

2004 ANNUAL MEETING PROGRAM



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<i>Year</i>	<i>Meeting Location</i>	<i>President</i>
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1918-1919	Atlantic City, NJ	Willy Meyer
1919-1920	New Orleans, LA	Willy Meyer
1920-1921	Boston, MA	Rudolph Matas
1921-1922	Washington, DC	Samuel Robinson
1922-1923	Chicago, IL	Howard Lilienthal
1923-1924	Rochester, MN	Carl A. Hedblom
1924-1925	Washington, DC	Nathan W. Green
1925-1926	Montreal, QUE	Edward W. Archibald
1926-1927	New York, NY	Franz Torek
1927-1928	Washington, DC	Evarts A. Graham
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1930-1931	San Francisco, CA	Ethan Flagg Butler
1931-1932	Ann Arbor, MI	Frederick T. Lord
1932-1933	Washington, DC	George P. Muller
1933-1934	Boston, MA	George J. Heuer
1934-1935	New York, NY	John Alexander
1935-1936	Rochester, MN	Carl Eggers
1936-1937	Saranac Lake, NY	Leo Eloesser
1937-1938	Atlanta, GA	Stuart W. Harrington
1938-1939	Los Angeles, CA	Harold Brunn
1939-1940	Cleveland, OH	Adrian V.S. Lambert
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1945-1946	Detroit, MI	Claude S. Beck
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1947-1948	Montreal, QUE	Alton Ochsner
1948-1949	New Orleans, LA	Edward D. Churchill
1949-1950	Denver, CO	Edward J. O'Brien
1950-1951	Atlantic City, NJ	Alfred Blalock
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1954-1955	Atlantic City, NJ	Edward S. Welles
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1957-1958	Boston, MA	Brian Blades
1958-1959	Los Angeles, CA	Michael E. DeBakey
1959-1960	Miami Beach, FL	William E. Adams
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1970-1971	Atlanta, GA	Thomas H. Burford
1971-1972	Los Angeles, C A	John W. Strieder
1972-1973	Dallas, TX	Frank Gerbode
1973-1974	Las Vegas, NV	Lyman A. Brewer, in
1974-1975	New York, NY	Wilfred G. Bigelow
1975-1976	Los Angeles, C A	David J. Dugan

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1998-1999	New Orleans, LA	Lawrence H. Cohn
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1930-1935	Duff S. Allen
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1947-1951	Brian Blades
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1923-1925	Charles Gordon Heyd
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1928-1933	Carl Eggers
1933-1939	Edward D. Churchill
1939-1946	Isaac A. Bigger
1946-1954	William E. Adams
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1963-1968	C. Rollins Hanlon
1968-1974	Paul C. Adkins

1974-1979	James R. Malm
1979-1984	Paul A. Ebert
1984-1989	Floyd D. Loop
1989-1994	William A. Gay, Jr.
1994-1999	Andrew S. Wechsler
1999-2003	Richard A. Jonas
2003-	Alec Patterson

DEVELOPING THE ACADEMIC SURGEON SYMPOSIUM

SATURDAY, APRIL 24, 2004

GRANTSMANSHIP - A WORKSHOP

North Bldg., Rm 206C, Metro Toronto Convention Centre

*Chairman: Pedro J. del Nido, Boston Children's Hospital
and Harvard Medical School*

12:00 - 1:00 p.m

12:00 noon Introduction - Pedro J. del Nido

12:10 p.m. Navigating the NIH: a primer - Gail Pearson M.D. (NHLBI)

12:35 p.m. The Grant Review Process - Ralph Damiano, M.D.

**12:55 p.m. Announcements (TSFRE, and Clinical Research Training
Program)**

DEVELOPING THE ACADEMIC SURGEON - A SYMPOSIUM

North Bldg., Ste 205, Metro Toronto Convention Centre

*Co-Chairs: Larry K. Kaiser
Robert C. Robbing*

1:00 p.m. Grantsmanship: Keys to a Successful Submission

*Pedro J. del Nido, Boston Children's Hospital and Harvard Medical
School*

1:30 p.m. From Division Chief to Physician Executive: How and Why?

Victor F. Trastek, Mayo Clinic Scottsdale

2:00 p.m. Evolving Trends in Surgical Education

Michael Cusimano, St. Michael's Hospital

2:30 p.m. Clinical Trials (and Tribulations)

*Eric A. Rose, College of Physicians and Surgeons, Columbia
University*

3:00 p.m. BREAK

**3:20 p.m. Academic Practice versus Private Practice: Is there a
Difference?**

Richard D. Prager, University of Michigan

3:50 p.m. Keynote Address

**"Managing Sleep Need, Circadian Phase, and Human
Performance: Professionalism in a 24-7 Environment**

David F. Dinges, Ph.D.

4:30 p.m. The Malpractice Mess: How to Avoid Getting Sued

Plaintiff Attorney:

Mark A. Hoffman, J.D., Kline and Specter, P.C.

Defense Attorney:

James A. Young, Esq., Christie, Pabarue, Mortensen and Young,
Attorneys-At-Law

5:00 p.m. ADJOURN

5:00 - 7:00 p.m.

General Thoracic Biology Club

Location: TBA

5:00 - 7:00 p.m.

Cardiac Surgery Biology Club

Location: North Bldg., Rm. 201E

Metro Toronto Convention Centre

SUNDAY, APRIL 25, 2004

AATS/STS ADULT CARDIAC SYMPOSIUM

North Bldg., Hall C, Metro Toronto Convention Centre

Chairman: Ralph J. Damiano Jr.

*Washington University School of Medicine,
Barnes-Jewish Hospital*

SESSION I

Recent Advances in Cardiac Surgical Intensive Care

8:00 a.m. Neurocognitive Deficits After Cardiac Surgery: Fact or Fiction

David Stump, Wake Forest University School of Medicine

8:20 a.m. New Approaches to the Treatment of Right Heart Failure in the ICU

Laureen Hill, Washington University School of Medicine, Barnes-Jewish Hospital

8:40 a.m. Recent Advances in the Treatment of Postoperative Sepsis

Eric Jacobsohn, Washington University School of Medicine, Barnes-Jewish Hospital

9:00 a.m. Heparin-induced Thrombocytopenia and Thrombosis: Pathophysiology, Diagnosis and Treatment

Ted Warkentin, McMaster University

9:25 a.m. Panel Discussion

Moderator: Eric Jacobsohn, Washington University School of Medicine, Barnes-Jewish Hospital

9:45 a.m. BREAK

SESSION II

New Developments in the Treatment of Valvular Heart Disease

10:00 a.m. The Three-Dimensional Geometry of the Mitral Valve: Implications for Surgical Therapy

D. Craig Miller, Stanford School of Medicine

10:20 a.m. Complex Mitral Valve Repair: Surgical Techniques and Long-term Results in the Repair of Rheumatic Valves

Alain Carpentier, Universite de Paris Pierre et Marie Curie

10:50 a.m. Complex Mitral Valve Repair: Surgical Techniques and Long-term Results in the Repair of Barlow's Syndrome (Bileaflet Prolapse)

Delos M. Cosgrove, III, Cleveland Clinic Foundation

11:20 a.m. Minimally Invasive Mitral Valve Repair: The Leipzig Experience

F. W. Mohr, Klinik für Herzchirurgie, Universität Leipzig

11:40 a.m. Panel Discussion

Moderator: Delos M. Cosgrove, III, Cleveland Clinic Foundation

12:00 p.m. LUNCH

SESSION III

Current Surgical Strategies for Coronary Artery Bypass Grafting: Maintaining Surgery as a Competitive Option in the Treatment of Coronary Artery Disease

12:45 p.m. All-arterial Grafting: Should Saphenous Vein Grafts Ever Be Used?

Hendrick Earner, Washington University School of Medicine

1:05 p.m. The Use of Proximal and Distal Connectors in Coronary Surgery: Clinical Results and Future Applications

Thierry Carrel, Inselspital Universitätsspital Bern

1:25 p.m. Off-pump Coronary Bypass Grafting: Midterm Results

John D. Puskas, Emory Crawford Long Hospital

1:45 p.m. Non-sternotomy Approaches to Coronary Bypass Grafting

Valavanur Subramanian, Lenox Hill Hospital

2:05 p.m. Panel Discussion

Moderator: Ralph J. Damiano, Jr., Washington University School of Medicine, Barnes-Jewish Hospital

2:30 p.m. BREAK

SESSION IV

State-of-the-Art Surgical Treatments for Congestive Heart Failure: Heart Transplantation and Its Alternatives

2:45 p.m. Heart Transplantation: Current State-of-the-Art and Future Directions

Bruce A. Reitz, Stanford University School of Medicine

3:05 p.m. The Role of Valve Repair in the Treatment of End Stage Dilated Cardiomyopathy

Steven F. Bolling, University of Michigan Hospitals and Health Centers

3:25 p.m. Ventricular Remodeling: What is its Role in Patients with Ischemic Cardiomyopathy?

Irving L. Kron, University of Virginia Health System

3:45 p.m. Ventricular Assist Devices as Destination Therapy: Where Are We Going and Can We Afford It?

Eric A. Rose, Columbia University College of Physicians & Surgeons

4:05 p.m. Pharmacological and Molecular Remodeling of the Failing Heart

Sir Magdi Yacoub, Harefield Research Foundation

4:45 p.m. Panel Discussion

Moderator: Eric A. Rose, Columbia University College of Physicians & Surgeons

**5:00 p.m. ADJOURN TO WELCOME RECEPTION
EXHIBIT HALL**

SUNDAY, APRIL 25, 2004

AATS/STS GENERAL THORACIC SYMPOSIUM

North Bldg., Constitution Hall - Room 105

Metro Toronto Convention Centre

Chairman: Mark J. Krasna, MD

University of Maryland Medical School

7:50 a.m. Welcome Remarks

Mark J. Krasna, University of Maryland Medical School

SESSION I

Lung Cancer

Moderator: David J. Sugarbaker, Brigham and Women's Hospital

8:00 a.m. Staging of Lung Cancer

Bryan F. Meyers, Washington University School of Medicine,
Barnes Jewish Hospital

8:20 a.m. How I Do It: VATS Lobectomy

Thomas A. D'Amico, Duke University Medical Center

8:35 a.m. Trimodality for NSCLC

Benedict D.T. Daly, Boston Medical Center

8:55 a.m. How I Do It: Sleeve Lobectomy

Erino A. Rendina, University of Rome La Sapienza

9:10 a.m. Chemo-Radiation Therapy Followed by Surgery for Pancoast Tumors

Mark J. Krasna, University of Maryland Medical School

9:30 a.m. How I Do It: Anterior Approach to Pancoast Tumors

Phillippe G. Darteville, Marie Lannelongue Hospital

9:50 a.m. Discussion

10:10 a.m. BREAK

SESSION II

General Thoracic Surgery Update I

Moderator: Thomas W. Rice, Cleveland Clinic Foundation

10:30 a.m. LVRS for Emphysema

Robert J. McKenna, Jr., Cedars Sinai Medical Center

10:50 a.m. How I Do It: Extrapleural Pneumonectomy for Mesothelioma

David J. Sugarbaker, Brigham & Women's Hospital

11:05 a.m. Combined Modality Therapy for Thymoma

Garrett L. Walsh, Anderson Cancer Center

11:25 a.m. How I Do It: Minimally Invasive Thymectomy

Larry R. Kaiser, Hospital of University of Pennsylvania

11:40 a.m. Molecular Biologic Staging: Where Do We Stand Today?

King F. Kwong, University of Maryland Medical School

12:00 p.m. Discussion

12:15 p.m. LUNCH

SESSION III

Esophageal Cancer

Moderator: Mark Krasna, University of Maryland Medical School

- 1:15 p.m. Staging in Esophageal Cancer**
Bruce D. Greenwald, University of Maryland Medical School and Greensboro Cancer Center
- 1:35 p.m. How I Do It: Minimally Invasive Esophagectomy for Early Stage Esophageal Cancer**
Neil A. Christie, University of Pittsburgh Medical Center
- 1:50 p.m. Management of Barretts Esophagus**
Thomas W. Rice, Cleveland Clinic Foundation
- 2:10 p.m. Trimodality for Esophageal Cancer**
Mohan Suntharalingham, University of Maryland Medical School and Greensboro Cancer Center
- 2:30 p.m. How I do It: Three Field Esophagectomy**
Nasser K. Altorki, The New York Hospital, Cornell Medical Center
- 2:45 p.m. Discussion**
- 3:00 p.m. BREAK**

SESSION IV

- General Thoracic Update II**
Moderator: Neil A. Christie
- 3:10 p.m. Resection of Chest Wall Tumors**
Peter C. Pairolero, Mayo Clinic
- 3:30 p.m. How I Do It: Laparoscopic Myotomy with Partial Fundoplication**
Claude Deschamps, Mayo Clinic
- 3:50 p.m. Management of Esophageal Perforations**
Kamal A. Mansour, Emory University Clinic
- 4:10 p.m. Management of Postresection Pleural Empyema**
Joseph I. Miller, Jr., Emory University Clinic
- 4:30 p.m. Management of Postresection Pleural Empyema**
Walter Weder, University Hospital
- 4:45 p.m. Lung Transplantation-State of the Art**
Alec Patterson, Washington University School of Medicine
- 5:00 p.m. Discussion**
- 5:15 p.m. ADJOURN TO WELCOME RECEPTION EXHIBIT HALL**

SUNDAY, APRIL 25, 2004

AATS/STS CONGENITAL HEART DISEASE SYMPOSIUM

North Bldg., Constitution Hall - Room 107

Metro Toronto Convention Centre

Chairman: James S. Tweddell

Children's Hospital of Wisconsin

- 8:00 a.m. Introduction and Welcome**
James S. Tweddell, Children's Hospital of Wisconsin

SESSION I

Strategies to Improve Survival of Patients with HLHS After Stage 1 Palliation

Moderator: Ross M. Ungerleider, Doernbecher Children's Hospital, Oregon Health Sciences University

- 8:05 a.m. Home Monitoring**
Nancy Ghanayem, Children's Hospital of Wisconsin
- 8:20 a.m. Early Bidirectional Glenn Shunt**
Robert D. B. Jaquiss, Children's Hospital of Wisconsin
- 8:35 a.m. Tricuspid Valve Repair in Patients with Hypoplastic Left Heart Syndrome: Techniques and Results**
Edward L. Bove, University of Michigan
- 8:50 a.m. RV to PA Conduit: Impact on Interstage Survival**
Christian Pizarro, Nemours Cardiac Center, Alfred I. duPont Hospital for Children
- 9:05 a.m. Transplant for Patients with a Failing Fontan**
Max B. Mitchell, University of Colorado
- 9:20 a.m. Two-Ventricle Repair for Patients Initially Palliated with a Norwood Procedure**
Peter B. Manning, Cincinnati Children's Hospital Medical Center
- 9:35 a.m. Discussion**
- 9:50 a.m. BREAK**

SESSION II

Decision Making for Patients with Unbalanced Ventricles and Hypoplastic Structures

Moderator: S. Bertrand Li twin, Children's Hospital of Wisconsin

- 10:05 a.m. Critical Aortic Stenosis -When is a Norwood Procedure Indicated and How to Manage Late Presentation of HLHS**
Gary K. Lofland, University of Missouri, Kansas City, Children's Mercy Hospital
- 10:20 a.m. Interrupted Aortic Arch: Indications and Techniques for Managing the Hypoplastic Left Ventricular Outflow Tract**
Tom R. Karl, University of California, San Francisco
- 10:35 a.m. Pulmonary Atresia Intact Septum: Selection for Single, One-and-a-Half, and Two Ventricle Pathways**
Glenn S. Van Arsdell, Hospital for Sick Children
- 10:50 a.m. Management of Unbalanced Atrioventricular Canal**
Thomas L. Spray, Children's Hospital of Philadelphia
- 11:05 a.m. Management of Transposition of the Great Arteries and Unbalanced Ventricles**
Francois G. Lacour-Gayet, Denver Children's Hospital
- 11:20 a.m. Selection of RVOT Conduits**
Joseph M. Forbess, Emory University School of Medicine
- 11:35 a.m. Discussion**
- 12:00 p.m. LUNCH**

SESSION III

Complex and Innovative Procedures

Moderator: J William Gaynor, The Children's Hospital of Philadelphia

- 1:00 p.m. Aortic Root Autograft and Arterial Switch for Management of D-TGA with LVOTO**
Pedro J. del Nido, Boston Children's Hospital
- 1:20 p.m. Repair of Tetralogy of Fallot with Absent Pulmonary Valve**

- Viktor Hraska, Children's University Hospital
- 1:40 p.m. Surgical Myectomy for the Treatment of Hypertrophic Obstructive Cardiomyopathy**
Joseph A. Dearani, Mayo Clinic
- 2:00 p.m. Off-Pump Fontan Procedure**
Frank L. Hanley, Stanford University
- 2:20 p.m. Double Switch for Congenially Corrected Transposition of the Great Vessels**
Roger B. B. Mee, Cleveland Clinic Foundation
- 2:40 p.m. BREAK**

SESSION IV

- Update on Transplantation**
Moderator: Charles B. Huddleston, St. Louis Children's Hospital, Washington University School of Medicine
- 2:55 p.m. Update on Pediatric Lung Transplantation**
Charles B. Huddleston, St. Louis Children's Hospital, Washington University School of Medicine
- 3:10 p.m. ABO Incompatible Heart Transplantation in Infants**
John G. Coles, The Hospital for Sick Children
- 3:25 p.m. Discussion**

SESSION V

- Improving Outcomes**
Moderator: James S. Tweddell, Children's Hospital of Wisconsin
- 3:35 p.m. Learning from the Bristol Affair**
James L. Monroe, Southampton General Hospital
- 3:50 p.m. Application of Human Factors Analysis to Congenial Heart Surgery**
¹Marc R. de Leval, Great Ormond Street Hospital for Children NHS Trust
- 4:05 p.m. Practical Applications of a Global Congenital Heart Surgery Outcomes Database**
Jeffrey P. Jacobs, University of South Florida, All Children's Hospital
- 4:20 p.m. Patient Safety Initiatives in Cardiac Surgery**
James Jagers, Duke University Medical Center
- 4:45 p.m. Assessing Late Outcomes**
Gil Wernovsky, Children's Hospital of Philadelphia
- 5:00 p.m. Discussion**
- 5:15 p.m. ADJOURN TO WELCOME RECEPTION EXHIBIT HALL**

¹ 1973-74 Graham Fellow

SUNDAY AFTERNOON, APRIL 25, 2004

3:00 p.m.

C. WALTON LILLEHEI RESIDENT FORUM SESSION

*North Bldg., Rm 204, Metro Toronto Convention Centre
(7 minutes presentation, 8 minutes discussion)*

Moderators: Robert C. Robbins

Ross M. Ungerleider

L1. The Sequential Contraction of the Myocardial Band

Manuel Castella*, Gerald D. Buckberg, Saleh Saleh*, Mory Gharib*; Los Angeles, CA, Pasadena, CA

OBJECTIVE: Analyse sequential contraction pathway along the myocardial band of Ton-rent Guasp's "rope-heart model" to determine if structure/function relationship exists in the *outer* shell wrapping around both ventricles, and *inner* helical apical loop containing reciprocal descending and ascending spiral segments.

METHODS: In 24 pigs, temporal contraction by sonomicrometer crystals ECG, and Millar pressure transducers followed dP/dt and intraventricular pressure. We traced trajectory contractile patterns, evaluated active suction for ventricular filling, anisotropic function, and Purkinje activation/muscular contraction complexes.

RESULTS: Contractile sequence proceeded from right to left in basal loop, down the descending and up the ascending apical loop segments. The epicardial basal loop stiff outer shell, *always* contracted before endocardium of the underlying helix. Crystal site placement defined contractile trajectory as transverse in basal vs. oblique in apical loop, subendocardial in descending and subepicardial in ascending segments. Mean shortening fraction averaged $18 \pm 3\%$, with an anisotropic deformation allowing $5 \pm 1\%$ more apical than basal contraction. The outer ascending segment followed inner descending contraction by 82 ± 23 msec, and finishing 80 ± 20 msec later. Consequently, isovolumetric relaxation was absent, and active contraction caused suction for venous return; These sequential helical time intervals were shortened by dopamine ($\sim 39 \pm 5$), and lengthened by esmolol ($\sim 103 \pm 30$ msec.) to accentuate and diminish contraction and suction.

CONCLUSIONS: Contractile sequence followed the rope like myocardial band model to contradict traditional thinking with a) epicardial before endocardial contraction, despite early endocardial activation, and b) active contraction causes suction for venous return, as passive recoil from isovolumetric relaxation is absent.

**By Invitation*

L2. Alterations of Transmural Strains in the Ischemic Border Zone During Acute Mid-Circumflex Occlusion

Filiberto Rodriguez*, Frank Longer*, Katherine B Harrington*, Allen Cheng*, George T. Daughters*, John C. Criscione*, Neil B. Ingels, Jr.*, D. Craig Miller; Stanford and Palo Alto, CA, College Station, TX

OBJECTIVE: The left ventricle consists of helically oriented myofibers connected by a collagen weave to form transmural laminar "sheets". Normal LV wall thickening mechanics are complex

with 15% fiber shortening resulting in 40% radial wall thickening and 60% ejection fraction via laminar shear, extension and thinning. Regional ischemia should alter such LV mechanics, and the ischemic "border zone" may be important in the progression of ischemic cardiomyopathy. For better mechanistic understanding, we examined cardiac wall deformation and microstructure in the ischemic border zone.

METHODS: Nine sheep had radiopaque LV markers implanted to measure fractional area shrinkage [$FAS = 100 \times (\text{regional area}_{\max} - \text{regional area}_{\min}) / \text{regional area}_{\max}$]; 3 transmural bead columns were implanted at the equatorial level in the mid-lateral wall. 3D Marker coordinates were obtained with biplane video fluoroscopy. Data were acquired before and during 70 seconds of mid-circumflex occlusion (distal to first obtuse marginal). Myocardial deformations were quantified at 20% (subepicardial), 50% (mid), and 80% (subendocardial) wall depths using strain analysis of 3D bead displacement from end-diastole to mid-ejection along circumferential (**X1**), longitudinal (**X2**), and radial (**X3**) axes. Strains were transformed into fiber (**Xf**) and sheet (**Xs**) coordinates in 5 sheep using quantitative histological measurements of transmural myofibrillar and myolaminar angles.

RESULTS: Ischemia caused significant hemodynamic insult and decreased posterolateral and posteroseptal FAS (Table). FAS revealed that the transmural bead set was in the ischemic border between the posterolateral and anterolateral territories. Interestingly, FAS increased in the remote anteroseptal region. In the ischemic border, subepicardial circumferential (**E11**) shortening changed to lengthening, circumferential-radial shear (**E13**) increased, fiber-sheet shear (**Efs**) reversed, and midwall **Efs** increased.

Data expressed as Mean±SD. p-values from t-test for paired observations.

	CONTROL	ISCHEMIA	p
LV dp/dt _{max} (mmHg/s)	2,250±670	1,530±525	0.0001
Equatorial Anteroseptal FAS (%)	28±8	31±7	0.007
Equatorial Anterolateral FAS (%)	23±7	22±6	0.27
Equatorial Posterolateral FAS (%)	21±5	12±4	0.00007
Equatorial Posteroseptal FAS (%)	23±4	17±7	0.004
Circumferential Strain (E11)-subepicardial	-0.020±0.029	0.003±0.041	0.01
Circumferential-Radial Shear(E13)-subepicardial	0.030±0.034	0.076±0.033	0.01
Fiber-Sheet Shear (Efs)-subepicardial	-0.008±0.053	0.060±0.034	0.01
Fiber-Sheet Shear (Efs) - midwall	0.011±0.039	0.036±0.041	0.04

CONCLUSIONS: Increased regional FAS in non-ischemic sites reflects unloading of remote myocardium. Such unloading reverses **E11** and **Efs** and increases **E13** in the subepicardium while increasing midwall **Efs** shear in the border zone. These changes in transmural shears likely reflect "slipping" along ischemic border cleavage planes; such dyskinetic wall motion causes increased stretch and stress, which is myopathic. Understanding these processes is important for rational development of surgical therapies for ischemic cardiomyopathy.

*By Invitation

L3. Combined Endothelial and Myocardial Protection by Endothelin Antagonism Enhances Transplant Allograft Preservation

Paul W. M. Fedak*, Vivek Rao, Danny Ramzy*, Subodh Verma*, Laura Tumiati*, Patty Boylen*, Santiago Miriuka*, Richard D. Weisel; Toronto, ON, Canada

OBJECTIVE: Endothelin (ET-1) is a potent inflammatory peptide associated with myocardial dysfunction, coronary vasculopathy, and reduced survival after cardiac transplantation. We hypothesized that ET-1 antagonism during cardiac allograft storage would limit early endothelial dysfunction and improve myocardial performance following transplantation.

METHODS: Orthotopic transplants were performed in Yorkshire pigs (70kg) after cardioplegic arrest and a 6-hour period of ischemic storage. Treatment during storage with intermittent donor blood perfusion (CONTROL, n=8) was compared to ET-1 antagonist (ETA)-enhanced donor blood perfusion (TREATMENT, n=8) using 100 μ M Bosentan. A macrovascular tissue bath apparatus determined coronary endothelial function. LV performance was assessed by pressure-volume loop analysis after caval occlusion using a Millar micromanometer and conductance catheter to determine preload recruitable stroke work (PRSW). Myocardial ET-1 protein expression was measured by ELISA; TNF α and TGF β expression by immunoblotting. Oxidative stress was inferred by 8-isoprostane levels. Myocardial metabolism was assessed by measuring the extraction or production of oxygen, acid and lactate by the heart.

RESULTS: Endothelial-dependent coronary vasoreactivity (response to bradykinin) was diminished from baseline in transplanted hearts at 48 hrs after transplantation, but not earlier. Endothelial-independent coronary vasoreactivity (response to sodium nitroprusside) was unchanged in these hearts confirming an underlying endothelial-specific coronary vasomotor dysfunction. Notably, ETA exposure during preservation significantly limited coronary endothelial dysfunction 48 hrs after reperfusion (%Emax to bradykinin: 67 \pm 6 v 45 \pm 2%, $P=0.001$). In addition, weaning from CPB (7/8 v 5/8) and LV performance after transplantation was greater in ETA treated hearts (PRSW as % of baseline: 88 \pm 6 v 46 \pm 2%, $P=0.02$). Myocardial ET-1 expression increased during reperfusion following transplantation (36 \pm 8 v 15 \pm 4 fmol/mg, $P=0.001$) and the rise was comparable in both groups. TNF α was decreased with ETA treatment (109 \pm 13 v 133 \pm 14 units, $P=0.02$) while TGF β did not change ($P=0.86$). Isoprostane, oxygen, acid, and lactate levels were similar between groups excluding oxidative stress and enhanced metabolic recovery as the underlying mechanism of benefit.

CONCLUSIONS: These data indicate that ET-1 accumulates in cardiac allografts during storage and directly contributes to early endothelial and myocardial dysfunction after transplantation. ETA-enhanced donor blood perfusion during allograft preservation is a clinically applicable procedure that limits endothelial injury and enhances ventricular recovery after transplantation.

**By Invitation*

L4. Adenovirus-Mediated Modulation of Phosphatidylinositol 3-Kinase Signaling Reduces Intimal Hyperplasia in Aortocoronary Saphenous Vein Grafts

Jonathan A. Hata*, Jason A. Petrofski*, Jianhua Huang*, Jacob N Schroder*, Matthew L. Williams*, Michael T. Corwin*, Andre M. Jakoi*, Thomas R. Gehrig*, Christopher D. Kontos*, Carmelo A. Milano*; Durham, NC

OBJECTIVE: Approximately 50% of human saphenous vein grafts (SVGs) are occluded 10 years after coronary artery bypass grafting (CABC). Intimal hyperplasia (IH) is an initial step in SVG occlusion and is marked by vascular smooth muscle cell (VSMC) proliferation. The enzyme phosphatidylinositol (PI) 3-kinase and its downstream regulator, the inositol 3-phosphatase PTEN, are key regulators of IH. Studies demonstrate that PTEN overexpression in VSMCs inhibits their proliferation, migration, and survival. This study investigates whether treatment of SVGs with an

adenoviral vector encoding the PTEN transgene (AdPTEN) can limit SVG IH in a large-animal CABG model.

METHODS: Twenty-three dogs (30 kg) underwent CABG to the left anterior descending artery using autologous reversed saphenous vein. SVGs were treated with saline (CON, n=9), empty adenovirus (AdEV, n=7), or AdPTEN (n=7). The replication-deficient adenoviruses (5×10^{11} particles in 1 mL saline) were delivered by distending the SVG to 10 mmHg with adenovirus-containing solution for 20 minutes prior to anastomosis. Following AdPTEN infection, segments of each SVG were cultured *ex vivo* for 48 hrs to allow transgene expression, then homogenized and PTEN overexpression confirmed by Western blotting. In addition, a subset of dogs received SVGs treated with a marker transgene (Ad_{gal}, n=3) and were sacrificed on post-operative day (POD) 3 to confirm the distribution of transgene expression. Arteriograms performed on POD 30 and 90 assessed SVG patency. At POD 90, dogs were sacrificed and SVGs histologically analyzed to quantify IH. Data are expressed as mean \pm SEM; statistical analysis was performed across groups using ANOVA and between groups using Student's t-test.

RESULTS: In Ad_{gal}-infected SVGs, transgene expression was diffusely distributed throughout the intima, demonstrating efficient transgene delivery. Western blotting revealed marked PTEN overexpression in vessel segments infected with AdPTEN compared to control vessels. Arteriograms on POD 30 and 90 revealed all SVGs to be patent. The intima/media ratio was significantly lower in AdPTEN-treated SVGs compared to both AdEV and CON (0.50 ± 0.05 vs 1.37 ± 0.2 and 1.11 ± 0.14 ; $p < 0.005$). In addition, AdPTEN SVGs demonstrated reduced total intimal area compared to AdEV and CON (1.39 ± 0.13 vs 2.28 ± 0.37 and 2.57 ± 0.4 , mm²; $p < 0.05$). Medial area and maximum/minimum wall thickness were not significantly different among groups.

CONCLUSIONS: This study demonstrates that adenovirus-mediated expression of PTEN inhibits aortocoronary SVG IH in a clinically relevant, large-animal model. These results suggest that modulation of the PI 3-kinase pathway via PTEN overexpression may represent a novel potential therapy to prevent IH after CABG.

**By Invitation*

L5. Surgical Treatment for Congestive Heart Failure Using Autologous Adult Stem Cell Transplantation: A Prospective Randomized Study

Amit N. Patel*, Roberto F. Vina*, Luis Geffner*, Robert Kormos, Harold C. Urschel, Jr., Federico Benetti*, Pittsburgh, PA, Rosario, Argentina, Dallas, TX

OBJECTIVE: Autologous adult stem cell transplantation has been used to treat many diseases. The use in cardiovascular disease has only recently been performed. The human experience with a novel epicardial technique to deploy stem cells was compared to conventional therapy.

METHODS: After IRB and government approval, adult autologous stem cell transplantation (CD34+/CD45₋) was performed in patients with coronary artery disease and an ejection fraction of $< 35\%$ who are going to have primary OPCAB. Preoperatively the patients had an echocardiogram, stress thallium imaging SPECT, and a cardiac catheterization. These imaging modalities were used in identifying ischemic regions of heart and to guide in mapping for injection of the stem cells. The patients were prospectively randomized before operative therapy was performed. Patient follow-up was one, three, and six months with echocardiogram, SPECT, and angiography.

RESULTS: There were twenty patients enrolled in the study. In the study group, ten patients had successful transplantation of autologous stem cells into ischemic myocardium. The other ten

patients in the control group only had OPCAB. There were 8 males and 2 females in each group. The median number of grafts performed was 1 in both groups. On angiographic follow-up, all grafts were patent at 6 months. At 1, 3 and 6 months, there was improvement in perfusion on SPECT imaging in areas injected with stem cells. There were no perioperative arrhythmias, neurological or ischemic myocardial events in either group.

	Control	Study	p
n	10	10	
Mean EF % Preop	30.7 ± 2.5	29.4 ± 3.6	0.381
1 month	36.4 ± 2.6	42.1 ± 3.5	0.002
3 months	36.5 ± 3.0	45.5 ± 2.2	0.0004
6 months	37.2 ± 3.4	46.1 ± 1.9	0.0007

CONCLUSIONS: Improvement in cardiac function after autologous stem cell transplantation is promising. Further investigation is required to quantify the cellular effects of the therapy.

**By Invitation*

L6. Targeted Overexpression of Leukemia Inhibitory Factor Preserves Myocardium in Postinfarction Heart Failure

Mark F. Berry*, Timothy J. Pirolli*, Vasant Jayasankar*, Kevin J. Morine*,
Mirielle A. Moise*, Omar Fisher*, Timothy J. Gardner, Paul H. Patterson*, Y.
Joseph Woo; Philadelphia, PA, Pasadena, CA

OBJECTIVE: Ischemic cardiomyopathy is an increasingly prevalent condition with significant medical and economic implications. Leukemia inhibitory factor (LIF) is a cytokine that regulates the growth, differentiation, and function of many embryonic and adult tissues, including the heart. This study examined the effects of viral gene transfer of LIF in infarcted rat hearts.

METHODS: Lewis rats underwent ligation of the left anterior descending coronary artery and direct intramyocardial injection of replication-deficient recombinant adenovirus encoding LIF (n=6) or null virus as control (n=6) into the area of acute ischemia and the bordering myocardium. After six weeks, the following was evaluated: left ventricular (LV) geometry and architecture by histology; myocardial fibrosis by Masson's Trichrome staining; and cardiac function by in vivo pressure-volume conductance catheter measurements.

RESULTS: Rats treated with Adeno-LIF had more preserved myocardium in both the infarct and borderzone, with less fibrosis in the infarct region (LIF 27.5±3.7% fibrosis of infarct region vs Control 40.0±3.2%, p<0.05). LIF treated animals had improved thickness of the borderzone myocardium (1.9±0.1 mm vs 1.5±0.1 mm, p<0.05) with less dilation of the LV cavity (LIF LV cavity diameter 9.2±0.2 mm vs Control 9.9±0.2 mm, p<0.05). LIF treated animals had improved cardiac contractility, indicated by an upward and leftward shift in the pressure-volume relationships of their hearts compared to control hearts (LIF slope of maximum change in pressure over time versus end diastolic volume relationship 61.4±5.0 mm Hg/sec/μL vs Control 39.8±5.3 mm Hg/sec/μL, p<0.05).

CONCLUSIONS: Adenoviral-mediated myocardial gene transfer of LIF results in preservation of cardiac tissue, geometry, and contractile function 6 weeks after myocardial infarction in rats.

Treatment with LIF ultimately may be useful in preventing the development of ischemic cardiomyopathy.

**By Invitation*

L7. The Evolution of Ischemic Spinal Cord Injury in Inflammation, Function, and Cytoarchitecture and the Effects of Adenosine A_{2A} Receptor Activation

T. Brett Reece*, David O. Okonkwo*, Peter I. Ellman*, Patrick S. Warren*,
Irving L. Kron, Curtis G. Tribble, John A. Kern*; Charlottesville, VA

OBJECTIVE: The progression of ischemic spinal cord injury following reperfusion has not been defined in terms of the time course of changes in function, Cytoarchitecture and inflammatory markers. The aim of this study is to document progression of this injury and demonstrate that adenosine A_{2A} receptor activation with ATL-146e limits detrimental changes in each of these aspects.

METHODS: Mature swine underwent 30min of descending aortic occlusion. They were divided into 3 groups (Sham thoracotomy, IR: 30min ischemia, and ATL: 30min ischemia + ATL-146e for the first 3h reperfusion). Subgroups (each n=8) were sacrificed at 0h, 3h, 6h, 12h, 24h, and 48h of reperfusion. Functional outcomes were followed in the 48h groups. The spinal cord tissue was evaluated for neuronal viability, microtubule associated protein-2 preservation and neutrophil sequestration (myeloperoxidase assay, MPO). Finally, neuronal tissue, CSF and serum were evaluated for TNF- α using an ELISA kit.

RESULTS: Function was significantly impaired at 24h, 36h, and 48h in IR compared to both Sham and ATL (all $p < 0.05$, e.g. 48h 2.0 ± 0.5 vs 5.0 ± 0 and 4.5 ± 0.3). Neuronal Viability and MAP-2 staining by percentage of gray matter was significantly preserved in both Sham and ATL compared to control at both 24h and 48h ($p < 0.05$). The spinal cord tissue MPO levels were significantly higher in IR than Sham and ATL at both 24h and 48h. The TNF levels (pg/ml) in serum and CSF were low in all groups, but the spinal cord levels were significantly higher in IR compared to Sham and ATL at 6h (187 ± 75 vs 4 ± 2.6 and 9 ± 2.4) and 12h (184 ± 55 vs 4 ± 1.9 and 5 ± 2.3) (all $p < 0.05$).

CONCLUSIONS: Spinal cord ischemia leads to significant changes in neutrophil sequestration, MAP-2 staining and neuronal viability by H&E within 24 hours of reperfusion. Most importantly, despite low serum and CSF levels of TNF- α , spinal cord parenchymal levels of TNF- α rise significantly by 6-12 hours of reperfusion. Adenosine A_{2A} receptor activation prevents the rise in cytokine levels and markers of cellular inflammation, which may be critical in the preservation of neuronal function and Cytoarchitecture following ischemia/reperfusion.

**By Invitation*

L8. Gene Transfer of Soluble TIE2 Ameliorates Pulmonary Hypertension in Rodents

Masakuni Kido*, Lingling Du*, Stuart W. Jamieson, Patricia A.
Thistlethwaite*; San Diego, CA

OBJECTIVE: Overexpression of Angiopoietin-1 (Ang-1) in the lung has been associated with different forms of human pulmonary hypertension. We hypothesized that inhibiting the Ang-1 signaling pathway in the lung, by administration of a competitive inhibitor which blocks Ang-1

binding to its receptor, TIE2, would block the development of pulmonary hypertensive vasculopathy in a rodent model.

METHODS: Two rodent models of pulmonary hypertension were tested: 1) animals with pulmonary hypertension induced by constitutive Ang-1 expression in pulmonary vascular smooth muscle, and 2) animals with pulmonary hypertension induced by administration of monocrotaline. We injected 2×10^9 genomic particles of an adenoassociated virus containing an extracellular fragment of the TIE2 receptor (AAV-sTIE2) into main pulmonary artery of 30 rats with either Ang-1 or monocrotaline-induced pulmonary hypertension, while using adenoassociated virus-lacZ (AAV-lacZ) and carrier-injected rats as controls. All animals underwent survival surgery and were sacrificed at serial timepoints post gene delivery. At each timepoint, pulmonary artery pressures were measured and pulmonary angiography performed. Lungs were harvested for pathologic analysis, mRNA and protein analysis, and in situ hybridization to localize gene expression.

RESULTS: Pulmonary artery pressures of rats overexpressing Ang-1 in the lung and rats treated with monocrotaline were significantly increased compared to control groups ($p < 0.01$) at all timepoints. Administration of AAV-sTIE2 ameliorated pulmonary hypertension in both groups (from 36 ± 2.4 mmHg to 18 ± 1.6 mmHg in the Ang-1 group, $p < 0.01$; from 45 ± 2.3 mmHg to 17 ± 1.3 mmHg in the monocrotaline group, $p < 0.01$). Pathologic analysis of lungs treated with AAV-sTIE2 demonstrated reversal of smooth muscle cell proliferation within the medial layer of arterioles. Pulmonary angiography confirmed reversal of small pulmonary vessel occlusion in animals treated with AAV-sTIE2.

CONCLUSIONS: Molecular blocking of the interaction between Ang-1 and its endodielial receptor, TIE2, in the lung reverses pulmonary hypertension in two animal models of the disease. These experiments suggest a new strategy for treating pulmonary hypertension, based on the molecular biology of the pulmonary vascular wall.

5:00 p.m. ADJOURN TO WELCOME RECEPTION EXHIBIT HALL

**By Invitation*

84th ANNUAL MEETING

April 25-28, 2004

Metro Toronto Convention Centre

Toronto, Ontario, Canada

PROGRAM

MONDAY, APRIL 26, 2004

7:45 a.m. Business Session

(Limited to Members Only)

8:00 a.m. SCIENTIFIC SESSION

(8 minutes presentation, 12 minutes discussion)

North Bldg., Hall C, Metro Toronto Convention Centre

*Moderators: Joel D. Cooper
Irving L. Kron*

1. The Impact of Pre- and Post-Operative Atrial Fibrillation on Outcome After Mitral Valvuloplasty for Non-Ischemic Mitral Regurgitation

¹Ko Bando, Hitoshi Kasegawa*, Yukikatsu Okada*, Tomoki Shimokawa*, Michinori Nasu*, Mitsuhiro Hirata*, Akiko Kada*, Osamu Tagusari, Junjiro Kobayashi*, Toshikatsu Yagihara*, Soichiro Kitamura; Osaka, Japan, Tokyo, Japan, Kobe, Japan, Kanagawa, Japan

Discussant: Kevin D. Accola

OBJECTIVE: We sought to determine the impact of pre- or post-operative atrial fibrillation (AF) on cardiac function, survival and stroke after mitral valvuloplasty (MVP) for non-ischemic mitral regurgitation (MR).

METHODS: From 1992 and 2002, 1096 consecutive patients (pts) underwent MVP in 3 centers; 746 pts in sinus rhythm (Group A), 350 pts in atrial fibrillation or flutter preoperatively (Group B). In group B, a concomitant Maze procedure was performed in 155 pts (Group BM) while the remaining 195 pts (Group BN) did not undergo a Maze procedure primarily due to 1) longer duration of AF (> 20 yrs), 2) f-wave in lead V1 < 0.1mV, 3) emergency surgery or 4) surgeon preference. The impact of pre- and post-op heart rhythm on cardiac function was determined by serial echocardiographic data.

RESULTS: See table (* by ANOVA, † by log rank test). Pts with pre-op AF generally had larger left atrial dimensions (LAD) and reduced left ventricular function (%FS) before surgery. The combination of a Maze procedure, MVP and a smaller LAD resulted in an improved %FS late after surgery (3.6±1.2 yrs post-op) as compared to MVP alone. A Cox hazard model using propensity score revealed that risk factors for late mortality included advanced age (p<0.001), late stroke (p=0.01) and chronic AF after surgery (p=0.02).

Impact of Pre- and Post-op AF on Outcome of MVP				
	Group A	Group BH	Group BN	P value
Pre-op LAD (mm)	51.2±5.2	59.9±4.5	60.3±5.3	0.002*
Late post-op LAD (mm)	39.9±6.4	43.2±7.8	54.8±6.9	<0.0001*
Pre-op %FS(%)	37.0±8.9	32.1±8.4	26.7±6.5	0.003*
Late post-op % FS (%)	42.5±5.5	38.6 ±4.2	31.5±5.2	0.001*
Late Survival (5 yrs)(%)	99.0±1.0	98.7±1.2	80.8±3.0	0.001†
Freedom from Stroke (5 yrs)(%)	99.0±0.5	99.3±0.3	74.2±4.6	<0.001†
Freedom from AF (5 yrs)(%)	96.3±0.2	80.7±3.6	6.1±2.2	0.0001†

CONCLUSIONS: Chronic AF before surgery was associated with dilated left atrium and reduced left ventricular function for pts with MR. The addition of a Maze procedure to MVP helped to improve late cardiac function, improved survival and decreased the incidence of late stroke. However, the best results were achieved by early surgery before the development of AF.

**By Invitation*

¹1991-92 Graham Fellow

2. Complications of Lung Transplantation

Bryan F. Meyers*, Maite De La Morena*, Tracey J. Guthrie*, Eric N.

Mendeloff, Stuart C. Sweet*, Charles B. Huddleston, Elbert P. Trulock*, Joel

D. Cooper, G. Alexander Patterson; St. Louis, MO

Discussant: Shaf Keshavjee

OBJECTIVE: To review the incidence and outcome of lung transplantation complications observed over 15 years at a single center.

METHODS: We conducted a retrospective review from our databases tracking outcomes after adult and pediatric lung transplantation. The 980 operations took place between 7/88 and 9/03 and included 274 pediatric recipients and 706 adult recipients. Bilateral lung (75%), unilateral lung (19%) and living lobar (4%) comprised the bulk of this experience. Retransplantations accounted for 44 (4.5%) of the operations, including a single recipient who was retransplanted twice.

RESULTS: The groups differed markedly by indication for transplantation. The adult transplant cohort included 57% emphysema and 17% cystic fibrosis, while the pediatric cohort included no emphysema and 54% cystic fibrosis. Overall hospital mortality was 90/980 (9.2%) and included 40/274 (14%) of the children and 50/706 (7%) of the adults. Despite an early survival advantage in adults, the overall survival curves did not differ between adults and children ($p=.05$). The freedom from bronchiolitis obliterans syndrome (BOS) at 5 and 10 years was 42% and 14% for adults and 46% and 30% for children ($p=0.4$). The main causes of death for adults were BOS (47%), respiratory failure (12%) and infection (11%); while the causes of death in children were BOS (31%), infection (30%) and respiratory failure (21%), ($p<0.01$). Post-transplantation lymphoproliferative disease was diagnosed in 12% of pediatric recipients and 6% of adults, ($p<0.01$). The frequency of patients treated for airway complications did not differ between adults and children (8.4% versus 10.9%, $p=0.2$). The frequency of early graft dysfunction did not differ between children (17.9%) and adults (20.5%) despite uniform use of cardiopulmonary bypass in children.

CONCLUSIONS: These single-center results highlight the major complications faced after lung transplantation. Despite differences in underlying diagnoses and specific operative techniques, the two cohorts of patients experienced remarkably similar outcomes.

**By Invitation*

3. Increasing Duration of Deep Hypothermic Circulatory Arrest is Associated with an Increased Incidence of Postoperative Electroencephalographic Seizures

J William Gaynor, Susan C. Nicolson*, Gail P. Jarvik*, Gil Wernovsky*, Lisa

M. Montenegro*, Nancy B. Burnham*, Diane M. Hartman*, Andy Louie*,

Thomas L. Spray, Robert R. Clancy*; Philadelphia, PA, Seattle, WA

Discussant: Ross M. Ungerleider

OBJECTIVE: Electroencephalographic (EEG) seizures have been shown to occur in up to 20 % of neonates undergoing the arterial switch operation for transposition of the great arteries (TGA) and are associated with adverse long-term neurodevelopmental sequelae. The contemporary

incidence of postoperative seizures after repair of other cardiac defects in neonates and infants is not known.

METHODS: A single institution prospective study of 178 patients \leq 6 months of age undergoing cardiopulmonary bypass (CPB) with or without deep hypothermic circulatory arrest (DHCA) was conducted from September 2001 to March 2003 to identify postoperative seizures assessed by 48-hour continuous video-EEC monitoring.

RESULTS: Cardiac defects included hypoplastic left heart syndrome (HLHS) or variant (n = 60), tetralogy of Fallot (TOF) (n = 24), ventricular septal defect (VSD) (n=22), TGA with or without a VSD (n = 12), other functional single ventricle (n = 14), VSD with coarctation (n = 6), and "other" (n = 40). Median age at surgery was 7 (range 1-188) days and was \leq 30 days in 110 (62%). DHCA was utilized in 117 patients (66%) with multiple episodes in 9. Median total duration of DHCA was 40 (range 1-90) min.

EEC seizures were identified in 20 patients (11 %). Seizures occurred in 15/110 (14 %) of neonates and 5/68 (7 %) of older infants. Seizures occurred in 11/60 (18 %) with HLHS or variant, 1/12 (8 %) with TGA, and 1/24 (4 %) of patients with TOF. By stepwise logistic regression analysis once increasing duration of total DHCA (p=0.041) was considered, no other variable improved prediction of occurrence of a seizure. Patients with DHCA duration >40 min had a significantly increased incidence of seizures (14/58, 24.1%) compared to those with DHCA duration \leq 40 min (4/59, 6.8%), p=0.043. The incidence of seizures for patients with DHCA duration \leq 40 min was not significantly different from those in whom DHCA was not utilized (2/61, 3.3 %), p>0.1.

CONCLUSIONS: In the current era, continuous EEC monitoring demonstrates early postoperative seizures in 11% of a heterogeneous cohort of neonates and infants with complex congenital heart defects. Only increasing duration of DHCA could be identified as a predictor of seizures. However, the incidence of seizures in children when the duration of DHCA was \leq 40 min was similar to that identified in infants undergoing continuous CPB alone.

**By Invitation*

4. Incomplete Revascularisation During Op CAB Surgery Is Associated With Reduced Mid-term Event Free Survival

Massimo Caputo*, Barnaby Reeves*, Chanaka Rajakaruna*, Hazaim Alwair*,

Kirkpatrick Santo*, Gianni Angelini; Bristol, UK

Discussant: Paul T. Sergeant

OBJECTIVE: To estimate the rate and effects of incomplete myocardial revascularisation on mid-term clinical outcomes in patients undergoing OPCAB surgery.

METHODS: Data were extracted from a prospective database for all patients with double or triple vessel disease who had OPCAB surgery between April 1996 and November 2002. Patients were classified as having incomplete revascularisation when the number of distal anastomoses was less than the number of diseased coronary segments. Deaths were identified from the UK NHS Central Registry. Cardiac-related events included: recurrence of symptoms of angina (CCS class >1) or dyspnoea (NYHA class >2), myocardial infarction, heart failure and need for repeat revascularisation.

RESULTS: During the study period 1401 patients underwent OPCAB surgery, and of these, 15.8% (191) had incomplete revascularisation. Patients with incomplete revascularisation had more

preoperative risk factors; compared with those with complete revascularisation. They were more likely to be female, to have had previous cardiac surgery, COAD, peripheral vascular disease, poorer ejection fraction and congestive cardiac failure, creatinine >150 μ g/L and higher Parsonnet score. The most common cause for incomplete revascularisation was the presence of small and/or severely diseased artery (70%). Follow-up data were available in 1260 patients (90%). Patients with incomplete revascularisation were more likely to die and to experience cardiac-related events compared with patients with complete revascularisation. Unadjusted hazard ratios for survival and event-free survival (Figure) were 2.58 (95% CI 1.59 to 4.20, $p < 0.001$) and 1.65 (95% CI 1.42 to 1.90, $p < 0.001$) respectively, and 1.85 (95% CI 1.14 to 3.00, $p < 0.01$) and 1.68 (95% CI 1.39 to 2.03, $p < 0.001$) respectively after adjusting for preoperative risk-factors.

CONCLUSIONS: In this study the rate of incomplete revascularisation in OPCAB surgery is similar to that reported in the literature for conventional on-pump coronary surgery. Our data confirm the importance of completeness of revascularisation on survival and event-free survival.

9:30 a.m. Thoracic Surgery Foundation for Research and Education

John R. Benfield, President

9:35 a.m. INTERMISSION - VISIT EXHIBITS

*North Bldg., Exhibit Hall
Metro Toronto Convention Centre*

**By Invitation*

10:20 a.m. SCIENTIFIC SESSION

(8 minutes presentation, 12 minutes discussion)

North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: Tirone E. David

Irving L. Kron

5. Anastomotic Complications After Tracheal Resection: Prognostic Factors and Management

Cameron D. Wright, Hermes C. Grille, John C. Wain, Dean M. Donahue*,

Henning A. Gaissert*, Daniel R. Wong, Douglas J. Mathisen; Boston, MA

Discussant: Ernio Angela Rendina

OBJECTIVE: Anastomotic complications after tracheal resection (separation, stenosis or granulations) cause significant morbidity. We sought to identify prognostic factors for early anastomotic complications following tracheal resection and to report the results of management of these complications.

METHODS: Retrospective single institution review between 1975 and 2003 of 787 tracheal resection and reconstruction operations. Multivariable logistic regression analysis was used to identify important variables associated with anastomotic complications.

RESULTS: Of 787 patients, 70 (9%) developed anastomotic complications (AC). The following variables were not associated with AC: steroid use, diabetes, hemoglobin level, height, body mass index >30, incision (cervical, mediastinal or transthoracic) and earlier operation (<1990).

Univariable analysis indicated the following variables were associated with AC: males ($p=.05$), laryngotracheal anastomosis (versus tracheo-tracheal) ($p=.02$), preop stoma ($p=.0003$), need for tracheostomy at end of operation ($p=.0057$), reoperation ($p<.0001$), postintubation stenosis (PITS) as the reason for operation (versus tumor or idiopathic stenosis) ($p=.005$), age <17 ($p=.002$), length of resection $>4\text{cm}$ ($p=.0004$) and need for a release procedure ($p<.0001$). Multivariable analysis revealed 4 variables associated with AC: reoperation (Odds Ratio (OR) 2.6, $p=.004$), PITS (OR 2.4, $p=.03$), length $>4\text{cm}$ (OR 1.8, $p=.04$) and need for release (OR 2.9, $p=.002$). Patients who had an AC had a greater risk of death (6/70, 9%) than those who did not (5/717, 0.1 %) ($p<.0001$). Of the 64 patients who survived an AC, 37 had a good airway at the end of treatment by means of a reresection (11 patients) or by temporary stenting with a T tube (26 patients). The remaining 27 patients required long-term T tubes or a tracheostomy. The length of stay was only minimally longer in patients with AC (11.5 d) than in those without complication (8 d).

CONCLUSIONS: Patients who have reoperations, resections $>4\text{cm}$, PITS or who require a release are at elevated risk for developing an anastomotic complication after tracheal resection and reconstruction. The risk of death after tracheal resection is markedly increased in the presence of an anastomotic complication. Most patients can be returned to a good airway after an anastomotic complication by either reoperation or temporary stenting with a T tube.

6. Results of Surgery in Acute Type A Aortic Dissection: the IRAD (International Registry of Acute Aortic Dissection) Experience

Santi Trimarchi*, Christoph Nienaber*, Vincenzo Rampoldi*, Truls Myrmel*,

Toru Suzuki, Rajendra H. Menta, Eduardo Bossone, Jeanna Cooper*, Dean

Smith*, Lorenzo Menicanti*, Alessandro Frigiola*, Jae K. Oh, Michael G.

Deeb, Eric M. Isselbacher*, Kim A. Eagle*; S. Donate Milanese, Italy,

Rostock, Germany, Tromsø, Norway, Tokyo, Japan, Rochester, MN, Ann

Arbor, MI, Boston, MA

Discussant: Joseph E. Bavaria

OBJECTIVE: Surgical results for acute type A aortic dissection (AAD) reported in different experiences of single centers or surgeons evidences high variability, ranging from 7% to 30%. The International Registry of Acute Aortic Dissection (IRAD), collecting patients in 18 referral centers world-wide, provides a preoperative risk stratification scheme and a real average surgical mortality for AAD in the current era.

METHODS: A comprehensive analysis of 290 clinical variables and their relation to surgical outcomes on 526 out of 1032 patients (mean age 59.7 ± 13.6 yrs, males 69.9%) enrolled in the IRAD from 1996-2001 was completed. Extracted cases, categorized according to risk profile, were defined unstable (group I) in presence of cardiac tamponade, shock, CHF, CVA, stroke, coma, myocardial ischemia and/or infarction, ECG's with new Q's or ST elevation, acute renal failure, or mesenteric ischemia/infarction at surgery. Patients without such preoperative conditions were categorized as stable (group II).

RESULTS: The overall in hospital mortality was 25.1%. In group I was 31.4%, compared to 16.7% in group II ($p<0.001$). Univariate predictors of surgical mortality ($p<0.05$ for all) were age (>70 years), female gender, prior aortic dissection, severe or worst ever pain, migrating pain, hypotension (systolic blood pressure (SPB) $< 100\text{mmHg}$), shock (SBP $<80\text{mmHg}$) or tamponade (SPB $<80\text{mmHg}$), any pulse deficit, congestive heart failure, chest X-ray findings of a widened mediastinum, EGG findings of ischemia/infarction, preoperative neurological deficits, limb ischemia, prolonged time from symptom onset to surgery, surgery delayed and necessity to perform CABG. Multivariate preoperative significant risk factors for operative mortality, are as shown (table) (c-index 0.77, Hosmer-Lemeshow Chi-square = 5.88; degree of freedom 7; $p=0.55$).

Variables at presentation	Overall Type A %	% Among survivors	% Among deaths	Model p-value	Mortality Odds Ratio (95% CI)
History of aortic valve replacement	4.4	3.5	7.4	0.02	3.12 (1.16, 8.40)
Migrating chest pain	14.2	12.1	20.5	0.001	2.77(1.49,5.15)
Presenting hypotension as sign of AAD	17.6	13.3	30.4	0.02	1.95(1.08,3.52)
Pre-op hypotension	24.7	19.5	40.7	0.002	2.69(1.41,5.11)
Pre-op cardiac tamponade	15.7	11.8	27.6	0.01	2.22 (1.17,4.22)
Pre-op limb ischemia	9.7	7.8	15.8	0.04	2.10(1.00,4.38)

CONCLUSIONS: IRAD evidences that patient selection plays an important role in determining surgical outcomes in AAD patients. Knowledge of significant risk factors for operative mortality can contribute for a better management and a more defined risk-assessment in patients affected by AAD.

**By Invitation*

7. Mid-term Clinical Result of Tissue-Engineered Vascular Autografts Seeded with Autologous Bone Marrow Cells

Toshiharu Shin'oka*, Hiromi Kurosawa, Goki Matsumura*, Narutoshi Hibino*,

Yuji Naito*, Takashi Azuma*, Akira Murata*, Manabu Watanabe*, Takeshi

Konuma*, Masayoshi Natatsu*, Takahiko Sakamoto*; Tokyo, Japan

Discussant: John E. Mayer, Jr.

OBJECTIVE: Prosthetic and bioprosthetic materials currently in use lack growth potential and therefore must be repeatedly replaced in pediatric patients as they develop. Tissue engineering (TE) is a new discipline that offers the potential for creating replacement structures from autologous cells and biodegradable polymer scaffolds. In May 2000 we initiated clinical application of tissue-engineered vascular grafts seeded with cultured cells. However, cell culturing is time-consuming and xeno-serum must be used. To overcome these disadvantages, we began to use bone marrow cells (BMCs), readily available on the day of surgery, as a cell source. The aim of the study was to assess the safety and feasibility of this technique for creating vascular tissue under low pressure system like pulmonary artery or venous pressure.

METHODS: Since August 2000, TE grafts seeded with autologous BMCs have been implanted in thirty-five patients. The patients and/or their parents were fully informed and had given consent to

the procedure. Five ml/kg of bone-marrow was aspirated under general anesthesia prior to the skin incision. The polymer tube serving as a scaffold for the cells was composed of a co-polymer of l-lactide and ϵ -caprolactone (PCL-PLA, 50:50). This co-polymer is degraded by hydrolysis. The matrix is >80% porous and the diameter of each pore is 100-200 μ m. Polyglycolic acid (PGA) woven fabric with a thickness of 0.5 mm was used for reinforcement. Twenty-one TE conduits (TCPC grafts) and fourteen TE patches were used for the repair of congenital heart defects. The patients' ages ranged from 1 to 24 years (median, 5.5 years). All patients underwent a catheterization study and/or computed tomography (CT) scans for evaluation after the operation. The patients received anticoagulation therapy for 3 to 6 months after surgery.

RESULTS: Mean follow-up after surgery was 424 days (maximum, 38 months). There were no thrombosis or obstruction, but two stenosis of TE patch, which was successfully released by balloon angioplasty. One late death at 3 months after TCPC was noted in HLHS patients, which was unrelated to the TE graft function. There was no evidence of aneurysm formation or calcification on cineangiography or CT. All tube grafts were patent, and the diameter of the tube graft increased over time ($110 \pm 7\%$ of the implanted size).

CONCLUSIONS: Biodegradable conduits or patches seeded with autologous BMCs showed normal function (good patency up to maximum follow-up of 38 months). As living tissues, these vessels may have the potential for growth, repair and remodeling. The TE approach may provide an important alternative to the use of prosthetic materials in the field of pediatric cardiovascular surgery. Longer follow-up is necessary to confirm the feasibility of this approach.

11:25 a.m. PRESIDENTIAL ADDRESS

"Thank You for Being a Doctor"

Joel D. Cooper, St. Louis, Missouri
Introduced by: Tirone E. David

12:15 p.m. ADJOURN FOR LUNCH - VISIT EXHIBITS

North Bldg., Exhibit Hall

Metro Toronto Convention Centre

**By Invitation*

MONDAY AFTERNOON, APRIL 26, 2004

1:45 p.m. SIMULTANEOUS SCIENTIFIC SESSION - ADULT CARDIAC SURGERY

(8 minutes presentation, 12 minutes discussion)

North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: David A. Fullerton

R. Scott Mitchell

8. Early and Midterm Patency of Vein Grafts Performed with Symmetry

ConnectonAControlled Angiographic Study

Jacob Bergsland*, Runar Lundblad*, Kjell Arne Rein*, Per Snorre LingEšas*,
Rune Andersen*, Per Kristian Hoi*, Steinar Halvorsen*, BjÄrn Erik MÄrk*,
Erik Fosse*; Oslo, Norway
Discussant: John D. Puskas

OBJECTIVE: This study compared patency of vein grafts in two groups undergoing off pump coronary bypass. In "Symmetry" group proximal anastomosis were performed with "Symmetry" proximal connector and in "Sutured" group with partial occlusion and polypropylene suture.

METHODS: Two consecutive groups (total n= 46) were included. All patients had off pump bypass surgery through sternotomy by experienced surgeons. Patients received one LIMA and at least one vein graft. Proximal anastomosis were done first. Intraoperative patency was examined by flowmetry and angiogram. Postoperative angiogram was performed in most cases. Radiologists evaluated angiograms and graded graft quality : 0 (normal graft), 1 (50-99% stenosis), 2 (occluded graft). Stenosis in the proximal part of the vein-grafts was noted.

RESULTS: 66% of LIMA - and SV -grafts were angiographically studied at the surgery. Postoperative angiograms were done in 86% of LIMA- and 80% of vein grafts after a median time of 4 months. All LIMA grafts studied were patent intra and postoperatively.

Intraoperatively 88% of "Symmetry" grafts were patent and 100 % of "Sutured" grafts. The difference was not significant.

Postoperative patency was reduced in "Symmetry" group. 8% of "Sutured" grafts were totally occluded while 50% of "Symmetry" grafts were Grade 2 ($p<0.01$). No "Sutured" grafts were Grade 1 while 25 % of "Symmetry" had 50-99% obstruction ($p< 0.01$). Changes in vein grafts were localized in or close to the device. Several "Symmetry" patients underwent percutaneous interventions. 25% of "Symmetry" grafts were graded 0 compared to 92% of "Sutured" ($p< 0.01$).

CONCLUSIONS: The introduction of "Symmetry" was met with enthusiasm because it promised less manipulation of the aorta during proximal anastomosis. This was attractive in high risk and off pump surgery and early patency rates were encouraging. In our prospective, controlled study pre- and postoperative angiograms were obtained in a high percentage of patients. LIMA graft patency was identical in both groups. While vein grafts in the control group showed only slight deterioration over time, "Symmetry" grafts frequently occluded over the first 3-6 months. In addition 25% of the open "Symmetry" grafts had significant abnormalities related to the device. These results points out that new anastomotic devices should not be introduced in routine coronary surgery until controlled studies including serial angiography have been performed.

**By Invitation*

9. Surgical Treatment of Atrial Fibrillation: Predictors of Late Recurrence

Sydney L. Gaynor*, Richard B. Schuessler*, Marti S. Bailey*, John P
Boineau*, Marye J. Gleva*, Yosuke Ishii*, Ralph J. Damiano, Jr.; St. Louis,
MO
Discussant: A. Marc Gillinov

OBJECTIVE: The Cox-Maze CM) procedure was introduced 16 years ago for the treatment of atrial fibrillation (AF). Since then, four versions of this procedure have been performed, yet there has been no report comparing the long-term results of these different modifications. This study

evaluates the results and predictors of late AF recurrence in 276 consecutive patients who underwent a CM procedure at our institution.

METHODS: From 1987 through June 2003, 276 patients (79 female and 197 male) underwent the CM procedure, with a mean age of 55 ± 11 years. Thirty-three patients had a CM I, 16 patients had CM II, and 197 patients had the CM III procedure. The last 30 patients underwent a modified procedure (CM IV) using bipolar radiofrequency ablation to replace a number of the surgical incisions. There were 113 patients (41%) who had a concomitant cardiac operation with the most common being a mitral valve procedure (19%) or coronary artery bypass grafting (20%). Data were analyzed by stepwise Cox-Regression analysis with pre- and postoperative variables used as covariates. Patient follow-up was conducted by questionnaire, physician examination, and electrocardiographic documentation. All patients had a minimum of 3-month follow-up following their procedure.

RESULTS: There was a significant difference in the freedom from AF recurrence between CM versions ($p=0.036$) (see Table). Risk factors for late AF recurrence were age at time of surgery ($p=0.03$), duration of preoperative AF ($p=0.001$), and CM version ($p=0.048$). There was no difference in operative mortality between the groups. Patient follow-up was achieved in 92.4% of cases with a mean follow-up time of 5.6 ± 3.6 years. There was no difference in actuarial ten-year survival between the CM I, II, and III groups being 92%, 93%, and 94%, respectively.

Table

	Duration of AF (years)	Postoperative Pacemaker (% \leq 30 days) (%)	Operative Mortality (%)	Freedom from AF at last follow- up (%)	Mean follow-up (years)
CM I (n=33)	10.5 \pm 9.7	10(30.3)	0	84.6	13.7
CM II (n=16)	5.9 \pm 5.1	3(18.8)	6.2	93.7	9.6
CM III (n=197)	8.1 \pm 7.5	29(14.7)	1.5	97.3	9.6
CM IV (n=30)	7.4 \pm 7.4	4(13.3)	0	93.3	1.4
P value between CM versions	0.184	0.155	0.319	0.036	

CONCLUSIONS: The CM procedure remains the gold standard for the treatment of AF, and has evolved over time into a procedure with high long-term efficacy and a low morbidity and mortality. The most significant predictor of late recurrence was duration of preoperative AF suggesting that earlier surgical intervention would further increase the efficacy of the procedure.

**By Invitation*

10. Changes in Microvascular Perfusion Measured With OPS- Imaging Correlate With Neuropsychologic Outcome After CPB

Frank Christ*, Behin Dadasch*, Sandra Eifert*, Bruno Reichart*; Munich, Germany

Discussant: John W. Mammon, Jr.

OBJECTIVE: Minor neuropsychological deficits after cardio-pulmonary bypass (CPB) occur in up to 80% of patients undergoing heart surgery and are mostly due to hypoperfusion, macro- and

microemboli. The purpose of our study was to see whether there is a correlation between changes in microvascular perfusion during CPB, detectable with OPS (Orthogonal Polarization Spectral) - imaging, and the severity of the patients postope.

METHODS: We visualized the microcirculation using OPS-Imaging in 29 patients undergoing open-heart surgery to examine the changes in microvascular perfusion during CPB. Microvascular diameter (DIA [pm], red cell velocity (VEL [mm/s]) and functional capillary density (FCD [cm/cm²]) were measured. Images were taken from the sublingual mucosa immediately after induction of anaesthesia (T1), at the beginning of CPB (T2), during the last 30 minutes of CPB (T3), during decanulation of the aorta (T4) and one hour after reperfusion.

Pre-and postoperatively we evaluated the patients neuropsychologic status with 4 standardised tests.

RESULTS: None of the patients showed severe neuropsychologic injury, however, all had some minor or moderate deficits. Thus we divided them into 2 groups according to the severity of the neurocognitive changes; group 1 (n=22) with minor and group 2 (n=7) with moderate deficits. DIA was significantly increased in both groups at T2 ($42,3 \pm 20,0$ and $47,1 \pm 21,6$) compared to T1 ($39,5 \pm 21,3$ and $40,4 \pm 19,7$), VEL was significantly decreased in group 1 at T2 ($0,57 \pm 0,2$) compared to T1 ($0,75 \pm 3,9$) and FCD was significantly decreased in both sub-populations at T3 ($133,1 \pm 10,0$ and $116,8 \pm 7,5$) compared to T1 ($144,9 \pm 13,7$ and $143,0 \pm 12,8$), recovering to preoperative values at T5 ($148,9 \pm 14,3$ and $141,5 \pm 5,7$).

CONCLUSIONS: Microvascular blood flow was well maintained during CPB. However, since the decrease in FCD was more pronounced in group 2, we suggest a correlation between impaired microvascular blood flow and neuropsychological deficits detectable with OPS-Imaging.

2:45p.m. INTERMISSION - VISIT EXHIBITS

North Bldg., Exhibit Hall

Metro Toronto Convention Centre

**By Invitation*

3:20 p.m. SIMULTANEOUS SCIENTIFIC SESSION - ADULT CARDIAC SURGERY

North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: David A. Fullerton

R. Scott Mitchell

11. Results of Aortic Valve Replacement with the Toronto SPY Bioprosthesis at 10

Years

Tirone E. David, Christopher M. Feindel*, Joanne Bos, Susan Armstrong*,
Joan Ivanov*; Toronto, ON, Canada

Discussant: John G. Byrne

OBJECTIVE: To examine the clinical outcomes of aortic valve replacement (AYR) with the Toronto SPY bioprosthesis at 10 years.

METHODS: The Toronto SPV was used for AYR in 332 patients from July 1991 to December 2001. There were 231 men and 101 women whose mean age was 64.5 ± 10.3 years. Aortic stenosis was present in 78% of patients, coronary artery disease in 37%, and left ventricular ejection fraction

(EF) <40% in 13%. Patients were interviewed annually and had a Doppler echocardiographic study. The mean follow-up was 6.3±2.9 years and was complete.

RESULTS: The table below shows the freedom from morbid events at 5 and 10 years of follow-up. There were one operative, 7 valve-related, 14 cardiac and 29 non-cardiac deaths. Sixteen patients developed echocardiographic evidence of bioprosthetic dysfunction and 15 were re-operated on. Cox regression analysis revealed that age/5-year increment had a risk ratio of 0.73, 95% CI 0.6-0.9. At the latest follow-up, the mean systolic gradient across the valve (6.8±4.4 mmHg) and the effective orifice area (2.0±0.6 cm²) and remained unchanged throughout the observation. Aortic insufficiency was progressive in 14% of patients and absent in 86% during the follow-up. Most patients were in NYHA functional classes I and II and only 7% were in class III at the latest follow-up.

<i>Kaplan-Meier estimates of freedom from morbid events</i>			
Variable	Number of Events	5 year	10 year
Death	51	91 ±2%	77±4%
Valve-related death	7	99±0.5%	96±2%
Endocarditis	6	99±0.5%	97±1%
Thromboembolism	29	92±2%	85±4%
Valve failure	16	100%	86±4%
Reoperation	19	99±0.5%	83±4%
Valve-related death or morbidity	54	91±2%	66±5%

CONCLUSIONS: This bioprosthesis has provided excellent symptomatic improvement and survival during the first decade after implantation, and is durable in patients >65 years of age.

**By Invitation*

12. Does Reporting of Coronary Artery Bypass Grafting Outcomes from Administrative Databases Accurately Assess Actual Clinical Outcomes?

Michael J. Mack, Morley A. Herbert*, Syma L. Prince*, April Simon*, Todd M. Dewey*, Mitchell J. Magee*; Dallas, TX, Zionsville, IN
Discussant: T. Bruce Ferguson, Jr.

OBJECTIVE: Quality assessment of coronary artery bypass grafting (CABG) surgery has traditionally been performed using data from clinical databases. Increasingly, administrative databases relying primarily on billing data have been employed as tools for public reporting of number of procedures and mortality rates, implying an assessment of quality. The accuracy of these sources and their usage has not been confirmed.

METHODS: We analyzed the data of all patients undergoing CABG surgery in one hospital between 1999 and 2001. This information is collected before, during and after the surgery and hospital stay by designated people involved with the patient care and then entered into a clinical database (STS National Database). This data was compared for the hard endpoints of number of procedures and mortality with administrative data as reported by the federal government

(MEDPAR), state government (Texas Health Care Information Council (THCIC)), hospital system (HCA Casemix Database), and an internet web site (Healthgrades.com). Data was analyzed based upon population reported, definitions used, risk assessment algorithms, and case volumes.

RESULTS: The table compares procedure volume and mortality rates on the same group of patients as reported by the different groups. Using the audited STS database as standard, case volumes varied by as much as 46% and mortality by as much as 76% depending upon the reporting agency. The disparate risk adjusting algorithms used produced different variances between the data sets. Despite the sources labeling the results as 1999-2001, they use different reporting periods either calendar years or Oct-Sept. time periods.

Source	Source of Data	Risk Adjusting Algorithm	Reported Volume	In-hospital Mortality Rate	Predicted Mortality	Risk Adjusted Rate
All CABG Patients 1999-2001 CRSTI - STS Database	STS Database	STS	1121	2.8	3.6	2.1
HCA Casemix	Hospital Billing	-	1248	3.1	-	-
THCIC	Admin	3M	1353	3.4	4.0	3.7
Medicare Patients Only CRSTI (Medicare Only)	STS Database	STS	460	4.6	5.6	2.3
HCA Casemix (Medicare Only)	Hospital Billing	-	671	4.2	-	-
MEDPAR	Medicare	None	439	5.0	N/A	N/A
Healthgrades.com	MEDPAR	Proprietary	377	4.5	4.0	N/A

CONCLUSIONS: Wide variability of reported outcomes is seen in various data sets in the hard endpoints of number of procedures performed and mortality making it impossible for the non-clinician to make an informed decision. Definition of quality as defined by these data sets is questionable.

**By Invitation*

13. Valve Sparing Aortic Root Replacement (Yacoub Remodeling) in Bicuspid Aortic Valves - A Reasonable Option?

Diana Aicher*, Frank Longer*, Anke Kissinger*, Henning Lausberg*, Hans-Joachim Schafers; Homburg, Germany

Discussant: Christopher M. Feindel

OBJECTIVE: Aortic dilatation occurs in many patients with bicuspid aortic valves (BAY) and may have an adverse impact on the results of valve repair. We added aortic root replacement using the remodeling technique of Yacoub- originally designed for tricuspid valves (TAV) - to BAY repair for treatment of the dilated root. We compared our results of root remodeling in BAY with those achieved in TAV.

METHODS: From 10/1995 to 8/2003, 175 patients underwent remodeling of the aortic root for aortic regurgitation and proximal aortic dilatation. A BAY (group A) was seen in 56 patients, a TAV in 119 patients (group B). Patients were younger in group A (A 53±11 years; B 64±13 years p<0,001). There were more emergency procedures for acute dissection in group B (A 4/56=7%; B 27/119=23% p=0,012). Sinu-tubular and aorto-ventricular diameters were identical in both groups

(A: 40mm \pm 0,58; 27mm \pm 0,17; B: 41mm \pm 0,64; 26mm \pm 0,16). Correction of cusp prolapse by suture plication (A 36/56=64%; B 41/119= 35% p=0,0003) or triangular resection (A 20/56=36%; B 1/119= 0,8% p<0,0001) was significantly more often performed in group A. Concomitant procedures were proximal arch (A 13/56=23%; B 65/119=55%; p< 0,001) or total arch replacement (A 0/56; B 13/119= 11%;p=0,010) and coronary bypass (A 8/56=14%; B 35/119=29%; p=0,048). Transthoracic echocardiography was performed at 1 week, 6 and 12 months and every 12 months thereafter. Cumulative follow-up was 5669 patients months (mean 34 \pm 23).

RESULTS: Mortality in group B was 5,4% (5/92; 1,7%- 12%/ 95% CL) after elective and 11,1% (3/27; 2,3%-29%/ 95% CL) after emergency operations. No patient died in group A. Mean systolic gradients at 1 year were 4,8mmHg \pm 2,1 (group A) versus 4,0mmHg \pm 2 (group B) and at 5 years 4,5mmHg \pm 2,3 (group A) versus 3,9mmHg \pm 2,2 (group B). Actuarial freedom from aortic regurgitation grade 2 or higher after 1/ 5/ 8 years was 98%/ 95%/ 95% in group A and 95%/ 83%/ 78% in group B (p=0,10). Freedom from reoperation at 1/5/8 years was 98% in group A and 98%/ 98%/ 90% in group B (p=0,86).

CONCLUSIONS: Valve-sparing aortic replacement using root remodeling can be applied for the combination of aortic dilatation and regurgitant BAV. The hemodynamic function of a repaired BAV is almost identical to tricuspid anatomy. Up to 8 years valve stability is at least identical to that of TAV, and freedom from repair failure and reoperation is better than results published for isolated BAV repair.

**By Invitation*

14. Does the Risk of Repeat Aortic Valve Replacement Justify the Use of Tissue Prostheses in Younger Patients?

D Dean Potter, Jr.*, Thoralf M. Sundt III, Kenton J. Zehr*, Joseph A. Dearani, Richard C. Daly, Charles J. Mullany, Christopher G.A. McGregor, Francisco J. Puga, Hartze U. V. Schaff, Thomas A. Orszulak; Rochester, MN

Discussant: Robert W. Emery

OBJECTIVE: The choice between mechanical and bioprosthetic valves must balance the risks of thromboembolism and anticoagulant associated hemorrhage against the risk of reoperation for prosthetic valve deterioration. Improved durability of bioprosthetic valves has encouraged their use in younger patients. Our objective was to examine the risk of repeat aortic valve replacement (AYR) in the current era.

METHODS: Between 1/1993 and 1/2001, 162 patients underwent repeat AYR \pm coronary artery bypass (CAB) while 2290 underwent primary AVR \pm CAB. The repeat and primary groups were similar in gender (women 37% versus 37%), preoperative functional class (2.8 \pm 1 versus 2.8 \pm 1), and ejection fraction (58% \pm 15% versus 57% \pm 15%). Prior prostheses were bioprosthetic in 75 (46%), mechanical in 61 (38%), homograft in 24 (15%), and autograft in 2 (1%). Mean time to reoperation was 9-7 \pm 6.8 years.

RESULTS: Early mortality for repeat AVR \pm CAB (8/162, 5%) was not statistically different from primary AVR \pm CAB (71/2290, 3%, $P=0.20$). Patients undergoing repeat AVR \pm CAB were younger than primary AVR \pm CAB (64 \pm 15 years versus 70 \pm 13, $P<0.001$). Endocarditis was more common in the repeat group (22% versus 3%, $P<0.001$); when endocarditis was excluded from the analysis, early mortality for repeat and primary AVR \pm CAB was 4/126 (3.0%) and 70/2231 (3.0%), respectively. For all patients, multivariate predictors for early mortality were advanced preoperative functional class ($P<0.001$, odds ratio 2.3), prosthetic valve endocarditis ($P=0.005$, odds ratio 8.9),

and peripheral vascular disease ($P=0.008$, odds ratio 2.0). Neither reoperation nor advanced age were independent predictors of early mortality. After adjusting for the significant predictors identified by the multivariate model, there was no difference in early mortality between the groups ($P=0.94$).

CONCLUSIONS: The risk of repeat AYR is low, and similar to primary AYR. These data support the expanded use of bioprosthetic valves in younger patients.

**By Invitation*

15. Repair of Functional Tricuspid Valve Insufficiency Using a Partial Prosthetic Ring Annuloplasty or a Partial Suture Annuloplasty: 15-Year Experience of Two Reconstructive Techniques

Rainald Seitelberger*, Jan Bialy*, Roman Gottardi*, Ernst Wolner; Vienna, Austria

Discussant: Neal D. Kon

OBJECTIVE: Surgical repair for functional tricuspid insufficiency (FTI) is associated with a high perioperative mortality and poor long-term survival, especially in combination with additional cardiac procedures. Although several basic types of tricuspid annuloplasty have been introduced over the last decades, little is known about possible differences in their influence on long-term outcome and their efficacy to prevent recurrence of insufficiency. This study retrospectively compares perioperative and long-term outcome of the two most common reconstructive techniques for FTI: partial prosthetic ring annuloplasty (PPRA) and partial suture annuloplasty (De Vega, PSA).

METHODS: The study population includes 194 adult patients, who underwent repair of FTI of at least functional Grade II between November 1984 and August 2003. 144 patients (mean age: 63 ± 16 years, male/female: 50/94) received a PPRA and 50 patients (mean age: 65 ± 15 years, male/female: 16/34) received a PSA. Additional cardiac procedures were performed in all patients. The mean follow-up was 8.23 ± 4.25 years for the PPRA (range: 0.1-15.6 years) and 7.84 ± 4.1 years for the PSA-group (range: 0.1-12.84 years).

RESULTS: According to preoperative anamnestic data, patients receiving a PSA had a slightly higher operative risk than those with a PPRA (Euroscore: $9.36 \pm 2.4\%$ vs $8.4 \pm 3.5\%$). Accordingly, the in-hospital mortality was higher in the PSA- than in the PPRA-group (16% vs 9.7%). Recurrence of tricuspid insufficiency of at least Grade II at latest follow up was substantially higher in the PSA as compared to the PPRA-group (36 vs 4.9%, $p < 0.001$). In addition, 1- and 10-year survival was significantly lower in patients receiving a PPRA (82% and 66%) as compared to those receiving a PSA (75% and 32%). Clinical evaluation at latest follow up revealed that more patients with a PPRA were in NYHA-functional Class I and II (83%) than those undergoing a PSA (66%, $p < 0.05$).

CONCLUSIONS: The results of this retrospective study clearly demonstrates that in patients with functional tricuspid insufficiency, PPRA is superior to PSA with regard to early- and late mortality, recurrence of insufficiency and functional status. It is therefore recommended as the method of choice in patients with FTI.

5:00 p.m. ADJOURN

7:00 p.m. ATTENDEE RECEPTION

Eternal Egypt: Masterworks of Ancient Art from the British Museum

Royal Ontario Museum

(separate subscription)

*By Invitation

MONDAY AFTERNOON, APRIL 26, 2004

1:45 p.m. SIMULTANEOUS SCIENTIFIC SESSION - GENERAL THORACIC SURGERY

(8 minutes presentation, 12 minutes discussion)

North Bldg., Rm 105, Metro Toronto Convention Centre

Moderators: Larry R. Kaiser

Carolyn E. Reed

16. The Impact of Chemoradiotherapy on Pulmonary Morbidity After

Esophagectomy

Ara A. Vaporciyan*, Boon K. Lee*, James D. Cox*, Stephen G. Swisher*,
Ritsuko Komaki*, W. Roy Smythe*, Garrett L. Walsh*, David C. Rice*, Jack
A. Roth, Joe B. Putnam, Jr.; Houston, TX

Discussant: Thomas W. Rice

OBJECTIVE: Esophagectomy for esophageal cancer remains a high risk procedure with perioperative mortality, mostly due to pulmonary morbidity, reported between 2% and 10%. Improved long-term survival with preoperative Chemoradiotherapy (pCRT) has been reported in a subset of esophageal cancer patients who achieve a pathologic response. However, an increase in pulmonary morbidity after esophagectomy in patients who received pCRT, may offset any potential oncologic benefit. We examined the impact of pCRT, and other pre and perioperative factors, on the incidence of postoperative major pulmonary events (MPE: pneumonia or acute respiratory distress syndrome) after esophagectomy.

METHODS: A prospectively collected database identified all patients undergoing esophagectomy for primary esophageal cancer from 1/97 to 6/03. Only patients who received all their therapy at our institution were included. The influence of pCRT, the total radiotherapy dose, an estimate of the radiation dose to the lung, and common pre and perioperative factors on the incidence of MPE were examined using univariate analysis. Any significant factors (defined as $p < 0.25$) were included in a multivariable analysis.

RESULTS: A total of 245 patients met inclusion criteria. 141 received pCRT. The overall incidence of MPE was 20.8% (51). Mortality was significantly increased in patients who developed a MPE (18.6% versus .6%, $p < 0.01$). Use of pCRT, the total dose of radiotherapy (as a continuous or categorical variable), or the estimated dose of radiotherapy delivered to the lung (the "off-cord dose"; as a continuous or categorical variable) were not associated with MPE by univariate analysis. The factors that were associated with an increased risk of MPE by univariate and subsequent multivariable analysis are shown in the table below.

Factors predictive of MPE (relative risk; 95% confidence interval)		
Factors	Univariate	Multivariable

Weight loss > 10%	1.7; 0.7-3.7	NS
Male	0.5; 0.2-1.3	NS
Smoking < 1 month before surgery	1.8; 0.8-4.1	2.2; 1.0-5.1
Hx of CAD	1.8; 0.8-3.9	NS
Hx of thoracic surgery	4.0; 0.8-20.3	NS
% predicted FEV1 < 85%	2.2; 0.9-5.5	NS
Length of surgery (each hour)	1.2; 1.0-1.4	1.1; 1.0-1.3
Intraoperative Transfusions (each unit)	1.2; 1.0-1.3	1.1; 1.0-1.3

CONCLUSIONS: The use of pCRT was not associated with an increased risk of MPE after esophagectomy at our institution. In addition, the dose of radiotherapy or the delivery technique did not increase the risk of MPE using conventional measurements of radiation dosing. Factors that were associated with MPE in this population include the timing of smoking cessation, length of surgery and use of intraoperative transfusions.

**By Invitation*

17. Do Combined PET/CT Scans Reliably Predict Pathologic Staging in Resectable Primary Non-Small Cell Lung Cancer?

Stephen C. Yang*, Kristin M. Yang*, Malcolm V. Brock*, David P. Mason*,
Carmen M. Roig*, Richard L. Wahl*, Rex C. Yung*, Julie Brahmer*, David S.
Ettinger*; Baltimore, MD

Discussant: Bryan F. Meyers

OBJECTIVE: Isolated PET scanning is widely utilized to evaluate and stage lung nodules suspicious for cancer. However, its exact role and ability to supplant surgical staging remains to be defined. Since the technology and sensitivity of these scanners have advanced, this study sought to determine the accuracy of combined PET/CT in staging patients with potentially resectable NSCLC.

METHODS: This was a single institution study of prospectively collected data from 133 patients between July 2001 and October 2003. All patients had proven or suspected NSCLC that was potentially resectable initially, and underwent combined PET/CT at this Institution's scanner (GE Corp.).

PET/CT identified 19 (14%) patients with potentially advanced disease. Five (4%) had biopsy proven distant metastatic disease and excluded. Tissue confirmation of N2 disease by mediastinoscopy precluded surgical resection in 10 (8%); 4 were later resected after induction chemotherapy and included in this study. Also included were the remaining 4 patients who had negative mediastinoscopy despite PET/CT findings. All patients with a final diagnosis of NSCLC had lymph node sampling/dissection at the time of surgery.

RESULTS: There were 122 subjects in the study population (median age 68, 66 men). Based on pathology after surgery, PET/CT correctly identified 94 of 100 malignant lesions, but only 8 of the 22 benign masses.

For the 100 cancer patients, PET/CT was correct regarding pathologic nodal (N) status in 61 patients (56 with NO, 2 with N1, and 3 with N2 disease). However, 18 patients had pathologically positive nodes (9 each N1 and N2) that were not seen on PET/CT (false negative). Interestingly,

PET/CT findings overstaged pathologic N status in 20 patients (5 N1 NO, 8 N2 NO, 2 N3 NO, and 5 N2 N1), while understaging 19 (9 NO N1, 9 NO N2, and 1 N1 N2). Tumor and N status data analysis are tabulated below.

Analysis of T and N Status				
	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
T Status	94%	36%	87%	57%
N Status	38%	79%	41%	76%

CONCLUSIONS: These results show that integrated PET/CT is highly sensitive in identifying malignant lesions, but less accurate for benign nodules. It is good in predicting NO disease, but overall N staging remains extremely difficult, especially distinguishing N1 from N2 disease. It has proven useful in detecting distant metastatic disease which obviates surgical resection. Although our results may be comparable to PET scan alone, we feel that combination PET/CT has imaging advantages and should be included in the preoperative staging of potential patients with NSCLC, but not replace surgical staging of mediastinal nodal disease.

**By Invitation*

18. Improved Survival After Living-Donor Lobar Lung Transplantation

Hiroshi Date*, Motoi Aoe*, Yoshifumi Sano*, Itaru Nagahiro*, Kalsumasa Miyaji*, Keiji Goto*, Masaaki Kawada*, Shunji Sano*, Nobuyoshi Shimizu*; Okayama, Japan
Discussant: John C. Wain, Jr.

OBJECTIVE: The survival after living-donor lobar lung transplantation (LDLLT) has been reported to be similar to that after cadaveric lung transplantation. The purpose of this study was to summarize our 5-year experience of LDLLT for critically ill patients.

METHODS: From October 1998 to August 2003, LDUT was performed in 5 children and 19 adults. Mean age was 29.0 years (range 8 to 53 years). Diagnoses included primary pulmonary hypertension (n = 9), idiopathic interstitial pneumonia (n = 5), bronchiolitis obliterans (n = 3), bronchiectasis (n = 3), lymphangioleiomyomatosis (n = 2), cystic fibrosis (n = 1), Eisenmenger's syndrome (n = 1). All recipients were oxygen dependent, 17 were unable to walk and 4 were on a ventilator. Intensive postoperative management included slow weaning from mechanical ventilator, relatively low dose immunosuppressant, careful clinical rejection monitoring with no transbronchial lung biopsy, routine use of inhaled nitric oxide, aggressive physiotherapy and frequent fiberoptic bronchoscopy.

RESULTS: The average duration of mechanical ventilator was 14.6 days, ICU stay was 23.1 days and hospital stay was 61.0 days. Clinically judged acute rejection occurred 1.45 episodes/ patient during the first month, but no infection was encountered. Their mean vital capacity (1920 ml or 68.7% of predicted) and arterial oxygen tension on room air (99-7 mmHg) were excellent at one year. Three patients (12.5%) developed unilateral bronchiolitis obliterans 10, 12, 42 months after LDLLT. Their FEV1 significantly decreased (2250 ml to 1250 ml, 1650 ml to 780 ml, 1250 ml to 800 ml) but reached plateau within 6 months. All 24 recipients are currently alive with a follow-up period of 2-60 months (mean 21.3 months, Figure). All donors have returned to their previous life styles.

CONCLUSIONS: LDLLT can be applied to both pediatric and adult patients with various lung diseases. With intensive postoperative care, it may provide better survival than conventional cadaveric lung transplantation.

**By Invitation*

19. Esophageal Adenocarcinoma in African-Americans: A Clinicopathological Variant of Esophageal Cancer?

Pierre Theodore*, Craig Hooker*, Eric Syphard*, Leonard Sowah*, Arlene Forastiere*, Elizabeth Montgomery*, David Mason*, Stephen Baylin*, James Herman*, Stephen Yang*, Malcolm V. Brock*; Baltimore, MD

Discussant: Carolyn E. Reed

OBJECTIVE: Recent increases in the incidence rates of esophageal adenocarcinoma in the U.S. have largely been confined to Caucasian males. Among African-Americans (AA), esophageal cancer is most commonly of squamous cell histology. There are only a few reports comparing the Clinicopathological characteristics of AA and Caucasian patients with adenocarcinoma.

METHODS: From 1984 to 2002, 574 patients with esophageal adenocarcinoma presented to a single institution in a metropolitan area with a large AA population. Of these, only 3.5% (20/574) were AA which represents one of the largest experiences of AA with adenocarcinoma reported. Clinical and pathological data as well as overall survival were compared between AA and Caucasian esophageal adenocarcinoma patients.

RESULTS: Median age was 62 years in AA (range 36-83) and 64 years in Caucasians (range 19-94) with a male:female ratio of 3:1 and 7:1 respectively. Compared to Caucasians, AA were significantly less likely to have endoscopically proven Barrett's metaplasia (57% (317/554) vs. 20% (4/20); $p=0.001$) and did not have as strong a history of gastroesophageal reflux disease (GERD) (54% (301/554) vs. 35% (7/20); $p=0.09$). The rates of cigarette smoking did not differ significantly between the two groups. AA were significantly more likely to present with more advanced stage disease with 45% (9/20) of patients presenting in stage IV versus 22.2% (123/554) of Caucasians ($p=0.05$). AA were also significantly less likely to have surgical resection than their Caucasian counterparts (30% (6/20) vs. 63% (351/554); $p<0.01$). Overall survival rates in AA were significantly worse than Caucasians with no AA patient surviving more than 3 years.

CONCLUSIONS: Esophageal Adenocarcinoma in AA is rare, less male-sex predominant, less likely to be associated with GERD and Barretts metaplasia, but is associated with worse survival compared to esophageal adenocarcinoma in Caucasians. The pathological features and demographics of adenocarcinoma in AA suggest an etiology separate from the Barrett's esophagus-dysplasia-carcinoma sequence,

3:05 p.m. INTERMISSION - VISIT EXHIBITS

North Bldg., Exhibit Hall

Metro Toronto Convention Centre

**By Invitation*

MONDAY AFTERNOON, APRIL 26, 2004

3:40 p.m. SIMULTANEOUS SCIENTIFIC SESSION -GENERAL THORACIC SURGERY

North Bldg., Rm 105, Metro Toronto Convention Centre

Moderators: Larry R. Kaiser

Carolyn E. Reed

20. Resectional Surgery Combined with Chemotherapy Remains the Treatment of Choice for Multidrug Resistant Tuberculosis

Yuji Shiraishi*, Naoya Katsuragi*, Makoto Kurai*, Nobumasa Takahashi*,
Yutsuki Nakajima*; Tokyo, Japan

Discussant: Andrew A. Conlan

OBJECTIVE: Multidrug resistant tuberculosis remains a significant health problem. The best available treatment of multidrug resistant tuberculosis has been the combination of pulmonary resection and antituberculous chemotherapy. This study was aimed to evaluate the results of resectional surgery combined with chemotherapy for multidrug resistant tuberculosis in the current century.

METHODS: Between 1983 and 2002, 87 patients underwent 95 pulmonary resections for multidrug resistant tuberculosis. Of these patients, 30 patients (34%) were operated on from 2000 to 2002, which were reviewed in this study. All patients shed strains resistant at least to isoniazid and rifampin upon admission, and were treated with multidrug regimens for at least three months prior to operation. Indications for surgery were persistent positive sputum despite chemotherapy and high risk of relapse even though sputum conversion was achieved by chemotherapy. There were 33 pulmonary resections because three patients underwent staged multiple resections. Procedures included completion pneumonectomy (n=1), pneumonectomy (n=11), lobectomy (n=17), and segmentectomy (n=4). The bronchial stump was reinforced with a latissimus dorsi muscle flap in 29 resections. All patients were kept on multidrug regimens for at least one year postoperatively.

RESULTS: Operating time ranged from 140 to 623 minutes (median, 270 minutes). The median intraoperative blood loss was 180 ml (range, 10 to 1330 ml). There was no operative mortality. All patients attained negative sputum status after the operation. Major complication occurred in seven patients. Bronchopleural fistula with empyema, which resulted from recurrent disease at the bronchial stump, occurred in two patients. A space problem occurred in five patients, being treated by thoracoplasty. Relapse of multidrug resistant tuberculosis occurred in three patients. Of these, two patients had a relapse at the bronchial stump and underwent open window thoracostomy. The remaining one had a relapse in the post-lobectomy space, being successfully treated by completion pneumonectomy following open window thoracostomy. Twenty-eight patients (93%) were free from disease with a median follow-up of 26 months (range, 9 to 44 months).

CONCLUSIONS: An increasing number of patients with multidrug resistant tuberculosis are requiring resectional surgery in the 21st century. Pulmonary resection combined with chemotherapy achieves high cure rates with acceptable morbidity, and remains the treatment of choice for multidrug resistant tuberculosis.

**By Invitation*

21. Surveillance CT Scans Following Complete Resection for Non-small Cell Lung Cancer: Analysis of Results and Costs

Robert J. Korst*, Heather T. Gold*, Jeffrey L. Port*, Paul C. Lee*, Nasser K. Altorki; New York, NY

Discussant: Keith S. Naunheim

OBJECTIVE: Patients with completely resected nonsmall cell lung cancer (NSCLC) are at risk for developing recurrent or new primary lung cancer. We sought to determine the utility of and costs associated with surveillance computed tomography of the chest and upper abdomen (CT) for the detection of recurrent or new primary lung cancer in patients with previously resected NSCLC.

METHODS: We reviewed the records of all patients who presented for followup in 2002 with completely resected NSCLC. To be included in the cohort, patients had to be disease-free with no signs/symptoms suggestive of recurrent or new primary disease at the beginning of 2002. Data collected included demographics, initial tumor stage, the radiologists' and surgeons' impressions of any surveillance CT scans performed in 2002, and the results of any further tests instigated by CT results. Surveillance CT scans were defined as only those performed in patients with no signs/symptoms of lung cancer. The cost associated with surveillance CT scans combined with any resulting studies/therapies for the entire cohort was then calculated using Medicare fee schedules.

RESULTS: 213 patients met the criteria for entry into the study cohort, including 141 undergoing a total of 168 surveillance scans. 105 scans were interpreted as abnormal (nodules, adenopathy or pleural fluid) by the radiologist, but in only 32 was the surgeon suspicious for recurrent or new primary lung cancer. 43 additional diagnostic tests/procedures were performed in these 32 patients, including biopsy attempts in 18. Recurrent or new primary lung cancer was diagnosed in 16/32 patients with suspicious scans, with 6 undergoing a second complete resection. 9 patients developed recurrence in 2002 which was detected independent of surveillance CT scans (interval cancers). The total cost associated with the performance of surveillance scanning for the entire cohort combined with subsequent testing/therapies was \$602,328. If surveillance CT scans were not performed in these patients and all new lung cancer was allowed to progress to stage IV prior to detection, the total cost of treatment for the 16 patients with new primary or recurrent lung cancer would have been \$789,008.

CONCLUSIONS: From these data, we conclude that (1) Postoperative surveillance CT scans are read as abnormal by the radiologist in nearly 2/3 of patients after complete resection for NSCLC. (2) The surgeon's impression of suspicious findings on the CT scan is only 50% specific for recurrent or new primary lung cancer. (3) Resectable lung cancer can be detected using surveillance CT scans after previous resection for NSCLC, and, (4) The total costs associated with surveillance CT scanning may compare favorably with the alternative of no postoperative surveillance.

**By Invitation*

22. Selective Management of Intrathoracic Anastomotic Leak After Esophagectomy

Juan A. Crestanello*, Claude Deschamps, Stephen D. Cassivi*, Francis C. Nichols III*, Mark S. Allen, Peter C. Pairolero; Rochester, MN

Discussant: Richard E. Heitmiller

OBJECTIVE: To analyze our experience with management of intrathoracic anastomotic leak after esophagectomy

METHODS: All patients who had intrathoracic anastomotic leakage after esophagectomy were reviewed. Management and factors affecting outcome were analyzed.

RESULTS: Between March 1993 and March 2003, 761 patients had esophagectomy with intrathoracic anastomosis at our institution. Forty-eight patients (6.3%) developed an anastomotic leak. Twenty-four patients (50%) had a contained leak on contrast studies. Twenty-seven patients (56%) were managed non-operatively. The remaining 21 patients (44%) required surgical intervention that included primary anastomotic repair in 19 and esophageal diversion in 2. A single reoperation was done in 16 patients, 2 in 4, and 4 in 1. Median hospitalization was 31 days (range, 11 to 97 days) in the surgical group and 21 (range 10 to 42 days) in the non-operative group. Four patients died (8.5%), 3 in the surgical group (15%) and one in the non-operative group (3.7%). Cause of death was sepsis in 3 patients and congestive heart failure in one. At last follow up (median, 13 months; range, 1-122 months), 15 patients in the surgical group (83%) were eating a normal diet; 5 (28%), however, required at least one dilatation. Similarly, 22 patients in the non-operative group (85%) were eating a normal diet and 9 (35%) required at least one dilatation.

CONCLUSIONS: Intrathoracic anastomotic leaks after esophagectomy are associated with significant mortality. Contained leaks can often be managed non-operatively. Long-term functional results are satisfactory and similar for both non-operative and operative management. Total diversion is unnecessary in the majority of patients.

**By Invitation*

23. The U.S. Experience with Lung Transplantation for Pulmonary Lymphangioleiomyomatosis

Jacques Kpodonu*, Malek G. Massad, John C. Lee*, Rabih Chaer*, Alexander N. Evans*, Amitra Caines*, Michael Fitzgerald*, Norman Snow, Alexander Geha; Chicago, IL
Discussant: Walter Weder

OBJECTIVE: Pulmonary Lymphangioleiomyomatosis (LAM) is a rare disease of unknown origin that predominantly affects women in their reproductive years as well as patients of both sexes with tuberous sclerosis. The disease leads to progressive deterioration of lung function and ultimately death. Lung transplantation has been utilized as a therapeutic option that may improve survival. In this study, we tapped the United Network for Organ Sharing (UNOS) database to analyze the pooled data from 20 U.S. lung transplant centers. Our aim was to evaluate the outcome of patients with LAM who underwent lung transplantation with the aim of making some recommendations regarding patient management.

METHODS: We conducted a retrospective review of 84 patients who underwent lung transplantation for end stage pulmonary LAM between 1987-2003 and were reported to UNOS.

RESULTS: All patients were women with a mean age of 42 years (range 24-65 years). Forty-seven patients (56%) received double-lung and 37 (44%) received single lung transplants. The mean cold ischemia time was 4.7 hours. The 30-day mortality was 5%. There were 2 intra-operative deaths. The cause of death among the 4 patients who died within the first 30 postoperative days was acute lung injury in 3 patients and a cardiovascular event in 1. There were 20 late deaths (>30 days post-transplant). Of those, 5 were from multi-system organ failure, 4 from pulmonary complications and

3 from aspergillus infection. Chronic rejection and bronchiolitis obliterans accounted for two deaths each. Four patients (5%) were re-transplanted. Follow up was complete on all 84 patients. The mean follow up was 37 months (range 0-128 months). The actuarial Kaplan-Meier survival at 1-year was 85.2%, at 3-years 78.3% and at 5-years 65.4%. There was a statistically significant difference in survival among patients with organ ischemia time 4 hours compared to those with > 4 hours (70% vs. 62%, $p<0.05$). Survival was also affected by the recipients' age; those 40 years had a 76% survival vs. 65% for those > 40 years ($p<0.05$), but not by transplant eras (1987-1994 vs. 1995-2003).

CONCLUSIONS: Lung transplantation is a valuable therapeutic option for patients with end-stage pulmonary LAM, and should be considered in patients who demonstrate deteriorating lung functions and poor work effort. The operative mortality among patients who undergo lung transplantation is low, and recurrence of the disease in the lung allograft has not been reported. Lung transplantation offers survival rates that are equivalent to, if not better than, those of patients who receive lung transplantation for other pulmonary indications.

5:00 p.m. ADJOURN

7:00 p.m. ATTENDEE RECEPTION

Eternal Egypt: Masterworks of Ancient Art from the British Museum

*Royal Ontario Museum
(separate subscription)*

**By Invitation*

MONDAY AFTERNOON, APRIL 26, 2004

1:45 p.m. SIMULTANEOUS SCIENTIFIC SESSION - CONGENITAL HEART DISEASE

(8 minutes presentation, 12 minutes discussion)

*North Bldg., Rm 107, Metro Toronto Convention Centre
Moderators: Thomas L. Spray*

Ross M. Ungerleider

24. Outcomes of Mitral Valve Replacement in Children: A Competing Risks Analysis

Fatima Kojori, Rui Chen*, Christopher A. Caldarone*, Sandra L. Merklinger*, Anthony Azakie*, William G. Williams, Glen S. Van Arsdell*, John Coles, Brian W. McCrindle*; Toronto, ON, Canada
Discussant: Vincent Tarn**

OBJECTIVE: Mitral valve replacement (MVR) in children is associated with important ongoing morbidity, risk of valve failure and death. We sought to determine factors associated with these outcomes in children after MVR.

METHODS: Demographic, anatomic, procedural and outcome data were collected for all MVR from 1973 to 2003. Competing risks analysis for each valve was used to determine time-related redo MVR (valve longevity) and death without redo MVR, and associated factors.

RESULTS: MVR was performed 138 times in 104 patients (50% male). Initial MV disease was congenital in 65%, rheumatic 13%, Shones 6%, Marians 3%, endocarditis 2%, and other in 11%. Prior MV repair had been performed in 58%. Median age at initial MVR was 5.9 years (range, birth to 19 years), with 26 patients having at least one redo MVR. Overall, there were 18 deaths after initial and 9 after a redo MVR. Of the 138 MVRs, the median ratio of valve size to body weight was 1.2 mm/kg (range, 0.4 to 6.4). Valve type was St. Jude in 37%, Bjork-Shiley 25%, Carbomedics 20%, Ionescu-Shiley 10%, Hancock 4% and other in 4%. Post-operative complications included arrhythmia in 25%, bleeding 10%, pacemaker implantation 10%, perivalvar leak 5%, and stroke 3%, with 20% requiring reoperations before discharge. Complications during follow-up of each valve included a bleeding episode in 6%, valve thrombosis 3%, TIAs 3% (no strokes), arrhythmia 16%, endocarditis 6%, and perivalvar leak in 17%. In competing risks analysis, at 10 years after MVR 30% of valves were in survivors without redo, 45% of valves had been replaced, and 25% were in patients who had died without redo MVR. Time-related mortality after any MVR was characterized by an early hazard phase superimposed on a low level of constant risk, while time-related risk of redo MVR (valve longevity) was characterized by a high immediate hazard rapidly falling to low levels which then rose progressively during follow-up. Incremental risk factors for mortality included MVR for endocarditis, presence of subaortic stenosis before MVR, longer duration of cardiopulmonary bypass, larger size of valve relative to patient weight and use of valve type other than Carbomedics valves. Incremental risk factors for redo MVR included the presence of associated aortic stenosis or regurgitation, smaller absolute size of implant, and use of Hancock or Ionescu-Shiley valves. Age at MVR and initial vs. redo MVR were not significantly associated with mortality or valve longevity.

CONCLUSIONS: MVR in children is associated with important morbidity and mortality. After failed valve repair, MVR options (type and size) are often limited. High risk patients (eg. unavoidably high ratio of valve size to patient weight, preoperative subaortic stenosis) may be better managed with alternative strategies such as transplantation or single ventricle palliation.

**By Invitation*

25. Mid-Term Results of Mitral Valve Repair Using Artificial Chordae in Children

Kazu Minami*, Hideaki Kado*; Fukuoka, Japan

Discussant: Joseph A. Dearani

OBJECTIVE: Artificial chordal replacement using expanded polytetrafluoroethylene (ePTFE) sutures has become an established component in the technique for mitral valve repair. We have applied this procedure in children and reported favorable clinical results. However, the long-term durability of this procedure following patients' growth is a great concern. Therefore, we present our series during the last 8 years to evaluate the efficacy of the mitral valve repair using artificial chordae in children.

METHODS: From April 1995 to September 2003, 40 children underwent mitral valve repair with chordal replacement using ePTFE. In all patients, the grade of mitral regurgitation (MR) was more than moderate mainly as the result of prolapse of the anterior mitral leaflet. Isolated MR was diagnosed in 26 patients. The mean age and body weight at the time of operation was 4.9 years (1 month to 17.8 years) and 15.2 kg (3.9 to 35.5 kg), respectively. The cause of prolapse was as follows; elongation of the chordae in 21, torn chordae in 14, and absence of the chordae in 5 patients. We placed 4-0, 5-0, or 6-0 ePTFE sutures as artificial chordae. According to the width of the prolapsed leaflet portion and length of chordae in opposite normal leaflet, we decided the number and length of the ePTFE sutures. The mean number and length of ePTFE was 1.4 sutures

(1 to 3 sutures) and 19.2 mm/BSA (8.3 to 31.9 mm/BSA), respectively. In addition to the chordal replacement, we performed unilateral or bilateral Kay-Reed annuloplasty to correct annular dilatation in all patients. The mean follow-up period and body weight at the latest follow-up was 4.7 years (10 months to 8.2 years) and 23.8 kg (6.9 to 50 Kg), respectively.

RESULTS: There was no operative or late death. During the follow-up period, one patient required mitral valve replacement due to recurrent MR at 17 days after the initial repair. In two patients, re-mitral valve plasty was required at 2 and 5 years after the initial repair. The actuarial reoperation free rate at 5 and 10 years were 94.8% and 89.5%, respectively. Less than trivial MR measured by trans-thoracic echo was observed in 34 (85.0%) patients. The mean flow velocity, diameter of mitral annuls, and diastolic descent rate of anterior leaflet before discharge and the latest follow-up period was 106.3cm/s vs. 110 cm/s, 102% vs. 104%, and 64.2 mm/s vs. 62.4mm/s, respectively. We also measured the ratio of diameter of mitral annuls to depth of coaptation. In all cases, this ration has been unchanged. All patients were NYHA class I at the latest follow-up.

CONCLUSIONS: Although continued surveillance is required to watch the mitral valve reconstructed with ePTFE, this procedure demonstrated favorable mid-term outcome. The mitral valve repair using artificial chordae in children would be safe and effective procedure with adaptability of patients' growth.

**By Invitation*

26. An Approach to Two Ventricle Repair in Infants with Pulmonary Atresia and Intact Ventricular Septum

John E. Foker, James Berry*, Lee A. Pytes*; Minneapolis, MN

Discussant: Frank L. Hanley

OBJECTIVE: Infants with pulmonary atresia and intact ventricular septum (PA/IVS) have a severe group of lesions. As a result, the mortality remains high and only about 30% end up with a two ventricle repair. We have shown that flow across the AV valve will provide the signal for ventricular growth. Moreover, the response is relatively rapid and, within days to weeks, the ventricles will enlarge dramatically. Our hypothesis was that growth could be induced in these infants, however, the ultimate success would depend on addressing the other significant lesions. Important connections between the right ventricle and the coronary arteries (CA) may occur, for example, and coronary blood flow may be predominantly retrograde.

METHODS: The treatment of infants with PA/IVS has evolved over 15 years as the individual components have been better understood. From 1990-1998, 26 infants with PA/IVS were treated to achieve a two-ventricle repair. No patients were turned down because of RV hypoplasia and only those with Ebstein's anomaly are excluded from this study. RV and tricuspid valve (TV) analysis was done by echo measurements in two orthogonal planes, avoiding the falsely low 4-chamber estimates. The Z-scores of the RVs and TVs were calculated from standard nomograms. Our approach to achieve a two-ventricle repair includes (1) ligation of RV-CA connections off bypass to prevent a steal phenomenon (2) RV decompression with an outflow patch (3) snared control of an ASD to ensure systemic output and increase tricuspid valve flow and (4) either reduction of the PDA with more favorable RVs or the placement of a central shunt if the RVs are very small ($Z = -7.0$).

RESULTS: All had an RVOT patch and the RV-CA connections, (up to 7/pt) were ligated when significant (in 36%). The 21 (81%) longer term survivors formed the basis of this study and the measurements of RV and TV size were assessed serially by echo. All had two-ventricle repairs,

none were on a palliative course, and all shunts were closed. The RV size initially was $Z=-7.0 \pm 2.1$ (range -2.8 to -11.0). Six months later, the range was +0.8 to -3.2 with all normal in function. The tricuspid valves were more complicated. Preoperatively: $Z=-3.5 \pm 0.9$ (range -2.3 to -5.8). Six months later, $Z=-1.1 \pm 2.5$ (range 2.0 to -2.4). Of 10 studied in detail, 7 were normal and 3 stenotic requiring dilation. There were no discernible effects from the RV/CA ligations either acutely or long term. All survivors had a two-ventricle repair with no residual shunts.

CONCLUSIONS: (1) Two ventricle repairs can be reliably achieved in PA/IVS patients with improved longer term survival. (2) Rapid catch-up growth of RV and TV size has been demonstrated. (3) Growth enhanced RVs will have normal function. The benefits of the two-ventricle repair should increase with time.

**By Invitation*

27. Left Ventricular Performance of Pulmonary Atresia With Intact Ventricular Septum After Right Heart Bypass Surgery

Yoshihisa Tanoue*, Hideaki Kado*, Taketoshi Maeda*, Yuichi Shiokawa*, Naoki Fusazaki*, Shiro Ishikawa*; Fukuoka, Japan

*Discussant: David Bichell**

OBJECTIVE: Left ventricular performance of pulmonary atresia with intact ventricular septum (PA/IVS) before and after the bidirectional Glenn procedure and a staged total cavopulmonary connection was compared with that of tricuspid atresia (TA).

METHODS: Contractility (end-systolic elastance; Ees), afterload (effective arterial elastance; Ea), and ventricular efficiency (ventriculoarterial coupling; Ea/Ees, and the ratio of stroke work and pressure-volume area; SW/PVA) were approximated on the basis of the cardiac catheterization data before the bidirectional Glenn procedure (PreG), before and after the staged total cavopulmonary connection (PreT, PostT₀), and around 1 year after the total cavopulmonary connection completion (PostT₁) in 20 patients of PA/IVS and 21 patients of TA.

RESULTS: Contractility and ventricular efficiency in PA/IVS patients is inferior to those in TA patients after the total cavopulmonary connection.

<i>Time Course of Ventricular Performance</i>					
		PreG	PreT	PostT ₀	PostT ₁
Ees (mmHg/ml/M²)	PA/IVS	1.10±0.42	1.36±0.19	1.60±0.44	1.85±0.54
	TA	1.49±0.48	1.72±0.49	2.19±0.73	2.60±0.69
Ea (mmHg/ml/M²)	PA/IVS	1.10±0.29	1.38±0.29	1.62±0.33	1.97±0.61
	TA	1.37±0.53	1.51±0.37	1.90±0.51	2.29±0.85
Ea/Ees	PA/IVS	1.09±0.40	1.03±0.25	1.07±0.28	1.12±0.37
	TA	0.95±0.31	0.91±0.24	0.94±0.38	0.91±0.33
SW/PVA	PA/IVS	65.7±7.2	66.4±5.6	65.7±6.0	64.9±7.0
	TA	68.4±6.7	69.1±5.4	69.0±8.0	69.5±7.5

CONCLUSIONS: The high-pressure residual right might impair the left ventricular performance of PA/IVS after the right heart bypass surgery.

3:05 p.m. INTERMISSION - VISIT EXHIBITS

North Bldg., Exhibit Hall

Metro Toronto Convention Centre

**By Invitation*

3:40 SIMULTANEOUS SCIENTIFIC SESSION - CONGENITAL HEART DISEASE

North Bldg., Rm 107, Metro Toronto Convention Centre

Moderators: Thomas L. Spray

Ross M. Ungerleider

28. Surgical Management of Transposition of the Great Arteries with Intact Ventricular

Septum in Infants Older Than 21 Days

Emre Belli*, Dominique Piot*, Anita Touchot*, Regine Roussin*, Emir Mokhfi*, Claude Planche*, ¹Alain Serraf; Le Plessis-Robinson, France

Discussant: ²Marc de Leval

OBJECTIVE: Rapid 2-stage arterial switch operation (ASO) following left ventricular (LV) retraining has become a safe alternative to the primary ASO for the treatment of transposition of the great arteries with intact ventricular septum (TGATVS) in infants older than 21 days. However, criteria predicting post-operative LV performance remains controversial.

METHODS: Between 1993 and 2002, 49/538 patients who underwent ASO for TGA/IVS were > 21 (median 44; 22 to 367) days old. Primary ASO was performed in 28 (group I) (median age 32, 22 to 172) while 21 (group II) underwent a rapid 2-stage (median delay 11 days) management with initial pulmonary artery banding, this associated with a systemic-to-pulmonary shunt in all but 1. At preoperative echocardiography, LV geometry as well as the LV mass index, mass/ volume ratio and LV diastolic posterior wall thickness/LV diastolic diameter ratio and also the patency of arterial duct were considered. Post-operative LV function and outcome measurements were recorded. In early experience, indications were based on the LV mass only (< 35 g/ m²). The decision criteria for initial left ventricle retraining has evolved with time.

RESULTS: There were 3 (6%; 70% CI 2-11%) hospital deaths : 2 after primary ASO and one because of mediastinitis between the 2 stages. Three patients required ECMO support: 1 after first stage procedure and 2 after primary ASO. The indexed LV mass/volume ratio appeared to be the principal parameter predicting postoperative LV failure (p<.05).

CONCLUSIONS: A preoperative mass/volume ratio > 1.2 allowed to perform an uneventful primary ASO until 6 months of age. The outcome after rapid 2-stage ASO remains encouraging.

**By Invitation*

¹1993-94 Graham Fellow

²1973-74 Graham Fellow

29. Biventricular Repair in Atrioventricular Septal Defects with a Small Right Ventricle: Anatomical and Surgical Considerations

Nílto Carias de Oliveira*, Rekwan Sittiwangkul*, Brian W. McCrindle*, Anne Dipchand*, John G. Coles, William G. Williams, Glen S. Van Arsdell*;
Toronto, ON, Canada
Discussant: Giovanni Stettin

OBJECTIVE: Single ventricle palliation (SVP) in children with a small right ventricle and AVSD (sRV/AVSD) in the presence of trisomy 21 has suboptimal results. We have therefore adopted a strategy of pushing the limits for biventricular repair (BVR), with or without an atrial fenestration.

METHODS: From January 1989 to July 2003, 32 children (median age 6 mo, 1 - 47 mo) with a sRV/AVSD underwent a BVR (sRV/AVSD/BVR). A sRV was identified by echocardiographic impression and defined for this analysis by detailed measurements of complete atrioventricular valve (CAV) area and diameter, and annulus to RV and LV apex. A theoretic partitioning plane for the AVSD on the right side of the septum allowed for calculations of left and right atrioventricular valve (LAV, RAV) dimensions and ratio. Measurements of the sRV patients were validated against case match controls of balanced AVSD. Seven other children having sRV/AVSD with SVP were studied. Down's syndrome was present in 37 patients.

RESULTS: By case match control sRV/AVSD/BVR children had lower RAV/CAV area ratio (mean 0.41 ± 0.1 vs control 0.52 ± 0.1 , $p < .0001$); lower RV/LV length ratio (0.78 ± 0.1 vs control 0.99 ± 0.17 , $p < .0001$); and lower median RAV/CAV diameter ratio (0.48 ± 0.12 vs control 0.55 ± 0.1 , $p < .03$). SVP children had the smallest RV dimensions: compared to sRV/AVSD/BVR they were: RV/LV length ratio (0.64 ± 0.13 vs 0.78 ± 0.1 , $p = .002$) and lower median RAV/CAV diameter ratio (0.36 ± 0.1 vs 0.48 ± 0.12 , $p = .03$); however, there was no difference in RAV/CAV ratio suggesting that RV volume was smaller in the SVP group. There were 5 operative deaths (3 in sRV/AVSD/BVR and 2 in SVP). Kaplan Meyer estimates of survival were 90 % at 10 years for sRV/AVSD/BVR vs. 69 % for SVP patients ($p = 0.23$). Compared to the SVP, patients after sRV/AVSD/BVR had lower CVP on arrival to the ICU (11.2 ± 2.6 mmHg vs 17 ± 6.3 mmHg, $p = .003$) and 24 hours later (13.2 ± 6.3 mmHg vs 22 ± 12.8 mmHg, $p = .04$). In the sRV/AVSD/BVR group, O₂ sat at 24 hours correlated with right AV annulus size ($r = 0.47$, $p = 0.02$). O₂ saturations at 24 hours were not different between the sRV/AVSD/BVR and the SVP in contrast to last follow-up, being higher in the BVR group (0.93 ± 0.06 vs 0.83 ± 0.14 , $p = 0.04$). A restrictive atrial fenestration was left in 9 patients after BVR. Absolute RAV dimension was smaller in the fenestrated group (1.04 vs 1.48 , $p = 0.03$) Patients with a fenestration had a lower O₂ saturations at 24 hours (91 % vs 97 %, $p = 0.003$).

CONCLUSIONS: These findings suggest that an aggressive strategy towards BVR in patients having sRV/AVSD is beneficial. BVR was successful in infants having a RAVV/CAVV ratio as small as 0.32 and an RV/LV ratio as small as 0.66. An atrial fenestration extends the anatomical limits for BVR and was not detrimental to oxygen saturation as compared to the SVP cohort.

**By Invitation*

30. Evolving Techniques in the Repair of Truncus Arteriosus 1990-2003

Jonathan M. Chen*, Julie S. Glickstein*, Ryan R. Davies*, Michelle L. Mercado*, Ralph S. Mosca, Jan M. Quaegebeur; New York, NY
Discussant: Constantine Mavroudis

OBJECTIVE: While previous methods of truncus arteriosus (TA) repair have employed various conduits to establish right ventricle (RV) to pulmonary artery (PA) continuity, recent techniques using direct RV-PA anastomosis with anterior patch augmentation have been promoted to delay or avoid later RVOT reconstruction. Whether these measures postpone reoperation (REOP), or instead replace it with catheter-based interventions (CBI, e.g., stent placement, balloon angioplasty) remains unclear. To address this, we evaluated our experience with primary repair of TA.

METHODS: Records were reviewed of all patients undergoing repair of TA from 6/90 - 6/03. Functional and demographic parameters were evaluated and patients divided according to type of primary TA repair: homograft, or non-valved direct anastomosis with anterior patch materials. Postoperative outcomes, including the need for CBI or REOP were evaluated by univariate and multivariate analysis.

RESULTS: 51 patients underwent primary repair of TA during the 13 year period; 4 patients first operated elsewhere who had reoperative homograft replacements were excluded from the analysis. Median age at repair was 14 days. RV-PA connections used a homograft in 16, and direct connection with autologous pericardial (6), bovine pericardial (8), cryopreserved pericardial (7), Cortex (13) and other (1) hoods. Mean follow-up was 86.9 months (range 0-161 months). One patient died postoperatively. Of the remaining 50 patients, 26 required no further interventions.

The number of patients requiring any intervention (CBI or REOP) was comparable in both homograft and direct connection cohorts (40.0% vs 46.7%). The number of patients requiring REOP was higher for homograft (46.7% vs. 20.0%, $p = 0.054$), and the number requiring CBI was higher for direct connection (31.4% vs. 13.3%, $p = 0.181$) patients. No patients with Cortex hoods required reoperation, (0% vs 38.9%, $p = 0.001$) and only 3 (23.1% vs. 52.78%, $p = 0.039$) required CBI.

Median time to any intervention was 103.3 months for direct connection and 108.1 months for homograft recipients. Nonparametric analysis of survival free from any intervention demonstrated a significant difference ($p < 0.007$) according to anterior hood type: autologous pericardial (5.6 months), cryopreserved pericardial (7.5 months), bovine pericardial (64.1 months) and Cortex (97.3 months).

CONCLUSIONS: When compared to homograft recipients, patients undergoing direct connection for primary repair of TA require fewer reoperations but more CBI, and appear to require intervention according to the type of patch material used for hood augmentation, likely due to hood dilatation or branch PA distortion. Despite the need for CBI, direct connection repair may allow for patient growth, thereby either eliminating or postponing the need for later reoperation.

**By Invitation*

31. The Sutureless Technique for Repair of Pulmonary Veins: Extension from Post-Repair Pulmonary Vein Stenosis to Primary Repair of Pulmonary Venous Anomalies

Tae-Jin Yun*, John G. Coles, Wald M. Rachel*, Glen S. Van Arsdell*, William G. Williams, Jeffrey Smallhorn*, Christopher A. Caldarone*; Toronto, ON, Canada

Discussant: Francois Lacour-Gayet

OBJECTIVE: We have previously reported a limited but favorable experience with a novel sutureless technique for surgical management of postoperative pulmonary vein stenosis (PVS) occurring after repair of total anomalous pulmonary venous drainage (post-repair pulmonary vein stenosis). Because this technique requires integrity of the retro-cardiac space for hemostasis, extension of the technique to the primary repair of pulmonary vein anomalies requires evaluation. This analysis reviews our experience with the sutureless technique in patients with post-repair PVS as well our extension of the technique into primary repair of pulmonary vein anomalies.

METHODS: Retrospective univariable/multivariable analysis of all pulmonary vein stenosis procedures and sutureless pulmonary vein procedures over a 20 year period (1983-2003) was performed.

RESULTS: Sixty patients underwent 73 procedures. PVS was present in 65 procedures. The sutureless technique was used in 40 procedures (32 with PVS, 7 with PR-PVS, 24 with no prior surgery). 'Conventional' management, including direct pulmonary vein-to-atrial anastomoses and stenting procedures, was used in 33 procedures. Mean followup: 2.9 yrs. Mean age: 1.1yrs.

Using the entire cohort, freedom from reoperation or death at 5 years after initial procedure was 49%. Variables associated with increased risk of reoperation or death included bilateral stenosis (hazard ratio 7.22), right atrial isomerism (HR 11.04), and the use of stents (HR 3.59). After controlling for identified risk factors, the use of the sutureless technique was associated with decreased but not statistically significant risk of reoperation or death (HR 0.64, $p=0.34$).

The sutureless technique was used as a primary procedure in 24 patients with PVS ($n = 19$) or at increased risk of PVS ($n=5$). Despite the absence of a retrocardiac adhesions, operative mortality was not increased ($p=0.64$). In 4 patients, dissection through the pleural reflection resulted in bleeding into the pleural cavity which was easily controlled with a straightforward trans-pleura! approach to the pulmonary hilum.

24 patients had post-repair pulmonary vein stenosis of whom 7 underwent a sutureless repair and 17 underwent conventional management. The sutureless technique was associated with decreased risk of re-operation or death (univariable $p=0.03$) with no reoperations or death in the sutureless group (mean followup: 3.1yrs).

CONCLUSIONS: The sutureless technique for post-repair pulmonary vein stenosis is associated with excellent mid-term results. Extension of the indications for the technique to primary repair appears safe with development of simple hemostatic maneuvers and offers potential for improved freedom from postoperative PVS.

5:00 p.m. ADJOURN

7:00 p.m. ATTENDEE RECEPTION

Eternal Egypt: Masterworks of Ancient Art from the British Museum

Royal Ontario Museum

(separate subscription)

TUESDAY MORNING, APRIL 27, 2004

7:00 a.m. CARDIAC SURGERY FORUM SESSION

(5 minutes presentation, 7 minutes discussion)

North Bldg., Rm 206C, Metro Toronto Convention Centre

Moderators: W. Randolph Chitwood, Jr.

Pedro J. del Nido

F1. Preliminary Results of Fetal Cardiac Bypass Using Non-human Primates

Akio Ikai*, R. Kirk Riemer*, Chandra Ramamoorthy*, Frank L. Hanley, V.

Mohan Reddy; Stanford, CA

OBJECTIVE: Fetal cardiac surgery has potential benefits for treatment of some congenital heart defects. We have already established successful implementation of cardiac bypass in the ovine fetus, however, the presence of fetal stress induced by cardiac bypass resulted in placental dysfunction. In this study, we evaluated the technical feasibility of cardiac bypass in the fetal baboon to advance to human surgical intervention and evaluate the efficacy of different anesthetic approaches in reducing fetal stress.

METHODS: A total of twelve baboon fetuses, average gestation 142 ± 8 days and weight 736 ± 185 grams, were used. Three fetuses were excluded from the study because of nuchal cord presentations. The animals were separated into two anesthesia groups: fentanyl/midazolam anesthesia ($n=3$), and Isoflurane anesthesia ($n=6$). All fetuses were placed on a miniature conventional roller pump circuit (priming volume <20 ml) without oxygenator for 30 minutes and returned to normal fetal circulation for an hour. No blood transfusion was performed. Blood gas samples for evaluating placental dysfunction and fetal stress were collected pre-bypass, and 15, 30, and 60 min- post-bypass.

RESULTS: All fetuses were successfully placed on the cardiac bypass circuit. All maternal baboons survived. Five of six fetuses in Isoflurane group survived for 60 minutes, whereas all three fetuses in fentanyl group did not survive for 60 min post-bypass. However, placental dysfunction resulting in the decline of blood gas was not prevented in either anesthetic group. (PaO₂ pre-bypass, post 15 min, and post 60 min: Isoflurane 33 ± 3 , 23 ± 6 , and 18 ± 9 mmHg, fentanyl; 21 ± 9 , and 17 ± 6 mmHg). Maternal baboons exhibited an extremely high tolerance to fentanyl compared with normal human subjects and uterine tone was sustained with fentanyl anesthesia compared with Isoflurane anesthesia

CONCLUSIONS: The technical feasibility of cardiac bypass in non-human primate fetus, even with extremely low body weight, including no maternal mortality, was confirmed. Isoflurane anesthesia appears to be superior to Fentanyl anesthesia with better uterine relaxation and better fetal-placental gas exchange.

**By Invitation*

F2. Tissue Oxygenation Index is a Useful Monitor of Histological and Neurological Outcome after Cardiopulmonary Bypass in Piglets

Ikuko Hagino*, Vesa Anttila*, David Zurakowski*, Hart G. W. Lidov*, Richard A. Jonas; Boston, MA

OBJECTIVE: Tissue oxygenation index (TOI) is a novel monitoring function derived from near infrared spectroscopy (NIRS). Measurement over three path lengths allows calculation of an absolute value in contrast to percent change from baseline as for previous NIRS monitoring functions. We hypothesized that TOI could predict a minimum safe flow rate for specific bypass conditions.

METHODS: Thirty-six piglets (43 ± 5 days, 9.0 ± 1.1 kg) underwent CPB with cerebral NIRS (NIRO-300). Animals were cooled for 40 min to 15, 25, or 34°C (pH-stat, Hct 20 or 30%, pump flow 100 ml/min/kg), followed by 120 minutes of low flow perfusion (10, 25, or 50 ml/ mm/kg). Neurological deficit score (NDS) and behavioral evaluations were performed daily for 4 days. The brain was then fixed for histological assessment. Analysis employed repeated-measures ANOVA and logistic regression.

RESULTS: During low flow bypass, average TOI, minimum TOI and TOI at 15 minutes after the beginning of low flow were highly correlated (all Spearman rho = 0.98, $p < 0.001$). Animals with TOI greater than 60% had no histological or functional evidence of cerebral injury while all animals with TOI less than 55% had evidence of injury. An inverse correlation was found between average TOI during low flow and NDS on first postop day (Spearman rho = -0.55, $p < 0.01$). Temperature ($p < 0.001$), flow rate ($p < 0.001$), and hematocrit ($p = 0.02$) were significant multi-variable predictors of TOI based on logistic regression using a cutoff of $< 55\%$ for TOI.

CONCLUSIONS: TOI is a useful monitor of cerebral oxygenation during CPB and can therefore be used to define the safety and adequacy of perfusion by CPB. Minimum safe flow rate is influenced by hematocrit as well as temperature.

**By Invitation*

F3. Identification of a Set of Genes that Enable Clustering of Individuals with Bicuspid and Tricuspid Aortic Valves into Separate Groups

Marineh Yagubyan*, Thoralf M. Sundt HI, Mark E. Bolander*, Gobiada Sarkar*, Alok Srivastava*, Jay W. Ellison*, Kenton J. Zehr*, Joseph A. Dearani, Richard C. Daly, Thomas A. Orszulak, Charles J. Mullany, Hartzell V. Schaff, Rochester, MN

OBJECTIVE: Patients with bicuspid aortic valves (BAY) have an increased risk of ascending aortic dissection and aneurysm compared to those with tricuspid aortic valves (TAV). Identification of the genes responsible for BAY may provide insights into this phenomenon. Pursuant to this end, we have applied genomic technologies including gene expression arrays and bioinformatics analysis software to investigate clinical specimens of ascending aorta.

METHODS: Total RNA was extracted from ascending aortic tissue of 11 patients (4 BAY with aneurysm, 1 BAY without aneurysm, 3 TAV with aneurysms and 3 TAV without aneurysm) undergoing cardiac operations and subjected to in-situ micro array hybridization to 22,283 probe sets of the Affymetrix® UI33A DNA chips. After normalization and data filtering, patients were grouped according to gene expression patterns using unsupervised hierarchical clustering (dChip software). The method of nearest centroid analysis was applied to the results of the clustering procedure. A summary of genes whose expression pattern best contributed to the classification of patients into the different clusters was determined using PAM (Prediction Analysis for Micro arrays,

Stanford University Labs) software. The latter analysis was performed at a threshold choice of 3.5. The findings were examined in the light of clinical phenotype.

RESULTS: The hierarchical cluster analysis grouped the patients into 2 major clusters and multiple minor clusters as illustrated by the dendrogram (figure). There was apparent correlation between the major clusters (1 & 2) and valve morphology (BAV vs. TAV) but not other patient characteristics, including age, gender, presence or absence of aneurysm, functional pathology or hypertension. Nearest centroid analysis identified a set of 45 genes out of 22,283 (0.2%) that were responsible for the clustering pattern of the 11 samples.

CONCLUSIONS: These results demonstrate two basic gene expression profiles in the ascending aorta, one characteristic of patients with BAV, and the other of those with TAV. This suggests that the biological abnormality responsible for BAV is manifested in the aorta as well as the valve. Investigation of the set of genes responsible for such a classification of the studied patients as well as gene expression analysis of additional patients is in progress.

**By Invitation*

F4. Surgical Treatment of Ischemic Mitral Regurgitation Will Not Influence Infarction Induced Ventricular Remodeling

Sina L. Moainie*, Joseph H. Gorman III*, Yoshiharu Enomoto*, Benjamin M. Jackson*, Theodore Plappert*, Martin G. St. John-Sutton*, Robert C. Gorman; Philadelphia, PA

OBJECTIVE: Surgical treatment for ischemic mitral regurgitation (IMR) has become more aggressive. However, no clinical study has conclusively demonstrated that the surgical correction of IMR improves survival beyond that expected from medical management and revascularization. We used four well-developed ovine models of post infarction left ventricular (LV) remodeling to test the hypothesis that IMR does not significantly contribute to post infarction LV remodeling.

METHODS: Infarction of 21% to 24% of the LV mass was induced by coronary ligation in 77 sheep. Infarctions varied only by anatomic location in the LV: anteroapical (AA), n=26; anterobasal (AB), n=16; laterobasal (LB), n=9 and posterobasal (PB) n=20. Six additional sheep had ring annuloplasty *prior* to PB infarction. End systolic volume (ESV), end diastolic volume, end systolic muscle to cavity area ratio (EMSCAR), LV sphericity, ejection fraction (EF) and degree of IMR as determined by quantitative echocardiography were assessed before infarction and at 2, 5 and 8 weeks after infarction to evaluate the extent of LV remodeling.

RESULTS: All infarcts resulted in significant post infarction remodeling and decreased EF (table). AA infarcts lead to LV aneurysms and resulted in more severe remodeling than the three other infarct locations. Only PB infarcts caused severe and progressive IMR. Remodeling due to PB infarcts was not more severe than that caused by infarcts at other locations. Furthermore, prophylactic annuloplasty prevented the development of MR after PB infarction but had no effect on remodeling.

Infarct Location	IMR at 8 weeks (0=no MR, 4=severe MR)	ESV at 8 weeks as % of preinfarction	EMSCAR at 8 weeks as % of preinfarction	EF at 8 weeks as % of preinfarction
Anteroapical(AA) n=26	0.7±0.2	238±11	86±4	76±34

Anterobasal(AB) n=16	0.5±0.2	203±17*	75±6	75±38
Laterobasal(LB) n=9	0.2±0.2	191±19	83±8	74±23
Posterobasal(PB) n=20	2.8±0.2**	218±12	74±7	73±21
Posterobasal(PB) w/ Annuloplasty	0.5±0.2	195±17	77±14	69±19

*ESV significantly greater for AA infarcts than all other infarct locations at 8 wks

** IMR significantly greater for PB infarcts than all other infarct locations at 8 wks

CONCLUSIONS: The extent of post infarction remodeling is determined by infarct size and location. The development of IMR does not contribute to adverse remodeling. IMR is a manifestation rather than a cause of post infarction remodeling. The current aggressive surgical approach to IMR should be reassessed.

**By Invitation*

F5. Optimal Temperature for Selective Cerebral Perfusion

Justus T. Strauch*, David Spielvogel*, Alexander Lauten*, Ning Zhang*,
Sindy Rinke*, Donald Weisz*, Carol A. Bodian*, Randall B. Griep; New
York, NY

OBJECTIVE: Although combinations of hypothermic circulatory arrest (HCA) and ante grade selective cerebral perfusion (SCP) are widely utilized for cerebral protection during aortic arch surgery, there is no consensus regarding optimal temperature during SCP. This study explored the impact of different temperatures during SCP on cerebral metabolism and neurologic outcome.

METHODS: In this blinded study, 40 pigs (20-22 kg) were randomized into 4 groups after 30 minutes of HCA at 20°C. During a subsequent 60-minute interval of SCP, with flow regulated to maintain a perfusion pressure of 50 mm Hg, pigs were perfused at 10°C, 15°C, 20°C and 25°C. Fluorescent micro spheres enabled calculation of cerebral blood flow (CBF) during perfusion and recovery. Hemodynamics, intracranial pressure (ICP), cerebrovascular resistance (CVR), and oxygen consumption (CMR02) were also monitored. Behavioral scores (in which 12 is normal and 0 indicates coma or death) were obtained for 7 days postoperatively.

RESULTS: CBF decreased significantly ($p<0.002$) during cooling in all groups: it was significantly higher throughout SCP in the 20-25°C vs the 10-15°C groups ($p=0.0001$), and remained higher during recovery ($p=0.0001$). As seen below, CMR02 fell significantly with cooling ($p=0.0001$), remained low during perfusion, and rebounded with rewarming, but was significantly lower with 10-15°C than with 20-25°C throughout SCP ($p=0.003$), and after CPB was discontinued ($p=0.001$). Postoperative behavioral scores, also shown below, were significantly higher following SCP at 10-15°C than at 20-25°C, ($p = 0.001$).

CONCLUSIONS: This study suggests that SCP at 10-15°C provides better global cerebral protection than SCP at 20-25°C, even though CMR02 remains low for several hours after SCP at 10-15°C. Prompt return of metabolism to baseline levels after HCA/ SCP does not necessarily predict superior behavioral outcome.

**By Invitation*

F6. Systemic Delivery is Superior to Regional Retrograde Perfusion of an Adenosine Analogue for Attenuating Injury and Inflammation, and for Cytoarchitecture Preservation After Spinal Cord Ischemia-Reperfusion

T. Brett Reece*, Curtis G. Tribble, David O. Okonkwo*, Patrick S. Warren*, Peter I. Ellman*, Randall Woodford*, Joel Linden*, Irving L. Kron, John A. Kern; Charlottesville, VA

OBJECTIVE: Spinal cord (s.c.) injury is a devastating complication of thoracic aortic surgery. Systemic therapy with a selective adenosine A_M agonist, ATL-146e, during reperfusion attenuates ischemic s.c. injury. In theory, retrograde regional delivery has the advantage of more potent local effects. We hypothesized that not only does retrograde venous perfusion of ATL-146e reach the s.c. parenchyma, but when compared to systemic therapy it produces superior preservation of function and cytoarchitecture (histology and microtubule associated protein-2 or MAP-2), while reducing neutrophil sequestration.

METHODS: Thirty-five pigs underwent s.c. ischemia with reperfusion by 30min thoracic aortic cross-clamping. Pigs received: retrograde saline (control); retrograde ATL-146e (GroupII); systemic ATL-146e (GroupIII); systemic ATI-146e+retrograde saline (GroupIV); or systemic ATI-146e+retrograde ATI-146e (GroupV). Retrograde therapies were via accessory hemiazygous vein during ischemia. Systemic ATL-146e (0.06mg/kg/min) was given intravenously for 3h beginning 10min before reperfusion. At 24h, motor function was assessed (Tarlov scores: 0 paralyzed-5 normal gait). Tissue was analyzed for neuronal viability, MAP-2 immunostaining, and neutrophil sequestration (myeloperoxidase activity or MPO, DOD/mg/min).

RESULTS: Two pigs received retrograde barium perfusion showing both radiographic and histologic spinal cord perfusion. Tarlov Scores at 24h were significantly improved vs. control in Groups II, III, IV (control: 1.33 ± 0.8 ; GroupII: 5.00 ± 0.00 ; GroupIII: 4.83 ± 0.17 ; GroupIV: 5.00 ± 0.00 ; $p < 0.05$). Neuronal viability (viable neurons/hpf) was significantly preserved compared to controls in all systemic ATI groups (control: 7.20 ± 0.47 ; GroupIII: 8.52 ± 0.46 ; GroupIV: 9.27 ± 0.58 ; $p < 0.05$). MAP-2 immunoreactivity in gray matter was likewise significantly preserved vs. controls in all systemic ATL groups (control: $16.49 \pm 1.71\%$; GroupIII: $34.80 \pm 2.04\%$; GroupIV: $39.78 \pm 2.26\%$; GroupV: $29.87 \pm 1.65\%$; $p < 0.003$). Systemic ATL administration significantly lowered MPO activity versus controls (control: 7.20 ± 0.47 ; GroupIII: 8.52 ± 0.46 ; GroupIV: 9.27 ± 0.58 ; GroupV: 6.69 ± 0.51 ; $p < 0.01$).

CONCLUSIONS: Although retrograde perfusion of ATL-146e delivers drug to the spinal cord, systemic therapy provides significantly better preservation of function and neuronal cytoarchitecture, while limiting s.c. neutrophil sequestration. The attenuation of ischemic spinal cord injury by ATL-146e is optimal with systemic therapy, possibly through enhanced treatment of systemic inflammatory cells usually absent in spinal tissue.

**By Invitation*

F7. Early Ischemic Preconditioning Is Superior To Late Ischemic Preconditioning In Spinal Cord Protection After Descending Thoracic Aortic Occlusion

Ioannis K. Toumpoulis*, John C. Papakostas*, Miltiadis I. Matsagas*, Vassiliki D. Malamou-Mitsi*, Lina S. Pappa*, Constantine E. Anagnostopoulos; Ioannina, Greece, New York, NY

OBJECTIVE: We previously showed that both early and late ischemic preconditioning (IPC) significantly reduced spinal cord injury caused by 35-minute descending thoracic aortic occlusion (DTAO) in a porcine experimental model. In this study we investigated the effect of IPC on ischemic spinal cord injury after 45-minute DTAO.

METHODS: Thirty-two pigs (28 to 32 kg) were divided into five groups: group 1 (n=6) underwent a sham operation, group 2 (n=6) underwent DTAO for 20 minutes, group 3 (n=6) underwent DTAO for 45 minutes, all without IPC. Group 4 (n=6) underwent DTAO for 20 minutes and 48 hours later DTAO for 45 minutes (late IPC) and group 5 (n=8) underwent DTAO for 20 minutes and 80 minutes later DTAO for 45 minutes (early IPC). DTAO was accomplished by using 2 balloon occlusion catheters placed Duoroscopically beyond the origin of the left subclavian artery and at the aortic bifurcation. Neurologic evaluation was performed by an independent observer according to Tarlov's score (0-4, 4=normal). The lower thoracic and lumbar spinal cords were harvested at 120 hours and examined histologically with hematoxylin-and-eosin stain. The number of neurons was counted and the grade of inflammation was scored (0-4, 4=no inflammation). Results were expressed as the mean \pm standard deviation and statistical analysis was by means of the Kruskal-Wallis (Tarlov score and grade of inflammation) and 1-Way ANOVA test (number of neurons).

RESULTS: Results are summarized in table. Group 5 (early IPC) had better Tarlov score by comparison to group 3 (control, no IPC; $P=0.001$) as well as to group 4 (late IPC; $P=0.001$). The histologic changes were propotional to the Tarlov scores, with the least histologic damage in the animals of group 5 as compared to group 3 (number of neurons, $P<0.001$ and grade of inflammation, $P=0.004$) or group 4 (number of neurons, $P<0.001$ and grade of inflammation, $P=0.006$).

Results: Tarlov score, inflammation, number of neurons			
	Tarlov score	Inflammation	Number of neurons
Group 1 (sham)	4.00 \pm 0.00	4.00 \pm 0.00	171+8
Group 2 (20 min DTAO)	4.00 \pm 0.00	4.00 \pm 0.00	167 \pm 7
Group 3 (45 min DTAO)	0.33 \pm 0.52	1.33 \pm 0.82	31+6
Group 4 (late IPC)	0.67 \pm 0.82	1.50 \pm 0.84	47 \pm 17
Group 5 (early IPC)	3.63 \pm 0.52	3.38 \pm 0.92	136+34
P value	<0.001	<0.001	<0.001

CONCLUSIONS: Early IPC is superior to late IPC in reducing spinal cord injury even after the extreme ischemia of 45 minutes DTAO. This was confirmed by Tarlov score and histopathology.

**By Invitation*

F8. Cardioprotective Stress Response in the Human Fetal Heart

John G. Coles, Mark Takahashi*, Diane Grant*, Xiaojing Dai*, Changqing Du*, Cathy Boscarino*, Gregory Hannigan*; Toronto, ON, Canada

OBJECTIVE: We propose that the fetal heart is highly resilient to hypoxic stress, on the basis of a robust stress-inducible gene repertoire. Our objective was to elucidate the human fetal gene expression profile in response ischemia/ reperfusion (I/R), in order to identify targets which confer innate cardio protection.

METHODS: Primary cultures of human fetal cardiac myocytes (HFCM) (gestational age 15-20 weeks) were exposed to simulated I/R in vitro using ischemic buffer and anoxic conditions. Total

RNA from treated and baseline cells were isolated, reverse transcribed, and labeled with Cy3 or Cy5, and hybridized to a human cDNA micro array. Significance of changes in sequential gene expression was determined by repeated permutation of MIAME-compliant data using Significance Analysis for Micro array (SAM). Results from the SAM analysis were visualized as hierarchical clusters and significant (false discovery rate < 3%) genes classified by their differential response to ischemia and/or reperfusion. Post-translational changes in the protein kinase B (PKB) signaling pathway was determined based on phosphorylation of PKB, mitogenactivated protein kinase (MAPK), and glycogen synthase kinase-3 β (GSK-3 β).

RESULTS: HFCM exhibited no detectable apoptosis induction after 4 hr I with or without R, in comparison to >3-fold increase over baseline in neonatal rat CM, as measured in situ using TUNEL or Hoechst staining (p<0.05). Hierarchical gene-wise clustering revealed 4 temporally distinct expression strata: **A:** Repression during I and R; **B:** Repression during I; **C:** Activation during I and/or R; and **D:** Activation during I; repression during R. The fetal response included suppression of *IL-6*, *MAPK*, and the zinc finger transcription factor, *ERF-1*, implying a transcriptional response dominated by anti-inflammatory and anti-proliferative properties during I and R. This prediction is supported by rapid (de-activating) de-phosphorylation of PKB and MAPK, and a concordant (activating) de-phosphorylation of GSK-3 β .

CONCLUSIONS: HFCM exposed to I/R exhibit a uniquely adaptive transcriptional response. The "fetal" response includes a limited number of functional clusters dominated by predicted anti-inflammatory properties. The de-induction of the MAPK and PKB signaling cascade in HFCM may serve the energetically beneficial purpose of dampening agonist-induced, pro-inflammatory and pro-proliferative signaling during I/R. The stress-inducible fetal CM gene repertoire is a useful platform for identification of targets relevant to the mitigation of cardiac ischemic injury, and highlights a novel mechanism of action (*IL-6* transcription blockade) for preventing cardiac myocyte injury associated with ischemia and reperfusion.

*By Invitation

F9. Aprotinin Decreases Ischemic Damage During Coronary Revascularization

Harold L. Lazar, Yusheng Bao*, Leslie Tanzillo*, Paul O'Gara*, Deborah Reardon*, David Price*, Richard Crowley*; Boston, MA

OBJECTIVE: Aprotinin decreases blood loss and limits the use of blood products during cardiac surgery. Aprotinin may also limit the inflammatory response during cardiopulmonary bypass. This study sought to determine whether the favorable anti-inflammatory effects of aprotinin might limit ischemic damage during the revascularization of ischemic myocardium.

METHODS: Twenty pigs underwent 90 minutes of coronary occlusion followed by 45 minutes of blood cardioplegic arrest and 180 minutes of reperfusion. Ten animals received a loading dose of aprotinin (40,000 IU/kg) during the start of coronary occlusion followed by an infusion of 20,000 IU/kg/hour. Ten animals received no aprotinin. Parameters assessed included the incidence of cardio versions for ventricular arrhythmias, the percent (%) increase of lung water (H₂O), endothelial function using % coronary artery relaxation to bradykinin, and infarct size using Area Necrosis/Area Risk (AN/AR).

RESULTS: All values represent the mean \pm standard error.

Results		
Aprotinin	No Aprotinin	P Value

# Cardioversions	1.0±0.7	3.6±0.6	<0.001
Lung H2O(%)	1.0±0.2	6.2±0.9	0.038
Coronary Relaxation(%)	34.1±5.9	9.2±3.5	0.01
AN/AR(%)	20±1	39±1	0.0003

CONCLUSIONS: Aprotinin limits ischemic injury during acute coronary revascularization by decreasing ventricular arrhythmias and lung edema, preserving endothelial coronary function, and minimizing myocardial necrosis.

**By Invitation*

F10. Normalization of Coronary Micro vascular Reactivity and Improvement in Myocardial Perfusion by Surgical VEGF Therapy Combined With Oral Supplementation of L-Arginine in a Porcine Model of Endothelial Dysfunction

Pierre Voisine*, Cesario Bianchi*, Tanveer A. Khan*, Marc Ruel*, Shu-Hua Xu*, Jun Feng*, Jianyi Li*, Tamer Malik*, Audrey Rosinberg, Frank W. Sellke; Boston, MA, Ottawa, ON, Canada

OBJECTIVE: The angiogenic effects of VEGF are mediated in part through NO release, whose availability is decreased in endothelial dysfunction associated with advanced coronary artery disease. This is a possible explanation for the poor results of VEGF therapy in clinical trials compared to animal models. We sought to evaluate the influence of L-arginine supplementation to VEGF therapy on coronary micro vascular reactivity and myocardial perfusion in a porcine model of endothelial dysfunction.

METHODS: Twenty-four pigs were fed either a normal (NORM, n=8) or high cholesterol diet, with (CHOL-ARG, n=8) or without (CHOL, n=8) L-arginine. All pigs underwent ameroid placement on the circumflex artery, then were randomized 3 weeks later to receive surgical VEGF- or placebo- treatment (n=4 each per diet group) in the ischemic territory. Four weeks post-treatment, endothelial-dependent coronary micro vascular responses to ADP, FGF-2 and VEGF were assessed by video microscopy. Lateral myocardial perfusion was quantified by isotope-labeled micro spheres at baseline and after treatment. VEGF and eNOS protein levels were determined by Western blotting.

RESULTS: Pigs from the 3 placebo groups showed endothelial dysfunction in the circumflex territory, with decreased micro vascular relaxation to ADP (all $p < 0.05$ vs non-ischemic LAD territory). VEGF therapy normalized the endothelial-dependent relaxation to ADP in both the NORM and the CHOL-ARG groups, but not in the CHOL group. VEGF treatment also improved myocardial perfusion in the NORM group (Post- vs pre-treatment ratios of lateral/anterior wall blood flow were 0.77 (placebo) and 1.38 (VEGF), $p = 0.002$) but was ineffective in the CHOL group (ratios 0.71 (placebo) vs 0.80 (VEGF), $p = \text{NS}$). Addition of L-arginine to VEGF resulted in restoration of its angiogenic effect despite the high cholesterol diet (ratios 1.08 (placebo) vs 1.25 (VEGF) for CHOL-ARG group, $p = 0.01$). L-arginine treatment was also associated with an increase in both VEGF and eNOS protein levels in the ischemic territory, in contrast to the 2 other diet groups where both were decreased.

CONCLUSIONS: Hypercholesterolemia-induced endothelial dysfunction results in resistance to the effects of exogenous VEGF on coronary micro vascular reactivity and angiogenesis in a swine model of chronic myocardial ischemia. L-arginine supplementation can restore the normal response

to endothelium-dependent vasorelaxants as well as the angiogenic response to VEGF treatment, and is associated with increased expression of VEGF and eNOS. These findings suggest a putative role for L-arginine in combination with VEGF therapy for end-stage coronary disease.

**By Invitation*

TUESDAY MORNING, APRIL 27, 2004

7:00 a.m. GENERAL THORACIC FORUM SESSION

(5 minutes presentation, 7 minutes discussion)

North Bldg., Rm 206D, Metro Toronto Convention Centre

*Moderators: ¹Yolanda Colson**

Thomas A. D'Amico

F11. Experimental Generation of a Tissue Engineered Functional and Vascularized Trachea

Thorsten Walks*, Heike Mertsching*, Bettina Giere*, Paolo Macchiarini*,
Hannover, Germany

OBJECTIVE: To establish methods to grow smooth muscle cells (SMC), chondrocytes (CC) and respiratory epithelium (RE) on a vascularized biological matrix (BioVaM) as a scaffold for tracheal tissue engineering.

METHODS: We obtained tracheal, costal and auricular cartilage, SMC, RE and endothelial progenitor cells (EPC) from porcine donor animals ($n = 10$). SMC were cultured in vitro till the 3rd passage and disseminated on a tubular cellular biological scaffold with a preserved capillary system (BioVaM). CCs were cultured in brooch shape on the BioVaM. The luminal surface was cultured with RE. We applied HE and azan staining to determine tissue formation. Life-dead and MTT assay to determine cell viability and proliferation. Quantitative western blots and immunohistochemical methods served as protein chemical markers of cellular differentiation and function.

RESULTS: Autologous reendothelialization of the BioVaM with EPC resulted in a vascularized scaffold. SMC seeding resulted in muscular tube formation. The fibrillating RE showed a viability of >80% and was successfully cultured on the luminal surface. CC grew encapsulated solitary in lacunas producing extra cellular cartilaginous matrix already after 2 weeks in culture. Life-Dead staining and MTT assay documented viability and proliferation in vitro. Rib and tracheal CC showed a similar growth pattern. Amplified collagen production paralleled high cellular viability and proliferation.

CONCLUSIONS: For the first time we generated and combined all tissues required for a functional bioartificial tracheal graft. The BioVaM offers an extra cellular matrix composition that facilitates *i*) functional respiratory epithelialization, *ii*) growth of viable and functional chondrocytes *iii*) co-cultivation of chondrocytes with muscle cells and leads to viable tracheobronchial grafts. Clinical applicability has to be tested in a large animal model.

**By Invitation*

¹2002-04 Research Scholar

F12. Cisplatin-mediated Enhancement of Cytotoxicity of Tumor-selective Adenovirus expressing GFP-TRAIL (Green Fluorescence Protein-TNF-Related Apoptosis Inducing Ligand) Fusion Protein in Cultured Cancer Cells of the Lung, Esophagus, and Pleura

Rishindra M. Reddy*, Justin B. Maxhimer*, George W. Cole, Jr.*, Alexander Chua*, Binglang Fang*, David S. Schrupp, Dao M. Nguyen*; Bethesda, MD, Houston, TX

OBJECTIVE: Cancer cells frequently exhibit resistance to TRAIL cytotoxicity despite the expression of functional receptors (DR4/DR5). Pretreatment of TRAIL-refractory cells with cisplatin (CDDP) sensitizes them to this ligand. TRAIL can be delivered to cancer cells either as soluble protein or via adenoviral vectors. Moreover, it is well recognized that CDDP enhances adenoviral transgene expression. This study aims to evaluate: 1/ cytotoxic potency of the tumor-specific adenoviral vector expressing the GFP/TRAIL fusion protein driven by the human telomerase reverse transcriptase promoter (Ad/gTRAIL) and 2/the ability of CDDP to enhance the cytotoxic effect of this novel adenoviral vector in cultured lung (NSCLC), esophageal (EsC) and malignant pleural mesothelioma (MPM) cancer cells.

METHODS: NSCLC (H322), EsC (TE2, TE12) and MPM (H513, H2373, H28) cells and primary normal cells (human endothelial cells and fibroblasts) were infected with Ad/gTRAIL or control vector Ad/GFP at MOI of 3 - 60 pfu/cell with or without CDDP (0.5 to 2 μ g/ml x 24hrs) pretreatment. Adenoviral transgene expression was determined by GFP fluorescence intensity using flow cytometry. Treatment-mediated cytotoxicity was measured by MTT assays and DNA fragmentation ELISA kits. Ad/gTRAIL IC50 values were estimated from dose-response curves.

RESULTS: GFP-TRAIL fusion protein expression was detected in cancer cells but not normal cells. CDDP enhanced GFP-TRAIL fusion protein expression by 2- to 12-fold. While Ad/gTRAIL induced mild cytotoxicity (IC50 values > 500 pfu/cell), CDDP pretreatment resulted in dose-dependent enhancement of Ad/gTRAIL-mediated cytotoxicity as indicated by drastic reduction of Ad/gTRAIL IC50 values in all cancer cell lines (4 ± 0.1 to 42 ± 1.7 pfu/cell, n=4). CDDP + Ad/gTRAIL combination mediated a 8- to 14-fold increase of DNA fragmentation (versus <5-fold in cells treated with CDDP or Ad/gTRAIL alone). There was no cytotoxicity mediated by the Ad/GFP control vector on cancer cells, nor was there cytotoxicity in normal cells treated with the CDDP + Ad/gTRAIL combinations.

CONCLUSIONS: CDDP pretreatment enhances Ad/gTRAIL cytotoxicity in malignant but not normal cells. The mechanisms underlying this salutary effect may involve both enhancement of the susceptibility of CDDP-treated cells to TRAIL as well as CDDP-mediated enhancement of TRAIL expression in Ad/gTRAIL infected cells. These findings provide rationale for development of Ad/gTRAIL-based therapy for thoracic malignancies.

**By Invitation*

F13. Proteasome Inhibition Sensitizes Non-Small Cell Lung Cancer to Histone Deacetylase Inhibitor-Induced Apoptosis Through the Generation of Reactive Oxygen Species

Chadrick E. Denlinger*, Brian K. Rundall*, David R. Jones*; Charlottesville, VA

OBJECTIVE: Non-small cell lung cancer (NSCLC) remains resistant to both traditional and novel forms of chemotherapy including histone deacetylase (HDAC) inhibitors. The HDAC inhibitor, SAHA induces apoptosis other malignancies, in part, through the generation of reactive oxygen

species (ROS). In NSCLC, HDAC inhibitors potently activate the anti-apoptotic transcription factor NF- κ B which is known to protect cells from the ROS generation. Pharmacological proteasome inhibition with Velcade suppresses NF- κ B transcriptional activity and sensitizes NSCLC to apoptosis. We hypothesize that proteasomes inhibition will enhance SAHA-induced generation of ROS and induce apoptosis in NSCLC.

METHODS: Four tumorigenic NSCLC cell lines (H157, H358, H460 and A549) were treated with nothing, SAHA (5 μ M), Velcade (50 nM) or both SAHA and Velcade. NF- κ B transcriptional activity was determined by a 3x- κ B-luciferase reporter gene and by transcription of the endogenous gene IL-8. ROS generation was quantified by flow cytometry using the ROS sensitive fluorophore, H₂DCFDA. Cell viability was determined following sequential or concomitant treatment by clonogenic assays, and apoptosis determined by a nucleosome ELISA and by activation of caspase-3. Finally, apoptosis assays were repeated in similarly treated cells incubated in the presence or absence of the free radical scavenger, N-acetyl cysteine.

RESULTS: SAHA significantly enhanced 3x- κ B-luciferase reporter gene and endogenous IL-8 transcription, and these effects were significantly inhibited by Velcade ($p = 0.001$). Combined HDAC and proteasome inhibition induced significantly greater ROS generation compared to all other treatments. Concomitant therapy dramatically suppressed clonogenicity relative to single drug or sequential drug administration. Combined treatment with SAHA and Velcade significantly enhanced apoptosis relative to all other treatment groups ($p = 0.0003$). The free radical scavenger N-acetyl cysteine rescued cell death in NSCLC cells treated with combined therapy ($p = 0.004$).

CONCLUSIONS: SAHA and Velcade synergistically induce the generation of ROS in NSCLC cells, and this plays a critical role in the induction of tumor apoptosis following treatment. Combined HDAC and proteasome inhibition may be an effective treatment strategy for NSCLC.

**By Invitation*

F14. Profound Induction of Apoptosis of Lung and Esophageal Cancer Cells by the Histone Deacetylase Inhibitor Trichostatin A/Protein Kinase C Inhibitor Calphostin C Combination

Justin B. Maxhimer*, Rishindra M. Reddy*, George W. Cole, Jr.*, David S. Schrupp, Dao M. Nguyen*; Bethesda, MD

OBJECTIVE: Histone deacetylase inhibitors (HDACi) are pharmacologic agents with potent antitumor activities which are currently in clinical trials. It is well recognized that HDACi induce profound up regulation of NF- κ B transcription and p21 protein levels, both of which have been shown to impede the ability of HDACi to induce apoptosis in cancer cells. Signaling via the protein kinase C (PKC) has been implicated as an upstream event of HDACi-induced p21 and possibly NF- κ B modulation. This study aims to determine if pharmacologic inhibition of PKC using Calphostin C (CC) would result in enhancement of apoptosis in nonsmall cell lung cancer (NSCLC) and esophageal cancer (EsC) cells treated with the HDACi, Trichostatin A (TSA).

METHODS: NSCLC (H460, H322) and EsC (TE2, TE12) cells were concurrently treated with CC (0.1 to 4 μ M) and TSA (0.1 to 2 μ M). NF- κ B transcriptional activity was quantitated by NF- κ B-Luciferase assay. Transcription of the p21 gene and p21 protein levels were evaluated by p21 promoter-Luciferase assay and p21 ELISA respectively. Apoptosis was evaluated by the TUNEL-based ApoBrdU assay.

RESULTS: Exposure of NSCLC and EsC cells to TSA (0.1 and 1.0 μ M) resulted in dose- and cell-dependent 2- to >20-fold increase of NF- κ B as well as p21 transcriptional activity. Concurrent

treatment with TSA and CC (1 or 2 $\hat{1}/4$ M) led to a 50% to 90% decrease in NF-kB and p21 transcriptional activity. Similarly, TSA-mediated 2- to >20-fold dose-dependant elevation of p21 protein levels was profoundly (60% to > 90%) diminished by CC. Inhibition NF-kB activity by either adenovirally mediated expression of the super repressor I κ B or by the pharmacologic inhibitor Parthenolide resulted in significant dose-dependant reduction (30% to >99%) of TSA-mediated up regulation of p21 transcription. This indicates that NF-kB may serve as a major transcriptional regulator of increased p21 expression in TSA-treated cancer cells. Most importantly, while exposure of cultured cancer cells to either CC or TSA alone resulted in <10% cell death, 60% to 95% of NSCLC or EsC cells treated with the CC+TSA combination underwent apoptosis.

CONCLUSIONS: Pharmacologic inhibition of PKC abrogates TSA-mediated up regulation of NF-kB transcriptional activity and p21 expression coinciding with profound induction of apoptosis in NSCLC and EsC cells. PKC may be a novel target for enhancing the efficacy of HDACi in cancer therapy.

**By Invitation*

F15. Epidermal Growth Factor Is Important to Malignant Mesothelioma Cell Growth and Survival and Mediates Its Effects via the PI3 Kinase Pathway

Philip A. Rascoe*, Xiaobo Cao*, Jonathan C. Daniel*, Steven D. Miller*, W. Roy Smythe; Houston, TX

OBJECTIVE: The PI3 kinase (PI3K) pathway is important to cell growth and survival and is deregulated in some malignancies. We have previously shown high levels of the PI3K downstream mediator phosphorylated AKT (pAKT) in human malignant mesothelioma (MM) tumor specimens, as well as a decrease in pAKT, MM apoptosis in vitro and reduced tumor burden in vivo with exposure to LY249002, a PI3K inhibitor. It is known that PI3K is recruited by cell surface receptors for peptide growth factors that directly activate cell survival pathways. We sought to determine which receptor reactions play a role in regulating the PI3K pathway in MM and how their overall contribution effects cell survival.

METHODS: The human MM cell lines REN and 1-45 were maintained in culture. Cells were treated with varying doses of receptor inhibitors of epidermal growth factor (EGF - AG1478), platelet derived growth factor (PDGF - AG1295), and insulin-like growth factor (IGF - AG538) with DMSO vehicle as control. At 72 hours following treatment, a cell viability assay (XTT) was performed to determine the survival fraction, and Western blot for pAKT. To assess the effects of EGF on the PI3K-AKT pathway, cells were treated with or without one-hour exposure of LY294002 and then exposed to 10nM of EGF followed by pAKT Western blot analysis at 15,30 and 60 minutes.

RESULTS: The PDGF inhibitor did not influence MM cell viability or pAKT levels. IGF inhibition led to a decrease in cell viability (p< .01 AG538 vs. DMSO) but did not affect pAKT levels. Only the EGF inhibitor resulted in a combined reduction in pAKT and cell viability in both cell lines (p< .01 AG1478 vs. DMSO). Following serum starvation, baseline expression of pAKT was negligible. Cells stimulated by EGF showed significant increases in pAKT levels, however, those cells in the presence of LY294002 showed minimal or zero expression.

CONCLUSIONS: In MM, constitutive phosphorylation of AKT results in cell survival and contributes to the malignant phenotype. We have shown that EGF inhibition leads to cell death via down-regulation of pAKT levels in MM cell lines. In addition, EGF can be shown to activate

phosphorylation of AKT and likely drives PI3K mediated inhibition in MM. Both PI3K and EGF inhibition in MM may be clinically relevant.

**By Invitation*

F16. Suppression of Prometastasis Phenotypes Expression in Malignant Pleural Mesothelioma Cells by the Epidermal Growth Factor Receptor Tyrosine Kinase Inhibitor PD 153035

George W. Cole, Jr.*, Rishindra M. Reddy*, Justin B. Maxhimer*, Annette Alleva*, David S. Schrupp, Dao M. Nguyen*; Bethesda, MD

OBJECTIVE: Malignant pleural mesothelioma (MPM) is notorious for loco-regional recurrence despite aggressive multi-modality therapy. EGFR expression has been observed on MPM cells. EGFR-mediated signaling plays important roles in proliferation and metastasis of cancer cells. At the cellular level, metastasis is a multi step process that involves cell proliferation, angiogenesis, cell motility and invasion through extra cellular matrix. This study aims to evaluate the ability of the EGFR tyrosine kinase inhibitor PD153035 (PD) to modulate the expression of prometastasis phenotypes in MPM cells in vitro.

METHODS: EGFR expression was quantitated by flow cytometry and compared to levels expressed on primary normal cells (skin keratinocytes). Cultured MPM cells were treated with PD (0.5 to 5 μ M); cell growth was determined by MTT, VEGF levels in conditioned media were measured by ELISA, cell motility and invasion of extra cellular matrix were determined by in vitro wound healing and Matrigel invasion assays respectively.

RESULTS: EGFR expression was detected on all 6 cultured MPM cells with 4/6 having normal (< 2-fold) and 2/6 over expressing this receptor (> 4-fold the level of primary keratinocytes). PD inhibited proliferation and VEGF production only in MPM cells expressing high levels of EGFR (H513 and H2595). On the other hand, PD profoundly suppressed motility and invasion through extra cellular matrix of all MPM cells regardless of their EGFR expression status (Table 1; *Mean fluorescence intensity normalized for IgG isotype control; Keratinocytes = 8.** 2.5 μ M PD153035 x 4 days; Mean \pm SD, n=4. #Semiquantitative analysis of cell motility, 5.0 μ M PD vs control media, n=3.## 2.5 μ M PD vs control media, n=3;† p<0.03,‡ p= Non significant, Student's t-test).

	H513	H2595	H2373	REN	H2052	H28
EGFR [†]	49	30	18	14	8	8
% Growth Inhibition [†]	50 \pm 4	30 \pm 5	5 \pm 3	0	20 \pm 6	9 \pm 3
% Inhibition of Motility*	100	50	100	50	100	50
Inhibition of Invasion *	+++	+++	+++	+++	+++	+++
% Inhibition of VEGF [†]	83 \pm 17 [†]	48 \pm 12 [†]	40 \pm 20 [†]	25 \pm 5 [†]	0	5 \pm 5

CONCLUSIONS: EGFR inhibitor PD 153035 significantly inhibited motility and invasion of MPM cells in vitro. Inhibition of EGFR-dependent signaling may be a useful strategy to diminish MPM recurrence following aggressive cytoreductive therapy.

**By Invitation*

F17. Facilitating Cell-mediated Alloengraftment is Dependent on an FcÎ²RIÎ³ Signaling Pathway

Kendra N. Taylor*, Rahilya Napoli*, Renee Wright*, ¹Yolonda L. Colson*,
Boston, MA

OBJECTIVE: The facilitating cell (FC) is a bone marrow-derived cell population that promotes allogeneic stem cell (SC) engraftment and donor-specific transplantation across complete MHC-disparities. This function is dependent on the expression of a unique heterodimer on the cell surface of the FC, which consists of the T cell receptor beta chain (TCRÎ²) and a novel 33kD protein, FCp33. All known TCRÎ² effect or functions are mediated through a group of related proteins within the CD3Î¶ family. The two predominant members are CD3Î¶, which is utilized by conventional Î±Î²Tcells for induction of proliferative and cytotoxic responses, and FcÎ²RIÎ³, which has been shown to play a role in the regulation of T cell and natural killer cell development and differentiation. We hypothesized that the dependence of FC-mediated alloengraftment on TCRÎ²Î±-FCp33 expression was the result of required TCRÎ² signaling within the FC. Therefore, the objective of the current study was to identify whether a CD3Î¶ or FcÎ²RIÎ³ dependent signaling pathway was required for FCp33-mediated alloengraftment *in vivo*.

METHODS: FC were isolated by flow cytometric cell sorting as CD8⁺/Î±Î²⁺TCR⁻, from donor bone marrow of CD3Î¶^{-/-} or FcÎ²RIÎ³^{-/-} C57B1/6 (B6) knock out mice. Lethally irradiated B10.BR recipients were reconstituted with 50,000 FC and 10,000 purified SC obtained as Sca⁺ ckit⁺ Lin⁻ from normal B6 mice. Allogeneic SC engraftment was confirmed by flowcytometric peripheral blood lymphocyte typing of donor MHC antigen expression 28 days post-transplant.

RESULTS: Recipients reconstituted with SC and FC either isolated from control B6 or CD3Î¶^{-/-} donors survived and exhibited >90% donor chimerism, demonstrating that the FC does not mediate facilitation via CD3Î¶ signaling. In marked contrast, all recipients reconstituted with SC but with FC from FcÎ²RIÎ³^{-/-} donors (n=9), failed to engraft resulting in a 40-day mortality of 100%.

CONCLUSIONS: This is the first report of a TCRÎ²-FCp33 receptor-signaling pathway that is critical for FC-mediated alloengraftment *in vivo*. The dependence of FC function has previously been shown to require TCRÎ²-FCp33 expression and the current data suggests that the necessary signaling through this receptor is dependent on a non-conventional Tcell signaling pathway that involves FcÎ²RIÎ³. Approaches to induce tolerance through the FCp33 receptor and /or FcÎ²RIÎ³ signaling offer new direction and insight into alloreactivity and immunomodulation, with the potential to revolutionize clinical organ transplantation in the future.

*By invitation

²2002-04 Research Scholar

F18. Adenosine A2A Receptor Activation Attenuates Lung Reperfusion Injury Independent of Circulating Leukocytes

Victor E. Laubach*, Thomas Maxey*, Joel Linden*, Allan Doctor*, Carlos Tache Leon*, Curtis Tribble, Irving L. Kron; Charlottesville, VA

OBJECTIVE: Reperfusion injury is a major cause of mortality after lung transplantation. Activation of adenosine A2A receptors, found mainly on neutrophils, monocytes, macrophages, platelets, and mast cells, produces anti-inflammatory responses. We have previously shown that A2A receptor activation reduces lung reperfusion injury in a blood-perfused model. In this study, we investigated the effects of an A2A agonist in buffer-perfused lungs to ascertain if tissue protection is still noted in the absence of blood.

METHODS: A model of ischemia-reperfusion injury in a murine, buffer-perfused, isolated lung system (Hugo Sachs Elektronik, Germany) was utilized. Three groups of C57BL6 mice were studied. All lungs underwent 10 min equilibration on the apparatus. Lungs from the Control group underwent 60 min ischemia and hypoxic ventilation followed by 60 min constant flow reperfusion under normoxia. The A2A agonist group (ATL) was identical to Control except that ATL-303, a novel, specific and potent A2A receptor agonist, was included in the perfusate buffer at 100 nM. A Sham group was perfused for 120 min without ischemia. Lung compliance (LC), airway resistance (AR), mean pulmonary artery pressure (PAP) were measured throughout reperfusion and histology was assessed at the end of reperfusion.

RESULTS: The lungs which received ATL-303 displayed significantly increased LC and significantly decreased PAP and AR throughout reperfusion compared to Controls ($p < 0.001$). At the end of reperfusion, LC for ATL (13.2 ± 1.4 ul/cm H₂O) was significantly higher than Control (8.3 ± 0.7) ($p < 0.001$). At the end of reperfusion, PAP for ATL (19.3 ± 2.1 cm H₂O) was significantly lower than Control (36.8 ± 4.7) ($p < 0.001$). At the end of reperfusion, AR for ATL (1.67 ± 0.25 cmH₂O(sec)/ul) was significantly lower than Control (3.38 ± 0.43) ($p < 0.001$). In addition, ATL-303-treated lungs displayed reduced evidence of lung injury by histology (see Figure).

CONCLUSIONS: These results suggest that specific activation of A2A receptors improves lung reperfusion injury even in a non-blood perfused system, indicating the importance of resident, parenchymal lung cells such as macrophages and endothelial cells, and not just circulating leukocytes such as neutrophils.

**By Invitation*

F19. Early Development of Bronchiolitis Obliterans Syndrome After Lung Transplantation is Associated With Bile Acid Aspiration

Frank D'Ovidio*, Marco Mura*, Melanie Tsang*, Thomas K. Waddell*,
Michael Hutcheon*, Lianne G. Singer*, Andrew Pierre*, Dennis Hadjiliadis*,
Ceciha Chaparro*, Carlos Gutierrez*, Gail Darling*, Mingyao Liu*, Shaf
Keshavjee; Toronto, ON, Canada

OBJECTIVE: Gastro-esophageal reflux disease with associated aspiration is currently being investigated as a potential contributor to BOS following lung transplantation. We prospectively investigated aspiration by assessing presence of bile acids in surveillance broncho-alveolar lavage fluid (BALF) and determined its role towards development of BOS.

METHODS: Ninety-three consecutive lung transplant patients followed with surveillance PFT, and bronchoscopies were evaluated. Diagnosis of BOS (grade Op-3) was formulated after at least 6-months of follow-up from transplant. Time from transplant to BOS development was defined as early or late whether or not BOS occurred within 12 months of the transplant. BALF samples were collected at each surveillance bronchoscopy and were assayed for differential cell count, bile acids,

IL-8 (neutrophil chemokine) and IL-15 (lymphocyte stimulator). The BALF bile acids levels were considered elevated when greater than normal serum levels ($= 8 \text{ } \mu\text{mol/L}$). Bile acids were concurrently tested in serum samples from 20 patients collected within 24-hrs of the BAL.

RESULTS: There was no correlation between bile acid levels in serum and BALF. Elevated bile acids were measured in BALF from 19/93 (20%) of patients. BOS was diagnosed in 30/93 (32%) of patients, and judged early in 17/30 (57%). BALF bile acids in BOS pts (median $2 \text{ } \mu\text{mol/L}$, range 0-71) were greater than in non BOS pts ($0 \text{ } \mu\text{mol/L}$, range 0-31) (Mann-Whitney test $p=0.004$). Bile acids in early BOS pts ($6.5 \text{ } \mu\text{mol/L}$, range 0-71) were greater than in late BOS pts ($0 \text{ } \mu\text{mol/L}$, range 0-8.6) ($p=0.006$). Bile acids levels in early BOS pts correlated with IL-8 and alveolar neutrophilia (Spearman Rank Correlation, $r = 0.4$, $p = 0.02$, and $r = 0.6$, $p = 0.02$, respectively) but not with IL-15. No correlation was observed in late BOS pts. The figure shows the actuarial curves relative to freedom from BOS in all patients sub-grouped according to the bile acids levels (Logrank Mantel Cox $p=0.0001$).

CONCLUSIONS: Duodeno-gastro-esophageal reflux related pulmonary aspiration is highly prevalent in lung transplant patients as evidenced by bile acid detection in the BAL. Furthermore elevated broncho-alveolar bile acids levels promote early development of bronchiolitis obliterans syndrome likely by contributing to an inflammatory process mediated by IL-8 and alveolar neutrophilia. These findings strongly support the role of gastro-esophageal reflux disease within the development of bronchiolitis obliterans syndrome.

**By Invitation*

F20. Safety and Feasibility of Airway Bypass Stent Placement and Influence of Topical Mitomycin on Stent Patency

¹Cliff K. Choong*, Fabio J. Haddad*, Joel D. Cooper; St. Louis, MO

OBJECTIVE: Airway bypass via trans bronchial fenestration has been shown to improve forced expiratory volume and flow in explanted human emphysematous lungs. The aim of this study was to evaluate the feasibility and safety of in vivo airway bypass stent placement using a canine model and to assess the influence of topical mitomycin (MMC), an anti-inflammatory and antifibrotic agent, on prolongation of stent patency.

METHODS: Twelve specially bred research mongrel dogs were utilized for the study. Under general anesthesia, suitable segmental and sub segmental bronchial wall sites were selected by direct visualization using a flexible bronchoscope. The absence of adjacent peribronchial blood vessels was confirmed using a Doppler probe passed through the bronchoscope channel. Trans bronchial fenestrations were formed by puncture with a 22 gauge trans bronchial needle and dilatation of the needle track using a 2.5mm angioplasty balloon. A 3 mm long by 3 mm wide balloon expandable stainless steel stent covered with a sleeve of silicone rubber was placed within the fenestration. Seventy stents were placed in 12 dogs. Animals were bronchoscoped weekly to assess stent patency and for topical MMC application. Control stents were placed in all 12 dogs and were untreated ($n=35$). Stents treated with MMC ($n=35$) had topical application of 0.2mls of MMC (concentration 1 mg/ml). All MMC stents were treated at the time of stent placement and subsequently at weekly intervals as shown in Table.

RESULTS: Four instances of minor bleeding ($< 20\text{mls}$ of bleeding) occurred and were easily controlled with topical diluted epinephrine solution. One pneumothorax occurred and was treated

by chest tube placement without any adverse sequelae. There was no mortality associated with stent placement. No delayed hemorrhage or pneumothorax occurred. Patency results are shown in Table.

Duration of topical MMC treatments	Number of Stents Placed	Duration of Follow Up (weeks)	Median Duration of Patency (weeks)
Controls (No treatment at all)	35	8-20	<1 week
MMC given at time of placement only	8	8	3 weeks
MMC given for 3 consecutive weeks after stent placement	9	8	8 weeks
MMC given for 6 consecutive weeks after stent placement	10	8	>8 weeks (At 8 weeks, 6/10 stents patent)
MMC given for 8 consecutive weeks after stent placement	8	20	>20 weeks (At 20 weeks, 5/8 stents patent)

CONCLUSIONS: Airway bypass stent placement can be performed safely. In an animal model, the majority of the stents become occluded within 1 week but topical mitomycin application results in significant prolongation of patency.

9:00 a.m. BASIC SCIENCE LECTURE

A Shortage of Oxygen: Lessons from the Summit of Mt. Everest

John B. West, M.D.

North Bldg., Hall C, Metro Toronto Convention Centre

Introduced By: Joel D. Cooper

**By invitation*

¹2002-03 Graham Fellow

TUESDAY MORNING, APRIL 27, 2004

9:45 a.m. SCIENTIFIC SESSION

(8 minute presentation, 12 minutes discussion)

North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: Joel D. Cooper and Irving L. Kron

32. Single-stage Repair of Extensive Thoracic Aortic Aneurysms: Experience With The Arch-first Technique And Bilateral Anterior Thoracotomy

Nicholas T. Kouchoukos, Michael C. Mauney*, Paolo Masetti*, Catherine F. Castner*; St. Louis, MO

Discussant: R. Scott Mitchell

OBJECTIVE: Staged procedures for extensive aneurysmal disease of the thoracic aorta are associated with a substantial cumulative mortality (>20%) that includes hospital mortality for the two procedures and death (often from aortic rupture) in the interval between the two procedures. We have utilized a single-stage technique for operative repair of most or all of the thoracic aorta.

METHODS: Forty-three patients with extensive disease of the thoracic aorta were managed by a single-stage procedure using a bilateral anterior thoracotomy, circulatory arrest and reperfusion of the aortic arch vessels first to minimize brain ischemia. Twenty-six patients with chronic, expanding type A aortic dissections had previous operations for acute type A dissection (18), aortic valve replacement (5), or CABG (3). The remaining 17 patients had degenerative aneurysms (13) or chronic dissection (4). The ascending aorta and aortic arch were replaced in all patients combined with resection of various lengths of descending aorta (proximal 1/3 [9], proximal 2/3 [30], or all [4]). CABG and /or valve replacement were performed concomitantly in 17 patients.

RESULTS: Thirty day mortality was 7% (3 patients). Morbidity included reoperation for bleeding (19%), assisted ventilation >48 hours (47%), tracheostomy (12%), and temporary renal dialysis (9%). No patient sustained a stroke. There have been 4 late deaths (2,18,34, and 79 months postoperatively). Two patients have undergone reoperation (false aneurysm, progression of disease).

CONCLUSIONS: The single stage, arch-first technique is a safe and suitable alternative to the two-stage procedure for repair of extensive thoracic aortic disease.

10:05 a.m. C. WALTON LILLEHEI RESIDENT FORUM AWARD PRESENTATION

North Bldg., Hall C, Metro Toronto Convention Centre

10:10 a.m. INTERMISSION - VISIT EXHIBITS

Exhibit Hall

10:55 a.m. SCIENTIFIC SESSION

(8 minute presentation, 12 minutes discussion)

North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: Joel D. Cooper

Irving L. Kron

33. Risk Factors Associated With Mortality and Reinterventions in 474 Neonates with Interruption of the Aortic Arch: A Congenital Heart Surgeons Society Study

Brian W. McCrindle*, Christo I. Tchervenkov, Igor E. Konstantinov*, William G. Williams, Rodolfo A. Neirotti, Marshall L. Jacobs, Eugene H. Blackstone; Toronto, ON, Canada, Montreal, PQ, Canada, Grand Rapids, MI, Philadelphia, PA, Cleveland, OH

Discussant: Ralph S. Mosca

OBJECTIVE: To determine outcomes and associated patient and management factors for neonates with interruption of the aortic arch (IAA).

METHODS: From 1987 to 1997, 474 neonates were enrolled prospectively from 33 institutions. Medical record data were submitted and abstracted. Competing risks methodology was used to determine demographic, morphologic, institutional and procedural risk factors for the time-related events of death and reintervention for left heart outflow and arch obstruction.

RESULTS: The majority had Type B IAA (71%), with 27% having associated anomalies other than VSD, including 51 patients with truncus arteriosus. Nineteen patients died without intervention and 3 had primary transplantation. The remaining 452 had IAA repair, with

biventricular repair of all defects achieved in a single stage in 291 and multiple stages in 93, univentricular repair in 10, heart transplantation in 1, with 52 dying and 5 survivors without complete repair. Overall, there were 167 deaths after repair. During follow-up 55 patients had balloon dilation and 56 had reoperation for aortic arch obstruction. In addition, 138 patients had procedures for LV outflow obstruction either before, during (including 52 aortopulmonary connections) or after IAA repair (with reinterventions in 21), 72 of which were for subaortic obstruction. Procedures for both were performed in 23 patients. Competing risks at 15 years after IAA repair showed 42% alive with no arch reintervention. At least one arch reintervention had been performed in 29% (prolonged early hazard phase), with incremental risk factors including earlier date of birth, younger age at admission, presence of truncus arteriosus or aortopulmonary window or double outlet RV, failure to close the VSD at IAA repair, and 6 institutions (2 protective) and institutions entering less than 10 patients. None of the procedural characteristics of the arch repair were significant. Death without an arch reintervention was noted in 29% (steep early hazard phase), with incremental risk factors including earlier date of birth, male gender, lower birth weight, non-Type A IAA, presence of truncus arteriosus or multiple VSD's, smaller size VSD, need for dopamine at presentation, prostaglandins not used at presentation, lower weight at IAA repair, aortopulmonary connection (DKS) performed at IAA repair, arch augmentation not performed at IAA repair, and 5 institutions (1 protective).

CONCLUSIONS: Mortality is high for neonates with IAA, with an important risk of ongoing reinterventions in survivors after IAA repair, particularly those with associated truncus arteriosus. Risk of death and reinterventions improved over the study period.

**By Invitation*

34. Pretransplant T-Cell Depletion and Tacrolimus Near-Monotherapy in Human Lung Transplantation

Kenneth R. McCurry*, Adrianna Zeevi*, Diana B. Zaltonis*, Aldo Iacono*,
Thomas E. Starzl*, Pittsburgh, PA

Discussant: ¹Bruce K. Rosengard

OBJECTIVE: Lung transplantation remains plagued by poor outcomes from rejection as well as toxicities of immunosuppression. Current international results of one-year survival of 70-75% and 5-year survival of 45% remain significantly below those of other organs. We postulated that a strategy consisting of profound T-cell depletion prior to transplantation followed by minimization of post transplant immunosuppression (tacrolimus near-monotherapy) would result in improved outcomes and facilitate variable acquired tolerance.

METHODS: Between 6/02 and 10/03, 50 unselected patients (pts) underwent cadaveric lung transplantation. T-cell depletion was accomplished prior to allograft reperfusion with either high dose polyclonal anti-thymocyte globulin (Thymoglobulin (Thymo) 4-7 mg/kg iv, n=37) or the monoclonal agent Campath (30 mg, n=13). Post transplant immunosuppression consisted of tacrolimus (tac) in all pts and, in some pts, prednisone 5 mg/day (37/37 Thymo pts, 7/13 Campath pts). Weaning of tac was considered 4-6 months post transplant.

RESULTS: Pretreatment with either agent resulted in profound T-cell depletion. T-cell repopulation began and recovered, however, much faster following Thymo (CDS cells recovered by 3-4 months, CD4 cells returned to near normal by 6 months) than Campath. One-year actuarial survival for Thymo-treated pts was 82% (30-day survival 97%) (follow-up 288±99 days, range 115-465) while overall survival is 92% (12/13) for Campath-treated pts (follow-up 88±58 days,

range 3-269). Twenty-seven percent (10/37) of thymo-treated pts required additional anti-T cell therapy for early rejection while there has been no rejection in Campath-treated pts. There have been 2 cases of CMV pneumonia's and 4 pts with opportunistic infections among Thymo-treated pts and 1 opportunistic infection in Campath-treated pts (all successfully treated). Of the 24 Thymo-treated pts more than 6 months from transplant, 17 are receiving tac only once a day (n=7) or a few times/wk (n=10) while both Campath-treated pts more than 6 months from transplant are weaning (1 pt on once a day tac and the other 4 times per wk).

CONCLUSIONS: These results demonstrate that our novel approach results in excellent outcomes following lung transplantation with variable ability to wean immunosuppression. There was less early rejection with Campath but whether lymphoid depletion with Thymo or Campath provides an advantage remains to be determined. This approach has the potential to significantly improve global outcomes following lung transplantation.

11:35 a.m. ADDRESS BY HONORED SPEAKER

Leadership and Surgery: A View from Inside the Ocean

Joseph Macinnis, M.D.

North Bldg., Hall C, Metro Toronto Convention Centre

Introduced By: Joel D. Cooper

12:20 p.m. ADJOURN FOR LUNCH - VISIT EXHIBITS

North Bldg., Exhibit Hall

Metro Toronto Convention Centre

CARDIOTHORACIC RESIDENTS' LUNCHEON

North Bldg., Suite 205, Metro Toronto Convention Centre

TUESDAY AFTERNOON, APRIL 27, 2004

2:00 p.m. SIMULTANEOUS SCIENTIFIC SESSION - ADULT CARDIAC SURGERY

(8 minutes presentation, 12 minutes discussion)

North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: Bruce W. Lytle

Axel Haverich

35. Current Prognosis of Ischemic Mitral Regurgitation Managed by Routine

Mitral Valve Repair

Donald Glower, Robert H. Turtle*, Linda K. Shaw*, Ricardo E. Orozco*, J. Scott Rankin; Durham, NC, Nashville, TN

Discussant: David H. Adams

OBJECTIVE: Most studies have shown that surgical therapy for moderate-to-severe post-infarction, or ischemic (I), mitral regurgitation (MR) has been associated with diminished early and late survival, as compared to non-ischemic (N) forms of MR. Conversion from mitral valve (MV)

replacement to valve repair (Rpr) seems to have improved prognosis somewhat, but it is not clear if IMR continues to be an independent predictor of outcome after routine surgical Rpr, especially if other risk factors are considered simultaneously.

METHODS: 535 patients undergoing MVRpr (primarily Carpentier ring annuloplasty) +/- coronary bypass from 1993-2002 were reviewed retrospectively. Follow up was 99% complete, and a total of 93 deaths occurred over the 9 years of follow up. A Cox proportional hazards model evaluated long-term survival as a function of 10 simultaneous covariates: IMR vs NMR, age, gender, diabetes (DM), renal insufficiency (RI), pulmonary disease (PD), ejection fraction (EF), NYHA class, coronary disease (CD), and reoperation.

RESULTS: IMR patients (n=141) had greater age (69v59yrs), lower EF (.40v.50), more CD (100%v16%), and higher comorbidity (DM, RI, and PD) (all $p<0.001$), as compared to NMR (n=394). Unadjusted 30-day mortality was: IMR=4.3%; NMR=1.0% ($p=0.01$), and unadjusted 5-year mortality was: IMR=44+/-5%; NMR=16+/-3% ($p<0.001$). In the full multivariable model, only advanced age and preoperative comorbidities (DM, RI, PD) were significant independent predictors of survival (all $p<0.012$), while IMR, EF, CD, NYHA class, gender, and reoperation did not achieve significance (all $p>0.19$). After adjusting for differences in these patient characteristics, long-term survival was not statistically different between IMR and NMR (Figure, $p=0.39$).

CONCLUSIONS: With routine application of modern surgical techniques for MVRpr, IMR is not an independent predictor of long-term outcome after adjusting for demographics, preexisting comorbidities, and clinical findings. Future surgical risk assessment and therapeutic decision making should be based on overall patient condition and should not be biased by ischemic etiology of MR.

**By Invitation*

36. Recurrent Mitral Regurgitation after Anuloplasty for Functional Ischemic Mitral Regurgitation: Anuloplasty Type Makes a Difference

Edwin C. McGee, Jr.*, A. Marc Gillinov, Gideon Cohen*, Eugene H. Blackstone, Jeevanantham Rajeswaran*, Farzad Najam*, Joseph F. Sabik*, Patrick M. McCarthy, Bruce W. Lytle, Delos M. Cosgrove; Cleveland, OH

Discussant: D. Craig Miller

OBJECTIVE: The temporal course of return of mitral regurgitation (MR) after anuloplasty for functional ischemic MR and factors that accelerate the rate of return are unknown. Therefore, objectives of this study were to 1) characterize that temporal pattern and 2) identify its predictors, particularly with respect to anuloplasty type.

METHODS: From 1985 to 2003, 584 patients underwent anuloplasty alone for functional ischemic MR, generally with concomitant coronary revascularization (95%). A flexible band (Cosgrove-Edwards) was used in 68%, a semi-rigid ring (Carpentier-Edwards) in 21%, and bovine pericardium (Peri-Guard) in 11%. 685 echocardiograms assessing postoperative MR were available in 423 patients for longitudinal analysis. Median time to echocardiogram was 8 days; however, 10% were performed beyond 2 years.

RESULTS: The proportion of patients with 0-1 + MR decreased from 71 % early postoperatively to 41% at 1 year after repair, and the proportion with 3-4+ MR increased from 13% to 34%

($P<.0001$); MR was stable thereafter. This temporal pattern was similar for Cosgrove-Edwards and Carpentier-Edwards anuloplasties, but substantially worse for Peri-Guard anuloplasties (Fig). Risk factors for higher MR grade included greater degree of preoperative MR ($P<.0001$), complex MR jet ($P=.02$), more severe left ventricular dysfunction ($P=.001$), and use of Peri-Guard anuloplasty ($P=.005$). Small anuloplasty size was not associated with decreased postoperative MR ($P=.2$); however, Cosgrove-Edwards flexible bands were employed in most patients receiving 26- and 28-mm anuloplasties.

CONCLUSIONS: During the first year after anuloplasty for functional ischemic MR, important MR is present in 34% of patients. Pericardial anuloplasty is unsatisfactory, but equivalent results are obtained with Cosgrove-Edwards bands and classic Carpentier-Edwards rings. These results suggest the need to address additional mechanisms to prevent return of MR.

**By Invitation*

37. Does the Left Internal Mammary Artery to the Left Anterior Descending Artery Confer any Benefit in Combined Coronary and Valve Operations?

Shishir Karthik*, Arun K. Srinivasan*, Antony D. Grayson*, Brian M. Fabri*;
Leeds, UK, Liverpool, UK

Discussant: Bruce W. Lytle

OBJECTIVE: The benefits of Left Internal Mammary Artery (LIMA) to left anterior descending artery (LAD) in combined coronary artery bypass graft (CABG) and valve operations have not been fully investigated. We aimed to quantify the impact of LIMA to LAD on early- and mid-term outcomes in these patients.

METHODS: Data was collected prospectively as part of routine clinical practice on 630 consecutive patients who underwent revascularisation of the LAD with concomitant valve operations between April 1997 and March 2003. Multivariate logistic regression was used to adjust in-hospital outcomes for treatment selection bias. Deaths occurring over time were described using Kaplan-Meier techniques. Multivariate Cox proportional hazards analysis was used to calculate adjusted hazard ratios (HR) and to adjust the Kaplan-Meier survival curves. A propensity score for LIMA use was constructed to control selection bias. The variables included in the propensity score were as follows: age, sex, body mass index, priority, ejection fraction, aortic valve gradient, systolic pulmonary artery pressure, extent of coronary disease, diabetes, cerebrovascular disease, renal dysfunction, and respiratory disease (C statistic = 0.71). This was included along with the comparison variable in the multivariate analyses.

RESULTS: 478 (75.9%) had LIMA to the LAD. Patients who received LIMA were significantly younger but less likely to be female, or have poor ejection fraction, renal dysfunction, respiratory disease or have emergency surgery. Both LIMA and non-LIMA patients had a median of 3 distal anastomoses ($p=0.92$), and median of 1 valve either repaired or replaced ($p=0.83$). On the univariate analyses, LIMA patients had significantly lower in-hospital mortality (6.3% ($n=30$) versus 13.2% ($n=20$); $p<0.01$) and postoperative renal failure (8.2% ($n=39$) versus 13.8% ($n=21$); $p=0.038$). There were no significant differences with regards to stroke, re-exploration for bleeding, myocardial infarction, sternal wound infection, and length of hospital stay. After adjusting for treatment selection bias (with the propensity score), in-hospital mortality (adjusted odds ratio (OR) 0.74 [95% confidence intervals (CI) 0.37 to 1.45]; $p=0.37$) and renal failure (adjusted OR 0.93

[95% CI 0.49 to 1.77]; $p=0.82$) were no longer significantly different. A total of 127 (20.2%) deaths occurred during the follow-up, with a total follow-up of 1,736 patient-years. The crude HR for LIMA was 0.64 ($p=0.02$). After adjusting for the propensity score, the adjusted HR was 0.86 ($p=0.47$).

CONCLUSIONS: LIMA to the LAD does not seem to affect the short- and medium-term outcomes adversely in patients undergoing concomitant CABG and valve operations.

3:00 p.m. INTERMISSION - VISIT EXHIBITS

*North Bldg., Exhibit Hall
Metro Toronto Convention Centre*

**By Invitation*

3:40 p.m. SIMULTANEOUS SCIENTIFIC SESSION - ADULT CARDIAC SURGERY

*North Bldg., Hall C, Metro Toronto Convention Centre
Moderators: Bruce W. Lytle
Axel Haverich*

38. Should the Ascending Aorta be Routinely Replaced in Patients with Bicuspid Aortic Valve Disease?

Michael A. Borger, Mark Preston*, Joan Ivanov*, Paul W. Fedak*, Piroze Davierwala*, Susan Armstrong*, Tirone E. David; Toronto, ON, Canada*

Discussant: Ludwig K. von Segesser

OBJECTIVE: Patients with bicuspid aortic valve (BAY) disease often have associated dilation of the ascending aorta. Controversy exists regarding the optimal diameter at which replacement of the ascending aorta should be performed.

METHODS: We reviewed all BAY patients undergoing aortic valve replacement at our institution from 1979 to 1993 ($n = 201$). BAY patients operated on after 1993 were excluded to allow for adequate long-term follow up. Patients undergoing concomitant replacement of the ascending aorta were also excluded. Follow up was obtained on 100% of patients.

RESULTS: Mean (\pm SD) length of follow up was 10.2 ± 3.7 years. Average patient age was 56 ± 14 years, and 76% were male. The ascending aorta was normal in 111 patients (55%), mildly dilated (40 - 45 mm) in 66 patients (33%), and moderately dilated (45 - 50 mm) in 24 patients (12%). (All BAY patients with marked dilation (> 50 mm) underwent replacement of the ascending aorta and were therefore not part of this study.) Fifteen year survival was 63%. During follow up, 4] patients (20%) required reoperation, predominantly for aortic valve prosthesis failure. Thirteen patients (6.5%) had long-term complications related to the ascending aorta: 9 developed ascending aortic aneurysm (> 50 mm), 1 patient suffered from aortic dissection, and 3 patients died of sudden cardiac death. Importantly, 10 of these 13 patients (77%) had an aortic diameter equal to or greater than 40 mm at the time of initial surgery. Fifteen-year freedom from ascending aorta-related complications was 92% in patients with an aortic size of < 40 mm versus 80% for patients with an aortic size of 40 mm or greater ($p = 0.02$).

CONCLUSIONS: Patients undergoing surgery for bicuspid aortic valve disease should undergo concomitant replacement of the ascending aorta if the diameter is 40 mm or greater.

**By Invitation*

39. Map-Guided Surgery for Atrial Fibrillation

Takashi Nitta*, Takashi Sasaki, Hiroya Ohmori*, Shun-Ichiro Sakamoto*,
Yoshiaki Saji, Kazuhiro Hinokiyama*, Yasuo Miyagi*, Shigeto Kanno*,
Kazuo Shimizu*; Tokyo, Japan

Discussant: James L. Cox

OBJECTIVE: Although current surgical procedures result in a high success rate for AF, they are not guided by electrophysiologic findings in individual patients, and thus may include unnecessary incisions in some patients or be inappropriate for other patients. Map-guided AF surgery can avoid unnecessary incisions, reduce the surgical mortality and morbidity, and preserve a greater atrial transport function.

METHODS: A 256-channel three-dimensional dynamic mapping system with custom-made epicardial patch electrodes was used to examine the atrial activation during AF and to determine the optimal procedure in 34 permanent and 8 paroxysmal AF patients intraoperatively. Underlying heart disease consisted of valvular heart disease and congenital heart disease in 33 and 5 patients, respectively, while 4 patients had no associated heart disease. The mapping system successfully displayed the activation wavelets during AF as a movie using three-dimensional computer constructed atrial models.

RESULTS: Concurrent multiple repetitive activations arising from the pulmonary veins or LA appendage were observed in all patients except for one who exhibited LA macroreentry. The fastest activation of the repetitive activations propagated toward the RA, conducting through Bachmann's bundle with a progressive conduction delay or block in the pathway, resulting in an irregular and desynchronized RA activation. Surgery for AF was not indicated in 3 patients in whom the atrial electrograms had a low voltage over a broad area. A simple procedure, consisting of pulmonary vein isolation and LA incisions without any RA incisions, was performed in 6 patients in whom the RA activation was passive, and all were cured of AF with a significant atrial contraction. The radial procedure was performed in the remaining 33 patients in whom the RA activation exhibited focal or reentrant activation, and 30 of the patients (91%) were cured of AF. In this subset of patients, 10 exhibited reentrant or focal activation in the posterior LA between the right and left pulmonary veins and required an additional linear ablation on the posterior LA.

CONCLUSIONS: Intraoperative mapping facilitates determining the optimal procedure for AF in each patient.

**By Invitation*

40. Hypertrophic Obstructive Cardiomyopathy: Outcomes by Propensity Score after Myectomy or Alcohol Ablation

Anthony Ralph-Edwards*, Anna Woo*, Brian W. McCrindle*, Jonathan L. Shapero*, Leonard Schwartz*, Harry Rakowski*, Douglas Wigle*, William G. Williams; Toronto, ON, Canada

Discussant: Marko I. Turina

INTRODUCTION: In November 1998, our centre began offering alcohol ablation (AA) as an alternative to surgical myectomy (M) for patients with hypertrophic obstructive cardiomyopathy (HOCM). Patients with concomitant lesions were referred for surgery and the others were offered either treatment option. We sought to review the early outcomes for both protocols.

METHODS: 147 patients had intervention for HOCM. to June 30, 2003. Sixty pts. elected to have alcohol ablation, 4 crossed over to surgery. A total of 91 pts had a myectomy. Hospital records were reviewed and follow-up contact (mean 1.6 years) with the pt or referring cardiologist and recent echo reports were obtained. Differences in clinical and hemodynamic outcomes between achieved treatment groups were compared after adjustment for differing baseline patient characteristics, including use of a propensity score, in order to adjust for the non-randomization.

RESULTS: The AA pts (N = 60) were older (58 vs 48 years), had fewer associated lesions (1 vs. 39 pts), lower pressure gradients (67 vs. 73 torr), and had similar symptomatic status and degrees of mitral regurgitation compared to the M group.

AA was abandoned in 7 pts, 3 of whom underwent M. Among the completed AA, there are 2 late deaths, and 1 other pt. was referred for M. One late death occurred after M.

At latest follow-up (3 year survival 97%), 92 % of the pts are in NYHA II or I.

Adjusted comparisons showed significantly lower post-intervention LV outflow gradients at rest in the M group (7 vs. 27 torr; $p=0.008$), with provocation (11 vs. 51mmHG; $p = 0.0001$), mitral regurgitation (none or trivial in 69% vs. 23%; $p=0.0002$), and NYHA ($p=0.0002$). No significant difference was present in post-intervention septal thickness or freedom from post-intervention pacing, although in time-related analysis, the 3 year freedom from pacing is 83% vs. 59% ($p = 0.004$).

CONCLUSIONS: Either AA or M offer substantial clinical improvement for pts with HOCM. Hemodynamic resolution of the obstruction and its sequelae is more complete with M. Residual lesions after AA may affect longer-term outcomes.

**By Invitation*

41. Value Of Autopsy Examination For Quality Control After Cardiac Surgery

Ardawan J. Rastan*, Jan F. Gummert*, Nicole Lachmann*, Thomas Walther*,
Dierk V. Schmitt*, Volkmar Falk*, Nicolas Doll*, Paul Caffier*, Markus
Richter*, Christian Wittekind*, Friedrich W. Mohr; Leipzig, Germany

Discussant: Edward D. Verrier

OBJECTIVE: To assess the impact of autopsy on quality control in the current era of advanced diagnostic technology.

METHODS: From 01/2000 to 09/2003 779/13.402 (5.8%) patients who underwent elective or urgent cardiac surgery died in hospital. Autopsy rate was 408/779 (52.4%) forming the study population. Clinical and pathological findings were evaluated prospectively and independently by clinicians and pathologists. The data were compared concerning causes of death, postoperative complications, concomitant diseases and pathologies of operative procedures.

RESULTS: Patients died after a mean of 14.2 days postoperatively. 65.9% were male, mean age was 68.6y. 59.4% had urgent surgical indication with acute coronary syndrome in 30.2% at the time of operation.

Causes of death are shown on table 1, they were unexpected in 65 pat. (15.9%). These included pulmonary embolism (7), acute myocardial infarction (29), low output syndrome (8), respiratory (7), technical failure (6), gastrointestinal bleeding (3), cerebral stroke (1) and multi-organ-failure (4). 80% (24/30) of clinically unclear causes of death could be determined by autopsy, including 9/15 sudden cardiac deaths.

Clinically unrecognized postoperative complications were found in 293 (71.8%) patients. These were nonfatal pulmonary embolism (54), deep vein thrombosis (41), acute cerebral ischemia (16), acute pancreatitis (12), gastrointestinal ischemia (11), pneumonia (43) and others (116).

Unknown concomitant diseases were found in 318 patients (77.9%), which might have been relevant for therapy in 67 patients (21.1%), including 24 unknown malignant tumours.

In 84 patients (20.6%) pathological findings of operative situs were recognized at autopsy with 31 known premortem. These included significant CABG stenosis/occlusion in 28 (21 known), bleeding in 11 (8), valve endocarditis in 1 (0), valve thrombosis in 9 (2), aortic rupture in 1 (0), left ventricle rupture in 2 (0) and tamponade in 2 (0) patients.

CONCLUSIONS: A significant part of autopsies reveals major discrepancies between clinical and postmortem examinations. Autopsy remains of great importance for quality control of perioperative treatment and education in cardiac surgery.

Autopsy causes of death

causes of death	%	n
cardiac	48.9	199
multi organ failure/sepsis	25.0	102
cerebral	5.9	24
respiratory	6.1	25
pulmonary embolism	2.9	12
technical	5.1	21
gastrointestinal	3.9	16
others	0.7	3
unknown	15	6

5:00 p.m. EXECUTIVE SESSION

(Members Only)

North Bldg., Hall C, Metro Toronto Convention Centre

**By Invitation*

TUESDAY AFTERNOON, APRIL 27, 2004

2:00 p.m. SIMULTANEOUS SCIENTIFIC SESSION - GENERAL THORACIC SURGERY

(8 minutes presentation, 12 minutes discussion)

North Bldg., Rm 105, Metro Toronto Convention Centre

Moderators: Alec Patterson

David J. Sugarbaker

42. High-Dose Radiation in Tri-Modality Treatment of Pancoast Tumors Improves Pathologic Complete Response Rates and Confers Survival Advantage

¹King F. Kwong*, Lindsay B. Cooper*, Martin J. Edelman*, Mohan Suntharalingam*, Ziv Gamliel*, Whitney Burrows*, Petr Hausner*, L. Austin Doyle*, Mark J. Krasna; Baltimore, MD

Discussant: Valerie W. Rusch

OBJECTIVE: To study the clinical characteristics and outcomes of patients treated with a surgery inclusive multi-modality approach for Pancoast tumors over a 10-year period.

METHODS: Clinical records of all patients who completed neoadjuvant chemoradiation followed by surgery between 1993-2003 at our institution were reviewed retrospectively.

RESULTS: Thirty-six patients completed treatment of their Pancoast tumors with neoadjuvant chemoradiation followed by *en bloc* lung and chest wall resection during this period. Study population included 22 men (mean age 54, range 31-76) and 14 women (mean age 56, range 36-74). Pulmonary resections included lobectomies (n=33) and pneumonectomies (n=3). Operative approaches included standard posterior-lateral, anterior-superior, and anterior hemi-clamshell thoracotomies. Pre-treatment clinical stages were IIB, IIIA, IIIB, and IV (presenting with single isolated brain metastasis) in 18 cases, 7 cases, 6 cases, and 5 cases, respectively. Complete surgical resection with negative margins was achieved in 35 patients (97.2%). Operative mortality was 2.7% (n=1). Radiotherapy was successfully tolerated in all patients and mean total radiation dose was 56.7 Gy. Pathologic complete response (p-CR) was found in 41.7% patients (n=15). Recurrences were found in 50% of all treated patients (n=18). Distant recurrences were most commonly found as brain metastases (n=9, 50% total recurrences, 25% all patients). Other distant recurrences accounted for 4 patients (22.2% total recurrences, 11.1% all patients) while local recurrences included 5 patients (27.7% total recurrences, 13.8% all patients). Median survival time (MST) for entire cohort is 31-6 months (2.6 years). However, MST for patients with p-CR was 93.1 months (7.8 years). Interestingly, the MST of patients with positive pre-treatment lymph nodes (n=12 patients) remains undefined (not reached). Log rank comparisons of survivals were performed. Statistical significance was limited by sample size, however, encouraging trends are evident.

CONCLUSIONS: Surgical resection of Pancoast tumors after neoadjuvant high-dose radiation and chemotherapy can be safely performed and with improved clinical outcomes. High-dose radiation as part of a tri-modality treatment regimen can be successfully tolerated and may confer a survival advantage. Pre-treatment lymph node metastasis should not necessarily exclude patients from tri-modality treatment. Local cancer control of Pancoast tumors can be accomplished by aggressive tri-modality therapy, but the high number of distant metastasis to the brain suggests that adjuvant prophylactic cranial irradiation (PCI) may play an integral part of a cohesive multi-modality treatment regimen for this disease.

*By Invitation

43. Does Esophagogastric Anastomotic Technique Influence Outcomes in Patients with Esophageal Cancer?

Sina Ercan*, Thomas W. Rice, Sudish C. Murthy, Lisa A. Rybicki*, Eugene H. Blackstone; Cleveland, OH

Discussant: Mark B. Orringer

OBJECTIVE: To compare outcomes of patients with esophageal cancer who had either standard hand-sewn or simplified hybrid stapled cervical esophagogastric anastomosis following esophagectomy.

METHODS: From March 1996 to October 2002, 274 patients with esophageal cancer underwent esophagectomy with gastric replacement and cervical esophagogastric anastomosis. For the most recent cohort of patients (March 2001 to October 2002, n=86), a simplified hybrid stapled technique (stapled) was used to construct the cervical esophagogastric anastomosis (Fig); standard hand-sewn technique (sewn) was used on all others (n=188). Using a propensity score based on 8 variables (age, sex, race, surgeon, type of operation, pathologic stage, histologic cell type, induction chemoradiotherapy), 85 patient pairs were matched. All patients were followed for tumor-related events. Outcomes compared were cervical wound infection, cervical anastomotic leak, postoperative hospital stay, need for dilatation, and overall survival.

RESULTS: At 30 days, freedom from cervical wound infection was 92% for stapled vs. 71% for sewn anastomoses ($P=.001$), and freedom from cervical anastomotic leak was 96% vs. 89% ($p=.09$), respectively. Postoperative hospital stay was similar for both groups ($P>.2$). At 2 years, freedom from dilatation was 34% for stapled vs. 10% for sewn anastomoses ($P<.0001$), and mean number of dilatations per patient was 2.4 vs. 4.1 ($P=.0001$), respectively. Survival at 30 days, 6 months, and 24 months was 98%, 91%, and 77% for stapled anastomoses and 98%, 88%, and 69% for sewn anastomoses ($P=.3$).

CONCLUSIONS: The simplified hybrid stapled anastomotic technique dramatically improves outcomes after esophagectomy and should become the preferred technique for cervical esophagogastric anastomosis.

**By Invitation*

44. Large Cell Neuroendocrine Carcinoma: An Aggressive Form of Non-Small Cell Lung Cancer

¹Richard J. Battafarano*, John Ritter*, Felix Fernandez*, Bryan F. Meyers, Tracey J. Guthrie*, Joel D. Cooper, G. Alexander Patterson; St. Louis, MO

Discussant: William H. Warren

OBJECTIVE: Large cell neuroendocrine carcinomas (LCNEC) of the lung display morphologic and immunohistochemical characteristics common to neuroendocrine tumors and the morphologic features of large cell carcinomas (LCC). Surgical resection of LCNEC in many series has been

described with 5 year actuarial survival rates ranging from 13-47%. Considerable debate has emerged as to whether these tumors should be classified and treated as non-small cell lung cancers (NSCLC) or small cell carcinoma (SCC). The objective of this study was to report the outcome of surgical resection in patients with LCNEC.

METHODS: An analysis of our tumor registry was identified all patients undergoing surgical resection of lung cancer between July 1, 1998 and December 31, 2002 for large cell tumors. Cases were then segregated into LCNEC, Mixed LCNEC (in which at least one portion of the tumor was LCNEC), or LCC on the basis of morphology and differentiation. Follow-up was complete on all patients with a mean follow-up of 48 months. Type of resection, mortality, and survival by stage were analyzed. Kaplan Meier survival was determined for all patients from the date of surgery. Cox Proportional Hazards model analysis incorporating the variables of age, gender, histology, and stage estimated the impact of LCNEC and Mixed LCNEC on recurrence and death. All patients were staged according to the 1997 AJCC guidelines.

RESULTS: Of the 2,089 patients that underwent resection, 82 (3.9%) had large cell lung cancers. Perioperative mortality was 2.4%. Overall survival and freedom from recurrence at 5 years for the entire group was 47.1% and 58.4% respectively. Survival by histologic subtype is presented below. The presence of LCNEC in the specimen (groups LCNEC and Mixed LCNEC combined) was significantly associated with decreased freedom from recurrence (Relative Risk (RR) 2.96, 95% Confidence Interval (CI) 1.12-7.81, P=0.015).

	LCNEC	Mixed LCNEC	LCC
All stages	36.6% (n=45)*	36.4% (n=11)	70.9% (n=26)
Stage I	41.9% (n=30)*	33.3% (n=3)	79.5% (n=21)

*p=0.03 compared to LCC

CONCLUSIONS: Patients with LCNEC have a worse survival after resection than patients with LCC, even in stage I disease. Accurate differentiation of LCNEC from LCC is important because it identifies those patients at highest risk for developing recurrent lung cancer.

**By Invitation*

¹2001-03 Research Scholar

45. Value of Positron Emission Tomography Following Induction Therapy of Locally Advanced Bronchogenic Carcinoma

Thomas Peter Graeter*, Dirk Hellwig*, Dieter Ukena*, Carl-Martin Kirsch*,
Hans-Joachim Schafers*; Homburg/ Saar, Germany

*Discussant: Robert J. Cerfolio**

OBJECTIVE: Induction therapy is a promising modality in patients with locally advanced bronchogenic carcinoma. Following induction therapy it is unclear, whether tracer accumulation on positron-emission-tomography with ¹⁸F-fluorodeoxyglucose (FDG-PET) in restaging predicts tumor viability. We compared FDG-PET results following induction therapy with histology obtained at subsequent surgery.

METHODS: From 7/98 to 2/03, 45 patients (age: 58±9 years) with advanced bronchogenic carcinoma (stage IIIA and B) and induction therapy (chemo- and/or radiation therapy) were evaluated by FDG-PET before planned pulmonary resection. FDG-PET interpretation was visual,

in addition tracer accumulation was quantified measuring standardized uptake values (SUV). By conventional staging 4 patients were in complete remission (CR), 33 were in partial remission (PR) and 8 had no change (NC).

RESULTS: In 9 patients unexpected distant metastases were found by PET and verified histologically in 8 cases; these patients did not undergo resection. In the assessment of the primary tumor all patients with CR had non-viable tumor cells (SUV:1.9±0.4) whereas all NC patients had viable tumor cells (SUV:9±5.9). In patients with PR 8 had non-viable cells (SUV:3±1.9) and 23 had residual tumor cells (SUV:5.9±5). Overall, viable tumor cells were seen in the specimen in 25 of 36 surgical patients (SUV:6.4±5.2; range 1.9-21.6). In 11 patients there was no of viable tumor (SUV:2.9±1.6; range 1.2-6.3; $p < 0.01$). All patients with a SUV of >5.8 had residual tumor cells. Using a SUV level of 3.25 to differentiate between viable or non-viable tumor, sensitivity was 80% and specificity 64% (positive predictive value (PPV) :80%; negative predictive value (NPV) :44%). In the evaluation of mediastinal lymph node disease after induction therapy, PET had a sensitivity of 50% and a specificity of 83% (PPV:72.7%; NPV:92%). Survival at 36 months was significantly higher in patients with a SUV of less than 4 (SUV<4:78±11%, n=17; SUV>4:22±13%, n=15; $p < 0.0008$).

CONCLUSIONS: Tumor cell viability can be detected by FDG-PET following induction therapy. Due to the high negative predictive value of PET in lymph node staging repeated mediastinoscopy may be omitted. The SUV level in the tumor region after induction therapy is a prognostic factor.

3:20 p.m. INTERMISSION - VISIT EXHIBITS

*North Bldg., Exhibit Hall
Metro Toronto Convention Centre*

4:00 p.m. SIMULTANEOUS SCIENTIFIC SESSION - GENERAL THORACIC SURGERY

North Bldg., Rm 105, Metro Toronto Convention Centre

Moderators: Alec Patterson

David J. Sugarbaker

**By Invitation*

46. Surgical Resection of Limited Disease Small Cell Lung Cancer in the New Era of Platinum Chemotherapy: Its Time Has Come

Malcolm V. Brock*, Craig Hooker*, James Syphard*, William Westra*, Li Xu*, Anthony Alberg*, David Mason*, Stephen Baylin*, James Herman*, David Ettinger*, Stephen Yang*; Baltimore, MD

Discussant: Frances Shepard

OBJECTIVE: Although surgery has almost always been excluded from the treatment of limited-disease small cell lung cancer (LD-SCLC), new platinum drugs and modern staging techniques have allowed re-evaluating the role of surgery in this disease.

METHODS: We reviewed our experience from 1976-2002 of 1415 patients with SCLC of whom 84/1415 (6%) underwent surgery with curative intent. All long-term survivors were re-examined by a single pathologist to ensure accuracy with modern histological classifications.

RESULTS: Median age at surgery was 62 years old with most patients undergoing lobectomy or greater resection. Mixed morphology SCLC/Large Cell occurred in 15% (13/84), while other mixed tumors represented 12% (10/84). Treatment consisted of surgery alone in 22% of cases (19/84), neoadjuvant therapy in 10% (8/84), adjuvant therapy in 55% (46/84), and 13% (11/84) of patients received combined neoadjuvant and adjuvant therapy. Prophylactic cranial irradiation was given to 33% (28/84) of patients while platinum and non-platinum based chemotherapy (85% cyclophosphamide, adriamycin, vincristine) was administered to 26% (22/84) and 39% (33/84) of patients, respectively. The 5-year and 10-year survival rates for the entire cohort were 41% and 33% respectively. Patients receiving platinum based chemotherapy had significantly longer 5-year survival rates than patients who did not (48% vs. 13%, $p=0.02$). Survival rates differed significantly before and after 1987 ($p=0.003$), the first year of widespread platinum use at our institution. The overall 5-year and 10-year survival rates for the 43 patients with very limited disease (T1-2 NO) were 55% and 44% respectively. Of those with very limited disease who received chemotherapy, the 5-year survival rates for platinum and non-platinum based chemotherapy were 76% and 39%, respectively. Survival outcomes also differed by gender with females having a statistically significant 5-year and 10-year survival advantage over males (58% vs. 28% and 49% vs. 22%, respectively; $p=0.03$). Stage, pack year tobacco history, age at surgery, administration of platinum-based chemotherapy, and presence of mixed morphology SCLC did not differ between genders.

Survival Curves of Patients With Resected Small Cell Lung Cancer Who Received Platinum or Non-Platinum Chemotherapy (N=55)

CONCLUSIONS: Our favorable long term survival in selected patients with ID-SCLC supports a re-evaluation of the multimodality therapeutic approach to ID-SCLC that now only includes radiotherapy and chemotherapy. Surgery may play a significant role in the treatment paradigm of this disease.

**By Invitation*

47. Sublobar Resection with 125 Iodine Intraoperative Brachytherapy for Peripheral Small Stage IA Non-Small Cell Lung Cancers

Hiran C. Fernando*, Ricardo S. Snatos*, John R. Benfield, Frederic W. Grannis, Jr.*, Robert J. Keenan, James D. Luketich, Rodney J. Landreneau; Pittsburgh, PA, Los Angeles, CA, Duarte, CA
Discussant: ¹Joseph P. Shrager

OBJECTIVE: Aggressive CT screening programs are identifying small peripheral NSCLC amenable to sublobar resection (SR) with clear margins; however, popular belief among thoracic surgeons is that SR should be only used as "compromise therapy" for physiologically impaired patients when lobar resection (LR) may be hazardous. Recent results in the literature demonstrating good results with sublobar resection (SR) lead us to review our experience with SR compared to lobar resection (LR) for stage IA NSCLC. We also evaluated the effect of 125 Iodine intraoperative brachytherapy (Brachy) on local recurrence following SR.

METHODS: Three hundred patients (149 men) undergoing either SR (n= 128) or lobectomy (LR n=172) for peripheral stage IA NSCLC were analyzed. Brachy was utilized in 63 SR patients. Patients were stratified by tumor diameter (<2cm; n=141) or (2-3cm; n=159) and type of resection. Chi square and Kaplan-Meier survival were used for statistical analysis.

RESULTS: SR patients were older (69 versus 66 years; $p=0.017$); with poorer pulmonary function (FEV1% 53% versus 78%; $p=0.001$). The general results of our analyses are seen in the table below. In the <2cm SR patients local recurrence was 1/22 (4.5%) with Brachy compared to 9 / 35 (25.7%) without Brachy*. SR of 2-3cm lesions was associated with a local recurrence in 1/41 patients (2.2%) with Brachy and 2/30 patients (6.7%) without Brachy**. Overall, Brachy decreased local recurrence from 16.9% to 3.2% among all SR patients ($p=0.010$). Survival was similar between SR and LR for stage 1A patients with <2 cm tumors. Patients with 2-3cm tumors had lower survival with SR vs. LR; however, cancer deaths were not different between groups (LR-15% versus SR-21%; $p=0.296$).

CONCLUSIONS: Sublobar resection of peripheral stage IA NSCLC <2cm diameter appears reasonable. Intraoperative brachytherapy may reduce local recurrence following SR. For tumors >2cm, differential survival between SR and LR may be related to impaired functional status in our patient selected for SR. Prospective study is recommended to confirm these findings.

Results of Analyses of Lobar vs. Sublobar Resections						
Resection/ Tumor Size	Lobar/<2cm (n=84)	Sublobar/ <2cm (n=57)	p	Lobar/ 2-3cm (n=88)	Sublobar/ 2- 3cm (n=71)	p
Local Recurrence	8(9.5%)	10(17.5%)*	0.161	3(3.4%)	3(3.2%)**	0.788
Distal Recurrence	15(17.9%)	8(14%)	0.547	16(18.2%)	20(28.2%)	0.135
Survival	96 months	82 months	0.97	69 months	45 months	0.0037

*By Invitation

¹1999-01 Research Scholar

48. Pain and Return of Physical Function are no Different Following Auxiliary Muscle-sparing versus Modified Posterolateral Thoracotomy

E. Andrew Ochroch*, Allan Gottschalk, John G. Augoustides*, Larry R. Kaiser, ¹Joseph B. Shrager; Philadelphia, PA, Baltimore, MD

Discussant: Steven J. Mentzer

OBJECTIVE: We hypothesized that pain and impairment of physical function during hospitalization and the first postoperative year would be less in patients undergoing the vertical, auxiliary, wholly muscle-sparing thoracotomy (MT) vs. serratus-sparing, posterolateral thoracotomy (PT).

METHODS: Prospective data collected for a randomized, double-blinded study comparing two modes of intraoperative epidural drug administration were analyzed with respect to MT and PT incisions for segmentectomy, lobectomy, or bilobectomy without chest wall resection. Incision type was determined by the surgeon. Pain, physical activity, and the extent that incision pain interferes with several activities were assessed with standard questionnaires (Brief Pain Inventory and SF-36) on postop days 1-5, and at postop weeks 4, 8, 12, 24, 36, and 48 by a blinded research assistant. Postoperative pain management was standardized for all subjects, and included epidural analgesia until after thoracostomy tube removal.

RESULTS: 82 underwent MT and 39 underwent PT during the 16 month accrual period. There were no significant differences in demographics, tumor stage or size between the two groups. The mode of epidural analgesia had no impact as a covariate, and there was no difference in the amount of any type of analgesics received by the 2 groups. Early postoperative pain (averaged over days 1-5) was similar in both groups (Table). At 4 weeks, PT trended towards more pain, but this trend was not statistically significant, and at week 12 the pain scores were nearly identical (Table). The number of patients with pain > 3 out of 10 at 48 weeks was also not different between groups. Physical activity levels showed a significant drop from preop to 4 weeks postop, but with no difference between MT and PT (p=0.28). Incision type did not predict complications, morbidity or mortality. Women suffered more pain than men regardless of incision type.

	Incision Type							
	Posterolateral				Muscle Sparing			
	POD 1	POD 5	Wk 4	Wk 12	POD 1	POD 5	Wk 4	Wk 12
Number of Subjects	38	27	35	34	82	61	73	78
Worst Pain (0-10)	4.5	5.2	5.1	2.3	5.7	5.3	4.3	2.4
Average Pain (0-10)	2.7	3.2	2.8	1.5	3.3	3.0	2.3	1.5
Inference of Pain on:								
General Activity (0-10)	2.5	2.4	1.7	1.2	4.4	2.9	1.7	0.9
Walking(0-10)	4.0	2.6	1.4	1.2	5.9	1.5	1.0	0.5
Relationships (0-10)	0.5	0.7	0.8	0.7	0.4	1.2	0.6	0.6
Sleep (0-10)	1.3	2.2	1.5	1.1	1.6	1.7	1.5	0.9
Enjoyment (1-10)	1.8	1.8	1.2	1.0	2.1	2.3	1.3	1.0
Activity Score(10 -30)	PreOp: 27		22	22.5	PreOp: 28		23	26

Pain scores are means. Influence of Pain: 0= does not affect, 10= completely inhibits, scores are means. Activity scores are medians. No statistically significant differences were found using p<0.05 as a cutoff.

CONCLUSIONS: In this study with prospectively acquired pain data on a large cohort of patients, we failed to find a significant difference in early or late pain or recovery of function comparing MT vs PT. One might choose muscle sparing incisions in particular patients for purposes of cosmesis or preservation of arm strength, but it does not appear that one should anticipate reduced pain or more rapid overall recovery of function following this incision, at least when epidural analgesia is used aggressively for perioperative pain control.

5:00 p.m. EXECUTIVE SESSION

(Members Only)

North Bldg., Hall C, Metro Toronto Convention Centre

**By Invitation*

¹1999-01 Research Scholar

TUESDAY AFTERNOON, APRIL 27, 2004

2:00 p.m. SIMULTANEOUS SCIENTIFIC SESSION - CONGENITAL HEART DISEASE

(8 minutes presentation, 12 minutes discussion)

North Bldg., Rm 107, Metro Toronto Convention Centre

Moderators: Richard A. Jonas

Scott M. Bradley

49. Does Duration of Donor Brain Injury Affect Outcome After Orthotropic Pediatric Heart Transplantation?

Jonah Odum*, Hillel Laks, Chris Vincent*, Charles Murphy*, Caron Burch*, Kausik Mukherjee*, Anamika Banerji*, David Gjertson*; Los Angeles, CA

Discussant: Leonard L. Bailey

OBJECTIVE: There are scarce data relating donor brain injury to outcomes after heart transplantation. We tested the hypothesis that the duration of donor brain injury had an adverse effect on recipient rejection and mortality in pediatric heart transplantation.

METHODS: Ninety-three pediatric patients from 1997 to 2003 underwent orthotropic heart transplantation at our center. The donor and recipient medical records were reviewed. The primary outcomes were the number of rejection episodes and the time to first rejection. Secondary outcome was mortality.

RESULTS: Of the 93 recipients of cardiac allografts, 8 (9%) and 2 (2%) received second and third allografts respectively. Overall mortality for the group was 7% (6/93). Median time duration of donor brain injury to declaration of death, death to organ removal, and graft ischemia time were 38, 24, and 3.3 hours respectively. Cox regression analysis (adjusting for UNOS status, ventilator dependence, ECMO/VAD status, diagnosis of congenital heart disease, gender and CMV mismatches, and type of immunosuppression) demonstrated that recipients of donor hearts with relatively long periods from brain injury to death declaration (96 hours) or from death to organ removal (34 hours) had significantly lower rejection rates [HRs = 0.3 (p=0.01) and 0.5 (p=0.05) for injury and death times, respectively]. In this series, prolonged donor heart ischemia (4.6 hours) did not impact rejection rates.

CONCLUSIONS: The longer duration of neurohormonal discharge and stress related to donor brain injury and death, may attenuate factors in the recipient associated with rejection. Further study of these phenomena are warranted.

**By Invitation*

50. Repair of Congenital Heart Lesions Combined with Lung Transplantation for the Treatment of Severe Pulmonary Hypertension: A Thirteen-Year Experience

Charles B. Huddleston, ¹Cliff K. Choong*, Eric N. Mendeloff, Stuart C. Sweet*, Tracey J. Guthrie*, Fabio J. Haddad*, Pam Schuler*, Maite De La Morena*; St Louis, MO

OBJECTIVE: Treatment options of patients with severe pulmonary hypertension associated with congenital heart disease include a combined repair of the underlying congenital heart lesion and lung transplantation (CCIT) or alternatively a heart-lung transplant (HET). We prefer to perform lung transplantation (LT) with repair of the cardiac lesion so as to augment the donor pool and to avoid the cardiac complications associated with heart transplant. We report our experience with CCLT and compare the results to patients who had HIT during the same time period.

METHODS: Patients who had CCLT (n=35) and HIT (n=16) performed between 7/90 and 9/ 03 were reviewed retrospectively and shown in table.

RESULTS: Underlying congenital heart disease (CHD) in the CCLT patients included transposition of great vessels (n=2), atrioventricular canal defect (n=2), ventricular septal defect (n=9), pulmonary venous obstruction (n=7), Scimitar syndrome (n=2), pulmonary artery atresia or stenosis (n=5) and others (n=8). Thirteen (37.1%) of the CCLT patients had their CHD repair prior to LT, while the remaining CHD repairs were performed concomitantly with LT. Causes of hospital mortality in the CCLT group were graft failure (n=5), severe intraoperative hemorrhage (SIH) (n=2) and infection (n=2). Causes of late mortality were bronchiolitis obliterans (BO) (n=3), infection (n=5) and malignancy (n=2). Sixteen patients underwent HLT because of poor LV function or single ventricle anatomy associated with severe pulmonary hypertension. Causes of hospital mortality in the HLT group were graft failure (n=2), SIH (n=2) and infection (n=1). Causes of late mortality were cardiac arrest related to coronary arteriopathy (n=1) and infection (n=1). Kaplan-Meier (KM) freedom from BO at 1, 3, 5 years were 72.9%, 54.7%, 54.7% for CCLT group and 77.8%, 51.9%, 38.9% for HLT group respectively. KM survival at 1,3,5 years were 62.9%, 51.4%, 51.4% for CCLT group and 66.5%, 66.5%, 60% for HLT group respectively.

	CCLT(n=35)	HLT(n=16)	p value
Age at transplant (years)	1.7 (IQR: 0.7-11)	14.8 (IQR: 12-17)	<0.001
Pretransplant PVR (woods units)	21+7	30 +11	0.008
Required ventilation pretransplant	11(31%)	1(6%)	0.075
Time on waiting list (days)	150 + 290	453 + 402	0.013
CPB time (minutes)	187 + 58	224 + 127	0.161
Length of stay in PICU (days)	18 (IQR: 6-28)	5 (IQR: 3-8)	0.006
Length of hospital stay (days)	30(IQR: 15-47)	15 (IQR: 10-19)	0.010
Hospital Mortality 1990-1995	7/22 (32%)	4/8 (50%)	
Hospital Mortality 1996-2003	2/13(15%)	1/8(13%)	

CONCLUSIONS: CCLT is a feasible surgical treatment option and hospital mortality has markedly improved over the course of time. Long term outcome is determined by associated complications related to lung transplantation. Despite the complexity of performing a combined CHD repair with lung transplant and the resulting increased perioperative morbidity, the patients experienced a similar hospital mortality and long-term outcomes as compared to patients who had HLT.

*By Invitation

¹2002-03 Graham Fellow

51. Long Segment Congenital Trachea! Stenosis: Slide Tracheoplasty and a Multi-disciplinary Approach Improve Outcomes and Reduce Costs

Ergin Kocoyildirim*, Catherine Dunne*, Ben Hartley*, Clare McLaren*, Quen Mok*, Clair Noctor*, Nick Pigott*, Derek Roebuck*, Savjeet Uppal*, Colin Wallis*, Martin Elliott; London, UK

Discussant: Hermes C. Grillo

OBJECTIVE: Long segment congenital trachea! stenosis (LSCTS) is rare, life-threatening, difficult and expensive to treat. Management remains controversial. A Multi-Disciplinary Tracheal Team (MDTT) (Cardiothoracic Surgeon, ENT Surgeon, Interventional Radiologist, Intensivist, Respiratory Physician, Specialist Nurses, etc.) was formed in 2000 to deal with a large number of children with airway problems referred for management. We review the impact of that service and a simultaneous shift to slide tracheoplasty (ST) as the preferred treatment option.

METHODS: From 1997 to 2003, 33 patients with LSCTS (19 patients had cardiovascular anomalies) had surgery. Prior to MDTT, pericardial patch tracheoplasty (PPT), +/- auto graft was the preferred method of repair. After MDDT, an integrated care plan preferring slide tracheoplasty was initiated. Cardiac lesions were corrected simultaneously.

RESULTS: Treatment strategies overlapped eras. PPT was performed (1997 - 2001) on 15 infants. 12 patients had a 'suspended' PPT, of whom 2 pts (17%) died late. Three patients had a simple, unsuspended patch, 2 (67%) died in early post-operative period. Four patients underwent trachea! autograft repair with 2 (50%) early deaths. All patients in this group required additional stent insertion.

14 pts underwent ST, with 1 early death (7.14%) and no late deaths. Only 1 ST patient has required stenting. Postoperative length of stay was halved.

CONCLUSIONS: Despite the heterogeneity of this group, the combination of slide tracheoplasty and MDTT management has resulted in a dramatic improvement in outcome for the patients with LCTS, and surrogate measures of cost reveal savings.

**By Invitation*

52. Trends in Vascular Ring Surgery

Carl L. Backer, Lauren D. Holinger*, Constantine Mavroudis; Chicago, IL

Discussant: Mark W. Turrentine

OBJECTIVE: Review our clinical experience with infants and children with anatomically complete vascular rings (VR), ie, double aortic arch (DM) and right aortic arch with left ligamentum (RAA), and define trends in diagnostic and surgical strategies and clinical outcomes.

METHODS: From 1946 through 2003, 209 patients (113 DAA, 96 RAA) have had surgical repair of their VR. Mean and median ages at operation were: DAA 1.4±2.4 years and 0.75 years, RAA 2.7±3.9 years and 0.9 years, respectively. Male: female ratios for DAA and RAA patients were 1.3:1 and 1.8:1, respectively. Fourteen patients with an RAA had an associated Kommerell's diverticulum (KD). Associated cardiac diagnoses were present in 18 RAA patients (19%): VSD

(8), TOF (3), LTGA (2), PDA (3), absent left pulmonary artery (1), and dextrocardia (1). In 8 DAA patients (8%), associated cardiac diagnoses were: left superior vena cava (2), pulmonary atresia (1), LTGA (1), VSD (1), PDA (1), absent left pulmonary artery (1), and dextrocardia (1).

RESULTS: There has been no operative mortality after repair of a VR since 1959- Mean and median hospital stay was: DAA 6.9 ± 17.1 and 3 days, and RAA 5.8 ± 6.1 and 4 days, respectively. The primary means of diagnosis has shifted in the past 10 years from barium swallow and angiography (66% of patients through 1991 to 44% of patients 1992-2003) to CT scan or MRI (29% to 80%). In the past 10 years 52% have had a pre- or intraoperative bronchoscopy. For DAA patients the right arch was dominant in 85 patients (75%), left arch was dominant in 20 patients (18%), and the arches were equal in 8 patients (7%). Arch division strategy is guided by the preoperative CT scan. In RAA patients, 45 (47%) had a retroesophageal LSA, 15 (16%) had mirror image branching. The technique of operation has shifted to a muscle-sparing left thoracotomy without routine chest drainage (n=55). This has reduced the median hospital stay to 2 days for DAA and 3 days for RAA patients. In 5 earlier RAA patients the KD was pexed to the chest wall, in 7 recent RAA patients the KD was resected and the left subclavian artery (LSA) was transferred to the left carotid artery as a primary procedure. All patients undergoing LSA transfer have a patent anastomosis. In patients without cardiac anomalies, 2 DAA patients were repaired via a right thoracotomy; and 1 RAA was repaired via median sternotomy. Two DAA patients and 2 RAA patients underwent late reoperation (4/209, 2%) for aortopexy.

CONCLUSIONS: At our institution, CT scan has replaced barium swallow as the diagnostic procedure of choice for VR evaluation. All VR patients should have pre- or intraoperative bronchoscopy, and a preoperative echocardiogram to rule out cardiac pathology. RAA with an associated KD is an indication for KD resection with LSA transfer to the left carotid artery. Use of a muscle-sparing thoracotomy incision without routine chest drainage has improved the median hospital stay.

3:20 p.m. INTERMISSION - VISIT EXHIBITS

North Bldg., Exhibit Hall A & B

Metro Toronto Convention Centre

**By Invitation*

4:00 p.m. SIMULTANEOUS SCIENTIFIC SESSION - CONGENITAL HEART DISEASE

North Bldg., Room 107

Metro Toronto Convention Centre

Moderators: Richard A. Jonas

Scott M. Bradley

53. Preoperative Cerebral Blood Flow is Diminished in Neonates with Severe Congenital Heart Defects

Daniel J. Licht*, Jiongjiong Wang*, David W. Silvestre*, Susan C. Nicolson*, Lisa M. Montenegro*, Sarah Tabbutt*, Suzanne M. Burning*, Mayadah Shabbout*, David M. Shera*, J. William Gaynor, Thomas L. Spray, Robert R. Clancy*, Robert A. Zimmerman*, John A. Detre*, Philadelphia, PA

Discussant: Erie H. Austin, III

OBJECTIVE: Impaired neurological outcome represents a major morbidity for survivors of neonatal surgery for congenital heart defects (CHD). Previous studies in these neonates have reported preoperative microcephaly and periventricular leukomalacia (PVL). The hypothesis of this study is that cerebral blood flow (CBF) is significantly diminished in neonates with severe forms of CHD, and may be an underlying etiology for the microcephaly and PVL seen.

METHODS: We measured CBF in infants with CHD utilizing a novel *non-invasive* MRI technique termed pulsed arterial spin label perfusion MRI (PASL-pMRI). CBF measurements were made immediately before surgery, under standard ventilator settings (PaCO_2 mean = 40.7 ± 5.4) and repeated under conditions of increased inspired carbon dioxide (PaCO_2 mean = 61.6 ± 7.0). Structural MR imaging of the brain was also obtained.

RESULTS: Of the 25 term preoperative infants studied, 13 were female, average weight was 3.1 ± 0.4 kg (range 2.4-4), average age was 4.4 ± 4.6 days (1-25 days), and all patients were intubated and received similar sedation and muscle relaxation. CHD lesions included hypoplastic left heart syndrome (10), transposition of the great arteries (6), tetralogy of Fallot (2) and others (7). Head circumference (HC) mean was 33.2 ± 1.2 cm (normal = 35 cm). Microcephaly, defined as HC < 2nd percentile, was seen in 24% (6/25). Baseline CBF was 19.7 ± 9.2 ml/100g/min (range 8.0-42.2) with normal values reported by ^{133}Xe clearance as 50 ± 3.4 ml/100g/min for term infants. Five patients had CBF below 10 ml/100g/min. With hypercarbia, CBF increased in all patients to a mean of 40.1 ± 20.3 (range 11.4-94.0, $p < 0.001$) and percent change above baseline was $99.1 \pm 50\%$ (range 11.6 to 224.8%). Univariate analysis found a lower hemoglobin was associated with higher baseline CBF ($p = 0.04$) and microcephaly trended toward an association with lower CBF ($p = 0.13$). A larger CBF percent change above baseline with hypercapnia was associated with a lower hemoglobin ($p = 0.012$) and higher mean arterial pressure ($p = 0.004$). Structural imaging showed PVL in 28% (7/25). The presence of PVL was associated with both decreased resting CBF ($p = 0.05$) and a smaller change in CBF with hypercarbia ($p = 0.003$).

CONCLUSIONS: When compared to published normative data, the mean CBF for this cohort was low, and drastically low in some. Chronic cerebral hypo perfusion in these preoperative neonates is associated with structural brain injury and may contribute to the adverse neurodevelopmental outcomes seen in some survivors of neonatal heart surgery. With hypercarbia, CBF increased to levels considered normal for this age group. PASL-pMRI is a novel technique with broad pediatric application. The accuracy of severely low CBF measurements and their physiologic significance requires continued investigation.

**By Invitation*

54. Replacement of Stage I Norwood by Ductal Stenting and Bilateral Pulmonary Artery Banding

Paul R. Vogt*, Hakan Ismail Akinturk*, Ina Michel-Behnke*, Klaus Valeske*, Matthias Muller*, Josef Thul*, Dietmar Schranz*, Giessen, Germany

Discussant: Thomas L. Spray

OBJECTIVE: The classical Norwood pathway is associated with an important inter stage mortality. Interventional ductal stenting + surgical bilateral pulmonary artery banding followed by aortic arch reconstruction + bidirectional Glenn anastomosis, later completed by total cavopulmonary connection (TCPC), replaces stage I Norwood and decreases the overall mortality along the Norwood pathway.

METHODS: Between 1998 and 2003, 27 patients with hypoplastic left heart syndrome (HLHS) (n=20; 74%) or hypoplastic left heart complex (HLHC) (n=7; 26%) underwent interventional ductal stenting, balloon dilatation atrial septectomy, if indicated, and bilateral pulmonary artery banding. Out of 20 HLHS patients, 12 (60%) had arch reconstruction + bidirectional Glenn after a mean of 4±1 months (3.5 to 6 months), followed by TCPC in 5 patients after a mean of 3 years (2 to 3.5 years) after arch reconstruction and bidirectional Glenn. None had deep hypothermic circulatory arrest along this pathway. After ductal stenting + bilateral pulmonary artery banding, 4 children not eligible for the Norwood pathway underwent cardiac transplantation (HTX) after a mean waiting time of 55 days (23 to 364 days). After ductal stenting + bilateral pulmonary artery banding, left ventricular growth was observed in 7 children (26%), 6 subsequently undergoing biventricular repair after a mean 4.5 months (3.5 to 7 months).

RESULTS: Out of 27 children, 3 (11 %) had ductal stenting + bilateral pulmonary artery banding, now awaiting the next stage; 12 (44%) had aortic arch reconstruction + bidirectional Glenn, and, 5 (18.5%) had TCPC. 30-day mortality was 7% for ductal stent + bilateral pulmonary artery banding; 8% for aortic arch reconstruction + bidirectional Glenn, and, 0% for TCPC. Up to now, 5 out of 20 patients (25%), undergoing ductal stenting + bilateral pulmonary artery banding, finally completed the Norwood pathway. Overall, 5 patients died (18%) during the study period: 2 (7%) died from ductal stent displacement early in this series in 1999, 2 (7%) died on the waiting list for HTx and 1 child (4%), for whom parents refused proposed HTx for religious reasons, died after arch reconstruction + bidirectional Glenn. Operative mortality was 0% for both group of patients, for those undergoing HTx, and for those receiving biventricular reconstruction.

CONCLUSIONS: For children with HLHS and HLHC, early postnatal ductal stenting + bilateral pulmonary artery banding replaces stage I Norwood in selected children undergoing the Norwood pathway, decreasing its overall mortality rate. In addition, ductal stenting + pulmonary artery banding extends the safe period on the waiting list for those children with HLHS undergoing HTx, and allows observation of left ventricular growth to identify children with HLHC suitable for biventricular repair.

**By Invitation*

55. The Contegra Conduit in the Right Ventricular Outflow Tract Induces Supravalvular Stenosis

Leen Van Garsse*, Bart Meyns*, Benedicte Eyskens*, Luc Mertens*, Derize Boshoff*, Marc Gewillig*, Willem Daenen*; Leuven, Belgium

Discussant: John W. Brown

OBJECTIVE: To evaluate the incidence and nature of pulmonary stenosis after implantation of the bovine jugular vein graft (Contegra) in the right ventricular outflow tract (RVOT).

METHODS: Between May 2000 and September 2002, 58 Contegra conduits (12 to 22 mm) were implanted in the RVOT during primary repair (n=27) or redo surgery (n=31) in 57 patients. The ages ranged from 2 days to 48 years (mean 9 years).

Indications were truncus arteriosus (17), tetralogy of Pallet (27), pulmonary replacement in the Ross operation (10) and Rastelli type repair for double outlet right ventricle (4). Echocardiography was prospectively performed by a fixed team of investigators during follow-up (mean 19.08±14.67 months, 98% complete). An instantaneous peak gradient > 50mmHg was considered as a severe stenosis.

RESULTS: Two patients died from staphylococcus aureus septicemia and enterococcal endocarditis after 12 days and 12 weeks respectively.

Freedom of severe stenosis was $91\pm3\%$ at 3 months, $68\pm6\%$ at 12 months and $49\pm8\%$ at 24 months. The incidence of pulmonary stenosis increases linearly in time. Younger age and its derivatives (graft size, indication) are significantly related to the occurrence of severe stenosis ($p=0.0004$).

All stenoses were located at the distal anastomosis. Seventeen conduits (29%) required an endovascular intervention (balloon dilatation or stent). Seven conduits (12%) were explanted (2 because of endocarditis, 5 because of stenosis). Histological analysis of the explanted conduits showed important proliferation of neo-intima at the level of the distal anastomosis. Severe valve regurgitation was observed in 6 conduits (10%) and was always secondary to dilatation in the presence of severe graft stenosis.

CONCLUSIONS: The Contegra conduit induces a neo-intima proliferation at the level of the pulmonary anastomosis. This leads to a high incidence of severe stenosis at intermediate-term follow-up.

5:00 p.m. EXECUTIVE SESSION

(Members Only)

North Bldg., Hall C, Metro Toronto Convention Centre

**By Invitation*

WEDNESDAY MORNING, APRIL 28, 2004

7:00 a.m. EMERGING TECHNOLOGIES AND TECHNIQUES FORUM

(7 Minutes Presentation, 8 Minutes Discussion) North Bldg., Hall C, Metro Toronto Convention Centre

Moderators: D. Craig Miller

Craig R. Smith

T1. Antegrade Off Pump Versus Retrograde On Pump Delivery Valved Stents For

Surgical Suture less Aortic Valve Replacement on The Search For The

Right Direction

Christoph H. Huber, Bettina Marty*, Pierrgiorgio Tozzi*, Antonio F. Corno*, Enrico Ferrari*, L. K. Von Segesser; Lausanne, Switzerland*

Discussant: W. Randolph Chitwood

OBJECTIVE: Extra corporal cardiopulmonary bypass still remains a necessity for surgical aortic valve replacement. We evaluated feasibility of ante grade off-pump suture less aortic valve replacement using Valved Stents.

METHODS: Feasibility of A) suture less ante grade off-pump aortic valve replacement (3 pigs ($65.0\pm10\text{Kg}$) was evaluated comparing handling, access method and delivery technique of a self-expanding Valved Stent (3F Therapeutics) to B) a retrograde on-pump approach (6 calves, 74.3 ± 2.4

Kg). Prior to implantation all valved Stents were tested under dynamic pulsatile mock loop conditions.

Assessment was performed using intravascular (IVUS) and intracardiac ultrasound (AcuNav™) including: leaflet motion, planimetric valve orifice and residual-coronary-sinus-stent-index (distance stent to aortic wall/coronary diameter) calculations, transvalvular gradient, regurgitation and paravalvular leaking. Macroscopic analyse was performed at necropsy.

RESULTS: In the off-pump group A) all Valved Stent were placed correctly, in B) 5 of 6 Valved Stents were deployed at target site. In both groups, two-dimensional intracardiac ultrasound showed good leaflet motion, with full valvular opening and closing. In A) no paravalvular leak was found, in B) 2 of 6 valves showed minor to moderate paravalvular leak due to size mismatch and 1 valve showed mild to moderate regurgitation. In both groups, all implanted Valved Stents showed a low transvalvular gradient of 5.2 ± 4.2 mmHg (mean, peak to peak) on invasive measurements and 5.8 ± 3.5 mmHg in two-dimensional intracardiac sonography. Planimetric valve orifice was 1.8 ± 0.2 cm². There were no signs of coronary flow impairment. Residual-coronary-sinus-stent-index was 1.9 ± 1.4 .

At necropsy in A) all and in B) 4 of 6 Valved Stents were correctly placed and safely anchored to the aortic wall.

CONCLUSIONS: Suture less aortic valve insertion into the orthotropic aortic position is feasible. Using an ante grade approach via the left ventricular apex makes beating heart aortic valve implantation possible. Furthermore it's low transvalvular gradient, absence of interference with the coronary blood flow as well as excellent acute valve function are promising character for further long-term studies.

**By Invitation*

T2. Epidural Anesthesia Results in More Efficient Use of Hospital Resources in Minimally Invasive Direct Coronary Artery Bypass Surgery

Haldun Y. Karagoz*, Murat Kurtoglu*, Berlin Sonmez*, Beyhan Bakkaloglu*,
Taner Cetintas*, Sanser Ates*, Ayhan Yigit*, Kemal Bayazit*; Ankara, Turkey
Discussant: ¹Lisbon Aklog

OBJECTIVE: Minimally invasive direct coronary artery bypass (MIDCAB) surgery in the awake patient with epidural anesthesia had been previously reported. However, there is no prospective randomized study comparing MIDCAB surgery with epidural anesthesia versus general anesthesia.

METHODS: Between January 2002 and May 2003, 76 patients who consented for awake MIDCAB surgery were randomly assigned into either MIDCAB under general anesthesia (GA Group) or MIDCAB under epidural anesthesia (EA Group). EA Group patients did not receive concomitant general anesthesia and they were conscious throughout the procedure. All patients had a left internal thoracic artery to left anterior descending coronary artery bypass using the same MIDCAB techniques. There were 42 patients in the GA Group and 34 patients in the EA Group. The demographic characteristics of the groups were similar.

RESULTS: Results are depicted in the Table. There were no mortality or major morbidity in both groups. EA Group patients had lower arterial oxygen saturations and higher partial carbon dioxide pressures, but these were not clinically significant. EA Group patients had significantly less intensive care unit (ICU) and hospital stay periods, as well as significantly less postoperative pain

and blood loss. There was not any difference in regard to patient satisfaction after the procedure between the two groups.

Variable	GA Group	EA Group	P value
Duration of operation (min)	91,7±23,6	89,5±17,8	NS
Intensive care unit stay (hours)	18,2±4,8	5,5±6,5	p<0.001
Hospital stay (hours)	58,6±17,9	31,4±20,7	p<0.001
Arterial blood pressure (systolic, mmHg)	95,8±21	100±24,7	NS
Heart rate (beats/min)	82,1±11,3	66,5±8,4	p<0.001
Arterial oxygen saturation (%)	97,4±1,3	93,3±3,2	p<0.001
PCO2(mmHg)	41,5±2,5	45,8±3,6	p<0.001
Postoperative blood loss (ml)	371,7±315,3	184,2±169	p<0.01
VAS-pain (0=no pain, 10=worst pain)	2,3±,6	1,06±,6	p<0.001
VAS-patient satisfaction at discharge (0=least satisfied, 10=most satisfied)	7,7±1,3	8,2±1,1	NS
VAS-patient satisfaction at 2 months (0=least satisfied, 10=most satisfied)	8,9±,9	8,9±,9	NS

CONCLUSIONS: It can be concluded that, similar surgical results can be achieved by MIDCAB surgery with general or epidural anesthesia. Although epidural anesthesia has no impact on the degree of patient satisfaction after the procedure, it yields significantly shorter ICU and hospital stay periods, which may result in more efficient use of hospital resources.

Values are expressed as mean ± standard deviation

NS: Not significant

VAS: Visual analog score

**By invitation*

¹1998-99 International Fellow

T3. The Completely Robotic Oncologic Minimally Invasive Esophagectomy

Kemp H. Kernstine*, Daniel T. Dearmond*, Mohsen Karimi*, Dany M. Shamoun*, Jeffrey E. Everett*, Iowa City, IA

Discussant: Scott J. Swanson

OBJECTIVE: Esophagectomy is a palliative and potentially curative treatment for esophageal cancer. To improve long-term survival, induction chemoradiotherapy and lymphadenectomy have been added, at the expense of increased surgical difficulty, morbidity and mortality. Success has been demonstrated with a minimally invasive esophagectomy. We investigated the use of robotics to perform esophageal resection and a three-field lymphadenectomy after induction therapy.

METHODS: Ten patients, 66 ± 13 y, BMI 30.9 ± 3.7 underwent esophagectomy with the da Vinci™ (Intuitive Surgical) robot. Lesion characteristics: 8 cancer, 2 high-grade dysplasia, 5 adenocarcinoma, 3 squamous cell cancer; 2 middle third, 6 lower third; 2 T2N1, 2 T3N0, 3 T3N1

and 1 T4N1 at presentation. Key patient characteristics: 6 preoperative chemoradiotherapy, 4 prior abdominal surgeries, 2 prior upper abdominal surgeries, and 1 prior gastrostomy. Patients were chronologically grouped, Group I (3), thoracic only, robotic-assisted esophagectomy was performed; Group II (3), robotic-assisted thoracic esophagectomy plus thoracic duct ligation, with a laparoscopic gastric conduit and no pyloric procedure; Group III (4), a completely robotic esophagectomy. In Groups II and III a 4 cm wide gastric tube was created.

RESULTS: In Group III, the total operating room time was 11.9 ± 0.8 hours (11.3-13) and console time was 5.1 ± 0.5 hours (4.8-5.8). The estimated blood loss was 600 ± 200 ml (200-950). In-Group I, 1 had a thoracic duct leak. In Groups II and III, a thoracic duct ligation resulted in no further leaks. Other postoperative complications included: atrial fibrillation (3), cervical anastomotic leak (1), wound infection (1), renal failure (1), azotemia (1), and bilateral vocal cord paresis requiring tracheostomy (1). There were no cases of gastric outlet obstruction. In 5 no ICU time was required. The survival to date is 100%.

CONCLUSIONS: Robotics facilitates an oncologically sound esophageal resection, even with prior induction therapy and abdominal surgery. Proper initial port placement and the operating room team are critical to reduce operating time. Larger scale trials are needed to define the role of this technique.

**By Invitation*

T4. The Incidence of Emboli During Cardiac Surgery: A Histopathologic Analysis of 2,297 Patients

Keith A. Horvath, Gerald Berry*, for the ICEM Investigators*; Chicago, IL, Stanford, CA

Discussant: Curtis G. Tribble

OBJECTIVE: Manipulation of the atherosclerotic aorta during cardiac surgery is assumed to cause immobilization, which can contribute to adverse outcomes. Recently, as a result of worldwide trials deploying the EMBOL-X intra-aortic filter during cardiac surgery, such emboli were captured and processed for histopathologic analysis.

METHODS: Filters with a pore size of 120 microns were placed in 2,297 patients who underwent the following operations: CABG (68%), valve (16%), combination CABG/valve (11%), and other (2%).

RESULTS: Filters captured at least one embolus in 98% of the patients. An average of 8.3 particles were captured per filter (range of 0-74). The surface area of the emboli were on average 5.8mm² (range of 0-188mm²). Histologic analysis of the captured particles indicated that in 79% of the filters fibrous atheromata were noted, in 44% there were platelets and fibrin, 8% had red blood cell thrombus, 3% had fibro fatty/adventitial tissue, 2% had other material including cartilage, myocardium, lung, suture, and a Teflon pled get. Of the patients enrolled, 1,569 were high-risk. The average number of particles captured in the high-risk patients was 8.5 vs. 5.8 for the low to moderate risk patients ($p < .0001$). Concomitantly there was an increase in the embolic burden between the higher and lower risk patients (surface area 6.6 vs. 4.0mm², $p < .0001$). In these high-risk patients, intra-aortic filtration led to fewer complications, particularly a reduction in neurologic injury.

CONCLUSIONS: These data show the ubiquitous incidence of emboli during cardiac procedures. Intra-aortic filtration should reduce adverse outcomes as was demonstrated for the high-risk patients in this study.

**By Initiation*

T5. The Hybrid Surgical-Transcatheter Approach for the Treatment of Congenital Heart Disease: An Emerging Strategy

Mark Galantowicz*, John P. Cheatham*, Samuel Weinstein*, Terrance J. Davis, Craig Fleishman*, Sharon Hill*, Vyas M. Kartha*, Columbus, OH

Discussant: Emile Bacha

OBJECTIVE: A collaborative interaction between pediatric cardiothoracic surgeons and interventional cardiologists, coupled with new technology has enabled the development of hybrid treatment strategies for patients with congenital heart disease. These new hybrid treatments may improve short-term and long-term outcomes. We describe our experience with 7 different hybrid procedures in 21 patients.

METHODS: From 7/2002 to 10/2003, 21 patients, ages 5 days to 4.3 years, weighing 1.2-11.5kg, underwent one of the following procedures. 1) 13 patients with HLHS were initially palliated with bilateral PA bands and a PDA stent. 2) 3 patients had intra-operative stents placed in pulmonary arteries (2) or pulmonary vein (1). 3) One patient (1.6kg) with PA/VSD had per ventricular placement of a RVOT stent. 4) One patient had per ventricular device closure of two VSDs. 5) One patient (1.2kg) underwent balloon aortic valvuloplasty via a Tran carotid cut down. 6) One patient (2.5kg) had a combined balloon pulmonary valvuloplasty and epicardial pacemaker insertion. 7) One patient had a transcatheter Fontan completion after a modified hemi-Fontan. Procedures 1-4 were performed in a modified OR outfitted with a mobile, digital, cardiac C-arm while procedures 5-7 were in a biplane cath-lab adapted for surgical procedures.

RESULTS: All devices were successfully delivered to the target lesions with protection of pulmonary blood flow & PDA patency, relief of stenoses, occlusion of defects, and completion of a Fontan circuit. Balloon valvuloplasties were successful. One patient required a 2nd PDA stent within 24 hours. The only death was in a patient (2.1 kg), with HLHS, undergoing PA bands & PDA stent. Autopsy revealed an unsuspected congenital stenosis (<1.5mm) of the origin of the transverse arch compromising retrograde coronary and cerebral perfusion after stent placement.

CONCLUSIONS: These examples of collaborative management of congenital heart disease build on the strengths of the shared techniques and technology while minimizing the weakness of either a surgical or interventional procedure alone. This level of hybrid thinking will lead to novel treatment strategies, such as PDA stent & PA banding for HLHS, which may significantly reduce the cumulative impact of interventions, thereby improving quality of life and survival. Venue modifications in either the operating room or cath-lab facilitate hybrid procedures. Success in this small cohort of patients warrants further investigation and follow-up of hybrid procedures.

**By Invitation*

T6. 3-Dimensional Echo Guided Beating-Heart Surgery Without Cardiopulmonary Bypass: Feasibility Study

Yoshihiro Suematsu*, Gerald R. Marx*, Jeffrey A. Stoll*, Pierre E. Dupont*, Robert D. Howe*, John K. Friedman*, Tomislav Mihaljevic*, Bassem N. Mora*, Bernie J. Savord*, Ivan S. Salgo*, Pedro J. Del Nido; Boston, Cambridge and Andover, MA

Discussant: Patrick M. McCarthy

OBJECTIVE: Techniques for beating-heart coronary bypass surgery have evolved substantially. For intracardiac beating heart interventions however, only catheter based techniques are currently in use. To develop surgical techniques for reconstructive beating-heart repair of atrial septal defect (ASD) in children, and mitral valve plasty (MVP) in adults, we have gathered a multidisciplinary team to adapt real-time 3-dimensional echocardiography (RT3DE) with specialized instrumentation to facilitate ASD closure and MVP procedures.

METHODS: **Exp. I:** a modified RT3DE system with x4 matrix transducer (Sonos 7500, Philips Medical Systems, Andover, MA) was compared to 2-D echo in the performance of common surgical tasks. Completion times, deviation from an ideal trajectory using an electromagnetic tracker, and deviation of suture from an echogenic target (mm) were measured. **Exp. II:** porcine ASDs were created and closed with an original design semi-automatic suturing device (n=4), and in separate exp. ASDs were closed with a 5-mm endoscopic stapler and pericardial or 0.1mm PTFE patch (n=4). **Exp. III:** A pulsatile porcine mitral valve model was developed and suture placement through the anterior and posterior mitral leaflets (Alfieri et al) was performed determining suture placement at the end of each surgical task (n=8). During all experiments the operator was blinded to the target and operated only under ultrasonic guidance.

RESULTS: Compared to 2DE guidance, completion times improved by $23 \pm 5\%$ ($p < 0.01$) with high trajectory accuracy, and deviation of suture was significantly smaller (2DE: 4.3 ± 1.9 mm, 3DE: 1.3 ± 0.5 mm, $p < 0.05$) in RT3DE guided tasks. In both ASD closure and MVP, RT3DE provided satisfactory images and sufficient anatomical detail for suturing and patch deployment. The needles and staples penetrated the tissue and/or patch material consistently, and all surgical tasks were successfully performed with accuracy. In both procedures, collateral tissue injuries were not observed.

CONCLUSIONS: RT3DE provides adequate imaging and anatomic detail to act as a sole guide for surgical task performance. These initial experiments demonstrate the feasibility of beating-heart direct or patch closure of ASD and MVP without cardiopulmonary bypass.

**By Invitation*

T7. Surgical Ventricular Restoration Improves Mechanical Dyssynchrony in Post-Infarction Ischemic Cardiomyopathy

Marisa Di Donate*, Michel Sabatier*, Vincent Dor, Anna Toso*, Lorenzo Menicanti*; The Restore Group; Firenze, Italy, Monaco Cedex, Monaco, San Donate Milanese, Italy

Discussant: Edward D. Verrier

OBJECTIVE: In ischemic Cardiomyopathy, dyssynchrony of left ventricular (LV) mechanical contraction produces adverse hemodynamic consequences. This study tests the capacity of geometric rebuilding by surgical ventricular restoration (SVR) to restore a more synchronous contractile pattern following a mechanical, rather than electrical intervention.

METHODS: A prospective study of the global and regional components of dyssynchrony were studied in 30 pts (58 ± 8 years) undergoing SVR. The protocol used simultaneous measurements of ventricular volumes and pressure, in order to construct Pressure/Volume (P/V) to study global function, and Pressure/Length (P/L) loops to evaluate endocardial regions contributing to global function. Angiograms were done before and after SVR to study a 600 msec cycle during Pacing at 100 beats/min.

RESULTS: Mean QRS duration was similar at 100 ± 17 pre and 114 ± 28 msec post-operatively (NS). Pre-operative LV contraction was highly asynchronous, as P/V loops showed abnormal isometric phases with a right shifting. The contributing components of regional endocardial time-motion was either early or delayed at the end systolic phase so that P/L loops were markedly abnormal in size, shape and orientation. Post operatively, SVR resulted in leftward shifting of P/V loops and increased area (Fig); endocardial time-motion and P/L loops almost normalized to allow a better contribution of single regions to global ejection.

The hemodynamic consequences of SVR, that produced these components of global and regional synchrony included improved Ejection Fraction (30 ± 13 to $45 \pm 12\%$, 0.001); reduced End Diastolic and End Systolic Volume Index (202 ± 76 to 122 ± 48 and 144 ± 69 to 69 ± 40 ml/m², 0.001); more rapid Peak Filling Rate (1.75 ± 0.7 to 2.32 ± 0.7 EDV/sec, 0.0001); Peak Ejection Rate (1.7 ± 0.7 to 2.6 ± 0.9 ; 0.0002) and Mechanical Efficiency (0.56 ± 0.15 to 0.65 ± 0.18 , 0.04). Fig shows PA⁷ loops in one pts before and after SVR.

CONCLUSIONS: These global and regional effects that changed preoperative dyssynchrony were independent of conduction delay, did not need biventricular pacing, and show that SVR produces a mechanical intra-ventricular "re-synchronization" that improves LV performance.

**By Invitation*

T8. A New Mechanical Connector for Distal Coronary Artery Anastomosis in CABG: A Randomized Controlled Study

Lars Wiklund*, Luis Bonilla*, Eva Berglin*; Gothenburg, Sweden, St. Paul, MN

Discussant: Randall K. Wolf

OBJECTIVE: Recently, special interest has been taken in mechanical anastomotic devices in order to facilitate minimal invasive techniques or limited access surgery in patients undergoing coronary artery bypass grafting.

METHODS: Between April and December 2002, 60 patients scheduled for elective multivessel bypass grafting were prospectively randomized. One vein graft-to-coronary artery anastomosis per patient was either performed by the St. Jude Medical ATG coronary connector system (n=30) or hand sewn (n=30). A selective coronary angiography or coronary magnetic resonance imaging of the studied graft and vessel was included in the 6-month follow-up.

RESULTS: Twenty-eight of the connectors were successfully implanted. Two were excluded from the study because of conversion to hand-sewn anastomoses. The intraoperative graft blood flow after weaning from CPB in the connector group was 47 ± 8 ml/min and in the control group 46 ± 4 ml/min indicating that all anastomoses were patent at the end of the procedure. Six connector-made anastomoses were bleeding at the anastomotic site. At the time of follow-up (190 days postoperatively) all control anastomoses/grafts were patent whereas 26% (7 out of 28) of the connector-anastomoses were occluded.

CONCLUSIONS: The St. Jude Medical ATG coronary connector system for distal anastomoses represents a new concept for suture-less anastomoses in cardiac surgery. This randomized controlled study shows lower graft patency in anastomoses performed with the connector compared to hand-sewn controls. It illustrates the importance of controlled studies when evaluating new technical equipment in medicine

**By Invitation*

WEDNESDAY MORNING, APRIL 28, 2004

7:00 - 9:00 a.m.

GLOBAL INITIATIVES IN CARDIOTHORACIC SURGERY: AN UPDATE

North Bldg., Ste 205, Metro Toronto Convention Centre

*Co-Chairmen: James I. Cox
Marko I. Turina*

7:00 a.m. Evolution of Global Strategies in Humanitarian Cardiothoracic Surgery

A. Thomas Pezzella, The World Heart Foundation

7:10 a.m. Pediatric Cardiology and Cardiovascular Surgery in Iraq

Ra-id Abdulla, University of Chicago

7:20a.m. Plans for a New Pediatric Cardiac Program in Iraq

Richard A. Jonas, Boston Children's Hospital

7:30 a.m. Cardiac Surgery in an Underdeveloped Country - the Beginning and the Way Forward

Ahmed Sayed Ahmed Elsayed, Sudan Heart Center

7:40a.m. Various Modes of Medical Cooperation in Developing Areas. A Personal Experience

Jean E. Bachet, Institute Mutualiste Montsouris

7:50 a.m. Panel Discussion

Moderators: James L. Cox and Marko I. Turina

CONTROVERSIES IN CARDIOTHORACIC SURGERY PLENARY SESSION

North Bldg., Hall C, Metro Toronto Convention Centre

9:15 a.m. Topic: The Legal Profession is the Guardian of Medical Standards

Moderator: Joseph J. Bongiovi, III

Pro: John S. Romano

Con: Michael E. Royce

**CONTROVERSIES IN CARDIOTHORACIC SURGERY ACQUIRED
CARDIAC CONTROVERSIES**

North Bldg., Hall C, Metro Toronto Convention Centre

10:30a.m. Topic: Atrial Fibrillation Surgery Should Be Performed On Patients Undergoing

Mitral Valve Replacement

Moderator: W. Randolph Chitwood

Pro: Delos M. Cosgrove

Con: Tirone E. David

11:15a.m. Topic: The Ross Operation Is The Procedure of Choice For a 40 Year Old Patient

With Aortic Valve Disease

Moderator: Andrews. Wechsler

Pro: Vaughn A. Starnes

Con: Lawrence H. Cohn

12:00 noon ADJOURN

**By Invitation*

Wednesday Morning, April 28, 2004

**CONTROVERSIES IN CARDIOTHORACIC SURGERY GENERAL
THORACIC CONTROVERSIES**

North Bldg., Rm 105, Metro Toronto Convention Centre

10:30a.m. Topic: Minimally Invasive Esophagectomy is a Major Advance in the Care of the

Patient with Esophageal Cancer

Moderator: Richard F. Heitmiller

Pro: Mark J. Krasna

Con: Nasser Altorki

11:15a.m. Topic: Post-Operative Adjuvant Therapy Should Be Offered To All Patients

With Resected Lung Cancer

Moderator: Larry R. Kaiser

Pro: David Johnson

Con: Harvey I. Pass

12:00 noon ADJOURN

WEDNESDAY MORNING, APRIL 28, 2004

CONTROVERSIES IN CARDIOTHORACIC SURGERY CONGENITAL HEART CONTROVERSIES

North Bldg., Rm 107, Metro Toronto Convention Centre

**10:30a.m. Topic: Catheter-Delivered Devices Are Preferred Over Surgery For Management
of Secundum ASD**

Moderator: Constantine Mavroudis

Pro: Andrew Redington

Con: Richard A. Jonas

**11:15a.m. Topic: The Symptomatic Infant Less Than 6 Months of Age With Tetralogy
Should Be Managed With a Shunt**

Moderator: William G. Williams

Pro: Charles D. Fraser

Con: Ross M. Ungerleider

12:00 noon ADJOURN

**By Invitation*

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The Graham Education and Research Foundation supports the Evarts A. Graham Memorial Traveling Fellowship program. Since the inception of the program in 1951, fifty-one young surgeons from twenty-eight countries have completed their training at thoracic surgical centers throughout North America. The Foundation also supports the Research Scholarship program, which was established in 1985. Annual and planned gifts to the Foundation help support these fellowship and scholarship programs and provide an opportunity for donors to leave their legacy in cardiothoracic surgery. Planned gifts can include a bequest in one's will, through a life insurance policy or retirement plan or through a charitable lead or remainder trust.

For more information about planned giving, please contact the Foundation at 900 Cummings Center, Suite 221-U, Beverly, Massachusetts, 01915.

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1st	1951-52	L. L. Whytehead Winnepeg, Manitoba, CANADA
2nd	1953-54	W.B. Ferguson Newcastle-upon-tyne, ENGLAND
3rd	1954-55	Lance L. Bromley London, ENGLAND
4th	1955-56	Raymond L. Hurt Radlett Herts, ENGLAND
5th	1956-57	Mathias Paneth London, ENGLAND

6th	1957-58	Peter L. Brunnen Aberdeen, SCOTLAND
7th	1958-59	N.G. Meyne Amsterdam, HOLLAND
8th	1960-61	Godrej S. Karai Calcutta, INDIA
9th	1961-62	Fritz Helmer Vienna AUSTRIA
10th	1962-63	Theodor M. Scheinin Helsinki, FINLAND
11th	1963-64	Masahiro Saigusa Tokyo, JAPAN
12th	1963-64	Adarl. Hallen Uppsala, SWEDEN
13th	1964-65	Stuart C. Lennox London, ENGLAND
14th	1964-65	Elias Carapistolis Thessaloniki, GREECE
15th	1965-66	Gerhard Frichs Graz, AUSTRIA
16th	1965-66	Ary Blesovsky London, ENGLAND
17th	1966-67	C. Peter Clarke Fitzroy, AUSTRALIA
18th	1966-67	G.B. Parulkar Bombay, INDIA
19th	1967-68	Glaus Jessen Copenhagen, DENMARK
20th	1969-70	Peter Brucke Linz-Puchenu, AUSTRIA
21st	1970-71	Michel S. Slim

		New York, NY, USA
22nd	1971-72	Severi Pellervo, Mattila Kaunianen, FINLAND
23rd	1972-73	Yasuyuki Fujiwara Tokyo, JAPAN
24th	1973-74	Marc Roger de Leval London, ENGLAND
25th	1974-75	J. J. DeWet Lubbe Cape Town, SOUTH AFRICA
26th	1975-76	Mieczyslaw Trenkner Gdansk, POLAND
27th	1976-77	Bum Koo Cho Seoul, KOREA
28th	1977-78	Alan William Gale Sydney, AUSTRALIA
29th	1978-79	Eduardo Otero Goto Valencia, SPAIN
30th	1980-81	Richard K. Firmin Leicester, ENGLAND
31st	1981-82	Claudio A. Salles Belo Horizonte, MG, BRAZIL
32nd	1982-83	Yasuhisa Shimazaki Osaka, JAPAN
33rd	1983-84	Georg S. Kobinia Klagenfurt, AUSTRIA
34th	1984-85	Aram Smolinsky Tel Hashomer, ISRAEL
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45th	1997-98	Jun Wang Beijing, CHINA
46th	1998-99	Christian Kreutzer Buenos Aires, ARGENTINA
47th	1999-00	Andes Franco-Cereceda Stockholm, SWEDEN
48th	2000-01	Albertus Scheule Tuebingen, GERMANY
49th	2001-02	Anna Maria Ciccone Rome, ITALY
50th	2002-03	Cliff K.C. Choong Auckland, NEW ZEALAND
51st	2003-04	Edvin Prifti Tirana, ALBANIA
52nd	2004-05	Smruti Ranjan Mohanty

Bangalore, Karnataka, INDIA

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The American Association for Thoracic Surgery Research Scholarship was established by the Association in 1985. Funded by the Association and individual contributions, the Research Scholarship provides opportunity for research, training and experience for North American surgeons committed to pursuing an academic career in cardiothoracic surgery. Administered by the Graham Education and Research Foundation, the program is undertaken within the first three years after completion of an approved cardiothoracic residency and is about two years in duration.

EDWARD D. CHURCHILL RESEARCH SCHOLARSHIP

"Pharmacology of the Pulmonary Lymphatics"

1986-1988 Mark K. Ferguson

University of Chicago. Department of Surgery

ALFRED BLALOCK RESEARCH SCHOLARSHIP

**"Efficacy and Toxicity of a New Blood Substitute: Polymerized,
Ultra-Pure, Stroma-Free Bovine Hemoglobin"**

1988-1990 Gus J. Vlahakes

Massachusetts General Hospital and Harvard Medical School

JOHN H. GIBBON, JR., RESEARCH SCHOLARSHIP

**"Load-Independent Assessment of Cardiac Performance by
Noninvasive Means"**

1990-1992 **Donald D. Glover**

Duke University Medical Center

ALTON OCHSNER RESEARCH SCHOLARSHIP

**"Experimental Cardiac Graft Arteriosclerosis: Pathogenesis and
Prevention of Lesion Development"**

1992-1994 David H. Adams

Brigham and Women's Hospital

ROBERT E. GROSS RESEARCH SCHOLARSHIP

**"Role of Intra-Cellular Messenger cAMP and cGMP in Organ
Preservation"**

1994-1996 Mehmet C. Oz

Columbia-Presbyterian Medical Center

"Development of a Model of Chronic Pulmonary Rejection in Miniature Swine"

Thoralf Mauritz Sundt, III

Washington University School of Medicine

JOHN ALEXANDER RESEARCH SCHOLARSHIP

"Strategies to Prevent Hyperacute Rejection of the Pig Lung by Human Blood"

1996-1998 Richard Morris Pierson, HI

Vanderbilt University Medical Center

ANDREW G. MORROW RESEARCH SCHOLARSHIP

"The Detection of Telomerase Activity in Patients with Non-Small Cell Lung Cancer"

1997-1999 Stephen C. Yang

Johns Hopkins University School of Medicine

DWIGHT HARKEN RESEARCH SCHOLARSHIP

"Chimeric Hearts Test the Role of Antigen Presenting Cells in Rejection and Tolerance"

1998-2000 Bruce Rosengard

The University of Pennsylvania

SECOND EDWARD D. CHURCHILL RESEARCH SCHOLARSHIP

"The Role of Respiratory Muscle Adaptation in Lung Volume Reduction Surgery"

1999-2001 Joseph B. Shrager, M.D.

The University of Pennsylvania

SECOND ALFRED E. BLALOCK RESEARCH SCHOLARSHIP

"CD-4 Lymphocytes and Cardiac Allograft Vasculopathy"

2000-2002 Abbas Ardehali

UCLA School of Medicine

"Monocyte-Endothelial Cell Interactions in Delayed Xenograft Rejection"

Thomas K. Waddell

University of Toronto and Toronto General Hospital

SECOND JOHN H. GIBBON, JR., RESEARCH SCHOLARSHIP

"Adjuvant Immunotherapy in the Treatment of Esophageal Cancer"

2001-2003 Richard J. Battafarano, M.D.

Washington University School of Medicine

"B-Adrenergic Receptor Based Gene Therapy During Cardiopulmonary Bypass"

Carmelo A. Milano, M.D.

Duke University Medical Center

SECOND ALTON OCHSNER RESEARCH SCHOLARSHIP

"Nonablative Approaches to Chimerism-Induced Transplantation Tolerance"

2002-2004 Yolonda Lorig Colson, M.D.

Brigham & Women's Hospital

"Alveolar Macrophage in Reperfusion Injury of Lung"

Michael S. Mulligan, M.D.

University of Washington School of Medicine

SECOND ROBERT E. GROSS RESEARCH SCHOLARSHIP

"Tumorstatic Mechanisms of Cyclo-oxygenase-2 Inhibition in Lung Cancer"

2003-2005 Ross H. Bremner, M.D.

Keck School of Medicine of the University of Southern California

"Transplant Vasculopathy: The Role of the Endothelium"

Vivek Rao, M.D.

Toronto General Hospital

SECOND JOHN ALEXANDER RESEARCH SCHOLARSHIP

"Proteomic Analysis of Metastatic Mechanisms in Lung Cancer"

2004-2006 King F. Kwong, M.D., University of Maryland

THE AMERICAN ASSOCIATION FOR THORACIC SURGERY

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The American Association for Thoracic Surgery Scientific Achievement Award was established by the Association in 1994. The award serves to honor individuals who have achieved scientific contributions in the field of thoracic surgery worthy of the highest recognition the Association can bestow. Honorees receive a Medallion for Scientific Achievement from the Association presented by the president at the Annual Meeting and the honoree's name and biography is printed in the Journal of Thoracic and Cardiovascular Surgery.

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1995 John W. Kirklin, Birmingham, Alabama

1998 Norman E. Shumway, Stanford, California

1999 Michael E. DeBakey, Houston, Texas

2000 Denton A. Cooley, Houston, Texas

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The AATS Traveling Fellowship was established in 1997 by the American Association for Thoracic Surgery. Administered through the Graham Education and Research Foundation, it provides grants to young North American Cardiothoracic Surgeons who are within two years of the completion of their formal Cardiothoracic surgery training. The award allows the recipient to study abroad for one year to intensify training in different disciplines and to travel to several sites to broaden the overall training and increase contacts with thoracic surgeons internationally. Awards are made to surgeons of unique promise who have been regarded as having potential for later international thoracic surgical leadership.

1998-99 Lishan Aklog, West Roxbury, MA

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Unlike other organizations to which you make philanthropic contributions, The Thoracic Surgery Foundation for Research and Education works directly for your specialty. TSFRE supports research and education initiatives to increase knowledge and enhance treatment of patients with cardiothoracic diseases; develops the skills of cardiothoracic surgeons as surgeon-scientists and health policy leaders; and, strengthens society's understanding and trust in the profession.

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Physicians, *Trustees and Health Care Leaders*. To date, TSFRE has named 117 individuals to receive Alley-Sheridan Scholarships to attend this course.

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Wechsler, Andrew S	Domm, Sheldon E	Overstreet, John W
Whitman, Glenn J. R.	Memphis	Putnam, Joe B, Jr.
Pittsburgh	McBurney, Robert P	Reardon, Michael J
Hardesty, Robert L	Pate, James W	Reul, George J, Jr.
Hattler, Brack G, Jr.,	Robbins, S. Gwin, Sr	Roth, Jack A
Keenan, Robert J	Rosensweig, Jacob	Safi, Hazim J
Kormos, Robert L	Shochat, Stephen J	Walker, William E
Landreneau, Rodney J	Watson, Donald C	Wukasch, Don C
Luketich, James D	Weiman, Darryl S	Kemp
Magovern, George J		Davis, Milton V
Magovern, George J, Jr.		Lampasas
Magovern, James A		Henly, Walter S
Pontius, Robert G		
Lubbock	Fredericksburg	WEST VIRGINIA
Bricker, Donald L	Armitage, John M	Charleston
Feola, Mario	McLean	Walker, James H
Hood, R. Maurice	Conrad, Peter W	Huntington
Plano	Wallace, Robert B	Ferraris, Victor A
Edgerton, James R.	Norfolk	Morgantown
San Antonio	Baker, Lenox D	Graeber, Geoffrey M
Calhoon, John H	Reston	Gustafson, Robert A
Cohen, David J	Boyd, Thomas F	Hill, Ronald C
Dooley, Byron N	Richmond	Murray, Gordon F
Treasure, Robert L	Bosher, Lewis H, Jr.	Warden, Herbert E
UTAH	Brooks, James W	Parkersburg
Park City	Lower, Richard R	Tarnay, Thomas J
Hughes, Richard K	Springfield	WISCONSIN
Salt Lake City	Mills, Mitchell	Altoona
Doty, Donald B	WASHINGTON	McEnany, M. Terry
Hawkins, John A	Belfair	Brookfield

Jones, Kent W	Jones, Thomas W	Johnson, W. Dudley
Karwande, Shreekanth V	Bellingham	Madison
Liddle, Harold V	Varco, Richard L	Chopra, Paramjeet S
McGough, Edwin C	Issaquah	Love, Robert B.
Mortensen.J. D.	Gentsch, Thomas O	Weigel, Tracey L.
Nelson, Russell M	Kirkland	Young, William P
VERMONT	Mills, Waldo O	Marshfield
Burlington	Mercer Island	Myers, William O
Leavitt, Bruce J	Li, Wei-I	Milwaukee
Hartland	Seattle	Almassi, G. Hossein
Marrin, Charles A. S.	Aldea, Gabriels	Haasler, George B
Richford	Allen, Margaret D	Litwin, S. Bert
Grondin, Claude M	Anderson, Richard P	Tector, Alfred J
VIRGINIA	Manhas, Dev R	Tweddell, James S
Altavista	Mansfield, Peter B	West Bend
Pierucci, Louis, Jr.	Merendino, K. Alvin	Gardner, Robert J
Annandale	Miller, Donald W, Jr.	WYOMING
Akl, Bechara F	Rittenhouse, Edward	Teton Village
Burton, Nelson A	Sauvage, Lester R	Kaunitz, Victor, H
Lefrak, Edward A	Thomas, George I	
Charlottesville	Verrier, Edward D	
Crosby, Ivan Keith	Wood, Douglas E	
Dammann, John F	Silverdale	
Daniel, Thomas M	Malette, William G	
Kron, Irving L	Spokane	
Minor, George R	Berg, Ralph, Jr.	
Muller, William H, Jr.		
Nolan, Stanton P		
Tribble, Curtis G		
Wellons, Harry A, Jr.		

AMERICAN ASSOCIATION FOR THORACIC SURGERY 2003-2004

GEOGRAPHICAL ROSTER

(Current as of January, 2004)

OTHER COUNTRIES		
ARGENTINA	CANADA	Oakville
Buenos Aires	ALBERTA	Allen, Peter
Kreutzer, Guillermo O	Calgary	Ottawa
AUSTRALIA	Bharadwaj, Baikunth	Hendrv, Paul J
QUEENSLAND	Miller, George E	Keon, Wilnert J
Brisbane	Edmonton	Sundaresan, R. Sudhir
O'Brien, Mark F, FRCS	Gelfand, Elliot T	Toronto
SOUTH AUSTRALIA	Koshal, Arvind	Baird, Ronald J
Beaumont	Rebeyka, Ivan M	Bigelow, Wilfred G
Sutherland, H D'Arcy, M.S. FRCS	Ross, David B	Christakis, George T
AUSTRIA	Sterns, Laurence P	Coles, John G
Salzburg	BRITISH COLUMBIA	David, Tirone E
Unger, Felix H	Vancouver	Feindel, Christopher M
Thumersbach	Ashmore, Phillip G	Fremes, Stephen E
Bruecke, Peter E	Jamieson, W. R. Eric	Keshavjee, Shaf
Vienna	Tyers, G. Frank O	McKneally, Martin F
Mepetko, Walter	Victoria	Scully, Hugh E
Wolner, Ernst	Field, Paul	Trimble, Alan S
BELGIUM	Stenstrora, John D	Trusler, George A
Aalst	MANITOBA	Weisel, Richard D
Vanermen, Hugo K. I.	Winnipeg	Williams, William G
Bertem	Barwinsky, Jaroslaw	Waubashene
Sergeant, Paul T	Cohen, Morley	Mickleborough, Lynda L
Leuven	NOVA SCOTIA	Westbrook
Flameng, Willem J	Halifax	Lynn, R. Beverley
Lerut, Antoon E. M. R.	Casson, Alan G.M.B.	QUEBEC
BRAZIL	Murphy, David A	Montreal
Rio de Janeiro	ONTARIO	Blundell, Peter E
Meier, Milton A	Almonte	Carrier, Michel

SanJose do RioPreto	Todd, Thomas R. J	Chartrand. Claude C. C.
Braille, Domingo M	Collingwood	Chiu, Chu-Jeng (Ray)
Sao Paulo	Heimbecker, Raymond	Cossette, Robert
Jatene, Adib D	London	Dobell, Anthony R.C.
Oliveira, Sergio A	McKenzie, F. Neil	Duranceau, Andre C. H.
	Menkis, Alan H	MacLean, Uoyd D
	Novick, Richard J	Morin, Jean E
	Mansfield	Mulder, David S
	Pearson, F. Griffith	Pelletier, L. Conrad
	North York	Scott, Henry J
	Goldman, Bernard S	Shennib, Hani
		Tchervenkov, Christo I
		Sainte-Laurent
		DesLauriers, Jean

CHINA	Montpellier	IRELAND
Beijing	Thevenet, Andre A	Dublin
Ying-Kai, Wu	Paris	O'Malley, Eoin
ENGLAND	Bachet, Jean E	ITALY
Bath, Avon	Blondeau, Philip	Bergamo
Belsey, Ronald	Cabrol, Christian E. A.	Parenzan, Lucio
Bristol	Carpentier, Alain F	Chieti
Angelini, Gianni D.	Chachques, Juan C	Calafiore, Antonio M
Cambridge	Chauvaud, Sylvain M	Milan
Rosengard, Bruce R	Menasche, Philippe	Peracchia, Alberto
Wallwork, John	Piwnica, Armand H	Montegrotto Terme
Harefield	Pessac	Bortolotti, Uberto
Dreyfus, Gilles D	Couraud, Louis	Naples
Herts	GERMANY	Cotrufo, Maurizio
Lennox, Smart C	Aachen	Padova
London	Messmer, Bruno J	Stellin, Giovanni
Braimbridge, Mark V	Bad Oeynhausen	Palermo
de Leval, Marc R	Korfer, Reiner	Marcelletti, Carlo
Goldstraw, Peter	Berlin	Rome
Lincoln, Christopher R	Alexi-Meskishvili, Vladimir	Di Donato, Roberto

Ross, Donald N	Hetzer, Roland	Rendina, Erino Angelo
Stark, Jaroslav F	Freiburg	Venula, Federico
Taylor, Kenneth M	Beyersdorf, Friedhelm	JAPAN
Yacoub, Magdi	Hasse, Joachim T.W.	Hamamatsu
Oxford	Hannover	Kazui, Terushisa
Westaby, Stephen	Haverich, Axel	Kanazawa
Somerset	Macchiarini, Paolo	Iwa, Takashi
Abbey-Smith, R	Leipzig	Watanabe, Yoh
Suffolk	Mohr, Friedrich W	Kitakyushushi
Kennedy, John H	Loiching	Miyamoto, Alfonso T
Worcestershire	Sebening, Fritz	Kobe
Landymore, Roderick W	Munich	Okita, Yutaka
FINLAND	Borst, Hans G	Kyoto
Grankulla	Neuss	Wada, Hiromi
Mattila, Severi P	Bircks, Wolfgang H	Minoo City
Helsinki	GREECE	Kawashima, Yasunaru
Harjula, Ari L. J.	Athens	Miura Gun
FRANCE	Palatianos, George M	Suma, Hisayoshi
Bordeaux	Sards, George E	Osaka
Fontan, Francis M	GUATEMALA	Bando, Ko
Bordeaux-Pessac	Guatemala	Kitamura, Soichiro
Baudet, Eugene M	Castaneda, Aldo R	Matsuda, Hikaru
Creteil	Herrera-Uerandi, Rodolfo	Sapporo
Loisance, Daniel	HONG KONG	Abe, Tomio
Le Flessis Robinson	Shatin, NT	Sendai
Binet, Jean-Paul	He, Guo-Wei	Fujimura, Shigefumi
Dartevelle, Philippe G	Yim, Anthony P	Mohri, Hitoshi
Planche, Claude	INDIA	Shinjuku-ku
Serraf, Alain	Chennai	Imai, Yasuharu
Marseille	Cherian, K. Mammen	
Metras, Dominique R		
Tokyo	ROMANIA	SWITZERLAND
Koyanagi, Hitoshi	Targu-Mures	Lausanne

Kurosawa, Hiromi	Deac, Radu C	vonSegesser, Ludwig K
Naruke, Tsuguo	RUSSIA	Pully
Wada, Juro J	Moscow	Naef, Andreas P
KOREA	Bockeria, Leo A	Zurich
Seoul	SAUDI ARABIA	Turina, Marko I
Cho, Bum-Koo	Riyadh	Weder, Walter
MONACO	Al-Halees, Zohair Y	SYRIA
Monaco Cedex	SCOTLAND	Damascus
Dor, Vincent	Edinburgh	Kabbani, Sami S
NETHERLANDS	Logan, Andrew	THAILAND
Leiden	Glasgow	Bangkok
Dion, Robert	Wheatley, David J	Arom, Kit V
Utrecht	SPAIN	VENEZUELA
Jansen, Erik W. L.	Barcelona	Caracas
NEW ZEALAND	Arts, Alejandro	Tricerri, Fernando E
Waiwera Auckland	Murtra, Marcos	
Barratt-Boyes, Brian G	Pomar, Jose L.	
PORTUGAL	Madrid	
Carnaxide	Comas, Juan V	
Melo, Joao Q	Rivera, Ramiro	
Coimbra	Santander	
Antunes, Manuel J	Revuelta, Jose Manuel	
	SWEDEN	
	Stockholm	
	Bjork, Viking	
	Umea	
	Aberg, Jorkel H	

AMERICAN ASSOCIATION FOR THORACIC SURGERY CHARTER MEMBERS

E. Wyllis Andrews	Arthur A. Law
John Auer	William Lerche
Edward R. Baldwin	Howard Lilienthal
Walter M. Boothby	William H. Lockett
William Branower	Morris Manges
Harlow Brooks	Walton Martin
Lawrason Brown	Rudolph Matas
Kenneth Bulkley	E.S. McSweeney
Alexis Carrel	Samuel J. Metzler
Norman B. Carson	Willy Meyer (Founder)
J. Frank Corbett	James Alexander Miller
Armistead C. Crump	Robert T. Miller
Charles N. Dowd	Fred J. Murphy
Kennon Dunham	Leo S. Peterson
Edmond Melchior Eberts	Eugene H. Pool
Max Einhorn	Walter I. Rathbun
Herman Fischer	Martin Rehling
Albert H. Carvin	B. Merrill Ricketts
Nathan W. Green	Samuel Robinson
John R. Hartwell	Charles I. Scudder
George J. Heuer	William H. Stewart
Chevalier Jackson	Franz Torek
H. H. Janeway	Martin W. Ware
James H. Kenyon	Abraham O. Wilensky
Adrian V. S. Lambert	Sidney Yankauer

AMERICAN ASSOCIATION FOR THORACIC SURGERY THE BY-LAWS

ARTICLE I. NAME

The name of this Corporation is The American Association for Thoracic Surgery (hereinafter the "Association").

ARTICLE II. PURPOSE

The purposes of the Association shall be:

To associate persons interested in, and carry on activities related to, the science and practice of thoracic surgery, the cure of thoracic disease and the related sciences.

To encourage and stimulate investigation and study that will increase the knowledge of intrathoracic physiology, pathology and therapy, and to correlate and disseminate such knowledge.

To hold scientific meetings featuring free discussion of problems and developments relating to thoracic surgery, and to sponsor a journal for the publication of scientific papers presented at such meetings and other suitable articles.

To succeed to, and continue to carry on the activities formerly conducted by The American Association for Thoracic Surgery, an unincorporated association.

ARTICLE III. MEMBERSHIP

Section 1. There shall be three classes of members: Honorary, Senior, and Active. Admission to membership in the Association shall be by election. Membership shall be limited, the limits on the respective classes to be determined by these By-Laws. Only Active and Senior Members shall have the privilege of voting or holding office, except as provided by these By-Laws. Honorary members shall have the privilege of voting but shall not be eligible to hold office.

Section 2. Honorary Membership shall be reserved for such distinguished persons as may be deemed worthy of this honor by the Council with concurrence of the Association

Section 3. The number of Senior Members shall be unlimited. Active Members automatically advance to Senior Membership at the age of sixty-five years. In addition, a younger Active Member may be eligible for Senior Membership if incapacitated by disability, but for no other reason.

Section 4. Active Membership shall be limited to six hundred. A candidate to be eligible must be a physician and a citizen of the United States of America or Canada, unless in unusual cases this citizenship requirement shall have been waived by the Council. The candidate shall have achieved distinction in the thoracic field or shall have made a meritorious contribution to knowledge pertaining to thoracic disease or its surgical treatment.

Section 5. Election to Honorary, Senior or Active Membership shall be for life, subject to the provisions of Section 8 following. All new members shall be elected directly to Honorary or Active status.

Section 6. Candidates for membership in this Association must be formally nominated and seconded, in an approved manner, by not less than three Active, Senior or Honorary Members. Such nomination must have been in the hands of the Membership Committee for not less than four months, and the name of the candidate must have been distributed to all members of the Association before final action may be taken on any new candidate for election to Active Membership. Provided the foregoing requirements have been met and the candidates have been approved by the Membership Committee and by the Council, their names shall be presented to the Association at a future regularly convened annual meeting for final action. A three-fourths vote of those present and voting shall be required to elect. Any candidate for membership in the Association who has failed of election three times shall automatically cease to be a candidate and may not be renominated until after a lapse of three years.

Section 7. The report of the Membership Committee shall be rendered at the second executive session of each annual meeting of the Association. Candidates shall be presented in groups in the following order: Candidates for Honorary Membership; retirement of Active Members to Senior Membership; Candidates for Active Membership; members dropped from the rolls of the Association.

Section 8. Membership may be voluntarily terminated at any time by members in good standing. The Council, acting as Board of Censors, may recommend the expulsion of member on the grounds of moral or professional delinquency, and submit his/her name, together with the grounds of complaint, to the Association as a whole at any of the regularly convened meetings, after giving such member ample opportunity to appear in his own behalf

Section 9. The Council shall recommend that any Active Member whose dues are in arrears for two years shall have his membership terminated.

Section 10. Notwithstanding Section 9, any member of the Association over 65 years of age is excused from the attendance requirement and upon his/her specific request may likewise be excused from the payment of dues.

ARTICLE IV. BOARD OF DIRECTORS ("COUNCIL")

Section 1. The Board of Directors of the Association shall be called the Council and shall be composed of the President, President-Elect, Vice-President, Secretary, Treasurer, six Councilors and the Editor of the Association who shall be a member ex-officio without vote. All members of the Council must be Active or Senior Members of the Association, except that the Editor may be an Honorary Member.

Section 2. The Council shall be the governing body of the Association, and shall have full power to manage and act on all affairs of the Association, except as follows:

- a. It may not alter the initiation fees or annual dues, or levy any general assessments against the membership, except that it may, in individual cases, waive annual dues or assessments.
- b. It may not change the Articles of Incorporation or By-Laws.
- c. It may neither elect new members nor alter the status of existing members, other than to apply the provisions of Article III, Section 8.

Section 3. At the conclusion of the annual meeting, the retiring President shall automatically become a Councilor for a one-year term office. One of the other five Councilors shall be elected at each annual meeting of the Association to serve for a four-year term of office in the place of the elected Councilor whose term expires at such meeting. When appropriate, one of the Councilors shall be elected from among the non-North American members of the Association to serve for a three-year term of office. No Councilor may be reelected to succeedhimself/herself. Any Councilor so elected shall take office upon the conclusion of the annual meeting at which he/she is elected.

Section 4. Vacancies in the office of Councilor shall be temporarily filled by the Council subject to approval of the Association at the next annual meeting of the Association.

ARTICLE V. OFFICERS

Section 1. The officers of the Association shall be President, a President-Elect, a Vice-President, a Secretary, and a Treasurer. All officers must be Active or Senior Members of the Association. Said officers shall be ex-officio members of the Council of the Association.

Section 2. The Council may, for the purposes of Article IV, give status as officers of the Association to the individual members of an ad hoc Committee appointed by the Council.

Section 3. The President, President-Elect, Vice-President, Secretary and Treasurer shall be elected at the annual meeting of the Association and shall take office upon conclusion of the meeting. The President, President-Elect, and the Vice-President shall be elected for a one-year term of office. The Secretary and the Treasurer shall be elected for a one-year term of office and may be reelected for not more than four additional terms.

Section 4. The President of the Association shall perform all duties customarily pertaining to the office of President. He/She shall preside at all meeting of the Association and at all meetings of the Council.

Section 5. The President-Elect of the Association shall, in the absence or inability of the President to serve, perform all duties customarily pertaining to the office of President. In this instance the Council shall advance the Vice-President to the office of the President-Elect and appoint an interim Vice-President as necessary.

Section 6. The Secretary of the Association shall perform all duties customarily pertaining to the office of Secretary. He/She shall serve as Secretary of the Association and as Secretary of the Council. When deemed appropriate an Active or Senior Member may be elected to serve as an understudy to the Secretary in anticipation of the latter's retirement from office.

Section 7. The Treasurer of the Association shall perform all duties customarily pertaining to the office of Treasurer. He/She shall serve as Treasurer of the Association.

Section 8. The Editor of the Association is not an officer of the Association. The Editor shall be appointed by the Council at its annual meeting; provided, however, that such appointment shall not become effective until approved by the Association at the annual meeting of the Association. The Editor shall be appointed for a five-year term and may be reappointed to no more than two additional one-year terms. The Editor shall serve as the Editor of the Official Journal and shall be ex officio the Chair of the Editorial Board and a member of the Council of the Association without vote.

Section 9. Vacancies occurring among the officers named in Section I or a vacancy in the position of Editor shall be temporarily filled by the Council, subject to approval of the Association at the next meeting of the Association.

ARTICLE VI. COMMITTEES

Section 1. The Council is empowered to appoint a Membership Committee, a Program Committee, a Necrology Committee and such other committees as may in its opinion be necessary or desirable. All such committees shall render their reports at an executive session of the Association, except that no ad hoc committee need report unless so directed by the Council.

Section 2. The Membership Committee shall consist of seven Active or Senior Members. The Council may appoint not more than one of its own members to serve on this Committee. The duties of the Membership Committee are to investigate all candidates for membership in the Association and to report its findings as expeditiously as possible to the Council through the Secretary of the Association. This Committee is also charged with searching the literature of this and other countries to the end that proper candidates may be presented to the Association for consideration. Appointment to this Committee shall be for a period of one year, and not more than five of the members may be reappointed to succeed themselves. This Committee is also charged with maintaining a record of membership attendance and participation in the scientific programs and reporting to the affected members and to the Council any deviations from the requirement of Article VIII, Section 4, of these By-Laws.

Section 3. The Program Committee shall consist of at least 14 members: the President, the President-Elect, the Vice President, the Secretary and the Editor and at least 9 members-at-large, three each representing the areas of adult cardiac, pediatric cardiac and general thoracic surgery. Three of these members-at-large shall be appointed each year by the President for a three-year term. Additional Committee members shall be appointed for one or two-year terms. The duties of this Committee shall be to arrange, in conformity with instructions from the Council, the scientific program for the annual meeting.

Section 4. The Necrology Committee shall consist of one or more Active or Senior Members. Appointments to this Committee shall be for a one-year term of office. Any or all members of this committee may be reappointed to succeed themselves. The Council may, if it so desires, appoint one of its own members to serve as Chair of this Committee. The duties of the Necrology Committee shall be to prepare suitable resolutions and memorials upon all deaths of members of the Association and to report such deaths at every annual meeting.

Section 5. The Nomination Committee shall consist of the five (5) immediate Past Presidents of the Association. The most senior Past President shall serve as Chair. This Committee shall prepare a slate of nominees for Officers and Councilors upon instruction from the Council as to the vacancies which are to be filled by election and shall present its report at the second Executive Session of the Annual Meeting.

Section 6. The Association as a whole may authorize the Council to appoint Scientific or Research Committees for the purpose of investigating thoracic problems and may further authorize the Council to support financially such committees to a limited degree. When Scientific or Research Committees are authorized by the Association, the Council shall appoint the Chairs of these Committees, with power to organize their committees in any way best calculated to accomplish the desired object, subject only to the approval of the Council. Financial aid rendered to such Committees shall not exceed such annual or special appropriations as may be specifically voted for such purposes by the Association as a whole. Members are urged to cooperate with all Scientific or Research Committees of the Association.

Section 7. The Evarts A Graham Memorial Traveling Fellowship Committee shall consist of eight members: two cardiac surgeons, two general thoracic surgeons, two transplant surgeons, and two pediatric heart surgeons, two to be appointed each year for four year terms with the senior two members of the Committee serving as Co-Chairs. The duties of the Committee shall be to recommend Fellowship candidates to the Graham Education and Research Foundation and to carry out other business pertaining to the Fellowship and Fellows, past, present and future.

Section 8. The Editorial Board shall be appointed by the Editor, subject only to the approval of the Council. The Editor shall be, ex officio, the chairman of this board and shall be privileged to appoint and indefinitely reappoint such members of the Association, regardless of class of membership, and such non-members of the Association as in his opinion may be best calculated to meet the editorial requirements of the Association.

Section 9. The Ethics Committee shall consist of five members appointed by the Council. The Ethics Committee shall advise the Council concerning alleged breaches of ethics. Complaints regarding alleged breaches of ethics shall be received in writing by the Ethics Committee and shall be investigated by it. In addition, the Ethics Committee may investigate on its own initiative.

Section 10. The Thoracic Surgical Workforce Committee shall be a Joint Committee of this Association and The Society of Thoracic Surgeons. The Committee shall consist of two members of this Association, two members of The Society of Thoracic Surgeons, and a Chair who shall be a member of this Association and The Society of Thoracic Surgeons. The duties of this Committee, and the manner of appointment and term of its members and chairman, shall be determined jointly by the Council of this Association and the Council of The Society of Thoracic Surgeons.

Section 11. The Committee on Graduate Education in Thoracic Surgery shall consist of five members appointed by the Council. One member shall be appointed each year for a five-year term. The committee shall review graduate medical education in thoracic surgery and makes its recommendations to the Council to assist in meeting the educational mission of the Association.

Section 12. The Committee on Publications shall consist of the Secretary as Chair, the President-Elect, the Vice President, the Treasurer, and the Executive Director. The Committee shall oversee the business relationships between the Association and the publisher of its journal maintain liaison among the publisher, the Editor, and the Council, and shall have advisory oversight for all official scientific publications of the Association and make recommendations to the Editor and the Council.

Section 13. The Cardiothoracic Residents Committee shall consist of eight members appointed by the Council. Two members shall be appointed each year for a four-year term with the senior two members of the Committee serving as Co-Chairs. At least two members shall represent adult cardiac surgery, general thoracic surgery, congenital heart surgery, and the Editorial Advisory Board of THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY. The duties of the committee shall include the development of educational activities specifically directed at cardiothoracic residents, the review of scientific material submitted for any resident award program and the selection of any such awardees and the responsibility for recommending to the Council the generation of new programs of interest to cardiothoracic residents.

ARTICLE VII. FINANCES

Section 1. The fiscal year of the Association shall begin on the first day of January and end on the last day of December each year.

Section 2. Members shall contribute to the financial maintenance of the Association through initiation fees, annual dues, and special assessments. The amount of the annual dues and the initiation fees shall be determined by these By-Laws. If, at the end of any fiscal year, there is a deficit in the current funds of the Association, the Council may send out notices to that effect and invite Active members to contribute the necessary amount so that no deficit is carried over from one fiscal year to another. The Association may, in any regularly convened meeting, vote a special assessment which shall become an obligatory charge against the classes of members affected thereby.

Section 3. To meet the current expenses of the Association, there shall be available all revenue expenses derived by the Association.

ARTICLE VIII. MEETINGS

Section 1. The time, place, duration, and procedure of the annual meeting of the Association shall be determined by the Council and the provisions of the By-Laws.

Section 2. Notice of any meeting of the Association shall be given to each member of the Association not less than five nor more than forty days prior to any annual meeting and not less than thirty nor more than forty days prior to any special meeting by written or printed notice delivered personally or by mail, by or at the direction of the Council, the President or the Secretary. Such notice shall state the place, day and hour of the meeting and in the case of a special meeting shall also state the purpose or purposes for which the meeting is called.

Section 3. A special meeting of the Association may be called by the Council or on the written request of fifteen members delivered to the Council, the President or the Secretary. The specific purposes of the meeting must be stated in the request.

Section 4. Attendance at annual meetings and participation in the scientific programs shall be optional for all Honorary and Senior Members, but it shall be expected from all Active Members.

Section 5. Each annual meeting shall have at least two executive sessions.

Section 6. When the Association convenes for its annual meeting, it shall immediately go into the first executive session, but the business at this session shall be limited to:

1. Appointment of necessary committees.

2. Miscellaneous business of an urgent nature.

Section 7. The second executive session of the Association shall be held during the afternoon of the second day of the meeting. The business at this session shall include, but is not limited to:

1. Reading or waiver of reading of the minutes of the preceding meetings of the Association and the Council.

2. Report of the Treasurer of the last fiscal year.

3. Audit Report.
4. Report of the Necrology Committee.
5. Report of the Program Committee.
6. Action on amendments to the Articles of Incorporation and By-Laws, if any.
7. Action on recommendations emanating from the Council.
8. Unfinished Business.
9. New Business
10. Report of the Membership Committee.
11. Election of new members.
12. Report of Nominating Committee.
13. Election of officers.

Section 8. Except where otherwise required by law of these By-Laws, all questions at a meeting of the members shall be decided by a majority vote of the members present in person and voting. Voting by proxy is not permitted.

Section 9. Fifty voting members present in person shall constitute a quorum at a meeting of members.

Section 10. While the scientific session of the annual meeting is held primarily for the benefit of the members of the Association, it may be open to non-members who are able to submit satisfactory credentials, who register in a specified manner, and who pay such registration fee as may be determined and published by the Council from year to year.

Section 11. There shall be an annual meeting of the Council held during the annual meeting of the Association. Additional meetings of the Council may be called on not less than seven days' prior written or telephonic notice by the President, the Secretary or any three members of the Council.

Section 12. Six members of the Council shall constitute a quorum for the conduct of business at any meeting of the Council, but a smaller number may adjourn any such meeting.

Section 13. Whenever any notice is required to be given to any member of the Council, a waiver thereof in writing, signed by the member of the Council entitled to such notice, whether before or after the time state therein, shall be deemed equivalent thereto.

Section 14. Any action which may be or is required to be taken at a meeting of the Council may be taken without a meeting if a consent in writing, setting forth the action so taken, shall be signed by all of the members of the Council. Any such consent shall have the same force and effect as a unanimous vote at a duly called and constituted meeting.

ARTICLE IX. INDEMNIFICATION AND DIRECTORS AND OFFICERS

Section 1. The Association shall indemnify any and all of its Councilors (hereinafter in this Article referred to as "directors") or officers or former directors or officers, or any person who has served or shall serve at the Association's request or by its election as a director or officer of another corporation or association, against expenses actually and necessarily incurred by them in connection with the defense or settlement of any action, suit or proceeding in which they, or any of them, are made parties, or a party, by reason of being or having been directors or officer's or a director or officer of the Association, or of such other corporation or association, provided, however, that the foregoing shall not apply to matters as to which any such director or officer or former director or officer or person shall be adjudged in such action, suit or proceeding to be liable for willful misconduct in the performance of duty or to such matters as shall be settled by agreement predicated on the existence of such liability.

Section 2. Upon specific authorization by the Council, the Association may purchase and maintain insurance on behalf of any and all of its directors or officers or former directors or officers, or any person who has served or shall serve at the Association's request or by its election as a director or officer of another corporation or association, against any liability or settlement based on asserted liability, incurred by them by reason of being or having been directors or officers as director or officer of the Association or of such other corporation or association, whether or not the Association would have the power to indemnify them against such liability or settlement under the provisions of Section 1.

ARTICLE X. PAPERS

Section 1. All papers read before the Association shall become the property of the Association. Authors shall leave original copies of their manuscripts with the Editor or reporter, at the time of presentation, for consideration for publication in the official Journal.

Section 2. When the number of papers makes it desirable, the Council may require authors to present their papers in abstract, and may set a time limit on discussions.

ARTICLE XI. INITIATION FEES, DUES AND ASSESSMENTS

Section 1. Honorary Members of the Association are exempt from all initiation fees, dues, and assessments.

Section 2. Annual dues for Active Members shall be \$200.00 and shall include a year's subscription to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY.

Section 3. Senior Members are exempt from dues.

Section 4. The initiation fee for those elected directly to Active Membership shall be \$ 100.00.

Section 5. Active Members must subscribe to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY to retain their membership status.

Section 6. Subscription to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY is optional for Senior Members.

Section 7. Bills for membership dues and for subscriptions to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY will be mailed to members by the Treasurer after the Annual Meeting.

ARTICLE XII. PARLIAMENTARY PROCEDURE

Except where otherwise provided in these By-Laws or by law, all parliamentary proceedings at the meetings of this Association and its Council and Committees shall be governed by the then current Sturgis Standard Code of Parliamentary Procedure.

ARTICLE XIII. AMENDMENTS

Section 1. These By-Laws may be amended by a two-thirds vote of the members present and voting at an executive session of a properly convened annual or special meeting of the Association provided that the proposed amendment has been moved and seconded by not less than three members at a prior executive session of that meeting or a prior meeting of the Association.

Section 2. These By-laws may be suspended in whole or in part for a period of not more than twelve hours by a unanimous vote of those present and voting at any regularly convened meeting of the Association.

As amended, May, 2003

DISCLOSURE INDEX

PROG#	FIRST	MID.	LAST	DISCLOSURE
F.1	Akio		Ikai	Nothing To Disclose
F.2	Ikuo		Hagino	Nothing To Disclose
F.3	Marineh		Yagubyan	Nothing To Disclose
F.4	Sina	L	Moainie	Nothing To Disclose
K.5	Justus	T	Strauch	Nothing To Disclose
F.6	T	B	Reece	Nothing To Disclose
F.7	Ioannis	K	Toumpoulis	Nothing To Disclose
F.8	John	G	Coles	Nothing To Disclose
F.9	Harold	L	Lazar	Bayer Pharmaceuticals Grants/Research Support
F.10	Pierre		Voisine	Nothing To Disclose
F.12	Rishindra	M	Reddy	Nothing To Disclose
E.13	Chadrick	E.	Denlinger	Nothing To Disclose
F.14	Justin	B	Maxhimer	Nothing To Disclose
F.15	Philip	A	Rascoe	Nothing To Disclose
F.16	George	W	Cole	Nothing To Disclose
F.17	Kendra	N	Taylor	Nothing To Disclose
F.18	Victor	E	Laubach	Nothing To Disclose
E19	Frank		D'Ovidio	Nothing To Disclose
F.20	Cliff	K	Choong	Nothing To Disclose
L.1	Manuel		Castella	Nothing To Disclose
L.2	Filiberto		Rodriguez	Nothing To Disclose
L.3	Paul	WM	Fedak	Nothing To Disclose

L.4	Jonathan	A	Hata	Nothing To Disclose
L.5	Amit	N	Patel	Nothing To Disclose
L.6	Mark	F	Berry	Nothing To Disclose
L.7	T	B	Reece	Nothing To Disclose
L.8	Masakuni		Kido	Nothing To Disclose
1	Ko		Bando	Nothing To Disclose
2	Bryan	F	Meyers	Nothing To Disclose
3	J	William	Gaynor	Nothing To Disclose
4	Massimo		Caputo	Nothing To Disclose
5	Cameron	D	Wright	Nothing To Disclose
6	Santi		Trimarchi	Nothing To Disclose
7	Toshihani		Shin'oka	Nothing To Disclose
8	Jacob		Bergsland	Nothing To Disclose
9	Sydney	L	Gaynor	Nothing To Disclose
10	Benin		Dadasch	F. Christ, Consultant"
11	Tirone	E	David	St. Jude Medical, Consultant
12	Michael	J	Mack	Nothing To Disclose
13	Diana		Aicher	Nothing To Disclose
14	D	Dean	Potter	Nothing To Disclose
15	Rainald		Seitelberger	Nothing To Disclose
16	Ara	A	Vaporciyan	Nothing To Disclose
17	Stephen	C	Yang	Nothing To Disclose
18	Hiroshi		Date	Nothing To Disclose
19	Pierre		Theodore	Nothing To Disclose
20	Yuji		Shiraishi	Nothing To Disclose
21	Robert	J	Korst	Nothing To Disclose
22	Juan	A	Crestanello	Nothing To Disclose
23	Jacques		Kpodonu	Nothing To Disclose
24	Fatima		Kojori	Nothing To Disclose
25	Kazu		Minami	Nothing To Disclose
26	John	E	Foker	Nothing To Disclose
27	Yoshihisa		Tanoue	Nothing To Disclose
28	Emre		Bel	Nothing To Disclose
29	Nilto		Carias de Oliveira	Nothing To Disclose
30	Jonathan	M	Chen	Nothing To Disclose
31	Tae-Jin		Yun	Nothing To Disclose
33	Brian	W	McCrindle	Nothing To Disclose
34	Kenneth	R	McCurry	Nothing To Disclose
35	Donald		Glower	Edwards Lifesciences, Grants/Research Support
35	Donald		Glower	St. Jude Medical, Consultant
37	Shishir		Karthik	Nothing To Disclose
38	Michael	A	Borger	Nothing To Disclose
39	Takashi		Nitta	Nothing To Disclose
40	Anthony		Ralph-Edwards	Nothing To Disclose
41	Ardawan	J	Rastan	Nothing To Disclose
42	King	F	Kwong	Nothing To Disclose
43	Sina		Ercan	Nothing To Disclose
44	Richard	J	Battafarano	Nothing To Disclose
45	Thomas	Peter	Graeter	Nothing To Disclose
46	Malcolm	V	Brock	Nothing To Disclose
48	E	Andrew	Ochroch	Nothing To Disclose
49	Jonah		Odim	Nothing To Disclose
50	Cliff	K	Choong	Nothing To Disclose
51	Ergin		Kocyildirim	Nothing To Disclose
52	Carl	L	Backer	Nothing To Disclose
53	Daniel	J	Licht	Pfizer, Grants/Research Support
54	Hakan	Ismail	Akinturk	Nothing To Disclose
55	Leen		Van Garsse	Nothing To Disclose
T.1	Christoph	H	Huber	Nothing To Disclose
T.2	Haldun	Y	Karagoz	Nothing To Disclose
T.3	Kemp	H	Kernstine	Nothing To Disclose
T.4	Keith	A	Horvath	Nothing To Disclose
T.5	Mark		Galantowicz	Nothing To Disclose
T.6	Yoshihiro		Suematsu	Nothing To Disclose
T.7	marisa		Di Donate	Nothing To Disclose
T.8	Lars		Wiklund	St. Jude Medical Inc, Grants/Research Support