Western Thoracic Surgical Association

43rd Annual Meeting
COLORADO SPRINGS, COLORADO
June 21-24, 2017 • The Broadmoor

Scientific Program
VISION
Build the foundation for the next generation of Cardiothoracic Surgeons

MISSION
Educate in a collegial environment

FUTURE MEETINGS

44TH ANNUAL MEETING
June 27–30, 2018
Bacara
Goleta, California

45TH ANNUAL MEETING
June 26-29, 2019
Squaw Creek at Lake Tahoe
Olympic Valley, California
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OFFICERS AND COUNCIL

President	James I. Fann
Stanford, California

Vice President	Ross M. Bremner
Phoenix, Arizona

Immediate Past President &
Representative to the
ACS Board of Governors
John D. Mitchell
Aurora, Colorado

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Seattle, Washington

Editor	Richard D. Weisel
Toronto, Ontario
2017–2018 COMMITTEES

INDUSTRY RELATIONS COMMITTEE
Steven R. DeMeester, Chair (2018)
Brian S. Cain (2018)
Fernando Fleischman (2018)
Gregory P. Fontana (2018)
T. Brett Reece (2018)
Frederick A. Tibayan (2018)

LOCAL ARRANGEMENTS COMMITTEE
Michael P. & Andrea Fischbein, Co-Chairs
Michael P. Fischbein, Samson Fun Run
Joseph C. Cleveland, Jr., Golf Tournament
Jessica S. Donington, Tennis Tournament

MEMBERSHIP COMMITTEE
Donald E. Low, Chair (2017)
Anthony D. Caffarelli (2017)
Michael M. Madani (2017)
James M. Maxwell (2018)
Joseph B. Shrager (2018)
Y. Joseph Woo (2019)

NOMINATING COMMITTEE
Robert C. Robbins, Chair (2017)
Thomas A. Burdon (2019)
John C. Chen (2018)
John D. Mitchell (2021)
Michael S. Mulligan (2020)

PROGRAM COMMITTEE
Nahush A. Mokadam, Chair (2017)
Leah M. Backhus (2019)
James Jaggers (2018)
David M. McMullan (2017)
Craig H. Selzman (2018)
Richard J. Shemin (2019)
James I. Fann, Ex-Officio (2017)
Sean C. Grondin, Ex-Officio (2017)
Richard D. Weisel, Ex-Officio (2017)
PROGRAM SUBCOMMITTEES

Adult Cardiac
John R. Doty (2017)
John S. Ikonomidis (2017)
Ali Khoynezhad (2017)
Murray H. Kwon (2017)

Congenital Heart
Jonathan M. Chen (2017)
Richard D. Mainwaring (2017)
Sameh M. Said (2017)
Ram Kumar Subramanyan (2017)

General Thoracic
Aaron M. Cheng (2017)
David T. Cooke (2017)
Jessica S. Donington (2017)
Susan D. Moffatt-Bruce (2017)

REPRESENTATIVES

Representative to the Board of Governors, American College of Surgeons
John D. Mitchell
Aurora, Colorado

Representative to the Advisory Council for Cardiothoracic Surgery, American College of Surgeons
John C. Chen
Honolulu, Hawaii
SCHEDULE OF EVENTS
For Registered Professional Attendees

**WEDNESDAY, June 21, 2017**

1:00 pm – 6:00 pm  
Registration  
*Intl Center Foyer*

1:00 pm – 6:00 pm  
Speaker Ready Room  
*Intl Center Foyer*

7:00 pm – 9:00 pm  
New Members/Welcome Reception  
*Main Pool Lawn (Weather back-up Lake Terrace Dining Room)*

**THURSDAY, June 22, 2017**

6:00 am  
Samson Fun Run  
*Start Line: Golf Clubhouse*

7:00 am – 8:00 am  
Breakfast  
*Intl Center South*

7:00 am – 12:00 pm  
Exhibits  
*Intl Center South*

7:00 am – 12:30 pm  
Registration  
*Intl Center Foyer*

7:00 am – 12:30 pm  
Speaker Ready Room  
*Intl Center Foyer*

8:00 am – 9:00 am  
Scientific Session I  
*Intl Center North*

9:00 am – 9:10 am  
New Member & Samson Prize Finalist Introductions  
*Intl Center North*

9:10 am – 9:55 am  
Presidential Address  
*Intl Center North*

9:55 am – 10:20 am  
Coffee Break: Visit Exhibits & Posters  
*Intl Center South*

10:20 am – 11:40 am  
Scientific Session II  
*Intl Center North*

11:40 am – 12:25 pm  
Controversies Debate: We Are Ready for Competency-Based Cardiac Surgical Training  
*Intl Center North*

12:30 pm – 1:45 pm  
Lunch Symposium (Non-CME)  
*Colorado Hall B*  
*For more information please visit page 266.*
1:45 pm – 3:45 pm  Resident Symposium – Transition to Practice  
*Colorado Hall B*

5:00 pm – 6:30 pm  Evening Symposium (Non-CME)  
*Colorado Hall B*  
*For more information please visit page 266.*

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**FRIDAY, June 22, 2017**

6:00 am – 12:00 pm  Registration  
*Intl Center Foyer*

6:00 am – 12:00 pm  Speaker Ready Room  
*Intl Center Foyer*

6:30 am – 7:50 am  Breakfast Session:*  
*Losing Our Shirts: The Impact of Disruptive or Novel Technology on Our Livelihood*  
*Colorado Hall B*

7:00 am – 8:00 am  Breakfast  
*Intl Center South*

7:00 am – 12:00 pm  Exhibits  
*Intl Center South*

8:00 am – 8:50 am  Postgraduate Course:  
*Young Blood for Old Brains*  
*Intl Center North*

8:50 am – 10:30 am  Scientific Session III  
*Includes David J. Dugan Distinguished Service Award Presentation*  
*Intl Center North*

10:30 am – 11:00 am  Coffee Break: Visit Exhibits & Posters  
*Intl Center South*

11:00 am – 12:00 pm  Scientific Session IV  
*Intl Center North*

12:30 pm – 1:45 pm  Lunch Symposium (Non-CME)  
*Colorado Hall B*  
*For more information please visit page 266.*

12:30 pm  Golf Tournament*  
*West Course*

2:00 pm  Tennis Tournament*  
*Tennis Courts*

6:00 pm – 10:00 pm  Wild Wild West Theme Dinner  
*Cheyenne Lodge*

*Separate Subscription Required*
SATURDAY, June 24, 2017

6:00 am – 12:00 pm  Registration  
Intl Center Foyer

6:00 am – 11:30 am  Speaker Ready Room  
Intl Center Foyer

6:30 am – 7:30 am  Breakfast  
Intl Center South

6:30 am – 10:30 am  Exhibits  
Intl Center South

7:00 am – 8:15 am  Concurrent Forums  
Adult Cardiac  
Intl Center North  
General Thoracic  
Colorado Hall B  
Congenital Heart Disease  
Colorado Hall C

8:30 am – 9:50 am  Scientific Session V  
Intl Center North

9:50 am – 10:10 am  Coffee Break: Visit Exhibits & Posters  
Intl Center South

10:10 am – 11:10 am  Scientific Session VI  
Intl Center North

11:10 am – 12:00 pm  C. Walton Lillehei Point/Counterpoint Session: Ethics and End of Life Care: Everyone Needs TAVR, LVAD, ECMO Before They Die versus We Are the Stewards of Healthcare  
Intl Center North

12:00 pm – 12:30 pm  Annual Business Meeting (Members Only)  
Intl Center North

12:30 pm – 2:00 pm  Family Luncheon  
Lakeside Terrace

7:00 pm – 11:00 pm  President’s Reception & Banquet  
Intl Center Foyer (Reception) &  
Intl Center North (Banquet)

*Separate Subscription Required
ACCME

Accreditation

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American College of Surgeons (ACS) and the Western Thoracic Surgical Association (WTSA). The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

The American College of Surgeons designates this live activity for a maximum of 14.75 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

CONTINUING MEDICAL EDUCATION CREDIT INFORMATION

Accreditation
This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American College of Surgeons and Western Thoracic Surgical Association. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™
The American College of Surgeons designates this live activity for a maximum of 14.75 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Of the AMA PRA Category 1 Credits™ listed above, a maximum of 0.00 credits meet the requirements for Self-Assessment.
LEARNING OBJECTIVES
This activity is designed for WTSA members and guest physicians in the field of thoracic and cardiovascular surgery. Upon completion of this course, participants will be able to:

1. Discuss current investigations and novel approaches in the management of adult cardiac, general thoracic and congenital heart disease patients suffering from an array of surgical conditions relating to the heart, lungs, organs of the thorax, and other airway/circulation diseases

2. Discuss current basic science investigations relating to advances in the treatment and management of cardiothoracic and/or congenital heart disease patients and conditions

3. Discuss current investigative studies in clinical outcomes for patients with surgical cardiothoracic and/or congenital heart disease disorders or pathologies.

DISCLOSURE INFORMATION
In accordance with the ACCME Accreditation Criteria, the American College of Surgeons, as the accredited provider of this activity, must ensure that anyone in a position to control the content of the educational activity has disclosed all relevant financial relationships with any commercial interest. Therefore, it is mandatory that both the program planning committee and speakers complete disclosure forms. Members of the program committee were required to disclose all financial relationships and speakers were required to disclose any financial relationship as it pertains to the content of the presentations. The ACCME defines a ‘commercial interest’ as “any entity producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients”. It does not consider providers of clinical service directly to patients to be commercial interests. The ACCME considers “relevant” financial relationships as financial transactions (in any amount) that may create a conflict of interest and occur within the 12 months preceding the time that the individual is being asked to assume a role controlling content of the educational activity.

ACS is also required, through our joint providership partners, to manage any reported conflict and eliminate the potential for bias during the activity. All program committee members and speakers were contacted and the conflicts listed below have been managed to our satisfaction. However, if you perceive a bias during a session, please report the circumstances on the session evaluation form.
Please note we have advised the speakers that it is their responsibility to disclose at the start of their presentation if they will be describing the use of a device, product, or drug that is not FDA approved or the off-label use of an approved device, product, or drug or unapproved usage.

The requirement for disclosure is not intended to imply any impropriety of such relationships, but simply to identify such relationships through full disclosure and to allow the audience to form its own judgments regarding the presentation.

**Disclosure List**

Please see the insert to this program for the complete disclosure listing.

**EDUCATIONAL GRANTS**

The Western Thoracic Surgical Association wishes to recognize and thank the following company for its educational support, received as of June 14, 2017.

Medtronic

**MARKETING & EXHIBITOR SUPPORT**

The Western Thoracic Surgical Association wishes to recognize and thank the following companies for their marketing and exhibitor support, received as of June 14, 2017.

Abbott  
Admedus  
AtriCure, Inc.  
Bard Davol  
Baxter Healthcare  
Blickman Inc.  
ConvaTec  
CryoLife  
Delacroix-Chevalier  
Edwards Lifesciences  
Eight Medical  
Getinge Group  
Gore & Associates  
Johnson & Johnson  
Karl Storz Endoscopy-America, Inc.  
KLS Martin  
LivaNova  
LSI Solutions  
Medtronic  
Quest Medical  
rEVO Biologics  
RTI Surgical, Inc.  
Scanlan International, Inc.  
TandemLife  
Terumo Cardiovascular Systems  
Thoracic Surgery Foundation  
Veran Medical Technologies  
Vitalcor, Inc.  
Wexler Surgical  
Zimmer Biomet
GENERAL INFORMATION

DRESS CODE

Except for the Theme Dinner and President’s Reception/Banquet, the dress code for the Annual Meeting is Resort Casual; jacket and ties are not required. The Theme Dinner is casual/country and the President’s Reception/ Banquet is black tie preferred, with dark suits acceptable.

REGISTRATION

The Registration Desk will be open in the Intl Center Foyer during the following hours:

- Wednesday, June 21: 1:00 pm – 6:00 pm
- Thursday, June 22: 7:00 am – 12:30 pm
- Friday, June 23: 6:00 am – 12:00 pm
- Saturday, June 24: 6:30 am – 12:00 pm

SPEAKER READY ROOM

The Speaker Ready Room will be located in Intl Center Foyer. Presenting authors are requested to turn in their PowerPoint slides to the technician in the Speaker Ready Room at least 30 minutes prior to the opening of the session at which they are to present (presentation slides can be turned in as early as Wednesday, June 21st). All presentations must be submitted in PowerPoint format only.

EXHIBITS

Commercial Exhibits are located in Intl Center South and open during the following hours:

- Thursday, June 22: 7:00 am – 12:00 pm
- Friday, June 23: 7:00 am – 12:00 pm
- Saturday, June 24: 6:30 am – 10:30 am

Breakfast is available for all registered professional attendees in the Exhibit Hall during the following hours:

- Thursday, June 22: 7:00 am – 8:00 am
- Friday, June 23: 7:00 am – 8:00 am
- Saturday, June 24: 6:30 am – 7:30 am

Coffee and other beverages will be available during scheduled breaks.
BADGE IDENTIFICATION

Member and Spouse    Cream
Guest Physician and Spouse    Blue
Allied Personnel    Green
Exhibitor    Orange

INCLUDED IN THE REGISTRATION FEE

Included in the registration fee are the New Members/Welcome Reception on Wednesday evening, the Thursday morning Samson Fun Run, Wild Wild West Theme Dinner on Friday evening, the Saturday Family Luncheon, the President’s Reception and Banquet on Saturday evening, and daily breakfasts (served in the Exhibit Hall for registered professional attendees and in the Hospitality Suite for registered spouses, registered guests, and registered children). Supervised Kids & Teens Receptions, for ages 5–18, will provide dynamic, entertaining, and safe programs during Wednesday’s New Members/Welcome Reception and Saturday’s President’s Banquet. Children 4 and under will need to be accompanied by a private babysitter, please reference child care services in the Social Program. Please remember that individual tickets for events are not offered; full registration is required.

For descriptions of the events included with your registration fee, as well as of the separate-subscription Friday golf and tennis tournaments, please consult the Social Program. In that brochure you will also find information on child care services.
GUIDELINES FOR SPEAKERS AND DISCUSSANTS

The Program Committee has determined that no slides are to be included in either the invited discussion or spontaneous discussion.

1. Scientific Session speakers will be allowed ten minutes for their presentations, and primary discussants will be allowed two minutes. Concurrent Forum speakers will be allowed five minutes for their presentations.

2. Speakers are requested to present their PowerPoint Presentations in the Speaker Ready Room located in Intl Center Foyer, at least 30 minutes prior to the opening of the session at which they are to present (presentation slides can be turned in as early as Wednesday, June 21st). All presentations must be submitted in PowerPoint format only. Speakers with a disclosure will be asked to state the nature of their disclosure prior to the presentation. No personal laptops will be allowed at the podium.

3. Discussion of Papers: Only members of the Association and invited guests have the privilege of discussing papers. Non members may discuss a paper at the invitation of a member. All discussions will be presented from floor microphones.

4. In publication, it is customary to group discussions together on a series of papers. Transcription of the discussions will be forwarded to discussants for review and correction. Any delay in the return of corrected discussions means that publication of all papers on the subject will be held up. Such a delay is manifestly unfair to those who are conscientious in the prompt submission of their remarks. Unreasonable delay will preclude publication.
PROGRAM OUTLINE

**WEDNESDAY, JUNE 21, 2017**

1:00 pm – 6:00 pm  **REGISTRATION, Intl Center Foyer**

1:00 pm – 6:00 pm  **SPEAKER READY ROOM, Intl Center Foyer**

7:00 pm – 9:00 pm  **NEW MEMBERS/WELCOME RECEPTION, Main Pool Lawn**

**THURSDAY, JUNE 22, 2017**

6:00 am  **SAMSON FUN RUN, Golf Clubhouse**

7:00 am – 12:30 pm  **REGISTRATION, Intl Center Foyer**

7:00 am – 12:30 pm  **SPEAKER READY ROOM, Intl Center Foyer**

7:00 am – 12:00 pm  **EXHIBITS, Intl Center South**

7:00 am – 8:00 am  **BREAKFAST, Intl Center South**
8:00 am – 9:00 am  SCIENTIFIC SESSION I

Intl Center North
(10 minutes presentation, 10 minutes discussion)

Moderators: James I. Fann
Ross M. Bremner

+1. A Cost-Utility Analysis of Transcatheter Versus Surgical Aortic Valve Replacement for the Treatment of Aortic Stenosis in the Intermediate Surgical Risk Population
Derrick Y. Tam¹, Avery Hughes², Saerom Youn², Rebecca L. Howard-Hancock², Peter C. Coyte², Stephen E. Fremes¹, Harindra Wijeysundera³
¹Division of Cardiac Surgery, Sunnybrook Health Sciences Centre, Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, ON, Canada; ²Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, ON, Canada; ³Division of Cardiology, Sunnybrook Health Sciences Centre, Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, ON, Canada

DISCUSSANT: MICHAEL P. FISCHBEIN

2. Determinants of Late Survival and Reoperation Following Bioprosthetic Pulmonary Valve Replacement in Adults with Repaired Tetralogy of Fallot
Mayo Clinic, Rochester, MN

DISCUSSANT: AARON ECKHAUSER

+ Samson Resident Prize Essay
* WTSA Member
3. Perioperative Outcomes in Minimally Invasive Versus Open Esophagectomy: An ACS-NSQIP Analysis
Stanford University School of Medicine, Stanford, CA
DISCUSSANT: DONALD E. LOW

9:00 am – 9:10 am
NEW MEMBER & SAMSON PRIZE FINALIST INTRODUCTIONS, Intl Center North

9:10 am – 9:55 am
PRESIDENTIAL ADDRESS
Intl Center North
Introduction: Ross M. Bremner
The Seasons of a Thoracic Surgeon
James I. Fann

9:55 am – 10:20 am
COFFEE BREAK: VISIT EXHIBITS & POSTERS, Intl Center South

10:20 am – 11:40 am
SCIENTIFIC SESSION II
Intl Center North
(10 minutes presentation, 10 minutes discussion)
Moderators: Nahush A. Mokadam
John D. Mitchell

+4. Cost of Individual Complications Following Coronary Artery Bypass Grafting
James H. Mehaffey¹, Robert B. Hawkins¹, Eric J. Charles¹, Clifford Fonner², Irving L. Kron¹, Mohammed Quader³, Alan Speir⁴, Jeff Rich², Gorav Ailawadi¹
¹University of Virginia, Charlottesville, VA; ²Virginia Cardiac Surgery Quality Initiative, Falls Church, VA; ³Virginia Commonwealth University, Richmond, VA; ⁴INOVA Heart and Vascular Institute, Falls Church, VA
DISCUSSANT: ANTHONY P. FURNARY

+ Samson Resident Prize Essay
* WTSA Member
5. Initial Experience Following Implementation of Lung Cancer Screening at an Urban Safety Net Hospital
Katrina A. Steiling¹, Juan A. Munoz-Largacha², Nirupama Vellanki³, Marjory Charlot⁴, Carmel Fitzgerald¹, Hasmeena Kathuria¹, Kei Suzuki², Virginia R. Litle²
¹Boston University School of Medicine, Department of Medicine, Division of Pulmonary, Allergy, Sleep and Critical Care Medicine, Boston, MA; ²Boston University School of Medicine, Department of Surgery, Division of Thoracic Surgery, Boston, MA; ³Boston University School of Medicine, Boston, MA; ⁴Boston University School of Medicine, Department of Medicine, Division of Hematology and Medical Oncology, Boston, MA
DISCUSSANT: ROBERT A. MEGUID

S. Chris Malaisrie¹, Patrick M. McCarthy¹, Jane Kruse², Adin-Cristian Andrei³, Maria Grau-Sepulveda⁴, Daniel J. Friedman⁵, James L. Cox¹, J. Matthew Brennan⁴
¹Northwestern University Feinberg School of Medicine, Chicago, IL; ²Northwestern Medicine, Chicago, IL; ³Northwestern University, Chicago, IL; ⁴Duke University, Durham, NC; ⁵Duke Univeristy, Durham, NC
DISCUSSANT: WILLIAM T. CAINE

7. Long-Term Transplant Outcomes of Donor Hearts with Left Ventricular Dysfunction
Agustin Sibona¹, Kiran K. Khush², Udo E. Oyoyo¹, Timothy P. Martens¹, Nahidh W. Hasaniya¹, *Anees J. Razzouk¹, *Leonard L. Bailey¹, *David G. Rabkin¹
¹Loma Linda University Medical Center, Loma Linda, CA; ²Stanford University Medical Center, Palo Alto, CA
DISCUSSANT: MURRAY H. KWON

* WTSA Member
11:40 am – 12:25 pm  CONTROVERSIES DEBATE, Intl Center North  
We Are Ready for Competency-Based Cardiac Surgical Training  
Moderator: Sean C. Grondin  
**Pro:** We Are Already Doing It!  
David Latter  
**Con:** Wait! We Are Not Ready!  
Edward D. Verrier

12:30 pm – 1:45 pm  LUNCH SYMPOSIUM (Non – CME), Colorado Hall B  
Sponsored by Medtronic

1:45 pm – 3:45 pm  RESIDENT SYMPOSIUM – Transition to Practice, Colorado Hall B  
Moderators: James I. Fann  
Nahush A. Mokadam

1:45 pm – 1:55 pm  Introduction  
Nahush A. Mokadam  
University of Washington

1:55 pm – 2:05 pm  Where Are the Jobs?  
Craig H. Selzman  
University of Utah

2:05 pm – 2:20 pm  Interview Preparation  
Leah M. Backhus  
Stanford School of Medicine

2:20 pm – 2:35 pm  Negotiating a Contract  
David M. McMullan  
Seattle Children’s Hospital

2:35 pm – 2:50 pm  Transition to Practice – University  
Dustin M. Walters  
University of Virginia

2:50 pm – 3:05 pm  Transition to Practice – Non University  
Anthony P. Furnary  
Starr-Wood Cardiac Group
3:05 pm – 3:20 pm  **They Never Taught Me That in Residency**  
Craig J. Baker  
*University of Southern California, Keck School of Medicine*

3:20 pm – 3:35 pm  **Social Media**  
Thomas K. Varghese Jr.  
*University of Utah*

3:35 pm – 3:45 pm  **Question and Answer**

5:00 pm – 6:30 pm  **EVENING SYMPOSIUM (Non-CME), Colorado Hall B**  
*Sponsored by Convatec*

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**FRIDAY, JUNE 23, 2017**

6:00 am – 12:00 pm  **REGISTRATION, Intl Center Foyer**

6:00 am – 12:00 pm  **SPEAKER READY ROOM, Intl Center Foyer**

6:30 am – 7:50 am  **BREAKFAST SESSION, Colorado Hall B**  
*Losing Our Shirts: The Impact of Disruptive or Novel Technology on Our Livelihood*  
Moderator:  David A. Fullerton  
Speakers:  
*Adult Cardiac:*  Y. Joseph Woo  
*General Thoracic:*  Michael A. Smith  
*Congenital Heart:*  James Jaggers

7:00 am – 12:00 pm  **EXHIBITS, Intl Center South**

7:00 am – 8:00 am  **BREAKFAST, Intl Center South**
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<td>Young Blood for Old Brains</td>
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<td>Tony Wyss-Coray</td>
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<td>Stanford University, Standford, CA</td>
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<td>8:50 am – 10:30 am</td>
<td>SCIENTIFIC SESSION III</td>
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<td>Intl Center North</td>
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<td>(10 minutes presentation, 10 minutes discussion)</td>
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<td>Moderators: Leah M. Backhus</td>
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<td>Richard J. Shemin</td>
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</table>

8. Should Thoracic Surgeons Be Doing EBUS and Other Advanced Bronchoscopic Cases?
*Richard Whyte, Jorind Beqari, Lukas Ritzer, Jennifer Wilson, Sidhu Gangadharan, Adnan Majid, Michael Kent
Beth Israel Deaconess Medical Center, Boston, MA
DISCUSSANT: JASMINE HUANG

9. Immediate Extubation in the Operating Room After Pediatric Cardiac Surgery; Its Incidence and Risk Factor for Reintubation
Takeshi Shinkawa, Jessica Holloway, Xinyu Tang, Jeffrey M. Gossett, Rahul Dasgupta, Michael L. Schmitz, Michiaki Imamura
Arkansas Children’s Hospital, Little Rock, AR
DISCUSSANT: SAMEH M. SAID

Mayo Clinic, Rochester, MN
DISCUSSANT: ERIC J. LEHR

+ Samson Resident Prize Essay
* WTSA Membe
11. Pretreatment with Diazoxide Enhances the Neuroprotective Function of Erythropoietin Against Spinal Cord Ischemia and Reperfusion Injury Through Upregulation of Beta Common Receptor
University of Colorado, Aurora, CO
DISCUSSANT: FERNANDO FLEISCHMAN

+12. Pre-Operative Pulmonary Hypertension for Left Ventricular Assist Device Patients Does Not Adversely Impact Long Term Outcomes Following Heart Transplantation: Review of the United Network for Organ Sharing Database
Ann C. Gaffey, Jennifer J. Chung, Carol W. Chen, Mallory L. Irons, Michael A. Acker, Pavan Atluri
Hospital of the University of Pennsylvania, Philadelphia, PA
DISCUSSANT: STEPHEN H. MCKELLAR

10:30 am – 11:00 am COFFEE BREAK: VISIT EXHIBITS & POSTERS, Intl Center South

+ Samson Resident Prize Essay
* WTSA Member
13. The New Paradigm of Value-Driven Care in Cardiothoracic Surgery: Defining and Achieving “Perfect Care” for Patients Following Coronary Artery Bypass Surgery to Promote Cost-Effectiveness
University of Utah, Salt Lake City, UT
DISCUSSANT: BENEDICT J. TAYLOR

+14. Variability in Invasive Mediastinal Staging for Lung Cancer: A Multi-Center Regional Study
Lucas W. Thornblade¹, *Douglas E. Wood¹, *Michael S. Mulligan¹, Alexander S. Farivar², *Michal Hubka³, Kimberly E. Costas⁴, *Bahirathan Krishnadasan⁵, Farhood Farjah¹
¹University of Washington, Seattle, WA; ²Swedish Cancer Institute, Seattle, WA; ³Virginia Mason Medical Center, Seattle, WA; ⁴Providence Regional Medical Center, Everett, WA; ⁵CHI Franciscan Health System, Tacoma, WA
DISCUSSANT: JANE YANAGAWA

15. Ninety Day Readmissions of Bundled Valve Patients: Implications for Healthcare Policy
Michael S. Koeckert, Eugene A. Grossi, Mathew R. Williams, Gary Kalkut, Didier F. Loulmet, Elias A. Zias, Michael Querijero, Aubrey C. Galloway
NYU School of Medicine, New York, NY
DISCUSSANT: RICHARD L. PRAGER

+ Samson Resident Prize Essay
* WTSA Member
12:30 pm – 1:45 pm  LUNCH SYMPOSIUM (Non-CME), Colorado Hall B  
Sponsored by LivaNova

12:30 pm  GOLF TOURNAMENT**, West Course

2:00 pm  TENNIS TOURNAMENT**, Tennis Courts

6:00 pm – 10:00 pm  THEME DINNER, Cheyenne Lodge  
*Buses will loop from the Main Building beginning at 5:45 pm and the last bus will be at 10:15 pm.  
Country or Casual Attire.

SATURDAY, JUNE 24, 2017

6:00 am – 12:00 pm  REGISTRATION, Intl Center Foyer

6:00 am – 11:30 am  SPEAKER READY ROOM, Intl Center Foyer

6:30 am – 10:30 am  EXHIBITS, Intl Center South

6:30 am – 7:30 am  BREAKFAST, Intl Center South

7:00 am – 8:15 am  CONCURRENT FORUMS  
(5 minutes presentation, 3 minutes discussion)

ADULT CARDIAC

Intl Center North

Moderators:  Brett T. Reece
            Howard K. Song

CF1.  Ascending Thoracic Aortic Aneurysm Wall Stresses in Bicuspid Versus Tricuspid Aortic Valves  
Yue Xuan, Raymond Liu, Henrik Haraldsson,  
Michael D. Hope, David A. Saloner,  
Julius M. Guccione, Liang Ge, *Elaine Tseng  
UCSF Medical Center and SFVAMC, San Francisco, CA

* WTSA Member  
** Separate Subscription Required
CF2. Vascular Complications in the Sapien 3 Era: Continued Role of Transapical Approach to TAVR
William Toppen, Cayley Bowles, Peyman Benharash, Olcay Aksoy, William Suh, *Richard J Shemin,
*Murray H. Kwon
UCLA Medical School, Los Angeles, CA

CF3. Identification of Genetic Defects Causing Thoracic Aortic Aneurysm by Whole Exome Sequencing: Experience in 211 Patients
Bulat A. Ziganshin, Allison E. Bailey, Adam Brownstein, Maryann Tranquilli, Allen E. Bale, John A. Elefteriades
Yale University School of Medicine, New Haven, CT

CF4. Is Prophylactic Ablation for Atrial Fibrillation Warranted During Mitral Surgery
Christopher Mehta¹, Patrick M. McCarthy¹, Adin-Cristian Andrei², Jane Kruse³, Andrei Churyla¹,
S. Chris Malaisrie¹, Duc T. Pham¹, James L. Cox¹
¹Northwestern University Feinberg School of Medicine, Chicago, IL; ²Northwestern University, Chicago, IL;
³Northwestern Medicine, Chicago, IL

CF5. Midterm Results of a Novel Single Stage Hybrid Aortic Arch Replacement Technique to Reduce Bypass and Circulatory Arrest Duration
*Castigliano M. Bhamidipati, *Joshua L Hermsen, Felix G. Vladimir, *Jason W. Smith, Mark H. Meissner,
Matthew P. Sweet, *Jay D. Pal
University of Washington, Seattle, WA

CF6. Long-Term Outcomes of Aortic Valve Replacement in Adults ≤40 Years Old: An Analysis of 1478 Patients in 136 Hospitals in the State of California
William L. Patrick, Andrew B. Goldstone, Peter Chiu,
*Michael J. Paulsen, Bharathi Lingla, Michael Baiocchi,
*Y. Joseph Woo
Stanford University, Stanford, CA

* WTSA Member
CF7. High Risk Coronary Artery Bypass: Impact of Heart Failure Symptoms Versus Left Ventricular Function
Robert B. Hawkins¹, J. Hunter Mehaffey¹,
Sarah A. Schubert¹, Clifford Fonner², Jeffrey B. Rich²,
Alan M. Speir³, Mohammed Quader⁴, Gorav Ailawadi¹,
Irving L. Kron¹
¹University of Virginia, Charlottesville, VA; ²Virginia Cardiac Services Quality Initiative, Falls Church, VA;
³Inova Heart and Vascular Institute, Falls Church, VA;
⁴Virginia Commonwealth University, Richmond, VA

CF8. Should We Place 23 mm or Larger Valve for Young Female Patients Undergoing Aortic Valve Replacement?
Ahmed A. Kolkailah, Julius I. Ejiofor, Fernando Ramirez Del Val, Ritam Chowdhury, Siobhan McGurk,
Jiyae Lee, Prem S. Shekar, Sary F. Aranki,
Marc P. Pelletier, Tsuyoshi Kaneko
Brigham and Women’s Hospital, Harvard Medical School, Boston, MA

GENERAL THORACIC

Colorado Hall B

Moderators: Jessica S. Donington
            Farzaneh F. Banki

CF9. Incremental Cost of Complications of Lobectomy for Stage I NSCLC
Abraham D. Geller, Douglas J. Mathisen,
Cameron D. Wright, Michael Lanuti
Massachusetts General Hospital, Boston, MA
CF10. Incidence of LKB1 Inactivation in Esophageal Adenocarcinoma
Timothy G. Whitsett¹, Sumeet K. Mittal¹, Jennifer M. Eschbacher², *Michael A. Smith¹, *Ross M. Bremner¹, Landon J. Inge¹
¹Norton Thoracic Insitute., St. Joseph’s Hospital and Medical Center, Phoenix, AZ; ²St. Joseph’s Hospital and Medical Center, Phoenix, AZ

CF11. A Role for Stereotactic Body Radiation Therapy in a Multi-Modality Approach to Pulmonary Metastatic Sarcoma
UCSF, San Francisco, CA

CF12. Comparative Effectiveness of Upfront Esophagectomy Versus Induction Chemoradiation in Clinical Stage T2N0 Esophageal Cancer
Tara R. Semenkovich, Roheena Panni, Theodore Thomas, Leisha C. Elmore, Jessica L. Hudson, Bryan F. Meyers, Benjamin D. Kozower, Varun Puri
Washington University in St. Louis, St. Louis, MO

CF13. Hyperthermic Intrathoracic Extracorporeal Chemotherapy for Pleural Malignancies
Daniel L. Miller¹, Jordan M. Wetstone¹, Rabih I. Bechara², Christopher S. Parks², Loana R. Bonta², Patricia L. Rich²
¹Kennestone Regional Medical Center/WellStar Health System, Marietta, GA; ²Southeastern Regional Medical Center/CTCA, Newnan, GA

* WTSA Member
CF14. Early Fundoplication Is Associated with Slower Decline in Lung Function After Lung Transplantation in Patients with Gastroesophageal Reflux Disease
Sreeja Biswas Roy¹, Cassandra Haworth², Shaimaa Elnahas³, Rosemarie Serrone³, Michael T. Olson⁴, Paul Kang⁵, *A. Samad Hashimi¹, *Michael A. Smith¹, *Ross M. Bremner¹, *Jasmine Huang¹
¹Norton Thoracic Institute, Phoenix, AZ; ²A.T. Still University, Phoenix, AZ; ³St. Joseph’s Hospital and Medical Center, Phoenix, AZ; ⁴Grand Canyon University, Phoenix, AZ; ⁵University of Arizona College of Public Health, PHOENIX, AZ

CF15. Needle Localization of Small Pulmonary Nodules – Lessons Learned in Over 250 Cases
*Patricia A. Thistlethwaite, Jonathan Gower, Andrew Picel, Anne Roberts
University of California, San Diego, La Jolla, CA

CF16. Emergency Room Utilization Is High & Feeding Tube Problems Are the Biggest Culprit: Analysis of Resource Utilization After Esophagectomy
Biniam Kidane¹, Suha Kaaki¹, Yu Shen², Adam Bassili², John Peel³, Frances Allison², Thomas Waddell², Gail Darling²
¹University of Manitoba, Winnipeg, MB, Canada; ²University of Toronto, Toronto, ON, Canada; ³University of British Columbia, Vancouver, BC, Canada

* WTSA Member
CF17. Outcomes of Surgical Intervention on Primary Pulmonary Vein Obstruction
University School of Medicine, Atlanta, GA

CF18. Novel Perioperative Strategy for the First Blalock-Taussig Shunt in Infants with PDA Dependent Circulation
Sadahiro Sai, Satoshi Matsuo, Shingo Takahara, Naoki Masaki, Koh Sakatsume, Akinobu Konishi
Miyagi Children’s Hospital, Sendai, Japan

CF19. The Right Axillary Incision: A Potential New Standard of Care for Selected Congenital Heart Surgery
Timothy Lee, Aaron J. Weiss, Elbert E. Williams, Shinobu Itagaki, Khanh H Nguyen
Icahn School of Medicine at Mount Sinai, New York, NY

CF20. Outcome of Reoperation After Initial Repair of Truncus Arteriosus: Analysis of 113 Patients
Mayo Clinic, Rochester, MN

CF21. Results of a Novel “Taco” Technique for Correction of Aortic Coarctation and Arch Hypoplasia
Seattle Children’s Hospital, University of Washington, Seattle, WA

* WTSA Member
CF22. Virtual Cardiac Surgery Planning to Improve Blood Flow Dynamics using 3D Image Processing

1Division of Cardiac Surgery, Johns Hopkins Hospital, Baltimore, MD; 2Division of Cardiology, Children’s National Health System, Washington DC, DC; 3Sheikh Zayed Institute for Pediatric Surgical Innovation, Children’s National Health System, Washington DC, DC; 4Institute of Physiology, University of Zürich, Zürich, Switzerland; 5Institute of Design, Materials and Fabrication, Eidgenössische Technische Hochschule Zürich, Zürich, Switzerland.

CF23. Determinants of Late Survival and Reoperation in Patients Undergoing Repair of Subaortic Stenosis

Mayo Clinic, Rochester, MN.

CF24. Impact of Phrenic Nerve Palsy and Need for Diaphragm Plication Following Surgery for Pulmonary Atresia with Ventricular Septal Defect and Major Aortopulmonary Collaterals

Stanford University School of Medicine, Stanford, CA.

* WTSA Member
+16. **Root Repair with Valve Resuspension Is Safe for Acute Type A Aortic Dissection but Results in Increased Risk of Reoperation**
Peter Chiu, Jeffrey Trojan, Sarah Tsou, Andrew B. Goldstone, *Y. Joseph Woo,* *Michael P. Fischbein*

*Department of Cardiothoracic Surgery, Stanford University, School of Medicine, Stanford, CA*

**DISCUSSANT:** **DAVID G. RABKIN**

17. **Growth Characteristics and Reintervention Following Aortic Arch Reconstruction in Infants Undergoing Biventricular Repair**
Christoph Haller¹, Guillermo Larios², Kasey Moss¹, Wenli Xie¹, James Meza¹, Brian McCrindle¹, Glen S. Van Arsdell¹, Luc Mertens², Osami Honjo¹

¹*Division of Cardiovascular Surgery, The Labatt Family Heart Centre, The Hospital for Sick Children and University of Toronto, Toronto, ON, Canada;*²*Division of Cardiology, The Labatt Family Heart Centre, The Hospital for Sick Children and University of Toronto, Toronto, ON, Canada*

**DISCUSSANT:** **BRAIN L. REEMTSEN**

18. **Development of a 3D Printing Based Cardiac Surgical Simulation Curriculum to Teach Septal Myectomy**
*Joshua L. Hermsen, Thomas M. Burke, L. Myria Jacobs,* *Edward D. Verrier, *Nahush A. Mokadam*

*University of Washington, Seattle, WA*

**DISCUSSANT:** **CRAIG J. BAKER**

+ Samson Resident Prize Essay
* WTSA Member
19. The Mid-Term Survival of Robotic Lobectomy Resection of Non-Small Cell Lung Cancer (NSCLC): A Multi-Institutional Study
*Robert J. Cerfolio¹, Asem F. Ghanim¹, Mark Dylewski², Giulia Veronesi³, Lorenzo Spaggiari⁴, Bernard J. Park⁵
¹UAB, Birmingham, AL; ²Baptist Health of South Florida, South Miami, FL; ³Istituto Clinico Humanitas Cancer Center, Istituto Europeo Di Oncologia, Milan, Italy; ⁴Istituto Europeo Di Oncologia, Milan, Italy; ⁵Memorial Sloan Kettering Cancer Center, New York, NY
DISCUSSANT: MARK F. BERRY

9:50 am – 10:10 am COFFE BREAK: VISIT EXHIBITS & POSTERS, Intl Center South

10:10 am – 11:10 am SCIENTIFIC SESSION VI

Intl Center North
(10 minutes presentation, 10 minutes discussion)
Moderators: David M. McMullan
Craig H. Selzman

20. Twenty-One Years and 626 Patients Later: Contemporary Outcomes After Bidirectional Cavopulmonary Anastomosis
*Lauren C. Kane, Luis E. De León, Ruth Ackah, Rohini R. Sigireddi, Carlos M. Mery, Iki Adachi, Jeffrey S. Heinle, E. Dean McKenzie, Charles D. Fraser, Jr.
Texas Childrens Hospital/Baylor College of Medicine, Houston, TX
DISCUSSANT: TARA KARAMLOU

* WTSA Member
+21. Glycogen Synthase 3β Inhibition Modulates Mitochondrial Pathways Resulting in Improved Myocardial Oxidative Stress and Collagen Production in Swine Model of Chronic Myocardial Ischemia and Metabolic Syndrome
Brittany A. Potz, Laura A. Scrimgeour, Sharif A. Sabe, Neel R. Sodha, Frank W. Sellke
Brown University, Providence, RI
DISCUSSANT: AHMAD Y. SHEIKH

22. Clinicoradiographic Predictors of Aggressive Behavior in Resected Malignant Ground Glass Opacity Lesions
David Nelson¹, Myrna Godoy¹, Marcelo Benveniste¹, Jitesh Shewale³, Arlene Correa¹, Jonathan Spicer², Wayne Hofstetter¹, Reza Mehran¹, David Rice¹, Boris Sepesi¹, Garett Walsh¹, Ara Vaporciyan¹, Stephen Swisher¹, Jack Roth¹, Mara Antonoff¹
¹MD Anderson Cancer Center, Houston, TX; ²McGill University Health Center Research Institute, Montreal, QC, Canada
DISCUSSANT: THOMAS K. VARGHESE, JR.

11:10 am – 12:00 pm C. WALTON LILLEHEI
POINT/COUNTERPOINT SESSION

Intl Center North

Ethics and End of Care Life: Everyone Needs TAVR, LVAD, ECMO Before They Die versus We Are the Stewards of Healthcare

Moderator: Robert M. Sade

Pro: Everyone Needs TAVR, LVAD, ECMO Before They Die
Nicholas G. Smedira

Con: We Are the Stewards of Healthcare
Richard I. Whyte

+ Samson Resident Prize Essay
12:00 pm – 12:30 pm  ANNUAL BUSINESS MEETING (Members Only)

12:30 pm – 2:00 pm  FAMILY LUNCHEON, Lakeside Terrace

7:00 pm – 11:00 pm  PRESIDENT’S RECEPTION AND BANQUET,
                      Intl Center Foyer and North
                      Black Tie/Evening Dress Preferred
WEDNESDAY, JUNE 21, 2017

1:00 pm – 6:00 pm  REGISTRATION, Intl Center Foyer
1:00 pm – 6:00 pm  SPEAKER READY ROOM, Intl Center Foyer
7:00 pm – 9:00 pm  NEW MEMBERS/WELCOME RECEPTION, Main Pool Lawn

THURSDAY, JUNE 22, 2017

6:00 am  SAMSON FUN RUN, Golf Clubhouse
7:00 am – 12:30 pm  REGISTRATION, Intl Center Foyer
7:00 am – 12:30 pm  SPEAKER READY ROOM, Intl Center Foyer
7:00 am – 12:00 pm  EXHIBITS, Intl Center South
7:00 am – 8:00 am  BREAKFAST, Intl Center South
OBJECTIVES: Recent evidence suggests that transcatheter aortic valve implantation (TAVI) is non-inferior to surgical aortic valve replacement (SAVR) for early (30 days) and long term (2 years) mortality outcomes in patients with severe symptomatic aortic stenosis (AS), who are at an intermediate surgical risk. Our objective was to determine the cost-effectiveness of TAVI versus SAVR in the intermediate risk population.

METHODS: A fully probabilistic Markov model with 30 day cycles was constructed from the Canadian third party payer’s perspective to estimate the difference in cost and effectiveness (measured as Quality-Adjusted Life Years, QALYs) of TAVI versus SAVR for the intermediate risk patient population over a lifetime time horizon (Figure 1). Clinical trial data from the Placement of Aortic Transcatheter Valves 2 Trial (PARTNER 2), comparing a second generation balloon-expandable heart valve system (Edwards Lifesciences Sapien XT) to SAVR, was used to inform the efficacy inputs. Data from the Canadian Institute of Health Information Patient Cost-Estimator and the Ontario Schedule of Benefits were obtained for cost inputs. Incremental Cost-Effectiveness Ratios (ICERs) were calculated. All costs and utilities were discounted.
at 5% per annum. One-way sensitivity analyses and a Monte Carlo probabilistic sensitivity analysis (PSA) were conducted. All costs are presented in 2016 Canadian dollars (CAN). $1.00 CAN = $0.76 United States Dollar (Bank of Canada Currency Exchange Rate—January 7, 2017).

RESULTS: In the base case analysis, the total life-time costs in present values for the TAVI and SAVR arms were $46,743 ± 4,075 and $36,838 ± 7,321 respectively while the QALYs gained were 4.63 ± 1.17 and 4.43 ± 1.17 for TAVI and SAVR respectively. Thus, the incremental cost of TAVI was $9,906 and the incremental gain in QALYs was 0.19. This resulted in an ICER of $51,288/QALY. Deterministic one-way analyses showed that the ICER was sensitive to rates of complications, cost of the TAVI valve and hospital lengths of stay. The PSA indicated moderate uncertainty in that TAVR was the preferred option in only approximately 52% (Figure 2) and 56% of the simulations at a $50,000 and $100,000 per QALY willingness-to-pay threshold (Figure 3), respectively. The driver of the uncertainty appeared to be in efficacy, reflecting the non-inferiority nature of the input data.
CONCLUSIONS: This study represents the first formal cost-effectiveness analysis comparing TAVI versus SAVR in the intermediate surgical risk population. TAVI was found to be a cost-effective option for the treatment of severe AS in intermediate surgical risk patients.
2. Determinants of Late Survival and Reoperation Following Bioprosthetic Pulmonary Valve Replacement in Adults with Repaired Tetralogy of Fallot


Mayo Clinic, Rochester, MN

DISCUSSANT: AARON ECKHAUSER

OBJECTIVES: Pulmonary valve replacement (PVR) following complete repair of Tetralogy of Fallot (TOF) is a commonly performed adult congenital operation. Data regarding risk factors for reoperation, late survival, and the ideal bioprosthesis is lacking. We examined risk factors and late survival for bioprosthetic porcine vs. pericardial PVR.

METHODS: From January 1993 to December 2015, 247 adult patients with TOF underwent bioprosthetic PVR. Concomitant procedures included ASD/PFO closure (n = 89), tricuspid valve repair (n = 71), atrial arrhythmia surgery (n = 46), ventricular arrhythmia surgery (n = 43), VSD closure (n = 17) and others (n = 19). Mean age at operation was 39.7 ± 13.3 years (maximum 83 years) and 126 (51%) were males. Indication for PVR was pulmonary regurgitation (PR) in 220, pulmonary stenosis (PS) in 8 and both PR/PS in 19. The most common presenting symptoms were exercise intolerance (n = 175; 71%), palpitations (n = 80; 32%) and right-sided heart failure (n = 38; 15%). Preoperative MRI was performed in 72 patients with a mean RVEDVI of 164.11 ± 1.15 ml/m² and RVEF of 42.09 ± 8.46%.

RESULTS: Repeat sternotomy was employed in all patients, and average period of cardiopulmonary bypass was 83.72 ± 56.0 min. 205 (83%) had a porcine valve, while 42 (17%) had pericardial. Operative mortality was 1.6% (n = 4), and median follow-up was 5.1 years (maximum, 21.5 years). Overall survival at 5, 10 and 15 years was 94.3%, 85.8% and 82.2%, respectively, and this was significantly lower than an age-matched population (p < 0.001) (Figure 1). Older age at the time of PVR (HR = 1.06 [1.03–1.08], p < 0.001), elevated preoperative pulmonary valve gradient (HR = 1.03 [1.01–1.05], p = 0.001), higher right atrial pressure (HR = 1.18 [1.07–1.30], p < 0.001) and higher right ventricular systolic pressure (HR = 1.02 [1.00–1.03], p = 0.048) were risk factors for late mortality. There was no correlation between bioprosthetic valve type, size, or indexed size and late survival. The only concomitant procedure that was a risk factor for late survival was VSD repair (HR = 4.38[1.74–11.01], p < 0.001). Reoperation was required in 7 pts, while transcatheter valve-in-valve was performed in

* WTSA Member
two. Freedom from reoperation at 5, 10 and 15 years was 99.5%, 96.5% and 86.7%, respectively. Median time to reoperation was 10.6 years (maximum, 16.1 years). There was no clear correlation between bioprosthetic valve type and subsequent need for reoperation.

**CONCLUSION:** Pulmonary valve replacement in adults with repaired TOF can be performed with low early mortality and excellent freedom from reoperation. Late survival is however reduced when compared to an age-matched population, especially in those with a concomitant VSD repair.
3. Perioperative Outcomes in Minimally Invasive Versus Open Esophagectomy: An ACS-NSQIP Analysis
Stanford University School of Medicine, Stanford, CA
DISCUSSANT: DONALD E. LOW

BACKGROUND: Minimally invasive esophagectomy (MIE) has been shown to be feasible for esophageal cancer, yet advantages over open esophagectomy (OE) and adoption in clinical practice outside of highly specialized centers have not been well characterized. The purpose of this study was to quantify the use of MIE in a national multi-center patient cohort, and to test the hypothesis that MIE has less short-term morbidity compared to OE using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.

METHODS: All patients ≥ 18 years of age who underwent an esophagectomy for esophageal cancer in the 2005–2013 ACS-NSQIP database were identified, with MIE patients distinguished from OE patients by use of any minimally invasive current procedural terminology (CPT) codes for the procedure. Multivariable linear and logistic regressions were used to compare postoperative length of stay, morbidity, and mortality between MIE and OE in an overall NSQIP cohort; analyses were repeated using a propensity-matched cohort to account for confounding by indication.

RESULTS: Of 3,901 patients who met inclusion criteria, 638 (16.4%) were MIE and 3,263 (83.6%) were OE. The use of MIE increased from 6.5% in 2005 to 22.3% in 2013, and was most common in three-field approaches (26.6% [193/725]). Patients undergoing MIE were slightly older than those undergoing OE and were less likely to have been given pre-operative chemotherapy or radiation, but no other significant differences in demographics or comorbidities were observed (Table). MIE patients had a lower rate of major morbidity in univariate analysis, but there were no statistically significant differences in length of stay, readmission, re-operation, and mortality between the two groups (Table). MIE continued to be associated with a lower risk of major morbidity relative to OE (OR 0.80, p = 0.02) in multivariable analysis, an effect confirmed using a propensity-matched cohort (OR 0.83, p = 0.049). In multivariable subgroup analyses stratified by specific technique, MIE use was associated with less major morbidity in both Ivor-Lewis (OR 0.70, p = 0.01) and three-field (OR 0.70, p = 0.049) approaches, with results confirmed in propensity-matched cohorts.
<table>
<thead>
<tr>
<th>Overall Cohort</th>
<th>MIE (n = 638)</th>
<th>Open (n = 3263)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline Characteristics</strong></td>
<td></td>
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</tr>
<tr>
<td>Mean Age (years)</td>
<td>64.5</td>
<td>63.7</td>
<td>0.04</td>
</tr>
<tr>
<td>Male Gender (n, %)</td>
<td>530 (83.1%)</td>
<td>2737 (83.9%)</td>
<td>0.61</td>
</tr>
<tr>
<td>White Race (n, %)</td>
<td>564 (88.4%)</td>
<td>2748 (84.2%)</td>
<td>0.12</td>
</tr>
<tr>
<td>Mean BMI</td>
<td>28.0</td>
<td>27.9</td>
<td>0.61</td>
</tr>
<tr>
<td>Diabetes (n, %)</td>
<td>114 (17.9%)</td>
<td>576 (17.7%)</td>
<td>0.55</td>
</tr>
<tr>
<td>Recent Smoker (n, %)</td>
<td>175 (27.4%)</td>
<td>869 (26.6%)</td>
<td>0.86</td>
</tr>
<tr>
<td>Any Dyspnea on Exertion (n, %)</td>
<td>73 (11.4%)</td>
<td>351 (10.8%)</td>
<td>0.88</td>
</tr>
<tr>
<td>H/o COPD (n, %)</td>
<td>50 (7.8%)</td>
<td>144 (7.5%)</td>
<td>0.8</td>
</tr>
<tr>
<td>H/o CHF (n, %)</td>
<td>1 (0.2%)</td>
<td>4 (0.1%)</td>
<td>0.59</td>
</tr>
<tr>
<td>H/o HTN requiring medication (n, %)</td>
<td>343 (53.8%)</td>
<td>1705 (52.3%)</td>
<td>0.49</td>
</tr>
<tr>
<td>Independent Functional Status (n, %)</td>
<td>633 (99.2%)</td>
<td>3213 (98.5%)</td>
<td>0.43</td>
</tr>
<tr>
<td>Metastatic cancer (n, %)</td>
<td>14 (2.2%)</td>
<td>101 (3.1%)</td>
<td>0.22</td>
</tr>
<tr>
<td>&gt;10% weight loss in 6 m PTS (n, %)</td>
<td>138 (21.6%)</td>
<td>649 (19.9%)</td>
<td>0.32</td>
</tr>
<tr>
<td>Chemotherapy in 30 d PTS (n, %)</td>
<td>44 (6.9%)</td>
<td>312 (9.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Radiation in 90d PTS (n, %)</td>
<td>77 (12.1%)</td>
<td>589 (18.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Length of Stay (days, 95% CI)</td>
<td>14.7 (13.6–15.8)</td>
<td>15.4 (14.3–16.5)</td>
<td>0.19</td>
</tr>
<tr>
<td>Readmission (n, %)</td>
<td>55 (11.2%)</td>
<td>222 (12.0%)</td>
<td>0.62</td>
</tr>
<tr>
<td>Reoperation (n, %)</td>
<td>73 (14.7%)</td>
<td>257 (13.7%)</td>
<td>0.57</td>
</tr>
<tr>
<td>Composite Major Morbidity (n, %)</td>
<td>230 (36.1%)</td>
<td>408 (40.5%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Mortality (n, %)</td>
<td>14 (2.2%)</td>
<td>106 (3.3%)</td>
<td>0.16</td>
</tr>
</tbody>
</table>

MIE = Minimally invasive esophagectomy  
BMI = Body mass index  
COPD = Chronic obstructive pulmonary disease  
CHF = Congestive heart failure  
HNT = Hypertension  
PTS = Prior to surgery
CONCLUSIONS: In an early period where MIE was used in a minority of patients undergoing resection of esophageal cancer, an MIE approach was associated with lower rates of major morbidity but otherwise similar outcomes to open procedures. These results suggest it is safe for surgeons to introduce MIE into their practice, though further evaluation will be needed to evaluate the benefits of MIE over OE as experience with MIE techniques increase across a variety of practice environments.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>9:00 am – 9:10 am</td>
<td><strong>NEW MEMBER &amp; SAMSON PRIZE FINALIST INTRODUCTIONS, Intl Center North</strong></td>
</tr>
<tr>
<td>9:10 am – 9:55 am</td>
<td><strong>PRESIDENTIAL ADDRESS</strong></td>
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<td><em>Intl Center North</em></td>
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<td></td>
<td>Introduction: Ross M. Bremner</td>
</tr>
<tr>
<td></td>
<td><strong>The Seasons of a Thoracic Surgeon</strong></td>
</tr>
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<td></td>
<td>James L. Fann</td>
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<tr>
<td>9:55 am – 10:20 am</td>
<td><strong>COFFEE BREAK: VISIT EXHIBITS &amp; POSTERS, Intl Center South</strong></td>
</tr>
</tbody>
</table>
+4. **Cost of Individual Complications Following Coronary Artery Bypass Grafting**

James H. Mehaffey¹, Robert B. Hawkins¹, Eric J. Charles¹, Clifford Fonner², Irving L. Kron¹, Mohammed Quader³, Alan Speir⁴, Jeff Rich², Gorav Ailawadi¹

¹University of Virginia, Charlottesville, VA; ²Virginia Cardiac Surgery Quality Initiative, Falls Church, VA; ³Virginia Commonwealth University, Richmond, VA; ⁴INOVA Heart and Vascular Institute, Falls Church, VA

**DISCUSSANT: ANTHONY P. FURNARY**

**OBJECTIVE:** Given the fiscal challenges likely associated with the newly proposed bundled payment for coronary artery bypass surgery (CABG), it is critical to understand the financial implications of postoperative complications in cardiac surgery. The purpose of this study is to define the cost of perfect surgery (no complications) and demonstrate the incremental cost of each complication.

**METHODS:** All (36,588) isolated CABG patients were evaluated (2006–2015) from a statewide Society of Thoracic Surgeons (STS) database collaborative. Patients were stratified by presence of postoperative complications including major morbidities as defined by the STS (prolonged ventilation, renal failure, reoperation, stroke, and deep sternal wound infection). Hierarchical modeling was used to identify the independent inflation-adjusted cost of each complication while controlling for hospital variation and time.

**RESULTS:** The median age was 64, 74.3% were male and average predicted risk of mortality was 1.9%. A total of 24,738 (67.7%) patients experienced no complications at an average cost of $36,580. Each complication independently increases the cost of care (Table). The incidence of each additional major complication resulted in an exponential increase in cost (Figure). After accounting for incidence and incremental costs, institutions in our collaborative have spent an estimated $59.1 million on...
prolonged ventilation, $8.3 million on renal failure, $7.6 million on reoperation, $3.3 million on stroke, and $256,000 on deep sternal wound infections within the first 30 days after surgery over the past 10 years.

CONCLUSIONS: Perfect CABG without complication costs $36,580 on average. Major complications produce an exponential increase in costs and over the past ten years have totaled $78.6 million. As alternative payment models including bundled care are implemented, it is critical to understand the cost of adverse events to guide quality improvement projects, estimate true costs, and risk adjust payment models.
5. Initial Experience Following Implementation of Lung Cancer Screening at an Urban Safety Net Hospital
Katrina A. Steiling¹, Juan A. Munoz-Largacha², Nirupama Vellanki³, Marjory Charlot⁴, Carmel Fitzgerald¹, Hasmeena Kathuria¹, Kei Suzuki², Virginia R. Litle²

¹Boston University School of Medicine, Department of Medicine, Division of Pulmonary, Allergy, Sleep and Critical Care Medicine, Boston, MA; ²Boston University School of Medicine, Department of Surgery, Division of Thoracic Surgery, Boston, MA; ³Boston University School of Medicine, Boston, MA; ⁴Boston University School of Medicine, Department of Medicine, Division of Hematology and Medical Oncology, Boston, MA

DISCUSSANT: ROBERT A. MEGUID

OBJECTIVE: Lung cancer screening with low-dose computed tomography (LDCT) reduced lung cancer mortality within a high risk population of smokers in the National Lung Screening Trial. The adoption of a standardized Lung-Reporting and Data System (Lung-RADS) and the use of a multidisciplinary team (MDT) have shown to be essential for a successful screening program. Safety net hospitals provide most of their care to low-income, uninsured and vulnerable populations who have high rates of smoking and in whom delays in cancer screening are established barriers. We hypothesized that socioeconomic barriers might pose important challenges to the success of a lung cancer screening program at a safety net hospital. We aimed to determine LDCT follow-up compliance in Lung-RADS 4 patients, the rate of diagnostic and treatment procedures and the cancer diagnosis rate.

METHODS: A retrospective review of all the patients enrolled in our Lung Cancer Screening Program was conducted. From March 2015–July 2016, 554 patients were evaluated in our MDT screening program. Demographics, smoking status, Lung-RADS score, and number of diagnostic and therapeutic interventions and cancer diagnoses were captured.

RESULTS: Mean age was 63 years (range 47–85) with 95% between 55–80 years. Sixty percent were male, 48% white non-Hispanic, 31% African-American, 10% Hispanic, 5% Asian, 5% declined this information or was not documented. Sixty-four percent had Medicare/Medicaid and 36% had a private/other insurance. All patients had a history of smoking with a mean number of pack-years of 42.2. Screening referral came from primary care physicians and pulmonary/medicine services in 82% and from other services in the remaining 18% of the cases. Ninety-two percent (512/554) of the patients were categorized into Lung-RADS 1–3 and 8% (42/554) into Lung-RADS 4. Of the Lung-RADS 4, 98% (41/42) completed their recommended follow-up and 1 patient died from unrelated cause before diagnostic intervention. Twenty-nine
percent (12/42) of the Lung-RADS 4 underwent a diagnostic procedure, for a 2%
(12/554) overall diagnostic intervention rate (Table 1). Of these 12, 92% had cancer
and 1 patient had sarcoidosis. The overall rate of surgical resections was 0.9%
(5/554) and the diagnostic intervention for non-cancer diagnosis was 0.1% (1/554).

**CONCLUSIONS:** Implementing a MDT lung cancer screening program at a safety
net hospital is feasible. Ninety-eight percent of our Lung-RADS 4 patients com-
pleted recommended follow-up despite social barriers. The number of Lung-RADS
4 patients identified in our study was higher than reported in other studies and the
compliance with interventional recommendations was high in this socially chal-
lenged population.
<table>
<thead>
<tr>
<th>Patient #</th>
<th>Lung-RADS Category</th>
<th>Diagnostic Procedure</th>
<th>Histologic Diagnosis</th>
<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>4A</td>
<td>CT-guided biopsy</td>
<td>Adenocarcinoma</td>
<td>VATS resection</td>
<td>IA</td>
</tr>
<tr>
<td>2</td>
<td>4X</td>
<td>CT-guided biopsy</td>
<td>Adenocarcinoma</td>
<td>Definitive chemoradiotherapy</td>
<td>IIIB</td>
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<tr>
<td>3</td>
<td>4B</td>
<td>US-guided biopsy</td>
<td>Small Cell Carcinoma</td>
<td>VATS resection (LUL segmentectomy)</td>
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<td>4</td>
<td>4B</td>
<td>ENB and Mediastinoscopy</td>
<td>Squamous Cell Carcinoma</td>
<td>Chemotherapy</td>
<td>Limited Stage</td>
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<tr>
<td>5</td>
<td>4A</td>
<td>Bronchoscopy and Mediastinoscopy</td>
<td>Adenocarcinoma</td>
<td>VATS lobectomy</td>
<td>IA</td>
</tr>
<tr>
<td>6</td>
<td>4A</td>
<td>CT-guided biopsy</td>
<td>Adenocarcinoma</td>
<td>VATS lobectomy</td>
<td>IA</td>
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<tr>
<td>7</td>
<td>4B</td>
<td>Diagnostic VATS wedge resection</td>
<td>Adenocarcinoma</td>
<td>Definitive chemo-radiotherapy</td>
<td>IIIB</td>
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<tr>
<td>8</td>
<td>4B</td>
<td>Bronchoscopy and Mediastinoscopy (LLL segmentectomy)</td>
<td>Adenocarcinoma</td>
<td>Chemotherapy</td>
<td>IB</td>
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<tr>
<td>9</td>
<td>4B</td>
<td>Bronchoscopy</td>
<td>Squamous Cell Carcinoma</td>
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<td>VATS lobectomy</td>
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<td>Adenocarcinoma</td>
<td>Adenocarcinoma</td>
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</tr>
</tbody>
</table>

S. Chris Malaisrie¹, Patrick M. McCarthy¹, Jane Kruse², Adin-Cristian Andrei³, Maria Grau-Sepulveda⁴, Daniel J. Friedman⁵, James L. Cox¹, J. Matthew Brennan⁴

¹Northwestern University Feinberg School of Medicine, Chicago, IL; ²Northwestern Medicine, Chicago, IL; ³Northwestern University, Chicago, IL; ⁴Duke University, Durham, NC; ⁵Duke Univeristy, Durham, NC

DISCUSSANT: WILLIAM T. CAINE

OBJECTIVES: Published reports on the association between preoperative atrial fibrillation (AF) and post-operative outcomes among patients undergoing coronary artery bypass grafting (CABG) have relied on single center, non-contemporary patient cohorts. This study compares early and late outcomes in patients with and without preoperative AF in a contemporary, nationally representative Medicare cohort.

METHODS: In the Medicare-Linked Society of Thoracic Surgeons database, 361,138 patients underwent isolated CABG from 2006 to 2013, of whom 37,220 (10.3%) had preoperative AF; 13,161 (35.4%) were treated with concomitant surgical ablation and were excluded from the analysis. Generalized estimating equations were used to compare 30-day mortality and combined perioperative major morbidity between groups. Long-term survival was summarized using Kaplan-Meier curves and the log-rank test (unadjusted), and Cox regression models (adjusted). Stroke incidence was modeled using the Fine-Gray model for competing risks and the CHA₂DS₂–VASc score was used to analyze stroke risk. Median follow-up was 4 years (IQR 2–6 years).

RESULTS: Preoperative AF was associated with a higher adjusted 30-day mortality (odds ratio [OR] 1.5 (95% confidence interval [CI] 1.39–1.62), p < 0.001) and combined major morbidity including stroke, renal failure, prolonged ventilation, reoperation, and mediastinitis (OR 1.32 (CI 1.27–1.37), p < 0.0001). Likewise, patients with preoperative AF experienced a higher adjusted long-term risk of all-cause mortality (hazard ratio [HR] 1.45 (CI 1.41–1.48), p < 0.001, Figure) and stroke (HR 1.24 (CI 1.19–1.30), p < 0.001) compared to those without preoperative AF. At five years, the survival probability in the preoperative AF group by CHA₂DS₂–VASc scores was 74.8% (score 1–3), 56.5% (score 4–6), and 41.2% (score 7–9) [p < 0.001]; and the cumulative incidence of stroke was 7.9% (score 1–3), 12.2% (score 4–6), and 15.4% (score 7–9) [p < 0.001].
CONCLUSIONS: Without concomitant AF ablation, preoperative AF is independently associated with worse early and late post-operative outcomes. The long-term risk of stroke and mortality increases with increasing CHA$_2$DS$_2$–VASc score. Further analyses of the comparative effectiveness of concomitant AF ablation and/or left atrial appendage interventions have important implications for this high-risk cohort.
7. **Long-Term Transplant Outcomes of Donor Hearts with Left Ventricular Dysfunction**

Agustin Sibona¹, Kiran K. Khush², Udo E. Oyoyo¹, Timothy P. Martens¹, Nahidh W. Hasaniya¹, *Anees J. Razzouk¹, *Leonard L. Bailey¹, *David G. Rabkin¹

¹Loma Linda University Medical Center, Loma Linda, CA; ²Stanford University Medical Center, Palo Alto, CA

**DISCUSSANT: MURRAY H. KWON**

**OBJECTIVES:** Despite several single-center reports demonstrating acceptable short and medium term transplant outcomes using donor hearts (DH) with left ventricular (LV) systolic dysfunction, 19% of hearts eligible for transplantation in the current era are not utilized exclusively due to LV dysfunction. The purpose of this study was to investigate modern, long-term outcomes of transplanted DH with LV systolic dysfunction with a large cohort from a diverse group of transplant centers.

**METHODS:** Using the United Network for Organ Sharing transplant database, we reviewed all adult, isolated heart transplants between January 1, 2000 and March 31, 2016. Transplanted DH were divided into four groups: Group 1: LV ejection fraction (EF) ≥ 55%, Group 2: LVEF 40–49%, Group 3: LVEF 30–39% and Group 4: LVEF 20–29%. DH with no recorded LVEF, LVEF < 20% and LVEF ≥ 50% but <55% were excluded from the study. Kaplan-Meier survival curves were compared among recipient groups. A covariates-adjusted Cox regression model with robust standard errors was developed to estimate post-transplant mortality Hazard Ratios (HR) with 95% confidence intervals (CI) for LV dysfunction. Covariates in the model included donor and recipient age, gender, race, body mass index and mechanism of death. Baseline characteristics and postoperative length of stay (LOS) were also compared between groups.

**RESULTS:** 31,735 DH were transplanted during the study period (Group 1: n = 28,044, Group 2: 595, Group 3: 96, Group 4: 21) 279 were excluded for not having a recorded LVEF, 758 were excluded for LVEF < 20% and 1,942 were excluded for LVEF ≥ 50% but <55%. Median follow-up was 4,333 days. Comparison of Kaplan-Meier curves revealed no statistically significant differences in recipient survival between groups up to 6000 days of follow up (P = 0.105, Log-Rank test) although there was a statistically insignificant trend towards reduced survival in Group 4 that became apparent after 3000 days. Covariates-adjusted HR for LV dysfunction showed that for every 10% point increase in LVEF, there was a 1.2% decrease in mortality (HR = 0.988, 95% CI = 0.991–1.001). DH with diminished LVEF were younger (Group 1: 32.1 ± 12.0, Group 2: 27.6 ± 10.9, Group 3: 23.9 ± 8.8, Group 4: 22.9 ± 9.0,

* WTSA Member
p < 0.001), more likely to be from male donors (Group 1 % male: 70.45%, Group 2: 74.29%, Group 3: 78.13% and Group 4: 71.43, p < 0.001) and had lower mean body mass index (Group 1: 26.9 ± 5.6, Group 2: 25.5 ± 4.7, Group 3: 24.6 ± 4.9, Group 4: 25.2 ± 5.2, p < 0.001). Differences in postoperative LOS were significant (Group 1: 20.32 days ± 23.79 SD, Group 2: 23.89 ± 28.48, Group 3: 31.19 ± 52.93 and Group 4: 12.6 ± 8.03, p = 0.0007).

**CONCLUSIONS:** Selected DH with LVEF 40–49% can be transplanted with recipient survival equivalent to DH with normal LV systolic function. Although hospital LOS is increased in recipients of DH with LVEF 30–39%, these hearts may be transplanted with excellent long-term outcomes. Carefully selected potential DHs with LVEF ≥ 30% should not be excluded from consideration of transplantation on the basis of depressed LVEF alone.
11:40 am – 12:25 pm  **CONTROVERSIES DEBATE, Intl Center North**

*We Are Ready for Competency-Based Cardiac Surgical Training*

Moderator: Sean C. Grondin

**Pro:** *We Are Already Doing It!*
David Latter

**Con:** *Wait! We Are Not Ready!*
Edward D. Verrier

12:30 pm – 1:45 pm  **LUNCH SYMPOSIUM (Non – CME), Colorado Hall B**

*Sponsored by Medtronic*

1:45 pm – 3:45 pm  **RESIDENT SYMPOSIUM – Transition to Practice, Colorado Hall B**

Moderators: James I. Fann
            Nahush A. Mokadam

1:45 pm – 1:55 pm  **Introduction**

Nahush A. Mokadam
*University of Washington*

1:55 pm – 2:05 pm  **Where Are the Jobs?**

Craig H. Selzman
*University of Utah*

2:05 pm – 2:20 pm  **Interview Preparation**

Leah M. Backhus
*Stanford School of Medicine*

2:20 pm – 2:35 pm  **Negotiating a Contract**

David M. McMullan
*Seattle Children’s Hospital*

2:35 pm – 2:50 pm  **Transition to Practice – University**

Dustin M. Walters
*University of Virginia*

2:50 pm – 3:05 pm  **Transition to Practice – Non University**

Anthony P. Furnary
*Starr-Wood Cardiac Group*
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:05 pm – 3:20 pm</td>
<td><strong>They Never Taught Me That in Residency</strong></td>
<td>Craig J. Baker</td>
<td>University of Southern California, Keck School of Medicine</td>
</tr>
<tr>
<td>3:20 pm – 3:35 pm</td>
<td><strong>Social Media</strong></td>
<td>Thomas K. Varghese Jr.</td>
<td>University of Utah</td>
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<tr>
<td>3:35 pm – 3:45 pm</td>
<td><strong>Question and Answer</strong></td>
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<tr>
<td>5:00 pm – 6:30 pm</td>
<td><strong>EVENING SYMPOSIUM (Non-CME), Colorado Hall B</strong></td>
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FRIDAY, JUNE 23, 2017

6:00 am – 12:00 pm  REGISTRATION, Intl Center Foyer

6:00 am – 12:00 pm  SPEAKER READY ROOM, Intl Center Foyer

6:30 am – 7:50 am  BREAKFAST SESSION, Colorado Hall B
Losing Our Shirts: The Impact of Disruptive or Novel Technology on Our Livelihood
Moderator: David A. Fullerton
Speakers:
  - Adult Cardiac: Y. Joseph Woo
  - General Thoracic: Michael A. Smith
  - Congenital Heart: James Jaggers

7:00 am – 12:00 pm  EXHIBITS, Intl Center South

7:00 am – 8:00 am  BREAKFAST, Intl Center South

8:00 am – 8:50 am  POSTGRADUATE COURSE
intl Center North
Young Blood for Old Brains
Tony Wyss-Coray
Stanford University, Standford, CA
8:50 am – 10:30 am  **SCIENTIFIC SESSION III**

*Presentation*  

**Intl Center North**  
*(10 minutes presentation, 10 minutes discussion)*

**Moderators:** Leah M. Backhus  
Richard J. Shemin

**8. Should Thoracic Surgeons Be Doing EBUS and Other Advanced Bronchoscopic Cases?**  
*Richard Whyte, Jorind Beqari, Lukas Ritzer, Jennifer Wilson, Sidhu Gangadharan, Adnan Majid, Michael Kent*  
*Beth Israel Deaconess Medical Center, Boston, MA*  

**DISCUSSANT:** JASMINE HUANG

**BACKGROUND:** Bronchoscopic procedures have, historically, been the purview of thoracic surgeons. The development of the field of Interventional Pulmonology (IP) has created a scenario where non-surgeons compete with surgeons for cases done in an operating room. In spite of having a strong theoretical and practical background for doing these cases, relatively few thoracic surgeons have taken up the mantle of this new specialty. We hypothesize that one reason for the relative paucity of surgeons taking up these procedures is because they are perceived as providing less compensation per hour of Operating Room (OR) time; i.e., it is inefficient use of their time. To determine whether such a reimbursement discrepancy exists, we examined actual reimbursement for a variety of thoracic surgical and IP cases.

**METHODS:** Case duration, OR and total patient contact time, billed and actual reimbursements were determined for eight types of thoracic surgical and two types of IP cases in an academic thoracic surgical and IP practice.

**RESULTS:** Billing and reimbursement data from a total of 464 (366 surgical and 98 IP) cases were reviewed. Thoracic surgical payments per OR hour ranged from $380 to $688 (mean $495). When considering time for post-op management as well, the rates ranged from $270 to $436 (mean $368) (Figure). VATS decortication and open lobectomy had the highest hourly reimbursement rates while mediastinoscopy and laparoscopic hiatal hernia repair were the lowest. For IP cases, the average reimbursement rate was $292 for OR time only—with little difference when accounting for post-procedure care time.

* WTSA Member
CONCLUSIONS: Hourly rates of reimbursement for thoracic surgical procedures were reasonably consistent across procedures and were, on average, 26% greater than IP procedures. Surgeons with busy surgical schedules may be better off encouraging the development of an independent IP practice in their institutions while surgeons with relatively open schedules could capture significant revenue by adopting IP procedures.
9. Immediate Extubation in the Operating Room After Pediatric Cardiac Surgery; Its Incidence and Risk Factor for Reintubation

Takeshi Shinkawa, Jessica Holloway, Xinyu Tang, Jeffrey M. Gossett, Rahul Dasgupta, Michael L. Schmitz, Michiaki Imamura

Arkansas Children’s Hospital, Little Rock, AR

DISCUSSANT: SAMEH M. SAID

OBJECTIVES: The objectives of this study were to access the incidence of immediate endotracheal extubation in the operating room after pediatric cardiac surgery and the factors associated with immediate extubation, and to investigate risk factors for reintubation after immediate extubation at a single institution.

METHODS: This is a retrospective study for all patients who had cardiac surgery with cardiopulmonary bypass from January 2011 through June 2016 at a single institution. Patients who were intubated preoperatively and who had an open sternum or mechanical circulatory support postoperatively were excluded since they were not candidate for immediate extubation. Risk factor analysis for reintubation after immediate extubation was performed only for a subset of patients who underwent the stage II palliation (Glenn or Hemi-Fontan operation) for single ventricle physiology.

RESULTS: Nine hundred and nine patients who were candidates for immediate extubation in the operating room were identified. Immediate extubation was performed in 591 patients (65.0%), and the incidence of immediate extubation increased during the study period in all age groups. A multiple logistic regression model showed that surgeries performed in more recent years (p < 0.001), shorter cardiopulmonary bypass times (p < 0.001), shorter aortic cross clamp times (p = 0.008), and lower STAT scores (p < 0.001) were significantly associated with immediate extubation. The identities of the surgeon (p = 0.041) and the anesthesiologists (p < 0.001) were also associated with immediate extubation. Reintubation in the intensive care unit was performed for 37 patients among 591 immediate extubation patients (6.3%), significantly less frequent reintubation rate when compared to those without immediate extubation (49 patients among 320 non-immediate extubation patients, 15.3%; p < 0.001). Between patients with reintubation after immediate extubation and those without in the stage II palliation, there were significant differences in age (0.4 vs. 0.5 years, p = 0.044), pO2/FiO2 at the last blood gas analysis (suggestive of lung injury, 66 vs. 98 mmHg, p = 0.032), pO2 at last blood gas analysis (39 vs. 47 mmHg, p = 0.008), inotropic score (4 vs. 0, p = 0.014), and intraoperative packed red blood cell use (420 vs. 334 ml, p = 0.006). A univariate analysis showed that younger age (p = 0.061), higher inotropic score (p = 0.056), and lower pO2/FiO2 (p = 0.032) were associated with reintubation after immediate extubation in univariate model, and only younger age (p = 0.042) was associated in multivariable model.
CONCLUSIONS: Immediate tracheal extubation in the operating room after pediatric cardiac surgery with cardiopulmonary bypass can be performed safely in many patients. Age is a predictor for reintubation after immediate extubation in the stage II palliation for patients with single ventricle physiology.
BACKGROUND: Bilateral internal mammary artery (BIMA) use is shown to have a survival advantage over left internal mammary artery and saphenous vein grafts (LIMA-SV) for multivessel coronary artery disease. It is uncertain whether BIMA is beneficial in perceived “high risk” patients. We sought to identify the trends in BIMA use, and impact of patient co-morbidities on relative benefit of BIMA versus LIMA-SV.

METHODS: A retrospective review of all isolated Coronary artery bypass grafting (CABG) for multivessel coronary artery disease at our institution from 2000 to 2015 was performed. Propensity score matching was done between the BIMA and the LIMA-SV group (1128 matched pairs) to control for age, gender, smoking status, diabetes, body mass index (BMI), peripheral vascular disease, cerebrovascular disease, chronic lung disease (CLD), renal failure, ejection fraction (EF), left main > 50%, number of diseased coronary vessels, and emergent surgery. BIMA use in “High risk” patients (EF < 30, BMI > 30, age > 70, diabetes mellitus, CLD, cerebrovascular accident) was evaluated and its effect on survival was sought. We also compared operative, cardiopulmonary bypass (CPB), and cross clamp times between the groups given the potential for these variables to influence conduit selection.

RESULTS: A total of 9,084 CABG procedures were performed (7,901 LIMA-SV, 1,183 BIMA) during the study period. There was an increasing trend in BIMA utilization across the 15 year period (P = 0.049), with a higher percentage noted in each of the last 5 years, increasing from 11% in 2011 to 25% in 2015. Propensity-matched comparisons showed a survival advantage for the BIMA group (Hazard Ratio 0.80, Confidence Interval 95%, 0.65, 0.98, P = 0.028) (Figure 1) but with twice the incidence of sternal site infection (BIMA 3.0%, LIMA 1.4%, P = 0.010). None of the “high risk” patient factors had an adverse bearing on the survival of BIMA patients [age >70 years (P = 0.768), EF < 30% (P = 0.474), BMI > 30 (P = 0.250), gender (P = 0.642), diabetes mellitus (P = 0.699), cerebrovascular accident (P = 0.887), CLD (P = 0.883), non-elective surgery (P = 0.849)] or showed a differential effect of BIMA on sternal site infection. BIMA use was associated with shorter aortic cross clamp time (P < 0.001) but higher CPB and incision times (P < 0.001).
CONCLUSIONS: We observed an increased use of BIMA in recent years. Selected “high risk” patients even with age more than 70 years, diabetes mellitus, higher BMI and CLD, can benefit from BIMA over LIMA-SV in multivessel CABG.
11. Pretreatment with Diazoxide Enhances the Neuroprotective Function of Erythropoietin Against Spinal Cord Ischemia and Reperfusion Injury Through Upregulation of Beta Common Receptor


University of Colorado, Aurora, CO

DISCUSSANT: FERNANDO FLEISCHMAN

OBJECTIVE: Paraplegia remains a most terrible complication of thoracoabdominal aortic intervention. While erythropoietin (EPO) has shown the neuroprotective effects in spinal cord ischemia, EPO does not work until the Beta Common Receptor (bcR) subunit of the EPO receptor is induced by ischemia. Diazoxide (DZ) has been shown to mediate the neuroprotective preconditioning effect against ischemic insult. We hypothesized that bcR induced by DZ prior to ischemia amplifies the neuroprotective effects of EPO in mouse with spinal cord ischemia-reperfusion injury.

METHODS: To determine the optimal time to administer DZ, adult male C57/BL6 received DZ (40 mg/kg) by oral gavage. At time points 0, 12, 24, 36 and 48 hours following the administration of DZ, spinal cords were harvested. The expression of bcR was assessed by western blot analysis (WB). For the optimal dosing, DZ (0, 5, 10, 20, 40 mg/kg) was administered. The expression of bcR was analyzed by WB. To determine the optimal dosage of EPO, one or two daily intraperitoneal injection of EPO (10 or 40 μg/kg) was given 4 hours before surgery. Then spinal cord ischemia was induced by 4-minutes thoracic aortic cross-clamp, and functional scoring (Basso Mouse Score) was assessed after 48 hours reperfusion. Four groups were studied: PBS (pretreatment)+PBS (4 hours before surgery) (n = 10), PBS + EPO (n = 7), DZ + PBS (n = 7), DZ + EPO (n = 7), and sham ischemia (operation without cross-clamping, n = 4). After 4-minutes thoracic aortic cross-clamp, functional scoring was done at 12-hour intervals until 48 hours, and spinal cords were harvested for histological analysis. In these 4 groups, spinal cords were harvested 0, 1, 2, 4 and 6 hours after injection of EPO or PBS, and activation of AKT, STAT3, and CREB were evaluated by WB.

RESULTS: Optimal bcR upregulation occurred 36 hours after administration of DZ. Optimal dosage for bcR induction was 20 mg/kg of DZ. Optimal dosage of EPO was one daily injection of 40 μg/kg. The motor function of DZ+EPO (6.7 ± 1.0) 48 hours after reperfusion was significantly preserved compared to all other groups (Figure),
while the DZ + PBS (3.2 ± 0.9) and PBS + EPO (3.4 ± 1.0) groups were significantly better than PBS + PBS (0 ± 0.9) respectively. In DZ + PBS and PBS + EPO group, there were significantly more viable neurons in anterior horn of spinal cord than PBS + PBS. Moreover mice treated with DZ + EPO had significantly more comparing mice treated with DZ + PBS and PBS + EPO. Activation of AKT, STAT3, and CREB in DZ + EPO group peaked 4 hours after injection of EPO. AKT and STAT3 activation in DZ + EPO 4 hours after injection was highest comparing all other groups.

Postoperative motor function

CONCLUSIONS: Pharmacological upregulation of bcR with DZ can increase the efficacy of EPO in preventing the spinal cord ischemia and reperfusion injury. Better understanding of this two stage protective mechanism may serve to further prevent ischemic complications for high risk aortic intervention.
Pre-Operative Pulmonary Hypertension for Left Ventricular Assist Device Patients Does Not Adversely Impact Long Term Outcomes Following Heart Transplantation: Review of the United Network for Organ Sharing Database

Ann C. Gaffey, Jennifer J. Chung, Carol W. Chen, Mallory L. Irons, Michael A. Acker, Pavan Atluri
Hospital of the University of Pennsylvania, Philadelphia, PA

DISCUSSANT: STEPHEN H. MCKELLAR

OBJECTIVES: Severe pre-transplant pulmonary hypertension (PH) has been associated with adverse short-term clinical outcomes after heart transplantation. Improvement in PH through the use of a left ventricular assist device (LVAD) has enabled a subset of patients to be eligible for heart transplantation. Skepticism remains, however, in the long-term post-transplant survival in patients with continued elevations in PH post-LVAD implant. We investigated the association of pre-transplant PH in BTT patients with post-transplant outcomes in the United Network for Organ Sharing dataset (UNOS).

METHODS: We retrospectively analyzed UNOS adult heart transplant data from June 2004 to December 2013. Pre-transplant pulmonary vascular resistance (PVR) was noted in 48,993 patients (53%). Presence or absence of mechanical support was noted in 3,951 patients (4.3%). The recipients were divided into three cohorts based on PH category: no PH BTT (0–1 Wood units, n = 281), moderate PH BTT (1–3 Wood units, n = 1,454), and severe PH BTT (3+ Wood units, n = 592). Analysis of morbidity and mortality was conducted.

RESULTS: No differences existed with regard to recipient age (p = 0.07), gender (p = 0.85), or presence of diabetes (p = 0.47), cerebral vascular disease (p = 0.60), kidney (p = 0.53) or liver dysfunction (p = 0.79), and waitlist time (p = 0.42). Donors did not differ in age (p = 0.13), gender (p = 0.10), left ventricular ejection fraction (p = 0.26) or allograft ischemic time (p = 0.24). Post-operatively, the incidence of re-operation (p = 0.67), stroke (p = 0.48), dialysis (p = 0.67), infection (p = 0.37), and heart block (p = 0.77) were similar amongst the three cohorts. The rate of rejection was low and statistically similar in all three cohorts (4.5%, 2.3%, vs. 3.7%, p = 0.33). There was no difference in length of hospital stay (p = 0.56). One year (91.6%, 90.0%, vs 87.0%), three year (83.7%,82.5%, vs 81.0%) and 5 year (76.3%, 73.5%, vs. 71.5%) survival were similar in all cohorts, using Kaplan-Meier Survival Analysis (log rank p = 0.4310).
CONCLUSIONS: For patients bridged to transplantation with an LVAD, the presence of pre-transplant PH does not appear to affect recipient outcomes following heart transplantation, in this study population. Reconsideration of the role of pulmonary hypertension in post-transplant outcomes may be warranted.

10:30 am – 11:00 am  COFFEE BREAK: VISIT EXHIBITS & POSTERS,  
Intl Center South
**OBJECTIVES:** The Centers for Medicare and Medicaid Services (CMS) have announced their intention to implement a bundled payment model for coronary artery disease that will emphasize quality of care instead of quantity of care. Given this impending change in the regulatory environment, cardiothoracic surgeons must develop systems and methods to define achievable clinical metrics that are correlated with costs of care. This will allow surgeons to measure, track, and improve quality and value of care in order to successfully build and maintain a practice within the new CMS payment structure. Using unique tools merging costing and our electronic data warehouse, we sought to determine the cost-effectiveness and value of achieving “perfect” post-operative care in patients undergoing CABG. We report the results of our iterative value driven process as a model for cardiothoracic surgeons to adapt individual practices and health care systems to flourish in this new environment.

**METHODS:** In the first phase of the study, we tracked seven Society of Thoracic Surgery Database-derived measures of quality, including (1) antibiotics delivered within one hour prior to surgery, (2) antibiotics discontinued between 24–48 hours post-operatively, (3) antiplatelet prescribed at hospital discharge, (4) anti-lipid prescribed at discharge, (5) use of internal mammary artery, (6) no reintubation, and (7) beta-blockers prescribed at hospital discharge. In the second phase of our protocol-driven process, we tracked (8) discontinuation of inotrope use within 24 hours, and (9) use of <500 mL of albumin for resuscitation. All data were collected directly from our institution’s electronic medical record using automated systems. “Perfect care” was defined as achieving ALL nine metrics per patient episode. Costs were calculated as the mean of total, as well as by categories including but not limited to facility utilization, supplies, pharmacy, laboratory, and imaging.
RESULTS: Over a 26-month period, 381 consecutive, risk-unadjusted patients undergoing isolated CABG were analyzed. Perfect care was successfully achieved in 257 patients (67%). There were no observed differences in mortality between patient groups. In examining causes for not meeting perfect care, failure to extubate within 24 hours, reintubation, failure to wean inotrope therapy off within 24 hours, and failure to use less than 500mL of albumin most commonly displayed variable compliance, whereas pass rates for the other 6 metrics were above 95%. In this cohort, total cost for patients with perfect care was 45% less than those without perfect care. The largest reductions in costs were related to facility utilization and respiratory therapy services.

CONCLUSIONS: When perfect care is achieved in patients undergoing CABG, significant cost-reductions can be obtained. Innovative tools linking automated tracking of quality metrics to costing provide significant opportunities for focused interventions (e.g., ventilator weaning protocols) that increase quality, decrease costs, and thereby enhance the value of CABG for our patients and healthcare system. This study provides evidence for the effectiveness of a systematic approach to define, measure and modulate the drivers of value for cardiothoracic surgery patients.
Variability in Invasive Mediastinal Staging for Lung Cancer: A Multi-Center Regional Study

Lucas W. Thornblade¹, *Douglas E. Wood¹,
*Michael S. Mulligan¹, Alexander S. Farivar²,
*Michal Hubka³, Kimberly E. Costas⁴,
*Bahirathan Krishnadasan⁵, Farhood Farjah¹

¹University of Washington, Seattle, WA; ²Swedish Cancer Institute, Seattle, WA; ³Virginia Mason Medical Center, Seattle, WA; ⁴Providence Regional Medical Center, Everett, WA; ⁵CHI Franciscan Health System, Tacoma, WA

DISCUSSANT: JANE YANAGAWA

OBJECTIVES: We sought to determine whether rates of invasive mediastinal staging for lung cancer varied across hospitals participating in a regional quality improvement and research collaborative.

METHODS: We performed a retrospective study (July 2011–December 2013) of resected lung cancer patients treated in the Puget Sound region of Washington State using data from the Surgical Clinical Outcomes and Assessment Program (a physician-led quality initiative that monitors performance by benchmarking processes of care). Invasive mediastinal staging was defined by mediastinoscopy (MED), endobronchial ultrasound-guided nodal-aspiration (EBUS), and/or esophageal ultrasound-guided nodal-aspiration (EUS) performed prior to and/or at the time of lung resection. In order to avoid inflated estimates of hospital-level variation, we used a mixed-effects model to account for the influence of chance (which can arise from relatively small sample sizes/surgical volumes at any one hospital). We also adjusted for hospital-level differences in the frequency of clinical stage IA disease. A likelihood ratio test was used to test whether rates of invasive staging varied across hospitals.

RESULTS: A total of 406 patients (mean age 68 years, 57% female, 69% clinical stage IA, 83% lobectomy, and 40% thoracotomy) underwent resection at 5 hospitals (4 community, 1 academic). Overall, invasive staging occurred in 66% of patients (95% confidence interval 61–71%). Mediastinoscopy was the most commonly performed invasive staging modality (MED only 85%; EBUS & MED 11%; EBUS only 3%; EBUS, EUS & MED <1%). Rates of invasive staging varied significantly (p < 0.001) across hospitals after adjusting for random variation (i.e. chance) and clinical stage (Figure). Adjustment for clinical stage accounted for only 3% of the observed variability in rates of invasive staging across hospitals. Confidence interval inspection revealed that two hospitals performed invasive staging significantly more often than the population average, whereas two hospitals performed invasive staging significantly less often than the overall average (Figure).

* Samson Resident Prize Essay
* WTSA Member
CONCLUSIONS: We demonstrate—for the first time—that rates of invasive mediastinal staging vary significantly across hospitals. Variation not explained by chance or case-mix is often believed to represent poor quality care. However, because low levels of evidence support current practice guidelines, it is equally plausible that variation in care could represent clinical uncertainty over the appropriate indications for invasive mediastinal staging. A randomized trial comparing patient outcomes between varying staging strategies may clarify the indications for invasive mediastinal staging.
15. Ninety Day Readmissions of Bundled Valve Patients: Implications for Healthcare Policy

Michael S. Koeckert, Eugene A. Grossi, Mathew R. Williams, Gary Kalkut, Didier F. Loulmet, Elias A. Zias, Michael Querijero, Aubrey C. Galloway

NYU School of Medicine, New York, NY

DISCUSSANT: RICHARD L. PRAGER

OBJECTIVE: Medicare’s Bundle Payment for Care Improvement (BPCI) Model 2 bundles the cost of valve surgery into 90-day episodes of care (EOC) which include the operative cost, in-patient stay, physician fees, post-acute care, and any readmission during the 90-day EOC. As we undergo a national review of recent healthcare initiatives, there is little data to understand the appropriateness of such financial models. To explore this risk-bearing, we analyzed our BPCI patient’s outcomes and EOC thru 90 days to understand the financial impact and sustainability of the bundle payment system for valve patients.

METHODS: We previously implemented management strategies including pre-surgical risk stratification, standardized post-discharge management led by cardiac nurse practitioners (CNP) and post-discharge emergency department triage protocols. For the first 30 postoperative days the CNP’s maintain weekly contact, use telemedicine, and attempt to guide any post-discharge encounters (PDE); when possible <48 hr hospital observation was utilized instead of full readmission. All PDEs were tracked prospectively. The Medicare master claims data was incorporated to provide details of all (internal and external) 30–90 readmissions. We analyzed all bundled readmissions as tabulated by Medicare, for all BPCI valve patients from 10/13 (start of risk sharing phase) through 12/15.

RESULTS: Analysis included 376 BPCI valve patients—202 open surgical valves and 174 transcatheter aortic valves (TAVR). TAVR patients were older (83.6 vs 73.8 years; p = 0.001) and had higher STS predicted risk (7.1% vs 2.8%; p = 0.001). Readmissions were categorized as early (≤30 days) or late (31–90 days). Overall, 18.6% of patients (70/376) had one or more readmission within 90-days. Readmissions were more common among TAVR patients (22.4% (39/174) vs 15.3% (31/202), p = 0.05). While there was no difference between early readmission claims, TAVR patients had significantly higher late readmissions and greater late claims cost. See Table. Those patients having an early readmission were at no higher risk of subsequent late readmission (2/20; 10.0%) for open valves, but more likely to have subsequent late-readmission (8/21; 38.1%) for TAVR (p = 0.04). Univariate analysis revealed that older age (81.4 vs 77.9 years; p = 0.02), diabetes (46.7% vs 21.6%; p = 0.05), and having two falls in the 6 months prior to surgery (13.3% vs 5%; p = 0.08) were associated with late readmission.
<table>
<thead>
<tr>
<th>Patients with any Readmission</th>
<th>All Bundle Valves (n = 376)</th>
<th>Open Valves (n = 202)</th>
<th>TAVR (n = 174)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 (18.6%)</td>
<td>31 (15.3%)</td>
<td>39 (22.4%)</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Patients with Early Readmission</td>
<td>41 (10.9%)</td>
<td>20 (9.9%)</td>
<td>21 (12.1%)</td>
<td>0.65</td>
</tr>
<tr>
<td>Patients with Late Readmission</td>
<td>39 (10.4%)</td>
<td>13 (6.4%)</td>
<td>26 (14.9%)</td>
<td>0.03</td>
</tr>
<tr>
<td>&gt;1 Early readmits</td>
<td>8 (2.1%)</td>
<td>3 (1.5%)</td>
<td>5 (2.9%)</td>
<td>0.28</td>
</tr>
<tr>
<td>&gt;1 Late readmits</td>
<td>10 (2.7%)</td>
<td>5 (2.5%)</td>
<td>5 (2.9%)</td>
<td>0.81</td>
</tr>
<tr>
<td>Late readmit dollars Mean [sum]</td>
<td>$14,179 [553,018]</td>
<td>$10,740 [139,628]</td>
<td>$15,899 [413,389]</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**CONCLUSION:** Significant bundle dollars are consumed by readmissions; particularly in TAVR, where early readmission predicts late readmission. Identifying high-risk patients may allow targeting resources for optimized late outpatient management. Alternatively, late readmissions in high-risk patients may represent chronic disease management and this group may not be appropriate for prolonged EOC risk sharing. These data question the appropriateness of such a national strategy.
12:30 pm – 1:45 pm LUNCH SYMPOSIUM (Non-CME), Colorado Hall B  
Sponsored by LivaNova

12:30 pm GOLF TOURNAMENT**, West Course

2:00 pm TENNIS TOURNAMENT**, Tennis Courts

6:00 pm – 10:00 pm THEME DINNER, Cheyenne Lodge

*Buses will loop from the Main Building beginning at 5:45 pm and the last bus will be at 10:15 pm.  
Country or Casual Attire.

** Separate Subscription Required
SATURDAY, JUNE 24, 2017

<table>
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<tr>
<th>Time</th>
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<th>Location</th>
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<tr>
<td>6:00 am – 12:00 pm</td>
<td>REGISTRATION, Intl Center Foyer</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>6:00 am – 11:30 am</td>
<td>SPEAKER READY ROOM, Intl Center Foyer</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>6:30 am – 10:30 am</td>
<td>EXHIBITS, Intl Center South</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>6:30 am – 7:30 am</td>
<td>BREAKFAST, Intl Center South</td>
<td>Intl Center South</td>
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<tr>
<td>7:00 am – 8:15 am</td>
<td>CONCURRENT FORUMS (5 minutes presentation, 3 minutes discussion)</td>
<td></td>
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ADULT CARDIAC

*Intl Center North*

Moderators: Brett T. Reece
            Howard K. Song

**CF1.** Ascending Thoracic Aortic Aneurysm Wall Stresses in Bicuspid Versus Tricuspid Aortic Valves

Yue Xuan, Raymond Liu, Henrik Haraldsson, Michael D. Hope, David A. Saloner, Julius M. Guccione, Liang Ge, *Elaine Tseng

*UCSF Medical Center and SFVAMC, San Francisco, CA*

**OBJECTIVES:** Guidelines for repair of bicuspid aortic valve (BAV) associated ascending thoracic aortic aneurysms (aTAA) have been changing, most recently to the same criteria as tricuspid aortic valve (TAV)-associated aTAA unless family history of dissection or sudden death exists. However, rupture or dissection occurs when wall stress exceeds wall strength. Recent studies suggest similar strength of BAV vs TAV aortic aneurysms; however, comparative wall stresses between BAV and TAV are unknown. Our hypothesis was that BAV and TAV aTAA had similar wall stresses and our objective was to compare based upon patient-specific aTAA geometries, the wall stresses of BAV vs TAV-aTAA.

**METHODS:** Patients with >4.5 cm diameter aTAA were recruited for the study and underwent ECG-gated computed tomography angiography. 3D geometry was reconstructed for each patient to determine patient-specific geometry, which was loaded to systemic pressure after determining pre-stress 0mmHg geometry. Finite element analyses were performed using LS-DYNA solver with user-defined fiber-embedded material model to determine aTAA wall stresses.

* WTSA Member
**RESULTS:** BAV and TAV aTAA patients (BAV = 16, TAV = 20) were included in the study. Peak first principal wall stress on BAV-aTAA patients was $808 \pm 269$ vs $865 \pm 328$ kPa ($p = 0.34$) for TAV-aTAA patients at systolic pressure, while at diastolic pressure, peak first principal wall stress for BAV-aTAA was $502 \pm 155$ vs $555 \pm 199$ kPa ($p = 0.27$) for TAV-aTAA patients. The peak 1st principal stress was not significantly correlated to the aneurysm diameter (Figure 1, $R^2 = 0.034$ for BAV aneurysms and 0.244 for TAV aneurysms). Peak second principal wall stress on BAV-aTAA patients was $370 \pm 72$ vs $412 \pm 140$ kPa ($p = 0.21$) for TAV-aTAA patients at systolic pressure, while at diastolic pressure, peak second principal wall stress for BAV-aTAA was $256 \pm 58$ vs $275 \pm 100$ kPa ($p = 0.31$) for TAV-aTAA patients at diastolic pressure.

![Figure 1](image_url)
CONCLUSIONS: For this population of >4.5 cm thoracic aortic aneurysms, the 1\textsuperscript{st} and 2\textsuperscript{nd} principal wall stresses was comparable between BAV and TAV-associated aTAA. Given the lack of correlation between peak wall stress and aneurysm diameter, this study highlights the need for patient-specific aneurysm wall stress analysis to determine clinical risk of aortic dissection.
CF2. Vascular Complications in the Sapien 3 Era: Continued Role of Transapical Approach to TAVR
UCLA Medical School, Los Angeles, CA

OBJECTIVE: With the introduction of the latest generation Sapien 3 transcatheter aortic valve, there has been a reduction in the usage of transapical (TA) approach for TAVRs in many centers. However, despite the smaller sheath size and more streamlined delivery system, vascular complications continue to occur, especially in patients with peripheral vascular disease. Thus, our institution has maintained a stringent TA protocol aiming to prevent these complications. We hypothesize that this protocol has helped to reduce vascular complications and improve outcomes at our institution even in the Sapien 3 era.

METHODS: All TAVR procedures done at our institution were considered for analysis. Patients were grouped according to whether their procedure was done before (Pre-S3) or after (S3) the introduction of the Sapien 3 valve as well as whether they underwent a transapical or transfemoral (TF) approach. Femoral artery intraluminal diameter of <7.5 mm in the Pre-S3 era and <5.5 mm in the S3 era with circumferential calcifications triggered TA approach consideration. Vascular complications included vascular perforation, dissection, flow-limiting stenosis, unplanned vascular surgery, significant post-procedural bleeding, hematoma at access site, and retroperitoneal bleed. Welch’s t-test of unequal variance and chi-squared tests were used as appropriate. An alpha of <0.05 was considered significant.

RESULTS: 275 total patients were included in the analysis (121 Pre-S3, 154 S3). TA approach was utilized in 45% of Pre-S3 Era vs. 15% in the S3 Era (p < 0.001). Within the S3 era, 131 underwent TF approach compared to 23 undergoing TA. TA and TF patients were similar in all preoperative characteristics except hypertension (Table 1). Mortality was significantly lower in the S3 era (0% vs 4% in the pre-S3 era, p = 0.02). Overall rates of vascular complications were similar between the Pre-S3 and S3 eras (15.7% vs 13.5%, p = 0.63). Overall adverse outcomes were similar between TA and TF groups. TA patients saw significantly longer intensive care unit (ICU) and total hospital stay (Table 2).

* WTSA Member
Table 1: Sapien 3 Era Patient Characteristics

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Total N = 154</th>
<th>TF N = 131</th>
<th>TA N = 23</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, (mean ± SD), years</td>
<td>80 ± 11</td>
<td>80 ± 12</td>
<td>82 ± 10</td>
<td>0.36</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>74 (48)</td>
<td>61 (47)</td>
<td>13 (57)</td>
<td>0.39</td>
</tr>
<tr>
<td>BMI, (mean ± SD), kg/m²</td>
<td>26.6 ± 5.7</td>
<td>26.8 ± 5.9</td>
<td>25.8 ± 3.9</td>
<td>0.32</td>
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<tr>
<td>Ejection Fraction, (mean ± SD)</td>
<td>55 ± 15</td>
<td>55 ± 15</td>
<td>55 ± 17</td>
<td>0.90</td>
</tr>
<tr>
<td>STS Risk Score, (mean ± SD)</td>
<td>7.3 ± 4.7</td>
<td>7.1 ± 4.7</td>
<td>8.7 ± 4.7</td>
<td>0.13</td>
</tr>
<tr>
<td>Hypertension, n (%)</td>
<td>128 (83)</td>
<td>106 (81)</td>
<td>22 (97)</td>
<td>0.01</td>
</tr>
<tr>
<td>Diabetes Mellitus, n (%)</td>
<td>42 (27)</td>
<td>36 (27)</td>
<td>6 (26)</td>
<td>0.89</td>
</tr>
<tr>
<td>Preop Creatinine, (mean ± SD)</td>
<td>1.4 ± 1.1</td>
<td>1.4 ± 1.1</td>
<td>1.5 ± 1.2</td>
<td>0.61</td>
</tr>
<tr>
<td>Dialysis, n (%)</td>
<td>10 (6)</td>
<td>8 (6)</td>
<td>2 (9)</td>
<td>0.69</td>
</tr>
<tr>
<td>Smoker, n (%)</td>
<td>6 (4%)</td>
<td>5 (4%)</td>
<td>1 (4%)</td>
<td>0.91</td>
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</tbody>
</table>

Table 2: Sapien 3 Era Outcomes

<table>
<thead>
<tr>
<th>Outcomes in Sapien 3 Era</th>
<th>Total N = 154</th>
<th>TF N = 131</th>
<th>TA N = 23</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality, n (%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>Major Vascular Complications, n (%)</td>
<td>21 (14)</td>
<td>19 (15)</td>
<td>2 (9)</td>
<td>0.40</td>
</tr>
<tr>
<td>MACE, n (%)</td>
<td>6 (4%)</td>
<td>4 (3)</td>
<td>2 (9)</td>
<td>0.37</td>
</tr>
<tr>
<td>Length of Stay, mean ± SD</td>
<td>5.9 ± 7.5</td>
<td>5.5 ± 7.8</td>
<td>8.3 ± 5.1</td>
<td>0.03</td>
</tr>
<tr>
<td>ICU Hours, mean ± SD</td>
<td>44 ± 65</td>
<td>38 ± 64</td>
<td>84 ± 11</td>
<td>0.001</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Our results show that despite a smaller sheath size, vascular complications continue at a similar rate into the Sapien 3 era. This occurred in the setting of an ongoing aggressive TA utilization in select patients, specifically those with peripheral vascular disease. Maintaining this approach is likely a large contributor to both our current success and reduced mortality.
OBJECTIVES: Multiple genes have been discovered which cause syndromic and non-syndromic thoracic aortic aneurysm and dissection (TAAD). This study reports our experience in genetic testing of 211 TAAD patients by whole exome sequencing (WES). We focus on the frequency distribution of genetic mutations/variants.

METHODS: WES was performed in 211 patients, mean age 56.5 ± 14.2 (range 15–83), 73.0% males (n = 154), 43.1% with positive family history of aneurysm disease (FHAD). The entire exome of these patients was scanned for genetic variants that might underlie TAAD, with concentrated focus on genes known to cause TAAD. Among patients found to carry suspicious mutations/variants, we plotted the frequency distribution of these genetic defects in all patients and in three sub-cohorts: 1) patients < 60 years, 2) patients with a positive FHAD, and 3) patients in whom rare and completely novel (previously unreported) variants were detected. The younger patients and those with a positive family history were expected to manifest stronger genetic influence.

RESULTS: Of 211 patients, 150 (71.1%) were found to carry no mutations in TAAD-related genes. Among the remaining 61 patients, 65 mutations/variants were identified as potentially causative of TAAD. 7 of these variants were deleterious (FBN1 (n = 3), TGFBR2 (n = 2), FLNA (n = 1), MYLK (n = 1)), while 58 were classified variants of uncertain significance (VUS). Among the VUS, 24 were found to be “common” (frequency > 1/10,000 (ExAC database)), while 11 were found to be rare (frequency <1/10,000), and 21 were completely novel (0 or 1 entry in the ExAC). Variants in FBN1, NOTCH1, and MYH11 genes were seen most commonly (17%, 15%, and 14%, respectively) accounting for half of all identified variants (Figure). ACTA2 variants were not seen with the expected high frequency. In patients < 60 years (n = 30, 49.2%) FBN1 and NOTCH1 variants were most frequent (23% each), followed by MYH11 (10%), and COL5A1, FLNA, MYLK genes (7% each). Among patients with a positive FHAD (30, 49.2%) the following genes were most commonly affected: FBN1 (22%), NOTCH1 (15%), MYH11 and MYLK (12% each). In patients with rare/novel variants (39, 63.9%) the most common variants were identified in the FBN1 gene (21%), NOTCH1 (12%), COL5A2, FLNA, and MYH11 genes (7% each). Patients with a positive FHAD showed a stronger tendency for variants/mutations than non-familial cases (35.2% vs. 24.2%, p = 0.08), as well as more rare/novel variants (78.1% vs. 58.6%, p = 0.10).
CONCLUSIONS: Genetic defects in TAAD-related genes are identified in a quarter of all tested patients. Contrary to previous reports, not the ACTA2, but MYH11 and NOTCH1 variants are most commonly found. Familial cases are more commonly “explained” by variants/mutations. Positive identification of variants/mutations permits personalized aneurysm and enables definitive screening of family members.
CF4. Is Prophylactic Ablation for Atrial Fibrillation Warranted During Mitral Surgery
Christopher Mehta¹, Patrick M. McCarthy¹, Adin-Cristian Andrei², Jane Kruse³, Andrei Churyla¹, S. Chris Malaisrie¹, Duc T. Pham¹, James L. Cox¹
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OBJECTIVES: Atrial fibrillation (AF) ablation is recommended during mitral valve (MV) surgery for patients with pre-operative AF. We sought to determine the incidence and risk factors for de novo AF in patients without pre-operative AF.

METHODS: From 2004–2014, 1288 patients had MV ± other cardiac procedures without known pre-operative AF. Of those, 930 patients had follow-up rhythm information available at 90 days or more after the index surgery, as determined by query of our longitudinal database. AF-free survival, de novo AF, and death probability estimates were obtained using a semi-competing risks multi-state model. Univariable and multivariable risk factors for developing AF were identified using the Fine-Gray model.
RESULTS: The 5- and 10-year incidence of de novo AF was 14% and 23%, respectively (Figure 1). Univariable risk factors for developing AF were older age, more comorbidities, more complex operations, more tricuspid valve regurgitation, higher CHA2DS2-VASc score, and congestive heart failure (CHF) (all p < 0.05). In univariate analysis patients with degenerative mitral regurgitation were less likely to develop AF (HR 0.4, 95% CI (0.24, 0.65), p < 0.001) compared to other etiologies. Multivariable risk factors for de novo AF were tricuspid valve surgery (hazard ratio HR = 1.84, 95% CI (1.23, 2.75), p = 0.003), aortic valve surgery (HR 1.66 (1.09, 2.52), p = 0.017), and older age (HR 1.03 (1.02, 1.04), p < 0.001). Low preoperative EF and CHF were not significantly associated with the risk of AF. Development of de novo AF was not significantly associated with lower overall survival (p = 0.4).

CONCLUSIONS: A steady rate of de novo AF develops after MV surgery. An adequately controlled randomized trial to detect a 5-year 40% reduction of AF with 80% power at 2-sided 5% α-level, would require 2392 patients which is not clinically feasible. Given that older age is a risk factor for de novo AF, a targeted trial of prophylactic ablation for high risk patients, such as those ≥65 years with multiple valve surgery, may be a more practical approach. We found no evidence at this time to support the practice of performing prophylactic AF surgery in MV surgery patients without a prior history of AF.
CF5. Midterm Results of a Novel Single Stage Hybrid Aortic Arch Replacement Technique to Reduce Bypass and Circulatory Arrest Duration


University of Washington, Seattle, WA

OBJECTIVES: Hybrid repair procedures of the aortic arch have been utilized to reduce surgical risks and apply this therapy to patients who would not traditionally be candidates for open surgical repair. We present a variation on the frozen elephant trunk technique to further reduce cardiopulmonary bypass and circulatory arrest duration.

METHODS: After initiation of cardiopulmonary bypass and during systemic cooling, a wire is advanced from the femoral artery into the aortic arch. In the case of aortic dissection, intravascular ultrasound is used to confirm true lumen placement. Under circulatory arrest, the proximal aortic arch is resected and the wire externalized. Antegrade deployment of a stent graft is performed into the aortic arch and proximal descending aorta. The ascending aortic graft is sewn to the cut end of the aorta, incorporating the stent graft. The graft is cannulated and CPB reinitiated. The remainder of the arch replacement is performed during re-warming.

RESULTS: Sixteen patients underwent this novel hybrid arch replacement procedure for aortic pseudoaneurysm, aortic dissection, or aneurysm. In comparison to the frozen elephant trunk procedure, where a dacron graft is inserted into the descending aorta, and later fixed with an endograft, this technique allows for immediate distal fixation. In the case of aortic dissection, there is immediate expansion of the true lumen with distal seal, potentially obviating the need for additional procedures. Mean duration of follow up is 12 months (range 1–14 months). The mean duration of cardiopulmonary bypass was 110.19 ± 4.17 minutes. The mean duration of circulatory arrest was 18.63 ± 1.81 minutes at a mean temperature of 22.63 ± 0.63 degrees Celsius. There were no mortalities, no permanent disabling strokes, and no renal failure requiring dialysis.

* WTSA Member
CONCLUSIONS: This novel hybrid technique for aortic arch replacement is safe, significantly reduces cardiopulmonary bypass and circulatory arrest times, and is performed readily without need for fluoroscopy. In patients with thoracoabdominal aneurysms, the stent graft can be used as an elephant trunk for further TAAA repair or branched TEVAR procedures.
CF6. Long-Term Outcomes of Aortic Valve Replacement in Adults ≤40 Years Old: An Analysis of 1478 Patients in 136 Hospitals in the State of California
Stanford University, Stanford, CA

BACKGROUND: Young adults constitute a minority of patients undergoing aortic valve replacement (AVR). The theoretical advantages to placing mechanical valves instead of bioprosthetic valves in younger patients have yet to be demonstrated by a robust multicenter analysis of surgical outcomes in this population. The purpose of this study was to analyze the largest cohort of adults ≤40 years old to understand how the choice of either a mechanical or bioprosthetic valve affects long-term surgical outcomes in clinical practice.

METHODS: We obtained records of 1,478 adult patients ≤40 years old who underwent isolated AVR with either mechanical (1,062) or bioprosthetic (416) valves at 136 hospitals in the State of California between 1996 and 2013. Inverse probability weighting was used to compare long-term survival and rates of reoperation, stroke, bleeding, and endocarditis between these two cohorts. Weighted Cox proportional hazards regression with a robust variance estimator was used to compare survival; competing risk analyses were used to compare rates of longitudinal secondary endpoints. Standard errors were calculated from 500 bootstrap replicates.

RESULTS: The total number of AVRs declined over the study period while the proportion of bioprosthetic valves implanted significantly increased (17% in 1996, 28% in 2013, P < 0.001) (Figure A). Overall operative mortality was 1.3% (N = 19); there was no significant difference in operative mortality when compared between prosthesis types (P = 0.13). Bioprosthetic valves significantly reduced long-term survival compared with that of mechanical valves (HR 1.5, 95% CI 1.1–2.1) (Figure B). The cumulative incidence of bleeding was significantly higher among recipients of mechanical valves (HR 2.4, 95% CI 1.7–3.6) while that of stroke and endocarditis were equivalent between prosthesis types. Receipt of a biological prosthesis significantly increased the risk of reoperation during follow-up (HR 3.2, 95% CI 2.2–4.6); an inflection point in the incidence of reoperation was present at 6 years (Figure C). The operative mortality rate after redo AVR was 7.4% (N = 11/149).

* WTSA Member
Figure A: Number of bioprosthetic and mechanical valves implanted per year between 1996 and 2013.

Figure B: Long-term survival after AVR with either mechanical or bioprosthetic valve.
**Figure C:** Rate of reoperation after AVR with either mechanical or bioprosthetic valve.

**CONCLUSIONS:** In young adults ≤40 years old undergoing AVR, mechanical valves significantly improved long-term survival and reduced the risk of reoperation compared with that of bioprosthetic valves. In a cohort of patients receiving newer generation bioprostheses, the risk of reoperation in young adults rises early and is substantial.
High Risk Coronary Artery Bypass: Impact of Heart Failure Symptoms Versus Left Ventricular Function

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OBJECTIVES: The evidence comparing patients with heart failure and preserved versus reduced ejection fraction (EF) is inconclusive regarding risk for coronary artery bypass grafting (CABG). Studies have previously defined ventricular dysfunction primarily as an EF < 50%. We hypothesize that a clinically derived EF threshold can be utilized to better characterize the interaction between heart failure symptoms and EF.

METHODS: A total of 41,744 patients underwent isolated CABG within a regional consortium from 2005–2016 with both EF and heart failure status available. Hierarchic logistic regression was used to identify the lowest threshold for sufficiently preserved EF, over which EF was not a significant predictor of mortality. Patients were classified by heart failure status and reduced versus preserved EF based on this new EF threshold. Hierarchic logistic regression models identified independent predictors of mortality while adjusting for operative risk, clustering at the hospital level, and changing practices over time.

RESULTS: The threshold identified for preserved EF was 35%, over which EF was not a significant predictor of mortality (OR 0.99, p = 0.250). Of the cohort with preserved EF, 32,523 (77.9%) had no recent heart failure (NoHFpEF) while 3,336 (8.0%) had recent heart failure (HFpEF). Of patients with a reduced EF, 3,131 (7.5%) had no recent heart failure (NoHFrEF) while 2,754 (6.6%) had recent heart failure (HFrEF). The unadjusted mortality rate for each group was 1.4% (NoHFpEF), 4.1% (HFpEF), 3.5% (NoHFrEF), and 6.1% (HFrEF); the risk adjusted odds of mortality are provided in Table 1. The table also demonstrates that current risk models underestimate higher risk heart failure patients. After risk adjustment, the EF value in patients with a preserved EF adds no predictive clinical value (OR = 0.99, p = 0.226), while heart failure symptoms independently confer a 1.65 fold increase in odds of mortality (p < 0.0001). For patients with a reduced EF, ejection fraction is independently associated with mortality (OR = 0.97, p = 0.014), and heart failure symptoms trend towards significance (OR = 1.29, p = 0.093).
<table>
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<th>STS Operative Mortality</th>
<th>OR</th>
<th>CI</th>
<th>p value</th>
<th>O:E</th>
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<td></td>
<td></td>
<td>0.94</td>
</tr>
<tr>
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<td>(1.41–2.29)</td>
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<td>Heart Failure with reduced EF</td>
<td>2.35</td>
<td>(1.88–2.94)</td>
<td>&lt;0.0001</td>
<td>1.13</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** Risk assessment suggests the current EF threshold of 50% is too high for surgical patients, and instead a sufficiently preserved ejection fraction is greater than 35%. The elevated risk of mortality associated with heart failure symptoms despite preserved ejection fraction represents a possible area of improvement with preoperative management. This analysis provides an updated understanding of clinically useful thresholds for the expanding heart failure surgical population.
CF8. Should We Place 23 mm or Larger Valve for Young Female Patients Undergoing Aortic Valve Replacement?
Brigham and Women’s Hospital, Harvard Medical School, Boston, MA

BACKGROUND: The effects of patient-prosthesis mismatch (PPM) on clinical outcomes have been well studied, and the outcomes of valve-in-valve transcatheter aortic valve replacements (VIV-TAVR) in small prostheses (≤21 mm) are reported to be worse. Consequently, there is a consideration to place at least a 23 mm valve in young active females to avoid PPM and allow future VIV-TAVR. We assessed the clinical outcomes of young female patients undergoing surgical aortic valve replacement (SAVR) using small and large prostheses to identify whether small valve size alone is a risk factor as well as the incremental risk of PPM.

METHODS: Between January 2002 and June 2015, 451 young (≤ 65 years) female patients who underwent SAVR were identified. Patients were stratified into small prostheses (SP) ≤ 21 mm (n = 257) and large prostheses (LP) ≥ 23 mm (n = 194) groups. PPM was considered to be present if indexed effective orifice area (iEOA) < 0.85 cm²/m² and was classified into moderate if iEOA ≥ 0.65 cm²/m² or severe if iEOA < 0.65 cm²/m². Outcomes of interest were operative mortality and long-term survival. Cox proportional hazards modeling was used to evaluate predictors of long-term survival (Figure). Median follow-up duration was 6.09 (3.12, 9.59) years.

RESULTS: The mean age was 55.2 ± 9.0 years. SP were used in 257/451 (57%) of the patients. Mean BSA was 1.80 ± 0.22 m² in the SP group vs. 1.87 ± 0.25 m² in the LP group (p ≤ 0.002). Both groups had similar STS-PROM, 2.30 ± 2.36% in the SP group vs. 2.40 ± 5.14% in the LP group (p = 0.85). Operative mortality was 6/257 (2.3%) in the SP group and 2/194 (1.0%) in the LP group (p = 0.48). Moderate PPM was present in 101/257 (39.3%) patients in the SP group and 30/194 (15.5%) patients in the LP group (p ≤ 0.001). Severe PPM was observed in 28/257 (10.9%) patients in the SP group and 5/194 (2.6%) patients in the LP group (p ≤ 0.001). Overall 14-year survival was 75%, 74.64% in the SP group vs. 75.74% in the LP group. Multivariate Cox analysis identified age (HR 1.06, p = 0.014), renal failure (HR 4.60, p ≤ 0.001), CHF (HR 3.27, p ≤ 0.001) and severe PPM (HR 2.87, p = 0.013) as significant predictors of long-term survival, while valve size and moderate PPM were not found significantly contributory.
CONCLUSIONS: In young females undergoing SAVR, small valve size alone was not associated with worse long-term outcomes. The presence of severe PPM resulted in poor long-term outcomes, whereas moderate PPM was not associated with decreased long-term survival. Since future valve-in-valve TAVR will not fix the PPM problem, we suggest considering aortic root enlargement procedures to allow for placement of larger prostheses, specifically in patients with potential severe PPM.
CF9. Incremental Cost of Complications of Lobectomy for Stage I NSCLC
Abraham D. Geller, Douglas J. Mathisen, Cameron D. Wright, Michael Lanuti
Massachusetts General Hospital, Boston, MA

OBJECTIVES: Postoperative complications are widely understood to increase the cost of surgical care, but little has been done to quantify the cost impact of complications in thoracic surgery. The purpose of this study is to quantify the incremental cost of complications of lobectomy and identify specific targets for quality improvement and cost reduction.

METHODS: Patients treated with open or VATS lobectomy for stage I NSCLC between 2008 and 2014 were selected from an institutional patient database. A patient registry was queried for all adverse postoperative events (POE) recorded during a 90-day postoperative interval. POE was sub-classified as major or minor. Hospital billing data for each patient was obtained from a separate financial database and queried for all associated costs from the procedure until 90 days after surgery, and then concatenated with the clinical data by encounter. Linear regression analysis was used to assess the impact on cost of total vs. major POEs, and, in subsequent analysis, to estimate the mean incremental cost of each type of POE.

RESULTS: 494 patients were identified as having undergone lobectomy for stage I NSCLC between 2008 and 2014, and had complete 90-day follow-up and cost data available. 35% of those patients experienced at least 1 POE and 18% experienced at least one major POE. The most common complications were atrial arrhythmia (13% of patients), prolonged air leak (8.3%), atelectasis (6.7%), and transfusion requirement (6.5%). Minor POEs increased the cost of lobectomy by an average of 26% per event (95 CI 18–33%, P < 0.001) compared to the cost of an uncomplicated lobectomy, and major POEs increased total cost by an average of 61% per event (95 CI 54–67%, P < 0.001). The greatest predictor of increased 90-day cost was new renal failure (defined as Cr > 2 or Cr > 2 x baseline), which increased cost by 272% (95 CI 220–324%, P < 0.001) compared to uncomplicated lobectomy. Prolonged air leak increased mean cost by 20% (95 CI 4–37%, P = 0.016), pneumonia by 79% (95 CI 48–109%, P < 0.001) and atrial arrhythmia by 27% (95 CI 15–39%, P < 0.001). Other significant predictors of increased cost were major pulmonary POEs (81% increase, 95 CI 58–104%, P < 0.001), major cardiovascular POEs (29% increase, 95 CI
18–40%, \( P < 0.001 \), minor pulmonary POEs (39% increase, 95 CI 25–52%, \( P < 0.001 \)), major neurological POE (47%, 95 CI 14–80%), and other major POEs (76%, 95 CI 50–102, \( P < 0.001 \)).

**CONCLUSIONS:** Complications contribute significantly to total 90-day cost of lobectomy for stage I NSCLC. Analysis of 90-day postoperative outcomes more accurately captures costs associated with lobectomy not realized within a 30-day postoperative window. This study quantifies specific incremental costs associated with various types of complications. It also identifies actionable targets for cost reduction and surgical quality improvement. Further efforts to reduce cost while improving outcomes may identify strategies to predict and prevent the most common and costly complications identified here.
CF10. Incidence of LKB1 Inactivation in Esophageal Adenocarcinoma

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OBJECTIVE: The incidence of esophageal adenocarcinoma (EA) has increased by over 400% over a span of 30 years. Apart from mutations in TP53 gene, there is little data on genetic drivers of EAC. First identified as the causal gene for the familial cancer disorder, Peutz-Jegher’s Syndrome (PJS), Liver Kinase B1 (LKB1/STK11) has emerged as a multi-functional tumor suppressor regulating cell growth, differentiation and metabolism. Notably, PJS patients are at increased risk of gastro-esophageal cancers. Somatic inactivation of LKB1 has been described in several tumor types; however whether LKB1 inactivation has a role in EA is unknown. In the present study, we have analyzed publicly available genomic data of EA patients and patient samples from our own institution to assess the incidence of LKB1 inactivation in EA.

METHODS: Chromosomal deletion and mRNA expression of LKB1 in EA was investigated using publically available data (The Cancer Genome Atlas (TCGA) and www.oncomine.org). Protein expression was assessed by immunohistochemical (IHC) staining for LKB1 in a tissue microarray (TMA) containing EA (n = 29), dysplastic Barrett’s Esophagus (BE) (n = 16) and non-dysplastic BE (n = 3) from patients treated at a single institution.

RESULTS: Analysis of EA data in the TCGA dataset revealed deletion of chromosome 19p13.3, containing the LKB1 gene locus, was significant (q = 8.603 × 10⁻⁶). Single copy loss (shallow deletion) of LKB1 was present in 57% of EA samples (50 out of 87), while mRNA expression of LKB1 in EA samples with single copy loss was significantly lower compared to EA samples diploid for LKB1 (p = 0.004). Expression of LKB1 was significantly lower in EA tumors compared to normal esophagus (p = 0.002) in the Kim Esophagus dataset in Oncomine. IHC analysis for LKB1 showed reduced LKB1 protein expression in both EA (Figure 1E, F; 24 out of 29; 82%) and dysplastic BE (Figure 1C, D; 10/16; 62%). Expression of LKB1 was observable in non-dysplastic BE (Figure 1A, B; n = 3).

* WTSA Member
**CONCLUSIONS:** Analysis of TCGA EA dataset and our EA TMA suggest that inactivation of LKB1 frequently occurs in EA. Based upon the reported oncogenic effects of *LKB1* inactivation, combined with the lack of oncogenic drivers in EA, our data indicates that LKB1 loss may play a significant role in EA tumorigenesis and necessitates future studies.
CF11. A Role for Stereotactic Body Radiation Therapy in a Multi-Modality Approach to Pulmonary Metastatic Sarcoma
UCSF, San Francisco, CA

BACKGROUND: Aggressive surgical treatment of pulmonary metastatic sarcoma represents an unusual opportunity for control of an advanced cancer. Recurrence after initial metastasectomy is common, and can lead to difficult therapeutic decisions. Stereotactic body radiation treatment (SBRT) is successful in select primary lung cancers, and may provide an opportunity for multi-modality control of recurrent metastatic sarcoma.

METHODS: We reviewed our single institution experience with SBRT in the management of recurrent pulmonary metastatic sarcoma. SBRT patients were matched with patients who had undergone either one or more resections of recurrent pulmonary metastasis. Fisher’s exact test, Kaplan-Meier analysis, Log rank analysis and Cox proportional hazards modeling were used to compare patients in the surgery-alone (SA) and surgery plus SBRT groups.

RESULTS: Between 2008 and 2015, 34 patients underwent SBRT for recurrent pulmonary metastatic sarcoma. Of 90 treated lesions, only 1 demonstrated growth after SBRT (>98% local control). Two patients (5.9%) experienced severe radiation pneumonitis, which responded to steroid therapy. SBRT patients were matched, based on the number of episodes of recurrence and on initial disease-free-interval, with 96 SA patients from the same period. Radiographically-occult lesions were identified intra-operatively during 57 of 125 repeat metastasectomies (46%). Consistent with the limitations of SBRT in treating large, numerous or radiographically-occult lesions, SA patients, had, on average, larger recurrent tumors (3.2 ± 3.6 vs. 2.1 ± 1.6 cm, P < 0.05) and a greater number of treated recurrent metastatic lesions (4.7 ± 5.1 vs. 2.0 ± 1.2, P < 0.01). Although patients treated with SBRT were more likely to recur sooner with additional pulmonary metastases, overall survival was better, in the surgery plus SBRT group (HR 2.4, P < 0.01); multivariate analysis, however, indicated that the difference in number and size of recurrent lesions between the two groups accounted for most of this difference in overall survival (multivariate HR 1.7, P > 0.1).

CONCLUSIONS: Patients likely benefit from initial surgical metastasectomy, which not only allows the treatment of numerous and larger lesions with lower rates of recurrence, but also enables the detection and treatment of radiographically-occult masses. SBRT, however, may offer a reasonable option for patients as part of a long-term, aggressive approach for recurrent metastatic sarcoma.

* WTSA Member
OBJECTIVES: The purpose was to determine whether upfront esophagectomy or induction chemoradiation followed by esophagectomy confers improved survival in patients with clinically staged T2N0 (cT2N0) esophageal cancer, and to assess the impact of the diagnostic uncertainty of endoscopic ultrasound (EUS) on the expected benefit of chemoradiation in this group of patients.

METHODS: A decision analysis model (Figure 1) was created to represent two treatment strategies for cT2N0 esophageal cancer patients who are potential surgical candidates: 1) upfront esophagectomy followed by adjuvant therapy for patients who are upstaged and 2) induction chemoradiation for all cT2N0 patients followed by esophagectomy. Value estimates for variables within the model were obtained from a literature review, and median survival for specific pathologic subgroups within the tree was derived primarily from the National Cancer Database. The primary endpoint was expected survival for the two treatment strategies in the model. Staging uncertainty of endoscopic ultrasound was introduced into the model by varying the probability that a patient would be pathologically upstaged in sensitivity analyses.

RESULTS: The baseline decision analysis model showed comparable survival for both treatment strategies: upfront esophagectomy patients had an expected overall survival of 48.3 months versus 45.9 months for patients undergoing induction chemoradiation. Results of a sensitivity analysis demonstrated a benefit of induction chemoradiation if the probability of pathologic upstaging is greater than 48.1%, which is within the published range of 32–65% probability of pathologic upstaging after clinical T2N0 diagnosis (Table 1).
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</table>

**CONCLUSIONS:** The optimal treatment strategy for cT2N0 esophageal cancer is dependent upon the accuracy of EUS staging. Our results suggest that these patients may benefit from routine induction chemoradiation if the probability of upstaging is greater than 48.1%. Factors such as knowledge of individual institutional variation in rates of upstaging or incorporation of additional high-risk clinical or pathologic features to EUS data may aid in clinical decision making to recommend induction chemoradiation for cT2N0 patients who are surgical candidates.
CF13. Hyperthermic Intrathoracic Extracorporeal Chemotherapy for Pleural Malignancies
Daniel L. Miller¹, Jordan M. Wetstone¹, Rabih I. Bechara², Christopher S. Parks², Loana R. Bonta², Patricia L. Rich²
¹Kennestone Regional Medical Center/WellStar Health System, Marietta, GA; ²Southeastern Regional Medical Center/CTCA, Newnan, GA

OBJECTIVES: To evaluate the safety and efficacy of hyperthermic intrathoracic extracorporeal chemotherapy (HITEC) with cisplatin in patients who had undergone cytoreductive surgery pleurectomy/decortication (PD) for primary or secondary pleural malignancies (PM).

METHODS: After Health System and Cancer Committee approval, 25 patients who had unilateral chemoresistant pleural metastasis (15) or primary pleural malignancy (10) were registered prospectively. The patients’ primary sites of malignancy were under control for a median of 36 months (range, 26–61) prior to developing PM. Median time of systemic chemotherapy for PM was 29 months (range, 28–76). Primary pleural malignancy (mesothelioma) patients were diagnosed within 3 months of HITEC. All 25 patients underwent a unilateral radical P/D and lymph node dissection, 60 minutes pleural lavage (1,500–1,700 cc/min) with 225 mg/m² of cisplatin at 42°C. Cisplatin levels were drawn at time zero, 1 hour, 4 hours, and 24 hours after HITEC.

RESULTS: Median age was 57 years (range, 36–78); 20 patients (80%) were women. Metastatic tumor was breast in seven, thymus in four, colon in two, and renal cell and anal cancer in one each. Surgical approach was a thoracotomy in 23 patients (92%). Morbidity included prolonged air leak in six (24%), atrial fibrillation in three patients (12%), and acute respiratory distress syndrome in one (4%). Median hospital stay was 7 days (range, 4–14). Serum cisplatin levels peaked at 4 hours after lavage; no cisplatin levels were in the toxic range. Median dose of cisplatin was 392 mg (range, 250–450); no patient developed renal insufficiency. Median follow-up was 15 months (range, 1–24). Twenty-one patients (84%) had no signs of malignant disease at last follow-up; two patients (anal cancer–6 months, mesothelioma–10 months) developed local recurrence and two patients (renal cell cancer–9 months, breast cancer–10 months) developed metastatic disease, one contralateral pleural and the other liver, respectively. Two patients (8%) died from metastatic disease at 9 (anal cancer) and 12 months (mesothelioma) after HITEC. Twenty four patients (96%) experienced improved quality of life and respiratory function, as well as reduced pleuritic pain after PM cytoreduction and HITEC.

CONCLUSIONS: Surgical cytoreduction of primary or secondary pleural malignancies followed by HITEC with cisplatin was well tolerated. No patient developed cisplatin-related toxicities. Early results are promising. Longer follow-up is warranted to determine a survival and quality of life advantage as well as refinement of inclusion and exclusion criteria.
CF14. Early Fundoplication Is Associated with Slower Decline in Lung Function After Lung Transplantation in Patients with Gastroesophageal Reflux Disease

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OBJECTIVES: Gastroesophageal reflux disease (GERD) is prevalent after lung transplantation in patients with end-stage lung disease. Fundoplication is known to slow decline in lung function in patients with GERD, but the optimal timing of fundoplication is unknown.

METHODS: We retrospectively reviewed patients who underwent fundoplication after lung transplantation at our center between April 2007 and July 2014. Patients were divided into two groups: early fundoplication (within six months of lung transplantation) and late fundoplication. Wilcoxon rank sum and Fisher’s exact tests were used for continuous and categorical variables, respectively. Actuarial survival at one, three, and five years was estimated using the Kaplan-Meier method. A linear mixed model was used to analyze decline in % predicted forced expiratory volume in one second (FEV₁) yearly after lung transplantation.

RESULTS: In total, 84 of 273 (30.8%) patients underwent fundoplication for GERD after lung transplantation; 29 patients (34.5%) had early fundoplication; 55 patients (65.5%) had late fundoplication. The median time from lung transplantation to fundoplication was 4.7 months (2.2, 5.2) and 13.8 months (9, 16.1) for the early and late groups, respectively. The early fundoplication group had higher lung allocation scores (p = 0.006) and lower body mass indexes (p = 0.027) compared to the late fundoplication group. Age, sex, and type of fundoplication were comparable for both groups. Median acid exposure time in the distal pH channel increased from 101 minutes (52.7, 147.7) pre-transplant to 144.9 minutes (87.5, 173.9) pre-fundoplication in the early group, and from 58.6 minutes (12.9, 125.6) to 147 minutes (86, 244.8) in the late group. The late fundoplication group had a higher median DeMeester score (111 versus 62; p = 0.004). One-year, three-year, and five-year survival rates in the early group were 93%, 65%, and 44%; in the late group, these rates were 90%, 70%, and 46% (log-rank p = 0.60). A higher proportion of patients in the late group had
one or more episodes of acute rejection after fundoplication (30.9% versus 13.8%; p = 0.085). Three-year and five-year % predicted FEV₁ was lower in the late group by 7.5% (95% CI [-27.6, 12.58], p = 0.46) and 40.7% (95% CI [-68.5, -12.8], p = 0.004; Figure 1). A linear mixed model showed a 3.6% lower % predicted FEV₁ over time in the late fundoplication group (p = 0.587).

CONCLUSIONS: The severity of GERD appears to increase after lung transplantation. Early fundoplication may slow the rate of lung function decline after transplantation. In this study, patients with early fundoplication had a higher FEV₁ five years after transplantation and fewer episodes of acute rejection. Early fundoplication may protect against GERD-induced lung damage in transplant recipients with GERD.
**CF15. Needle Localization of Small Pulmonary Nodules – Lessons Learned in Over 250 Cases**  
*Patricia A. Thistlethwaite, Jonathan Gower, Andrew Picel, Anne Roberts  
*University of California, San Diego, La Jolla, CA*

**BACKGROUND:** Lung masses that are small and deep within lung parenchyma are often challenging to localize with VATS. Here we describe our cumulative experience using needle localization of small masses prior to surgical resection. We report procedural tips, operative results, as well as lessons learned over time.

**METHODS:** From July 1, 2009 until December 2016, 253 patients underwent needle localization of lung masses ranging between 0.5–1.1 cm under CT guidance, prior to surgery. Nodules were localized by placing two 20-gauge Hawkins III needles from different trajectories with tips adjacent to the mass, injection of 0.4 cc of methylene blue, deployment of 2 hook wires, and needle removal. Surgical wedge resection then established the diagnosis of adenocarcinoma in 139 patients, metastatic carcinoma in 45 patients, squamous cell carcinoma in 24 patients, fungal disease in 22 patients, large cell carcinoma in 9 patients, tuberculosis in 6 patients, sarcoidosis in 4 patients, radiation scar in 2 patients, and carcinoid in 2 patients. Intraoperative and perioperative outcomes were assessed.

**RESULTS:** Needle localization was successful in 243 patients (96.0%). Failures included: 1) wires falling out of lung parenchyma prior to operation (7 patients), 2) wire migration (2 patients), and 3) bleeding resulting in hematoma requiring transfusion (1 patient). The most common complication of needle localization was asymptomatic pneumothorax (12/254 total patients; 4.7%), and was higher in patients with bullous emphysema (9/55 patients; 16.4%). Only 1 patient required chest tube placement for symptomatic pneumothorax prior to operation. Of the 10 individuals who had unsuccessful needle localization, 9 had successful wedge resection in the area of methylene blue injection that included the mass; 1 required segmentectomy for diagnosis. Completion lobectomy (158 VATS, 2 mini-thoracotomy/172 patients) or VATS segmentectomy (12/172 patients) were performed based on preoperative pulmonary function testing, for patients with an intraoperative diagnosis of non-small cell carcinoma. The average length of hospital stay for wedge resection was 1.4 days, for VATS segmentectomy was 1.9 days, for VATS lobectomy was 3.1 days, and for mini-thoracotomy was 4.9 days. Perioperative survival was 100%.

**CONCLUSIONS:** Needle localization is an effective strategy to localize small, deep lung lesions for wedge resection and diagnosis. Multidisciplinary coordination between the thoracic surgeon and interventional radiologist is key to the success of this procedure.

* WTSA Member
CF16. Emergency Room Utilization Is High & Feeding Tube Problems Are the Biggest Culprit: Analysis of Resource Utilization After Esophagectomy

Biniam Kidane¹, Suha Kaaki¹, Yu Shen², Adam Bassili², John Peel³, Frances Allison², Thomas Waddell², Gail Darling²

¹University of Manitoba, Winnipeg, MB, Canada; ²University of Toronto, Toronto, ON, Canada; ³University of British Columbia, Vancouver, BC, Canada

OBJECTIVES: Esophagectomy is a complex operation with potential for significant morbidity and prolonged recovery. As part of a quality improvement initiative, the aim of this study was to evaluate health care resource utilization, specifically emergency department (ED) visits within 1 year of esophagectomy and to identify risk factors for ED visits as well as frequent ED use (FEDU).

METHODS: Retrospective cohort study was performed of consecutive esophagectomies at a tertiary Canadian centre (1999–2014). Fisher’s exact, Mann-Whitney U, t-tests and multivariable logistic regression were used to identify factors associated with higher ED visits to the index hospital as well as FEDU (≥3 visits) within 1 year of esophagectomy. Demographic, socioeconomic, medical/surgical factors were assessed.

RESULTS: There were 520 esophagectomies with an in-hospital mortality of 6% (n = 31). Of those surviving to discharge, 29.7% of patients (n = 145) had ≥1 ED visit within 1 year of discharge. The most common causes were feeding tube problems (39.3%, n = 57) and dysphagia/stricture (13.1%, n = 19). Many of the feeding tube problems appear to be related to tube blockages or unsubstantiated concerns about infection. On multivariable analysis, higher income (adjusted odds ratio [aOR] = 1.22 [1.04–1.42], p = 0.01) and use of thoracoscopic-assisted esophagectomy (aOR = 3.24 [1.71–6.11], p < 0.0001) were independently associated with a higher risk of ED visits. Patients with thoracoscopic-assisted esophagectomy were discharged significantly earlier than others (p < 0.0001). Living in a region further from the index hospital (aOR = 0.39 [0.29–0.52], p < 0.0001) and having surgery in the later years of the study period (aOR = 0.91 [0.86–0.97], p = 0.006) were both independently associated with lower risk of ED visits (aOR = 0.39 [0.29–0.52], p < 0.0001). Forty-three (8.8%) patients were frequent ED users, with the most common causes of repeat ED visits being feeding tube problems and dysphagia/stricture. On multivariable analysis, only the “region” predictor was independently associated with frequent ED visits. Living in a region further from the index hospital was associated with lower risk of frequent ED visits (aOR = 0.25 [0.14–0.45], p < 0.0001). Multivariable analyses including only the patients living in the regions within 1 hour of our hospital revealed the same finding. Resection type, specific in-hospital complications, use of chemotherapy or radiation therapy, age and comorbidity factors were not independently associated with higher ED utilization risk.
CONCLUSIONS: There is a high rate of ED utilization within 1 year of esophagectomy. Patients living further away from the index hospital had a lower rate of index hospital ED utilization; thus, the true rate of ED utilization is likely higher as these patients are likely utilizing their local hospitals. Some of our findings (higher risk with thoracoscopic-assisted esophagectomy & lower risk over time) likely reflect the effects of the learning curve of Minimally-Invasive Esophagectomy over time. Feeding tube problems are the most common causes of high ED utilization and are potentially modifiable with pre-emptive patient/caregiver education or arrangement of clinic visits in lieu of ED use. These interventions could represent significant cost savings & increased patient quality of life/satisfaction.
**OBJECTIVES:** Primary pulmonary vein obstruction (PPVO) is increasingly diagnosed in children with no prior pulmonary vein intervention history. Surgical management of PPVO is challenging and associated with high recurrence and mortality rates. We aim to describe characteristics of patients who underwent surgery for PPVO at our center, and examine factors associated with treatment failures.

**METHODS:** A retrospective review of all patients who underwent surgery for PPVO was completed (2002–16). Patients who had undergone prior cardiac surgery involving the pulmonary veins or atrial septum were excluded. Regression analyses were performed to examine patients/anatomic characteristics and surgical details associated with treatment failures (mortality, recurrent obstruction and re-intervention).

**RESULTS:** Thirty-four children including 14 males (41%) underwent surgery for PPVO at a median age of 8.9 months (IQR 0.48–1.68 years). Median number of affected veins was 2 (range 1–4) and they were on the left (n = 25, 73%), right (n = 6, 18%) or both sides (n = 3, 9%). Four patients (12%) had pulmonary vein atresia while the remaining 30 (88%) had stenosis with median pre-operative gradient of 10 mm Hg (IQR 6–12). The majority of patients (n = 28, 82%) had sutureless pericardial well repair technique.

There were 3 hospital deaths (9%) and 3 late deaths (9%). Fourteen patients (41%) developed recurrent obstruction at a median of 6.25 months following surgery and 7 (20%) underwent pulmonary vein re-intervention. On competing risks analysis, 1 year from pulmonary vein surgery, 9% had died, 27 % had undergone re-intervention, and 64% were alive without re-intervention. At 5 years, the numbers were 9%, 45% and 46%, respectively. [Figure] Overall survival at 1 and 5 years was 88% and 80%.
On regression analyses, factors associated with pulmonary vein re-intervention were bilateral disease (HR 5.65 (1.07–29.77) p = 0.041) and the number of veins involved (HR 3.25 (1.25–8.40) p = 0.015). Similarly, factors associated with overall mortality were bilateral disease (HR 5.65 (1.03–30.84) p = 0.046) and the number of veins involved (HR 5.65 (1.03–30.84) p = 0.046).

CONCLUSIONS: Surgical management of PPVO is challenging and associated with significant obstruction recurrence risk. Patients with multiple and/or bilateral pulmonary vein disease are at higher risk of recurrent obstruction and subsequently death, with the majority of those failures occurring within the first year following initial repair. Given these disappointing results, multi-disciplinary management strategy of those patients that combines attentive surgical, interventional and imaging efforts, and the experimental use of adjunctive medications need to be attempted to alter the unfavorable course of this disease. Given limited single-institutions experience in this pathology, collaborative multi-institutional efforts might be warranted.
**CF18. Novel Perioperative Strategy for the First Blalock-Taussig Shunt in Infants with PDA Dependent Circulation**  
Sadahiro Sai, Satoshi Matsuo, Shingo Takahara, Naoki Masaki, Koh Sakatsume, Akinobu Konishi  
*Miyagi Children’s Hospital, Sendai, Japan*

**OBJECTIVES:** Modified Blalock-Taussig shunt (mBTS) for pulmonary atresia (PA) or critical pulmonary stenosis (PS) patients which depend on patent ductus arteriosus (PDA) has still had non-negligible mortality and morbidity because of postoperative imbalance between pulmonary and systemic circulation. We have pursued the validity of our strategy for perioperative management of mBTS.

**METHODS:** Our first strategy was reducing dose or discontinuation of Lipo-prostaglandin E1 a week before surgery (op.) followed by inhalation of nitrogen if necessary, and targeting SpO2 70~80% to avoid cardiac failure by reducing preload (low pulmonary blood flow strategy). The second one was administration of PDEIII inhibitor from anesthetic induction to stabilize Qp/Qs by reducing afterload (low vascular resistance strategy). From July 2008 to July 2016, 43 pulmonary atresia and critical PS infants (PA 35, PS 8) underwent the first mBTS through median approach using no cardiopulmonary bypass were divided into two groups: Group C; conventional management (n = 20), Group S; new strategy (n = 23). Median age and body weight were 38 days (range 11 to 70) and 3.4kg (range 2.4 to 4.0). The primary endpoint was postoperative excessive or low pulmonary flow event such as cardiopulmonary resuscitation, PDA ligation, shunt clipping and ECMO installation. The secondary outcomes were preoperative change of SpO2 and BNP level, postoperative peak lactate and catecholamine index (CI) in each group.

**RESULTS:** There were one death and six postoperative excessive pulmonary flow events (30%) in Group C but no event in Group S. Preoperative SpO2 and BNP level were reduced during a week respectively. (88.0 ± 3.2% at 1 week before op. and 79.8 ± 5.0 % at op. in SpO2, 476 ± 190 pg/ml at 1 week before op. and 173 ± 146 pg/ml at op. in BNP level). Preoperative SpO2 at op. was 86.3 ± 7.1% in group C (vs. group S, p < 0.01). Preoperative BNP level at op. was 344 ± 617 in group C (vs. group S, p = 0.31). There were significant difference in postoperative CI and max lactate level between C and S group (CI 14.2 ± 1.4, max lactate 6.1 ± 7.6 mmol/L in group C); CI 8.0 ± 1.5 (p < 0.01), max lactate 2.7 ± 1.1 mmol/L (p < 0.05) in group S).
### Comparison of patient characteristics and perioperative parameters

<table>
<thead>
<tr>
<th></th>
<th>C group (n=20)</th>
<th>S group (n=23)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (BW) at op. (kg)</td>
<td>3.6 ± 1.5</td>
<td>3.2 ± 0.3</td>
<td>0.18</td>
</tr>
<tr>
<td>Age at operation (days)</td>
<td>33.8 ± 11.2</td>
<td>42.4 ± 18.2</td>
<td>0.08</td>
</tr>
<tr>
<td>Preoperative SpO₂ (%) at op.</td>
<td>86.3 ± 7.1</td>
<td>79.8 ± 5.0</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Preoperative BNP (pg/ml) at op.</td>
<td>344.1 ± 617.0</td>
<td>173.2 ± 146.5</td>
<td>0.31</td>
</tr>
<tr>
<td>Dose of PDE III inhibitor at anesthetic induction (µg/kg/min)</td>
<td>0.02 ± 0.12</td>
<td>0.47 ± 0.13</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>BT shunt graft size / BW (mm/kg)</td>
<td>1.1 ± 0.2</td>
<td>1.1 ± 0.1</td>
<td>0.24</td>
</tr>
<tr>
<td>Postoperative excessive pulmonary flow events</td>
<td>6 (30%)</td>
<td>0</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Hospital death</td>
<td>1 (5.0%)</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>Postoperative catecholamine index</td>
<td>14.2 ± 1.4</td>
<td>8.0 ± 1.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Postoperative maximum lactate level (mmol/L)</td>
<td>6.1 ± 7.6</td>
<td>2.7 ± 1.1</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Duration of ICU stay (day)</td>
<td>6.6 ± 5.7</td>
<td>3.9 ± 3.6</td>
<td>0.08</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** These strategies could contribute to carry low postoperative mortality and morbidity of the first mBTS in PA or critical PS infants with PDA dependent circulation who may suffer deleterious events in perioperative period.
OBJECTIVES: Congenital heart surgery is traditionally performed through a median sternotomy. However, for adolescent patients and their families, the prospect of having their sternum divided is understandably a source of major apprehension. Furthermore, the large, central scar may be psychologically and emotionally detrimental to many children. At our center, the solution has been to adopt the right axillary incision as the default approach for most patients. This technique is safe, versatile and provides an unsurpassed cosmetic result. Here we provide our experience with the axillary incision for a diverse array of congenital cardiac lesions.

METHODS: Data was retrospectively collected on all patients receiving an axillary incision for congenital cardiac surgery between 2005–2016. A brief technique description—the patient is placed in left lateral decubitus with the right arm abducted. A horizontal incision is made through the fourth intercostal space between the anterior and posterior axillary lines sparing the latissimus dorsi and serratus anterior (Figure 1a). The right lung is deflated using single lung ventilation if possible, and central cannulation is performed (Figure 1b). The heart is fibrillated for simple defects or arrested for complex procedures, and repair proceeds in standard fashion. Intercostal nerve block is performed routinely prior to completion, and the patient is extubated in the operating room.
<table>
<thead>
<tr>
<th>Primary Procedure</th>
<th>No. Patients (Female)</th>
<th>Age, Yrs, Median (IQR)</th>
<th>Weight, kg, Median (IQR)</th>
<th>Surgery Time, Min, Median (IQR)</th>
<th>CPB Time, Min, Median (IQR)</th>
<th>LOS, Days, Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD repair</td>
<td>244 (156)</td>
<td>5 (3–12)</td>
<td>18 (12–39)</td>
<td>156 (121–195)</td>
<td>27 (10–55)</td>
<td>3 (2–3)</td>
</tr>
<tr>
<td>VSD repair</td>
<td>72 (31)</td>
<td>3 (1–6)</td>
<td>13 (7–12)</td>
<td>200 (176–236)</td>
<td>89 (77–110)</td>
<td>3 (3–4)</td>
</tr>
<tr>
<td>Subaortic membrane resection</td>
<td>10 (8)</td>
<td>7 (2–9)</td>
<td>29 (14–47)</td>
<td>175 (161–206)</td>
<td>66 (55–78)</td>
<td>3 (3–3)</td>
</tr>
<tr>
<td>Tetralogy of Fallot repair</td>
<td>7 (3)</td>
<td>0.3 (0.2–0.4)</td>
<td>6 (5–7)</td>
<td>292 (226–324)</td>
<td>144 (93–163)</td>
<td>6 (4–11)</td>
</tr>
<tr>
<td>DCRV resection, RVOT patch</td>
<td>4 (3)</td>
<td>9 (4–14)</td>
<td>25 (14–52)</td>
<td>208 (156–263)</td>
<td>54 (48–79)</td>
<td>3 (3–4)</td>
</tr>
<tr>
<td>LVAD implantation</td>
<td>3 (1)</td>
<td>2 (0.2–7)</td>
<td>18 (9–24)</td>
<td>162 (114–287)</td>
<td>-</td>
<td>15 (13–19)</td>
</tr>
<tr>
<td>Mitral valve repair</td>
<td>2 (2)</td>
<td>12 (1–22)</td>
<td>29 (7–51)</td>
<td>223 (198–248)</td>
<td>131 (123–139)</td>
<td>5 (4–6)</td>
</tr>
<tr>
<td>Warden procedure</td>
<td>2 (1)</td>
<td>24 (1–49)</td>
<td>40 (12–67)</td>
<td>151 (38–263)</td>
<td>198 (136–259)</td>
<td>5 (3–7)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (9)</td>
<td>11 (1–21)</td>
<td>38 (8–62)</td>
<td>245 (185–296)</td>
<td>122 (75–143)</td>
<td>5 (3–7)</td>
</tr>
</tbody>
</table>
RESULTS: The right axillary incision was utilized in 358 patients (225 female, 63%) for 24 primary procedures (Table 1). The most common procedures were atrial septal defect repairs (n = 244, 68%) and ventricular septal defect repairs (n = 72, 20%); other surgeries included left ventricular assist device (LVAD) placement (n = 3, 1%), Tetralogy of Fallot repair (n = 7, 2%), mitral valve repair (n = 2, 1%), and subvalvular aortic membrane resection (n = 10, 3%). Median age was 5 years (range, 1 month to 60 years), and median weight was 17 kg (range, 4–124 kg). Cardiopulmonary bypass was instituted in 353 patients (98.6%) for a median time of 49 minutes (range, 5–386 minutes); bypass was not instituted for LVAD placement (n = 3, 1%), pericardial window (n = 1, 0.3%) or vascular ring division (n = 1, 0.3%). Median surgery time was 174 minutes (range, 37–433 minutes). Extubation in the operating room occurred in 342 (96%) patients. There were no intra-operative deaths, surgical conversions to sternotomy, or takebacks to repair residual defects. Median length of post-operative hospital stay was 3 days (range, 2 to 44 days). In-hospital complications included death in a patient with acute myocarditis and pre-operative multi-organ failure requiring emergency LVAD (n = 1, 0.3%), bleeding requiring surgical correction (n = 3, 1%), pneumothorax or pleural effusion requiring surgical/invasive intervention (n = 9, 3%) and need for permanent pacemaker (n = 5, 1%).

CONCLUSIONS: The axillary incision allows safe, effective repair for a diverse array of congenital cardiac defects and is a potential new standard of care for many patients.
CF20. Outcome of Reoperation After Initial Repair of Truncus Arteriosus: Analysis of 113 Patients
Mayo Clinic, Rochester, MN

OBJECTIVES: There is a paucity of data regarding reoperation in patients with truncus arteriosus (TA). The aim of this study was to analyze perioperative surgical, clinical, and congenital/anatomical factors and their relation to reoperation and mortality in patients with TA.

METHODS: From September 1967 to June 2015, 113 consecutive patients (60 males, 53%) with TA underwent at least one reoperation (194 total reoperations). Median age (interquartile range IQR) at initial surgery was 4.7 (0.8 to 6.7) years. The association of baseline factors with outcomes was analyzed with Cox regression and hazard ratio (HR) based on IQR change in continuous variables.

RESULTS: Out of 194 reoperations, 170(89%) were conduit re-replacement, 54 (29%) truncal valve replacements, and 8 (4%) truncal valve repairs.

Baseline truncal valve anatomy was tricuspid in 51 (60%) patients, quadricuspid in 19 (22%) and bicuspid in 15 (18%). At the initial operation (index surgery) 42 (38%) patients had either aortic or pulmonary homograft conduit, 66 (59%) had bioprosthetic conduit, 2 (2%) had a valveless conduit, and 1 (1%) had a mechanical conduit.

Late survival was 83.9, 80.4% and 73.5% at 5, 10 and 15 years respectively. Age at initial operation (HR = 1.80; 95% CI = 1.09–2.95; P = 0.021) and associated genetic abnormalities (HR = 2.83; 95% CI = 1.10–7.28; P = 0.031) both were associated with increased late mortality, while coronary artery anomaly (HR = 0.39; 95% CI = 0.16–0.95; P = 0.038) was associated with reduced late mortality. Late interventions were branch pulmonary artery stenting in 9 (5%) patients and transcatheter valve-in-valve in two (1%). Freedom from reoperation (after index surgery) was 62.8%, 24.8% and 9.7% at 5, 10 and 15 years respectively. On multivariate analysis both younger age at initial surgery (HR = 1.58; 95% CI = 2.12–1.19; P = 0.002) and initial truncal valve repair (HR = 2.02; 95% CI = 1.11–3.67; P = 0.021) were associated with decreased time to reoperation.

CONCLUSIONS: Reoperations after initial repair of truncus arteriosus can be performed with satisfactory long-term survival and freedom from late interventions. Younger age at initial operation and initial truncal valve repair are associated with higher rate of late interventions.

* WTSA Member
CF21. Results of a Novel “Taco” Technique for Correction of Aortic Coarctation and Arch Hypoplasia
Seattle Children’s Hospital, University of Washington, Seattle, WA

BACKGROUND: Optimal technique for repair of aortic coarctation and arch hypoplasia remain a subject of controversy due to the unique hyperbolic paraboloid shape of the lesser curvature of the aortic arch. Using standard techniques, up to 31% of patients will require reintervention for recurrent arch obstruction. The purpose of this study is to report our experience with a novel and reproducible technique for correcting diffuse aortic arch hypoplasia with coarctation.

METHODS: Medical records for patients who underwent aortic arch repair between 2014 to 2016 for hemodynamically significant aortic coarctation and arch hypoplasia were retrospectively analyzed. Patients who underwent single ventricle palliation were excluded. Surgical arch repair was performed via median sternotomy, employing cardiopulmonary bypass and continuous cerebral perfusion via direct aortic cannulation. Arch reconstructions were performed with a uniform circular autologous pericardial “taco-shaped” patch.

RESULTS: During the study period, thirteen patients underwent Taco arch reconstruction. Median patient age was 15 days (3 days to 3 years); median weight was 2.9 kg (1.7 to 13.1 kg). Seven patients (53.8%) had associated bicuspid aortic valve and five patients (38.4%) had clinical features consistent with Shone’s complex. Surgical repair of concomitant intracardiac defects was performed in 7 (53.8%) patients: (3 (23.1%) VSD closure, 1 (7.7%) complete atrioventricular septal defect repair, 1 (7.7%) subaortic membrane resection, and 1 (7.7%) aortic valvuloplasty). Median duration of cardiopulmonary bypass for isolated arch repair was 96 min (80 to 130 min); median duration of aortic cross-clamp was 40 min (32 to 60 min). Deep hypothermic circulatory arrest was utilized in 3 (23.1%) patients (12 min, 5 min and 1.3 min). All patients survived and freedom from arch reintervention was 77% during a median follow up period of 15 months (1 month to 33 months). Three (23%) patients required reintervention to address restenosis after a median interval of 0.97 months (range 0.3 months to 3.3 months (Figure). One patient required distal aortic arch balloon dilation. Two patients required revision patch augmentation of the proximal aortic arch for re-stenosis at the site of aortic cannulation. One patient (7.1%) developed left vocal cord paresis.
CONCLUSION: Circular “Taco” patch repair of aortic coarctation with aortic arch hypoplasia is a simplified, reproducible surgical technique that is associated with a relatively low rate of restenosis when compared to currently utilized techniques. Reintervention rates following Taco repair of arch hypoplasia maybe further improved by including the aortic cannulation site in the area of augmentation. This approach is well-suited for teaching complex aortic arch reconstruction to surgical trainees.
OBJECTIVE: Despite advances in the surgical management of congenital heart disease, significant morbidity and mortality arise due to the complexity of surgery, secondary to diverse patient anatomies. Ideal patient-specific conduit design is important for the success of surgical reconstructive repair for hypoplastic vessels or stenosis, and to avoid hemodynamically significant residual disease. However, current standard preoperative preparation does not include patient-specific conduit design. Preoperative patient-specific conduit design for the most ideal reconstructive route with the most optimal flow dynamics may yield long-term benefits for patients’ health and quality of life. The objective of this study is to determine if unique, patient-specific three-dimensional (3D) virtual cardiac surgery models will allow congenital heart surgeons to preoperatively visualize the Fontan circuit and perform patient-specific conduit design, in order to ensure the most optimal flow dynamics and anatomical arrangement, as an in silico rehearsal for the actual surgery.

METHODS: Cross-sectional images of patients who underwent Fontan surgery (n = 2) were used to create 3D models of Fontan circuits using standard segmentation software. For each patient, three 3D models were created, “native” (the patient’s actual post-operative Fontan circuit), a virtually designed “flared end” conduit and a virtually designed “bifurcated Y” conduit (Figure 1), with the goal of improving hepatic flow distribution (HFD) and reducing power loss. Steady-state computational fluid dynamic (CFD) simulations were performed on all six models, using MR-derived flow splits for boundary conditions to assess HFD and power loss.

RESULTS: Two types of virtually designed conduits (“flared end” and “bifurcated Y”) were successfully created for each Fontan patient, accommodating the conduit insertion sites, the size, length, direction and angle of their respective Fontan routes. CFD simulations showed that the “bifurcated Y” grafts improved HFD between left and right pulmonary artery from 77/23 to 63/37 and from 35/65 to 47/53,
respectively (Figure 1). Both “flared end” and “bifurcated Y” graft reduced power loss from 8.67 mW (native) to 6.43 mW and 6.93 mW (Patient 1), and 11.28 mW (native) to 8.09 mW and 4.66 mW (Patient 2) respectively.

**CONCLUSIONS:** Our virtual cardiac surgery approach has the potential to improve the quality of surgery by designing the most optimal conduit design before surgery, that has the most optimal HFD and least power loss. Future work will include validation of CFD calculations and further optimization of the conduit design model, using MRI data from more patients.
**CF23. Determinants of Late Survival and Reoperation in Patients Undergoing Repair of Subaortic Stenosis**  
Ishan K. Shah, Joseph A. Dearani, Richard C. Daly,  
*Sameh M. Said, John M. Stulak, Crystal R. Bonnichsen,  
Hartzell V. Schaff  
_Mayo Clinic, Rochester, MN_

**OBJECTIVE:** There is a paucity of data regarding long-term survival and risk of reoperation for membranous subaortic stenosis (SAS). We examined the late outcomes of membranectomy, with versus without concomitant ventricular septal myectomy (SM) on late survival and need for reoperation.

**METHODS:** We identified 141 patients (mean age 32.3 ± 22.3 years; 61% female; 43% children) undergoing surgery for fixed SAS from June 1971 to June 2014. The majority were asymptomatic (94%) and 6% had symptomatic heart failure. Aortic valve regurgitation (AR) was present preoperatively in 71 patients (mild = 35%, moderate = 12%, severe = 3%).

**RESULTS:** Transaortic exposure was utilized in all patients. Isolated membranectomy was performed in 21% (n = 30) and the remainder underwent membranectomy and concomitant left ventricular SM (n = 111). The aortic valve was replaced in 13 and repaired in 1. Operative mortality was 0.7% (n = 1). Median follow-up was 9.1 years (maximum 40 years; 95% CI 5.3–10.7). One, 10 and 20-year survival was 99%, 93% and 82% respectively (Figure 1). Older age at initial repair (HR = 1.04[1.01, 1.07], p = 0.001) was the only significant predictor of late mortality. There was no significant difference in late survival when patients were stratified by gender, type of procedure or presence of preoperative AR. Postoperative permanent pacemaker was required in 4.2% (n = 6/141), and one (1/141) required repair of iatrogenic ventricular septal defect; all these patients were older than 50 years of age and required concomitant SM. Reoperation for recurrent SAS was necessary in 15 patients at a median of 6.9 years (0.66–26.65) after repair; of which 60% (n = 9/15) had previous SM. Additionally, 6/15 patients required concomitant aortic valve replacement (AVR) for severe AR. Overall freedom from late reoperation was 3% at 5 and 17% at 10 years. There were no significant risk factors for late reoperation for SAS (Figure 2), but the presence of severe AR at the time of initial SAS surgery was a risk factor for reoperation for AVR (p < 0.001).
CONCLUSION: Resection of membranous subaortic stenosis can be performed with low early mortality and excellent late survival. When left ventricular outflow obstruction is caused by a membrane and severe septal hypertrophy, concomitant myectomy is safe, with minimal additional morbidity and similar late outcome compared to patients which need only membrane resection.
CF24. Impact of Phrenic Nerve Palsy and Need for Diaphragm Plication Following Surgery for Pulmonary Atresia with Ventricular Septal Defect and Major Aortopulmonary Collaterals
Stanford University School of Medicine, Stanford, CA

OBJECTIVES: Injury to the phrenic nerves may occur during surgery for Pulmonary Atresia with Ventricular Septal Defect and Major Aortopulmonary Collateral Arteries (PA/VSD/MAPCAs). These patients may develop respiratory failure and require diaphragm plication. The purpose of this study was to evaluate the impact of phrenic nerve palsy on recovery following surgery for PA/VSD/MAPCAs.

METHODS: This was a retrospective review of 24 patients who underwent surgery for PA/VSD/MAPCAs. Sixteen patients were undergoing their first surgical procedure, whereas eight were undergoing re-operations. All 24 patients had clinical evidence of a new phrenic nerve palsy post-operatively and subsequently underwent diaphragm plication.

The median interval from primary surgery to diagnosis of phrenic nerve palsy was 11 days, and the median interval from diagnosis to diaphragm plication was an additional 2 days. A cohort of matched “controls” were identified based on identical diagnosis and procedures but who did not sustain a phrenic nerve palsy.

RESULTS: Eighteen of the 24 patients (75%) had clinical improvement following diaphragm plication as evidenced by the ability to undergo successful extubation (5 ± 2 days), transition out of the intensive care unit (32 ± 16 days), and discharge from the hospital (42 ± 19 days). In contrast, there were six patients (25%) who did not demonstrate improvement following diaphragm plication, as evidenced by intervals of 61 ± 38, 106 ± 45, and 108 ± 46 days, respectively (p < 0.05 for all three comparisons). The six patients who failed to improve following diaphragm plication had a significantly greater number of co-morbidities compared to the 18 patients who demonstrated improvement (2.2 vs 0.6 per patient, p < 0.05). These co-morbidities are summarized in the Table below. Compared to the “control” group, patients who improved following diaphragm plication spent an additional 22 days in the hospital at a differential cost of $1,127,000 in total charges and $100,000 in direct costs. Patients who failed to improve following diaphragm plication spent an additional 90 days in the hospital at a cost of $4,515,000 in total charges and $402,000 in direct costs.
<table>
<thead>
<tr>
<th>Co-Morbidities</th>
<th>Patients Who Failed to Improve</th>
<th>Patients Who Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>DiGeorge syndrome</td>
<td>n = 3</td>
<td>n = 5</td>
</tr>
<tr>
<td>Alagille syndrome</td>
<td>n = 1</td>
<td>n = 1</td>
</tr>
<tr>
<td>ECMO</td>
<td>n = 1</td>
<td>n = 1</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>n = 3</td>
<td>n = 1</td>
</tr>
<tr>
<td>Bronchial obstruction</td>
<td>n = 0</td>
<td>n = 1</td>
</tr>
<tr>
<td>Bronchomalacia</td>
<td>n = 2</td>
<td>n = 0</td>
</tr>
<tr>
<td>Vocal cord paralysis</td>
<td>n = 1</td>
<td>n = 1</td>
</tr>
<tr>
<td>RUL collapse</td>
<td>n = 1</td>
<td>n = 0</td>
</tr>
<tr>
<td>Respiratory code</td>
<td>n = 1</td>
<td>n = 0</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** The data demonstrate a bifurcation of clinical outcome in patients undergoing diaphragm plication following surgery for PA/VSD/MAPCAs. This bifurcation appears to be linked to the presence or absence of other co-morbidities. Phrenic nerve palsy was associated with prolongation of hospital stay and came at a very significant financial price.
OBJECTIVES: Management of the aortic root in Acute Type A Aortic Dissection (AcA-AoD) is controversial, and opinions have varied over time on the need for routine aortic root replacement. We undertook the current study to evaluate whether limited root repair techniques with valve resuspension contributed increased risk of death or reoperation compared with root replacement in a contemporary cohort of patients.

METHODS: This was a retrospective review of patients undergoing repair for AcA-AoD at Stanford Hospital and Clinics between 1/2005 and 12/2015. Patients undergoing endovascular repair were excluded. Additionally, those with Marfan syndrome (strong indication for root replacement) were excluded. The subset of patients for whom any intervention on the aortic root was performed were identified, and propensity score analysis with inverse probability weighting to estimate the average treatment effect on the controls was used to create comparable pseudo-populations. Weighted logistic regression was used to compare in-hospital mortality. Weighted cox proportional hazards regression was used to compare overall survival between patients undergoing root repair with valve resuspension and root replacement. Reoperation on the root or valve was evaluated with death as a competing risk by estimating the subdistribution hazard with a weighted form of the Fine-Gray technique.

RESULTS: There were 390 patients with AcA-AoD who presented to our institution; 31 patients (7.9%) were managed non-operatively, 14 (3.6%) were treated with endovascular repair, and 345 (88.5%) patients underwent open repair. There were 246 patients who underwent root intervention and were eligible for the study. Patients
who underwent root replacement (n = 86) were younger and had fewer comorbidities than patients who underwent a limited root repair (n = 160) with biological glue, sauvage patch, or uni-Yacoub, but perioperative mortality was low for both groups: root repair (n = 16, 10.0%) and root replacement (n = 11, 12.8%). Patients undergoing root repair with valve resuspension had shorter cardiopulmonary bypass time (202.2 vs. 270.8 minutes, p < 0.001), shorter cross clamp time (118.3 vs 185.3 minutes, p < 0.001), but similar nadir core temperature (p = 0.2) and circulatory arrest time (p = 0.9). Inverse probability weighting created appropriately balanced groups (except for preoperative dialysis dependence). There was no difference in the odds of in-hospital mortality after weighting (p = 0.5); additionally, there was no difference in long-term survival between the two weighted groups (Figure 1A). Within the limited root repair group, the risk of reoperation was significantly greater (9.2%, 95% CI 0.0 to 20.0% at 10.2 years follow-up) than for root replacement (0%), p < 0.001 (Figure 1B).

CONCLUSIONS: At a high-volume aortic referral center, aortic root replacement did not appear to be associated with higher risk of mortality than a limited operation for AcA-AoD. Limited root repair with valve resuspension—while a safe option in appropriately selected patients—incurred a substantial increase in the risk of late reoperation suggesting that close surveillance is required for these patients.
17. Growth Characteristics and Reintervention Following Aortic Arch Reconstruction in Infants Undergoing Biventricular Repair

Christoph Haller1, Guillermo Larios2, Kasey Moss1, Wenli Xie1, James Meza1, Brian McCrindle1, Glen S. Van Arsdell1, Luc Mertens2, Osami Honjo1

1Division of Cardiovascular Surgery, The Labatt Family Heart Centre, The Hospital for Sick Children and University of Toronto, Toronto, ON, Canada; 2Division of Cardiology, The Labatt Family Heart Centre, The Hospital for Sick Children and University of Toronto, Toronto, ON, Canada

DISCUSSANT: BRAIN L. REEMTSEN

BACKGROUND: Congenital aortic arch hypoplasia necessitates extensive arch reconstruction on cardiopulmonary bypass with or without patch material. We sought to assess growth characteristics and reintervention rates of the aortic arch in infants who underwent extensive aortic arch reconstruction.

METHODS: 224 infants (median weight 3.44 kg, IQR 3.00–3.97; median age 10.0 days, IQR 5.0–40.8) with hypoplastic aortic arch who underwent repair on cardiopulmonary bypass via median sternotomy between 01/2005 and 12/2015 were included. Patients receiving a tubular vascular graft or with a single ventricle were excluded. Impact of primary diagnoses, type of repair, and extent of patching on aortic arch growth and reinterventions was assessed. Reconstruction type was categorized based on achieved anatomy (native vs. altered) and use of patch. Patients were grouped by arch hypoplasia (z-score ≤ –3 vs. > –3). Echocardiographic measurements of ascending aorta (AA), transverse arch (TA), isthmus (IA) and descending aorta (DA) were taken preoperatively, at discharge, and at latest follow-up (2.26 y, IQR 0.22–5.92). Measurements were compared with paired and independent samples t-tests. Binomial logistic regression was used to identify predictors for reintervention.

RESULTS: Common associated diagnoses were VSD (69, 30.8%), IAA (56, 25.0%), TGA (26, 11.6%), and DORV (24, 10.7%). 19 patients had isolated hypoplasia. Coarctation (CoA) was present in 116 (51.8%). Absolute aortic dimensions and z-scores significantly increased postoperatively in all segments (p < .0005). Continuous growth, indicated by increasing z-scores, was observed in AA and TA (AA: p < .0005; TA: p = .028) but not in distal arch segments (IA: p = .702; DA: p = .944) at latest follow-up (Figure 1). Aortic diameters exceeded expected values at AA (p = .010), TA (p < .0005), and DA (p = .002) during follow-up. Size of IA at follow-up was comparable irrespective of preoperative CoA (p = .768). Arch reintervention was required in 12 (5.4%) patients: 7 (3.1%) for ascending aorta and 5 (2.2%) for distal aortic arch. 3 and 5-year freedom from reintervention were 93.3% and 91.0%, respectively. Reintervention rate was comparable between patients with normal vs. hypoplastic preoperative TA dimensions (z-score > –3: 82.5%, z-score ≤ –3: 96.0%; p = .090). The
patients with preoperative CoA had a lower reintervention rate compared to those without (CoA: 96.8%, no CoA: 85.2%; p = .015). No factor was identified as a significant predictor for aortic arch reintervention in multivariable analysis.

**CONCLUSIONS:** Results of aortic arch reconstruction are excellent with low reintervention rate. Adequate growth was found following repair regardless of repair type. Presence or absence of CoA does not affect reintervention rate. Appropriate enlargement of the hypoplastic ascending aorta may further improve outcome.
18. Development of a 3D Printing Based Cardiac Surgical Simulation Curriculum to Teach Septal Myectomy


University of Washington, Seattle, WA

DISCUSSANT: CRAIG J. BAKER

OBJECTIVE: The use of three-dimensional printing (3Dp) in medicine continues to evolve. We sought to explore its use in cardiac surgical education as a simulation tool for teaching extended septal myectomy to senior level trainees (clinical PGY 4–7).

METHODS: A curriculum including didactic lectures, selected readings and an operative video was implemented. Six identical three-dimensional prints were constructed for each of three consecutive patients undergoing myectomy. Septal myectomy was performed on each printed heart by an attending surgeon and each of the 5 residents prior to operation. The volume of print resected was measured by liquid displacement in all cases. Technical feedback was given to the residents prior to resection of both the second and third models. All print resections were videotaped and blindly evaluated using a Likert scale assessment tool. A resident participated in each operation.

RESULTS: Myectomy resection volume (averaged across all prints) differed significantly between attending and residents. (Attending 13.8 ± 3.8 cm³ vs Resident 6.7 ± 4.3 cm³, p = 0.02 by unpaired t-test, Figure 1) However, the gap between attending and resident resection volumes decreased with each model to near equivalence (Print 1, 15 cm³ vs 3.1 cm³, Print 2, 17 cm³ vs 8.5 cm³, Print 3 9.5 cm³ vs. 8.4 cm³, Figure 2). The attending scored higher on the videotaped assessments and the resident scores decreased slightly during the study driven by a few important errors. (Figure 3).
CONCLUSIONS: A patient-specific 3D-printing based simulation module shows promise as a tool to improve cardiothoracic resident training in septal myectomy. This operation is difficult to teach compared to most other cardiac operations based upon limited visibility for the assistant and significant specific complications. The residents were quickly able to perform resections volumetrically on par with the attending. This study will enroll two additional patients (total n = 5) and include assessment of this simulation platform itself.
19. The Mid-Term Survival of Robotic Lobectomy Resection of Non-Small Cell Lung Cancer (NSCLC): A Multi-Institutional Study
*Robert J. Cerfolio¹, Asem F. Ghanim¹, Mark Dylewski², Giulia Veronesi³, Lorenzo Spaggiari⁴, Bernard J. Park⁵
¹UAB, Birmingham, AL; ²Baptist Health of South Florida, South Miami, FL; ³Istituto Clinico Humanitas Cancer Center, Istituto Europeo Di Oncologia, Milan, Italy; ⁴Istituto Europeo Di Oncologia, Milan, Italy; ⁵Memorial Sloan Kettering Cancer Center, New York, NY
DISCUSSANT: MARK F. BERRY

BACKGROUND: Our objective is to report the world’s largest series with the longest follow-up of robotic lobectomy for non-small cell lung cancer (NSCLC).

METHODS: This is a multi-institutional review of a consecutive series of patients from four institutions’ prospective robotic databases.

RESULTS: There were 1,339 patients (men 55%, median age 68). The median operative time was 136 minutes, median number of lymph nodes was 13 (5 N2 stations and 1 N1), median blood loss was 50 cc (4.005%, received intra-operative transfusions). Conversions occurred in 113 patients (8%) and for bleeding in 21 (2%). Median length of stay was 3 days. Major morbidity occurred in 8%. The 30-day and 90-day operative mortality was 0.2% and 0.5%, respectively. Follow-up was complete in 99% with a median follow up of 28 months (range 1–154 months). The 5-year stage-specific survival was: 83% for the 672 patients with stage IA NSCLC, 77% for the 281 patients with stage IB, 68% for the 118 patients with stage IIA, 70% for 99 patients with IIB, 62% for 143 patients with stage IIIA (122 had N2 disease, 73%) and 31% for 8 patients with stage IIIB (none had N3 disease). The 5-year survival curve is shown below. Recurrent NSCLC occurred in 128 patients (11%) local recurrence in the ipsilateral operated chest occurred in only 2%.

* WTSA Member
CONCLUSIONS: The mid-term oncologic results of robotic lobectomy for non-small cell lung cancer are promising especially for patients with pathologic N2 disease. Further studies are needed.

9:50 am – 10:10 am COFFEE BREAK: VISIT EXHIBITS & POSTERS, Intl Center South
10:10 am – 11:10 am  SCIENTIFIC SESSION VI

Intl Center North

(10 minutes presentation, 10 minutes discussion)

Moderators: David M. McMullan
Craig H. Selzman

20. Twenty-One Years and 626 Patients Later: Contemporary Outcomes After Bidirectional Cavopulmonary Anastomosis

*Lauren C. Kane, Luis E. De León, Ruth Ackah, Rohini R. Sigireddi, Carlos M. Mery, Iki Adachi, Jeffrey S. Heinle, E. Dean McKenzie, Charles D. Fraser, Jr. Texas Childrens Hospital/Baylor College of Medicine, Houston, TX

DISCUSSANT: TARA KARAMLOU

OBJECTIVES: The bidirectional cavopulmonary connection (BCPC) is a standard procedure in the multistage palliation of complex congenital heart disease (CHD), with varying reported rates of interstage mortality among centers. The purpose of this study was to determine the outcomes following BCPC and examine risk factors affecting transplant-free survival to Fontan palliation in a large single-institutional cohort.

METHODS: Patients undergoing BCPC from 1995 to 2016 were included. Competing risk analysis was performed to model events after BCPC (failure and Fontan completion). Transplant-free survival to Fontan was analyzed using the Kaplan-Meier method, and risk factors for transplant or death were examined using log-rank tests and Cox-regression models.

RESULTS: The cohort included 626 patients. Median age at surgery was 9 months, and median weight was 7 kg. Median follow-up was 3.4 years (5 days–14.6 years). Dominant ventricular morphology was left in 269 (43%), right in 313 (50%) and biventricular (BV) in 44 (7%) patients. Seventy-nine (13%) patients had primary BCPC and 547 (87%) had prior palliation. Operative mortality was 2%. Five years following BCPC, 370 (59%) patients have undergone Fontan or BV repair, 55 (9%) have failed (takedown, transplant or death), and 202 (32%) were alive waiting or were not deemed candidates for Fontan (Figure). Seventy-six patients (12%) underwent BCPC during the same hospitalization as stage I palliation. When comparing these patients to those who had surgery electively (n = 550), outcomes were worse in the perioperative period [operative mortality: 8/76 (10%) vs 6/550 (1%), p < 0.001].

* WTSA Member
Long-term results however, were comparable as evidenced by similar reintervention rates [24 (32%) vs 169 (31%), \(p = 0.88\)] and equivalent survival after Fontan [35/37 (95%) vs 374/383 (98%), \(p = 0.51\)]. Overall interstage attrition in our cohort was 9%. Actuarial 2-, 5-, and 8-year transplant-free survival following BCPC was 93%, 90% and 83%. On multivariate analysis, risk factors for death or transplant prior to Fontan were moderate or severe atroventricular valve regurgitation (\(p < 0.001\)), moderate or severe ventricular dysfunction (\(p = 0.04\)), and a dominant right ventricle (RV) (\(p = 0.003\)).

**CONCLUSIONS:** Survival after BCPC for complex CHD in infants has increased with improvement in surgical techniques and perioperative management of these patients. Patients who undergo BCPC during their index hospitalization have a more complicated perioperative course, however there appears to be no difference in long-term outcomes. Causes of interstage attrition are varied and the majority of deaths and transplantations appear to be influenced by ventricular function and morphological dominance. Patients with moderate or severe ventricular dysfunction, moderate or severe atroventricular valve regurgitation and a dominant RV, appear to be at higher risk for failure.
**+21. Glycogen Synthase 3β Inhibition Modulates Mitochondrial Pathways Resulting in Improved Myocardial Oxidative Stress and Collagen Production in Swine Model of Chronic Myocardial Ischemia and Metabolic Syndrome**

Brittany A. Potz, Laura A. Scrimgeour, Sharif A. Sabe, Neel R. Sodha, Frank W. Sellke

Brown University, Providence, RI

**DISCUSSANT: AHMAD Y. SHEIKH**

**BACKGROUND:** Glycogen synthase kinase 3β inhibition has been found to increase microvascular density and improve myocardial blood flow in a pig model of chronic myocardial ischemia in the setting of metabolic syndrome (MetS). Glycogen synthase kinase 3 beta (GSK-3β) activation is known to promote mitochondrial dysfunction leading to cellular apoptosis by inhibition of mcl-1 activity. Accumulation of the citric acid cycle intermediate succinate has been implicated in ischemic cardiomyocyte pathology. We hypothesized that GSK-3β inhibition would have a beneficial effect on oxidative stress in a pig model of chronic myocardial ischemia in the setting of metabolic syndrome.

**METHODS:** Pigs were fed a high fat diet for 4 weeks, then underwent placement of an ameroid constrictor to their left circumflex artery. Three weeks later animals received either: no drug (DMSO placebo: CON) or a GSK-3β inhibitor (GSK-3βI). The diets and placebo/GSK-3βI were continued for an additional 5 weeks. The pigs were then euthanized and their myocardial tissue was harvested. Oxidative Stress was analyzed via Oxyblot Analysis (Milipore Billerica, MA). Protein expression of the harvested myocardial tissue samples were analyzed via western blotting. Collagen expression was analyzed via picrosirius staining.

**RESULTS:** GSK-3β inhibition was associated with decreased expression of oxidative stress in the ischemic and non ischemic myocardial tissue compared to the control group. [Figure 1A] GSK-3β inhibition was also associated with decreased collagen expression in the ischemic and non ischemic myocardial tissue compared to the control group. [Figure 1B] Protein analysis identified decreased expression of Heat Shock Factor-1 (HSF-1) in the ischemic GSK-3β inhibited myocardial tissue compared to the control, which is consistent with decreased oxidative stress. There was also a decrease in expression of p-MCL-1 (ser 159), which is the inhibited form of the anti apoptotic BCL-2 family member protein, and a non significant decrease in expression of the pro apoptotic cleaved caspase 3/caspase 3 protein ratio (p = 0.09) in the ischemic GSK-3β inhibited myocardial tissue compared to the control. GSK-3β inhibition was also associated with decreased expression of succinate dehydrogenase in the
ischemic myocardial tissue compared to the control. Finally, GSK-3β inhibition was associated with a decrease in matrix metalloproteinase 9 (MMP-9) expression in the GSK-3β inhibited group compared to the control. [Figure 1C].

CONCLUSION: In the setting of MetS, inhibition of GSK-3β is associated with decreased oxidative stress and collagen formation in the ischemic and nonischemic myocardial tissue. GSK-3β may be working by inhibiting mitochondrial induced myocardial apoptosis and decreasing succinate dehydrogenase and MMP-9 expression.
22. Clinicoradiographic Predictors of Aggressive Behavior in Resected Malignant Ground Glass Opacity Lesions

David Nelson¹, Myrna Godoy¹, Marcelo Benveniste¹, Jitesh Shewale¹, Arlene Correa¹, Jonathan Spicer², Wayne Hofstetter¹, Reza Mehran¹, David Rice¹, Boris Sepesi¹, Garett Walsh¹, Ara Vaporciyan¹, Stephen Swisher¹, Jack Roth¹, Mara Antonoff¹
¹MD Anderson Cancer Center, Houston, TX; ²McGill University Health Center Research Institute, Montreal, QC, Canada

DISCUSSANT: THOMAS K. VARGHESE, JR.

OBJECTIVES: The unclear prognostic significance of ground glass opacities (GGOs) continues to pose a diagnostic challenge for thoracic surgeons, and reliable predictors of aggressive biologic behavior are in need. In this study, we aimed to evaluate the predictive role of clinicoradiographic features on the tumor grade and pathologic stage of resected malignant GGO lesions.

METHODS: A retrospective review was performed of patients who had NSCLC lesion described as a GGO on a preoperative imaging report and underwent surgical resection from 2008–2013. Inclusion criteria were as follows: T1-4, N0-1, and no receipt of induction chemotherapy. Pre-operative images were reviewed and detailed radiographic elements were collected and supplemented with clinical data from chart review. Clinicoradiologic data were then evaluated for correlation with post-operative pathologic findings.

RESULTS: 222 patients met inclusion criteria. Detailed radiographic analyses localized the malignancy within the known GGO for 67 patients, who thus comprised the final cohort. Further analyses were performed with these individuals. Lesion location by laterality, peripheral vs. central field, pure GGO vs. partial solid nodule, heterogeneity, cystic appearance, pleural tags, spiculation, reticulation, and lobulation were not associated with higher grade nor pathologic stage. On univariate logistic regression, lesion size was associated with tumor grade (p = 0.012). Air bronchogram displayed a nonsignificant trend toward association with tumor grade (p = 0.103). However, only lesion size was associated with tumor grade on multivariate regression (p = 0.025). For pathologic stage, lesion size and presence of air-bronchograms also displayed nonsignificant trends toward association with stage II or greater (p = 0.07 and p = 0.13, respectively). Among clinical factors, diabetes and smoking were associated with stage II or greater (p = 0.015 and p = 0.047, respectively). Multivariate regression of clinicoradiographic features showed association of diabetes and smoking history with pathologic stage (p = 0.009 and p = 0.024, respectively).
### Radiographic Predictors of Advanced Stage Among Patients with Resected Malignant GGOs

<table>
<thead>
<tr>
<th>Feature</th>
<th>OR</th>
<th>(95% Confidence Interval)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>1.03</td>
<td>(1.0–1.08)</td>
<td>p = 0.07</td>
</tr>
<tr>
<td>Type (pure GGO vs. PSN)</td>
<td>0.58</td>
<td>(0.16–2.08)</td>
<td>p = 0.40</td>
</tr>
<tr>
<td>Heterogenous</td>
<td>2.05</td>
<td>(0.40–10.4)</td>
<td>p = 0.39</td>
</tr>
<tr>
<td>Air-Bronchogram</td>
<td>2.65</td>
<td>(0.74–9.4)</td>
<td>p = 0.13</td>
</tr>
<tr>
<td>Cystic</td>
<td>1.58</td>
<td>(0.15–16.6)</td>
<td>p = 0.71</td>
</tr>
<tr>
<td>Pleural Tag</td>
<td>1.79</td>
<td>(0.46–6.98)</td>
<td>p = 0.40</td>
</tr>
<tr>
<td>Spiculation</td>
<td>1.58</td>
<td>(0.15–16.6)</td>
<td>p = 0.71</td>
</tr>
<tr>
<td>Reticulation</td>
<td>1.03</td>
<td>(0.27–3.87)</td>
<td>p = 0.97</td>
</tr>
<tr>
<td>Lobulation</td>
<td>1.33</td>
<td>(0.35–5.09)</td>
<td>p = 0.67</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** For patients with resected NSCLC arising in GGO, lesion size is associated with tumor grade, while diabetes and smoking history were associated with more advanced pathologic stage. These clinicoradiographic findings may help provide prognostic information regarding malignant GGOs, and may ultimately guide operative therapy in terms of extent of resection.
11:10 am – 12:00 pm  **C. WALTON LILLYHEI**
**POINT/COUNTERPOINT SESSION**

*Intl Center North*

**Ethics and End of Care Life: Everyone Needs TAVR, LVAD, ECMO Before They Die versus We Are the Stewards of Healthcare**

**Moderator:** Robert M. Sade

**Pro:** Everyone Needs TAVR, LVAD, ECMO Before They Die
Nicholas G. Smedira

**Con:** We Are the Stewards of Healthcare
Richard I. Whyte

12:00 pm – 12:30 pm  **ANNUAL BUSINESS MEETING (Members Only)**

12:30 pm – 2:00 pm  **FAMILY LUNCHEON, Lakeside Terrace**

7:00 pm – 11:00 pm  **PRESIDENT’S RECEPTION AND BANQUET, Intl Center Foyer and North**
Black Tie/Evening Dress Preferred
CONSTITUTION AND BYLAWS
THE WESTERN THORACIC SURGICAL ASSOCIATION
Founded as The Samson Thoracic Surgical Society

CONSTITUTION

ARTICLE I. NAME
The name of this Corporation is The Western Thoracic Surgical Association (hereinafter “the Association”).

ARTICLE II. CORE VALUES
The core values of the Association shall be:
• Scientific Endeavor in a Collegial Environment;
• Education and Progress;
• The Development of Young Surgeons;
• Professionalism; and
• Family and Friendship.

ARTICLE III. PURPOSES
The purposes of the Association shall be:

To succeed to, and to continue to carry on, the activities formerly conducted by The Samson Thoracic Surgical Society, a corporation.

To associate persons residing in the western United States and Canada who desire to advance the quality and practice of thoracic and cardiovascular surgery as a specialty.

To encourage research and study of thoracic and cardiovascular functions and disorders so as to increase knowledge and improve treatment.

To hold scientific meetings for the presentation and discussion of topics of interest to thoracic and cardiovascular surgeons and to encourage publication to these proceedings.
ARTICLE IV. MEMBERSHIP

Section 1.
The membership of this Association shall consist of surgeons whose principal professional activities are devoted to the practice of thoracic and cardiovascular surgery, and who either fulfill the qualifications specified in Section 4 below or both fulfill the qualifications specified in Section 3 below and who are admitted to membership pursuant to the procedure specified in the By-Laws.

Section 2.
There shall be five types of membership: Active, Senior, Honorary, Charter, and Candidate, as defined in the By-Laws.

Section 3.
A candidate for active membership must:

a. Be a Diplomat of the American Board of Thoracic Surgery of the United States, a Fellow in the Cardiovascular and Thoracic Surgery in the Royal College of Surgeons of Canada, or possess such educational credentials as judged equivalent by the Council.

b. Reside within or have completed a cardiothoracic residency training program within the geographic limits of the Association, which are the states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, and the provinces of Alberta, British Columbia, Manitoba, and Saskatchewan.

c. Have been engaged in the practice of thoracic and cardiovascular surgery either outside of or within the geographic limits of the Association for at least three years following completion of postgraduate training. One year of this three-years-in-practice requirement may be fulfilled by completion of either a thoracic surgical residency in an institution within the geographic limits of the Association or a one-year clinical fellowship in an institution within the geographic limits of the Association.

d. Have demonstrated interest in advancing the practice of thoracic and cardiovascular surgery through continuing professional contributions and scientific publications.

e. Have obtained the sponsorship of members of the Association as provided in the By-Laws.
Section 4.
All members in good standing of The Samson Thoracic Surgical Society in June, 1983 shall become members of the Association.

Section 5.
Charter members. Charter membership in the Association shall be accorded to those members who were charter members in good standing of the The Samson Thoracic Surgical Society in June, 1983.

Section 6.
The privilege of continuing membership shall be subject to adherence to the provisions of the Constitution and By-Laws of the Association.

ARTICLE V. OFFICERS
Section 1.
The officers of the Association shall be a President, a Vice President, a Secretary, a Treasurer, an Editor, and an Historian.

Section 2.
The term of office of the President, Vice President, Secretary and Treasurer shall be one year. The President and Vice President shall not be eligible for re-election. The Secretary and Treasurer shall be eligible for re-election but may serve for no more than four (4) consecutive years. The term of Editor and Historian shall be defined in the By-Laws.

Section 3.
Neither the Secretary nor the Treasurer may serve concurrently as the President.

Section 4.
The Officers shall be elected at the Annual Meeting of the Association in accordance with the procedures set forth in the By-Laws.

ARTICLE VI. COUNCIL
Section 1.
The governing body of the Association shall be the Council and its composition shall be as provided in the By-Laws.
ARTICLE VII. MEETINGS

Section 1.
The Association shall hold Annual Business and regular Scientific Meetings, the time and place to be determined by the Council. Only members of the Association may attend the Business Meetings.

Section 2.
Special meetings of the Council or of the members may be called as provided in the By-Laws.

ARTICLE VIII. AMENDMENTS

Proposed amendments to the Constitution shall be submitted in writing to the members at least 30 days prior to a regular business meeting at which the proposed amendments shall be presented to the membership. Notice of such proposed amendments shall be mailed to each member at least thirty days prior to the next regular meeting at which the vote shall be taken. An affirmative vote of two-thirds of the members present is required to adopt an amendment to the Constitution.
ARTICLE I. APPLICATION FOR ACTIVE MEMBERSHIP

Section 1. Applicant.

a. An applicant for Active membership shall obtain a sponsor who is a member of the Association and who, attesting to the applicant’s professional competence and ethical behavior, shall obtain for him from the Chairman of the Membership Committee the application form and a list of the qualifications for Active membership.

b. An applicant for Active Membership shall (1) have a full and unrestricted license to practice medicine in his or her respective state or province, and (2) have a current appointment on the surgical staff of a hospital with no reportable action pending which could adversely affect such applicant’s staff privileges at any hospital.

c. Any applicant for Active Membership must possess ethical and moral fitness, as well as professional proficiency, as determined, in part, on the basis of reports from members consulted as references, reports from other references and other information.

Section 2. Candidate for Membership.
An applicant shall become a candidate for membership upon receipt by the Chairman of the Membership Committee of a properly executed application form and the written recommendation of three members, including his sponsor, attesting to his professional competence and ethical behavior. The names of all candidates shall be included in the notice of the regular meeting.

Section 3. Election to Membership.
Candidates recommended by the Membership Committee and approved by the Council shall be submitted to a vote at the Annual Business Meeting. Election to Active membership shall require an affirmative vote of the majority of members present.

Section 4. Notice of Election.
Every newly elected member shall be furnished by the Secretary with an official notice of election, accompanied by a copy of the Constitution and By-Laws. A Certificate of Membership signed by the President, the Secretary, and the Chairman of the Membership Committee bearing the Seal of the Association shall be presented to the newly elected members at the first session of the next regular meeting immediately following their election.
Section 5. Candidates Not Elected.
The Secretary shall notify the primary sponsor of candidates not recommended for election and separately notify the candidate.

Section 6. Re-application.
An unsuccessful candidate may reapply for membership by submitting a written request and obtaining new sponsor letters, which may be obtained from the same persons who previously submitted sponsor letters. Re-application shall not be permitted more than two times.

ARTICLE II. MEMBERS
Section 1. Active Members.

a. **Duties and Rights.** It shall be the duty of each Active member to attend regularly the meetings of the Association, to participate in the Scientific Programs, and to uphold the ideals and objectives of the Association. Each Active member shall be entitled to one vote and may hold any office in the Association.

b. **Dues.** All Active members shall pay dues. The amount of dues may be changed upon the recommendation of the Council and approval of the majority of the members present at the Annual Business Meeting. Dues shall be payable on April 16th of each year. Members may not attend a meeting unless their dues are current.

c. **Number of Members.** The number of Active members residing within the geographic limits of the Association shall be limited to two hundred and fifty (250).

d. **Moving Outside Geographic Limits.** Active members who move outside the geographic limits of the Association may maintain their status and shall not be limited in number. They shall be exempt from the Annual Meeting attendance requirement under Section 1(f) below.

e. **Delinquency.** The Treasurer shall submit to the Council a list of the members who have failed to pay their dues by March 31st of each year, and notice of such delinquency shall be mailed to each such member at the address recorded in the records of the Association. If the delinquency is not made good within three (3) months of the mailing of such notice, or excused for adequate cause by the Council, the membership of each delinquent member shall be subject to termination pursuant to Section 1(g) below.
f. **Nonattendance.** The membership of any member who fails to attend three (3) consecutive meetings of the Association, unless such nonattendance is excused by the Council for adequate cause, shall be subject to termination pursuant to Section 1(g) below.

g. **Termination Procedure.** Any member whose membership has become subject to termination for delinquency or nonattendance shall be given written notice of such prospective termination not less than forty (40) days before the effective date of the termination. Any member who is subject to termination may apply for reconsideration by filing a written request with the Council, addressed to the Secretary, within thirty (30) days following the mailing of notice of such termination, which request shall state the reasons why such membership should not be terminated. If such a request is received within the requisite period, termination will be delayed until after the next Council meeting. If the Council finds the reasons given in the request to be adequate, membership shall not be terminated, conditioned upon payment of any arrears, where applicable. If the Council finds the reasons given in the request not to be adequate, the termination shall become effective on the sixth day after the Council meeting.

h. **Disability.** A member who becomes disabled may petition the Council for senior membership status and the Council may grant such request for a period of time until the member can return to practice.

i. **Resignation.** A member may resign from the Association at any time by tendering a resignation in writing and paying in full any dues or obligations owing the Association at the time.

**Section 2. Senior Members.**
Senior membership shall be obtained by written request and Council approval for members retired from active practice at age 60 or shall be automatic at age 70 provided that continuing active membership without respect to age shall be granted on written request. Senior members shall have the same duties, rights and privileges as active members except that they shall be exempt from dues and meeting attendance requirements and shall not hold office, except the office of the Historian. Their numbers shall not be limited.
Section 3. Honorary Members.
Honorary membership shall be granted to persons deemed suitable by reason of special contributions in the field of thoracic and cardiovascular surgery or professional accomplishments. Such persons need not be certified thoracic surgeons. Persons deemed suitable as Honorary members may become such when proposed by two members, endorsed by the Membership Committee and the Council, and approved by a majority of the members present at the next meeting. Honorary members shall be exempt from dues and meeting attendance requirements and shall have no rights to vote or hold office except as provided below. The Editor of THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY shall be an honorary member of the Association and ex-officio member of the Council without vote.

Section 4. Candidate Members.
Candidate membership is available to:

- Residents who are matched or enrolled in either a cardiothoracic surgery education program accredited by the Residency Review Committee for Thoracic Surgery under the authority of the Accreditation Council for Graduate Medical Education or a program approved for cardiothoracic surgery education by the Royal College of Surgeons of Canada—or their equivalency—from the Association’s geographic limits as defined by the Constitution of the Association;

- individuals who have completed their education in one of the above programs but do not yet meet all of the criteria for Active membership per Article IV, Section 3, of the Constitution; and

- individuals who trained outside the Association’s geographic limits who are now residing within the Association’s boundaries but do not yet have three years in practice.

Candidate members shall have no rights to vote or hold office. Candidate membership shall end when the Candidate becomes eligible for Active membership, at which time s/he is invited to apply for Active membership.

Section 5. Conduct & Discipline.

a. **Conduct.** A member of the Association shall conduct his relationship with patients, fellow physicians, and the public at large in a manner consistent with the Principles of Medical Ethics of the Society of Thoracic Surgeons, and with the purposes of this Association.
b. **Discipline.** Upon the recommendation of the Ethics Committee, the Council may take disciplinary action against a member for conduct inconsistent with the provisions of this Section or with the purposes of the Association. Any question concerning the conduct or discipline of a member shall be directed to the Chairman of the Ethics Committee. In the event that the Ethics Committee determines that disciplinary action should be considered in a particular case, the Committee shall submit to the Council a written recommendation of the disciplinary action which the Committee proposes be taken. Such determination by the Ethics Committee shall be made only after the member has been given not less than thirty (30) days written notice of the date, time and place of the Committee’s meeting, and of the nature of the complaint regarding the conduct of the member or charges against the member which are considered by the Committee, and informing the member that he may appear in person and/or by a representative and may submit whatever information he deems proper to refute the charges under consideration.

In the event that the Ethics Committee recommends to the Council that disciplinary action be taken against a member, such member shall be given thirty (30) days written notice of the time and place of the Council meeting at which such recommendation is to be considered, and of his right to appear in person or by representative to submit whatever information he deems appropriate to refute the recommendation of the Committee. Disciplinary action may consist of censure, probation, suspension, or expulsion from membership, as deemed appropriate by a majority of the Council following hearing and consideration as set forth above. No such disciplinary action shall become effective less than five (5) days after the scheduled date of the Council meeting at which the member had the opportunity to refute the Committee’s recommendation.

**ARTICLE III. OFFICERS**

**Section 1. Nomination and Election.** Candidates for election as Vice President, Secretary, Treasurer and Councilor-at-Large shall be placed in nomination by the Nominating Committee. Nominations for any of these offices may also be made from the floor. An affirmative vote by the majority of the members present at an Annual Meeting shall be required for election to office. The Vice President, Secretary and Treasurer shall be elected
annually, and will hold office from the termination of the meeting at which elected until the termination of the next regular meeting when their successor will be elected. The Vice President shall become the President upon completion of his term as Vice President.

**Section 2. Duties of the President.**
The President shall be the chief executive officer of the Association and shall have general supervision over the business of the Association, subject to the control of the Council. He shall preside at all meetings and generally shall perform all duties incident to the office of President, together with such other duties as may from time to time be delegated to him by the Council.

**Section 3. Duties of the Vice President.**
The Vice President shall perform the duties of the President in the absence or inability to act of the President, and such other duties as set forth in these By-Laws or as may from time to time be delegated to him by the Council.

**Section 4. Duties of the Secretary.**
The Secretary shall certify and maintain the records of the Association, including a copy of the Constitution and By-Laws, together with any amendment thereto, and a record of the names, classifications, and addresses of the members. The Secretary shall keep minutes of the meetings of the Association, shall file all non-financial reports required by law and shall send all notices required by law, by these By-Laws, or by direction of the Council, and shall perform such other duties as may be assigned by the Council.

**Section 5. Duties of the Treasurer.**
The Treasurer shall receive and have charge of all funds of the Association, subject to the direction of the Council. He shall perform the usual duties incident to the office of the Treasurer, including the collection of dues, the payment of the Association’s bills and obligations as approved by the Council, and the preparation, submission to the Council and presentation to the members of an annual financial report, including any that may be required by statute, together with such additional duties as may from time to time be assigned to him by the Council. The financial affairs and the financial statements of the Association shall be audited by an Audit Committee of members, or by an outside auditor as determined from year to year by the Council.
Section 6. Duties of the Editor.
The Editor of THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY shall be the Editor of the Association and shall be an ex-officio member without vote of the Program Committee and the Council. The Editor shall be appointed annually by the Council. The Editor shall serve as advisor to the Association on standards for editing and review for publication of manuscripts and proceedings of the Association.

Section 7. Duties of the Historian.
The Historian shall be the Parliamentarian and Historian of the Association and shall act as its public relations and press representative, and perform such other duties as may from time to time be delegated to him by the Council. The Historian shall be appointed annually by the Council.

Section 8. Duties of the Representative to the American College of Surgeons Board of Governors.
The representative to the Board of Governors of the American College of Surgeons shall represent the membership of the Association to the American College of Surgeons' Board of Governors in accordance with the duties of a specialty society Governor. Such Governor shall be appointed by the American College of Surgeons from nominees submitted by the Council of the Association and shall serve on the Council as an ex-officio member without vote.

Section 9. Compensation of Officers.
No Officer of the Association shall receive any compensation for his services, but may be reimbursed for expenses when authorized by the Council.

ARTICLE IV. COUNCIL
Section 1. Composition of the Council.
The Council shall be composed of the President, Vice President, Secretary, Treasurer, Immediate Past President, (3) Councilors-at-Large, up to (2) Councilors/Founders and ex-officio, without vote, the Historian, Editor, and Representative to the Board of Governors of the American College of Surgeons.

Section 2. Councilors-at-Large.
One Councilor-at-Large may be elected at each Annual Business Meeting by majority vote and serve three years.
Section 3. Duties of the Council.
The Council shall exercise all corporate powers, excepting as otherwise provided in the By-Laws. The Council shall appoint the Historian and the Editor, and may in its discretion appoint an Assistant Secretary or Assistant Treasurer.

Section 4. Liability of Councilors.
A Councilor shall have no liability based upon any alleged failure to discharge his obligations as a Councilor, except for any self-dealing transaction prohibited by law.

Section 5. Compensation of the Council.
No Councilor shall receive any compensation for serving as a Councilor of the Association, but may be reimbursed for expenses when authorized by the Council.

Section 6. Council Meetings.

a. Regular and Special Meetings. The Council shall hold regular meetings just before the beginning of the Annual Meeting of members, and shall hold such additional meetings as shall be called from time to time by the President or by any two voting members of the Council.

b. Notice. Meetings of the Council shall be held upon four days’ notice by first class mail or 48 hours’ notice delivered personally by telephone or telegraph. Notice of regular meetings need not be given if the time and place of such meeting has been set previously by the Council. Notice of a meeting need not be given to any Councilor who signs a waiver of notice or a written consent to holding the meeting or an approval of the minutes thereof, whether before or after the meeting, who attends the meeting without protesting, prior thereto or at its commencement, the lack of such notice to such Councilor. All such waivers, consents and approvals shall be filed with the corporate records or made a part of the minutes of the meetings.

c. Quorum. The presence of five (5) voting members of the Council shall constitute a quorum for a Council meeting.

d. Telephone Conference. Council members may participate in a meeting through the use of a conference telephone or similar communications equipment, so long as all members participating in such meeting can hear one another. Participation in a meeting pursuant to this section constitutes presence in person at such meeting.
e. **Manner of Acting.** Every act or decision done or made by a majority of the Councilors present at a meeting duly held at which a quorum is present is an act of the Council. A meeting at which a quorum is initially present may continue to transact business, notwithstanding the withdrawal of Councilors, if any action taken is approved by at least a majority of the required quorum for such meeting.

f. **Adjournment.** A majority of the Councilors present, whether or not a quorum is present, may adjourn any meeting to another time and place. If the meeting is adjourned for more than 24 hours, notice of such adjournment shall be given prior to the time of the adjourned meeting to the Councilors who were not present at the time of the adjournment.

**ARTICLE V. EXECUTIVE DIRECTOR**
The Council may appoint an Executive Director, who shall be responsible for the operational management of the affairs of the Association, under the executive direction of the Officers in their respective areas of responsibility. The Executive Director shall be bonded in an amount sufficient to safeguard the financial assets of the Association.

**ARTICLE VI. COMMITTEES**
Section 1. Standing Committees.
The Standing Committees of the Association shall be:

a. **Membership.** The Membership Committee shall consist of a Chairman and five members, each to serve for a term of three years provided that the terms are initially arranged such that two members retire each year. The Committee shall formulate and recommend to the Council, rules governing the qualifications and procedure with respect to elections of new members and, when appropriate, a recommendation as to the numerical limitations upon each type of membership. The Committee shall consider all applications for membership and report their recommendations to the Council for review and for presentation to the meetings of the members.
b. **Program.** The Program Committee shall consist of a Chairman and five members, each to serve for a term of three years, provided that the terms are initially arranged so that two members retire each year. The President, Secretary, and Editor shall also serve as members ex-officio without vote. It shall be the responsibility of the Program Committee to make all arrangements necessary to provide scientific sessions of high quality. The Program Committee shall submit a budget of expenses for the program, and the names of persons to be invited as guest speakers, to the Council for approval before making any final commitments regarding the expenses and guest speakers. The Program Committee shall have the additional responsibility of the initial editorial review of all manuscripts presented at the regular meeting before they are submitted to the Editor.

c. **Local Arrangements.** The Local Arrangements Committee shall consist of a Chairman and as many members as are deemed appropriate by the Council. The Committee shall serve for a term of one year. The responsibility of the Committee shall be to make the general arrangements for the Annual Meeting and to submit a report and budget for such arrangements to the Council at least thirty days before such Annual Meeting.

d. **Nominating.** The Nominating Committee shall consist of the five most recent surviving Past Presidents of the Association. The most senior Past President shall serve as Chairman. The Committee shall prepare a slate of nominees to fill any vacancies among the Officers and Council which exist or will occur at the time of the Annual Meeting. The Committee shall submit its proposed slate to the Council before presentation to the members at the Annual Meeting.

e. **Ethics.** The Ethics Committee shall consist of the three most recent surviving Past Presidents of the Association. The most recent Past President shall serve as Chairman. The Committee shall consider questions of conduct of members and make recommendations to the Council pursuant to Article II, Section 4 of these By-Laws.
f. **Industry Relations.** The Industry Relations Committee shall consist of a Chair and up to six members, each to serve a term of three years and so arranged such that no more than half of the Committee’s members retire each year. The Industry Relations Committee shall be responsible for preparing new ideas for consideration by Council that would expand and enhance relations with industry along with the resources required to develop such concepts, thereby sustaining the Association’s validity with industry.

**Section 2. Appointment.**
Appointment to vacant chairmanships or memberships of each Standing Committee, except the Nominating and Ethics Committees, shall be made by the Vice President for the year during which he will be President. The Vice President shall make known to the Nominating Committee and the Council for review and approval his selection of members for the Committee appointments. Vacancies on Committees occurring between regular meetings shall be filled by the President.

**Section 3. Special Committees.**
The Council from time to time may create such Special Committees and appoint the Chairman and members thereof as it deems appropriate for carrying out the purposes and activities of the Association.

**ARTICLE VII. MEETINGS OF MEMBERS**

**Section 1. Special Meetings.**
Special meetings of the members may be called by the President or by 5 percent or more of the members. Any special business meeting of the members called by the President to act on an amendment to the By-Laws shall be approved by the Council.

**Section 2. Notice of Meetings.**
Notice of each Annual or Special Meeting shall be given appropriately as determined by the President or by the Council to members of record at the close of business on the business day preceding the day on which notice is given, provided that such notice of the Annual Meeting or Special Meeting of the members shall be given to each member by the Secretary in writing at least thirty (30) and not more than ninety (90) days prior to the date thereof.
Section 3. Quorum.
No fewer than fifty (50) member shall constitute a quorum for the transaction of the business of the Association at any meeting. However, if fewer than one-third (1/3) of the members are present at the meeting, the only matters which may be voted upon are those matters as to which proper notice was given.

Section 4. Proposals to the Members.
Proposals concerning the operation or policies of the Association may be brought before meetings of the members upon majority vote of the Council or written request of a majority of the voting members delivered to the Secretary not less than thirty (30) days prior to such meeting. A decision reached at the meeting regarding such a proposal shall be a two-thirds (2/3) vote of the members, assuming a quorum, shall be binding on the Council and the Association.

Section 5. Proxies.
Attendance or voting at a meeting of members by proxy is prohibited and shall be invalid and of no effect.

Section 6. Reports and Papers.
All reports and papers read before the Association at the Annual Meeting shall be deposited with the Secretary at the time of their presentation.

ARTICLE VIII. GENERAL
Section 1. Operation of the Association.
The Association shall operate as set forth in its Articles of Incorporation, Constitution and By-Laws, and its funds, both income and principal, shall be used solely for the purposes therein set forth, no part of the same being available for the benefit of any member or other person, firm or society.

The Treasurer’s financial report referred to in Article III, Section 5, shall be considered the Annual Financial Report of the Association and the Council shall have no duty to cause any other financial report to be prepared. The financial report shall be distributed in writing to the members at the Annual Meeting or mailed to the members as the Council determines.

Section 3. Fiscal Year.
The fiscal year of the Association shall be from January 1 through December 31 of the next calendar year.
Section 4. Parliamentary Procedure.
The meetings of the members and Council, excepting as otherwise provided in the By-Laws shall be conducted pursuant to Sturgis Standard Code of Parliamentary Procedure, as set forth in the then current edition of said work.

Section 5. Reserve and Endowment Funds.
The Council may establish a reserve fund and from time to time direct that funds of the Association not required for current operations be transferred to such fund to provide long term financial stability to the Association and to be a means for accumulating funds for future projects. The reserve fund shall be deposited in an insured account or accounts in a savings bank and/or savings and loan association or invested in whole or in part in investments which legally may be made by trustees under the laws of the State of California. The Council may create a Reserve Fund Committee to make recommendations concerning the investment and deposit of the fund. The Council may in its discretion withdraw and use in the current operations of the Association the income of the fund, but withdrawals of principal shall be made only with the approval of the proposed withdrawal and use of the funds by a majority of the Council members present at a meeting.

The Council shall establish a Paul C. Samson Endowment Fund to perpetuate the educational activities of the Association and to underwrite in whole or in part the Paul C. Samson Resident Prize Award.

ARTICLE IX. ASSESSMENTS
If in the judgment of the Council special needs of the Association so require, it may propose an assessment of a specified amount to be charged to each member. Notice of such proposal shall be mailed to the members at least thirty (30) days in advance of the meeting at which the vote is to be taken, and shall be effective if approved by two-thirds (2/3) of the members present at such meeting.

ARTICLE X. GUESTS
Section 1. Guests of the Members.
Each member may invite one guest and accompanying person to meetings of the Association. Members shall notify the Secretary in advance of the names of their guests. The Council shall determine the charge to be made for guests and the expenses relating to the guests’ attendance shall be the responsibility of the member who has issued the invitation.
Section 2. Guests of the Program Committee.
The Program Committee may invite guests to participate in the scientific programs. Such guests shall be expected to bear the expenses related to their participation and attendance at meetings except as provided in Article X, Section 3.

The Council may invite guests to attend the meetings of the Association without charge when deemed appropriate and in the interest of carrying out the purposes of the Association.

Section 4. Participation of Guests.
Guests shall be expected to withdraw when the business of the Association is to be conducted, as an announcement by the President.

ARTICLE XI. INDEMNIFICATION
The Association shall indemnify any person, who is or was a Councilor, officer, employee or other agent of the Association, to the extent allowed by law, so long as such person acted in good faith, in a manner such person believed to be in the best interests of the Association and with such care, including reasonable inquiry, as an ordinary prudent person in a like position would use under similar circumstances.

ARTICLE XII. DISSOLUTION
Section 1. Voting.
The Association shall not be dissolved except by the affirmative vote of two-thirds (2/3) of the members entitled to vote.

Section 2. Conditions.
In the event of dissolution of the Association in any manner and for any cause, after the payment or adequate provision being made for payment of all of its debts, and liabilities, all of the remaining funds and assets of the Association shall be transferred to a nonprofit fund, foundation or corporation which is organized and operated exclusively for educational or scientific purposes related to the purpose of the Association, and which has established its tax exempt status under Section 501 (c) (3) of the Internal Revenue Code and Section 23701 (d) of the Revenue and Taxation Code of California, or equivalent statutes then in effect.
ARTICLE XIII. AMENDMENTS

Proposed amendments to these By-Laws shall be submitted in writing to the members at a business meeting called for that purpose immediately preceding the one at which the vote is taken. An affirmative vote of two-thirds (2/3) of the members present is required to adopt an amendment to the By-Laws.

Revised: June 1999
       June 2000
       June 2001
       June 2007
       June 2009
       June 2010
       June 2012
       June 2014
       June 2015
GUIDELINES FOR EXPERT WITNESS TESTIMONY

The Western Thoracic Surgical Association joins with other specialty organizations in emphasizing the obligation of objectivity when its members respond to requests to serve as expert witnesses in the judicial system. The perceived need for a guideline outlining policies and standards for expert testimony was recognized by the Council following a report by the Association’s Ethics Committee of a complaint against a member. Within the legal system the definition of an “expert” is far less stringent than what the medical profession might acknowledge. In a trial the attorneys introduce the qualifications of their experts and their testimony generally embodies relevant facts, the expert’s knowledge and experience, and the expert’s best judgment. Attacks on the credibility of an expert witness are termed impeachments and tactics can be employed during cross-examination to question the expert’s qualifications. It is this issue that the Association wishes to specifically address, the qualifications of an expert. An expert witness should have current experience and ongoing knowledge about the areas of clinical medicine in which they are testifying as well as familiarity with practices during the time and place of the episode being considered as well as the circumstances surrounding the occurrence. The expert witness should be an impartial practicing physician. He or she must not become an advocate or a partisan in a legal proceeding. Truthfulness is essential and misrepresentation or exaggeration of facts or opinions in an attempt to establish an absolute right or wrong may be harmful both to the individual parties involved and to the profession as a whole. The experts’s views must not narrowly reflect applicable standards to the exclusion of the other acceptable choices. The ultimate test for accuracy and impartiality is a willingness to prepare testimony that could be presented unchanged for use by either the plaintiff or the defendant. The solicitation of physicians to serve as expert witnesses by plaintiff’s attorneys who offer large fees may result in highly biased and inaccurate testimony. The expert witness should possess excellent special knowledge but be cognizant of the limitations of his competence in his own special field, and recognize the possibility of multiple accepted avenues of therapy. The expert witness gives testimony that educates the court and the jury rather than obfuscates and distorts for personal gain.
IMPORTANT NOTICE: The previous member listing is proprietary information of the Western Thoracic Surgical Association (“WTSA”) and may not be distributed or duplicated, in whole or in part, for any purpose without the prior written consent of the WTSA. Use of the information for telemarketing or any other solicitation of any persons on this list is strictly prohibited.

NECROLOGY

Edward B. Diethrich, MD, Phoenix, AZ
Frederick Firestone, MD, Pasadena, CA
Jack W. Love, MD, Santa Barbara, CA
Duane L. Merrill, MD, Redwood City, CA
F. Griffith Pearson, MD, Waterloo, ON, Canada
PAST PRESIDENTS

David J. Dugan
1974–1977

Bertrand V. Meyer

John C. Callaghan
1984–1985

Quentin R. Stiles
1988–1989

John E. Connolly
1977–1978

Paul A. Ebert
1981–1982

Richard M. Peters
1985–1986

John R. Benfield
1989–1990

Norman E. Shumway
1978–1979

Robert W. Jamplis
1982–1983

Ivan A. May
1986–1987

Richard P. Anderson
1990–1991

Harold V. Liddle
1979–1980

Arthur N. Thomas
1983–1984

Lucius D. Hill
1987–1988

Richard G. Fosburg
1991–1992
James B.D. Mark  
1992–1993

Daniel J. Ullyot  
1996–1997

David R. Clarke  
2000–2001

Steven W. Guyton  
2004–2005

Marvin Pomerantz  
1993–1994

Winfield J. Wells  
1997–1998

Donald B. Doty  
2001–2002

R. Scott Mitchell  
2005–2006

D. Craig Miller  
1994–1995

Kent W. Jones  
1998–1999

Edward D. Verrier  
2002–2003

Elliot T. Gelfand  
2006–2007

Richard G. Sanderson  
1995–1996

Bradley J. Harlan  
1999–2000

Vaughn A. Starnes  
2003–2004

Douglas E. Wood  
2007–2008
Robert C. Robbins
2011–2012

Robbin G. Cohen
2010–2011

David A. Fullerton
2008–2009

J. Scott Millikan
2009–2010

J. Scott Millikan
2009–2010

Robbin G. Cohen
2010–2011

Michael S. Mulligan
2014–2015

John C. Chen
2012–2013

John D. Mitchell
2015–2016

Thomas A. Burdon
2013–2014

John D. Mitchell
2015–2016

Robert C. Robbins
2011–2012

John C. Chen
2012–2013

Thomas A. Burdon
2013–2014

Michael S. Mulligan
2014–2015

John D. Mitchell
2015–2016
In 1984, on the tenth anniversary of its founding, the Samson Thoracic Surgical Society changed its name to the Western Thoracic Surgical Association in order to better describe its scope and to gain professional recognition as the major surgical specialty organization it had become. Thereafter, the Council sought a means to perpetuate the name of Paul C. Samson, the patron and inspiration of the society during its early years. Mindful of Paul’s legendary warmth and generosity to young surgeons and his lifelong dedication to both graduate and postgraduate surgical education, it was decided to link his name with the activities of the Association that pertained to these interests and in 1985 the Samson Endowment Fund was created.

The Fund is managed as an endowment and the interest accruing to the principal is used exclusively for specific educational purposes. One such purpose is the funding of the Samson Resident Prize Essay which each year brings to the scientific program the best work of residents from thoracic surgical education programs throughout North America and from abroad.

The Samson Endowment Fund has reached its goal and has now been capped. A new, unrestricted Samson WTSA Fund has been opened, the purpose of which is to help the WTSA achieve its ongoing mission of: associating persons who desire to advance the quality and practice of thoracic and cardiovascular surgery as a specialty; encouraging research and study of thoracic and cardiovascular functions and disorders so as to increase knowledge and improve treatment; and holding scientific meetings for the presentation and discussion of topics of interest to thoracic and cardiovascular surgeons and to encourage publication to these proceedings. It is suggested that each member make a contribution of $500 to the Samson Endowment and WTSA Funds. This may be viewed as a lifetime obligation to be discharged in any manner over any time period the Member chooses. Previous contributions to the now capped Samson Endowment Fund are totaled with any new donations to the Samson WTSA Fund when calculating whether a member has fulfilled his/her suggested lifetime contribution of $500. Contribution is entirely voluntary and failure to contribute is not penalized or singled out in any way. A line item for optional contribution is included on the annual dues statement only as a reminder.
The David J. Dugan Distinguished Service Award of the Western Thoracic Surgical Association is presented to members of the Association in recognition of distinguished achievement and outstanding contributions to the field of thoracic surgery in the areas of science or leadership over a sustained period of time. Nominations for this award are made by the Nominating Committee and are presented to the Council for consideration & approval.

1994  George E. Miller, Jr  
Pebble Beach, California

1997  Edward A. Smeloff  
Sacramento, California

1999  Jack M. Matloff  
Los Angeles, California

2002  Albert Starr  
Portland, Oregon

2004  Leonard L. Bailey  
Loma Linda, California

2005  Bruce A. Reitz  
Stanford, California

2007  W. Gerald Rainer  
Denver, Colorado

2009  Richard P. Anderson  
Seattle, Washington

2010  John A. Hawkins  
Salt Lake City, Utah
2013  Edward D. Verrier
       Seattle, Washington

2014  Harold C. Urschel, Jr.
       Dallas, Texas

2016  D. Craig Miller
       Stanford, California
DONALD B. DOTY EDUCATIONAL AWARD

The Donald B. Doty Educational Award is a $10,000 educational grant with a twofold purpose: 1) to foster innovative educational initiatives in cardiothoracic surgery by WTSA members, and 2) to provide an opportunity for the dissemination of this information to other training centers and academic institutions.

2005 LDS Hospital
Salt Lake City

2006 James I. Fann
Stanford, California

2007 Gordon A. Cohen
Seattle, Washington

2008 John D. Mitchell
Aurora, Colorado

2009 Robbin G. Cohen
Los Angeles, California

2010 Michael S. Mulligan
Seattle, Washington

2011 Gordon A. Cohen
Seattle, Washington

2012 James I. Fann
Stanford, California

2013 Winfield J. Wells
Los Angeles, California
2014  Nahush A. Mokadam
Seattle, Washington

2015  Sunil P. Malhotra
New York, New York

2016  Nahush A. Mokadam
Seattle, Washington
# PAST MEETING HIGHLIGHTS

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<tr>
<th>Year</th>
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<th>President</th>
<th>Secretary</th>
<th>Local Arrangements Chairman</th>
<th>Samson Resident Prize Essay Award</th>
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<tbody>
<tr>
<td>1975</td>
<td>The Santa Barbara Biltmore Hotel, Santa Barbara, California</td>
<td>David J. Dugan&lt;br&gt;Oakland, California</td>
<td>Arthur N. Thomas&lt;br&gt;San Francisco, California</td>
<td>John F. Higginson&lt;br&gt;Santa Barbara, California</td>
<td>William R. Brody&lt;br&gt;Bethesda, Maryland</td>
</tr>
<tr>
<td>1976</td>
<td>The Banff Springs Hotel, Banff, Alberta, Canada</td>
<td>David J. Dugan&lt;br&gt;Oakland, California</td>
<td>Arthur N. Thomas&lt;br&gt;San Francisco, California</td>
<td>John C. Callaghan&lt;br&gt;Edmonton, Alberta, Canada</td>
<td>Joe W. Ramsdell&lt;br&gt;San Diego, California</td>
</tr>
<tr>
<td>1978</td>
<td>Hotel Del Coronado, Coronado, California</td>
<td>John E. Connolly&lt;br&gt;Irvine, California</td>
<td>Arthur N. Thomas&lt;br&gt;San Francisco, California</td>
<td>Richard G. Fosburg&lt;br&gt;San Diego, California</td>
<td>James M. Wilson&lt;br&gt;San Francisco, California</td>
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</tbody>
</table>
PAST MEETING HIGHLIGHTS

1979  Sun Valley Lodge, Sun Valley, Idaho
President               Norman E. Shumway
                          Stanford, California
Secretary               Arthur N. Thomas
                          San Francisco, California
Local Arrangements Chairman Harold V. Liddle
                          Salt Lake City, Utah
Samson Resident Prize Essay Award Thomas H. Hoffmann
                          San Antonio, Texas

1980  Tamarron Lodge, Durango, Colorado
President               Harold V. Liddle
                          Salt Lake City, Utah
Secretary               Arthur N. Thomas
                          San Francisco, California
Local Arrangements Chairman W. Gerald Rainer
                          Denver, Colorado
Samson Resident Prize Essay Award Robert H. Breyer
                          Chicago, Illinois

1981  Hyatt Regency Hotel, Maui, Hawaii
President               Bertrand W. Meyer
                          Los Angeles, California
Secretary               Lucius D. Hill
                          Seattle, Washington
Local Arrangements Chairman Quentin R. Stiles
                          Los Angeles, California
Samson Resident Prize Essay Award Clifford M. Kitten
                          San Antonio, Texas

1982  Hotel del Coronado, Coronado, California
President               Paul A. Ebert
                          San Francisco, California
Secretary               Lucius D. Hill
                          Seattle, Washington
Local Arrangements Chairman Richard G. Fosburg
                          La Jolla, California
Samson Resident Prize Essay Award Douglas A. Murphy
                          Atlanta, Georgia
PAST MEETING HIGHLIGHTS

1983  The Broadmoor, Colorado Springs, Colorado

President  Robert W. Jamplis  
Palo Alto, California

Secretary  Lucius D. Hill  
Seattle, Washington

Local Arrangements Co-Chairmen  James B.D. Mark  
Stanford, California
W. Gerald Rainer  
Denver, Colorado

Samson Resident Prize Essay Award  Michael L. Dewar  
Montreal, Quebec, Canada

1984  Hyatt Regency Hotel, Maui, Hawaii

President  Arthur N. Thomas  
San Francisco, California

Secretary  Lucius D. Hill  
Seattle, Washington

Local Arrangements Chairman  David J. Dugan  
Oakland, California

Samson Resident Prize Essay Award  Keith D. Dawkins  
Stanford, California

1985  Hyatt Lake Tahoe, Incline Village, Nevada

President  John C. Callaghan  
Edmonton, Alberta, Canada

Secretary  Lucius D. Hill  
Seattle, Washington

Local Arrangements Chairman  Edward A. Smeloff  
Sacramento, California

Samson Resident Prize Essay Award  George T. Christakis  
Toronto, Ontario, Canada

1986  Silverado Country Club, Napa, California

President  Richard M. Peters  
San Diego, California

Secretary  Richard G. Fosburg  
Del Mar, California

Local Arrangements Chairman  John R. Benfield  
Duarte, California

Samson Resident Prize Essay Award  David E. Hansen  
Stanford, California
## PAST MEETING HIGHLIGHTS

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<tr>
<td>1989</td>
<td>Hyatt Regency Resort, Monterey, California</td>
<td>Quentin R. Stiles, Los Angeles, California</td>
<td>Richard G. Fosburg, Del Mar, California</td>
<td>Richard L. Murtland, Monterey, California</td>
<td>Michael A. Breda, Los Angeles, California</td>
</tr>
<tr>
<td>1990</td>
<td>Hotel Del Coronado, San Diego, California</td>
<td>John R. Benfield, Sacramento, California</td>
<td>D. Craig Miller, Stanford, California</td>
<td>Richard G. Fosburg, La Jolla, California</td>
<td>David A. Fullerton, Denver, Colorado</td>
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PAST MEETING HIGHLIGHTS

1991  Westin Hotel, Seattle, Washington
President  Richard P. Anderson
          Seattle, Washington
Secretary  D. Craig Miller
          Stanford, California
Local Arrangements Chairman  Philip C. Jolly
          Seattle, Washington
Samson Resident Prize Essay Award  John S. Pirolo
          St. Louis, Missouri

1992  Hyatt Regency Hotel, Kauai, Hawaii
President  Richard G. Fosburg
          La Jolla, California
Secretary  D. Craig Miller
          Stanford, California
Local Arrangements Co-Chairmen  Edward L. Hurley
          Sacramento, California
          Philip W. Wright
          Honolulu, Hawaii
Samson Resident Prize Essay Award  Luis J. Castro
          Stanford, California

1993  La Costa Resort, Carlsbad, California
President  James B.D. Mark
          Stanford, California
Secretary  D. Craig Miller
          Stanford, California
Local Arrangements Chairman  Walter B. Cannon
          Palo Alto, California
Samson Resident Prize Essay Award  Paul J. Pearson
          Rochester, Minnesota

1994  Resort at Squaw Creek, Olympic Valley, California
President  Marvin Pomerantz
          Denver, Colorado
Secretary  Kent W. Jones
          Salt Lake City, Utah
Local Arrangements Chairman  Daniel L. Smith
          Denver, Colorado
Samson Resident Prize Essay Award  Barbara L. Robinson
          Rochester, Minnesota
PAST MEETING HIGHLIGHTS

1995  The Coeur d’Alene Resort, Coeur d’Alene, Idaho
President  D. Craig Miller  Stanford, California
Secretary  Kent W. Jones  Salt Lake City, Utah
Local Arrangements Chairman  Ronald P. Grunwald  Spokane, Washington
Samson Resident Prize Essay Award  Michael J. Moulton  St. Louis, Missouri

1996  The Grand Wailea Resort, Wailea, Maui, Hawaii
President  Richard G. Sanderson  Tucson, Arizona
Secretary  Kent W. Jones  Salt Lake City, Utah
Local Arrangements Chairman  Edward A. Smeloff  Sacramento, California
Samson Resident Prize Essay Award  Daniel S. Schwartz  New York, New York

1997  The Silverado Country Club & Resort, Napa, California
President  Daniel J. Ullyot  Burlingame, California
Secretary  Kent W. Jones  Salt Lake City, Utah
Local Arrangements Chairman  Michael K. Wood  Hillsborough, California
Samson Resident Prize Essay Award  Edward M. Boyle, Jr.  Seattle, Washington

1998  The Chateau Whistler Resort, Whistler, B.C., Canada
President  Winfield J. Wells  Los Angeles, California
Secretary  Vaughn A. Starnes  Los Angeles, California
Local Arrangements Co-Chair  W.R. Eric Jamieson  Vancouver, B.C., Canada
Samson Resident Prize Essay Award  Vivek Rao  Toronto, Ontario, Canada
PAST MEETING HIGHLIGHTS

1999  The Resort at Squaw Creek, Olympic Valley, California
President  Kent W. Jones
Salt Lake City, Utah
Secretary  Vaughn A. Starnes
Los Angeles, California
Local Arrangements Chairman  J. Edward Okies
Portland, Oregon
Samson Resident Prize Essay Award  Leonard Y. Lee
New York, New York

2000  The Orchid at Mauna Lani, The Big Island, Hawaii
President  Bradley J. Harlan
Sacramento, California
Secretary  Vaughn A. Starnes
Los Angeles, California
Local Arrangements Co-Chairs  Paul B. Kelly and Linda M. Kelly
Fair Oaks, California
Samson Resident Prize Essay Award  Murray H. Kown
Stanford, California

2001  Rancho Bernardo Inn, San Diego, California
President  David R. Clarke
Denver, Colorado
Secretary  Vaughn A. Starnes
Los Angeles, California
Local Arrangements Co-Chairs  Myles S. Guber and Debbie Bishop
Denver, Colorado
Samson Resident Prize Essay Award  Baiya Krishnadasan
Seattle, Washington

2002  Big Sky Resort, Big Sky, Montana
President  Donald B. Doty
Salt Lake City, Utah
Secretary  R. Scott Mitchell
Stanford, California
Local Arrangements Chairman  John A. Hawkins
Salt Lake City, Utah
Samson Resident Prize Essay Award  Susan D. Moffatt-Bruce
Stanford, California
## Past Meeting Highlights

### 2003 La Costa Resort, Carlsbad, California
- **President**: Edward D. Verrier  
  *Seattle, Washington*
- **Secretary**: R. Scott Mitchell  
  *Stanford, California*
- **Local Arrangements Chairman**: Douglas E. Wood  
  *Seattle, Washington*
- **Samson Resident Prize Essay Award**: Albert J. Chong  
  *Seattle, Washington*

### 2004 Wailea Marriott, Wailea, Maui, Hawaii
- **President**: Vaughn A. Starnes  
  *Los Angeles, California*
- **Secretary**: R. Scott Mitchell  
  *Stanford, California*
- **Local Arrangements Chairman**: Winfield J. Wells  
  *Los Angeles, California*
- **Samson Resident Prize Essay Award**: Frederick A. Tibayan  
  *Stanford, California*

### 2005 Fairmont Empress Hotel, Victoria, BC, Canada
- **President**: Steven W. Guyton  
  *Seattle, Washington*
- **Secretary**: John A. Hawkins  
  *Salt Lake City, Utah*
- **Local Arrangements Chairman**: W. R. Eric Jamieson  
  *Vancouver, BC, Canada*
- **Samson Resident Prize Essay Award**: Matthew G. Whitten  
  *Salt Lake City, Utah*
- **Donald B. Doty Award**: LDS Hospital  
  *Salt Lake City, Utah*

### 2006 Sun Valley Resort, Sun Valley, Idaho
- **President**: R. Scott Mitchell  
  *Stanford, California*
- **Secretary**: John A. Hawkins  
  *Salt Lake City, Utah*
- **Local Arrangements Chairman**: Thomas A. Burdon  
  *Stanford, California*
- **Samson Resident Prize Essay Award**: T. Brett Reece  
  *Charlottesville, VA*
- **Donald B. Doty Award**: James I. Fann  
  *Stanford, California*
- **Norman E. Shumway Award**: John A. Hawkins  
  *Salt Lake City, Utah*
PAST MEETING HIGHLIGHTS

2007  Hyatt Regency Tamaya Resort & Spa, Santa Ana Pueblo, New Mexico

President  Elliot T. Gelfand
            Edmonton, AB, Canada

Secretary  John A. Hawkins
            Salt Lake City, Utah

Local Arrangements Chairman  Jorge A. Wernly
                              Albuquerque, New Mexico

Samson Resident Prize Essay Award  Jayan Nagendran
                                 Edmonton, Canada

Donald B. Doty Award  Gordon A. Cohen
                      Seattle, Washington

Norman E. Shumway Award  Michael J. Weyant
                        Aurora, Colorado

2008  Sheraton Keauhou Bay Resort and Spa, Kona, Hawaii

President  Douglas E. Wood
            Seattle, Washington

Secretary  John A. Hawkins
            Salt Lake City, Utah

Local Arrangements Chairman  Michael S. Mulligan
                              Seattle, Washington

Samson Resident Prize Essay Award  John Keech
                                   Seattle, Washington

Donald B. Doty Award  John D. Mitchell
                      Denver, Colorado

Norman E. Shumway Award  Joseph S. Carey
                        Torrance, California

2009  The Fairmont Banff Springs, Banff, Canada

President  David A. Fullerton
            Aurora, Colorado

Secretary  Thomas A. Burdon
            Palo Alto, California

Local Arrangements Chairman  Michael J. Weyant
                              Aurora, Colorado

Samson Resident Prize Essay Award  David C. Mauchley
                                   Denver, Colorado

Donald B. Doty Award  Robbin G. Cohen
                      Los Angeles, California

Norman E. Shumway Award  Anthony D. Caffarelli
                        Stanford, California
PAST MEETING HIGHLIGHTS

2010  Ojai Valley Inn, Ojai, California

President                J. Scott Millikan
                        Billings, Montana
Secretary                Thomas A. Burdon
                        Palo Alto, California
Local Arrangements Co-Chairs   Dominic and Carolyn Tedesco
                                Ventura, California
Samson Resident Prize Essay Award Phillip D. Smith
                                Aurora, Colorado
Donald B. Doty Award        Michael S. Mulligan
                                Seattle, Washington
Norman E. Shumway Award     Phillip D. Smith
                                Aurora, Colorado

2011  The Broadmoor, Colorado Springs, Colorado

President                Robbin G. Cohen
                        Los Angeles, California
Secretary                Thomas A. Burdon
                        Palo Alto, California
Local Arrangements Co-Chairs   David and Christine Fullerton
                                Aurora, Colorado
Samson Resident Prize Essay Award Jessica A. Yu
                                Denver, Colorado
Donald B. Doty Award        Gordon A. Cohen
                                Seattle, Washington
Norman E. Shumway Award     Agustin E. Rubio
                                Seattle, Washington

2012  The Grand Wailea, Maui, Hawaii

President                Robert C. Robbins
                        Stanford, California
Secretary                Thomas A. Burdon
                        Stanford, California
Local Arrangements Co-Chairs   James and Andrea Fann
                                Stanford, California
Samson Resident Prize Essay Award Ryan Kim
                                Saginaw, Michigan
Donald B. Doty Award        James I. Fann
                                Stanford, California
Norman E. Shumway Award     Sarah Geisbuesch
                                New York, New York
# PAST MEETING HIGHLIGHTS

## 2013 The Coeur d’Alene, Coeur d’Alene, Idaho

| President | John C. Chen | Honolulu, Hawaii |
| Secretary | Patricia A. Thistlethwaite | La Jolla, California |
| Local Arrangements Chair | Yong Shin | Clackamas, Oregon |
| Samson Resident Prize Essay Award | Janet Edwards | Calgary, Alberta |
| Donald B. Doty Award | Winfield J. Wells | Los Angeles, California |
| Norman E. Shumway Award | Ahmad Y. Sheikh | Stanford, California |

## 2014 The St. Regis Monarch Beach, Dana Point, California

| President | Thomas A. Burdon | Stanford, California |
| Secretary | Patricia A. Thistlethwaite | La Jolla, California |
| Local Arrangements Co-Chairs | Anthony and Jennifer Caffarelli | Newport Beach, California |
| Samson Resident Prize Essay Award | Jatin Anand | Houston, TX |
| Donald B. Doty Award | Nahush A. Mokadam | Seattle, Washington |
| Norman E. Shumway Award | Stephanie G. Worrell | Los Angeles, California |

## 2015 The Fairmont Chateau Whistler, Whistler, British Columbia

| President | Michael S. Mulligan | Seattle, Washington |
| Secretary | Sean C. Grondin | Calgary, Alberta |
| Local Arrangements Co-Chairs | Leah M. and Jeffrey Backhus | Stanford, California |
| Samson Resident Prize Essay Award | Ann C. Gaffey | Philadelphia, Pennsylvania |
| Donald B. Doty Award | Sunil P. Malhotra | New York, New York |
| Norman E. Shumway Award (tie) | Billanna Hwang | Seattle, Washington |
| | Justin M. Schaffer | Stanford, California |
2016  The Hilton Waikoloa Village, Waikoloa, Hawaii

President                      John D. Mitchell  
                               Aurora, Colorado

Secretary                     Sean C. Grondin  
                               Calgary, Alberta

Local Arrangements Co-Chairs  Ross M. & Kathleen Bremner  
                               Phoenix, Arizona

Samson Resident Prize Essay Award  Billie-Jean Martin  
                                  Calgary, Alberta

Donald B. Doty Award           Nahush A. Mokadam  
                               Seattle, Washington

Norman E. Shumway Award        Camille L. Stewart  
                               Aurora, Colorado
## POSTGRADUATE COURSES AND SPEAKERS

### 1979

**Management of the (Re-Do) Coronary Artery Patient**  
Edward B. Stinson, MD, Stanford, CA

**The Infected Artificial Heart Valve**  
Edward J. Hurley, MD, Sacramento, CA

**Changing Concepts in the Interpretation of Ventricular Filling Pressures**  
Gregory A. Misbach, MD, San Francisco, CA

**Are Randomized Trials Possible for Devices or Surgical Procedures**  
Lawrence I. Bonchek, MD, Milwaukee, WI

### 1980

**Preoperative Assessment of the Patient with Marginal Pulmonary Function**  
Richard M. Peters, MD, San Diego, CA

**Airway Management**  
G. Hugh Lawrence, MD, Portland, OR

**Postoperative Care of the Patient With Marginal Pulmonary Function**  
Alan Hilgenberg, MD, Denver, CO

### 1981

**Historical Perspective**  
John C. Callaghan, MD, Edmonton, Alberta, Canada

**Dysoxia of Cells**  
Eugene Robin, MD, Palo Alto, CA

**Crystalloid Solution for Myocardial Protection**  
R. Leighton Fisk, MD, Phoenix, AZ

**Blood Cardioplegia for Myocardial Protection**  
Gerald D. Buckberg, MD, Los Angeles, CA

**Before and After – Myocardial Preservation**  
Shahbudin Rahimtoola, MD, Los Angeles, CA

### 1982

**Current Diagnostics and Drug Therapy For Thoracic Infections**  
Arnold Weinberg, MD, Boston, MA

**Surgical Therapy of Pleural Space Infections**  
G. Hugh Lawrence, MD, Portland, OR

**Post-Operative Mediastinal Wound Infections**  
E.A. Rittenhouse, MD, Seattle, WA

**Current Therapy of Esophageal Perforations**  
Arthur N. Thomas, MD, San Francisco, CA
POSTGRADUATE COURSES AND SPEAKERS

1983  The Thymus: Master Gland of the Immune System
Robert A. Good, MD, PhD, New York, NY

The Mediastinum Imaging Techniques
James B.D. Mark, MD, Stanford, CA

Surgical Approaches to the Mediastinum
Philip C. Jolly, MD, Seattle, WA

Surgical Oncology of Mediastinal Tumors
John R. Benfield, MD, Los Angeles, CA

1984  The Surgical Management of Aortic Dissection
Paul A. Ebert, MD, San Francisco, CA

Routine Use of the Internal Mammary Artery Conduit for Coronary Bypass:
Late Clinical and Angiographic Follow-Up Studies
U. Scott Page, MD, Portland, OR

Cardiac Trauma
F. William Blaisdell, MD, Sacramento, CA

Physiologic Principles of Coronary Blood Flow as Applied to the Cardiac
Surgical Patient
Julien J.E. Hoffman, MD, San Francisco, CA

1985  Cardiac Support Devices
J. Donald Hill, MD, San Francisco, CA

Cardiac Transplantation – Present Status and Future Prospects
Jack G. Copeland, III, MD, Tucson, AZ

Will the Real Cass Study Stand up?
Richard P. Anderson, MD, Seattle, WA

1986  Cell Membranes – Implications on Cancer Control
Jonathan Singer, MD, San Diego, CA

Pathophysiology of Left Ventricular Dysfunction in a Surgical Perspective
Kirk Peterson, MD, San Diego, CA

1987  Anti-Platelet Therapy – Practical Clinical Strategies for Bypass Graft
Patients
Laurence A. Harker, MD, La Jolla, CA

Platelets, Vasospasm, and Aspirin – Thoughts on the Pathogenesis and
Prevention of Arteriosclerosis
Laurence A. Harker, MD, La Jolla, CA
POSTGRADUATE COURSES AND SPEAKERS

1988  Single Lung Transplantation  
       F. Griffith Pearson, MD, Toronto, Ontario, Canada

1989  Challenges of the Heights: Limits For Survival  
       Michael Wiedman, MD, Boston, MA

       The Western Thoracic Surgical Association Multi-Institutional Study of Results In Cardiac Surgery  
       Forrest L. Junod, MD, Sacramento, CA  
       Daniel J. Ullyot, MD, San Francisco, CA

1990  Cellular and Molecular Biology of Lung Cancer: Clinical Implications  
       Martin F. McKneally, MD, Albany, NY  
       John D. Minna, MD, Bethesda, MD

1991  Modern Statistical Analysis of Surgical Risks and Outcomes  
       Gary L. Grunkemeier, PhD, Portland, OR  
       Eugene Blackstone, MD, Birmingham, AL

       Andrew Baird, MD, PhD, La Jolla, CA  
       Alain Carpentier, MD, Paris, France

1993  Doing Better, Feeling Worse  
       Donald Kennedy, PhD, Stanford, CA

1994  Esophageal Carcinoma from Molecular Biology to Esophagectomy  
       Mark Orringer, MD, Ann Arbor, MI  
       David Beer, PhD, Ann Arbor, MI

1995  Molecular Genetics of the Marfan Syndrome and Related Connective Tissue Disorders  
       Hal Dietz, MD, PhD, Baltimore, MD

       Practical Update on Biostatistics for Cardiothoracic Surgeons  
       Gary Grunkemeier, PhD, Portland, OR

1996  Regulation of Intimal Thickening and Luminal Narrowing After Vascular Reconstruction: Molecular Mechanisms and Pharmacological Control  
       Alexander W. Clowes, MD, Seattle, WA
POSTGRADUATE COURSES AND SPEAKERS

1997  What is Wrong with the Failing Heart
      William W. Parmley, MD, San Francisco, CA

1998  The Surgical Treatment of End-Stage Heart Disease by Transplants and Mechanical Devices: Outcomes and Costs
      Keith Reemtsma, MD, New York, New York

1999  The Surgical Profession at the Turn of the Century: Challenges and Opportunities
      Samuel A. Wells, Jr., MD, Chicago, Illinois

2000  The Current Status of Therapy for Thoracic Aneurysms
      Denton A. Cooley, MD, Houston, Texas

2001  Thinking Beyond the Third Dimension
      Marc R. DeLeval, MD, FRCS, London, England

2002  Advances in Aortic Surgery
      Nicholas T. Kouchoukos, MD, FACS, St. Louis, Missouri
      Advances in Congenital Heart Disease Surgery
      Frank L. Hanley, MD, San Francisco, California
      Advances in Cardiac Valve Surgery
      Robert Karp, MD, Snowmass, Colorado

2003  Cell Transplantation to Prevent Heart Failure
      Richard D. Weisel, MD, Toronto, Ontario Canada

2004  Where, When and How it all Started
      Norman E. Shumway, MD, Stanford California

2005  Progress Toward A Tissue Engineered Heart Valve
      John E. Mayer, Jr., MD, Boston, MA

2006  Stem Cell Research
      Irving Weissman, MD, Stanford, CA

2007  Frontiers in Disease Phenotyping: The Example of Organ Transplantation
      Philip F. Halloran, MD, Edmonton, AB, Canada

2008  Allogeneic Stem Cell Transplantation for Malignant and Nonmalignant Hematologic Disorders
      Rainer F. Storb, MD, Seattle, Washington
POSTGRADUATE COURSES AND SPEAKERS

2009  Cardiac Surgery and Translational Research—A Critical Partnership in Critical Condition
Francis G. Spinale, MD, Charleston, South Carolina

2010  The Emerging Science of Healthcare Delivery
Nicholas Wolter, MD, Billings, Montana

2011  Why Would Anyone Want to Be on Your Surgical Team?
Robert C. Myrtle, Los Angeles, California

2012  Paging Dr. Moore, STAT
Arnold Milstein, Stanford, California

2013  Medical Miracles Cost Money
Geoffrey Sewell, Honolulu, Hawaii

How to Be Successful in the Accountable Care Organization (ACO) Movement
Francis J. Crosson, Alexandria, Virginia
J. Scott Millikan, Billings, Montana
Dominic J. Tedesco, Ventura, California

2014  From Checklists to Culture: What Spacewalking Brings to Surgery
David Williams, Toronto, Ontario

2015  Innovations in the Access to New Medical Devices
Michael J. Mack, MD, Plano, TX

2016  War Surgery in Iraq and Afghanistan
Cameron D. Wright, MD, Boston, MA
The Thoracic Surgery Foundation (TSF) was established in 1988 as a 501(c)(3) not-for-profit charitable organization. The TSF Board of Directors was composed of members of the four leading thoracic surgery societies: The American Association for Thoracic Surgery (AATS), The Society of Thoracic Surgeons (STS), the Southern Thoracic Surgical Association (STSA), and the Western Thoracic Surgical Association (WTSA). On October 1, 2014, TSF became the charitable arm of The Society of Thoracic Surgeons. The foundation represents thoracic surgery in the United States and its research and educational initiatives support the broad spectrum of thoracic surgery. The mission of TSF is to foster the development of surgeon scientists in cardiothoracic surgery, increasing knowledge and innovation to benefit patient care. STS underwrites all of TSF’s management expenses so that every dollar donated to the Foundation goes directly to support TSF CT Surgery Award programs.

For 29 years, TSF has supported over $15 million toward thoracic surgery research and education programs, and has supported over 285 Alley-Sheridan Scholarships.

Your donations to TSF have a direct impact on the future of cardiothoracic surgery and the welfare of our patients. Please consider making an annual donation to TSF via the following options:

- Donate in person at the TSF Booth #1
- Donate online at thoracicsurgeryfoundation.org/donate
- Donate by mail: TSF, 633 North St. Clair Street, 23rd Floor, Chicago, IL 60611

To receive more information about giving opportunities or TSF Awards, please contact Priscilla S. Kennedy, TSF Executive Director, at (312) 202-5868, or by e-mail at pkennedy@sts.org.
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2017 TSF RESEARCH AND EDUCATION AWARD
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TSF Research Award: Operational support of original research efforts by cardiothoracic surgeons who have completed their formal training, and who are seeking initial support and recognition for their research program. Awards of up to $40,000 a year for up to two years are made each year to support the work of an early-career cardiothoracic surgeon (within seven years of first faculty appointment).

David D. Odell, MD
Northwestern University
“Development of a Novel Lung Cancer Collaborative in Illinois”

Hiroo Takayama, MD, PhD
Columbia University
“Novel Non-invasive Assessment of Mechanical Stress on Aortic Valve During Continuous-Flow Left Ventricular Assist Device”

STS Research Award: Operational support of original research efforts by cardiothoracic surgeons who have completed their formal training, and who are seeking initial support and recognition for their research program. Awards of up to $40,000 a year for up to two years are made each year to support the work of an early-career cardiothoracic surgeon (within seven years of first faculty appointment). The STS Research Award designation is given to the highest-ranking TSF research application awarded by TSF based on merit as judged by a rigorous peer review process.

David M. Hoganson, MD
Boston Children’s Hospital
“Endothelialized Vascular Scaffold for Lung Engineering”
STS Research Award, $80,000
**TSF STSA Research Award:** Operational support of original research efforts by cardiothoracic surgeons who have completed their formal training and who are seeking initial support and recognition for their research program. Awards of up to $25,000 for one year will be granted to support the work of an early-career cardiothoracic surgeon (within seven years of first faculty appointment at the time of application deadline). STSA membership is not required; however, applicants must meet STSA membership eligibility requirements.

Anson M. Lee, MD  
Stanford University School of Medicine  
“Identifying the Common Final Pathway in Post-Operative Atrial Fibrillation with Transcriptome Profiling”

**TSF Nina Starr Braunwald Research Award:** Operational support of original research efforts by women cardiac surgeons who have completed their formal training, and who are seeking initial support and recognition for their research program. Awards of up to $40,000 per year for up to two years are made each year to support the work of an early-career woman cardiac surgeon (within five years of first faculty appointment).

Maral Ouzounian, MD, PhD  
Toronto General Hospital  
“Biomechanical and Metabolic Properties of Proximal Aortic Aneurysms in Patients with Bicuspid Aortic Valves”

**TSF Nina Starr Braunwald Research Fellowship Award:** Support of up to $30,000 per year for up to two years for a woman resident working in a cardiac surgical clinic or laboratory research program who has not yet completed cardiothoracic surgical training.

Lauren V. Huckaby, MD  
University of Pittsburg Medical Center  
“Estrogen and Sex Differences in Bicuspid and Tricuspid Aortic Valve Thoracic Aortic Aneurysm”
Carolyn E. Reed Traveling Fellowship: Support of $10,000 per fellowship will allow a clinically established woman thoracic surgeon to travel to another institution for the purpose of learning a new skill or technology.

Lisa M. Brown, MD
UC Davis School of Medicine
“University of Michigan Health Services Research Traveling Fellowship”

Lauren C. Kane, MD
Baylor College of Medicine
“Learning Surgical Strategies with Later Presenting Congenital Heart Disease in India and Beyond”

Michael J. Davidson Fellowship: Michael J. Davidson, MD was an outstanding cardiothoracic surgeon and teacher, who was murdered in January of 2015 at Brigham and Women’s Hospital in Boston. This tragedy profoundly affected the cardiothoracic community and brought to light Dr. Davidson’s achievements in mastering sophisticated catheter skills and advocating for a future that would meld the cardiac catheterization lab with the operating theatre. This award in his name will provide annual support of $25,000 for a deserving young early-career cardiothoracic surgeon (within seven years of first faculty appointment at the time of application deadline) committed to the vision of innovative and collaborative cardiovascular care that Dr. Davidson helped pioneer.

Brian T. Plunkett, MD
Brigham and Women’s Hospital
“Clinical Fellowship in Endovascular Cardiac Surgery”
TSF/Edwards Lifesciences Foundation Every Heartbeat Matters Award: Support of up to $37,500 for qualified surgeons who conduct charity work in underserved regions/populations. This award is designed to provide support for programs that educate, screen and/or treat underserved populations to reduce the global burden of heart valve disease, or to support other programs that advance health care and address underserved populations.

Reshma M. Biniwale, MD
University of California Los Angeles
“Hearts with Hope Foundation in Peru”

R. Morton Bolman, III, MD
University of Vermont Medical Center
“Addressing the Burden of Rheumatic Heart Disease in Rwanda: A Plan for Future Sustainability”

Frederick L. Grover, MD
University of Colorado
“Enhancing Access to Care and Treatment of Cardiovascular Disease in Nepal”

Reza A. Khodaverdian, MD
Stanford University School of Medicine
“VOOM Foundation in Nigeria”

Pranava Sinha, MD
Children’s Research Institute
“Management of Rheumatic Heart Disease in Uganda”

Luca A. Vricella, MD
Johns Hopkins University
“Pediatric Cardiac Surgery Mission to Cambodia”
The Levi Watkins Innovation and Leadership Development Scholarship: Levi Watkins, MD was an accomplished cardiothoracic surgeon and social activist at Johns Hopkins Medical Center, and made medical history by working with innovative physicians and engineers to implant the first automated internal cardiac defibrillator in a human-being. The Watkins Scholarship will provide a training and/or development grant to support travel to a center of excellence to acquire additional clinical, translational or leadership training to enhance skills and practice in an area of innovation or surgical significance. This award in his name will provide support of up to $5,000 for up to two weeks for cardiothoracic surgeons who are within seven years of first faculty appointment.

Errol L. Bush, MD
Johns Hopkins University
“Development of a Successful Ex-Vivo Lung Perfusion Program at Toronto General Hospital”
The Levi Watkins Innovation and Leadership Development Scholarship, $5,000
2017 TSF EDUCATION AWARD RECIPIENTS

TSF Alley-Sheridan Scholarships: TSF offers up to 10 partial scholarships of $2,500 toward the cost to attend the Leadership Program in Health Policy and Management at the Heller School of Public Policy and Management at Brandeis University, and the Surgeons as Educators Course, hosted by the American College of Surgeons.

Stephen R. Broderick, MD
Johns Hopkins University
Leadership Program for Health Policy and Management at Brandeis University

Christopher M. Genco, MD
Beebe Healthcare
Leadership Program for Health Policy and Management at Brandeis University

Chuong D. Hoang, MD
NIH – National Cancer Institute
Leadership Program for Health Policy and Management at Brandeis University

Ravi Ghanta, MD
Baylor College of Medicine
Leadership Program for Health Policy and Management at Brandeis University

Vigneshwar Kasirajan, MD
VCU Health
Leadership Program for Health Policy and Management at Brandeis University

Susan D. Moffatt-Bruce, MD
Ohio State University
Leadership Program for Health Policy and Management at Brandeis University
Meena Nathan, MD
Boston Children’s Hospital
Leadership Program for Health Policy and Management at Brandeis University

Anastasios C. Polimenak, MD
Children’s Hospital of Georgia/Medical College of Georgia
Leadership Program for Health Policy and Management at Brandeis University

Alexander Roitstein, MD
Aurora BayCare Medical Center
Leadership Program for Health Policy and Management at Brandeis University

Elaine Tseng, MD
University of California San Francisco
Leadership Program for Health Policy and Management at Brandeis University
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SYMPOSIA

LUNCH SYMPOSIUM
(Colorado B)
Thursday, June 22 12:30 pm – 1:45 pm
When to Intervene? VAD’s, Valves, and Cardiogenic Shock
Moderator: Craig H. Selzman
Speakers: Ashok N. Babu, MD, Joseph C. Cleveland, Jr., MD, and Nahush A. Mokadam, MD
Supported by Medtronic

EVENING SYMPOSIUM
(Colorado B)
Thursday, June 22 5:00 pm – 6:30 pm
Risk Mitigation of Infection Following Cardiac Surgery
Speakers: Scott Schubach, MD and Anthony P. Furnary, MD
Supported by ConvaTec

LUNCH SYMPOSIUM
(Colorado B)
Friday, June 23 12:30 pm – 1:45 pm
Perceval Sutureless Aortic Valve; A Comprehensive Review
Speaker: Kevin Teoh, MD
Supported by LivaNova
IS YOUR WTSA MEMBERSHIP INFORMATION CURRENT?

DO YOU HAVE:
A new email address for either work or home?
A new address or phone number?

Please let us know so that your WTSA records stay current, and that all important updates and news reaches you.

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Spouse Name

OFFICE ADDRESS

Institution

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Office Phone  Office Fax

HOME ADDRESS

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City  State  Zip  Country

Home Phone  Home Fax

I prefer to receive my mailings at:  HOME  OFFICE

During the Annual Meeting, you may leave the completed form with the WTSA Registration Desk. You may also fax this form to (978) 524-0498 or mail to:

Western Thoracic Surgical Association
500 Cummings Center, Suite 4400
Beverly, MA 01915
## SCHEDULE OF EVENTS
for Registered Professional Attendees

### WEDNESDAY, JUNE 21, 2017

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<td>Registration</td>
<td>Intl Center Foyer</td>
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<td>1:00 pm – 6:00 pm</td>
<td>Speaker Ready Room</td>
<td>Intl Center Foyer</td>
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<tr>
<td>7:00 pm – 9:00 pm</td>
<td>New Members / Welcome Reception</td>
<td>Main Pool Lawn</td>
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(Weather back-up Lake Terrace Dining Room)

### THURSDAY, JUNE 22, 2017

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<td>6:00 am</td>
<td>Samson Fun Run</td>
<td>Start Line: Golf Clubhouse</td>
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<td>7:00 am – 8:00 am</td>
<td>Breakfast</td>
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<td>7:00 am – 12:00 pm</td>
<td>Exhibits</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>7:00 am – 12:30 pm</td>
<td>Registration</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>7:00 am – 12:30 pm</td>
<td>Speaker Ready Room</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>8:00 am – 9:00 am</td>
<td>Scientific Session I</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>9:00 am – 9:10 am</td>
<td>New Member &amp; Samson Prize Finalist Introductions</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>9:10 am – 9:55 am</td>
<td>Presidential Address</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>9:55 am – 10:20 am</td>
<td>Coffee Break: Visit Exhibits &amp; Posters</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>10:20 am – 11:40 am</td>
<td>Scientific Session II</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>11:40 am – 12:25 pm</td>
<td>Controversies Debate:</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>12:30 pm – 1:45 pm</td>
<td>Lunch Symposium (Non-CME)</td>
<td>Colorado B</td>
</tr>
<tr>
<td>1:45 pm – 3:45 pm</td>
<td>Resident Symposium</td>
<td>Colorado B</td>
</tr>
<tr>
<td>5:00 pm – 6:30 pm</td>
<td>Evening Symposium</td>
<td>Colorado B</td>
</tr>
</tbody>
</table>

### FRIDAY, JUNE 23, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 am – 12:00 pm</td>
<td>Registration</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>6:00 am – 12:00 pm</td>
<td>Speaker Ready Room</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>6:30 am – 7:50 am</td>
<td>Breakfast Session:* Losing Our Shirts: The Impact of Disruptive or Novel Technology on Our Livelihood</td>
<td>Colorado B</td>
</tr>
<tr>
<td>7:00 am – 8:00 am</td>
<td>Breakfast</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>7:00 am – 12:00 pm</td>
<td>Exhibits</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>8:00 am – 8:50 am</td>
<td>Postgraduate Course: Young Blood for Old Brains</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>8:50 am – 10:30 am</td>
<td>Scientific Session III</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>10:30 am – 11:00 am</td>
<td>Coffee Break: Visit Exhibits &amp; Posters</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>11:00 am – 12:00 pm</td>
<td>Scientific Session IV</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>12:30 pm – 1:45 pm</td>
<td>Lunch Symposium (Non-CME)</td>
<td>Colorado B</td>
</tr>
<tr>
<td>12:30 pm</td>
<td>Golf Tournament*</td>
<td>West Course</td>
</tr>
<tr>
<td>2:00 pm</td>
<td>Tennis Tournament*</td>
<td>Tennis Courts</td>
</tr>
<tr>
<td>6:00 pm – 10:00 pm</td>
<td>Wild Wild West Theme Dinner</td>
<td>Cheyenne Lodge</td>
</tr>
</tbody>
</table>

(Buses will loop from the Main Building at 5:45pm and the last bus will return at 10:15pm)

### SATURDAY, JUNE 24, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 am – 12:00 pm</td>
<td>Registration</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>6:00 am – 11:30 am</td>
<td>Speaker Ready Room</td>
<td>Intl Center Foyer</td>
</tr>
<tr>
<td>6:30 am – 7:30 am</td>
<td>Breakfast</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>6:30 am – 10:30 am</td>
<td>Exhibits</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>7:00 am – 8:15 am</td>
<td>Concurrent Forums</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>7:00 am – 8:15 am</td>
<td>- Adult Cardiac</td>
<td>Colorado B</td>
</tr>
<tr>
<td>7:00 am – 8:15 am</td>
<td>- General Thoracic</td>
<td>Colorado C</td>
</tr>
<tr>
<td>7:00 am – 8:15 am</td>
<td>- Congenital Heart Disease</td>
<td>Colorado C</td>
</tr>
<tr>
<td>8:30 am – 9:50 am</td>
<td>Scientific Session V</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>9:50 am – 10:10 am</td>
<td>Coffee Break: Visit Exhibits &amp; Posters</td>
<td>Intl Center South</td>
</tr>
<tr>
<td>10:10 am – 11:10 am</td>
<td>Scientific Session VI</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>11:10 am – 12:00 pm</td>
<td>C. Walton Lillehei Point/Counterpoint Session: Ethics and End of Life Care: Everyone Needs TAVR, LVAD, ECMO Before They Die vs. We Are the Stewards of Healthcare</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>12:00 pm – 12:30 pm</td>
<td>Annual Business Meeting (Members Only)</td>
<td>Intl Center North</td>
</tr>
<tr>
<td>12:30 pm – 2:00 pm</td>
<td>Family Luncheon</td>
<td>Lakeside Terrace</td>
</tr>
<tr>
<td>7:00 pm – 11:00 pm</td>
<td>President's Reception &amp; Banquet</td>
<td>Intl Center Foyer (Reception) &amp; Intl Center North (Banquet)</td>
</tr>
</tbody>
</table>

### DRESS CODE:
Except for the Theme Dinner and President’s Reception/Banquet, the dress code for the Annual Meeting is Resort Casual; jacket and ties are not required. The Theme Dinner is casual/country and the President’s Reception/ Banquet is black tie preferred, with dark suits acceptable.