



# WESTERN VASCULAR SOCIETY

## **33rd Annual Meeting**

September 22 – 25, 2018

Eldorado Hotel | Santa Fe, NM

[westernvascularsociety.org](http://westernvascularsociety.org)

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# OFFICERS AND COMMITTEES

## OFFICERS

E. John Harris, MD \_\_\_\_\_ President  
York N. Hsiang, M.B., MHSc \_\_\_\_\_ President-Elect  
Steven Katz, MD \_\_\_\_\_ Past President  
Roy Fujitani MD \_\_\_\_\_ Secretary-Treasurer  
Michael Conte, MD \_\_\_\_\_ Recorder  
Larry W. Kraiss, MD \_\_\_\_\_ Councilor

## PROGRAM COMMITTEE

Wei Zhou, MD \_\_\_\_\_ Chair  
Stephen Murray, MD  
Vincent Rowe, MD  
Venita Chandra, MD  
E. John Harris, MD \_\_\_\_\_ President (Ex-Officio)  
York N. Hsiang, M.B., MHSc \_\_\_\_\_ President-Elect (Ex-Officio)  
Roy Fujitani, MD \_\_\_\_\_ Secretary-Treasurer (Ex-Officio)  
Michael Conte, MD \_\_\_\_\_ Recorder (Ex-Officio)

## MEMBERSHIP COMMITTEE

Misty Humphries, MD  
William Lee, MD  
Sherene Shalhub, MD  
Roy Fujitani, MD \_\_\_\_\_ Secretary-Treasurer (Ex-Officio)

## WVS REPRESENTATIVE TO THE SVS

Roy Fujitani, MD

## LOCAL ARRANGEMENTS COMMITTEE

Mark Langsfeld, MD

## PAST MEETINGS

1986	Dana Point, CA	Organizing Committee
1987	Tucson, AZ	W. Sterling Edwards, MD
1988	Monterey, CA	Robert B. Rutherford, MD
1989	Kauai, Hawaii	D. Eugene Strandness, Jr., MD
1990	Coronado, CA	Ronald J. Stoney, MD
1991	Rancho Mirage, CA	Victor M. Bernhard, MD
1992	Maui, Hawaii	Wesley S. Moore, MD
1993	Sonoma, CA	John M. Porter, MD
1994	Santa Barbara, CA	Eugene F. Bernstein, MD
1995	Phoenix, AZ	Robert L. Kistner, MD
1996	Dana Point, CA	Jerry Goldstone, MD
1997	Lana'I, Hawaii	Richard L. Treiman, MD
1998	Whistler, BC, Canada	Kaj H. Johansen, MD
1999	Lake Tahoe, NV	Ralph B. Dilley, MD
2000	Coeur d'Alene, ID	Peter F. Lawrence, MD
2001	Santa Fe, NM	William C. Krupski, MD
2002	Newport Beach, CA	Cornelius Olcott, IV, MD
2003	Kona, Hawaii	Lloyd M. Taylor, Jr., MD
2004	Victoria, BC, Canada	J. Dennis Baker, MD
2005	Park City, UT	Gregory L. Moneta, MD
2006	La Jolla, CA	George Andros, MD
2007	Kona, Hawaii	Jeffrey L. Ballard, MD
2008	Napa, CA	Alexander W. Clowes, MD
2009	Tucson, AZ	Fred A. Weaver, MD
2010	Sunriver, OR	Linda M. Reilly, MD
2011	Kauai, Hawaii	Ronald L. Dalman, MD
2012	Park City, UT	William J. Quinones-Baldrich, MD
2013	Jasper, AB, Canada	Joseph L. Mills, Sr., MD
2014	Coronado, CA	Peter A. Schneider, MD
2015	Wailea, Hawaii	Larry Kraiss, MD
2016	Colorado Springs, CO	William Pevac, MD
2017	Blaine, WA	Steven Katz, MD

## SECRETARY-TREASURERS

1986 - 1990	Wesley S. Moore, MD
1990 - 1993	J. Dennis Baker, MD
1993 - 1996	P. Michael McCart, MD
1996 - 1999	Gregory L. Moneta, MD
1999 - 2000	Terence M. Quigley, MD
2000 - 2002	Julie A. Freischlag, MD
2002 - 2005	Jeffrey L. Ballard, MD
2005 - 2008	Joseph L. Mills, MD
2008 - 2011	Larry W. Kraiss, MD
2011 - 2014	E. John Harris, Jr., MD
2014 - 2017	York N. Hsiang, M.B., MHSc
2017 - 2020	Roy Fujitani, MD

## RECORDERS

1987 - 1989	Victor M. Bernhard, MD
1989 - 1992	Eugene F. Bernstein, MD
1992 - 1995	Peter F. Lawrence, MD
1995 - 1998	William C. Krupski, MD
1998 - 2001	Roy L. Tawes, MD
2001 - 2004	Ronald L. Dalman, MD
2004 - 2007	Peter A. Schneider, MD
2007 - 2010	William C. Pevec, MD
2010 - 2013	Steven Katz, MD
2013 - 2017	Benjamin W. Starnes, MD
2017 - 2020	Michael Conte, MD

## NEW MEMBERS ELECTED IN 2017

**Sung Ham**

**George Lee**

**Rachel Lundgren**

**John Wang**

## WVS PRESIDENTIAL GUEST LECTURERS

1986	<b>Emerick Szilagyi</b>	2004	<b>None</b>
1987	<b>None</b>	2005	<b>Kevin G. Burnand</b>
1988	<b>James Stanley</b>	2006	<b>Jean Pierre Becquemin</b>
1989	<b>Brian Thiele</b>	2007	<b>None</b>
1990	<b>Frank Veith</b>	2008	<b>John H. N. Wolfe</b>
1991	<b>Allan Callow</b>	2009	<b>Jack L. Cronenwett</b>
1992	<b>Malcolm Perry</b>	2010	<b>None</b>
1993	<b>Norman Hertzner</b>	2011	<b>Germano Melissano</b>
1994	<b>Norman Browse</b>	2012	<b>Roy K. Greenberg</b>
1995	<b>Calvin Ernst</b>		<b>Hazim J. Safi</b>
1996	<b>Anthony Whittemore</b>	2013	<b>Spence M. Taylor</b>
1997	<b>None</b>	2014	<b>Alan B. Lumsden</b>
1998	<b>None</b>	2015	<b>Peter Gloviczki</b>
1999	<b>Jonathan Towne</b>	2016	<b>Alik Farber</b>
2000	<b>R. Thomas Grayston</b>	2017	<b>Bruce Perler</b>
2001	<b>William Hiatt</b>	2018	<b>Thomas Wakefield</b>
2002	<b>Thomas R. Russell</b>		
2003	<b>None</b>		

## **GENERAL INFORMATION**

### **EDUCATIONAL OBJECTIVES & METHODS**

The 33rd Annual Meeting of the Western Vascular Society was established with the specific purpose of advancing the art and science of vascular surgery, a goal that directly addresses competence, practice performance, and patient outcomes. The majority of the educational content includes scientific presentations by members, sponsored guests, and residents, selected by the WVS Program Committee.

### **OVERALL LEARNING OBJECTIVES**

This activity is designed for: vascular surgeons, fellows, residents, and general surgeons who find the art and science of vascular surgery rapidly changing with respect to scientific discovery and surgical technology.

Reflecting this rapid advancement, the meeting will feature oral scientific presentations by members, sponsored guests, and residents. Special features this year are an afternoon session featuring a Spine Access Symposium and Mock Oral Examinations.

Upon completion of this course, participants will be able to:

- Discuss and describe procedural planning, surgical techniques and outcomes of endovascular repair of complex thoracoabdominal, pararenal, and ruptured aortic aneurysms.
- Discuss long term outcomes, mortality rates and predictors of mortality following repair of aortic aneurysm.
- Describe techniques to treat endoleak following endovascular aneurysm repair.
- Discuss the role and outcomes of endovascular repair of aortic dissection.
- Describe strategies to reduce spinal cord ischemia from endovascular repair of thoracic aortic aneurysm.
- Explain the relationship between patient frailty and outcomes following vascular surgical intervention.

## **GENERAL INFORMATION** continued

- Describe techniques to optimize patient outcomes in the medical and surgical treatment of peripheral artery disease.
- Implement new techniques for the creation and maintenance of hemodialysis fistulas.
- Discuss new scientific insights into the biology of lipids, atherosclerotic plaque and peripheral artery disease.
- Describe new strategies to prevent venous thromboembolic disease.
- Discuss the diagnosis, management and outcomes of lower extremity arterial injury.
- Discuss techniques and outcomes of endarterectomy and stenting for symptomatic and asymptomatic carotid occlusive disease.
- Describe causes of finger ischemia in hospitalized patients.
- Recognize predictors of blood pressure response to renal artery stenting.
- Implement strategies to reduce radiation exposure during endovascular intervention.

## **EDUCATIONAL METHODS**

Authored papers are supported by PowerPoint presentations or ePoster sessions. Full papers have a primary discussant and ample time provided for questions and discussion from the audience. Panel and group discussions are encouraged.

## **DISCLOSURE INFORMATION**

In compliance with 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. All reported conflicts are managed by a designated official to ensure a bias-free presentation. Please see the insert to this program for the complete disclosure list.

## CONTINUING MEDICAL EDUCATION INFORMATION

### ACCREDITATION STATEMENT

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 Vascular Society. 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 **13.75** *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 **10.25** credits meet the requirements for Self-Assessment.



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## INSTRUCTIONS FOR CME CREDIT COLLECTION

To claim the 13.75 *AMA PRA Category 1 Credits™* please sign in each day at the registration desk and complete an evaluation form. At the end of the meeting each physician who returns the meeting evaluation form to the registration desk will be emailed a CME Certificate.

Alternatively, please feel welcome to use the online CME evaluation provided in the link sent to all attendees. Certificates will be sent to every attendee that completes this evaluation within ten days of the program.

To claim the 10.25 *AMA PRA Category 1 Credits™* for Self-Assessment please check your email for the link to the online self-assessment quiz and complete the quiz within 10 days of the program.

## ACKNOWLEDGEMENTS

The Western Vascular Society wishes to thank the following companies for their educational grants in support of the 33rd Annual Meeting.

### **Cook Medical**

### **Gore & Associates, Inc.**

The Western Vascular Society wishes to thank the following companies for sponsorship support of the 33rd Annual Meeting.

### **Abbott Vascular**

### **Cook Medical**

### **Medtronic**

### **Terumo Aortic**

The Western Vascular Society wishes to thank the following companies for exhibiting in support of the 33rd Annual Meeting.

### PLATINUM

### **Cook Medical**

### **Gore & Associates**

### **Medtronic**

### GOLD

### **Getinge Group**

### SILVER

### **Abbott Vascular**

### **Boston Scientific**

### **CR Bard**

### **Endologix, Inc.**

### **Penumbra**

### **Janssen Pharmaceuticals, Inc.**

### **Shockwave Medical**

### **Silk Road Medical**

### **Terumo Aortic**

### **Vascular Insights**



# SCHEDULE OF EVENTS

## SCHEDULE AT A GLANCE

### SATURDAY, SEPTEMBER 22, 2018

12:00 PM - 8:00 PM	<b>Registration Open</b> , Eldorado Concourse
1:00 PM - 4:00 PM	<b>Executive Council Meeting</b> , Pinion Board Room
5:00 PM - 6:00 PM	<b>ePoster Competition</b> , Ballroom Foyer
6:00 PM - 7:30 PM	<b>Welcome Reception with Exhibits</b> , Ballroom A
7:30 PM - 9:00 PM	<b>Past Presidents Dinner - Invitation Only</b>

### SUNDAY, SEPTEMBER 23, 2018

6:00 AM - 2:00 PM	<b>Registration Open</b> , Eldorado Concourse
7:00 AM - 1:00 PM	<b>Exhibits Open</b> , Ballroom A
7:00 AM - 7:45 AM	<b>Continental Breakfast with Educational Exhibitors</b> Ballroom A
7:45 AM - 8:00 AM	<b>Call to Order and Opening Announcements</b> Ballroom BC
8:00 AM - 9:40 AM	<b>Scientific Session I</b> , Ballroom BC
9:00 AM - 10:30 AM	<b>Companion Breakfast and Turquoise Presentation</b> , Zia Room
9:40 AM - 10:00 AM	<b>Coffee Break</b> , Ballroom A
10:00 AM - 12:00 PM	<b>Scientific Session II</b> , Ballroom BC
12:00 PM - 1:00 PM	<b>Diversity and Leadership in Vascular Surgery Lunch with Panel Discussion - Gore</b> Anasazi Room
1:30 PM	<b>Shuttle leaves for Towa Golf Course</b> , Lobby
1:30 PM - 5:30 PM	<b>Golf Tournament</b>
2:00 PM - 5:00 PM	<b>Museum Walking Tour</b> , Lobby <i>Preregistration required</i>
5:00 PM - 7:30 PM	<b>Reception and Casual Dinner</b> , Cava Santa Fe

## SCHEDULE AT A GLANCE continued

### MONDAY, SEPTEMBER 24, 2018

6:00 AM - 1:00 PM	<b>Registration</b> , Eldorado Concourse
6:00 AM - 1:00 PM	<b>Exhibits Open</b> , Ballroom A
6:30 AM - 7:30 AM	<b>Sponsored Breakfast Symposia - Abbott Vascular</b> Anasazi Room
7:00 AM - 8:00 AM	<b>Continental Breakfast with Educational Exhibitors</b> , Ballroom A
7:30 AM - 9:10 AM	<b>Scientific Session III</b> , Ballroom B
9:10 AM - 9:30 AM	<b>Coffee Break</b> , Ballroom A
9:30 AM - 10:50 AM	<b>Scientific Session IV</b> , Ballroom B
10:50 AM - 11:20 AM	<b>Presidential Guest Lecture - Thomas Wakefield, M.D.</b> , Ballroom B
11:20 PM - 11:45 AM	<b>Society of Vascular Surgery Update - Kenneth Slaw, M.D.</b> , Ballroom B
11:45 - 12:15 PM	<b>WVS Business Meeting</b> , Ballroom B
12:30 PM - 1:30 PM	<b>Santa Fe Cooking School</b> <b>Salsa Cooking Demonstration</b> <i>Preregistration required</i>
12:20 - 1:20 PM	<b>Sponsored Lunch Symposia - Cook Medical</b> Anasazi Room
1:30 PM - 3:00 PM	<b>Spine Access Symposium</b> , Ballroom B
3:00 PM - 5:00 PM	<b>Trainee Symposium: Mock Oral Board Examinations</b> , Ballroom B
5:30 PM - 7:30 PM	<b>Reception in the Casa Espana</b>
7:30 PM - 10:00 PM	<b>Western Vascular Society Presidential Patio Fiesta</b> , Presidential Patio

## SCHEDULE AT A GLANCE continued

### TUESDAY, SEPTEMBER 25, 2018

6:30 AM - 1:00 PM	<b>Registration Open</b> , Prefunction Foyer
6:30 AM - 7:30 AM	<b>Industry Sponsored Breakfast Symposium</b> <b>Terumo Aortic</b> , Anasazi Room
7:00 AM - 1:00 PM	<b>Exhibits Open</b> , Ballroom A
7:00 AM - 9:00 AM	<b>Sunrise Stretch and Meditation Classes</b> , Chapel
7:00 AM - 8:00 AM	<b>Continental Breakfast with</b> <b>Educational Exhibitors</b> , Ballroom A
7:30 AM - 9:00 AM	<b>Scientific Session V</b> , Ballroom B
9:00 AM - 9:30 AM	<b>Coffee Break</b> , Ballroom A
9:30 AM - 11:30 AM	<b>Scientific Session VI</b> , Ballroom B
11:30 AM	<b>Meeting Adjourns and Presentation of Awards</b>

### WEDNESDAY, SEPTEMBER 26, 2018

6:30 AM	<b>Hot Air Balloon Rides Albuquerque</b> <i>Preregistration required</i>
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# **INSTRUCTIONS TO AUTHORS**

Authors presenting papers are reminded that the presentation of the paper shall be limited to the following:

## **FULL PRESENTATIONS**

8 minutes presentation, 2 minutes invited discussant

## **MINI PRESENTATIONS**

5 minutes presentation, 5 minute general discussion

## **POSTER PRESENTATIONS**

3 minutes presentation, and 3 minutes discussion

## **ROBERT HYE MEMORIAL BEST RESIDENT PRESENTATIONS**

8 minutes presentation, 2 minutes invited discussant

## **INVITED DISCUSSION**

Two minutes and specifically critique the paper as presented. Visual aids may not be incorporated into the discussion. An electronic copy of the discussion is required to be submitted to the recorder.

## **AUDIO-VISUAL**

Authors are to provide their presentation to the technician one (1) hour prior to the beginning of the session in which they are to present.

C Sherman AV may be contacted for any technical challenges by calling 360-708-4226 or emailing [cs@cshermanav.com](mailto:cs@cshermanav.com).

## INSTRUCTIONS TO AUTHORS continued

### MANUSCRIPTS

Authors are **REQUIRED** to submit a manuscript of their presentation for possible publication in the Journal of Vascular Surgery Publications within one month of the Annual Meeting. The Editors of the Journal of Vascular Surgery Publications will determine the Journal in which accepted manuscripts will be published.

The guidelines for submission of your Manuscript(s) may be found on the Journal of Vascular Surgery Publications website [www.editorialmanager.com/jvs](http://www.editorialmanager.com/jvs). Please refer to the “Instructions for Authors.” Once the manuscript is submitted to the Journal by email, please send a confirmation of submission to Michael Conte, MD at [Michael.Conte2@ucsf.edu](mailto:Michael.Conte2@ucsf.edu).

The Annual Meeting Registration Desk will be located in the Eldorado Concourse, and open during the following hours:

<b>Saturday, September 22</b>	<b>12:00 p.m. – 8:00 p.m.</b>
<b>Sunday, September 23</b>	<b>6:00 a.m. – 2:00 p.m.</b>
<b>Monday, September 24</b>	<b>6:00 a.m. – 1:00 p.m.</b>
<b>Tuesday, September 25</b>	<b>7:00 a.m. – 11:00 a.m.</b>





# SCIENTIFIC PROGRAM

# SCIENTIFIC PROGRAM

SATURDAY, SEPTEMBER 22, 2018

1:00 – 4:00 p.m.

**EXECUTIVE COUNCIL MEETING**

5:00 – 6:00 p.m.

**POSTER COMPETITION**

**(8 posters—3 min presentation/3 min discussion)**

5:00 – 5:06 p.m.

**P1 Preadmission Does Not Correlate with Fewer Complications, Reduced Failure to Rescue or Improved Survival in EVAR and OAAA Patients**

**Justin Inman, MD**

University of California, San Francisco, CA, USA.

5:06 – 5:12 p.m.

**P2 Endovascular Removal of a Balloon Expandable Superior Mesenteric Artery Stent**

**Jeniann A. Yi, MD**

University of Colorado, Denver, CO, USA.

5:12 – 5:18 p.m.

**P3 Utility of Open Forefoot Amputation in the Management of Patients with Critical Limb Ischemia**

**Ramsey S. Elsayed, MD**

Keck School of Medicine, Los Angeles, CA, USA.

5:18 – 5:24 p.m.

**P4 Initial Experience with the Bolton TREO Device for Fenestrated EVAR**

**Benjamin W. Starnes, MD**

University of Washington, Seattle, WA, USA.

## SCIENTIFIC PROGRAM continued

5:24 – 5:30 p.m.

**P5 Traumatic Superior Mesenteric Artery Injuries: Analysis of Incidence, Morbidity and Mortality Compared to Other Visceral Arteries**

**Shelley Maithel, MD**

University of California, Irvine, Orange, CA, USA.

5:30 – 5:36 p.m.

**P6 Catheter-based Endovascular Interventions for Symptomatic Deep Vein Thrombosis in Children**

**Peter Lin, MD**

Baylor College of Medicine, Houston, TX, USA.

5:36 – 5:42 p.m.

**P7 Practice Patterns of Endovascular Interventions for Peripheral Arterial Disease in the Medicare Population**

**Rhusheet Patel, MD**

UCLA, Schaeffer Center for Health Policy, Los Angeles, CA, USA.

5:42 – 5:48 p.m.

**P8 Applicability of the Cook Inner Branched Arch Endograft**

**Christopher Burke, MD**

University of Washington, Seattle, WA, USA.

*\*Best Poster Competition Winner will be awarded at the end of the meeting on Tuesday.*

6:00 – 7:30 p.m.

**WELCOME RECEPTION**

7:30 p.m.

**PAST PRESIDENTS DINNER *(by invitation only)***

## SCIENTIFIC PROGRAM continued

SUNDAY, SEPTEMBER 23, 2018

7:00 a.m.

### **CONTINENTAL BREAKFAST WITH EDUCATIONAL EXHIBITORS**

7:45 a.m.

#### **Call to Order and Announcements**

E. John Harris, MD, President WVS

8:00 – 9:40 a.m.

### **SCIENTIFIC SESSION I - PAD**

**Presiding: E. John Harris, MD, and Michael Conte, MD**

8:00 – 8:20 a.m.

**1. \* Delayed Revascularization After a Trial of Conservative  
Therapy is Safe and Effective for Ischemic Wounds in a  
Multidisciplinary Setting**

**Joshua Gabel, MD**

Loma Linda University, Loma Linda, CA, USA.

*Discussant: Dr. Joseph Mills, Sr., MD*

8:20 – 8:40 a.m.

**2. \* Lower Extremity Revascularization with Transmetatarsal  
Amputation Improves Healing and Reduces Major Amputation**

**Evan C. Werlin, MD**

UCSF, San Francisco, CA, USA.

*Discussant: Dr. Charles Anderson*

8:40 – 9:00 a.m.

**3. \*Endovascular Reconstruction Offers Non-Inferior Outcomes  
at Reduced Cost Compared to Surgical Bypass for TASC-II D  
Aorto-Iliac Occlusive Disease**

**Joshua Gabel, MD**

Loma Linda University, Loma Linda, CA, USA.

*Discussant: Dr. Gale Tang*

## SCIENTIFIC PROGRAM continued

9:00 – 9:20 a.m.

**4. \* Impact of Physician Owned Office Based Laboratories on Physician Practice Patterns and Outcomes after Percutaneous Vascular Interventions for Peripheral Artery Disease**

**Nathan Itoga, MD**

Stanford University Medical Center, Stanford, CA, USA.

*Discussant: Dr. Peter Lawrence*

9:20 – 9:40 a.m.

**5. \* Preoperative Testing Among Patients Undergoing Arteriovenous Fistula Surgery**

**Brian Beckord, MD**

Harbor-UCLA Medical Center, Torrance, CA, USA.

*Discussant: Dr. Eugene Zierler*

9:40 – 10:00 a.m.

### COFFEE BREAK WITH EDUCATIONAL EXHIBITORS

10:00 a.m. – 12:00 p.m.

### SCIENTIFIC SESSION II - AORTIC

**Presiding: E. John Harris, MD and Wei Zhou, MD**

10:00 – 10:20 a.m.

**6. \* Late Graft Failure is Rare After EVAR Using the Zenith Stent-Graft: Fifteen-year Outcomes in a Cohort of High-Risk Patients**

**Joel L. Ramirez, MD**

University of California, San Francisco, CA, USA.

*Discussant: Dr. Rodney White*

10:20 – 10:40 a.m.

**7. \* Lessons Learned from The Largest Cohort of Type 3 Endoleaks with the Endologix AFX Stent Graft**

**Arielle Lee, MD**

University of California, San Diego, San Diego, CA, USA.

*Discussant: Dr. George Lee*

## SCIENTIFIC PROGRAM continued

10:40 – 11:00 a.m.

**8. \* Duplex Ultrasonography is a Clinically Useful Modality for Surveillance of Renal Branch Grafts After Fenestrated Endovascular Aneurysm Repair**

**Kenneth Tran, MD**

Stanford University Medical Center, Stanford, CA, USA.

*Discussant: Dr. Gregory Landry*

11:00 – 11:20 a.m.

**9. \* Variation In Center-level Frailty Burden and its Impact on Long-term Survival in Patients Undergoing Repair For Abdominal Aortic Aneurysms**

**Elizabeth L. George, MD**

Stanford University Medical Center, Stanford, CA, USA.

*Discussant: Dr. Karen Woo*

11:20 – 11:40 a.m.

**10. \* A Reliable Method for Renal Volume Measurement and its Application in FEVAR**

**Jason R. Hurd, MD**

University of Washington, Seattle, WA, USA.

*Discussant: Dr. Omid Jazaeri*

11:40 a.m. – 12:00 p.m.

**11. Anatomic Suitability for Standard, “Off-the-shelf” Thoracic Single Side-branched Endograft in Patients with Type B Aortic Dissection**

**Gregory A. Magee, MD, MSc**

University of Southern California, Los Angeles, CA, USA.

*Discussant: Dr. Stephen Cheng*

12:00 – 1:00 p.m.

**LEADERSHIP AND DIVERSITY IN VASCULAR SURGERY  
LUNCHEON - Anasazi Room**

1:30 p.m.

**Shuttle bus leaves for Towa Golf Course**

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

## SCIENTIFIC PROGRAM continued

2:00 p.m

**Museum Tour Group Meets in Lobby**

6:00 p.m.

**Reception at CAVA Santa Fe**

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

# SCIENTIFIC PROGRAM continued

MONDAY, SEPTEMBER 24, 2018

6:30 a.m. – 7:30 a.m.

## INDUSTRY SPONSORED BREAKFAST SEMINAR

**Endovascular Treatment of CLI:SFA & BTK Strategies**

7:00 a.m. – 8:00 a.m.

## CONTINENTAL BREAKFAST WITH EDUCATIONAL EXHIBITORS

7:30 – 9:10 a.m.

## SCIENTIFIC SESSION III

**Presiding: E. John Harris, MD and Stephen Murray, MD**

7:30 – 7:50 a.m.

### **12. \* The Effect of Combining Coronary Bypass with Carotid Endarterectomy in Patients with Unrevascularized Severe Coronary Disease**

**Linda J. Wang, MD, MBA**

Massachusetts General Hospital, Boston, MA, USA.

*Discussant: Dr. Niren Angle*

7:50 – 8:10 a.m.

### **13. \* Carotid Stenosis: The Impact of Frailty Syndrome on Patient Outcomes**

**Ashton Lee, MD**

Banner University Medical Center Tucson, Tucson, AZ, USA.

*Discussant: Dr. Benjamin Brooke*

8:10 – 8:30 a.m.

### **14. \* Prognostic Implications of Diagnosing Frailty and Sarcopenia in Vascular Surgery Practice: Form Versus Function**

**Amir A. Ghaffarian, MD**

University of Utah School of Medicine, Salt Lake City, UT, USA.

*Discussant: Dr. Misty Humphries*

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*



## SCIENTIFIC PROGRAM continued

8:30 – 8:50 a.m.

### **15. \* Surgical Management of Functional Popliteal Entrapment Syndrome in Athletes**

**Kedar S. Lavingia, MD**

Stanford University Medical Center, Stanford, CA, USA.

*Discussant: Dr. Hugh Gelabert*

8:50 – 9:00 a.m.

### **16. \* Factors Associated with Microembolization After Carotid Intervention**

**Joseph Sabat, MD, PHD**

University of Arizona, Tucson, AZ, USA.

9:00 – 9:10 a.m.

### **17. Establishing a Carotid Artery Stenosis Disease Cohort for Comparative Effectiveness Research Using Natural Language Processing**

**Robert W. Chang, MD**

Kaiser Permanente, South San Francisco, CA, USA.

9:10 – 9:30 a.m.

## **COFFEE BREAK WITH EDUCATIONAL EXHIBITORS**

9:30 a.m. – 10:50 a.m.

## **SCIENTIFIC SESSION IV – DIALYSIS ACCESS**

**Presiding:** E. John Harris, MD, and Roy Fujitani, MD

9:30 – 9:50 a.m.

### **18. Cost Effectiveness of Repeated Interventions on Failing Arteriovenous Fistula When is it Time to Start Over?**

**Benjamin S. Brooke, MD, PhD**

University of Utah School of Medicine, Salt Lake City, UT, USA.

*Discussant: Dr. Jason Faulds*

9:50 – 10:10 a.m.

### **19 \* Long Term Durability of Oakes Salvage Procedure to Preserve Forearm Dialysis Access in Patients with Failed Brescia**

**Anahita Dua, MD. MS. MBA**

Stanford University Medical Center, Stanford, CA, USA.

*Discussant: Dr. Wayne Gradman*

## SCIENTIFIC PROGRAM continued

10:10 – 10:30 a.m.

**20. \*Arteriovenous Fistulas Recruited with Regional Anesthesia  
Have Comparable Functional Outcomes**

**Devin S. Zarkowsky, MD**

University of California, San Francisco, CA, USA.

*Discussant: Dr. Mark Langsfeld*

10:30 – 10:50 a.m.

**21. Outcomes of Hemodialysis Vascular Access in Patients  
Initiating Dialysis with a Tunneled Catheter**

**Timothy Copeland, MPP**

UCLA, Los Angeles, CA, USA.

*Discussant: Dr. Stephen Kubaska*

10:50 – 11:20 a.m.

**PRESIDENTIAL GUEST LECTURER**

Thomas Wakefield, MD

11:20 – 11:45 a.m.

**SOCIETY OF VASCULAR SURGERY UPDATE**

Kenneth Slaw, MD

11:45 a.m. – 12:15 p.m.

**WVS BUSINESS MEETING**

12:20 p.m. – 1:20 p.m.

**INDUSTRY SPONSORED LUNCH SEMINAR**

**Long Term Durability – Impact of Fellowship Training on  
Advancing Aortic Endovascular Repair**

1:30 – 3:00 p.m.

**SPINE ACCESS SYMPOSIUM**

3:00 – 5:00 p.m.

**MOCK ORAL BOARD EXAMS**

5:30 – 7:30 p.m.

**RECEPTION AT THE CASA ESPANA**

7:30 p.m. – 10:00 p.m.

**PRESIDENT'S BANQUET WITH FIESTA ENTERTAINMENT**

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

## SCIENTIFIC PROGRAM continued

TUESDAY, SEPTEMBER 25, 2018

6:30 a.m. – 7:30 a.m.

### INDUSTRY SPONSORED BREAKFAST SEMINAR

**Advanced TEVAR Therapy: Current and Future Pipeline**

7:00 a.m.

### CONTINENTAL BREAKFAST WITH EDUCATIONAL EXHIBITORS

7:30 – 9:00 a.m.

### SCIENTIFIC SESSION V

**Presiding: York Hsiang, MD, MHSc and Vincent Rowe, MD**

7:30 – 7:50 a.m.

#### **22. \* Disease-based Observation Cohort Study of Patients with Thoracoabdominal Aortic Aneurysm**

**Chulhi Kang, MD,**

University of Washington, Seattle, WA, USA.

*Discussant: Dr. Linda Riley*

7:50 – 8:10 a.m.

#### **23. Fenestrated Endovascular Aortic Aneurysm Repair is Financially-Viable at a High-Volume Medical Center**

**Warren B. Chow, MD, MS**

University of Washington, Seattle, WA, USA.

*Discussant: Dr. Bruce Gewertz*

8:10 – 8:30 a.m.

#### **24. \* Percutaneous Approach to Endovascular Aortic Aneurysm Repair: A Cost-Minimization Study**

**Jonathan C. Hong, MD, MHS**

University of British Columbia, Vancouver, BC, Canada.

*Discussant: Dr. Sherene Shalhub*

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

## SCIENTIFIC PROGRAM continued

8:30 – 8:50 a.m.

**25. Management of Moderate Thoracic Blunt Aortic Injuries in Patients with Intracranial Hemorrhage**

**Elina Quiroga, MD, FACS**

University of Washington, Seattle, WA, USA.

*Discussant: Dr. Nii-Kbu Kabutey*

8:50 – 9:00 a.m.

**26. Association of Vascular Surgery Board of the American Board of Surgery Examination Performance with Clinical Outcomes: Experience Matters**

**Larry W. Kraiss, MD**

University of Utah, Salt Lake City, UT, USA.

9:00 – 9:10 a.m.

**27. Early Experience with the Octopus Endovascular Strategy in the Management of Thoracoabdominal Aneurysms**

**Anahita Dua, MD, MS, MBA**

Stanford University Medical Center, Stanford, CA, USA.

9:10 – 9:20 a.m.

**28. Integrated Residency is Associated with an Increase in Women Among Vascular Surgery Trainees**

**Susanna Shin, MD**

University of Washington, Seattle, WA, USA.

9:20 – 9:40 a.m.

**COFFEE BREAK WITH EDUCATIONAL EXHIBITORS**

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

## SCIENTIFIC PROGRAM continued

9:40 – 11:30 a.m.

### SCIENTIFIC SESSION VI

**Presiding:** York Hsiang, MD, MHSc and Venita Chandra, MD, FACS

9:40 – 10:00 a.m.

**29. \* Experienced Operators Achieve Superior Primary Patency and Wound Complication Rates with Endoscopic Greater Saphenous Vein Harvest Compared to Open Harvest in Lower Extremity Bypasses**

**Matthew Kronick, MD**

Oregon Health & Science University, Portland, OR, USA.

*Discussant: Dr. Vincent Rowe*

10:00 – 10:20 a.m.

**30. Plant-Based Diet Reverses Vascular Endothelial Dysfunction in Patients with Peripheral Arterial Disease**

**Peter Lin, MD**

California State University Los Angeles, Los Angeles, CA, USA.

*Discussant: Dr. Warren Gasper*

10:20 – 10:30 a.m.

**31. Multi-vessel Tibial Revascularization Does Not Improve Outcomes in Patients with Critical Limb Ischemia**

**Kedar S. Lavingia, MD**

Stanford University Medical Center, Stanford, CA, USA.

10:30 – 10:40 a.m.

**32. Lower Extremity Revascularization (LER) in the Medicare Population: The Ongoing Rise of Office-Based Atherectomy Critical Limb Ischemia**

**Michael Conte, MD**

University of California, San Francisco, CA, USA.

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

## SCIENTIFIC PROGRAM continued

10:40 – 11:00 a.m.

**33. Factors Influencing Accuracy of Volume Flow Measurement in Dialysis Access Fistulas: Analysis Based on Duplex Ultrasound Simulation**

**R. Eugene Zierler, MD**

University of Washington, Seattle, WA, USA.

*Discussant: Dr. Eugene Lee*

11:00 – 11:10 a.m.

**34. Comparison of Bovine Carotid Xenograft versus ePTFE Grafts for Forearm Loop Hemodialysis Access**

**Benjamin Colvard, MD**

Stanford University Medical Center, Stanford, CA, USA.

11:10 – 11:20 a.m.

**35. Leukocyte Phenotype is Altered in Peripheral Arterial Disease**

**Thomas A. Sorrentino, MD**

University of California, San Francisco, CA, USA.

11:20 – 11:30 a.m.

**36. Initial Open vs Endovascular Treatment and Subsequent Limb Loss After Primary Minor Amputation**

**Jonathan H. Lin, MD**

University of California, Davis, Sacramento, CA, USA.

## PRESENTATION OF ROBERT HYE MEMORIAL RESIDENT PRESENTATION AWARD

*\* Robert Hye Memorial Best Resident Presentation Award Competition Entry*

## NOTES

## NOTES



## NOTES

## NOTES



# **SCIENTIFIC SESSION ABSTRACTS**

## SCIENTIFIC SESSION ABSTRACTS

Presentation #1

### **Delayed Revascularization After a Trial Of Conservative Therapy is Safe and Effective for Ischemic Wounds in a Multidisciplinary Setting**

Joshua Gabel<sup>1</sup>, Isabella Possagnoli<sup>2</sup>, Udochukwu Oyoyo<sup>1</sup>, Ahmed Abou-zamzam Jr.<sup>1</sup>, Theodore Teruya<sup>1</sup>, Sharon Kiang<sup>1</sup>, Vicki Bishop<sup>2</sup>, Diana Eastridge<sup>2</sup>, Christian Bianchi<sup>1,2</sup>.

<sup>1</sup>Loma Linda University, Loma Linda, CA, USA, <sup>2</sup>Veterans Affairs Loma Linda Healthcare System, Loma Linda, CA, USA.

**Objectives:** Our group has previously shown that a high percentage of ischemic wounds in patients with PAD heal with conservative therapy alone. However, some patients require delayed revascularization. Our goal was to evaluate wound healing and limb salvage among patients with ischemic wounds when revascularization was necessary after a failure of conservative therapy.

**Methods:** Patients with PAD and tissue loss were prospectively enrolled into our Prevention of Amputation in Veterans Everywhere (PAVE) program. Limbs were stratified based on perfusion evaluation and a validated pathway of care. Conservatively treated limbs that failed to demonstrate a positive wound trajectory underwent delayed revascularization. Rates of wound healing, recurrence, limb salvage, and survival were retrospectively compared between patients who underwent delayed vs. immediate revascularization by uni- and multivariate analysis, controlling for Wound, Ischemia, and foot Infection (WIFI) classification.

**Results:** Between January 2008 and December 2017, 855 patients were prospectively enrolled in our PAVE program. Of 236 limbs stratified to a conservative approach, 185 (78%) healed and 33 (14%) underwent delayed (mean  $2.7 \pm 2.6$  months) revascularization. During this same period 203 limbs underwent immediate revascularization. Mean long-term follow-up (LTFU) was  $41.4 \pm 29.0$  months. Delayed compared to immediate revascularization demonstrated similar rates of wound healing (67% vs. 58%,  $p=0.33$ ), wound recurrence (24% vs. 19%,  $p=0.50$ ), limb salvage (82% vs. 75%,  $p=0.39$ ), and survival (55% vs. 51%,  $p=0.69$ ). After adjustment for WIFI classification, delayed revascularization remained non-inferior to immediate revascularization for wound healing (OR 1.4; 95% CI, 0.6-3.1), recurrence (OR 0.8; 95% CI,

## SCIENTIFIC SESSION ABSTRACTS continued

0.3-1.8), limb salvage (OR 0.7; 95% CI, 0.3-1.9) and survival (OR 0.2; 95% CI 0.6-2.5).

**Conclusions:** Patients who fail conservative therapy and undergo delayed revascularization achieve similar rates of wound healing and limb salvage compared to those undergoing immediate surgical intervention, independent of WIfI classification. A stratified approach to critical limb ischemia achieves acceptable clinical outcomes without introducing increased risk in patients who fail an initial attempt at conservative therapy.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #2

### **Lower Extremity Revascularization with Transmetatarsal Amputation Improves Healing and Reduces Major Amputation**

Evan C. Werlin, Melinda S. Schaller, Charles B. Parks, Brooke A. Goodman, Blake T. Wallace, Monara Dini, Michael S. Conte, Alexander M. Reyzelman, Warren J. Gasper.

UCSF, San Francisco, CA, USA.

**Objectives:** A transmetatarsal amputation (TMA) allows patients with forefoot wounds to maintain ambulatory function and preserve a sensate heel/ankle. However, healing after TMA is often compromised in older patients by peripheral artery disease (PAD). The aim of this study was to investigate the effect of lower extremity revascularization (LER) on TMA healing and prevention of major amputation.

**Methods:** A retrospective review of all patients who had a TMA at three centers of a multi-center vascular practice from 1/1/2008 to 12/31/2016. In 1/2012, a multi-disciplinary limb salvage team (MDLST) consisting of vascular surgeons and podiatrists was established. Data on demographics, procedural details and outcomes were collected.

**Results:** A total of 124 patients had 134 TMAs with a median follow-up of 1221d (IQR 730-1757). The mean age was  $60.9 \pm 11.5$ y, 81% were men, 87% had diabetes, 56% had PAD and 31% had coronary artery disease (CAD). 68% (91/134) of TMAs healed, 10% (14/134) had recurrent wounds and 22% (29/134) failed requiring above or below knee amputation (AKA/BKA). Patients with PAD/CAD had a significantly lower healing rate (51/84[61%] v. 40/50[80%],  $p=.021$ ) and significantly higher AKA/BKA rate (24/84[29%] v. 5/50[10%],  $p=.012$ ). LER was associated with significantly improved TMA healing rates (36/52[69%] v. 15/32[47%],  $p=.042$ ). Open LER had a significantly higher healing rate (16/31[52%] v. 4/20[20%],  $p=.024$ ) and lower AKA/BKA rate (2/31[6%] v. 9/22[41%],  $p=.002$ ) than endovascular LER. By Kaplan-Meier analysis, the median time to healing was 295d (IQR 99-754). The median time to AKA/BKA was 1062d (IQR 471-1595). In a multivariable Cox model, LER was associated with a lower risk ( $HR=0.43$ ,  $p=.039$ ) of AKA/BKA and PAD/CAD was associated with a higher risk ( $HR=5.41$ ,  $p=.001$ ).

## SCIENTIFIC SESSION ABSTRACTS continued

70% (94/134) of the TMAs were performed by the MDLST and there was an increase in TMA for WIFI stage 3/4 wounds (84/94[89%] v. 28/40[70%],  $p=.006$ ). In a multivariable Cox model, there was no change in TMA healing or AKA/BKA rates despite the higher WIFI category.

**Conclusions:** TMA is a successful and durable procedure for patients with advanced foot wounds. While TMA healing is time- and labor-intensive, aggressive use of LER can achieve TMA healing and avoid major amputation in older patients with PAD.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #4

### **Endovascular Reconstruction Offers Non-Inferior Outcomes at Reduced Cost Compared to Surgical Bypass for TASC-II D Aorto-Iliac Occlusive Disease**

Joshua Gabel, Roger Tomihama, Ahmed Abou-zamzam Jr., Theodore Teruya, Christian Bianchi, Sharon Kiang.

Loma Linda University, Loma Linda, CA, USA.

**Objectives:** To compare the clinical outcomes and cost of endovascular reconstruction of occlusive and near-occlusive disease of the aortic bifurcation to surgical bypass.

**Methods:** Thirty-three consecutive patients with symptomatic TASC-II D aortoiliac occlusive disease (AIOD) who underwent surgical bypass or endovascular reconstruction from 2012 to 2017 were retrospectively reviewed. Lesion characteristics, technical approach, survival, limb salvage, and patency were analyzed. Device, operating room, and length of stay costs were calculated based on rates provided by the Department of Veterans Affairs (VA) and compared between treatment groups.

**Results:** Nineteen patients at prohibitive risk for open surgery underwent endovascular reconstruction, while thirteen underwent surgical bypass. Kissing stent technique was used in all patients for reconstruction of the aortic bifurcation. The endovascular group had decreased operative time (157 vs 245 minutes,  $p=0.004$ ), blood loss (273 vs 763 milliliters,  $p=0.005$ ), and perioperative complications (5% vs 31%,  $p=0.045$ ) compared to surgical bypass. At mean follow-up of 2.8 years, endovascular reconstruction compared to surgical bypass demonstrated non-inferior primary/primary-assisted patency (85% vs 85%,  $p=0.98$ ), limb salvage (100% vs 92%,  $p=0.76$ ), and survival (90% vs 85%,  $p=0.65$ ). Endovascular device costs were \$4,223 greater than surgical bypass ( $p<0.001$ ), but with operating room cost \$3,332 less than surgical bypass ( $p=0.001$ ). Length of stay costs was \$13,580 less for patients undergoing endovascular reconstruction compared to surgery ( $p<0.001$ ) and led to an overall reduction of \$11,706 in hospitalization costs in favor of endovascular reconstruction ( $p<0.001$ ).



## SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Patients with occlusive and near-occlusive disease of the aortic bifurcation treated with endovascular reconstruction achieve non-inferior outcomes of patency, limb-salvage, and survival compared to surgical bypass at a mean 2.8 years. Decreased operative and length of stay costs associated with endovascular reconstruction produced an \$11,706 cost advantage relative to surgical bypass.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #4

### **Impact of Physician Owned Office Based Laboratories on Physician Practice Patterns and Outcomes After Percutaneous Vascular Interventions for Peripheral Artery Disease**

Nathan Itoga<sup>1</sup>, Laurence C. Baker<sup>1</sup>, Matthew W. Mell<sup>2</sup>.

<sup>1</sup>Stanford University Medical Center, Stanford, CA, USA, <sup>2</sup>UC Davis, Sacramento, CA, USA.

**Objectives:** Percutaneous vascular interventions (PVI) for peripheral artery disease (PAD) have shifted from hospital-based setting (HBS) to physician owned office-based laboratories (OBLs). We sought to evaluate the changes of physician treatment decisions and patient outcomes after transitioning to OBLs.

**Methods:** We identified patients with PAD with PVI from 2006-2013 in a 20% Medicare sample, and identified physicians who transitioned from predominantly HBS to OBLs (switch physicians) and compared them to those who performed procedures primarily in the HBS (control physicians). Patient outcomes included procedure type (balloon vs. atherectomy vs. stent), re-intervention rates, major adverse limb events (MALE), hospitalizations, and mortality. We used a difference in difference model to control for time effects.

**Results:** The cohort comprised 290 switch physicians who treated 8,011 patients 4,373 prior to OBL and 3,638 patients after transitioning to OBL), and 3756 control physicians treating 53,629 patients (40,405 in the pre-period and 13,224 in the post-period). Patient demographics and indication for interventions are recorded in Table 1. Switch physicians were observed to increase atherectomy use from 24% to 27% after the switch; however, the increase was larger for control physicians (20 to 30%,  $P<.001$ ; Table 2). Switching to OBL was independently associated with increased re-intervention rates at 30-days and 1-year ( $P<.001$ ), decreases in hospitalization rates at 30 days and one year ( $P<.001$ ), and similar 30-day and 1-year mortality compared with control physicians. Differences for MALE were not statistically significant when controlling for patient demographics; however, the 30-day and 1-year amputation rates decreased at a greater rate after switching to OBL.

**Conclusions:** Transition to OBLs was associated with lower amputation and hospitalization rates, at the expense of increased 30-day and 1-year re-

SCIENTIFIC SESSION ABSTRACTS continued

intervention rates after PVI. Further study is warranted to evaluate the financial implications of OBLs to justify or expand its current use.

Table 1. Patient demographics and procedure indication by switch and control physicians.

	Switch Physicians (n=290)	Control physicians (n=3,756)	P-value†
	Patients (n=8,011)	Patients (n=53,629)	
Age (years) ± SD	75.0 ± 9.6	75.23 ± 9.8	***
Male Gender	51.8%	50.7%	NS
Charlson Index ± SD	5.8 ± 3.3	6.1 ± 3.4	***
ESRD	10.6%	12.0%	**
<b>RACE</b>			
Unknown	<0.2%	<0.2%	***
White	84.7%	80.8%	
Black	11.3%	13.9%	
Other	0.8%	1.2%	
Asian	0.6%	0.8%	
Hispanic	1.8%	3.0%	
North American Native	0.7%	<0.2%	
<b>Indication for Intervention</b>			
PAD + wound	33.8%	35.2%	NS
ESRD - end stage renal disease			

† NS - P≥.05, \* - P< .05, \*\* P<.01, \*\*\* P<.001

Table 2. Procedure type and patient outcomes by switch and control physicians, stratifying by period.

	Switch Physicians		Control physicians		P-Value†
	Pre-Switch (n=4,373)	Post-Switch (n=3,638)	Pre-Period (n=40,405)	Post-Period (n=13,224)	
<b>Type of First Intervention‡</b>					
Balloon	22.5% vs. 23.2% <sup>NS</sup>		23.4% vs. 19.0% <sup>***</sup>		<.001
Stent	53.2% vs. 49.6% <sup>**</sup>		56.7% vs. 51.1% <sup>***</sup>		.32
Atherectomy	24.3% vs. 27.2% <sup>**</sup>		19.6% vs. 29.9% <sup>***</sup>		<.001
<b>Re-intervention Rates‡‡</b>					
30 - day	9.8% vs. 14.9% <sup>***</sup>		8.9% vs. 8.8% <sup>NS</sup>		<.001
1 - year	28.8% vs. 34.8% <sup>***</sup>		25.3% vs. 23.4% <sup>**</sup>		<.001
<b>Atherectomy as subsequent procedure‡‡</b>					
30 - day	3.7% vs. 5.6% <sup>***</sup>		2.5% vs. 3.4% <sup>***</sup>		.27
1 - year	10.6% vs. 13.4% <sup>***</sup>		8.3% vs. 9.8% <sup>***</sup>		.18
<b>MALE‡‡‡</b>					
30 - day	5.7% vs. 5.0% <sup>NS</sup>		5.7% vs. 5.0% <sup>**</sup>		.81
1 - year	15.6% vs. 12.0% <sup>***</sup>		14.6% vs. 12.4% <sup>***</sup>		.09
<b>Above Ankle Amputation‡‡‡</b>					
30 - day	2.5% vs. 1.2% <sup>***</sup>		2.2% vs. 2.2% <sup>NS</sup>		.002
1 - year	7.7% vs. 4.6% <sup>***</sup>		6.7% vs. 5.6% <sup>†</sup>		.001
<b>Hospitalization‡‡‡</b>					
30 - day	23.9% vs. 18.0% <sup>***</sup>		23.8% vs. 22.9% <sup>NS</sup>		<.001
1 - year	61.0% vs. 48.4% <sup>***</sup>		58.9% vs. 49.8% <sup>***</sup>		.003

†: Determined by difference-in-difference analysis

‡: Adjusted for age, race, Charlson score, gender, ‡‡procedure type, ‡‡‡ re-interventions

NS: P≥.05; \*, P< .05; \*\*, P<.01; \*\*\* P<.001

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #5

### **Preoperative Testing Among Patients Undergoing Arteriovenous Fistula Surgery**

Brian Beckord<sup>1</sup>, Lobsang Marcia<sup>2</sup>, Sarah Abdulla<sup>1</sup>, Ashkan Moazzez<sup>1</sup>, Christine Tung<sup>1</sup>, Christian de Virgilio<sup>1</sup>.

<sup>1</sup>Harbor-UCLA Medical Center, Torrance, CA, USA, <sup>2</sup>David Geffen School of Medicine, Los Angeles, CA, USA.

**Objectives:** The creation of an arteriovenous fistula (AVF) for hemodialysis access is a very low risk procedure. It is often time-sensitive, as avoidance of central venous catheters (CVC) and their complications is paramount. Thus, the role of Pre Anesthesia Testing (PAT) is debatable, particularly if it delays surgery for further work-up. We sought to determine the value and potential adverse impact of PAT.

**Methods:** A retrospective analysis of all AVF patients who had a delay in AVF surgery by PAT for further work-up, as compared to a randomly selected group of patients who were not delayed. Patients were tracked daily from the day of PAT for 6 months. Main outcome measures were need for CVC catheter intervention, emergency department (ED) visits for dialysis related reasons, and hospital visits for consultations/diagnostics.

**Results:** There were 51 patients who had AVF delayed by PAT, and 73 patients without delay. There was no significant difference between delayed and non-delayed groups when comparing age ( $p=0.65$ ), gender ( $p=0.33$ ), the American Society of Anesthesiologist (ASA) classification (median 3 for both,  $p=0.42$ ), the Revised Cardiac Risk Index (RCRI) (median score of 2 for both,  $p=0.12$ ), or prevalence of CVC for hemodialysis at time of PAT (62% vs 72%  $p=0.25$ ). In the delayed group, the median time from initial PAT evaluation to surgery was 90 days. Only 3/51 (5.88%) of the surgery delay group had a documented medical finding that prompted a change in management. In the 6 months following initial PAT, the delayed surgery group had a significantly higher average number of ER visits (0.47 vs 0.03;  $p<0.001$ ), need for new or replaced CVC (31.9% vs 1.37%  $p<0.001$ ), and an increase in general hospital visits (2.74 vs 0.34;  $p<0.001$ ).

## SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** In patients undergoing AVF surgery for hemodialysis access, delaying surgery for additional preoperative evaluation is associated with an increase in ED visits, an increase in CVC related interventions, and an increase in general hospital visits as compared to those without surgery delay. Only a small minority of the delayed surgery group underwent meaningful interventions to optimize surgery. These findings suggest that delaying surgery for further evaluation may be detrimental

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #6

### **Late Graft Failure is Rare After EVAR Using the Zenith Stent-Graft: Fifteen-year Outcomes in a Cohort of High-Risk Patients**

Joel L. Ramirez, Melinda S. Schaller, Bian Wu, Linda M. Reilly, Timothy A. M. Chuter, Jade S. Hiramoto.

University of California, San Francisco, San Francisco, CA, USA.

**Objectives:** Device-specific data on the long-term efficacy of endovascular aortic aneurysm repair (EVAR) is limited by the constant evolution of stent graft design. The Zenith bifurcated stent graft is the only one currently in use *not* to have undergone major structural modifications since its introduction. The purpose of this study is to report the long term outcomes of a single center experience of EVAR using the Zenith stent graft.

**Methods:** Retrospective analysis of 325 high-risk patients who underwent elective EVAR with Zenith stent grafts between 10/1998 and 12/2005 under a physician-sponsored investigational device exemption. Patient charts and death registries were reviewed to identify late graft failures and causes of death. Late graft failures occurring >30 days after the index procedure included: type I/III endoleaks; enlarging aneurysm sac requiring revision; limb kinking/occlusion, graft infection, renal artery occlusion, or aneurysm rupture.

**Results:** The mean age at treatment was  $75.9 \pm 7.4$  years and 300/325 (92%) were men. Mean aneurysm diameter was  $60 \pm 9$  mm. The median main body stent graft diameter was 28 mm (range: 22-32 mm). Over a mean follow-up time of  $5.9 \pm 4.0$  years, there were 6 (1.8%) aneurysm-related deaths caused by the following: 1 stent graft infection, 1 infection of a femoral-femoral bypass graft placed after limb occlusion, 1 infection of a stent graft placed to treat a type IB endoleak, and 3 aneurysm ruptures. There were 19 (5.8%) late graft failures occurring at an average of 4.6 years (range: 0.1 to 14.6 years) post-procedure (Table 1). Patients with late graft failure were more likely to have had impaired renal function ( $\text{Cr} \geq 2 \text{ mg/dL}$ ) (21% vs 6%,  $p=.03$ ) and less likely to have had cardiac disease (42% vs 67%,  $p=.04$ ) at the time of the index procedure. There was no significant association between late graft failure and: age, sex, aneurysm size, stent graft diameter, diabetes, smoking, or lung disease. Kaplan-Meier (KM) estimated overall survival was 60% at 5 years, 29% at 10 years, and 12%

SCIENTIFIC SESSION ABSTRACTS continued

at 15 years (Figure 1). KM estimated freedom from aneurysm-related mortality was 98% at 5 years, 97% at 10 years, and 97% at 15 years.

**Conclusions:** Late failures and aneurysm-related death are rare after EVAR using the Zenith stent graft, especially in high-risk patients whose comorbidities diminish life expectancy.

Figure 1. Kaplan-Meier freedom from aneurysm-related mortality and all cause mortality.

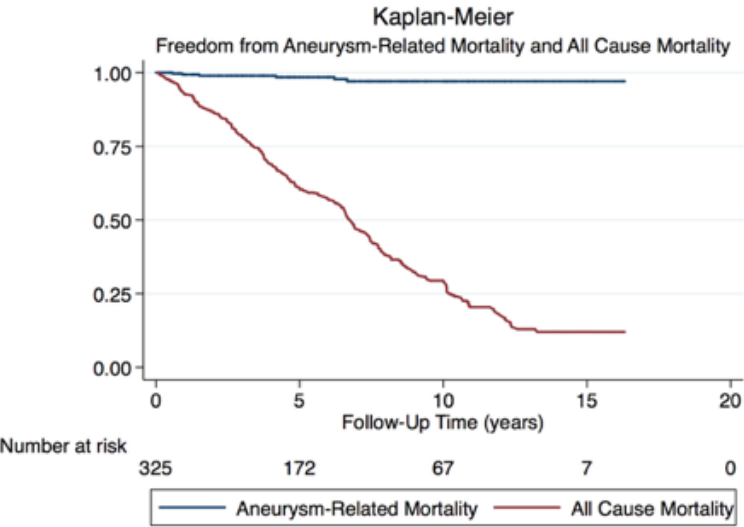


Table 1 - Primary causes of late graft failure.

Graft Failure	N=19	Time Since Operation (years)
Renal artery occlusion	1	0.6
Limb kink without occlusion	1	4.0
Infected stent-graft	1	1.5
Limb occlusion	2	0.1, 0.6
Aneurysm rupture	3	0.6, 6.1, 6.6
Type I endoleak	3	3.5, 7.9, 11.5
Enlarging aneurysm sac requiring graft revision	3	4.1, 5.3, 7.2
Type III endoleak	5	0.1, 1.5, 2.4, 8.6, 14.6

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #7

### **Lessons Learned from the Largest Cohort of Type 3 Endoleaks with the Endologix AFX Stent Graft**

Andrew Barleben<sup>1,2</sup>, Abid Mogannam<sup>1</sup>, Erik Owens<sup>1,2</sup>, John S. Lane<sup>1,2</sup>, Arielle Lee<sup>1</sup>.

<sup>1</sup>UCSD, San Diego, CA, USA, <sup>2</sup>VA San Diego, La Jolla, CA, USA.

**Objectives:** Our institution has noted a continual rise in the incidence of late graft failure by Type 3 endoleak (T3EL) with early generation AFX (Endologix, Irvine, CA) endografts. We also noted repeat T3ELs in these patients treated with bridging AFX grafts. Previous authors noted a much lower incidence of T3EL (0-5%), but high aneurysm related mortality (18%) when repairing T3ELs with bridging grafts. Failure rates may be due to significant aortic remodeling in this population.

**Methods:** We sought to further characterize this population by instituting a targeted campaign to improve follow-up in 107 patients who had EVAR with early generation AFX devices. We then analyzed clinical and radiographic data including index procedures, anatomic data and clinical follow-up between 2009 and 2018.

**Results:** Out of 107 patients with early generation AFX grafts, 26 developed T3EL (24.3%). CT scan follow-up was obtained in 63.1%. Complete endograft relining occurred in 22 patients. Indications were T3a EL (4) and T3b EL (18). Concomitant leaks included Type 1aEL (1), Type 1bEL (2) and migration (1). Complete endograft relining was performed with 100% technical success. After relining, all patients had resolution of T3EL and all associated endoleaks, on both angiogram and follow-up CT scan to date. Endografts used include Excluder (2), Zenith (1) and Ovation iX for our most recent 19 patients (86%). Average time to reline was 45.2 months (1.6 - 70.4 months) and average follow-up post relining was 13 months (1.0 - 41.8 months). Drastic changes were noted following relining in aortic diameter (-8 mm, -1.0 mm - -38.0 mm) and renal to aortic bifurcation lengths (-12 mm, -1.0 mm - -24.0 mm).

**Conclusions:** We have shown that, following initiation of a targeted follow-up campaign, the incidence of early Endologix AFX graft failure from T3EL is



## SCIENTIFIC SESSION ABSTRACTS continued

significantly higher than previously reported (24.3%). Changes to device design have improved on this issue. These patients have significant aortic remodeling potentially contributing to their failure. Adopting a complete endograft relining approach appears to take advantage of alternate locations of fixation and seal and completely excludes the previously placed endograft, achieving durable mid-term outcomes while maintaining a minimally-invasive approach.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #8

### **Duplex Ultrasonography is a Clinically Useful Modality for Surveillance of Renal Branch Grafts After Fenestrated Endovascular Aneurysm Repair**

Kenneth Tran, Graeme McFarland, Michael Sgroi, Jason T. Lee.

Stanford University Medical Center, Stanford, CA, USA.

**Objectives:** The use of duplex ultrasound for surveillance after FEVAR is not well studied. Our objective was to further characterize normal and abnormal duplex findings in renal branch grafts after FEVAR.

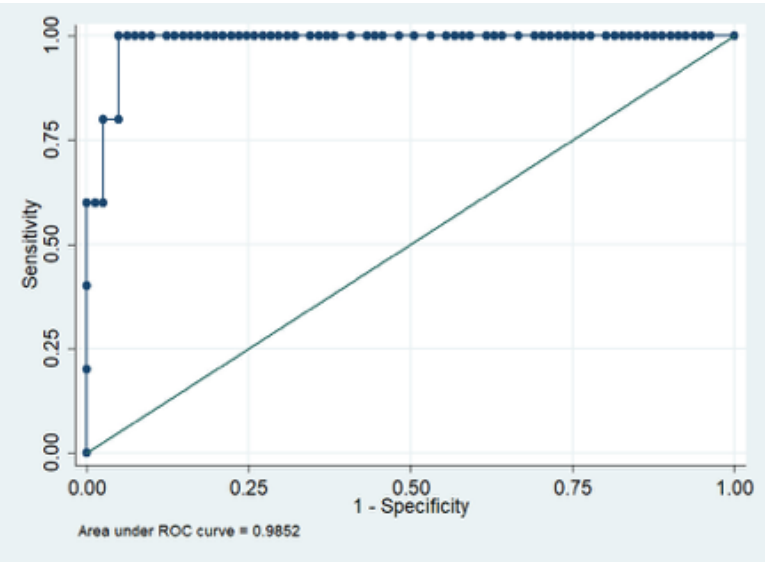
**Methods:** We retrospectively reviewed a single center experience involving consecutive patients treated with the Cook ZFEN device. Post-operative imaging with CT-A was obtained at usual intervals. As experienced progressed, duplex ultrasound was obtained in a non-standardized protocol, particularly in patients with reduced renal function. Loss of renal patency was defined as occlusion or stenosis >50%.

**Results:** A total of 116 patients were treated with FEVAR, of which 60 (51.7%) had concurrent CT and renal duplex ultrasound images available for review. Six patients (10%) had limited ultrasound studies due to bowel gas and were excluded. This left a total of 94 renal stents placed in 54 patients with a mean follow-up of 23 months. Twelve cases of renal patency loss in 10 patients (9 stenoses, 3 occlusions) were found on CT, 11 (91.6%) of which had concurrent abnormalities found on ultrasonography. Stents with compression at the fenestration junction exhibited elevated mean PSVs compared to non-stenosed stents (349.2 vs 115.3 cm/s,  $p=.003$ ). Stenosis in the most proximal portion of the stent (i.e. within the main body) showed no difference in proximal PSVs (86.0 vs 131.9 cm/s,  $p=.257$ ), however showed significantly dampened PSVs in the mid (17.5 vs 109.9 cm/s,  $p=.027$ ) and distal (19.0 vs 78.3 cm/s,  $p=.028$ ) segments compared to non-stenosed stents. All occluded stents demonstrated no flow detection. Proximal PSV served as a strong classifier for junctional stenosis (AUC 0.98, Fig. 1). A combined criterion of proximal PSV >215cm/s or distal PSV <25cm/s resulted in a sensitivity of 91.6% and specificity of 85.3% for detecting patency loss. All stents underwent successful reintervention. Seven of ten (70%) patients had detectable >25% increase in serum creatinine associated with renal patency loss.

SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Duplex ultrasonography is a clinically useful modality for surveillance of renal branch grafts after FEVAR. Patterns of segmental velocity elevation (proximal PSV >215cm/s) and dampening in the distal renal indicate potential hemodynamic compromise and those patients should be considered for secondary intervention.

Fig. 1



## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 9

### **Variation in Center-level Frailty Burden and its Impact on Long-term Survival in Patients Undergoing Repair for Abdominal Aortic Aneurysms**

Elizabeth L. George<sup>1</sup>, Kelly Blum<sup>1</sup>, Amber W. Trickey<sup>1</sup>, Benjamin Brooke<sup>2</sup>, Larry Kraiss<sup>2</sup>, Matthew W. Mell<sup>3</sup>, Philip Goodney<sup>4</sup>, Jason Johannings<sup>5</sup>, Jason Hockenberry<sup>6</sup>, Shipra Arya<sup>1</sup>.

<sup>1</sup>Stanford University Medical Center, Stanford, CA, USA, <sup>2</sup>University of Utah, Salt Lake City, UT, USA, <sup>3</sup>University of California - Davis, Sacramento, CA, USA, <sup>4</sup>Dartmouth Hitchcock, Lebanon, NH, USA, <sup>5</sup>University of Nebraska, Lincoln, NE, USA, <sup>6</sup>Emory University, Atlanta, GA, USA.

**Objectives:** Frailty is increasingly recognized as a key determinate in predicting postoperative outcomes. Centers may see patients who are more frail, potentially accounting for poorer outcomes in hospital comparisons that may not be captured in risk adjustment. We aimed to evaluate the variability in frailty burden among centers in the Vascular Quality Initiative (VQI) database and determine the effect of frailty on long-term mortality in patients undergoing AAA repair.

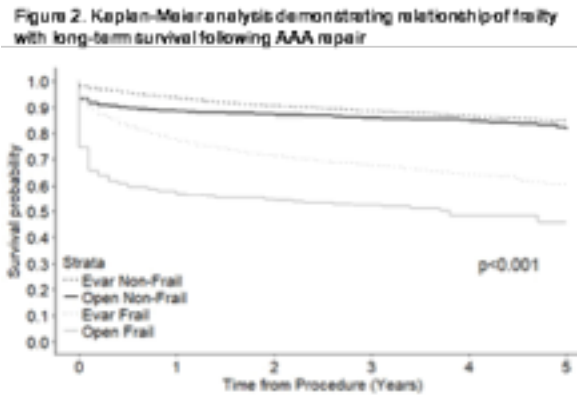
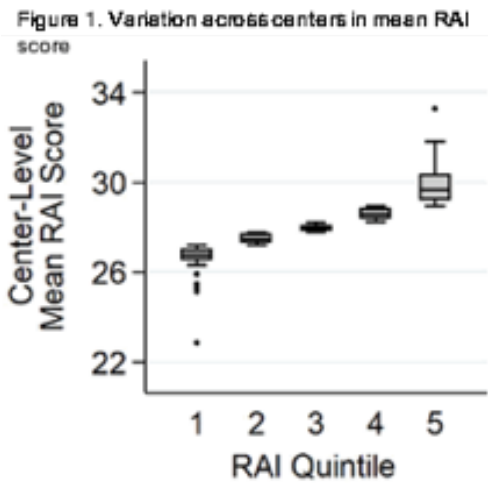
**Methods:** Patients undergoing open and endovascular AAA repair (2003-2017) were identified. Patients with complete data on component variables of the validated Risk Analysis Index (RAI) and centers with >10 AAA repairs were included. VQI RAI characteristics are: sex, age, body mass index, renal failure, congestive heart failure, dyspnea, preoperative ambulation, functional status, and mental status. Frailty was defined as the top 10% of RAI scores (RAI  $\geq 37$ ). Center-level RAI differences were assessed by global F test of center ID fixed effects in linear regression. The relationship between patient frailty and survival was evaluated by hierarchical Cox proportional hazards regression with random intercept for center, controlling for race, insurance, AAA diameter, AAA case-mix, and year.

**Results:** A total of 20,657 patients with complete records from 190 centers were included. RAI scores ranged from 3 to 63 (mean 28, SD 6.3). RAI varied significantly across centers, with center mean range 22.6-31.8, and percentage of frail patients range 0-31.3% (F test  $p < 0.001$ , Figure 1). In Kaplan-Meier analysis, frailty was associated with poor survival ( $p < 0.001$ , Figure 2) and most of the risk varied in the first postoperative year. Frailty was independently

SCIENTIFIC SESSION ABSTRACTS continued

associated with long-term mortality (hazard ratio 3.0, 95% CI 2.7-3.3) after accounting for center-level variance.

**Conclusions:** There is considerable variability of preoperative frailty in AAA patients among centers. Adjusting for center level variation in frailty burden, frailty still had a significant association with long-term mortality. Routine measurement of frailty preoperatively by centers to identify high-risk patients and implementation of perioperative interventions may help mitigate procedural and long term mortality and improve shared-decision making regarding AAA repair.



Presentation #10

### **A Reliable Method for Renal Volume Measurement and its Application in FEVAR**

Jason R. Hurd<sup>1</sup>, Xiyang Chen<sup>2</sup>, Billi Tatum<sup>1</sup>, Danielle Katsman<sup>1</sup>, Niten Singh<sup>1</sup>, R. Eugene Zierler<sup>1</sup>, Benjamin W. Starnes<sup>1</sup>.

<sup>1</sup>University of Washington, Seattle, WA, USA, <sup>2</sup>Sichuan University Division of Vascular Surgery, Chengdu, China.

**Objectives:** Renal volume has been shown to decline in the sixth decade of life and beyond. We sought; 1) to assess the inter-rater reliability for manually measuring renal volume using computed tomography and 2) to assess changes in renal volume over time as it relates to Fenestrated EVAR (FEVAR).

**Methods:** This study was conducted as part of a physician-sponsored IDE (#NCT01538056).

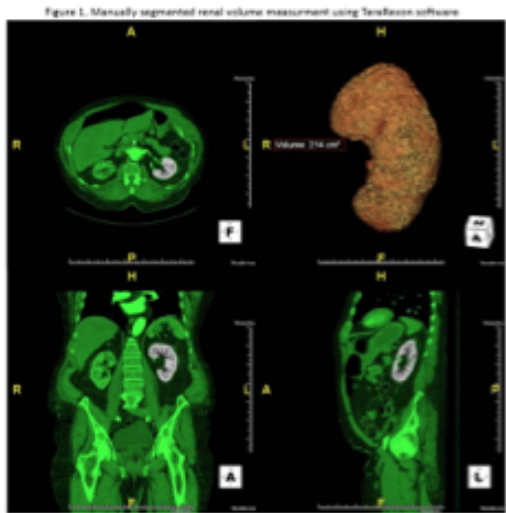
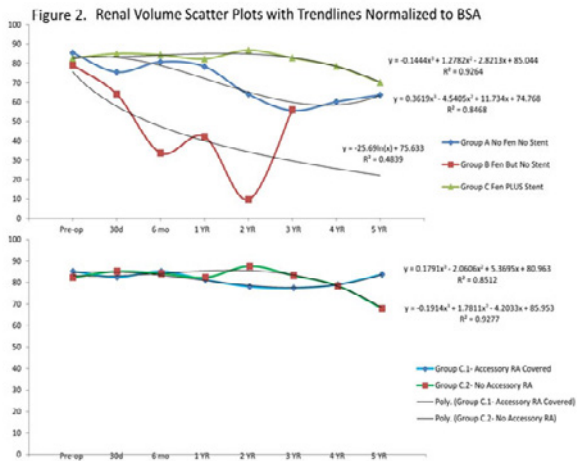
1) 30 consecutive kidneys of pre-operative FEVAR subjects were randomly measured by two independent raters using manual segmentation and TeraRecon (Foster City, CA) software (Figure 1). Renal volumes were calculated and compared. Cohen's Kappa was calculated for differences in renal volume of 1, 3, 5 and 10%.

2) Renal volumes were then recorded for 100 subjects undergoing FEVAR with follow up out to five years and then normalized by dividing the value by the subjects Body Surface Area (DuBois formula;  $BSA = (W^{0.425} \times H^{0.725}) \times 0.007184$ ). Kidneys were divided into three groups and two sub-groups. Group A kidneys were those that were fed by a renal artery that had no fenestration and no stent. Group B were those kidneys fed by an artery with a fenestration but no stent and Group C were those kidneys fed by renal arteries that were stented through a fenestration. Finally, Group C was further sub-divided into those kidneys that had additional accessory renal arteries that were covered by the stent graft (Group C.1) and those kidneys without accessory renal arteries (Group C.2).

**Results:** 1) Inter-rater reliability (kappa) for manual renal volume measurement was 0.19, 0.63, 0.84 and 1.00 for renal volume differences of 1, 3, 5, and 10% respectively. 2) There were 10 kidneys in Group A, 7 kidneys in Group B and 172 kidneys in Group C. Group C.1 included 11 kidneys and Group C.2 included 161 kidneys. Scatterplots comparing Groups A, B and C AND C.1 and C.2 are shown in Figure 2.

SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Manual renal volume measurements are highly reliable and reproducible to within a 5% difference between raters. Renal volume decreases over time, regardless of whether the renal artery is stented or not. It appears that renal volume does not decline as rapidly when renal arteries are stented as part of FEVAR. Coverage of accessory renal arteries appears safe and does not significantly lead to decline in renal volume.



## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #11

### **Anatomic Suitability for Standard, “Off-the-shelf” Thoracic Single Side-branched Endograft in Patients with Type B Aortic Dissection**

Gregory A. Magee, Narek Veranyan, Sung W. Ham, Kenneth R. Ziegler, Fred A. Weaver, Fernando Fleischman, Michael Bowdish, Sukwu M. Han.

University of Southern California, Los Angeles, CA, USA.

**Objectives:** Treatment of Type B aortic dissections with thoracic endovascular aortic repair (TEVAR) has been adopted in many centers with the goal to cover the proximal entry tear. Coverage of the left subclavian artery (LSCA) is commonly required in order to achieve a dissection-free proximal seal zone. A novel thoracic single side-branched endograft (TSSB) device offers a potential off-the-shelf option to achieve total endovascular incorporation of LSCA during zone 2 TEVAR. The aim of this study was to determine what percentage of patients with Type B aortic dissection who require zone 2 TEVAR meet the anatomical requirements for this device.

**Methods:** All consecutive patients undergoing TEVAR for Type B aortic dissections at a single institution from 2006 to 2016 were evaluated. Three-dimensional centerline reconstruction of preoperative computed tomography angiography (CTA) was performed to identify the diameter of the aorta, distances between branch vessels, diameter of the target branch vessel, and the location of the primary entry tear. Only patients who require zone 2 TEVAR were included in the analysis. The primary outcome was percentage of patients that meet all anatomical requirements for TSSB. The specific requirements leading to non-suitability were also calculated.

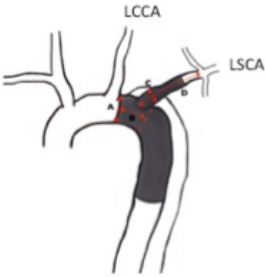
**Results:** Eighty-seven patients who underwent TEVAR for TBAD were reviewed. Fifty-seven of 87 would have required zone 2 TEVAR. Indications for TEVAR were malperfusion (12), aneurysm (15), persistent pain (22), rupture (3), uncontrolled hypertension (5), and other (3). Mean follow-up was 19 months (range: 1-72 months). Only 17 patients (30%) met all the requirements for anatomic suitability (Fig. 1). The reasons for failing anatomic suitability were covered stent graft length proximal to the branch portal (61%), aortic diameter at the proximal seal zone (11%), left subclavian diameter (16%), left subclavian length to its first branch (14%), access vessel diameter (40%).



**Conclusion** Although the standard TSSB device can allow for a more proximal seal zone and eliminate the need for open aortic arch debranching, only 30% of patients with Type B dissection who require zone 2 TEVAR meet all the anatomic requirements for this device. The most common reason for failure of anatomic suitability is the proximity of the left carotid to the left subclavian origin.

**Fig 1. Number (%) of patients meeting criteria for TSSB device**

Number of patients	57
A. Aortic diameter at the proximal seal zone	51 (89%)
B. Covered stent graft length proximal to the branch portal	25 (44%)
C. Target side branch vessel diameter	48 (84%)
D. Target side branch vessel length	41 (72%)
E. Adequate access vessel caliber	34 (60%)
Meeting criteria A-D	17 (30%)
Meeting criteria A-E	14 (25%)



## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 12

### **The Effect of Combining Coronary Bypass with Carotid Endarterectomy in Patients with Unrevascularized Severe Coronary Disease**

Linda J. Wang<sup>1</sup>, Emel A. Ergul<sup>1</sup>, Jahan Mohebbi<sup>1</sup>, Philip P. Goodney<sup>2</sup>, Virendra Patel<sup>3</sup>, Mark F. Conrad<sup>1</sup>, Matthew J. Eagle<sup>1</sup>, W. Darrin Clouse<sup>1</sup>.

<sup>1</sup>Massachusetts General Hospital, Boston, MA, USA, <sup>2</sup>Dartmouth-Hitchcock Medical Center, Lebanon, NH, USA, <sup>3</sup>Columbia University Medical Center, New York, NY, USA.

**Objectives:** Management of significant carotid stenosis in those with symptomatic coronary disease remains controversial. Staged and combined carotid endarterectomy (CEA) with coronary bypass (CABG) have been described. Yet, understanding of the additive risks of these approaches is poor. This study sought to assess outcomes in patients with clinically relevant coronary disease undergoing either isolated CEA (ICEA) or combined CEA-CABG (CCAB).

**Methods:** All CEA in the Vascular Quality Initiative (VQI) from 2003-2017 were reviewed. CCAB were identified as were ICEA in patients with unrevascularized stable angina, unstable angina, or myocardial infarction (MI) within 6 months of operation. CCAB were compared with ICEA as well as a risk-matched cohort of ICEA. Primary outcomes included 30-day stroke, death, and MI, and these as composite (SDM). Univariate analysis and logistic regression were performed.

**Results:** 4,042 patients were identified including 2,582 ICEA (64%) and 1,460 CCAB (36%). 61% were male, 91% were Caucasian, and 39% had symptomatic carotid disease. Overall stroke was 1.9%, death 1.8%, and SDM 4.9%. ICEA had higher rates of post-operative MI (1.9% v 0.9%,  $p=.01$ ), but lower rates of stroke (1.5% v 2.7%,  $p=.01$ ), death (1% v 3%,  $p<.001$ ), and SDM (4.1% v 6.4%,  $p=.001$ ). After regression, predictors of SDM were CHF (OR 1.8, 95%CI 1.3-2.5,  $p<.001$ ), urgent operation (OR 1.4, 95%CI 1.01-2.0,  $p=.04$ ), and CCAB (OR 1.4, 95%CI 1.1-1.9,  $p=.02$ ). After propensity matching, ICEA continued to have higher rates of perioperative MI (2.6% v 1.0%,  $p=.01$ ) and lower rates of death (1% v 3%,  $p=.001$ ). However, there were no longer differences in stroke (2% v 2.8%,  $p=.21$ ) or SDM (5.2% v 6.7%,  $p=.15$ ). Within the matched cohort,

## SCIENTIFIC SESSION ABSTRACTS continued

predictors of SDM included COPD (OR 1.7, 95%CI 1.2-2.5,  $p=.01$ ), CHF (OR 1.6, 95%CI 1.05-2.4,  $p=.03$ ), and symptomatic carotid disease (OR 1.5, 95%CI 1.04-2.2,  $p=.03$ ). CCAB was not significant (OR 1.3, 95%CI 0.9-1.9,  $p=.14$ ).

**Conclusions:** In patients with unrevascularized, clinically relevant coronary disease, CCAB reduces operative MI but increases risk of stroke and death. After risk adjustment, MI remains higher in ICEA, but differences in 30-day stroke and SDM between ICEA and CCAB are no longer appreciated. These data suggest CCAB is not inferior to staged risk of ICEA followed by coronary revascularization.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 13

### **Carotid Stenosis: The Impact of Frailty Syndrome on Patient Outcomes**

Ashton Lee, Viraj Pandit, Wei Zhou.

Banner University Medical Center Tucson, Tucson, AZ, USA.

**Objectives:** Frailty confers increased risk for morbidity and mortality after operative intervention. Intervention for carotid stenosis is associated with its share of risks. The aim of this study was to assess the impact of frailty on outcomes after carotid interventions, including both carotid endarterectomy (CEA) and carotid artery stenting (CAS)

**Methods:** We performed an 8-year (2005-2012) retrospective analysis of NSQIP including patients that underwent CEA or CAS for carotid artery stenosis. A modified frailty index (mFI) was calculated. Frail status was defined as:  $mFI \geq 0.27$ . Outcome measures were inpatient complications, mortality, failure to rescue, hospital length of stay, and 30-day readmissions. Multivariate regression analysis was performed.

**Results:** 37,875 patients were included with mean age  $74.9 \pm 6.3$  years, 95.7% had CEA while 4.3% had CAS. 27.3% patients were frail. 11.7% of patients had complications, 2.2% died, and 6.7% were readmitted after discharge. Frail patients had higher complication rate (23.5% vs. 7.2%,  $p < 0.001$ ), higher mortality (5.2% vs 1.1%,  $p = 0.02$ ), higher failure to rescue (12.1% vs 4.7%,  $p = 0.02$ ), longer hospital length of stay (3 [2-3] vs. 1 [1-2] days,  $p = 0.02$ ) and a higher 30-day readmission rate (14.9% vs. 3.7%,  $p = 0.03$ ) compared to the non-frail.

On regression analysis after controlling for age, gender, albumin level, type of surgery, and ASA class, frail status was an independent predictor of complications, mortality, and FTR, and 30-d readmissions (Table 1). On sub-analysis of patients undergoing CAS, there was no association between frail status and complications (OR:1.5 [0.8-3.2]), mortality (R: 1.2 [0.6-2.7]), FTR (OR: 0.9 [0.4-2.3]), and 30-d readmission rates (OR: 1.1 [0.5-3.1]).

**Conclusions:** Frailty is associated with morbidity and mortality among patients undergoing surgical intervention for carotid stenosis. Frailty was not associated with adverse outcomes in patients undergoing CAS. Incorporating frailty status in the treatment algorithm (CEA vs CAS) may help improve patient outcome.

Table I: Multivariate Regression Analysis			
	OR	95% Confidence Interval	<i>p</i> -value
Complications	3.2	2.1-4.8	0.01
Mortality	2.1	1.6-3.7	0.01
FTR	2.9	2.2-4.9	0.01
30-day readmission	1.9	1.6-3.9	0.01

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #14

### **Prognostic Implications of Diagnosing Frailty and Sarcopenia in Vascular Surgery Practice: Form Versus Function**

Amir A. Ghaffarian, Wylie T. Foss, Larry W. Kraiss, Brigitte K. Smith, Claire L. Griffin, Mark R. Sarfati, Benjamin S. Brooke.

University of Utah School of Medicine, Salt Lake City, UT, USA.

**Objectives:** Frailty and sarcopenia are related but independent conditions common in older patients that can be used to assess their ability to tolerate the stress of major vascular surgery. However, it is unclear whether frailty or sarcopenia is more predictive of surgical outcomes. We assessed the association between frailty and sarcopenia with long-term survival among patients undergoing surgical and non-surgical management of vascular disease.

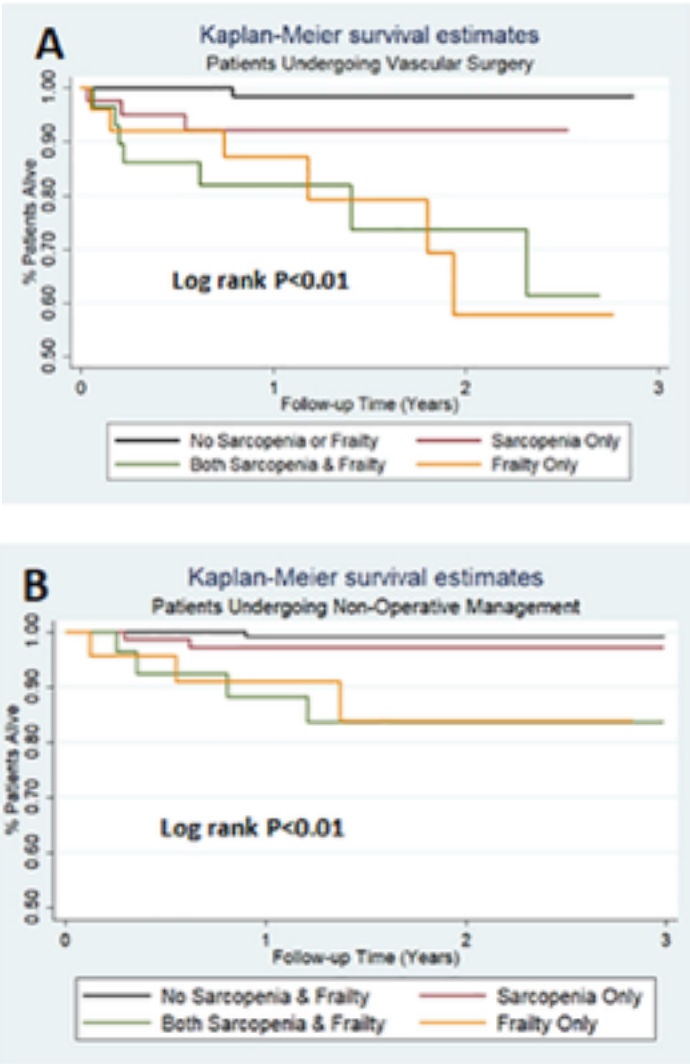
**Methods:** We retrospectively reviewed all patients who underwent prospective frailty assessment during their vascular surgery clinic visit using the Clinical Frailty Scale between December 2015 and August 2017, who also underwent an abdominal CT scan within the prior 12-month period. The cross-sectional area (cm<sup>2</sup>) of skeletal muscle was measured on a single axial CT-image at the L3 vertebrae. Sarcopenia was defined using established criteria of <52.4 cm<sup>2</sup>/m<sup>2</sup> for males and <38.5 cm<sup>2</sup>/m<sup>2</sup> for females. After stratifying patients by frailty & sarcopenia diagnoses along with comorbidities, the association with all-cause mortality was analyzed using Kaplan Meier curves and Cox regression models.

**Results:** A total of 415 patients underwent both frailty and sarcopenia assessment, of which 112 (27%) only met sarcopenia criteria, 48 (12%) only met frailty criteria, 56 (13%) were both sarcopenic & frail, while 199 (48%) controls didn't meet criteria for either condition. A vascular procedure was performed on 167 (40%) patients whereas 248 (60%) were managed non-operatively with a median (IQR) follow-up after CT imaging of 1.5 (1.1-2.2) years. Patients diagnosed with either sarcopenia or frailty were older (mean 65-yrs vs. 59-yrs; P<0.01) and more likely to be male (69% vs. 54%; P<0.01) when compared to control patients. Long-term survival was significantly decreased for patients diagnosed with either frailty alone or both frailty & sarcopenia who underwent both surgical (Figure A) and non-surgical management (Figure B). In multivariate regression models, frailty was the only independent variable (HR:

SCIENTIFIC SESSION ABSTRACTS continued

7.7, 95%CI: 3.2-18.7;  $P<0.001$ ) that predicted mortality.

**Conclusions:** Although frailty and sarcopenia have both been used to predict long-term survival among vascular patients, our data indicate that frailty alone is the only independent predictor associated with mortality.



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Presentation # 15

### **Surgical Management of Functional Popliteal Entrapment Syndrome in Athletes**

Kedar S. Lavingia, Anahita Dua, Michael Fredericson, Jason T. Lee.

Stanford University Medical Center, Stanford, CA, USA.

**Objectives:** Functional popliteal artery entrapment syndrome (FPAES) is a rare overuse condition described in physically active individuals that can be limb or performance threatening if untreated. We utilized provocative CT-As to guide partial debulking of the anterolateral quadrant of the medial head of the gastrocnemius muscle and reviewed outcomes of this technique in athletes.

**Methods:** Athletes referred with symptoms of FPAES underwent CT-A with provocative plantar and dorsi-flexion to confirm compression. Surgery consisted of a posterior approach exposure, adhesiolysis, arterial side branch ligation, and partial excision of the gastrocnemius muscle compressing the artery with or without fasciotomies.

**Results:** 36 athletes (mean age 24 years, 53% female) had a total of 56 limbs treated. Prior fasciotomies had already been performed in 31% of patients for chronic compartment syndrome. Sports involved included running (39%), soccer (28%), triathlete (8%), basketball (6%), gymnastics (3%), lacrosse (3%), diving (3%), tennis (3%), rugby (3%), water polo (3%), and skiing (3%). Bilateral symptoms were present in 27 (75%), but only 20/36 (56%) underwent bilateral surgery. Mean amount of gastrocnemius muscle removed was 6.8 cm<sup>3</sup>. Six patients (17%) also underwent vascular reconstruction along with debulking due to arterial stenosis/occlusion at presentation. No nerve or vascular complications were noted, although two patients had wound/seroma complications (6%). At latest f/u (mean 16mo), six patients (17%) reported recurrence of symptoms. 25/30 (83%) of athletes not undergoing vascular reconstruction reported full return to their preoperative competitive level of sport, while only 3/6 (50%) needing bypass returned to sport ( $p=.05$ ).

**Conclusions:** Over three-fourths of athletes limited by FPAES are able to return to prior competitive sport performance after fasciotomy and debulking of the anterolateral quadrant of the medial gastrocnemius. Need for arterial



## SCIENTIFIC SESSION ABSTRACTS continued

reconstruction significantly impacts future ability to return to sport, and recognizing symptoms early in this highly specialized cohort is important in improving outcomes.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 16

### **Factors Associated with Microembolization After Carotid Intervention**

Joseph Sabat, Tze-Woei Tan, Craig Weinkauf, Theodore Trouard, Gloria Guzman, Wei Zhou.

University of Arizona, Tucson, AZ, USA.

**Objectives:** Microembolization after carotid artery stenting (CAS) and endarterectomy (CEA) has been documented and may confer risk for neurocognitive impairment. Patients undergoing stenting are known to be at higher risk for microembolization. In this prospective cohort study we compare the microembolization rates for patients undergoing CAS and CEA and patient and perioperative characteristics that may be associated with microembolization.

**Methods:** Patients undergoing carotid artery stenting and endarterectomy were prospectively recruited under local IRB approval from an academic medical center. All patients also received 3T brain magnetic resonance imaging with a diffusion-weighted imaging (DWI) sequence preoperatively and within 48 hours postoperatively to identify procedure-related new embolic lesions. Preoperative, postoperative, procedural factors, and plaque characteristics were collected. Factors were tested for statistical significance with logistic regression.

**Results:** 202 patients were enrolled in the study. 107 underwent CAS and 95 underwent CEA. Patients undergoing CAS were more likely to have microemboli than patients undergoing CEA (78% v. 27%  $p < .05$ ). For patients undergoing CAS, patency of the external carotid artery (OR 11.4 [1.11, 117.6]  $p = 0.04$ ), lesion calcification (OR 5.68 [1.12, 28.79]  $p = 0.04$ ), and lesion length (OR 0.29 [0.08, 1.01]  $p = 0.05$ ) were all found to be independent risk factors for postoperative embolization. These factors did not confer increased risk to patients undergoing CEA.

## SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Patients undergoing CAS are at higher risk for postoperative embolization. The risk for postoperative embolization is related to the length of the lesion and calcification. Identifying the preoperative risk factors may help to guide patient selection and, thereby, reduce embolization-related neurocognitive impairment. Further work to understand how microembolization affects neurocognitive impairment is also underway.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 17

### **Establishing a Carotid Artery Stenosis Disease Cohort for Comparative Effectiveness Research Using Natural Language Processing**

Robert W. Chang<sup>1</sup>, Lue-Yen Tucker<sup>2</sup>, Kara A. Rothenberg<sup>3</sup>, Andrew L. Avins<sup>2</sup>, Hui C. Kuang<sup>4</sup>, Rishad M. Faruqi<sup>5</sup>, Bradley B. Hill<sup>5</sup>, Mai N. Nguyen-Huynh<sup>2,6</sup>.

<sup>1</sup>Department of Vascular Surgery, Kaiser Permanente, South San Francisco, CA, USA, <sup>2</sup>Division of Research, Kaiser Permanente, Oakland, CA, USA,

<sup>3</sup>University of California San Francisco - East Bay, Oakland, CA, USA,

<sup>4</sup>Department of Vascular Surgery, Kaiser Permanente, San Francisco, CA, USA,

<sup>5</sup>Department of Vascular Surgery, Kaiser Permanente, Santa Clara, CA, USA,

<sup>6</sup>Department of Neurology, Kaiser Permanente, Walnut Creek, CA, USA.

**Objectives:** Investigation of asymptomatic carotid stenosis treatment is hindered by the lack of a contemporary population-based disease cohort. We describe the use of natural language processing (NLP) to identify stenosis in patients undergoing carotid imaging.

**Methods:** Adult patients undergoing carotid imaging between 2008-2012 in a large integrated health care system were identified. An NLP process was developed to characterize carotid stenosis according to Society of Radiologists in Ultrasound guidelines. The resulting algorithm assessed text descriptors to categorize normal, moderate and severe stenosis as well as occlusion in both carotid ultrasound (US) and axial imaging (computed tomography and magnetic resonance angiography [CTA/MRA]). For US reports, internal carotid artery systolic and diastolic velocities and velocity ratios were assessed and matched for laterality to supplement accuracy. All abnormal studies and a random sample of normal studies were manually reviewed for confirmation. Sensitivity, positive predictive value (PPV) and prevalence were calculated.

**Results:** A total of 95,880 qualifying index studies (76,249 US and 19,631 CTA/MRA) were identified among 94,804 patients including 1,061 patients who underwent multiple studies on the same day. During follow-up through 2017, 30% of these patients underwent 60,672 additional studies. Overall, 16,830 diseased carotid artery imaging studies were identified with 5,349 (31.8%) exhibiting bilateral disease. This resulted in a laterality-specific cohort with 13,381 moderate, 5,177 severe, and 3,619 occluded arteries. For studies of

## SCIENTIFIC SESSION ABSTRACTS continued

normal arteries, the NLP algorithm showed excellent performance with a PPV of 99% for both US and CTA/MRA. After review of 1.6% of random samples, we excluded 72,563 studies without further review. PPV/Sensitivity to identify an abnormal artery with correct laterality in the CTA/MRA and US samples were 61%/96% and 79%/95%, respectively.

**Conclusions:** Use of NLP to detect carotid disease can result in accurate lesion identification with substantially reduced need for manual review. The resulting cohort allows for efficient research and holds promise for similar reporting in other vascular diseases.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 18

### **Cost Effectiveness of Repeated Interventions on Failing Arteriovenous Fistulas: When is it Time to Start Over?**

Benjamin S. Brooke, Richard E. Nelson, Claire L. Griffin, Larry S. Kraiss.

University of Utah School of Medicine, Salt Lake City, UT, USA.

**Objectives:** Arteriovenous fistulas (AVFs) used for hemodialysis commonly undergo multiple percutaneous and open interventions to maintain function patency, but it is unclear if this strategy is cost effective. The aim of this study was to evaluate the cost effectiveness of performing repeated interventions versus starting a new AVF

**Methods:** We reviewed all patients with mature radiocephalic, brachiocephalic, and brachiobasilic AVFs at a single academic institution between 2000 to 2016 and assessed open and percutaneous interventions to maintain functional patency after the fistula was created. These data were used to parameterize a Markov simulation model to determine the cost-effectiveness for performing an open or percutaneous intervention vs. creating an AV fistula location at a new anatomic location. This model compared strategies of creating a new AVF after the 1<sup>st</sup> to 4<sup>th</sup> reintervention within a 1-year time window, with the reference being creation of a new AVF on the 4<sup>th</sup> reintervention. We used this model to calculate incremental cost-effectiveness ratios (ICERs) using 2016 costs from Medicare's payer-perspective per quality-adjusted life-year (QALY) gained.

**Results:** A total of 720 mature AVFs were created during the 15-year period, and 283 (39%) underwent at least one intervention to maintain functional patency, with the median (IQR) time to first re-intervention of 12.6 (10-17) months. For the strategies of creating a new AVF after the 1<sup>st</sup> versus the 4<sup>th</sup> reintervention, costs ranged from \$672-846 for open procedures and \$172-\$846 for percutaneous procedures (Table 1). The ICERs for open interventions on failing AVFs were \$154,273/QALY after the 1<sup>st</sup> re-intervention and \$59,917/QALY after the 2<sup>nd</sup> re-intervention but creating a new AVF after the 3<sup>rd</sup> open re-intervention was dominated by other strategy and not cost effective. The ICERs for percutaneous interventions on failing AVFs ranged from \$574,494/QALY after the 1<sup>st</sup> re-intervention to \$203,946/QALY after 3<sup>rd</sup> re-intervention (Table 1).

SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** While the effectiveness of performing percutaneous interventions on failing AVFs diminishes following each re-intervention, they are nevertheless less costly than creating a new AVF. In comparison, our data shows that creating a new AVF is cost-effective after the 2<sup>nd</sup> open re-intervention procedure.

Table 1 - Calculation of incremental cost-effectiveness ratios (ICERs) using Medicare costs per quality-adjust

Strategy	Cost	QALYs	ICER
<b>Open Reintervention</b>			
New AV fistula on the 4th reintervention	\$672	0.5149	
New AV fistula on the 3rd reintervention	\$692	0.5153	Dominated
New AV fistula on the 2nd reintervention	\$728	0.5159	\$59,917
New AV fistula on the 1st reintervention	\$846	0.5167	\$154,273
<b>Percutaneous Reintervention</b>			
New AV fistula on the 4th reintervention	\$172	0.5149	
New AV fistula on the 3rd reintervention	\$248	0.5153	\$203,946
New AV fistula on the 2nd reintervention	\$404	0.5159	\$260,333
New AV fistula on the 1st reintervention	\$846	0.5167	\$574,494

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 19

### **Long Term Durability of Oakes Salvage Procedure to Preserve Forearm Dialysis Access in Patients with Failed Brescia**

Anahita Dua, Kara Rothenberg, Kedar Lavingia, Vy T. Ho, David Oakes, Ehab Sorial, Manuel Garcia-Toca.

Stanford University Medical Center, Stanford, CA, USA.

**Objectives:** In 2002, Oakes and colleagues described a novel procedure designed to salvage the distal cephalic venous outflow of a Brescia by placing a prosthetic graft between the brachial artery in the antecubital space and the cephalic vein at the wrist allowing for continued utilization of the wrist access. This study aimed to determine the long term primary, primary assisted and secondary patency rates of the brachial to distal cephalic vein Oakes procedure.

**Methods:** All patients who underwent the Oakes procedure from 2008 to 2012 at a single institution were included. Datapoints included demographic information, date of Brescia placement, date of Oakes procedure, days to intervention, type of intervention, number of interventions, and infection rates. Statistical analysis included descriptive statistics.

**Results:** Over the 5 year study period, 14 patients were identified who underwent the Oakes procedure of which 7 (50%) were female. The average age was 55.7 years (range 38-73). All patients had a previous placed Brescia that was not suitable for dialysis but was patent. The average number of days to placement of an Oakes brachial to distal cephalic graft was 396 (range 119-1167) days. 71% (10) of patients underwent an intervention to maintain the graft of which 50% (5) underwent an angioplasty and 50% (5) had a thrombectomy/revision procedure. The average number of days to first intervention was 367.3 (range 21-1048) from Oakes placement. Of this cohort, 30% (3) of patients had a second intervention of which 1 (33%) was an angioplasty and 2 were revisions (66%). One patient has a 3<sup>rd</sup> and a 4<sup>th</sup> intervention at 39 days and 74 days respectively that were both angioplasties. The overall number of days the Oakes procedure remained usable from placement was 843.6 (range 21-3790) days or 2.3 years. There were no deaths attributable to the fistula procedure nor were there any infections reported in this cohort.



## SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** This study concluded that the Oakes salvage procedure, by utilizing the venous outflow of the Brescia, may extend the utilization of the distal dialysis access site by 2.3 years without increasing infection and is hence a durable solution that should be consider in patients requiring dialysis access.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 20

### **Arteriovenous Fistulas Recruited with Regional Anesthesia Have Comparable Functional Outcomes**

Devin S. Zarkowsky<sup>1</sup>, Bian Wu<sup>1</sup>, Justin Inman<sup>1</sup>, Andrew T. Gray<sup>1,2</sup>, Adam Z. Oskowitz<sup>1,2</sup>, Shant M. Vartanian<sup>1,2</sup>.

<sup>1</sup>University of California, San Francisco, San Francisco, CA, USA, <sup>2</sup>Zuckerberg San Francisco General Hospital, San Francisco, CA, USA.

**Objectives:** Regional anesthesia induced vasodilation increases the proportion of patients with venous anatomy suitable for an arteriovenous fistula (AVF). The functional outcomes of AVF initially small for size on preoperative Duplex vein mapping (2.4mm) that are recruited under regional anesthesia have not been clearly defined. We aimed to evaluate re-intervention rates and functional outcomes of AVF recruited after induction of regional anesthesia.

**Methods:** A prospectively maintained quality improvement database from a single institution was queried for patients that had dialysis access created under regional anesthesia. We compared AVF created according to the original surgical plan (OSP, pre-operative minimum vein diameter > 2.5mm) to AVF recruited with regional anesthesia (RWR, pre-operative minimum vein diameter 2.4 mm). Endpoints included complication rates, re-intervention rates and functional outcomes at 6 months. Comparisons were performed using Chi-square tests.

**Results:** Between July 2014 and October 2017, 208 dialysis access cases were performed under regional anesthesia. Excluding grafts, revisions, patients with previous ipsilateral AVF and those without preoperative ultrasound vein mapping, 135 patients were included in our analysis. Induction of regional anesthesia with intraoperative Duplex ultrasound allowed for a change in surgical plan in 55/135 (42%) patients (RWR), including 31 patients originally scheduled for AVG (mean preoperative distal upper arm cephalic vein diameter 1.3mm, SD 0.9mm) who were converted to an AVF (12 brachio basilic [BB], 11 brachiocephalic [BC] and 8 radiocephalic [RC]). The remainder of RWR included 13 patients scheduled for BB who were converted to BC or RC, and 11 patients scheduled for BC that converted to RC. Comparing OSP vs. RWR, there were no differences in re-intervention rates (30% vs. 22%,  $p = .33$ ) or

## SCIENTIFIC SESSION ABSTRACTS continued

functional outcomes at 6 months (60% vs. 65% used on HD,  $p = .58$  and 13% vs. 9% failed,  $p = .59$ ).

**Conclusions:** In this series, regional anesthesia increased the proportion of patients who underwent AVF creation without compromising functional outcomes. Routine use of regional anesthesia in access surgery could have significant implications in meeting national guidelines for autogenous access in the prevalent HD population.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 21

### **Outcomes of Hemodialysis Vascular Access in Patients Initiating Dialysis with a Tunneled Catheter**

Timothy Copeland, Peter Lawrence, Karen Woo.

UCLA, Los Angeles, CA, USA.

**Objectives:** To determine factors that influence time to removal of tunneled hemodialysis catheter (THC), probability of repeat vascular access creation and time to repeat vascular access.

**Methods:** The Optum Clinformatics database, which contains claims from a large managed care organization, from 2011 to 2016 was queried for patients who initiated hemodialysis with a THC. Time from initial arteriovenous fistula (AVF)/graft (AVG) to THC removal and time to repeat AVF/AVG were analyzed using cox proportional hazards. Multivariate models included age, sex, race, diabetes, cardiac arrhythmia, congestive heart failure, peripheral vascular disease and obesity as covariates.

**Results:** 8355 vascular access met the inclusion criteria: 6648 (77%) AVF and 1940 (23%) AVG. Median follow-up was 424 days (range 1-2097). Patients undergoing AVF were younger, more likely to be male and White (Table). At 90 days, 20.3% (95% CI 19.3%, 20.3%) of AVF vs 56% (95% CI 53.7%, 58.4%) of AVG had their THC removed. At 180 days, 56.7% (95%CI 55.4%, 58.1%) of AVF vs 68.4% (95%CI 66.1%, 70.6%) of AVG had their THC removed. By day 315, 74% of patients in both AVG and AVG had their THC removed. Multivariate analysis demonstrated a significant interaction between vascular access type and age $\geq 70$  ( $P < 0.001$ ). In the age $< 70$  group, patients who underwent AVG had a THC removal rate 46% higher than patients who underwent AVF. In the age $\geq 70$  group, patients who underwent AVG had a THC removal rate 88% higher than patients who underwent AVF. 1982 (23.7%) patients underwent a second vascular access. Multivariate analysis demonstrated AVG vs AVF (OR 0.70, 95%CI 0.61, 0.81) and age  $\geq 70$  vs  $< 70$  (OR 0.87, 95%CI 0.78, 0.98) were associated with a lower odds of second access. In patients who underwent a second access, multivariate analysis demonstrated initial AVG was associated with longer time to second access (HR 0.60, 95% CI 0.54, 0.68).

SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Creation of AVG vs AVF significantly decreased the time to THC removal in dialysis-dependent patients, with a larger difference in patients aged  $\geq 70$  vs  $< 70$ . Initial AVG was associated with lower odds of second access and longer time to second access in those who underwent second access. These results contradict the dictum of “Fistula First” and support the judicious use of AVG in achieving the more recent shift towards “Catheter Last”.

Table - Demographics by Access Type

	Fistula (%) n=6486	Graft (%) n=1869	P-value
Mean age (SD)	66.2 (13)	69 (12)	<0.001
Age $\geq 70$	2979 (46)	1028 (55)	<0.001
Male	3920 (60)	811 (44)	<0.001
Race			<0.001
Asian	216 (3)	51 (3)	
Black	1586 (24)	677 (36)	
Hispanic	859 (13)	192 (10)	
White	3663 (56)	915 (49)	
Unknown	168 (3)	28 (1)	
Diabetes	5257 (81)	1565 (84)	0.001
Cardiac Arrhythmia	4688 (72)	1400 (75)	0.13
Congestive Heart Failure	5021 (77)	1480 (79)	0.073
Peripheral Vascular Disease	4406 (68)	1322 (71)	0.011
Obesity	2596 (40)	694 (37)	0.03

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #22

### **Disease-based Observation Cohort Study of Patients with Thoracoabdominal Aortic Aneurysm**

Chulhi Kang, Matthew A. Bartek, Sherene Shalhub, Derek P. Nathan, Matthew P. Sweet.

University of Washington, Seattle, WA, USA.

**Objectives:** Current understanding of thoracoabdominal aortic aneurysms (TAAA) is limited to case series and administrative data describing patients selected to undergo surgical repair. Little is known about the overall cohort of patients with TAAA, specifically those not selected for repair. The purpose of this study is to describe a disease-based cohort of patients with TAAA.

**Methods:** An academic multi-hospital institutional database was screened by diagnosis codes for TAAA from 2009 to 2017 using the International Classification of Diseases (ICD) versions 9 and 10. Diagnosis was then confirmed or rejected by chart review and the CT finding of aneurysmal degeneration  $> 3.2$  cm of the paravisceral aorta in continuity with aneurysmal aorta meeting standard criteria for repair. Patients under age 18 and those with mycotic aneurysm were excluded. Patients underwent four broad categories of repair: (1) Open, (2) Endovascular with branched grafts, (3) Hybrid, defined as visceral debranching followed by TEVAR, and (4) Incomplete repair in which the paravisceral segment was intentionally left unaddressed. The primary outcome measure for those receiving an operation was a composite measure of “good” outcome defined as survival at 1 year, return to pre-operative functional status, and freedom from permanent loss of organ system function.

**Results:** 406 subjects met the inclusion criteria. Demographic data and composite “good” outcomes are reported in Table 1. Survival estimates are reported in Figure A. 192 patients (47%) were deemed ineligible for or declined treatment. Reintervention was common and occurred at a significantly higher rate in the hybrid group compared to other groups (rates for hybrid, endovascular, partial, and open were 46%, 28%, 26%, and 18%, respectively).

**Conclusions:** This inclusive cohort study shows that nearly half of patients with TAAA do not undergo repair despite access to all treatment options. This suggests that data from operated case series are achieved in highly selected cohorts and do not reflect overall outcomes. Among those receiving

SCIENTIFIC SESSION ABSTRACTS continued

intervention, similar outcomes are achieved with different techniques in appropriately selected patients. Survival benefit was realized over a 30-month period in all operative groups except in the hybrid group compared to nonoperative patients.

Figure 1. Kaplan-Meier survival of TAAA patients by group.

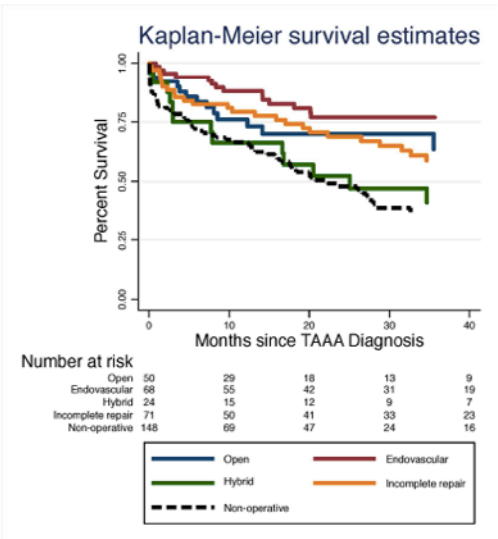


Table 1. Key demographics and outcomes of thoracoabdominal aortic aneurysm (TAAA) patients

Operation type	Open (N=50)	Endovascular (68)	Hybrid (24)	Incomplete (72)	None (192)	Total (406)	P
Age, median	62	75	64	70	73	72	<0.001
Male sex	64%	75%	63%	68%	49%	59%	0.001
Symptomatic/Ruptured	28%	18%	17%	36%	22%	25%	0.097
Dissection	38%	4.4%	33%	43%	26%	29%	<0.001
Crawford IV	38%	43%	17%	4.2%	34%	30%	<0.001
Connective tissue disease	24%	0%	25%	6%	2.1%	6.4%	<0.001
Previous aortic surgery	42%	44%	46%	42%	44%	44%	0.99
Significant comorbidity	8.2%	18%	13%	26%	50%	33%	<0.001
Composite “good” outcome	25/42 (60%)	47/61 (77%)	13/23 (57%)	29/53 (55%)	NA	NA	0.061

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 23

### **Financial Analysis of Fenestrated Endovascular Aortic Aneurysm Repair at a High-Volume Medical Center**

Warren B. Chow, Denise M. Leverentz, Billi Tatum, Benjamin W. Starnes.

University of Washington, Seattle, WA, USA.

**Objectives:** To examine hospital finances and physician payment associated with fenestrated endovascular aortic aneurysm repair (FEVAR) for complex aortic disease at a high-volume aortic center. To compare costs and reimbursement for FEVAR with open aortic aneurysm repair, and their trends over time.

**Methods:** Clinical and financial data were retrospectively collected from electronic medical and administrative records. Data for each patient included inpatient and outpatient encounters three months prior to and twelve months following the primary aorta operation.

**Results:** Between 2007 and 2017, 157 and 71 patients underwent physician-modified endograft (PMEG) and Cook Zenith Fenestrated (ZFEN) repair, respectively. Twenty-one additional patients evaluated for FEVAR underwent open repair instead. The 228 FEVAR patients provided a total positive contribution margin (CM, reimbursement minus direct cost) of \$3.25 million. The index encounter for operation and hospitalization accounted for the majority (74%) of the total CM. The largest component (50.3%) of direct cost (DC) for FEVAR at index encounter was implant/graft expenses (Fig 1). The average DC of FEVAR and of open repair for index encounter were \$34.6K and \$35.0K, respectively. The average CM for FEVAR vs open repair were approximately \$10.5K vs. \$21.2K, attributable to differences in reimbursement. The average DC of FEVAR trended down over time as cumulative experience increased. Average reimbursement per FEVAR increased after Centers for Medicare & Medicaid Services approved reimbursement with the Investigational Device Exemption (IDE) trial for PMEG in 2011, and a new technology add-on payment for ZFEN in 2012. These trends resulted in a transition from negative to positive average CM in 2012 (Fig 2).. The average physician payments for PMEG increased from \$128 before to \$5,848 after the start of the IDE trial. The average physician payments for ZFEN and open repair between 2011-2017 were \$7,597 and \$7,781, respectively.



**Conclusions:** FEVAR can be performed at a high-volume aortic center with positive CM and comparable physician payments to open repair. At this institution, hospital and physician payments improved for PMEG with the onset of the IDE trial, while hospital DC declined for both PMEG and ZFEN with increased experience.

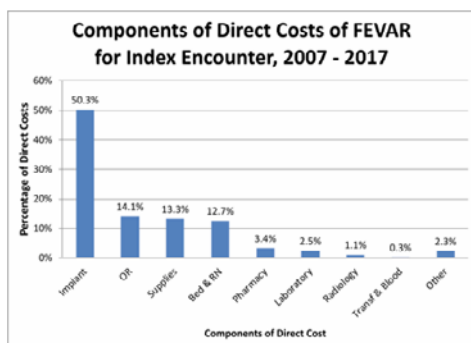


Fig 1. The components of the direct inpatient cost associated with the index encounter for Fenestrated Endovascular Aortic Aneurysm Repair.  
OR = operating room.

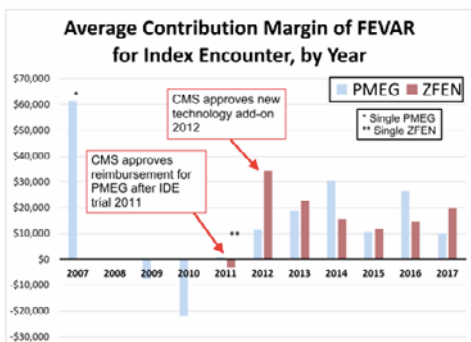


Fig 2. The average contribution per year (between 2007 and 2017) associated with the index counter for Fenestrated Endovascular Aortic Aneurysm Repair.  
PMEG = physician-modified endograft.  
ZFEN = Cook Zenith Fenestrated repair.  
CMS = Centers for Medicare and Medicaid Services.  
IDE = investigational device exception.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation # 24

### **Percutaneous Approach to Endovascular Aortic Aneurysm Repair: A Cost-Minimization Study**

Jonathan C. Hong<sup>1</sup>, Gary K. Yang<sup>1</sup>, Benjo A. Delarmente<sup>2</sup>, Rohan Khera<sup>3</sup>, Joel Price<sup>1</sup>, Jerry C. Chen<sup>1</sup>.

<sup>1</sup>University of British Columbia, Vancouver, BC, Canada, <sup>2</sup>Johns Hopkins School of Public Health, Baltimore, MD, USA, <sup>3</sup>UT Southwestern, Dallas, TX, USA.

**Objectives:** Percutaneous access for endovascular aortic aneurysm repair (P-EVAR) is less invasive compared to surgical access (S-EVAR). It is associated with shorter recovery and fewer wound complications. However, vascular closure devices (VCDs) are costly and the economic impact of P-EVAR has important implications for resource allocation. The objective of our study was to determine the differences in cost between P-EVAR and S-EVAR.

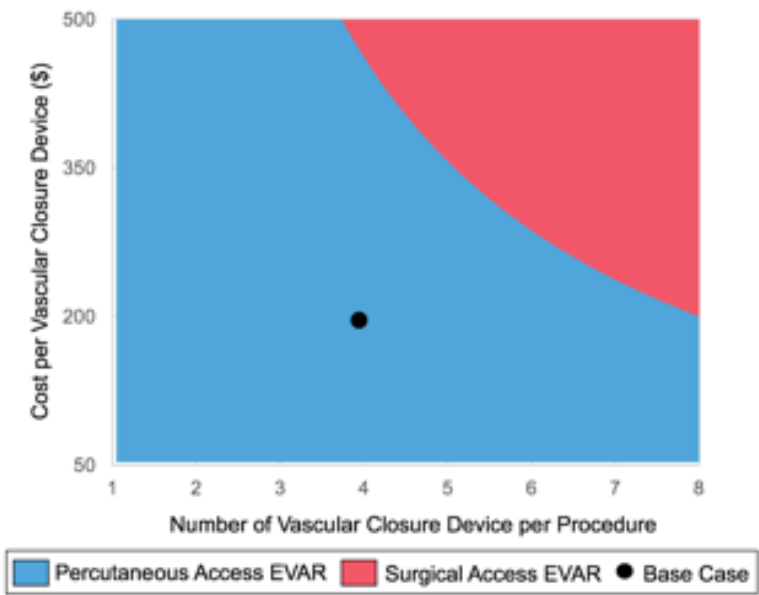
**Methods:** We used a decision tree to analyze costs from a payer perspective over the course of the index hospitalization. Probabilities, relative risks, and mean difference summary measures were obtained from a systematic review and meta-analysis. We modelled differences in surgical site infection, lymphocele, and length of hospitalization. Cost parameters were derived from the 2014 National Inpatient Sample using ICD-9-CM codes. Attributable costs were estimated using generalized linear models adjusted by age, sex, and comorbidities. Sensitivity analysis was performed to determine the robustness of the results.

**Results:** A total of 6876 abdominal and thoracic EVARs were identified. P-EVAR resulted in a cost saving of \$751 per procedure. The costs for P-EVAR were \$1,287 (95%CI: 884-1835) and S-EVAR were \$2,038 (95%CI: 757-4,280). P-EVAR were converted to open in 4.3% of cases. P-EVAR patients had a difference of -1.4 days (95%CI: -0.12 to -2.68) in length of hospitalization at a cost of \$1,190/day (SE: 298). The cost saving of P-EVAR was primarily driven by the cost difference in length of hospitalization. In the base case, 4 VCDs were used per P-EVAR at \$200/device. In the two-way sensitivity analysis, P-EVAR was cost saving even when 1.5 times more VCDs were used per procedure and the cost of each VCD was 1.5 times greater (Figure). In our probabilistic sensitivity analysis, P-EVAR was the cost saving strategy in 82.6%

SCIENTIFIC SESSION ABSTRACTS continued

of 10,000 Monte Carlo simulations when simultaneously varying parameters across their uncertainty ranges.

**Conclusions:** P-EVAR had lower costs compared to S-EVAR and could result in dramatic cost savings if extrapolated to the number of aortic aneurysms repaired. Our analysis was a conservative estimate that does not account for the improved quality-of-life after P-EVAR.



**Figure:** Two-way sensitivity analysis of the cost per vascular closure device and number of vascular closure devices per procedure. The figure displays the most cost saving strategy across a range of model parameters. For example, in the base case (average patient), the cost per vascular closure device was \$200 and four devices were used per procedure which lies in the blue area; therefore percutaneous EVAR is the most cost saving strategy.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #25

### **Management of Moderate Thoracic Blunt Aortic Injuries in Patients with Intracranial Hemorrhage**

Elina Quiroga, Benjamin W. Starnes, Nam T. Tran, Niten Singh.

University of Washington, Seattle, WA, USA.

**Objectives:** Thoracic blunt aortic injuries (TBAI) are the second most common cause of death due to blunt trauma in the US. Patients with minimal injuries don't require surgical repair; patients with severe injuries are treated emergently. Moderate aortic injuries are repaired in a semi-elective fashion; the optimal management of moderate TBAI patients and associated intracranial hemorrhage (ICH) is unknown. We sought to analyze the management and outcomes of patients presenting with concomitant moderate TBAI and ICH.

**Methods:** Single center, retrospective study of all consecutive patients who received a Thoracic Endovascular Aortic Repair (TEVAR) at our institution for treatment of moderate TBAI between 2014-2017. Patients were classified by our BAI classification into "minimal", "moderate", and "severe". ICH was identified on CT scan and its severity determined by a neurosurgical team. Outcome measures included surgical timing, technique and surgical outcomes.

**Results:** 87 patients presented with TBAI during the study period; 52 patients had a moderate TBAI and underwent TEVAR; mean age 44 (range 16-88). 41 were male (79%) and 20 patients (38 %) presented with ICH. Median time from admission to surgery was 58.5 hours for patients with ICH and 26.5 hours for non-ICH patients (Table 1). Operations were performed when the neurosurgical service felt the ICH was stable. Intravenous Heparin was administered in all patients without ICH and in 19/20 (95%) of non-ICH patients. Protamine reversal was utilized in 80% of patients with ICH and 75% of non-ICH patients. No patient developed stroke or spinal cord injury. Worsening ICH was seen in only one patient. This patient underwent operation 97 hours after admission and was receiving an IV heparin infusion for pulmonary embolus 24 hours before TEVAR. There was no aortic related mortality in either group. 30-day mortality was 5% for ICH patients, and 3% for non-ICH patients.

SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Moderate aortic injuries can be managed in a semi-elective fashion. TEVAR can safely be performed in patients with ICH once the patient’s ICH has been deemed stable. Administration of heparin has no influence on outcomes with regard to worsening of ICH.

Table 1: Management and outcome of patients presenting with moderate blunt aortic injury with and without associated intracranial hemorrhage.

	ICH	No ICH
Male	75% (24)	85% (17)
Age	46 (22-78) years	43 (16-88) years
Time to surgery (median ICR)	58.5 (11.5) hours	26.5 (16.5) hours
Anti-impulse Therapy	35% (7)	50% (16)
OR time ( minutes)	73 (40-106)	86 (45-168)
Contrast use	74 mL	75 mL
IVUS	90% (18)	87% (28)
Subclavian coverage	50% (10)	44% (14)
Subclavian revascularization	0%	0%
Hospital length of stay ( mean)	45 days	17 days
Disposition: home	35% (7)	69% (22)

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #26

### **Association of Vascular Surgery Board of the American Board of Surgery Examination Performance with Clinical Outcomes: Experience Matters**

Larry W. Kraiss<sup>1</sup>, Ragheed Al-Dulaimi<sup>1</sup>, Angela Presson<sup>1</sup>, Jack L. Cronenwett<sup>2</sup>, John F. Eidt<sup>3</sup>, Joseph L. Mills<sup>4</sup>, John (Jeb) Hallett<sup>5</sup>, K. Craig Kent<sup>6</sup>, Philip P. Goodney<sup>2</sup>, Benjamin S. Brooke<sup>1</sup>.

<sup>1</sup>University of Utah, Salt Lake City, UT, USA, <sup>2</sup>Dartmouth College, Hanover, NH, USA, <sup>3</sup>Baylor Scott & White Health, Dallas, TX, USA, <sup>4</sup>Baylor College of Medicine, Houston, TX, USA, <sup>5</sup>Medical University of South Carolina, Charleston, SC, USA, <sup>6</sup>Ohio State University, Columbus, OH, USA.

**Objectives:** The Vascular Surgery Board of the American Board of Surgery Vascular Surgery (VSB-ABS) Qualifying and Certifying examinations are meant to assess qualifications, but it is unclear whether examination performance correlates with clinical outcomes. We assessed this relationship using data from the Society for Vascular Surgery Vascular Quality Initiative (SVS-VQI).

**Methods:** VSB-ABS examination performance for vascular surgeons participating in the SVS-VQI registry was characterized according to pass/fail status. Surgical experience was measured by number of years since completion of training. Examination performance and experience were correlated with a composite outcome [in-patient major adverse cardiac events or post-operative death (MACE+POD)] following arterial reconstructions (carotid stenting or endarterectomy, aortic aneurysm repair, open peripheral surgical bypasses) registered in SVS-VQI. Multivariate mixed effects regression was performed adjusting for sex, surgery type, geographic region and clustering by surgeon/hospital.

**Results:** From 2003-2017, complete data were available for 776 vascular surgeons who performed 124,171 arterial reconstructions (carotid n=56,650; aortic n=34,764; peripheral n=32,757) registered in SVS-VQI. Patient characteristics associated with MACE+POD were female sex and age (Table). Of the 776 surgeons, 149 (17%) had failed at least one VSB-ABS exam. For each type of surgical reconstruction as well as all vascular procedures combined, VSB-ABS performance (pass/fail status) was not associated with risk-adjusted

## SCIENTIFIC SESSION ABSTRACTS continued

odds of MACE+POD. However, increasing surgical experience correlated with significantly lower likelihood of MACE+POD (2% lower odds/year of experience since training).

**Conclusions:** VSB-ABS examination performance by SVS-VQI surgeons does not correlate with registry-reported clinical outcomes. Increasing surgical experience is associated with lower odds of cardiovascular morbidity and death.

Table – Multivariable Analysis of Factors Associated with MACE+POD

Exposure	Odds Ratio	95% CI	P-value
AORTIC COHORT (n = 34,764)			
Patient Sex = Female	1.26	1.18 – 1.34	< 0.001
Patient Age	1.02	1.02 – 1.02	< 0.001
Exam Performance = Pass Only	0.93	0.82 – 1.05	0.303
Years From Completion of Training	0.98	0.98 – 0.99	< 0.001
CAROTID COHORT (n = 56,650)			
Patient Sex = Female	1.15	1.06 – 1.24	0.006
Patient Age	1.03	1.03 – 1.04	< 0.001
Exam Performance = Pass Only	0.99	0.85 – 1.14	0.872
Years From Completion of Training	0.98	0.98 – 0.99	< 0.001
PERIPHERAL COHORT (n = 32,757)			
Patient Sex = Female	1.10	1.03 – 1.18	0.016
Patient Age	1.04	1.03 – 1.04	< 0.001
Exam Performance = Pass Only	1.04	0.92 – 1.18	0.603
Years From Completion of Training	0.99	0.98 – 0.99	< 0.001
ALL RECONSTRUCTIONS COMBINED (n = 124,171)			
Patient Sex = Female	1.07	1.03 – 1.12	0.006
Patient Age	1.04	1.03 – 1.04	< 0.001
Exam Performance = Pass Only	0.97	0.89 – 1.05	0.517
Years From Completion of Training	0.98	0.98 – 0.99	< 0.001

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #27

### **Early Experience with the Octopus Endovascular Strategy in the Management of Thoracoabdominal Aneurysms**

Anahita Dua, Kedar Lavingia, Michael Dake, Jason Lee.

Stanford University Medical Center, Stanford, CA, USA.

**Objectives:** The Octopus endovascular strategy for TAAA involves placement of bifurcated graft(s) in the thoracic aorta to create separate limbs that facilitate deployment of multiple parallel covered stents for branch perfusion. We reviewed our early outcomes of the Octopus TAAA repair strategy.

**Methods:** Our standardized approach included a Gore Excluder main body, thoracic cuffs, and multiple Viabahn or VBX stents inserted from an axillary conduit in parallel fashion through the limbs for visceral perfusion.

**Results:** From 2015-2018 we treated 21 patients (48% female, aged 72.9 years) with mean TAAA diameter of 6.7cm. All patients had been turned down for open repair with 86% related to degenerative aneurysms and 14% dissection-related. Four patients were urgent with two ruptures. TAAA extent was 9% type 2, 62% type 3, 29% type 4. A mean of 3.04 visceral branches per patient were revascularized, with the SMA (90%) usually perfused through its own limb, and both renals usually reconstructed in parallel graft fashion with the distal abdominal extension through one of the main body limbs. Operative time was 8 hours, fluoro time 164min, contrast 182mL, and blood loss 807mL. We staged the thoracic and abdominal portions of the cases in 24% of patients. Technical success defined as TAAA exclusion and stenting of all planned visceral branches was achieved in 90% of cases. Perioperative complications included paraplegia (n=2), acute kidney injury (n=3), prolonged ventilation (n=2), MI (n=1), and ischemic bowel (n=1). In-hospital all-cause mortality was 14.2% with 30-day survival being 90.5%. On immediate postoperative imaging, gutter endoleak at the visceral limb was seen in three patients (19%), with all resolving by 6-month imaging. At latest follow-up (median 13.5 months), proximal type I endoleak rate was 9.5%, all being successfully treated with proximal cuffs. Primary patency of visceral branches was 93.8% (celiac 100%, SMA 94.7%, right renal 88.9%, left renal 94.8%). Six-month and one year survival for the entire cohort was 88.3% and 71.4%, and better for elective cases (92.9% and 78.6%) versus



## SCIENTIFIC SESSION ABSTRACTS continued

urgent/emergent cases (67% and 67%).

**Conclusions:** The Octopus procedure is a high-risk option for urgent or emergent endovascular TAAA repair with off the shelf devices in patients who are not candidates for open repair.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #28

### **Integrated Residency is Associated with an Increase in Women Among Vascular Surgery Trainees**

Susanna Shin<sup>1</sup>, Sherene Shalhub<sup>2</sup>.

<sup>1</sup>Surgery, University of Washington, Seattle, WA, USA, <sup>2</sup>University of Washington, Seattle, WA, USA.

**Objectives:** Over the past decade, the proportion of women within Graduate Medical Education (GME) has increased. Correspondingly, the proportion of women in almost every specialty has increased, including surgical specialties. We sought to evaluate the effect of establishing Vascular Surgery Integrated Residencies (VSIRs) on the proportion of women in VS training programs.

**Methods:** Resident data were obtained from the Accreditation Council for GME (ACGME) Data Resource Book for the academic years 2007-2016. Data were collected on overall ACGME residency numbers as well as on the following surgical subspecialties: Vascular, General, Thoracic, Neurological, Orthopedic, Ear Nose and Throat, Plastic, and Urological surgery. The number and proportion of women per year in VSIRs and VS fellowships were compared to those in the other surgical specialties.

**Results:** During the study period, the overall the number of women in ACGME accredited residency programs increased from 41% (N=43695/107851) to 44% (N=57130/129720) of residents. Since the advent of the VSIR, the number of trainees within VS has grown by 56% from 221 to 501 trainees. The proportion of women in VS training programs has increased from 12% (N = 27/221) to 33% (N = 164/501) of trainees. This increase over the 9-year study period was greater than in any other surgical subspecialty and greatest within the VSIR. Compared to fellowship training programs, integrated surgical training programs within the same subspecialty had a higher proportion of women though variability between surgical subspecialties remained notable.

**Conclusions:** While lower than the proportion of women within all GME training programs, an increasing proportion of women have entered VS training during the study period. This appears to be related to the introduction of VSIRs and exceeds the proportion of women entering other surgical subspecialties. Further work to understand surgical specialty preferences and choice of careers after training is warranted.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #29

### **Experienced Operators Achieve Superior Primary Patency and Wound Complication Rates with Endoscopic Greater Saphenous Vein Harvest Compared to Open Harvest in Lower Extremity Bypasses**

Matthew Kronick, Enjae Jung, Cherrie Abraham, Timothy Liem, Moneta Gregory, Gregory Landry.

Oregon Health & Science University, Portland, OR, USA.

**Objectives:** Prior studies have suggested improved wound complication rates but decreased primary patency in lower extremity bypasses performed with endoscopic vein harvest (EVH) vs open harvest (OVH). We hypothesize that the inferior patency reflects the initial learning curve for EVH, and that with experience, improved patency can be achieved.

**Methods:** Single institution review of 113 subjects with critical limb ischemia that underwent infrainguinal bypass with a continuous segment of greater saphenous vein harvested either endoscopically (n=49) or through a single open incision (n = 64) from 2012 to 2017. EVH was performed by surgeons with > 5 years experience with this technique. Operative outcomes, patency, complications and readmission rates were compared between the harvest methods.

**Results:** There were no significant differences in patient demographics, medications, operative indications, or inflow/outflow vessels between the two groups. Median operative time for OVH was 290 minutes and hospital length of stay 6 days, and for EVH 316 minutes and 5 days (p=ns). Harvest related wound complications were more frequent with OVH (29% vs 12%, p=0.04). Primary patency at 1 and 2 years was 57% and 41% for OVH, and 80% and 65% for EVH (p=0.03). Assisted primary patency at the same time points was 90% and 85% for OVH, and 97% at both times for EVH (p=0.11). Thirty day readmissions were similar between the two groups (OVH 25% vs EVH 12%, p=0.3), but 90 day readmissions were more frequent in the OVH group (33% vs 14%, p=0.04).

**Conclusions:** With experience, lower extremity bypass using EVH can result in improved primary patency compared to OVH, while also resulting in fewer wound complications and readmissions, with comparable operative times and hospital length of stay. This technique should be more widely adopted by vascular surgeons as a primary method of vein harvest.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #30

### **Plant-Based Diet Reverses Vascular Endothelial Dysfunction in Patients with Peripheral Arterial Disease**

Debra Leslie<sup>1</sup>, Mary Levine<sup>2</sup>, Garth Davis<sup>3</sup>, Caldwell B. Esselstyn, Jr<sup>4</sup>, Heather Hamza<sup>5</sup>, Peter H. Lin<sup>6,5</sup>.

<sup>1</sup>California State University Los Angeles, Los Angeles, CA, USA, <sup>2</sup>California State University Channel Islands, Camarillo, CA, USA, <sup>3</sup>University of Texas Health Science Center, Houston, TX, USA, <sup>4</sup>Cleveland Clinic Wellness Institute, Cleveland, OH, USA, <sup>5</sup>University Vascular Associates, Los Angeles, CA, USA, <sup>6</sup>Baylor College of Medicine, Houston, TX, USA.

**Objectives:** Peripheral arterial disease (PAD) is characterized by impaired arterial circulation to the extremities caused in part to atherosclerosis, a condition which has been linked to hypercholesteremic dietary lifestyle. This study examined the effect of plant-based diet (PBD) on vascular function in PAD patients.

**Methods:** A total of 42 patients with PAD and hypercholesterolemia were randomized to receive advice on PDB (n=21) or no specific dietary advice (control, n=21). Biochemical parameters, including lipid profile, C-reactive protein, nitric oxide, and superoxide dismutase were measured at baseline and 4 months. Vascular function including brachial artery flow-mediated vasodilation (FMD), carotid intima-media thickness (IMT), carotid-femoral pulse wave velocity (PWV), and brachial-ankle PWV were measured at baseline and 4 months after dietary intervention.

**Results:** Biochemical parameters were similar at baseline between the two groups. There was no change in any of the biochemical parameters in the control group at 4 months. However, patients in the PBD group had a significant decrease in total and LDL-cholesterol by 7.6% and 13.6%, respectively (P=0.01). Nitric oxide levels were greater ( $18.7 \pm 13.7 \mu\text{mol/L}$ ; P<0.01) in the PBD group at 4 months compared with baseline values ( $7.7 \pm 5.3 \mu\text{mol/L}$ ), whereas there were no changes in the control group. At baseline, FMD was similar between the two groups. After four months, FMD was significantly improved in the PBD group compared to the control group ( $8.7 \pm 5.6\%$  vs.  $5.1 \pm 4.5\%$ , P=0.03). There were no differences in carotid-femoral PWV and brachial-

## SCIENTIFIC SESSION ABSTRACTS continued

ankle PWV in the control group at 4 months. In contrast, the PBD group showed a significantly lower carotid-femoral PWV ( $695.4 \pm 93.7$  cm/sec versus  $938.5 \pm 163.4$  cm/sec;  $P=0.04$ ) and lower brachial-ankle PWV ( $1127.2 \pm 118.4$  cm/sec versus  $1546.7 \pm 162.1$  cm/sec;  $P=0.03$ ) compared to the control group. The ankle-brachial index (ABI) was improved by 7.6% in the PBD group. No difference in carotid IMT was found between the two groups.

**Conclusions:** The present study shows that plant-based diet improves vascular endothelial function in PAD patients, which may be partly mediated through nitric oxide production. Plant-based diet can result in decreased serum cholesterol which may further enhance vascular endothelial function.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #31

### **Multi-vessel Tibial Revascularization does not Improve Outcomes in Patients with Critical Limb Ischemia**

Kedar S. Lavingia, Kenneth Tran, Nathan Itoga, Anahita Dua, Matthew Mell, Venita Chandra.

Stanford University Medical Center, Stanford, CA, USA.

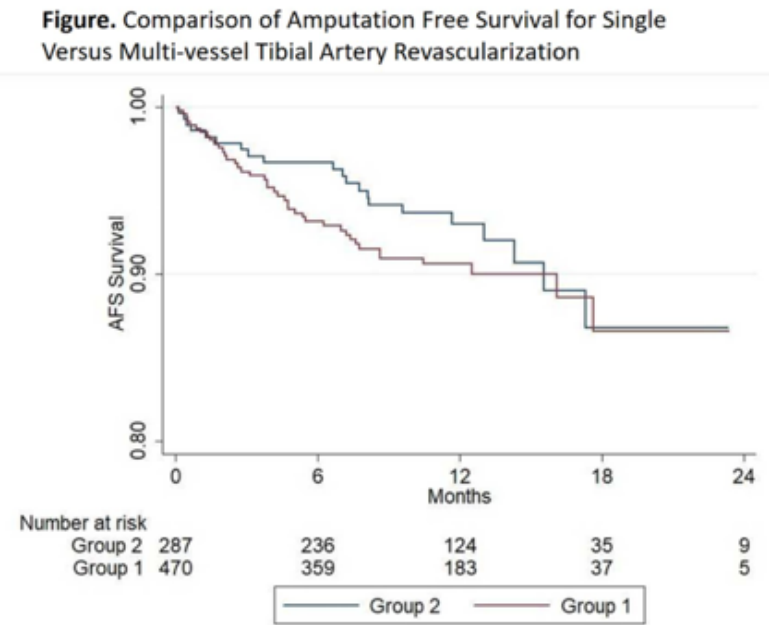
**Objectives:** Single versus multi-vessel revascularization for critical limb ischemia (CLI) remains controversial. The purpose of this study was to evaluate single versus multiple tibial vessel interventions in patients with multi-vessel tibial disease.

**Methods:** Using the Vascular Quality Initiative (VQI) registry we reviewed patients undergoing lower extremity endovascular interventions involving the tibial arteries. Patients with CLI were included if at least two tibial vessels were diseased and appropriate follow-up documented. Primary outcomes were amputation, primary-assisted patency and amputation free survival (AFS).

**Results:** After exclusions, a total of 761 patients with multi vessel tibial disease and CLI were evaluated. Of these, 473 (62.1%) underwent single vessel tibial intervention (Group 1), while 288 (37.9%) underwent multi-vessel ( $\geq 2$ ) intervention (Group 2). Patients in group 2 were younger (69.1 vs 73.2 years,  $p < .001$ ) with higher chance of smoking (29.5% vs 18.2%,  $p < .001$ ). Prior ipsilateral amputation (19.2% vs 22.2%,  $p = .22$ ) or inflow procedures (3.1% vs 2.8%,  $p = .29$ ) were similar. Group 1 more commonly had concurrent femoral or popliteal inflow interventions (83.7% vs 78.1%,  $p = .05$ ). Multi-vessel runoff on completion was significantly greater for group 2 (99.9% vs. 39.9%;  $p < .001$ ). Mean follow-up was  $337 \pm 62$  days. No differences were observed between groups 1 and 2 for major amputation (9.0% and 7.6%;  $p = .6$ ) patency (89.7% vs. 86.8%,  $p = .45$ ), or AFS ( $p = .372$ ; Fig 1). In a multivariate cox model, loss of patency was the only significant predictor of major amputation (HR 5.36 [2.7-10.6],  $p = .01$ ). A sub-group analysis of 355 (46.6%) patients with tissue loss data showed tissue loss prior to intervention was not predictive of future major amputation.

SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** In the VQI registry, patients with CLI and multi-vessel tibial disease did not appear to benefit in amputation, AFS or primary-assisted patency when undergoing multi-vessel tibial intervention compared with single tibial revascularization. Further studies are needed to determine when multi-vessel treatment is warranted for this population.



## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #32

### **Lower Extremity Revascularization (LER) in the Medicare Population: The Ongoing Rise of Office-Based Atherectomy**

Joy Walker<sup>1</sup>, Sean P. Roddy<sup>2</sup>, Michael S. Conte<sup>1</sup>.

<sup>1</sup>UCSF, San Francisco, CA, USA, <sup>2</sup>The Vascular Group, PLLC, Albany, NY, USA.

**Objectives:** Peripheral artery disease (PAD) is a growing healthcare burden, with rising costs related to utilization of LER. We sought to examine recent trends in procedure volumes by level of disease, provider specialty, and encounter setting.

**Methods:** The Medicare claims database was queried for 2012 and 2016 LER CPT codes and data was extracted for allowed charges, allowed claims, billing provider, and procedure place of service. We examined trends in procedure by level of arterial disease treated.

**Results:** In 2012, 246,513 CPT codes for LER were billed to Medicare (14% open[OPEN], 86% endovascular[ENDO]). In 2016 this number was 279,029 (10% OPEN, 90% ENDO), a 13% increase in overall utilization. In 2012, there were 99,823 outpatient (OP) and 28,903 office based (OB) ENDO procedures. By 2016, there were 104,083 OP and 71,873 OB procedures. The breakdown of ENDO procedures in 2012 was 36% angioplasty (PTA), 43% stenting (ST), and 21% atherectomy (ATH). Of these 9%, 11%, and 26% respectively were performed in an OB setting. Comparatively in 2016, ENDO interventions were comprised of 35% PTA, 36% ST, and 29% ATH of which 16%, 23%, and 51% respectively were performed in an OB setting ( $p<.001$ ). There was no significant change in iliac interventions over the time period; however, differences were pronounced at the infra-inguinal level. Total femoro-popliteal interventions were 101,071 (47%) in 2012 and 118,540 (47%) in 2016, with ATH increasing from 25,038 (25%) in 2012 to 37,453 (32%) in 2016, Fig 1. Total tibial ENDO interventions increased strikingly from 56,378 (23%) in 2012 to 79,333 (32%) in 2016, a relative volume increase of 41%. This was driven largely by increased use of tibial ATH; 19,008 (34%) in 2012 versus 34,438 (43%) in 2016 ( $p<.001$ ). Notably, OB procedures accounted for the bulk of the increase in ATH in 2016 (Fig. 1). In keeping with the trend, ATH

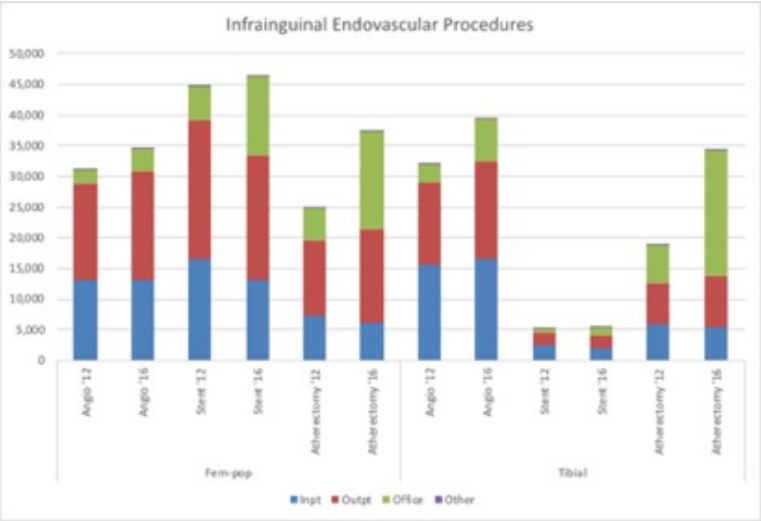


SCIENTIFIC SESSION ABSTRACTS continued

performed on an “additional tibial vessel” increased from 3,707 in 2012 to 6,494 in 2016. These trends were consistent across all provider specialties.

**Conclusions:** Despite a lack of comparative evidence to support its use, the volume of office-based ATH procedures in the Medicare population continues to grow dramatically, particularly at the tibial level. These secular trends were similar across provider specialties and have significant cost implications.

Fig. 1 – Intrainguinal Endovascular Procedures



Presentation #33

### **Factors Influencing Accuracy of Volume Flow Measurement in Dialysis Access Fistulas: Analysis Based on Duplex Ultrasound Simulation**

R. Eugene Zierler<sup>1</sup>, Daniel Leotta<sup>1</sup>, Kurt Sansom<sup>1</sup>, Alberto Aliseda<sup>1</sup>, Mark Anderson<sup>2</sup>, Florence Sheehan<sup>3</sup>.

<sup>1</sup>University of Washington, Seattle, WA, <sup>2</sup>Sheehan Medical LLC, Mercer Island, WA, <sup>3</sup>Sheehan Medical LLC, Seattle, WA

**Objectives:** Volume flow measurements obtained by duplex ultrasound (DU) are recommended for monitoring arteriovenous dialysis access fistulas (DAF) and assessing maturation. We developed a DU simulator and used it to assess the accuracy of volume flow measurements.

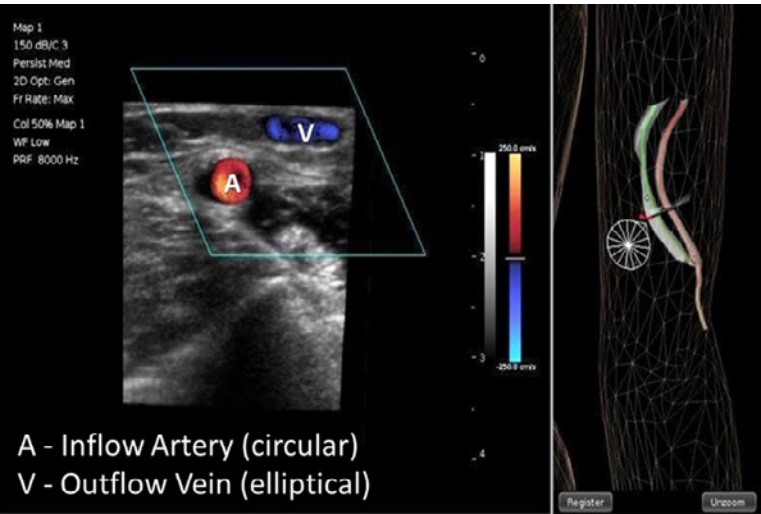
**Methods:** The DU simulator consists of a mannequin, computer, and mock transducer. Each simulated case is built from 2 dimensional (2D) B-mode images obtained from a patient that are used to create a gray-scale image volume and a 3D surface model of the fistula anastomosis and adjacent artery and vein. Computational flow modeling is then used to determine the spatial and temporal distribution of blood flow velocities based on vessel geometry. The simulator displays a real-time 2D B-mode and color-flow image corresponding to transducer position on the mannequin. Doppler spectral waveforms are generated according to user-defined settings such as sample volume size and beam angle. Accuracy was assessed by scanning each case on the mannequin and measuring volume flow in the inflow artery and outflow vein for comparison with the true volume flow values at the sample site.

**Results:** Four examiners made 96 volume flow measurements on 4 DAF models. The mean absolute deviation from the actual computed volume flow was significantly lower for arteries than veins ( $22 \pm 19\%$ ,  $N=48$  vs.  $58 \pm 33\%$ ,  $N=48$ ,  $p<0.0001$ ) but similar between examiners ( $p=NS$  by ANOVA). Error in volume flow measurement correlated significantly with error in measuring vessel diameter ( $r=0.67$ ,  $p<0.001$ ) and cross sectional area ( $r=0.92$ ,  $p<0.001$ ). Volume flow error also correlated closely with vessel eccentricity ( $r=0.58$ ,  $p<0.001$ ) and with error in blood flow velocity ( $r=0.50$ ,  $p<0.001$ ). Volume flow error was reduced from  $39 \pm 38\%$  to  $9 \pm 8\%$  ( $p<0.0001$ ) by calculating vessel area as an ellipse instead of a circle.

# SCIENTIFIC SESSION ABSTRACTS continued

**Conclusions:** Volume flow measurements by DU are based on a circular vessel shape but veins can be highly elliptical (Fig 1). Simulation-based analysis showed that error in measuring volume flow is mainly due to the assumption of a circular vessel cross section. For accuracy volume flow should be measured where the vessel is relatively circular; alternatively, major and minor axis dimensions should be measured to compute an elliptical cross sectional area.

Fig 1. Simulator transverse color-flow image of a DAF artery and vein.



## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #34

### **Comparison of Bovine Carotid Xenograft Versus ePTFE Grafts for Forearm Loop Hemodialysis Access**

Benjamin Colvard<sup>1</sup>, Kedar Lavignia<sup>1</sup>, Vy T. Ho<sup>1</sup>, Nathan Itoga<sup>1</sup>, Anahita Dua<sup>1</sup>, E John Harris<sup>1</sup>, Matthew Mell<sup>1</sup>, Ehab Sorial<sup>2</sup>, Manuel Garcia-Toca<sup>2</sup>.

Stanford University Medical Center, Stanford, CA, USA, <sup>2</sup>Stanford University Hospital, San Jose, CA, USA.

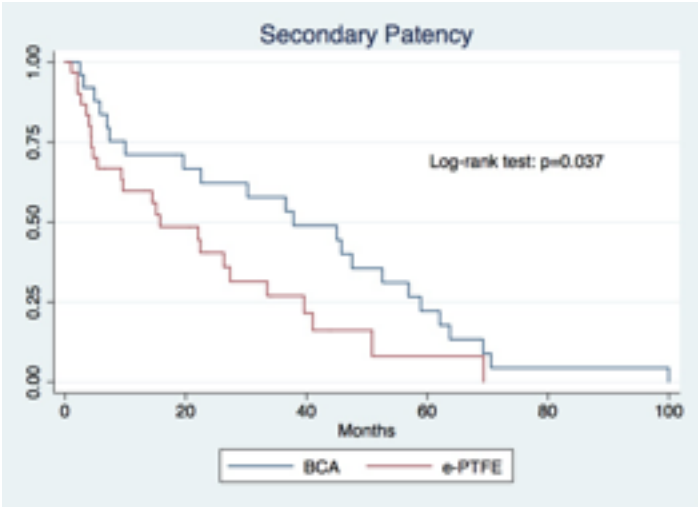
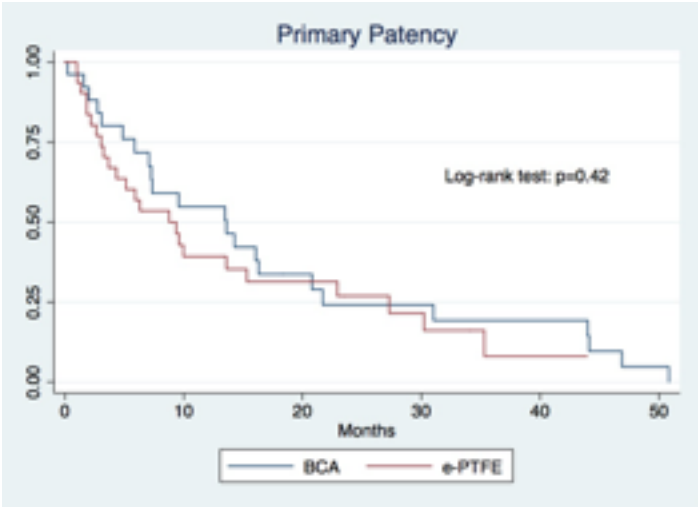
**Objectives:** Forearm loop grafts are a useful option for dialysis access in patients without suitable forearm veins. Bovine carotid artery (BCA) and expanded polytetrafluoroethylene (ePTFE) are commonly used grafts for this purpose, but no data exists to support the use of one over the other in the forearm loop conformation.

**Methods:** We performed a retrospective review of 57 forearm loop grafts implanted at two institutions with a shared patient population between January 2009 and May 2017. Primary and secondary patency rates were calculated via univariate analysis and a cox regression model adjusted for age, gender, and BMI.

**Results:** 26 BCA and 31 ePTFE grafts were placed during the study period. Mean follow-up was 37±25 months. Primary and secondary patency rates in the BCA group were 71.7% and 83.6%, 54.8% and 71.1%, and 28.9% and 62.2% at 6, 12, and 24 months respectively. In the ePTFE group, primary and secondary patency rates were 56.8% and 66.7%, 39.3% and 59.7%, and 26.9% and 40.4% at 6, 12, and 24 months (Figure 1). When adjusted for age, gender, and BMI, secondary patency was significantly better with BCA when compared to ePTFE ( $p=0.04$ ). Infection rates were 7% (2 grafts) for BCA and 3% (1 graft) for ePTFE.

**Conclusions:** Bovine carotid xenografts in forearm loop configuration for hemodialysis access have improved secondary patency and similar infection rates when compared to ePTFE forearm loops.

Figure 1. Kaplan-Meier estimates of primary and secondary patency



## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #35

### **Leukocyte Phenotype is Altered in Peripheral Arterial Disease**

Melinda S. Schaller, Thomas A. Sorrentino, Mian Chen, S Marlene Grenon, Michael S. Conte.

University of California, San Francisco, San Francisco, CA, USA.

**Objectives:** Peripheral arterial disease (PAD) is characterized by low-grade systemic inflammation. Monocytes (Mo) and Mo-derived macrophages (MDM) play a central role in vascular inflammation and its resolution. We hypothesize that impaired resolution in PAD contributes to adverse clinical outcomes.

**Methods:** In a cross-sectional study, we profiled serum cytokines, phagocytic activity of leukocytes, Mo cell surface markers, and gene expression of MDM from healthy subjects (HS,  $n \geq 10$ ) and patients with stable claudication ( $n \geq 10$ ). Leukocyte phagocytosis of fluorescently labeled E.coli and Mo surface markers were determined by flow cytometry. MDMs were cultured from peripheral blood Mo isolated by density gradient centrifugation. MDM cytokine production and gene expression, before and after stimulation with lipopolysaccharide (LPS), were determined by ELISA and qPCR, respectively.

**Results:** Patients with PAD had elevated serum hsCRP (3.7 vs 0.6 mg/L,  $p = .004$ ) and IL-6 (5.1 vs 1.1 pg/mL,  $p = .01$ ) and trended towards higher levels of MCP-1 and lower adiponectin compared to HS. Circulating Mo and PMN from PAD patients had reduced phagocytic activity for E.coli (Mo:  $>30\%$ ,  $p < .001$ ; PMN:  $>25\%$ ,  $p < .01$ ). Flow cytometry demonstrated a higher proportion of the pro-inflammatory intermediate Mo subset ( $CD14^{++}16^{+}$ , 1.8-fold,  $p = .04$ ) in PAD subjects. MDM from PAD subjects retain their intrinsic inflammatory program, producing more IL-6 ( $>4$  fold,  $p = .03$ ) and IL-1 $\beta$  ( $>10$  fold  $p = .04$ ), and demonstrating increased expression of M1 genes (TNF- $\alpha$ , MCP-1, CXCL10) and decreased expression of M2 genes (CCL17, MRC1) versus HS (Table 1).

**Conclusions:** Clinically stable PAD subjects have elevated serum inflammatory markers compared to healthy subjects. Circulating Mo and PMN in patients with PAD have reduced phagocytic activity and a greater proportion of the pro-inflammatory intermediate Mo subset. MDM from PAD patients preserve their elevated inflammatory state in culture. These data demonstrate a heightened inflammatory and impaired resolution phenotype in PAD that has potential

implications for disease progression and response to interventions.

Table 1. Monocyte-derived macrophage (MDM) gene expression of the PAD cohort relative to healthy subjects.

Gene	M1 or M2	PAD Subjects Relative to Healthy Subjects	
		Expression Fold Change	P Value
TNFα (veh)	M1	2.71	0.02*
TNFα (LPS)		0.81	0.33
MCP-1 (veh)	M1	1.92	0.05*
MCP-1 (LPS)		1.91	0.01*
iNOS (veh)	M1	1.34	0.26
iNOS (LPS)		1.04	0.94
CXCL10 (veh)	M1	7.87	0.04*
CXCL10 (LPS)		1.81	0.29
IL-10 (veh)	M2	1.50	0.19
IL-10 (LPS)		2.72	0.009*
CCL17 (veh)	M2	0.48	0.09
CCL17 (LPS)		0.22	0.14
MRC1 (veh)	M2	0.52	0.09
MRC1 (LPS)		0.30	0.01*

Expression fold change was calculated as  $2^{-(\Delta\Delta CT)}$ , and represents the fold change in the average expression of the target gene within the PAD cohort (n=10) versus the average expression of the target gene within the healthy subject cohort (n=10), normalized to the housekeeping gene (HPRT). MDM were stimulated with lipopolysaccharide (LPS), to mimic the occurrence of an acute inflammatory event, or vehicle (veh) for 24 hours prior to assessment of gene expression. \*P<0.05 by unpaired Student's t test. TNFα, tumor necrosis factor alpha; MCP-1, monocyte chemoattractant protein-1; iNOS, inducible nitric oxide synthase; CXCL10, C-X-C motif chemokine 10; IL-10, interleukin 10; CCL17, chemokine (C-C motif) ligand 17; MRC1, mannose receptor C Type 1.

## SCIENTIFIC SESSION ABSTRACTS continued

Presentation #36

### **Initial Open VS Endovascular Treatment and Subsequent Limb Loss After Primary Minor Amputation**

Jonathan H. Lin, Sun Young Jeon, Patrick S. Romano, Matthew W. Mell, Misty D. Humphries.

University of California, Davis, Sacramento, CA, USA.

**Objectives:** Studies of major amputation after initial minor amputation are limited with rates of subsequent major amputation ranging from 14-34 % with a limited understanding for associated comorbidities and time to subsequent amputation. We sought to determine major amputation rates for patients who undergo initial minor amputation and determine which factors are associated with limb preservation with open vs endovascular treatment.

**Methods:** Using statewide data we identified patients with peripheral artery disease (PAD), diabetes mellitus (DM), and both PAD/DM (PD) with a lower extremity ulcer who underwent minor amputation from 2005-2013. We studied rates of subsequent major amputation, time to amputation, and used Cox-Proportional hazards modeling to study which factors affect risk of subsequent major amputation.

**Results:** From 2005 to 2013, 11,597 patients (DM= 4254, PAD= 2142, PD= 5201) with ulcers underwent minor amputation. The rate of subsequent amputation was highest in patients with PD (23% vs DM=17 %, PAD=17%, p=NS). The rate of subsequent minor amputation was 16% in the PD group vs 15.2% in PAD and 12.2% in DM patients. Patients with PD had the highest rate of subsequent major amputation (6.3 % vs DM=5.2%, PAD=2.1%, p=NS). The median time to major amputation was lowest in patients with PAD (8.5months vs DM= 14 months, PD=13 months, p=NS). There was no difference in risk of subsequent major amputation for patients who underwent initial open revascularization vs endovascular therapy (HR= 0.92, CI= 0.92-1.04). There was also no difference in time to subsequent major amputation between open and endovascular therapy (9.8 vs 8.7 months, p=NS). In multivariable analysis, patients who could be treated completely in the outpatient setting were less likely to undergo amputation (HR=0.7, CI=0.5-0.99) compared to those that required hospitalization or presented to the



## SCIENTIFIC SESSION ABSTRACTS continued

emergency room.

**Conclusions:** Patients with ischemic ulcers and diabetes are at the highest risk for subsequent major and minor amputation, with most occurring within a year of the initial minor amputation. Initial endovascular treatment did not increase the risk of subsequent major amputation compared to open and there was no difference in time to amputation indicating the endovascular first approach may be reasonable for patients with CLI.

## ePOSTER PRESENTATION ABSTRACTS

ePoster Presentation #1

### **Preadmission Does Not Correlate with Fewer Complications, Reduced Failure to Rescue or Improved Survival in EVAR and OAAA Patients**

Justin Inman<sup>1</sup>, Devin S. Zarkowsky<sup>1</sup>, Adam Z. Oskowitz<sup>1</sup>, Mohammad H. Eslami<sup>2</sup>, Philip P. Goodney<sup>3</sup>, Shant M. Vartanian<sup>1</sup>, Caitlin W. Hicks<sup>4</sup>.

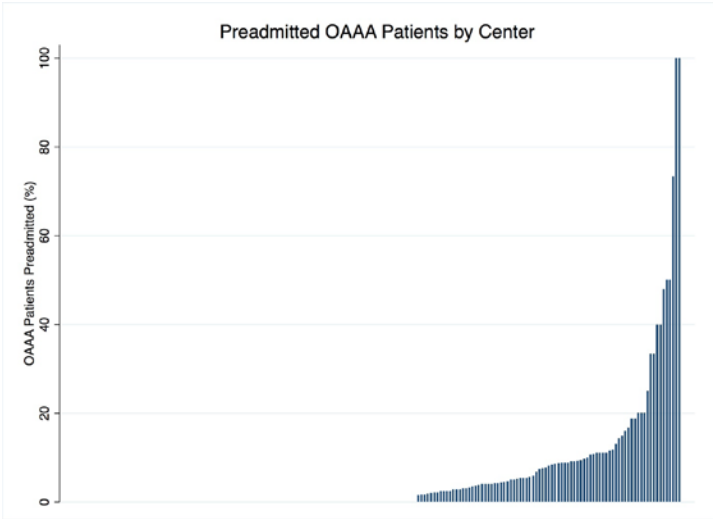
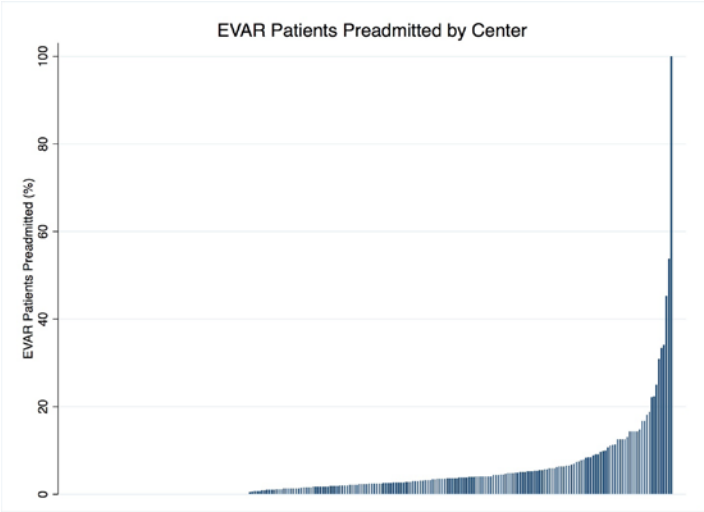
<sup>1</sup>University of California San Francisco, San Francisco, CA, USA, <sup>2</sup>University of Pittsburgh, Pittsburgh, PA, USA, <sup>3</sup>Dartmouth-Hitchcock Medical Center, Lebanon, NH, USA, <sup>4</sup>The Johns Hopkins Hospital, Baltimore, MD, USA.

**Objective:** Few data exist on the efficacy of preadmission before AAA surgery. We compare outcomes for patients admitted to the hospital the day before AAA repair vs those admitted on the day of surgery.

**Methods:** Elective EVAR and OAAA patients captured within the Vascular Quality Initiative dataset were examined. Appropriate univariate and multivariate tests analyzed outcomes - 30-day survival, failure to rescue, major complications - among patients admitted the day prior to surgery versus those admitted the day of surgery. Coarsened exact matching (CEM) validated results from the unmatched cohorts.

**Results:** Between 2003 and 2017, 1,208 of 25,824 (4.7%) EVAR patients and 340 of 6,079 (5.6%) OAAA patients were preadmitted to 247 and 191 centers, respectively. Figure 1 depicts the center-level distribution of patients admitted a day prior to surgery. Patients treated with EVAR differed statistically on 19 of 26 demographic and preoperative characteristics, while OAAA differed on 11 of 26 (all  $P < 0.05$ ). Preadmitted EVAR and OAAA patients experienced more frequent complications (both  $P < 0.05$ ). Failure to rescue was not different for patients preadmitted prior to EVAR (0.4% vs. 0.5%,  $P = 0.70$ ) or OAAA (2.9% vs. 1.8%,  $P = 0.21$ ), nor was 30-day survival (99.3% vs. 99.2%,  $P = 0.71$  and 96.8% vs. 97.7%,  $p = 0.38$ , respectively); these results persisted after CEM. Cox proportional hazards models demonstrated that preadmission did not correlate with 30-day survival in either the EVAR (OR 0.68,  $P = 0.38$ ) or OAAA groups (OR 0.70,  $P = 0.43$ ). MVLR models demonstrated that transfer from an outside facility was associated with preadmission (EVAR OR 14.92,  $P < 0.001$  and OAAA OR 4.70,  $P < 0.001$ ).

**Conclusions:** Preadmission occurred at more than 50% of centers treating AAA patients with EVAR. Neither EVAR nor OAAA patients preadmitted experience fewer complications, reduced failure to rescue, improved 30-day survival or 30-day mortality hazard in comparison to those admitted the day of surgery, suggesting this practice is of unclear benefit.



ePoster Presentation #2

### **Endovascular Removal of a Balloon Expandable Superior Mesenteric Artery Stent**

Jeniann A. Yi, David Kuwayama.

University of Colorado, Denver, CO, USA.

**Objectives:** A 63-year-old woman underwent superior mesenteric artery (SMA) stenting in 2007 for spontaneous dissection. In 2017 she underwent repeat stenting with a RX Herculink Elite (Abbott Vascular) balloon expandable cobalt chromium stent. Abdominal pain and a full body rash prompted allergy testing, which demonstrated cobalt and chromium reactivity. We describe an endovascular technique for SMA stent removal.

**Methods:** Bilateral open axillary and unilateral percutaneous femoral access was obtained. TourGuide 6.5F, 9mm deflection steerable sheaths (Medtronic) were introduced into the descending aorta from each axillary access point. With one TourGuide, Rosen wire access through the SMA stent and distal balloon control was obtained. With the other TourGuide, a 2.0mm EndoJaw disposable biopsy forceps (Olympus) was used to grasp the proximal end of the SMA stent. The stent was withdrawn into the aorta over the balloon shaft. While maintaining EndoJaw control of the stent, the balloon was retracted into the aorta and inflated; the stent was then released from the EndoJaw. Using a snare from the groin, a body floss wire was passed from the axillary balloon lumen out the femoral sheath. The femoral access was upsized to a 14F DrySeal sheath (Gore). From the groin, a gooseneck snare was advanced over the body floss and used to secure the stent in the thoracic aorta. The balloon was then deflated and removed, while the stent was pulled over the body floss wire into the femoral sheath and removed. Angiography and intravascular ultrasound confirmed no damage to the native SMA from stent removal.

**Results:** The patient was discharged on clopidogrel and rivaroxaban on post-procedure day 2 with minimal abdominal pain and improved rash.

**Conclusions:** We describe a safe endovascular approach to SMA stent removal. This approach maintained continuous control of the stent, preventing distal embolization; permitted interrogation of the native SMA to ensure patency; and minimized intravascular injury during stent removal from the patient.

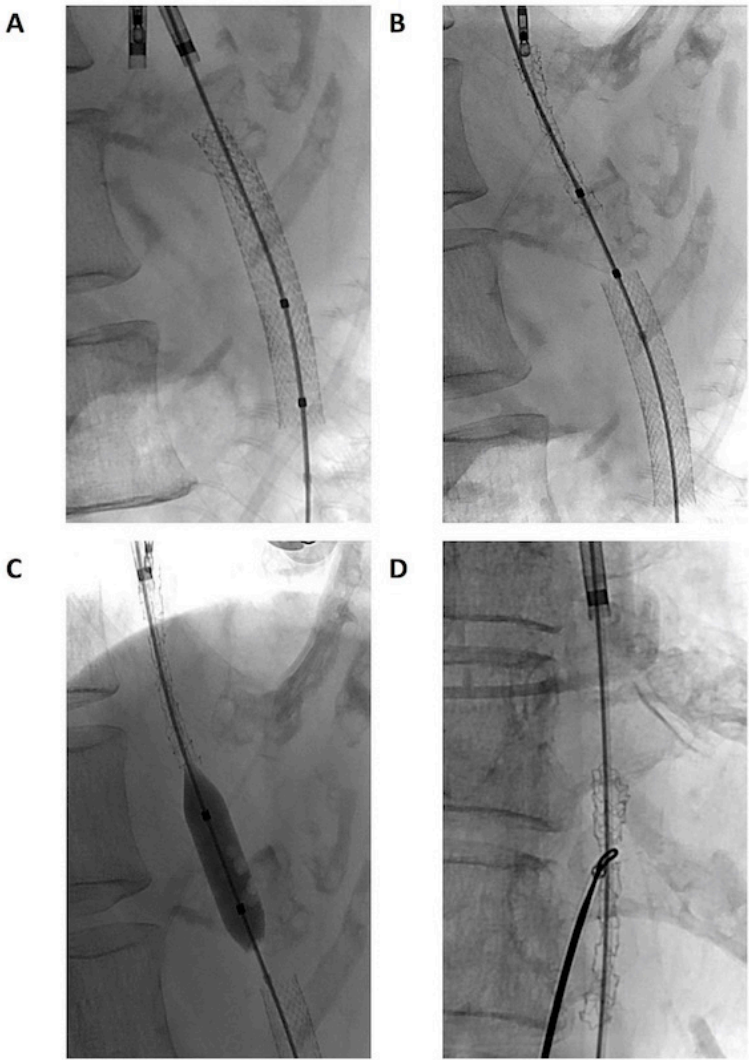


Figure 1. Endovascular retrieval of a superior mesenteric stent (A) using an EndoJaw disposable biopsy forceps (B) with balloon control to prevent distal embolization (C) and a snare to secure the stent to the wire (D).

### ePoster Presentation #3

#### **Utility of Open Forefoot Amputation in the Management of Patients with Critical Limb Ischemia**

Ramsey S. Elsayed, Louis L. Zhang, David G. Armstrong, Gregory A. Magee, Aria C. Woods, Leonardo C. Clavijo, Nallely Saldana-Ruiz, Vincent L. Rowe.

Keck School of Medicine, Los Angeles, CA, USA.

**Objective:** Management of patients with critical limb ischemia (CLI) and extensive foot necrosis presents a challenge for limb salvage. To achieve source control an open forefoot amputation is often required. Our study evaluates preoperative risk factors that contributed to durability and efficacy of open transmetatarsal amputation (TMA) in patients with critical limb ischemia.

**Methods:** Consecutive patients who underwent open TMA at a single institution between 2009-2018 were analyzed. Patient demographics, comorbidities, indications, limb revascularization history, postoperative complications, reinterventions, and functional status were collected. Descriptive statistics were used for analysis of entire cohort. Univariate and multivariate analyses were performed to determine predictors of morbidity.

**Results:** Forty-three complete forefoot amputations were performed in 39 patients, with 9 females. The mean age of our cohort was  $65 \pm 12$  years. Indications for TMA were dry gangrene in 56% and infection in 44%. Ninety percent of patients had diabetes, 54% had end-stage renal disease (ESRD), and 80% had prior toe amputations. Ipsilateral revascularization was performed on 34 limbs, 21 via open and 13 via endovascular approach. Mean follow-up was  $19.7 \pm 22$  months. All patients maintained their preoperative ambulatory status after their amputation, regardless of healing status. Time-to-healing was available for 20/43 limbs with a mean of  $8.7 \pm 11.4$  months. Limb salvage was successful in 39 limbs (91%) where major amputation in the form of a below-knee amputation (BKA) was required in 4 limbs (9%), all of which were ESRD patients. BKA was more prevalent in ESRD patients ( $p=0.05$ ). On univariate analysis, forefoot gangrene was the only predictor of amputation-free survival (APS) after TMA (odd ratio 0.2, 95% confidence interval 0.045-0.88) ( $p=0.03$ ). On multivariable analysis, after adjustment for ESRD, forefoot gangrene was no longer a predictor of APS (OR 0.2, 95% CI 0.04-1.17) ( $P=0.07$ ).

## ePOSTER PRESENTATION ABSTRACTS continued

**Conclusions:** Open TMA resulted in a very low rate of transition to BKA. Amputation-free survival among open TMA patients is mainly impacted by the presence of gangrene of the forefoot on presentation. ESRD was not associated with the need for further limb amputation.

ePoster Presentation #4

### **Initial Experience with the Bolton TREO Device for Fenestrated EVAR**

Benjamin W. Starnes, Billi Tatum, Brenda Allen-Kline, Niten Singh.

University of Washington, Seattle, WA, USA.

**Objective:** The Bolton TREO Device (Figure 1) is an endograft with unique features that lends itself to fenestrated EVAR (FEVAR) due to low device profile, wide amplitude stent design and increased inter-stent distance, providing for a large amount of “real estate” for individual fenestration placement. We sought to describe initial experience with this device for FEVAR to treat short neck and juxtarenal AAAs.

**Methods:** As part of an ongoing PS-IDE (#NCT01538056), subjects were prospectively enrolled and underwent elective FEVAR using a variety of devices. Demographics and procedural details were collected. Data from subjects treated with the TREO device were compared to patients undergoing elective FEVAR with other commercially available devices.

**Results:** 112 patients were enrolled in the study and 20 subjects underwent elective FEVAR with the Bolton TREO device. Demographics are listed in Table 1 and procedural details are listed in Table 2. Mean aneurysm size was 63.5mm. Mean pre-op neck length was 5.3mm and mean final seal zone length 45.7mm. Average hospital and ICU lengths of stay were 3.8 and 2.6 days respectively. There were 59 fenestrations created for 19 SMA's and 40 renal arteries (2.95 FENS/pt). Treatment success, defined as successful implantation of the device with all target vessels preserved, was 95% (19/20) with only one renal artery not successfully preserved (1.7%). Mean follow up was 402 days (14.4 mos). There were six endoleaks detected on follow up (T1a = 0, T1b = 0, T2=5, T3=1) requiring one re-intervention. Two subjects died within 30 days, one due to an intracranial hemorrhage and one due to respiratory failure. Compared with other commercially available devices, the TREO device performed favorably in terms of treatment success. Graft modification time was significantly shorter for TREO (41.6m) when compared to Zenith (54.9m) or Medtronic (54.1m)  $p < 0.0001$ , one-way ANOVA.

**Conclusions:** Our institution has exclusive world-wide experience using the



ePOSTER PRESENTATION ABSTRACTS continued

Bolton TREO device for FEVAR. This device provides for a highly efficient and technically successful procedure in the majority of patients. Procedural and fluoroscopy times are low even in the setting of high complexity. Technical success rates and simplification of the FEVAR procedure make this approach a preferred technique for a majority of patients.



Table 1: Patient Demographics

	N / Percentage
Mean Age (yrs)	74.7
Male Sex	14 / 70%
BMI (kg/cm <sup>2</sup> )	27.8
Hypertension	15 / 75%
CAD	8 / 40%
CHF	3 / 15%
Hyperlipidemia	17 / 85%
COPD	7 / 35%
Diabetes Mellitus	3 / 15%
Chronic Renal Insufficiency	5 / 25%

Table 2: Procedural Details

Procedural Detail	Value / %
Length of Procedure (min / SD)	128 +/- 39.7
Length of Anesthesia (min / SD)	176 +/- 44.3
Total Fluoroscopy Time (min / SD)	31.7 +/- 16.6
EBL (mL)	76.5 +/- 54.6
Contrast Usage (mL / SD)	103 +/- 16.7
Anesthesia (General)	95%

ePoster Presentation #5

### **Traumatic Superior Mesenteric Artery Injuries: Analysis of Incidence, Morbidity and Mortality Compared to Other Visceral Arteries**

Shelley Maithel, Areg Grigorian, Roy Fujitani, Nii-Kabu Kabutey, Samuel Chen, Jeffry Nahmias.

University of California, Irvine, Orange, CA, USA.

**Objectives:** Traumatic celiac, superior mesenteric artery (SMA) and inferior mesenteric artery (IMA) injuries are often grouped together as major visceral arteries with an incidence ranging from 0.01-1%. These injuries have mortality rates ranging from 38-50% for celiac injuries and 33-67% for SMA injuries. No large series have investigated the mortality rate of IMA injuries. We hypothesize that SMA injury leads to a higher risk of mortality in adult trauma patients.

**Methods:** The Trauma Quality Improvement Program was queried for patients with single visceral injury to either the celiac, SMA, or IMA. A multivariable logistic regression model was used for analysis.

**Results:** From 1,403,466 patients, 1,762 had single visceral artery injuries with 39.7% involving the celiac artery, 50.5% involving the SMA, and 8.1% involving the IMA. Compared to celiac and IMA injuries, SMA injuries had similar median age (38 years vs 40 years,  $p=0.48$ ), percentage male (78.4% vs 80.2%,  $p=0.36$ ), median injury severity score (21 vs 22,  $p=0.59$ ) but higher percentage of severe (grade >3) abbreviated injury scale for abdomen (57.5% vs 42.5%,  $p<0.001$ ) [Table 1]. Combined mortality for patients with visceral artery injury was 20%. Compared to celiac and IMA injuries, those with a SMA injury had a longer length of stay (9 days vs 10 days,  $p=0.01$ ), and higher rates of concurrent bowel resection (40.9% vs 30.6%,  $p<0.001$ ), packed red blood cell transfusions > 6 units in the first four hours (13.6% vs 8.9%,  $p<0.001$ ), deep venous thrombosis (6.3% vs 4.1%  $p=0.04$ ) and overall mortality (23.7% vs 16.3 %,  $p<0.001$ ) [Table 2]. After controlling for covariates, traumatic SMA injury increased risk of mortality (OR 1.72, CI=1.24-2.37,  $p<0.001$ ) in adult trauma patients, while celiac (OR 1.02, CI 0.66-1.57,  $p=0.94$ ) and IMA (OR 0.49, CI 0.17-1.38,  $p=0.18$ ) injury did not. Penetrating SMA injury increased risk of mortality (OR 3.65, CI=2.01-5.45,  $p<0.001$ ) while blunt force SMA injury did not increase risk of mortality (OR 1.22, CI=0.81-1.85,  $p=0.34$ ).

## ePOSTER PRESENTATION ABSTRACTS continued

**Conclusion:** Compared to injuries of the celiac and IMA, SMA injury is associated with a higher rate of concurrent bowel resection, DVT, PRBC transfusions and overall mortality. Moreover, penetrating SMA injury nearly triples the rate of mortality in adult trauma patients while blunt SMA injury does not increase mortality.

Table 2. Clinical outcomes in adult trauma patients with visceral artery injury

Outcome	Celiac (n=699)	p-value	SMA (n= 889)	p-value	IMA (n=142)	p-value
LOS, days, median (IQR)	9 (13)	0.01	10 (17)	0.01	10 (16)	0.96
ICU, days, median (IQR)	5 (11)	0.06	6 (13)	0.10	6 (11)	0.33
Ventilator, days, median (IQR)	4 (10)	0.70	4 (10)	0.97	4 (9)	0.59
PRBC transfusion >6 units within 4 hours, n (%)	55 (7.9%)	<0.001	121 (13.6%)	0.00	19 (13.4%)	0.41
Required bowel resection, n (%)	203 (29.0%)	<0.001	364 (40.9%)	0.00	53 (37.3%)	0.70
Unplanned return to OR, n (%)	23 (3.3%)	0.02	49 (5.5%)	0.14	7 (4.9%)	0.87
Deep vein thrombosis, n (%)	29 (4.1%)	0.10	56 (6.3%)	0.04	7 (4.9%)	0.69
Pulmonary embolism, n (%)	15 (2.1%)	0.56	21 (2.4%)	0.95	4 (2.8%)	0.86
Mortality, n (%)	103 (14.7%)	<0.001	211 (23.7%)	<0.001	28 (19.7%)	0.92

IQR = interquartile range, LOS = length of stay, ICU = intensive care unit, PRBC = packed red blood cells

Table 1. Demographics of adult trauma patients with visceral artery injury

Characteristic	Celiac (n= 699)	p-value	SMA (n= 889)	p-value	IMA (n= 142)	p-value
Age, year, median (IQR)	40 (28)	0.44	38 (29)	0.48	39 (29)	0.92
Male, n (%)	555 (79.5%)	0.84	697 (78.4%)	0.36	117 (82.4%)	0.34
ISS, median (IQR)	22 (20)	0.42	21 (13)	0.60	25 (18)	0.06
Smoker, n (%)	121 (17.3%)	0.17	139 (15.6%)	0.81	15 (10.6%)	0.07
Blunt force mechanism of injury, n (%)	517 (74.0%)	<0.001	573 (64.5%)	<0.001	92 (64.8%)	0.25
Penetrating mechanism of injury, n (%)	175 (25.0%)	<0.001	307 (34.5%)	<0.001	50 (35.2%)	0.25
AIS Thorax (grade>3), n (%)	116 (16.6%)	0.22	123 (13.8%)	0.11	23 (16.2%)	0.73
AIS Abdomen, (grade>3), n (%)	237 (33.9%)	<0.001	427 (48.0%)	<0.001	64 (45.1)	0.47

IQR = interquartile range, ISS = injury severity score, AIS = abbreviated injury scale

ePoster Presentation #6

### **Catheter-based Endovascular Interventions for Symptomatic Deep Vein Thrombosis in Children**

Peter H. Lin, Philip Lindsey, Angela Echeverria, Brian Thomas,  
Stanley M. Duchman, Mathew Cheung.

Baylor College of Medicine, Houston, TX, USA.

**Objective:** The occurrence of deep vein thrombosis (DVT) has been well described in the adult population, and is an infrequent event in children. The objective of this study was to review results with catheter-based interventions in pediatric patients with symptomatic DVT.

**Results:** Clinical records of all pediatric patients with symptomatic upper or lower extremity DVT who underwent endovascular interventions during a 14 year period were analyzed using a prospectively maintained database. Demographics, clinical presentation, diagnostic evaluation, treatment modalities, and clinical outcome were evaluated.

**Methods:** Forty-three patients with symptomatic DVT underwent endovascular interventions with thrombectomy and/or thrombolysis in 54 affected limbs (mean age 13.7 years, age range 4 - 18 years, 26 females). Presenting symptoms included pain (88%), swelling (79%), pulmonary embolism (13%), and phlegmasia cerulea dolens (12%). Risk factors for DVT include morbid obesity (44%), hypercoagulable disorders (37%), trauma (16%), cancer (14%), and infection (19%). Mean age of thrombus was 12 days (range 3 to 29 days). Thrombectomy devices used included AngioJet in 33 (77%), Helix Clot Buster in 8 (19%), Fetch catheter in 7, (16%), and Pronto catheter in 4 (9%) cases. Pharmacomechanical thrombectomy using AngioJet device with thrombolytic therapy was performed in 35 patients (81%). Ultrasound-enhanced thrombolytic therapy was utilized in 15 patients (35%). Procedural related adverse event occurs in 8 cases (15%), in which 5 cases were related to hemodynamic compromise or postprocedural hemoglobinuria associated with AngioJet device. Complete DVT resolution was achieved in 45 limbs (83%). Complete symptomatic relief was achieved in 37 patients (86%), with a mean time to resolution of 14.6 days. During a mean follow-up period of 25 months, all patients were free of symptoms or had symptomatic improvement.

## ePOSTER PRESENTATION ABSTRACTS continued

**Conclusions:** Symptomatic lower leg DVT can result in serious morbidities in pediatric patients. Obesity and hypercoagulable disorders are most common risk factors for DVT in children. The AngioJet device should be used with caution as prolong device activation can lead to hemodynamic compromise and postprocedural hemoglobinuria.

ePoster Presentation #7

### **Practice Patterns of Endovascular Interventions for Peripheral Arterial Disease in the Medicare Population**

Rhusheet Patel<sup>1</sup>, Karen Woo<sup>1</sup>, Laura Gascue<sup>2</sup>, Peter Lawrence<sup>1</sup>, John Romley<sup>2</sup>.

<sup>1</sup>UCLA, Los Angeles, CA, USA, <sup>2</sup>Schaeffer Center for Health Policy, Los Angeles, CA, USA.

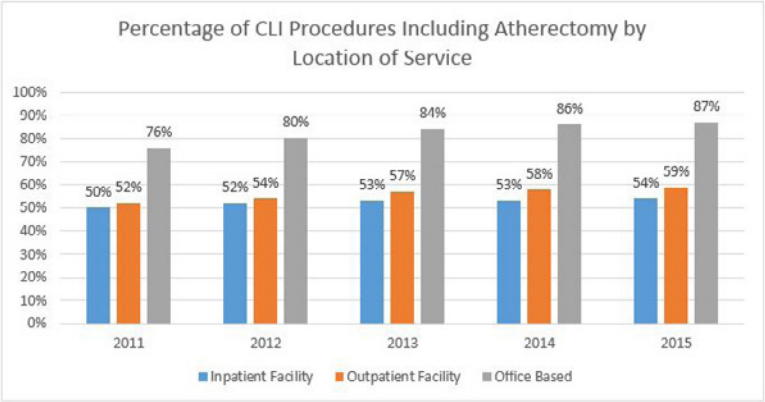
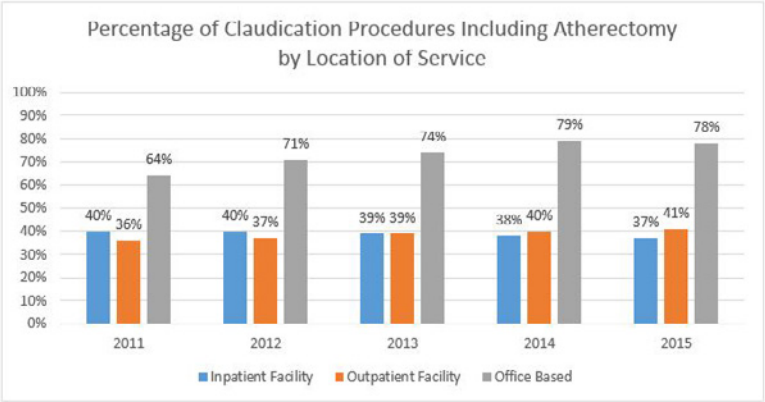
**Objective:** Society for Vascular Surgery Guidelines recommend use of ankle brachial index to establish a diagnosis of peripheral arterial disease and as surveillance after intervention. Guidelines recommend against endovascular interventions (EVI) of isolated infrapopliteal disease for claudication. The objective of this study is to compare practice patterns of EVI for claudication and critical limb ischemia (CLI) in the Medicare population.

**Methods:** The Medicare 100% sample between 2011 and 2015 was queried for all EVI performed for the diagnosis of claudication, rest pain, ulceration and gangrene. CLI was defined as rest pain, ulceration and gangrene.

**Results:** A total of 517,951 EVI were performed during the study period: 292,849 (56.5%) for claudication and 225,102 (43.5%) for CLI. In the six months prior to EVI for claudication, 61.6% of procedures had physiologic testing performed compared to 65.3% for procedures for CLI ( $P < 0.001$ ). Between 2011 and 2015, the proportion of EVI performed in the office increased from 8.7% to 24.9% for claudication and from 6.2% to 21.2% for CLI. Atherectomy was performed in 44.9% of EVI for claudication with an increase from 39% in 2011 to 49.6% in 2015 and 58.8% of EVI for CLI with an increase from 52.8% in 2011 to 63.9% in 2015. A significantly higher percentage of procedures including atherectomy were performed in office-based locations compared to inpatient and outpatient facilities with the difference being larger for claudication compared to CLI ( $P < 0.001$ ) (Figure). For claudication, 20.6% of procedures were isolated to the iliac arteries, 49.1% to the femoral/popliteal distribution, 7.7% to the tibial arteries and 22.7% were multilevel, vs 10.6%, 35.9%, 19.7% and 33.9%, respectively in CLI procedures.

**Conclusions:** The incidence of pre-procedure physiologic testing prior to endovascular interventions in the Medicare population is low overall with

the incidence being significantly lower in claudication vs CLI. The incidence of procedures including atherectomy is dramatically higher in office based locations compared to inpatient/outpatient facilities with a nearly 100% difference in claudication procedures compared to a 60% difference in CLI procedures. An inappropriately high percentage of procedures isolated to the tibial arteries are performed for claudication.



#### **Applicability of the Cook Inner Branched Arch Endograft**

Christopher Burke<sup>1</sup>, Jarin Kratzberg<sup>2</sup>, Anthony Yoder<sup>2</sup>, Jason Smith<sup>1</sup>, Gabriel Aldea<sup>1</sup>, Matthew P. Sweet<sup>1</sup>.

<sup>1</sup>University of Washington, Seattle, WA, USA, <sup>2</sup>Cook Research Incorporated, Bloomington, IN, USA.

**Objective:** Branched endografts are being developed to treat pathology of the aortic arch. The purpose of this study was to evaluate the clinical and anatomic features of patients with arch pathology to better understand the applicability of the Cook inner branched arch endograft (IBAE) as well as how design modifications might expand that applicability.

**Methods:** This study is a retrospective review of 60 consecutive patients with non-ruptured aortic arch pathology seen in the Cardiothoracic or Vascular surgery clinics at a single institution. Patients were assessed for operative candidacy and grouped into the following categories: standard risk, high risk, and prohibitive risk. Clinical covariates were obtained from chart review. Anatomic measurements were obtained on de-identified contrast enhanced computed tomography scans using a formal measurement protocol by a blinded engineer on a 3-D workstation.

**Results:** Demographics and clinical outcomes are shown in Table 1. A total of 43 operative interventions were performed. Overall, 27 (45%) patients had anatomy amenable to treatment with the existing IBAE. Inadequate proximal seal length and large ascending aortic diameters were the primary reasons for anatomic unsuitability. Shortening the inner curve seal zone from 25mm to 15mm and increasing the proximal seal zone diameter from 38mm to 42mm increased anatomic suitability to include 49 patients (82%) (Table 2). Of these, 31 were in the high risk cohort and 7 were deemed prohibitive risk; therefore, IBAE would have been strongly considered in these 38 patients (63% of the overall cohort).

**Conclusions:** Based on anatomic criteria alone, nearly half of patients with aortic arch pathology have anatomy suitable to the Cook IBAE in its current



design. Expanded criteria for proximal seal diameter and inner curve seal may increase anatomic suitability to over 80% of patients with arch pathology. Arch branch vessel anatomy was not a limitation of the applicability of the device. From a clinical standpoint, reserving endovascular repair for those at high or prohibitive risk of open repair, approximately 30% of patients overall would likely benefit from the IBAE in its current form. With the expanded criteria, clinical applicability would rise to approximately 60% of all patients with arch pathology.

Table 1. Clinical and procedural data

Variable	Standard Risk (n=13)	High Risk (n=40)	Prohibitive Risk (n=7)	Overall (n=60)
Age (years)	58.9	62.6	69	62.5
Gender (% male)	69.2	75	42.9	70
Dissection Present (%)	38.5	62.5	42.9	55
Previous Cardiac Surgery (%)	0	70	57.1	65
Operative Details	n=9	n=34		
Open	77.8	55.9		
Hybrid	22.2	44.1		
30d alive/discharge	100	88.2		
1y alive	87.5	74.2		
Successful repair 1y	87.5	48.4		

Table 2. Anatomic suitability of IBAE

	Standard Risk (n=13)	High Risk (n=40)	Prohibitive Risk (n=7)	Overall (n=60)
Fits Current IFU	5 (38%)	17 (43%)	5 (71%)	27 (45%)
All parameter fit with 15mm inner curve and 38mm proximal seal	5 (38%)	24 (60%)	6 (86%)	35 (58%)
All parameter fit with 25mm inner curve and 42mm proximal seal	9 (69%)	23 (58%)	6 (86%)	38 (63%)
All parameter fit with 15mm inner curve and 42mm proximal seal	11 (85%)	31 (78%)	7 (100%)	49 (82%)

## NOTES

## NOTES

## NOTES



# CONSTITUTION & BYLAWS

# CONSTITUTION & BYLAWS

## ARTICLE I - NAME

The name of this corporation is the Western Vascular Society (hereinafter the "Society").

## ARTICLE II - PURPOSES

The purpose of the Society shall be: (1) to promote study and discussion of the art and science of vascular surgery; (2) to promote exchange of information among the membership; (3) to hold annual meetings; (4) to do and engage in any and all lawful activities that may be incidental or related to the foregoing and to have and exercise all powers and authority now or hereafter conferred upon not-for-profit corporations under the laws of the State of California.

Notwithstanding the foregoing, (1) no part of the Corporation's net earnings or assets shall inure to the benefit of any member, director, officer, or other person, except that the Corporation shall be authorized and empowered to pay reasonable compensation for services rendered and to make other payments and distributions in furtherance of the purposes set forth above, and (b) the Corporation shall not carry on any activity not permitted to be carried on by an organization exempt from federal income tax under section 501 (c) (6) of the Internal Revenue Code of 1954, as amended (the "Code") or the corresponding provision of any further United States revenue statute.

## ARTICLE III - MEMBERSHIP

1. The membership of this Society shall be limited to surgeons who practice primarily vascular surgery, who are in good standing in their community as judged by members of the Society. Candidates for membership shall be certified by the American Board of Surgery added Certification in Vascular Surgery or the Royal Canadian College of Surgeons Certificate of Special Competence in Vascular Surgery. In exceptional cases, the Membership Committee may elect to accept equivalent periods of training for formal certification.
2. Members shall be drawn from the Western states, provinces and the Pacific Rim. This will be defined as follows: Alaska, Arizona,

## CONSTITUTION & BYLAWS continued

California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oklahoma, Oregon, Utah, Washington, Wyoming, Alberta, British Columbia and the Pacific Rim.

3. There shall be five types of members: active, senior, honorary, associate, and adjunct.
4. Active membership shall consist of the following members of the Organization plus subsequent individuals elected to membership by the Society. The total number of active members shall be limited to 160.
  - 4a. Prospective members should have completed a minimum of three (3) years of practice after vascular surgery training before applying for membership.
  - 4b. The prospective member should meet one or more of the following three (3) criteria in order to be considered for membership:
    - Excellence in Clinical Care – this can be reflected by letters from colleagues and collaborators, regional reputation, years in Home Annual Meeting Membership Corporate Partners About the WVS Contact Us practice, peer-recognition awards (Chief of Staff, senior surgeon in group, HMO recognition award), service on peer-review organizations, case lists and outcomes, community involvement or participation in clinical trials.
    - Contributions to Vascular Science – this can be reflected by peer-review publications, non-profit or federal grant support, invited lectures, professorships, faculty appointments, invited publications, participation in clinical trials, device development, active participation in local/regional vascular societies or serving on hospital committees.
    - Contributions to Vascular Education – this can be reflected by teaching responsibilities at a vascular or general surgery training program, hospital grand rounds, seminars, proctorship of new vascular procedures or other lectureships.
5. Senior members shall consist of active members who have reached the age of sixty-five (65) or who for reasons of health or other just cause, the Council recommends for classification in this category. Senior members shall not be bound by requirements for attendance at meetings; however, working senior members shall continue to pay annual dues until such time as they have notified

## CONSTITUTION & BYLAWS continued

- the Secretary-Treasurer that they have left active practice.
6. Honorary members of the Society shall consist of individuals who have made outstanding contributions in the field of vascular science. Honorary members shall not be bound by the requirements for attendance at meetings, shall have no voting privileges nor shall they be required to pay dues.
  7. Associate members of the Society shall consist of those individuals who were previously active members but have moved out of the geographic limits of the Western Vascular Society. Associate members shall not be bound by the requirements for attendance at meetings nor shall they be required to pay dues.
  8. Adjunct membership will be granted to those individuals who are not vascular surgeons but have made and continue to make meaningful contributions to the science and practice in the field of vascular disease. This category will include non-M.D.s who are working in the field of research. It will also include physicians who actively practice and publish in the field of non-surgical treatment of vascular diseases. Adjunct members shall not have voting privileges, be able to hold office, participate on standing committees, or be required to pay dues.
  9. Prospective members should attend an annual meeting of the Western Vascular Society prior to submitting application for membership. The prospective member is encouraged to attend the annual meeting.

### ARTICLE IV - SELECTION OF MEMBERS

Qualification for membership in the Society will be judged primarily upon evidence of a prospective member's scholarly contributions to the vascular surgery literature.

1. Active Members:
  - a. Application forms for membership shall be available only by request of a sponsoring member and shall be provided by the Secretary-Treasurer.
  - b. Application forms presenting the curriculum vitae of the candidates and signed by them and the sponsor shall be in the hands of the Secretary-Treasurer at least two (2) months before



## CONSTITUTION & BYLAWS continued

the Executive Session at which it is desired that the candidate be considered for election. Applications must be supported by a letter from the sponsor. Additional letters of recommendation from other members are desirable.

- c. The Secretary-Treasurer shall send to the Chairman of the Membership Committee these applications with all pertinent data, including supporting letters, at least two (2) months before the annual meeting. The Membership Committee shall review the professional qualifications of the candidates.
  - d. The list of candidates with data concerning them shall be circulated by the Secretary-Treasurer to all members of the Society at least one (1) month before the annual meeting.
  - e. The Membership Committee shall meet prior to the annual meeting to review the applications and to make recommendation for membership. The Chairman of the Membership Committee shall meet with the Council for purposes of presenting recommendations of the Membership Committee for review by Council before presenting recommendations to the membership at large at the time of the annual meeting.
  - f. The names of Candidates recommended by the Council for election shall be submitted by the Secretary-Treasurer to the membership in the annual report at the Executive Session of the Society.
  - g. Election to membership shall be by secret ballot, by a three-fourths affirmative vote of the membership present and voting at the annual Executive Session.
  - h. A candidate who fails election at one meeting may be presented for re-consideration of membership at a subsequent meeting by repeating the above process.
2. Honorary members:
    - a. Any active or senior member may nominate an individual for membership. The name and brief description of the accomplishments of the nominee must be submitted to the Secretary-Treasurer at least six (6) months prior to the annual meeting for circulation to an Honorary Membership Committee, which consists of the three (3) past presidents on the Council.

## CONSTITUTION & BYLAWS continued

- b. The Honorary Membership Committee shall make its recommendations to the Council.
  - c. Following its deliberation, the Council may recommend that the candidate's name be submitted by the Secretary-Treasurer to the membership in the annual report presented at the Executive Session of the Society.
  - d. Election to membership shall be by secret ballot, by a three-fourths affirmative vote of the membership present and voting at the annual Executive Session.
3. Associate members:
  - a. Any member in good standing, who leaves the geographic area of the Western Vascular Society, may request transfer in status to associate membership. If a member fails to request such transfer he/she will automatically be dropped from the membership roster.
4. Adjunct members:
  - a. The process of election shall be the same as for active members.

### ARTICLE V – BOARD OF DIRECTORS (“COUNCIL”)

1. The Board of Directors of the Society shall be called the Council.
2. The Council shall be composed of the President, the President-Elect, the Secretary-Treasurer, the Recorder, and the three (3) most recent available past presidents.
3. The Council shall be the governing body of the Society and shall have full power to manage and act on all affairs of the society except as follows:
  - a. It may not without the approval of the Society membership at an annual executive session alter the initiation fees or annual dues, or levy any assessments against the membership, except that it may, in individual cases, waive annual dues or assessments.
  - b. It may not amend the Articles of Incorporation or Bylaws.
  - c. It may neither elect new members nor alter the status of existing members, other than to apply the provisions of Article XI.
4. The President of the Society shall serve as Chairman of the Council and the Secretary-Treasurer of the Society as its Secretary.

## CONSTITUTION & BYLAWS continued

5. Meetings of the Council shall be held at the call of the President of the Society, and each member of the Council must be notified in writing of the time and place of each such meeting.
6. The annual meeting of the Council shall precede the Executive Session of the Society membership.
7. A majority of the voting members of the Council shall constitute a quorum for the transaction of business.
8. The act of a majority of the members of the Council present at a duly called meeting at which a quorum is present shall be the act of the Council, unless the act of a greater number of required by applicable statute, the Articles of Incorporation or these Bylaws.
9. Any action which is required by law or the Articles of Incorporation or these Bylaws to be taken at a meeting of the Council, or any other action which may be taken at a meeting of the Council, may be taken without a meeting if a consent in writing, setting forth the action taken, shall be signed by all the members of the Council entitled to vote with respect to the subject matter thereof. Any consent signed by all the members of the Council shall have the same force and effect as a unanimous vote of a duly called and constituted meeting of the Council.

### ARTICLE VI - OFFICERS

1. The Officers of the Society shall be a President, a President-Elect, a Secretary-Treasurer, and a Recorder, all to be elected as provided in these Bylaws. Said officers shall serve ex-officio as voting members of the Council.
2. All Officers of the Society shall be elected for terms of one (1) year each. Secretary-Treasurer and Recorder both serve three (3) year terms. The President may not serve more than one (1) term.
3. Officers of the Society shall be nominated by the Nominating Committee that shall present the slate to the membership at the Executive Session of the annual meeting. Additional nominations may be made from the floor of the Executive Session each year. The election shall take place at the Executive Session and election shall be by a majority of the votes cast.
4. The President shall preside at meetings of the Society and the

## CONSTITUTION & BYLAWS continued

Council, preserve order, regulate debates, announce results of elections, appoint committees not otherwise provided for, sign Certificates of Membership, and perform the duties of the President's office.

5. The President-Elect, in the absence or incapacity of the President, shall perform the duties of the President's office.
6. In the absence of both the President and the President-Elect, the Chair shall be taken by a Chairman Pro Tem, elected by such members of the Council as are present.
7. The Secretary-Treasurer shall ensure proper storage of the minutes of the meetings of the Society and Council, attest all official acts requiring certification; notify officers and members of their election; conduct correspondence; take charge of all papers not otherwise provided for. At least thirty (30) days but not more than forty (40) days prior to each annual or special meeting he shall ensure issue to all members of the Society a program of the forthcoming meeting. He/she shall compile a written report to be read at the annual Executive Session of the Society, in which shall be included a list of candidates proposed for membership, as approved by Council. He/she shall ensure receipt of all moneys and funds belonging to the Society; ensure payment of all bills; ensure rendering of bills for dues and assessments as soon as possible after the annual meeting; and report to the Council at each annual meeting the names of all members in arrears as to dues. He shall prepare a written report of the finances of the Society to be presented at the Council Meeting and at the Executive Meeting.
8. The Historian shall serve a one-year term and will be appointed by the President. It shall be the duty of the Historian to assemble and preserve the Archives of the Society for storage and reference. The archives shall consist of the roster of the members of the society since its inception and such photographs as are available. It shall be his/her duty to secure and file a photograph of each new member. At the request of the President, the Historian may be asked to provide an appropriate historical comment at either the executive session or the regular meeting. The records of the Western Vascular Society are preserved at the UCLA Medical Center by the archivist of the Louise Darling Library.
9. The Recorder shall ensure receipt of all papers and reports of

## CONSTITUTION & BYLAWS continued

discussions on papers presented before the Society. The Recorder, together with the Program Committee, shall ensure submission of manuscripts to the Journal of Vascular Surgery for publication.

### ARTICLE VII – COMMITTEES

1. Standing committees of the Society shall consist of a Membership Committee, a Nominating Committee, a Program Committee, and a Local Arrangements Committee for the annual meeting.
2. The Membership Committee shall consist of three (3) members who shall be appointed by the President to serve overlapping terms of three (3) years each. The Secretary-Treasurer shall be an ex officio member of the membership committee. The senior member in service on this Committee shall be the Chairman. Nominations to the Membership Committee shall be made by the Nominating Committee which shall present the slate to the membership at its annual business meeting. Election shall be by a majority of votes cast at the Executive Session. The functions of the Committee shall be to pass upon the professional and ethical qualifications of the applicants and to advise the membership of these recommendations.
3. The Nominating Committee shall consist of the three (3) most recent available past Presidents. The Committee shall be appointed by the President one (1) month before the annual meeting. Its function shall be to make up a slate of officers to be presented at the annual business meeting to the membership.
4. The Program Committee shall consist of four (4) members who shall be appointed by the President to serve overlapping terms of four (4) years each. The senior member in term of service on this Committee shall be the Chairman. The President, Secretary-Treasurer and Recorder shall be ex officio members of the Program Committee. The function of the Program Committee shall be to solicit presentations from members and other individuals and to make up the program for the annual meeting. The appointed members of the Program Committee shall serve as an advisory committee to act, with the Recorder, to ensure editorial review of the submitted manuscripts.
5. The Chairman of the Local Arrangements Committee for the

## CONSTITUTION & BYLAWS continued

annual meeting shall be appointed by the President and the members of the Committee shall be appointed by the Chairman. These individuals will consist of members resident in the general locality in which the annual meeting is to be held, together with the President, the Secretary-Treasurer, acting ex officio. The function of this Committee shall be the making of the general arrangements for the annual meeting.

6. The Council may from time to time establish such other Committees as it deems advisable. Each such Committee shall consist of such persons and shall have such duties and the Council upon establishment of the Committee from time to time may designate powers as thereafter. Unless otherwise provided by the Council, the President shall appoint the members of each such Committee.
7. Any vacancy occurring among the members of any elected Committee of the Society shall be filled by appointment by the President. The Appointee will serve until the next annual meeting of the Society membership.

### ARTICLE VIII - MEETINGS

1. The annual meeting of the Society shall be held at a time and place to be determined by the Council at least one year in advance.
2. The Council shall meet on the day prior to the annual meeting, at a time and place designated by the President. The Chairmen of the Membership Committee, the Nominating Committee and the Local Arrangements Committee shall meet with the Council in an advisory capacity.
3. Twenty (20) voting members present in person shall constitute a quorum at a meeting of the membership.
4. The vote of a majority of the votes entitled to be cast by the members present at a duly called meeting at which a quorum is present shall be necessary for the adoption of any matter voted upon by the members, unless a greater proportion is required by the applicable statute, the Articles of Incorporation, or the Bylaws.
5. Members may not cast their votes by proxy.
6. The Executive Session of the Society, attendance at which shall be limited to active, senior and honorary members, shall be held

## CONSTITUTION & BYLAWS continued

at a time and place to be set by the President. The business of the Society shall be conducted at that time.

7. The scientific session of the annual meeting shall consist of original presentations of papers and the discussion of these papers. An active or senior member must be a participant, co-author or sponsor of each presentation selected.
8. Special meetings of the Society may be called at any time by the President. The President must call a special meeting whenever he is requested to do so in writing by ten (10) members of the Society in good standing.
9. Notice of any Executive Session of any annual or special meeting of the Society shall be given to each member of the Society not less than thirty (30) nor more than forty (40) days prior to the Executive Session by written or printed notice delivered personally or by mail, by or at the direction of the Council, the President or the Secretary-Treasurer. Such notice shall state the place, day and hour of the Executive Session and in the case of a special meeting shall also state the purpose or purposes for which the Executive Session is called.
10. The Council may, by majority vote, revoke the membership of any active member who shall have been absent from three (3) consecutive meetings of the Society without providing the Secretary-Treasurer with an acceptable written explanation of such absence. An active member shall receive a warning letter from the Secretary-Treasurer following two (2) consecutive unexcused absences from the annual meetings, and the Secretary-Treasurer shall, within thirty (30) days after revocation of any active membership pursuant to this section, send written notice of such action to the individual whose active membership has been so revoked. In addition, in order to emphasize the importance of scholarly participation, it shall be the requirement for each member to be a named author of at least one abstract during a four year term or to be a named discussant of a paper selected for presentation. An active member shall receive a warning letter from the Secretary-Treasurer following three (3) consecutive years in which the member has failed to participate as described above. The Secretary-Treasurer shall, within thirty-(30) days after revocation of active membership pursuant to this section, send

## **CONSTITUTION & BYLAWS** continued

written notice of such action to the individual whose active membership has been so revoked. Any person whose active membership has been revoked by the Council pursuant to this section may, within six (6) months after such revocation, send to the Secretary-Treasurer a written request that the Council at its next meeting reconsider its decision. Such a request must be accompanied by a written statement for the reasons for the consistent absence or lack of participation from annual meetings of the Society. If the Council, upon reconsideration, determines by a majority vote that reinstatement is appropriate, the individual shall be reinstated as an active member upon payment in full of any outstanding dues or other financial obligations to the Society, including any such obligations which may have arisen during the period in which the revocation was in effect.

11. The societies current President and Recorder will moderate the first Scientific Session of the Annual Meeting. The incoming President-Elect and current Recorder will moderate the final Scientific Session of the Annual Meeting. All other moderators for all other sessions will consist of and be chosen by the Program Committee.

### **ARTICLE IX – INVITED GUESTS**

1. A member of the Society may invite one or more guest(s) to attend the Annual Meeting of the Society. Should a member wish to tender an invitation, formal request must be made to the Secretary-Treasurer to send a written invitation to the individual identified by the member. No guest will be admitted to the scientific sessions and/or social events without a formal invitation and active registration for the annual meeting.
2. The names of all guests attending the Annual Meeting shall be entered under a separate heading in the attendance list.
3. All invited guests shall be given the privilege of the floor by the President but shall not be present at the Executive Session.

### **ARTICLE X – FEES AND DUES**

1. Initiation fees, dues and assessments shall be levied by the Council



## CONSTITUTION & BYLAWS continued

and approved by the membership at the annual Executive Session.

2. Any member of the Society in arrears as to dues for one (1) year shall be notified of that fact by the Secretary- Treasurer, by email and registered letter, which shall contain a copy of this Section 2. If the dues are not paid before the next annual Council meeting, or some reasonable explanation of the delinquency is not forthcoming, the name of the delinquent member shall be presented at the Council meeting and on a majority vote of the Council the name may be stricken from the membership list. The Council may reinstate the delinquent member upon payment of the dues in arrears.

### ARTICLE XI – RESIGNATIONS AND DISCIPLINE

1. Resignation of members not in arrears as to dues may be accepted at any annual meeting of the Society by a majority vote of the members present.
2. Charges of unprofessional or unethical conduct may be brought against any member of the Society by a written complaint signed by three (3) members of the Society and delivered to the Secretary-Treasurer. The Council shall establish the rules governing disciplinary proceedings based upon such charges from time to time.

### ARTICLE XII – PAPERS AND REPORTS

1. All papers and reports read before the Society shall be submitted to the Journal of Vascular Surgery prior to the time of their presentation at the Annual Meeting. The Recorder shall be responsible for ensuring the submission of these manuscripts.
2. No paper shall be submitted for publication as having been read before the Society unless it has been read before the Society.

### ARTICLE XIII – PROCEDURE

The proceedings of the Society shall be conducted under Roberts Rules of Order Newly Revised.

## **CONSTITUTION & BYLAWS** continued

### **ARTICLE XIV – CERTIFICATE OF MEMBERSHIP**

Every elected member of the Society shall be entitled to a Certificate of Membership signed by the President and the Secretary-Treasurer and bearing the seal of the Society.

### **ARTICLE XV – SEAL**

This Society shall make, have, and use a seal bearing the name of the Society, the words “Corporate Seal, California,” and such other device and description, as the Society shall deem proper.

### **ARTICLE XVI – NOTICE AND WAIVER OF NOTICE**

1. Whenever, under applicable law, these Bylaws, or resolution of the Council, notice is required to be given to any member, Council member or Officer, such notice may be given in writing, by e-mail or standard mail, addressed to such member, Council member or Officer, at his or her address/electronic address as it appears on the records of the Society. Such mailed notice shall be deemed to be given when deposited in the United States Mail in a sealed envelope so addressed, with postage therein prepaid.
2. Whenever, under applicable law, these Bylaws, or resolution of the Council, any notice is required to be given, a waiver thereof in writing, signed by the person or persons entitled to such notice. Whether before or after the time stated therein, shall be deemed equivalent to the giving of such notice. In addition, the attendance of a member or Council member at any meeting shall constitute a waiver of notice of such meeting, except where an individual attends the meeting for the express purpose of objecting to the transaction of any business because the meeting is not lawfully called or convened.

# CONSTITUTION & BYLAWS continued

## ARTICLE XVII – INDEMNIFICATION

1. To the full extent in accordance with the procedure prescribed by the General Not-For-Profit Corporation Act, the Society shall indemnify any and all members of the Council (which members shall hereinafter in this Article be referred to as “Directors”) and any and all officers, employees, agents and representatives of the Society for certain expenses and other amounts paid in connection with legal proceedings in which any such person become involved by reason of their serving in any such capacity for the Society.
2. Upon specific authorization by the Council, the Society may purchase and maintain insurance on behalf of any or all Directors, Officers, employees, agents or representatives of the Society against any liability asserted against any such person and incurred in any such capacity, or arising out of the status of serving in any such capacity, whether or not the Society would have the power to indemnify them against such liability under the provisions of Section 1 of this Article.

## ARTICLE XVIII – AMENDMENT

These Bylaws may be amended by a three-fourths vote of the members present and voting at a properly called and convened Executive Session at an Annual or Special Meeting of the Society, provided that the proposed Amendment has been submitted to the Secretary-Treasurer by at least three (3) voting members of the Society at least three (3) months prior to the Executive Session of the Society. The Secretary-Treasurer shall mail the proposed Amendment at least thirty (30) days prior to the Executive Session, accompanied by notice that such Amendment will be acted upon at that Executive Session.

## ARTICLE XIX – RULES AND REGULATIONS

The Society may enact from time to time rules and regulations that will govern the actions of the Society. Such Rules and Regulations shall be enacted, amended or deleted by a majority (>50%) vote of those attending the annual business meeting. Proposed rules and regulations require notification of the membership no less than 30 days prior to

## NOTES

the annual meeting. Amendments to a proposed Rule and Regulation made at the time of the business meeting may be voted upon at the same business meeting and do not require an additional 30 day notification of members. All Rules and Regulations must be in conformity with the bylaws of the Society.

**Amended January 2017**



# 2018 MEMBERSHIP

## 2018 MEMBERSHIP

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# MEMBER UPDATE FORM

Help the Western Vascular Society keep your membership information current. We require an email address from all members for communication purposes, as well as your preferred mailing address.

Please return completed form to the WVS Registration Desk or fax to the Administrative Office at 360-261-6077 or email at [surgicalcs@gmail.com](mailto:surgicalcs@gmail.com).

## MEMBER INFORMATION (REQUIRED FOR ALL MEMBERS)

---

NAME

---

INSTITUTION

CITY

STATE

---

EMAIL ADDRESS

## MAILING INFORMATION

Preferred Mailing Address: ☐ Work ☐ Home

Please provide preferred mailing address below:

---

MAILING ADDRESS

---

MAILING ADDRESS CONTINUED

---

CITY

STATE

POSTAL CODE

COUNTRY

---

DAYTIME TELEPHONE

**Thank you!**

## CONTACT INFORMATION



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## NOTES

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The Western Vascular Society wishes to thank the following companies for their educational grants in support of the 33rd Annual Meeting.

**Cook Medical**  
**Gore & Associates, Inc.**

The Western Vascular Society wishes to thank the following companies for sponsorship support of the 33rd Annual Meeting.

**Abbott Vascular**  
**Cook Medical**  
**Medtronic**  
**Terumo Aortic**

The Western Vascular Society wishes to thank the following companies for exhibiting in support of the 33rd Annual Meeting.

PLATINUM  
**Cook Medical**  
**Gore & Associates**  
**Medtronic**

GOLD  
**Getinge Group**

SILVER

**Abbott Vascular**  
**Boston Scientific**  
**CR Bard**  
**Endologix, Inc.**  
**Penumbra**

**Janssen Pharmaceuticals, Inc.**  
**Shockwave Medical**  
**Silk Road Medical**  
**Terumo Aortic**  
**Vascular Insights**