. On multivariate analysis, no variables were found to be independent risk factors for development of endocarditis, conduit replacement, or conduit reintervention.

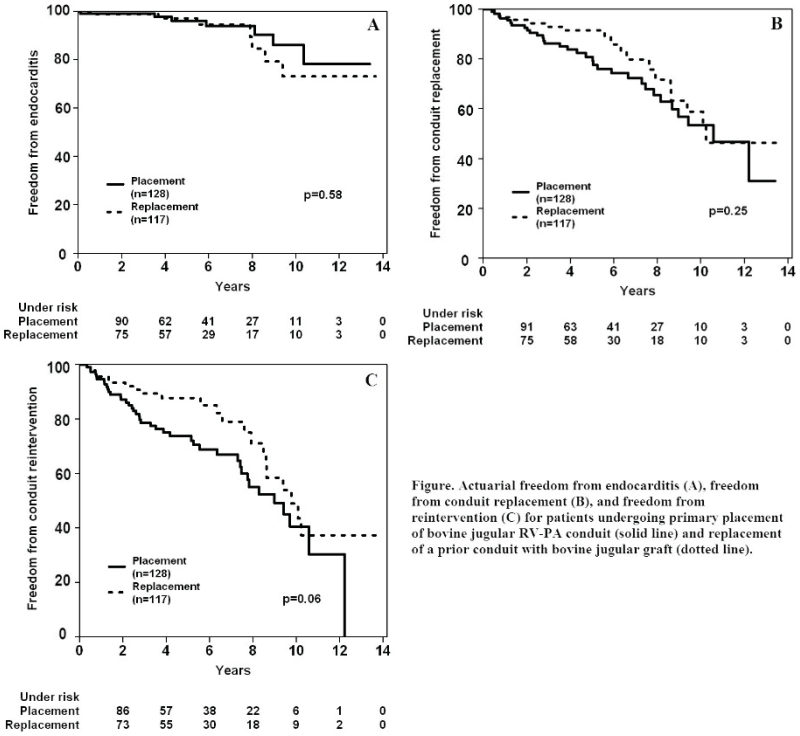


Figure. Actuarial freedom from endocarditis (A), freedom from conduit replacement (B), and freedom from reintervention (C) for patients undergoing primary placement of bovine jugular RV-PA conduit (solid line) and replacement of a prior conduit with bovine jugular graft (dotted line).

CONCLUSIONS: Despite reasonable short-term performance, bovine jugular RV-PA conduits are associated with considerable risk of late endocarditis and need for conduit replacement and reintervention. Due to the risk of endocarditis increased surveillance is warranted for these patients. Alternative graft conduits should be considered for patients in need for RV-PA reconstruction.

*AATS Member

95. Pulmonary Artery Flow Studies Are Useful and Valid in Intraoperative Decision-Making for Patients Undergoing Repair of Pulmonary Atresia with Ventricular Septal Defect and Major Aortopulmonary Collateral Arteries

Jiaquan Zhu, Atsuko Kato, Arezou Saedi, Devin Chetan, Rachel Parker, *John G. Coles, *Christopher A. Caldarone, *Glen S. Van Arsdell, Osami Honjo
Hospital for Sick Children, Toronto, ON, Canada

Invited Discussant:

OBJECTIVES: We evaluated the predictive value of the intraoperative pulmonary artery flow (PAF) study on VSD closure and mortality in patients with pulmonary atresia with ventricular septal defect and major aortopulmonary collateral arteries (PA/VSD/MAPCAs) who underwent complete unifocalization.

METHODS: Fifty patients with PA/VSD/MAPCAs (2000 to 2013) underwent repair and 40 consecutive patients since 2003 had a PAF study. The mean pulmonary artery pressure (PAP) was measured when calibrated pulmonary artery inflow reached 2.5 L/min/m^2. The cut off mean PAP to close the VSD in the study period was 30 mmHg. The ability to predict VSD closure was analyzed using a receiver operating characteristic curve.

RESULTS: Forty-seven patients (94%) had complete unifocalization of all MAPCAs. The median age of complete MAPCA unifocalization was 0.88 years (range: 0.05–16.2 years). Among 40 patients who had a PAF study, six (15%) patients had a mean PAP ≥ 30 mmHg and VSD was intentionally left open. VSD was closed in 34 patients who had a mean PAP ≤ 30 mmHg, of which four (11.8%) patients required salvage fenestration of the VSD patch due to suprasystemic right ventricular pressure (RVP) after weaning from cardiopulmonary bypass. The mean PAPs of these 4 patients were 18, 22, 24, and 25 mmHg (Figure 1A). The mean PAP accurately predicted VSD closure (area under the PAP curve 0.835; P < 0.001; Figure 1B). The sensitivity and specificity at the cut off value of 30 mmHg are 30.0% and 100.0%, and 60.0% and 83.3% if the cut off value of 25 mmHg. Within the whole cohort, there were 2 in-hospital deaths, 7 late deaths and 7 re-operations. Overall survival was 83.9%, 77.6% and 73.7% at 1, 3, and 5 years, respectively. Among the patients who had VSD closed, there is a trend toward higher mortality in patients with a higher PAP (25–30 mmHg) (37.5% vs. 4.5%; P = 0.08). Pulmonary artery catheter re-interventions were required in 27 (54%) patients. Patients who were not able to tolerate VSD closure had higher risks of death (P = 0.053), re-operation (P = 0.001), and pulmonary artery catheter re-interventions (P = 0.010) compared to the ones with VSD closed. Among patients who tolerated VSD closure, the follow-up systolic RVP did not drop in patients who needed pulmonary artery re-intervention (48.0 ± 11.0 vs. 49.3 ± 13.4 mmHg; P = 0.747), but significantly decreased in those who didn't require re-intervention (45.9 ± 14.2 vs. 32.9 ± 9.3 mmHg; P = 0.011).

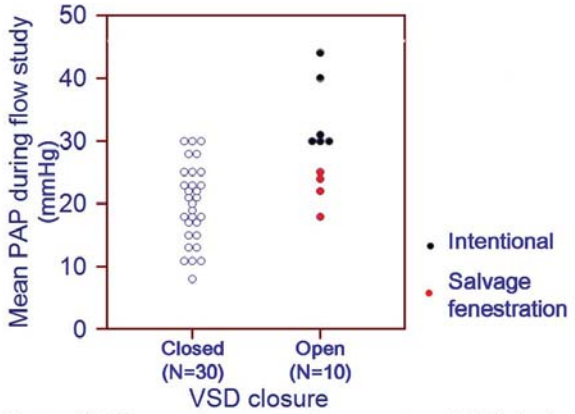


Figure 1A: Mean pulmonary artery pressure (PAP) during the intraoperative pulmonary artery flow study stratified by status of ventricular septal defect (VSD).

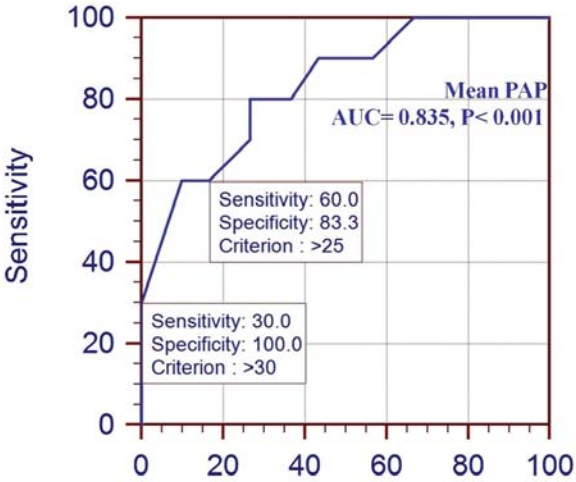


Figure 1B. Receiver operating characteristic curve for mean PAP. Mean PAP from flow study is a useful predictor of VSD closure. PAP : pulmonary artery pressure. AUC: area under the curve.

CONCLUSIONS: The intraoperative PAF study accurately predicted VSD closure in most patients with PA/VSD/MAPCAs and potentially predicts death. Careful interpretation is required if the mean PAP is greater than 25 mmHg.

*AATS Member

96. The Modification of Right Ventricle to Pulmonary Artery Conduit for Norwood Procedure Reduces the Number of Unintended Shunt-Related Events

Tomasz M. Mroczek, Rafal Zurek, Aleksandra Morka, Jerzy Jarosz, Katarzyna Szymanska, Janusz H. Skalski

Jagiellonian University, Krakow, Poland

Invited Discussant: *Minoo N. Kavarana

OBJECTIVE: The introduction of right ventricle to pulmonary artery conduit (RV-PAc) during Norwood procedure (NP) for hypoplastic left heart syndrome (HLHS) instead of traditional modified Blalock-Taussig shunt resulted in a higher survival rate in many centers, but increased number of unintended pulmonary and shunt interventions. We describe the impact of several modification applied to RV-PAc for NP on interstage course, surgical or catheter based interventions and pulmonary arteries development in HLHS cohort of patients.

METHODS: We retrospectively analyzed the three groups of non-selected, consecutive neonates who underwent NP between 2011 and 2014, with different RVPAc surgical techniques: Group I, left RV-PAc with distal homograft cuff (N = 32); Group II, right RVPAc with distal homograft cuff (N = 28); Group III, "dunk" right reinforced RV-PAc with direct distal anastomosis (N = 41). The technique of reconstruction of aorta during the NP was consistent during the entire study.

RESULTS: There was no difference in terms of age, weight, prevalence of aortic atresia, diameter of ascending aorta, deep hypothermic circulatory arrest time and hospital mortality rate (9.3 vs. 14.2 vs. 7.3%, respectively) between groups. There was significant reduction in numbers of catheter-based interventions during the interstage period in third group (34 vs. 25 vs 0%, respectively; p = 0.01) and /or concomitant surgical interventions (17.2 vs. 4.1 vs. 2.6%, respectively). The diameter of pulmonary arteries was most homogenous in third group.

CONCLUSIONS: Modified strategy of using "dunk," right reinforced RV-PAc with direct distal anastomosis during Norwood procedures for HLHS significantly reduces the number of catheter-based and surgical-unintended shunt- related interventions during the interstage period. This strategy allows for more homogenous development of pulmonary arteries before the second, surgical stage.

97. Right Ventricular Outflow Tract Reconstruction with a Polytetrafluoroethylene Monocusp Valve: A Twenty-Year Experience

*John Brown, Mohineesh Kumar, *Mark Rodefeld, *Mark Turrentine

Indiana University, Indianapolis, IN

Invited Discussant: *James A. Quintessenza

OBJECTIVE: In patients with tetralogy of Fallot, pulmonary atresia, and other congenital right ventricular outflow tract (RVOT) obstruction/lesions, polytetrafluoroethylene (PTFE) monocusp valves provide two means: addressing RVOT competence and unloading the RV volume. They have been widely used at our institution over the past two decades. The purpose of this study was to determine whether a PTFE monocusp valve was an acceptable short and mid-term remedy for patients with RVOT or pulmonary valve disease.

METHODS: From 1994 to 2014, 259 patients (mean age 2.8 ± 4.1 years; median 1.2 years; IQR, 0.7, 2.7 years) underwent reconstruction of the RVOT with a PTFE monsocusp valve. Patients were divided into 3 preoperative diagnostic subgroups: patients undergoing initial repair of tetralogy of Fallot or pulmonary atresia/ventricular septal defect (group 1: 176 pts, 68%), patients undergoing redo RVOT procedures (group 2: 37 pts, 14%), and patients undergoing complex initial repairs (group 3: 46 pts, 18%). Patients were studied intra-operatively, and serially postoperatively to determine pulmonary valve dysfunction defined as a peak gradient >40 mmHg or valve regurgitation > moderate. Valve failure was defined as the need for pulmonary valve balloon dilation or replacement. The mean follow-up duration was 11.2 ± 5.5 years (range: 1 month to 20 years).

RESULTS: There were 7 early and 8 late deaths (total 15/256; 5.8%). There was a significant difference between the preoperative and postoperative peak RVOT gradients (72.3 vs. 26.5 mm Hg). Of the 259 patients, 53 (20%) were lost to follow-up, and 77 (30%) required replacement of the monocusp valve 10.1 ± 4.4 years (range: 3 months to 18.9 years) after the original monocusp insertion. The remaining 129 patients have their original monocusp valve. Kaplan-Meier analysis showed no significant difference in all-cause mortality but there was a significant decrease in valve durability in group 2 as compared to groups 1 and 3 (see Figure).

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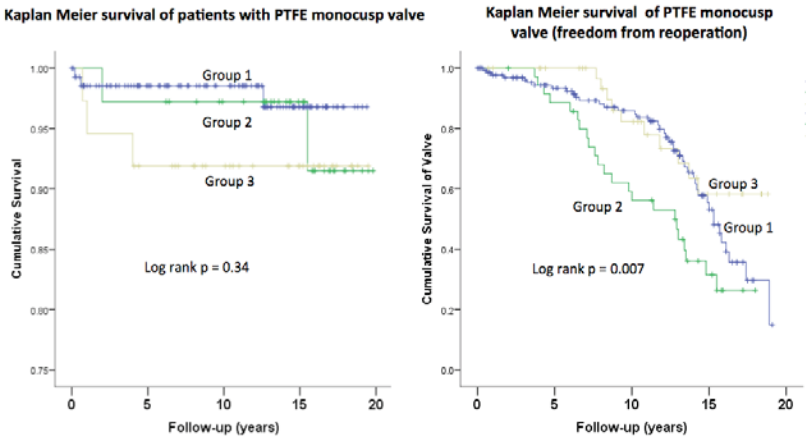


CONCLUSIONS: The PTFE monocusp valve is an excellent choice for reducing pulmonary insufficiency in patients with congenital RVOT disease, especially in tetralogy of Fallot and pulmonary atresia (group 1). It is easy to construct, inexpensive and remains free from significant stenosis. In the long-term, patients will likely require a pulmonary valve replacement for valve regurgitation and RV dilation.

On Building a Heart: Lessons from Man and Nature

*Duke E. Cameron, *Johns Hopkins Hospital*

Moderators: *Bahaaldin Alsoufi and *J. William Gaynor

98. Repair of Parachute and Hammock Valves in Infants and Children and Its Long-Term Outcome

Eva Maria Delmo Walter, Henryk Siniawski, Takeshi Komoda, *Roland Hetzer
Deutsches Herzzentrum Berlin, Berlin, Germany

Invited Discussant: *Emre Belli

OBJECTIVE: Surgical management of parachute and hammock valves in children remains the most challenging congenital malformations to correct. We aim to report our institutional experience with valve-preserving repair techniques and the long-term outcome in parachute and hammock valves in infants and children.

METHODS: From 1992 to 2013, 20 infants and children with parachute (n = 12, mean age 5.16 ± 5.0, median 2. 2 months to 13 years) and hammock (n = 8, mean age 4.3 ± 0.7 years, median 7 months, range: 1 month to 14.9 years) valves underwent mitral valve (MV) repair . Ten (50%) belong to age group <1 year. Seven had class IV mitral insufficiency (MI) and 13 had class III MI. All had moderate mitral stenosis (MS).

RESULTS: Intraoperative findings included fused and shortened chordae with single papillary muscles in children with parachute valves. MV repair was performed using annuloplasty, commissurotomy, leaflet incision extended towards the body of the papillary muscles and split towards its base assuring sufficient thickness of both "new papillary muscle heads." The children with hammock valves have dysplastic and shortened chordae, absence of papillary muscles with fused and thickened commissures in children with hammock valves (HV) with two patients having annular dilatation. Mitral valve repair consisted of carving off a suitably thick part of the left ventricular wall carrying the rudimentary chordae, ensuring that both the remaining left ventricular wall and the "new papillary muscles" maintain sufficient muscle thickness to maintain their function. The degree and extent of incision, commissurotomy and fenestration is determined by the minimal age-related acceptable mitral valve diameter to avoid mitral stenosis. Postoperative echocardiography showed absence or minimal MI, except for a one-month old infant whose MI was progressive and underwent MV replacement using a 14 mm biological prosthesis but died a week postoperatively. Another 4 month-old infant underwent repeat MV reconstruction a month after the initial repair, but severe MI persisted, hence underwent replacement with mechanical valve 2 weeks later and survived. During the 19-year follow-up, 5 patients with hammock valves and one with parachute valve underwent repeat MV reconstruction. A 7-month-old infant died of unknown cause 5 years after the initial repair. Freedom from reoperation was 60% and survival rate was 83.4%. Age less than 1 year proved to be a high-risk factor for reoperation and mortality (p = 0.00).

CONCLUSIONS: In children with parachute and hammock valves, surgical repair offered a satisfactory functional outcome during the long-term follow-up. Repeat MV repair may be necessary during the course of follow-up. Infants have a greater risk for reoperation and mortality.

99. Preliminary Experience in the Use of an Extracellular Matrix As a Tube Graft: Word of Caution

Narutoshi Hibino, Patrick McConnell, *Toshiharu Shinoka, *Mark Galantowicz
Nationwide Children's Hospital, Columbus, OH

Invited Discussant: *David L. Morales

OBJECTIVE: A number of materials have been used for the repair of congenital heart disease. However an ideal material has yet to be discovered. Decellularized extracellular matrix from porcine small intestinal submucosa (CorMatrix) has been developed and commercialized as a biologic tissue substitute. This has been used for valvuloplasty, septal defect repair, or angioplasty as a patch. In this study, we demonstrate our preliminary experience using CorMatrix as a tube graft.

METHODS: From May 2012 to May 2013, a retrospective review of 13 patients who underwent cardiac surgery using CorMatrix as an interposition graft was performed (10 patients for central pulmonary artery (PA) reconstruction in comprehensive stage II surgery of hybrid procedure for hypoplastic left heart syndrome variant, 3 patients for aortic arch reconstruction in interrupted aortic arch). Chart review consisted of assessment of diagnosis, operative procedures, implant location, echocardiograms, reinterventions and pathology studies related to any explanted CorMatrix.

RESULTS: The average diameter of the original CorMatrix tube was 8.3 ± 0.7 mm in PA graft and 11.3 ± 0.6 mm in aortic graft. At a mean follow-up of 9.7 months, 9 of 10 patients who underwent central pulmonary artery reconstruction using CorMatrix tube showed progressive significant stenosis. The stenosed graft was dilated from 1.96 ± 1.47 mm to 4.66 ± 1.12 mm using catheter intervention at 4.2 ± 0.8 months after surgery. One of nine patients underwent replacement of CorMatrix tube with homograft due to severe stenosis due to neointmal hyperplasia after the placement of stent. All 3 patients who had aortic arch reconstruction with CorMatrix tube demonstrated no stenosis, no dilatation, and no aneurysm formation.

CONCLUSIONS: While angioplasty using CorMatrix as an interposition tube vascular graft is feasible and safe in aorta, high ratio of intimal hyperplasia formation with significant stenosis was found in venous circulation. Longer-term follow-up is required to assess the potential for growth of arterial conduit. CorMatrix may not be the ideal material as conduit in venous circulation to provide long-term durable outcomes.

100. Neo-Aortic Valve Regurgitation After Arterial Switch: Outcomes from a Single Center

Kai Ma, Shoujun Li, *Shengshou Hu, Zhongdong Hua, Keming Yang, Jun Yan, Hao Zhang, Qiuming Chen, Sen Zhang

Fuwai Hospital, Beijing, China

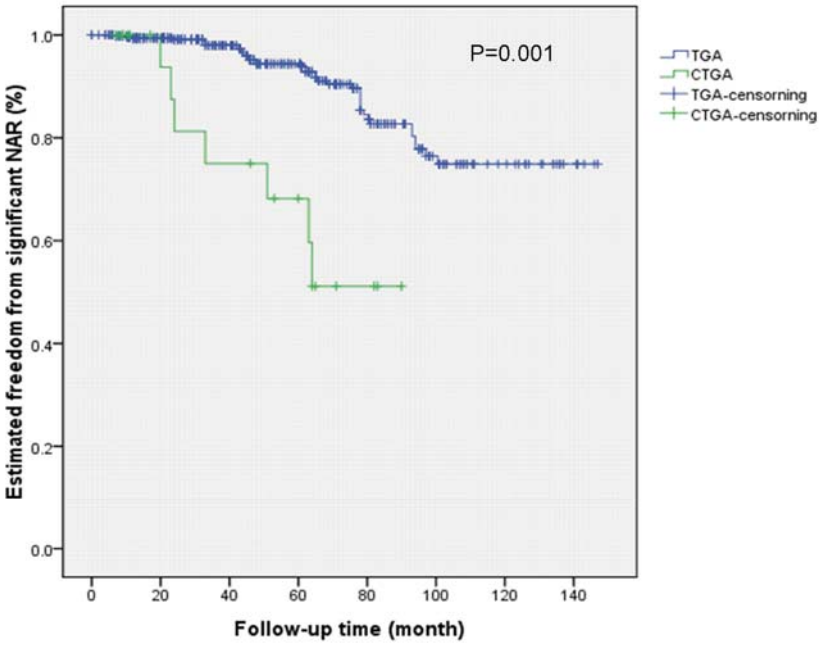
Invited Discussant:

OBJECTIVE: 1) To identify the risk factors of neo-aortic valve regurgitation (NAR) after arterial switch for patients with complete transposition of the great arteries (TGA) and corrected transposition of the great arteries (CTGA).

METHODS: From 2003 to 2013, a total of 583 patients who underwent arterial switch operation for TGA and 31 patients who underwent double switch (atrial + arterial switch) operation for CTGA at our institution were included in this retrospective study. The NAR was evaluated by color Doppler imaging and graded as "none-trivial," "mild," "moderate," or "severe" (0, 1 to 3), and was considered significant when documented as moderate or severe. Since 2011, concomitant neo-aortic sinotubular junction reconstruction was added if the aorta and pulmonary artery discrepancy (diameter ratio < 1:2) presented in patients with TGA.

RESULTS: The long-term survival rate was 92.5% (544/583) in TGA patients and 74.2% (23/31) in CTGA patients. No early postoperative significant NAR were noted in the total cohort. During the follow-up (Mean time: 46.0 ± 38.2 months) period, more NAR developed in patients with CTGA than patients with TGA (39.1% (9/23) versus 10.4% (56/539); $p < 0.001$), with a mean regurgitation level of 1.9 ± 0.8 and 1.8 ± 0.6, respectively. Moreover, the significant NAR (7.1% [38/539] vs. 26.1% [6/23]; $p = 0.010$) and the aortic valve replacement (0.6% [3/539] vs. 8.7% [2/23]; $p = 0.003$) were less in patients with TGA when compared with patients with CTGA. For TGA patients, estimated freedom from significant NAR was 99.8% at 1 year, 98.0% at 3 years and 94.4% at 5 years, respectively. In multivariate analysis for patients with TGA, previous left ventricular retraining and two great arteries diameter discrepancy were identified as risk factors for significant NAR. With the application of neo-aortic sinotubular junction reconstruction, no significant NAR was recorded in patients with two great vessels discrepancy. Respective freedom from significant NAR for CTGA patients was 100%, 75.0% and 68.2% at 1 year, 3 years and 5 years. There was no risk factor identified for significant NAR in patients with CTGA. However, all the 2 neo-aortic valve replacement in this subcategory of patient had previous morphological left ventricular retraining.

*AATS Member



CONCLUSIONS: After ASO, favorable incidence of NAR and rare neo-aortic valve replacement are documented. The failure of neo-aortic regurgitation may be related to CTGA diagnosis and previous left ventricular retraining. Patients with aorta and pulmonary artery discrepancy may benefit from neo-aortic sinotublar junction reconstruction.

101. Anatomic Variability of the Thoracic Duct in Pediatric Patients with Complex Congenital Heart Disease

Ji Hyun Bang, Chun Soo Park, Jeong-Jun Park, Tae-Jin Yun
Asan Medical Center, Seoul, Republic of Korea

Invited Discussant:

OBJECTIVE: Thoracic duct (TD) mass ligation through right thoracotomy, regardless of the sidedness of pleural effusion, is the standard procedure for the treatment of chylothorax. However, this procedure may not be successful, necessitating additional left peri-aortic mass ligation. We hypothesized that failure of right side approach may be attributable to the anatomical variation of the course of TD.

METHODS: Among the 8,880 children who underwent open heart surgery for congenital heart disease between 1992 and 2014, 70 patients (70/8,880, 0.8%) developed massive chylothorax and underwent TD mass ligation. Median age at cardiac surgery was 164 days (0 day to 70 months). Laboratory diagnosis of chylothorax was confirmed at 8.5 days (range: 2–118 days) after initial operation, and the first TD ligation was performed after a median duration of 31 days (range: 7–120 days) of medical treatment with a maximal drainage of 52 mL/kg/day (range: 14 to 259 mL/kg/day). Chylothorax resolved after right-side approach in most of patients (Group 1, n = 51) while additional left thoracotomy was required in 16 patients. In 3 patients with left chylothorax, left thoracotomy was initially performed. Thus, a total of 19 patients had left thoracotomy (Group 2). Demographic data, cardiac morphology, atrial situs, characteristics of chylous drainage, and postoperative outcomes were compared between the two groups.

RESULTS: In cardiac morphology, patients in group 2 were more likely to have dextrocardia (21.1% vs. 3.9%; p = 0.04), left isomerism (15.8% vs. 5.9%; p = 0.02), situs inversus (15.8% vs. 3.9%; p = 0.02) and abnormal great artery relationships (L-TGA, 15.8% vs. 5.9%; p = 0.02: side by side, 15.8% vs. 3.9%; p = 0.02). Incidence of right arch, right descending aorta, left superior vena cava, congenital esophageal anomaly were comparable between the two groups. There was no 30-days mortality, but 18 patients (20%) died during follow-up. Excluding 11 patients who died before chest tube removal, there was a gradual decrease in drainage after TD ligation, and chest tubes were eventually removed in 20 days (range: 4 to 79 days). After adjustment, both groups of patients showed a similar risk of death at 1 year (HR, 1.15; 95% CI [0.4–3.2]; p = 0.78). On multiple logistic regression analysis, peripheral leak syndrome (RR, 38.6; 95% CI [10.2–148.2]; p < 0.001) and postoperative low cardiac output (RR, 111.1; 95% CI [18.8–660.4]; p < 0.0.001) were identified as risk factos for death after TD ligation.

CONCLUSIONS: The course of the thoracic duct may be variable in pediatric patients with complex congenital heart disease. Left peri-aortic mass ligation should be considered in chylothorax refractory to right side TD mass ligation, especially in patients with abnormal atrial situs, dextrocardia, and great artery malposition.

*AATS Member

102. Double Outlet Right Ventricle with Non-Committed Ventricular Septal Defect

Olivier Villemain[1], Damien Bonnet[1], Mathieu Vergnat[2], Magalie Ladouceur[1], Virginie Lambert[1], Zakaria Jalal[1], Pascal Vouhé[1], *Emré Belli[2]

[1]Université Paris Descartes, Sorbonne Paris Cité, Paris, France; [2]Université Paris Sud, Le Plessis Robinson, France

Invited Discussant: *Jennifer C. Hirsch-Romano

OBJECTIVE: The management of Double Outlet Right Ventricle (DORV) associated with anatomically non-committed Ventricular Septal Defect (NCVSD) constitutes a surgical challenge. The limits for, and the specific outcomes after anatomical versus univentricular repair still remain to be established.

METHODS: Between 1993 and 2011, 35 consecutive patients presenting with DORV/NC-VSD and 2 adequately sized ventricles were included into the study at two centers forming the National Referral Center. The selection criteria included the absence of outflow tract VSD: 21 inlet (4 complete atrio-ventricular septal defect [AVSD]), 9 muscular and 5 perimembraneous. RVOTO was present in 18/35 (51%). Twenty patients had undergone 25 initial palliative procedures.

RESULTS: Anatomical repair by means of intraventricular baffle construction was performed in 23 (Group l) at a median age of 10.5 months. VSD was surgically enlarged in 11 (48%). An associated RVOT reconstruction was required in 11 and Arterial Switch Operation (ASO) was done in 5. The remaining 12 patients underwent univentricular palliative repair (Group ll). There were 4 hospital deaths (11.4%): 3 in Group l and one in Group ll ($p = .06$). 8/20 survivors of group l patients underwent 13 reoperations after a median delay of 24 months, with subaortic stenosis being the main cause for reoperation (6/8). There was one late death in group 2. At last visit, all survivors were in NYHA class l-ll. Ten years actuarial survival rate and freedom from reoperation were respectively 74.7 ± 5% and 58 ± 5 % in Group l, and, 80 ± 7% and 71 ± 7% in Group ll. Univariate analysis showed that AVSD and/or isolated mitral cleft were associated with death ($p = .04$) and need for reoperation ($p = .038$).

CONCLUSIONS: Despite the need for complex procedure and the high incidence of reoperation for subaortic obstruction, our results suggested the long-term advantages of anatomical repair in DORV with NCVSD. The presence of associated AVSD and/or isolated mitral cleft was the only risk factors for mortality and reoperation.

7:00 AM **GENERAL THORACIC SURGERY SIMULTANEOUS SCIENTIFIC SESSION** Room 608, WSCC

5 minute presentation, 6 minute discussion

Moderators: *Jessica S. Donington and *Sudish C. Murthy

In Case You Missed It!

Listen to a summary of the 95th Annual Meeting scientific programming from the general thoracic surgeon perspective.

*Sudish C. Murth, *Cleveland Clinic*

103. The Use of High-Risk Donors Decreases One-Year Survival in High-Risk Lung Recipients: A Review of the United Network of Organ Sharing Database

Matthew Mulligan, Pablo G. Sanchez, Charles F. Evans, Sina Rahimpour, Irina Timofte, Keshava Rajagopal, Aldo T. Iacono, June Kim, *James S. Gammie, *Bartley P. Griffith, *Si M. Pham

University of Maryland, Baltimore, MD

Invited Discussant:

BACKGROUND: There is a pressing need to increase the number of lung donors. Deviating from some standard donor criteria has allowed centers to increase donor use without compromising outcomes. Nevertheless a paucity of data exists about the decision making process on how to match grafts and recipients without compromising survival. In this report we investigated the one-year survival after waiting list registration of high and low-risk recipients that received lungs from either a low or high-risk donor. In addition we compared this outcome to recipients that were not transplanted and expired while waiting for a transplant.

METHODS: Using the UNOS dataset, we analyzed 12,822 candidates listed for lung transplantation from May 4, 2005 to December 31, 2012. We identified high-risk donors by using multivariate Cox proportional-hazard regressions. A high-risk donor was defined as: PaO_2 ≤300 and history of smoking ≥20 pack years, diabetes, or PaO_2 ≤300 and donor age ≥55 years old. High-risk recipients were defined as LAS ≥60 and age ≥55. Donors and recipients that did not match these criteria were considered low risk. Our primary outcome was one-year survival after waiting list registration. We also investigated one-year survival after transplant. We used Kaplan-Meier curves to assess survival.

RESULTS: 62.8% (N = 8,047) of the recipients were transplanted within one year after being placed on the wait list. 11.5% (N = 923) received high-risk donors. No significant difference between transplants with low or high-risk donors were detected in recipient diagnosis, LAS scores, single lung transplants, total ischemic time, and time on wait list. After wait list registration, one-year survival in low-risk recipients was not compromised by being transplanted with either low- or high-risk donors (0.911 vs. 0.922; p = 0.527) but was significantly better than not being transplanted (0.743; p = 0.0001;

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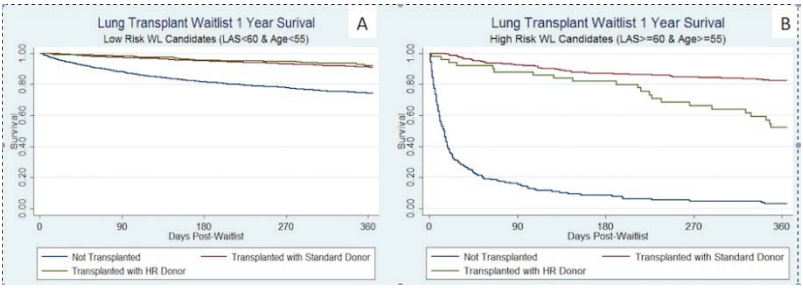
Figure A). One-year post wait list registration survival was significantly lower in high-risk recipients who received high-risk donors compared to high-risk recipients transplanted with low-risk donors (0.522 vs. 0.823; p = 0.0001). Nevertheless high-risk recipients receiving high-risk donors had a better survival than not being transplanted (0.031; p = 0.0001; Figure B). We did not detect significant differences in one-year post-transplant survival in low-risk recipients receiving either low or high-risk donors (0.890 vs. 0.883; p = 0.872). One-year post-transplant survival was lower for high-risk recipients receiving high-risk donors versus high-risk recipients receiving low-risk donors (0.806 and 0.526; p = 0.0001).



CONCLUSIONS: The use of high-risk donors is only associated with decreased one-year survival in high-risk recipients. Transplantation using high-risk donors yielded significantly better one-year post-registration survival over no transplantation, even in high-risk recipients.

104. Safety, Efficacy, and Durability of Lung Volume Reduction Surgery: A 10-Year Experience

Mark E. Ginsburg, Byron M. Thomashow, William M. Bulman, Patricia A. Jellen, Beth A. Whippo, Cody Chiuzan, Dan Bai, *Joshua Sonett

Columbia University, New York, NY

Invited Discussant: *Malcom M. DeCamp

OBJECTIVE: The National Emphysema Treatment Trial (NETT) validated the efficacy of lung volume reduction surgery (LVRS) in select patients with advanced emphysema. However, concerns about the safety and durability of the operation have limited its clinical application. We evaluated our ten-year experience with LVRS since Centers for Medicare and Medicaid Services (CMS) approval with respect to surgical morbidity and mortality, early and late functional outcomes, and long-term survival in order to better define its current role in the treatment of emphysema.

METHODS: Retrospective analysis was performed on 91 patients who were consented for bilateral LVRS at our institution between 1/2004 and 6/2014. All patients were also consented for inclusion in the LVRS Registry clinical database and data was collected prospectively. LVRS candidates were selected according to CMS inclusion/exclusion criteria and all patients were either NETT group 1 or 2. Two surgeries were limited to a unilateral procedure in the OR. Of the 89 bilateral procedures performed, 88% were VATS and 12% median sternotomy. VATS was used exclusively in all patients since 3/2006. The primary outcomes analyzed were 6-month surgical mortality and overall survival at 1, 2, and 5 years. Secondary outcomes (forced expiratory volume in one second (FEV_1) residual volume (RV), carbon monoxide diffusing capacity ($DLCO_2$), 6-minute walk, exercise capacity (maximal workload), and USCD Shortness of Breath questionnaire total score) were analyzed for mean change from baseline at 1, 2, and 5 years. post LVRS.

RESULTS: The 6-month all-cause surgical mortality rate was 0%. Baseline data: FEV1 (% predicted) 25.8 ± 6.2, RV (% predicted) 214.0 ± 42.0, DLCO (% predicted) 28.6 ± 7.2, and maximal workload (W) was 37.6 ± 19.9. The one, two, and five-year FEV1 (% predicted) post-LVRS respectively was 36.7 ± 12.9, 33.2 ± 11.1, and 36.0 ± 9.5; and the maximal workload (W) was 49.1 ± 17.5, 44.4 ± 17.4, and 45.0 ± 18. Overall survival (95% CI) for the group was: 0.99 (0.96–1.00) at 1 yr., 0.97 (0.93–1.00) at 2 years., and 0.80 (0.68–0.91) at 5 years. Only 12 of the 20 late deaths were due to pulmonary causes.

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	Follow-up		
Eligible Subjects	**1 year (10-18mo) N=78**	**2 year (19-30mo) N=72**	**5 year (49-72mo) N=45**
FEV_1-% of predicted value change Mean (95%CI)	10.8 (8.2, 13.4) P<0.0001	8.7 (6.1, 11.4) P<0.0001	10.6 (6.8, 14.5) P<0.0001
Follow-up N (%)	56 (71.8)	41 (56.9)	19 (44.2)
RV-% of predicted value change Mean (95%CI)	-62.7 (-70.9, -54.5) P<0.0001	-65.3 (-78.1, -52.6) P<0.0001	-91.7 (-107.2, -76.1) P<0.0001
Follow-up N (%)	56 (71.8)	40 (55.6)	19 (44.2)
$DLCO_c$-% of predicted value change Mean (95%CI)	5.3 (3.1, 7.5) P<0.0001	6.4(1.5, 11.3) P=0.0115	3.8 (0.1, 7.5) P=0.0440
Follow-up N (%)	56 (71.8)	40 (55.6)	19 (44.2)
Maximal workload-W change Mean (95%CI)	10.2 (6.4, 13.9) P<0.0001	7.6 (2.8, 12.4) P=0.0027	9.4 (3.6, 15.2) P=0.0033
Follow-up N (%)	52 (66.7)	38 (52.5)	18 (40.0)
Distance walked in 6min-ft change Mean (95%CI)	126.3 (73.8, 178.8) P<0.0001	125.3 (63.5, 187) P=0.0002	-75.8 (-235.3, 83.6) P=0.3309
Follow-up N (%)	56 (71.8)	40 (55.6)	19 (44.2)
UCSD Shortness of Breath score change Mean (95%CI)	-27.4 (-35.5, -19.4) P<0.0001	-22.2 (-31.7, -12.7) P<0.0001	-20.5 (-37.3, -3.8) P=0.0192
Follow-up N (%)	49 (63.6)	38 (53.5)	19 (44.2)

CONCLUSIONS: LVRS is a safe operation given proper patient selection. Early functional measurements are consistent with significant clinical benefit. Long-term results demonstrate that these improvements are durable. Surgical LVRS continues to represent the standard for lung volume reduction therapy.

105. Predictors of Prolonged Air Leak After Lung Resection

Sonam Maghera[1], Elham Sabri[2], Sudhir Sundaresan[2], Patrick James Villeneuve[2], Andrew Seely[2], Farid Shamji[2], Donna Maziak[2], Sebastien Gilbert[2]

[1]University of Ottawa, Ottawa, ON, Canada; [2]Ottawa Hospital, Ottawa, ON, Canada

Invited Discussant: *Philip A. Linden

OBJECTIVE: Prolonged air leak after lung resection is an affliction that increases the burden of care for the patient and for the health care system in general. Predictive models of prolonged air leak have relied on information that is not available preoperatively (e.g: extent of resection, pleural adhesions, air leak flow). Our objective was to construct a simple model to estimate the risk of prolonged air leak using preoperative factors exclusively.

METHODS: From April 2012 to June 2014, data was prospectively collected on consecutive patients undergoing elective pulmonary resection. Planned pneumonectomy patients (n = 16), patients who declined to participate (n = 10), and those with missing data (n = 4) were excluded. Air leak status was documented daily by a thoracic resident and/or thoracic surgeon. Prolonged air leak was defined as lasting >7 days and requiring hospitalization. Factors with a significant impact ($p < 0.2$) on the primary outcome were identified by univariate logistic regression. In a forward stepwise approach, variables were entered in a multivariate model until performance characteristics were optimized. Regression coefficients were used to develop a weighted scoring system for the risk of prolonged air leak.

RESULTS: Of 226 included patients, 8.4% (19/226) developed a prolonged air leak. Patient characteristics are summarized in the table that follows. A prolonged air leak was associated with: male gender ($p = 0.02$), smoking ($p = 0.04$), BMI ≤ 25 ($p = 0.08$), MRC dyspnea score >1 ($p = 0.03$), and DLCO% <80 ($p = 0.03$). These factors were selected for inclusion in the model. Weighted scores were assigned to each variable: male gender (1 point), BMI ≤25 (0.5 point), smoker (2 points), DLCO <80% (2 points), MRC Dyspnea >1 (1 point). The area under the receiver operating characteristic curve was 0.83 [95% CI = 0.74–0.90]. (See figure) Using different score thresholds, the sensitivity and specificity of the model were: > 3.5 points (sensitivity = 0.95 [95% CI = 0.72–0.99], specificity = 0.51 [95% CI = 0.44–0.58]), >4 points (sensitivity = 0.84 [95% CI = 0.59–0.96], specificity = 0.65 [95% CI = 0.58–0.71]), >4.5 points (sensitivity = 0.74 [95% CI = 0.49–0.90], specificity = 0.76 [95% CI = 0.69–0.81]). The corresponding false-positive rates for each cutoff are: 49% [95% CI = 42%–56%], 35% [95% CI = 29%–42%], and 24% [95% CI = 19%–31%].

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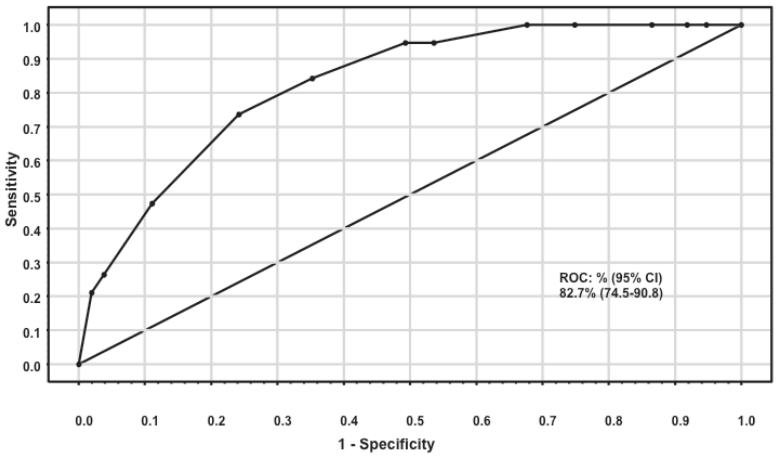
Table: Patient Characteristics of Those With and Without a Prolonged Air Leak ± SD (n = 226)

Variables	Air Leak ≤7 Days (n = 207)	Air Leak > 7 Days (n = 19)	p-Value
Age	65 ± 10.49	66 ± 11.86	0.84
BMI	28 ± 5.55	24 ± 2.98	<0.01
FEV1%	81 ± 23.16	78 ± 18.09	0.56
FVC/FEV1%	66 ± 17.82	62 ± 10.06	0.14
DLCO%	71 ± 21.34	63 ± 23.52	0.12
Gender (Male)	80 (38.1)	13 (65)	0.02
Smoker (Yes)	146 (69.52)	20 (100)	<0.01
MRC Dyspnea Score (> 1)	39 (18.57)	8 (40)	0.04
Anatomic vs. Non-Anatomic Resection	145 (69.05)	17 (85)	0.14

Figure 1: ROC curve for developed model.



CONCLUSION: Whether or not a patient will develop a prolonged air leak after lung resection can be effectively predicted using widely available preoperative factors. This scoring system is clinically relevant to the informed consent process, and allows preoperative patient selection for interventions (e.g., sealants, staple line buttressing) aimed at mitigating the risk of prolonged air leak. An air leak score >4 points offers the best compromise between sensitivity and false-positive rate.

106. Proportion of Newly Diagnosed Non-Small Cell Lung Cancer Patients That Would Have Been Eligible for Lung Cancer Screening

Geena Wu, Leanne Goldstein, Jae Y. Kim, Dan J. Raz

City of Hope National Medical Center, Duarte, CA

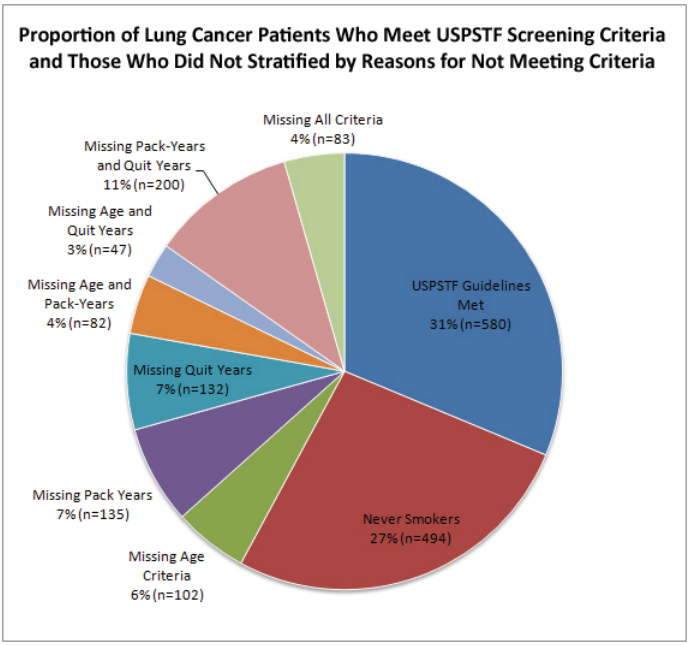
Invited Discussant: *Raja M. Flores

OBJECTIVE: The U.S. Preventative Services Task Force recommends lung cancer screening (LCS) with low-dose computed tomography (LDCT) for patients aged 55–80 who have at least a 30 pack-year history of smoking and quit within 15 years if they are former smokers. We set out to estimate the proportion of non-small cell lung cancer (NSCLC) cases that may have been detected by LCS using these criteria.

METHODS: 1,855 patients with NSCLC treated between 2004 and 2014 were identified through our institution's cancer registry. Smoking status, pack-years, and number of years quit were ascertained using a combination of text-mining of the electronic medical record and chart review. Patients with unknown smoking status were excluded from analyses. The number of years quit was referenced from the date of lung cancer diagnosis. All other clinical characteristics were available in the cancer registry. The proportion of patients meeting all three criteria for LCS eligibility and each individual criterion were determined and stratified by cancer stage, sex, and race. Significant differences were assessed using the Chi-Square test.

RESULTS: In our cohort, 28.3% (n = 525) were current, 45.1% (n = 836) were former, and 26.6% (n = 494) were never-smokers. Early stage (stage I–IIIa) patients consisted of more former smokers (n = 306, 51.0%) and fewer never-smokers (n = 117, 19.5%) than late stage (IIIb–IV) patients (41.2% and 29.7%, respectively; $p < .0001$). Women were more often never smokers than men (36.8% vs. 15.9%; $p < .0001$). In addition, Asian patients and Hispanics were most often never smokers (51.3% and 45.1%). Overall, 31.3% (n = 580) of patients in our cohort met USPSTF criteria for LCS. Among current and former smokers, 76.9% (n = 1,047) were between 55–80 years old, median pack-years was 40 (IQR 20–50), and 63.3% (n = 861) had a ≥30 pack-year smoking history. Among former smokers, 44.7% (n = 374) had quit within 15 years of diagnosis. Current smokers were more likely to meet screening criteria than former smokers (67.4% vs. 27.0%; $p < .0001$). Among 951 women, 25.7% of cases met all USPSTF criteria for LCS, and among the 375 female former smokers, 43.7% had quit within 15 years. Only 16.2% (n = 57) of Asians and 23.6% (n = 43) of Hispanics with NSCLC met USPSTF criteria, compared with 37.0% (n = 457) of Whites and 26.9% (n = 21) of Blacks with NSCLC ($p < .0001$).

*AATS Member



CONCLUSIONS: Less than one third of patients with NSCLC treated at our institution would have been eligible for LCS with LDCT. Former smokers were more likely to not meet screening criteria when compared to current smokers, perhaps due to less than half of former smokers meeting the quit year requirement. An evidence-based analysis of the utility of the "quit within 15 year" criterion is needed. Additional research is needed to identify high risk populations outside of existing USPSTF guidelines, particularly among women, Asians, and Hispanics.

Artificial Lung and Ambulatory ECMO

*Joseph B. Zwischenberger, *University of Kentucky*

107. Is Costly Surveillance Indicated for Indolent Causes of Cancer? The Carcinoid Story

Christopher Bariana, Siva Raja, Daniel P. Raymond, *Eugene H. Blackstone, *Sudish C. Murthy

Cleveland Clinic, Cleveland, OH

Invited Discussant: *John C. Wain

OBJECTIVE: Bronchopulmonary carcinoids are rare and slow growing malignancies that account for less than 3% of lung cancers. This study seeks to further characterize cardinoids' behavior and prognosis after resection and questions the relevance of costly post-resection surveillance for recurrence.

METHODS: From 2006 to 2013, 708 patients underwent lung resection for non-small-cell lung cancer (NSCLC; n = 652) and bronchopulmonary carcinoids (n = 56). The carcinoid cohort was assessed for the effect of clinical presentation, subtype, stage, and tobacco use on survival and recurrence. Additionally, surveillance methods were reviewed for effectiveness.

RESULTS: Carcinoid patients presented at a young age (mean: 51 ± 15 years) and with normal spirometry regardless of smoking status (forced 1-second expiratory volume, 88% ± 19% for never-smokers vs. 87% ± 16% for smokers). Forty-eight of 56 patients underwent a lobectomy--11 sleeve resections and 7 bilobectomies. The majority of carcinoids were of the typical (52/56, 93%) rather than atypical (4/56, 7%) subtype. Staging from pathology was unaffected by smoking status. Eight of 56 patients had positive lymph nodes at resection (13% of the typical and 25% of the atypical subtype). One recurrence was an atypical carcinoid in an individual without lymph node involvement at resection. Twenty of 56 patients were screened postoperatively with bronchoscopy, which revealed no recurrences. 144 follow-up computed tomography (CT) scans were performed on 53 of 56 subjects, and only 1 recurrence (1.8%) of an atypical carcinoid (described in previous text) was observed at 2.5 years after resection. There were no typical carcinoid recurrences identified by any post-resection surveillance technique.

CONCLUSIONS: Bronchopulmonary carcinoids are a different entity from NSCLC and have low recurrence and mortality risks independent of smoking status. Appreciating their indolent nature, following complete resection of typical carcinoids, it is hard to justify aggressive surveillance. Perhaps late CT scans at 5-year intervals might be reasonable and more cost effective.

*AATS Member

108. A Propensity-Matched Study of Lobectomy Versus Segmentectomy for Radiologically Pure Solid Small-Sized Non-Small Cell Lung Cancer

Terumoto Koike[1], Seijiro Sato[1], Takehisa Hashimoto[1], Tadashi Aoki[2], Teruaki Koike[2], Katsuo Yoshiya[2], Shin-chi Toyabe[1], Masanori Tsuchida[1]

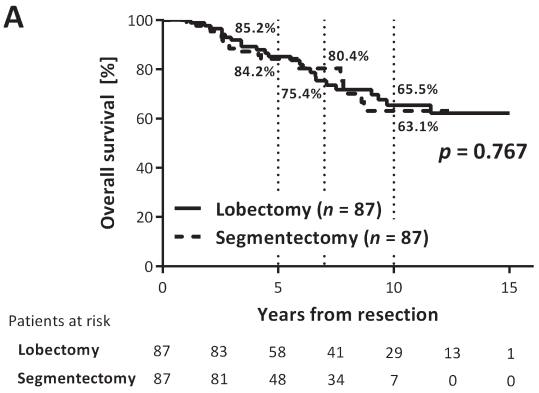
[1]Niigata University, Niigata, Japan; [2]Niigata Cancer Center Hospital, Niigata, Japan

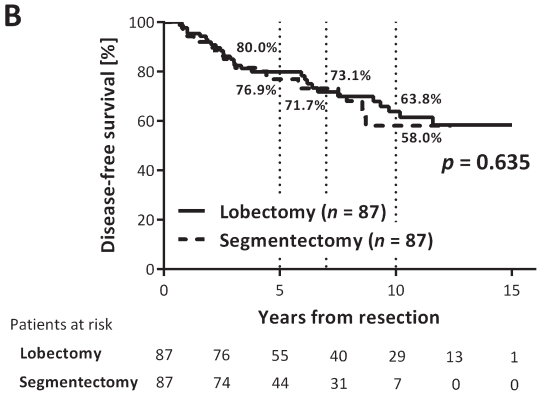
Invited Discussant: *Matthew J. Schuchert

OBJECTIVE: Numerous studies have documented strong correlations between radiological characteristics of pure ground-glass nodule (GGN) or part-solid GGN, and adenocarcinoma in situ and minimally invasive adenocarcinoma of lung. Many studies of intentional limited resection for non-small cell lung cancer (NSCLC) addressed these subtypes of tumors, and excellent surgical outcomes were demonstrated. However, the indications for limited resection of radiologically pure solid NSCLC are still controversial due to its invasive pathological characteristics, such as the high frequency of pathological lymph node metastasis and relatively poorer outcome following surgical treatment. This study was performed to compare the outcomes following lobectomy and segmentectomy in NSCLC patients with radiologically pure solid NSCLC.

METHODS: We retrospectively reviewed 251 patients with radiologically pure solid cT1a N0 M0 NSCLC who underwent lobectomy or segmentectomy. Preoperative characteristics of the patients treated with the two operative techniques were matched using propensity score methods. Overall survival (OS) and disease-free survival (DFS) curves were compared using the log-rank test, and differences in survival were also evaluated by the McNemar test. The preoperative factors and surgical procedure were analyzed with the multivariate Cox proportional regression model to identify independent predictors of poor OS and DFS.

RESULTS: Of the 251 patients, lobectomy was performed in 151 patients, and segmentectomy was performed in 100 patients, and patients who underwent lobectomy showed a higher preoperative serum carcinoembryonic antigen (CEA) level. After adjustment for propensity scores, 87 patients were selected from each group, and preoperative characteristics including CEA were balanced among the patients who underwent lobectomy or segmentectomy. In the propensity score-matched lobectomy and segmentectomy group, the 5-year and 10-year OS rates were 85% versus 84% and 66% versus 63%, respectively (Figure A), and the 5-year and 10-year DFS rates were 80% versus 77% and 64% versus 58%, respectively (Figure B). There were no significant differences between the two groups in OS or DFS by log-rank test, and also no significant differences in 3-year, 5-year, or 7-year OS or DFS by the McNemar test. By the multivariable analysis, although age, smoking status, pulmonary function, and CEA were identified as significant independent predictors of both OS and DFS, the surgical procedure was not identified.





CONCLUSIONS: Even though postoperative survival in patients with radiologically pure solid small-sized NSCLC should be poorer than in those with radiological characteristics of pure GGN and part-solid GGN, similar oncological outcomes following lobectomy and segmentectomy were indicated even among patients with radiologically pure solid small-sized NSCLC.

*AATS Member

109. In the Modern Era, Single Lung Transplantation from Diabetic Donors Is Associated with Increased Mortality

Vishnu Ambur, Sharven Taghavi, Senthil Nathan Jayarajan, Sagar Kadakia, Huaqing Zhao, Akira Shiose, Grayson Wheatley, III, *Thomas Sloane Guy, *Yoshiya Toyoda
Temple University, Philadelphia, PA

Invited Discussant: *David P. Mason

OBJECTIVE: There are no studies investigating the effect of diabetic donors in lung transplantation. We attempt to determine if single lung transplantation (SLT) with lungs from diabetic donors is associated with increased mortality in the modern era of the Lung Allocation Score (LAS).

METHODS: The United Network for Organ Sharing (UNOS) database was queried for all adult, single lung transplant recipients from 2006–2014. Patients receiving a donor lung from a diabetic donor were compared to those receiving a transplant from a non-diabetic donor. Multivariate Cox regression analysis using variables associated with mortality were used to examine survival.

RESULTS: There were 4,278 single lung transplant recipients with 3,968 (92.8%) from non-diabetic donors and 310 (7.2%) from diabetic donors. The recipient characteristics from the two groups were not significantly different with regard to age (62.1 vs. 62.6; p = 0.22), male gender (2546 (64.2%) vs. 184 (59.3%); p = 0.09), body mass index (26.3 vs. 26.3; p = 0.87), pre-transplant serum creatinine (0.9 vs. 0.9 mg/dL; p = 0.10), Lung Allocation Score (40.1 vs. 41.4; p = 0.12), ischemic time (4.2 vs. 4.2 hours; p = 0.84) and FEV1 (42.3% vs. 42.8%; p = 0.71). The recipients of diabetic donors were more likely to be race matched (1,683 [42.4%] vs. 151 [48.7%]; p = 0.03). The diabetic donor group were older (33.6 vs. 45.8; p < 0.001), less likely to be male (2,506 [63.2%] vs. 161 [51.9%]), and less likely to be Caucasian (2,435 [61.4%] vs. 162 [52.3%]; p = 0.002). The diabetic donor group also had a higher BMI (25.5 vs. 28.2; p < 0.001) and higher pre-transplant serum creatinine (1.25 vs. 2.1 mg/dL; p < 0.001). Outcomes in recipients of diabetic donors showed increased length of stay (19.9 vs. 25.6 days; p = 0.013) and a higher incidence of post-transplant airway dehiscence (34 [0.86%] vs. 7 [2.3%]; p = 0.02). There was no difference between groups with respect to acute rejection episodes (375 [9.5%] vs. 21 [6.8%]; p = 0.3), stroke (53 [1.3%] vs. 4 [1.3%] p = 0.11), and dialysis (139 [3.5%] vs. 8 [2.6%]; p = 0.64). On multivariate analysis receiving a single lung transplant from a diabetic donor was associated with increased mortality (HR, 1.28; 95% CI [1.07–1.54]; p = 0.007). Recipient age was also associated with increased mortality. Recipient female gender and race match were associated with improved mortality (see Table).

Table: Multivariate Cox Regression Analysis of Survival

COVARIATE	HR	95% CI	p-Value
Diabetic donor	1.28	1.07–1.54	0.007
Recipient female gender	0.88	0.79–0.97	0.011
Recipient age	1.026	1.018–1.033	<0.0001
Race match	0.97	0.82–0.998	0.047

CONCLUSIONS: Single lung transplantation using diabetic donors results in worse survival and post-transplant outcomes.

110. Black Patients Die Earlier After Surgery for Esophageal Cancer

Andrea S. Wolf[1], Emanuela Taioli[2], Marlene Camacho-Rivera[2], Andrew Kaufman[1], Dong-Seok Lee[1], Faiz Bhora[1], *Raja Flores[1]

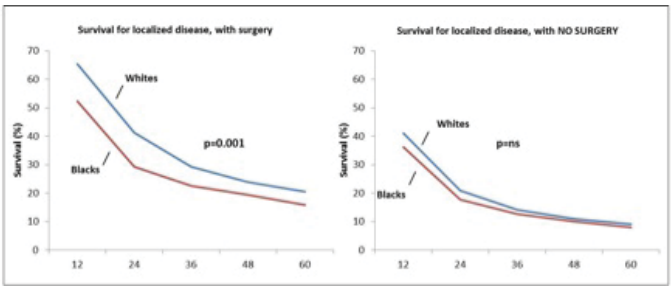
[1]*Mount Sinai Medical Center, New York, NY;* [2]*North Shore/LIJ/Hofstra School of Medicine, New York, NY*

Invited Discussant:

OBJECTIVE: Black patients with esophageal cancer have higher mortality rates than whites. Studies have suggested that differential rates of surgery for Black and White patients may explain the survival difference. We explored the Survival Epidemiology and End Results (SEER) database to determine the impact of surgery on survival in Blacks and Whites with esophageal cancer.

METHODS: The SEER database was analyzed from 1973 to 2011 to identify all cases of pathologically-proven local and regional adenocarcinoma and squamous cell carcinoma of the esophagus. Patients with cervical esophageal cancer were excluded. Age, sex, diagnosis year, stage, cancer-directed surgery, radiation, and vital status were analyzed according to self-reported race (Black or White). The association between prognostic factors and survival was estimated using a Cox proportional hazards model.

RESULTS: There were 14,170 White and 2,925 Black patients. The number of new cases annually was 1.9 per 100,000 Whites and 3.9 per 100,000 Blacks (age adjusted; $p < 0.0001$). Blacks were younger ($p < 0.0001$), more likely to have squamous histology ($p < 0.0001$), and experienced lower survival, with mean survival for Blacks of 20 months compared to 28 months in Whites ($p < 0.0001$). Mortality was higher in Blacks even after adjustment for age, sex, stage, histology, and therapy (HR, 1.15; 95% CI [1.07–1.24]). Surgery was an independent predictor of survival (HR, .39; 95% CI [.35-.42]). When patients with localized disease were stratified by surgery and race, the racial disparity in survival persisted only among those who underwent surgery, and most prominently at the first year postoperatively (see Figure).



CONCLUSIONS: Independent of confounders, including surgery, Black patients with esophageal cancer experience lower survival. Although surgery appears to reduce mortality, early survival postoperatively is lower for Blacks, suggesting that the type of surgery they are receiving is increasing their mortality. Investigation into racial disparities in access to experienced and qualified surgeons and centers performing esophagectomy is warranted to reduce racial differences in survival.

111. Locally Advanced Esophageal Cancer: What Becomes of Five Year Survivors?

Galal R. Ghaly, *Brendon M. Stiles, Mohamed Kamel, Abu Nasar, *Jeffrey Port, *Paul C. Lee, *Subroto Paul, *Nasser K. Altorki

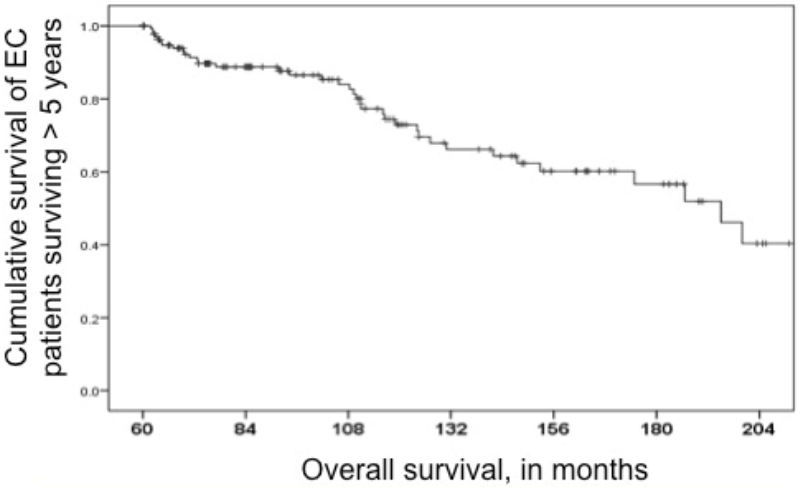
Weill Cornell Medical College, New York, NY

Invited Discussant: *Steven R. DeMeester

OBJECTIVE: Despite advances in multimodality therapy, locally advanced esophageal cancer (EC) is often a fatal disease. It is unclear whether EC patients who reach the 5-year survival milestone are cured of the disease. We sought 1-to define predictors of 5-year survival 2-to determine outcomes in these patients after 5 years and 3-to determine predictors of death after 5-year time point.

METHODS: We performed a retrospective review of a prospective database (January 1988 to September 2009). Patients with cT2N0 disease or higher were reviewed and clinico-pathologic data reviewed. Univariate predictors of survival above 5 years were explored by logistic regression model. Among 5-year survivors, we then further evaluated predictors of death.

RESULTS: Among 500 patients, we performed 356 (72.2%) esophagectomies on patients with cT2N0 disease or higher. Of these, median age = 64, 280 (79%) were males, 246 (69%) had adenocarcinoma, and 179 (50%) received neoadjuvant therapy. Among patients not receiving neoadjuvant therapy, final pathologic stages were I (6%), II (13%), III (30%), and IV (1%). Among patients with neoadjuvant therapy, final pathologic stages were yp0 19 (5%) patients had CPR, ypI (6%), ypII (12%), ypIII (26%), ypIV (1%). Recurrent EC developed in 192 patients. Among patients that recurred, 101 recurred in the first year (53%), 45 (23%) patients recurred in year 2, 27 (14%) in year 3, 7 (4%) in year 4, 4 (2%) in year 5, and 8 (4%) after year 5. 146 (41%) of patients survived a minimum of 5 years. Median follow-up of these patients after 5 years was 34 months. Overall survival was 89% at 7 years, 73% at 10 years, and 57% at 15 years. Interestingly, despite being at least 5 years from resection, tumor factors were still the most significant predictors of recurrence or death. On univariate analysis pT3-4 classification (OR, 3.23; CI 1.41–7.39) and pN+ (OR, 2.81; [CI 1.39–5.68]) predicted poor survival. On multivariate analysis, only positive pathologic N (OR 2.38; CI 1.07–5.26) significantly predicted delayed recurrence or death. For the entire cohort (n = 356), independent predictors by multivariable analysis for long term survival to at least 5 years were good performance status (0 vs. ≥1; OR, 1.87; CI [1.13–3.07]), en bloc resection (OR, 2.03; CI [1.08–3.82]), the absence of nodal metastases (OR, 2.86; CI [1.64–4.99]), and R0 resection (OR, 6.59; CI [1.47–29.51]).



At risk	5 years	7 years	10 years	12 years	15 years
	146	90	46	34	16

CONCLUSIONS: Despite what is often described as a therapeutic nihilism for patients with locally advanced EC, a relatively high proportion of these patients (41%) survive to reach the 5-year milestone. Predictors of survival to 5 years include good performance status, the absence of pathologic nodal disease, and an enbloc resection, complete resection. Following 5 years, only a small proportion of EC patients continue to be at risk for recurrence. The presence of pathologic nodal disease remained a predictor of death even in these patients.

*AATS Member

112. Post-Induction PET Mediastinal Activity Does Not Predict Persistent Nodal Disease or Overall Survival in Patients with Stage IIIA-N2 Lung Cancer

R. Taylor Ripley, Kei Suzuki, Camelia S. Sima, *Manjit Bains, *Prasad Adusumilli, James Huang, David J. Finley, *Bernard J. Park, *Robert J. Downey, *Nabil P. Rizk, *Valerie W. Rusch, *David R. Jones

Memorial Sloan-Kettering Cancer Center, New York, NY

Invited Discussant: *Arjun Pennathur

OBJECTIVE: Induction therapy is often recommended for clinical stage IIIA/pN2. Post-induction N2 nodal downstaging has been suggested by some to be a predictor of improved overall survival (OS). We sought to determine whether post-induction PET scans could predict pathological downstaging and OS for cIIIA/pN2 patients.

METHODS: We performed a retrospective review of prospectively-maintained, single-institution database (January 1, 2007 to December 31, 2012) of patients treated with induction chemotherapy for cIIIA/pN2 disease. Patients with induction chemoradiotherapy, synchronous tumors, superior sulcus tumors, lack of invasive mediastinal staging, or neuroendocrine tumors were excluded. No patient had mediastinal restaging prior to resection.

RESULTS: 101 consecutive patients had confirmed pN2 NSCLC prior to induction chemotherapy (Table 1). 30- and 90-day mortalities were both 2% (2). Tumor histologies were adenocarcinoma 76% (77/101), squamous cell carcinoma 15 % (15/101), or other 9% (9/101).

Pre- and post-induction PET scans were obtained in 99% (100/101) and 81% (82/101) of patients, respectively. The mean pre- and post-induction T SUVmax were 11.3 (±6.6), and 6.9 (±5.1), respectively. The mean pre- and post-induction N SUVmax was 7.2 (±4.2) and 4.9 (±4.1) for patients with residual mediastinal avidity. Downstaging occurred in 35% (35/101 < ypIIIA; Table 1). Seven (7/100) of pre-induction N stations were non-avid which increased to 45% (37/82) after induction therapy. Fifty-one percent (19/37) with non-avid mediastinal disease had persistent ypN2 disease. Of 28 patients with ypN0, 1 and pre-induction PET N2 avidity, 50% (14/28) had residual PET N2 nodal avidity and 50% (14/28) did not. Persistent ypN2 disease was present in 59% (60/101).

Actuarial 5-year OS for the entire cohort was 44%. The 5-year OS for < ypIIIA and ≥ypIIIA were 46% and 52%, respectively ($p = 0.81$). The 5-year OS of ypN0, 1, or 2 were 45%, 50%, and 52%, respectively (p = NS). In the patients with calculated post-induction SUVmax (n = 73/101; 72%), the 5-year OS with or without residual PET avidity in mediastinal nodes were 50% and 56%, respectively ($p = 0.35$). A decrease in the SUV of T or N descriptors, resolution of mediastinal SUV, or sterilization of N2 disease were not predictive of OS; adenocarcinoma histology was the only significant adverse prognostic factor.

Characteristics	No. (%)
Female Sex	49 (49)
Age at Operation (yr, median ± SD)	65.2 ± 9.1
Smoking status:	
Former	73 (72)
Current	10 (10)
Never	18 (18)
Pulmonary Function Testing	
Median FEV1	87 ± 15.9%
Median DLCO	77 ± 20.0%
Operation	**No. (%)**
Lobectomy/Bilobectomy	83 (82)
Pneumonectomy	8 (8)
Other	10 (10)
Resection	
R0	85 (84)
R1	9 (9)
R2	7 (7)
Post-Induction Pathological Stage (yp)	
0	2 (2)
IA	13 (13)
IB	11 (11)
IIA	4 (4)
IIB	5 (5)
IIIA	59 (58)
IIIB	3 (3)
IV	2 (2)

CONCLUSIONS: In our series, patients undergoing induction chemotherapy followed by surgical resection had a 5-year OS of 44%. Importantly, the OS of patients with or without post-induction FDG-avid N2 disease was equivalent. These results suggest that in appropriately selected patients, persistence of post-induction mediastinal nodal FDG-avidity is not predictive of outcomes and does not warrant mediastinal restaging.

*AATS Member

9:45 AM **ADULT CARDIAC MASTERS OF SURGERY VIDEO SESSION** Room 6B, WSCC

Moderator: *Thoralf M. Sundt, III

Panelists: *Tirone E. David, *Lars G. Svensson, *Friedrich Mohr, *A. Pieter Kappetein

9:45 AM – 10:05 AM
Aortic Root Valve-Sparing Procedure
*D. Craig Miller, *Stanford University*

10:05 AM – 10:25 AM
Complex MV Repair
*David H. Adams, *Mount Sinai Medical Center*

10:25 AM – 10:45 AM
Complex Aortic Case
*Joseph S. Coselli, *Baylor College of Medicine*

10:45 AM – 11:05 AM
Complex Arterial Revascularization
*John D. Puskas, *Mount Sinai Beth Israel*

9:45 AM **CONGENITAL MASTERS OF SURGERY VIDEO SESSION** Room 612, WSCC

Moderators: *Jonathan M. Chen and *Pirooz Eghtesady

9:45 AM – 10:05 AM
Starnes Procedure
*Vaughn A. Starnes, *Keck School of Medicine*

10:05 AM – 10:25 AM
Mitral Valve Replacement in Infants with Stent Mounted Valve
Sitaram Emani, *Boston Children's Hospital*

10:25 AM – 10:45 AM
Pulmonary-Aorto Fistula (Pott's Shunt) for Pulmonary Hypertension
*Emre Belli, *Institut Jacques Cartier*

10:45 AM – 11:05 AM
Circumflex Aorta
*Carl L. Backer, *Lurie Children's Hospital*

11:05 AM– 11:15 AM
Discussion

9:45 AM **GENERAL THORACIC MASTERS OF SURGERY VIDEO SESSION** Room 608, WSCC

Moderator: *Scott J. Swanson

Panelists: *Thomas A. D'Amico, *David J. Sugarbaker, *David R. Jones

9:45 AM – 10:01 AM
VATS Pancoast
*Robert J. McKenna, *Cedars Sinai Medical Center*

10:01 AM – 10:17 AM
Robotic Bronchial Sleeve
*Robert J. Cerfolio, *University of Alabama*

10:17 AM – 10:33 AM
Minimally Invasive Esophagectomy
*James D. Luketich, *University of Pittsburgh*

10:33 AM – 10:49 AM
VATS Pneumonectomy
*Todd L. Demmy, *Roswell Park Cancer Institute*

10:49 AM – 11:11 AM
When It Doesn't Go As Expected: Intra-Op VATS Repairs
*Shanda H. Blackmon, *Mayo Clinic*

*AATS Member