



WESTERN VASCULAR SOCIETY

34th Annual Meeting

September 28 - October 1, 2019

Fairmont Kea Lani | Maui, HI

www.westernvascularsociety.org

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OFFICERS AND COMMITTEES

OFFICERS

York N. Hsiang, M.B., MHSc _____ President
Benjamin W. Starnes, MD _____ President-Elect
E. John Harris, MD _____ Past President
Roy Fujitani MD _____ Secretary-Treasurer
Michael Conte, MD _____ Recorder
Steven Katz, MD _____ Councilor

PROGRAM COMMITTEE

Stephen Murray, MD _____ Chair
Omid Jazaeri, MD
Vincent Rowe, MD
Venita Chandra, MD
York N. Hsiang, M.B., MHSc _____ President (Ex-Officio)
Benjamin W. Starnes, MD _____ President-Elect (Ex-Officio)
Roy Fujitani MD _____ Secretary-Treasurer (Ex-Officio)
Michael Conte, MD _____ Recorder (Ex-Officio)

MEMBERSHIP COMMITTEE

Timothy Liem, 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

Raymond Lee, 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
2018	Santa Fe, NM	E. John Harris, 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. Pevac, MD
2010 - 2013	Steven Katz, MD
2013 - 2016	Benjamin W. Starnes, MD
2016 - 2019	Michael Conte, MD

NEW MEMBERS ELECTED IN 2018

Oliver Alami, MD

Jason Faulds, MD

Ali Azizzadeh, MD

Manuel Garcia-Toca, MD

Andrew Barleben MD

Muhammad Ali Rana, MD

Leo Daab, MD

Rachel Danczyk, MD

WVS PRESIDENTIAL GUEST LECTURERS

1986	Emerick Szilagyi	2004	None
1987	None	2005	Kevin G. Burnand
1988	James Stanley	2006	Jean Pierre Becquemin
1989	Brian Thiele	2007	None
1990	Frank Veith	2008	John H. N. Wolfe
1991	Allan Callow	2009	Jack L. Cronenwett
1992	Malcolm Perry	2010	None
1993	Norman Hertzner	2011	Germano Melissano
1994	Norman Browse	2012	Roy K. Greenberg
1995	Calvin Ernst		Hazim J. Safi
1996	Anthony Whittemore	2013	Spence M. Taylor
1997	None	2014	Alan B. Lumsden
1998	None	2015	Peter Gloviczki
1999	Jonathan Towne	2016	Alik Farber
2000	R. Thomas Grayston	2017	Bruce Perler
2001	William Hiatt	2018	Thomas Wakefield
2002	Thomas R. Russell	2019	Thomas Forbes
2003	None		

GENERAL INFORMATION

EDUCATIONAL OBJECTIVES & METHODS

The 34th 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.

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.
- Describe techniques to optimize patient outcomes in the medical and surgical treatment of peripheral artery disease.

GENERAL INFORMATION continued

- 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

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 the 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 **10.25 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 **9.25** credits meet the requirements for Self-Assessment.



AMERICAN COLLEGE OF SURGEONS

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AMERICAN COLLEGE OF SURGEONS
DIVISION OF EDUCATION

INSTRUCTIONS FOR CME CREDIT COLLECTION

To claim the **10.25** *AMA PRA Category 1 Credits™*: Physicians please sign in everyday at the registration desk and complete the meeting evaluation online using the link provided via email.

To claim the **9.25** 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.

Alternatively, you can visit the website www.westernvascularsociety.org and find the links on the annual meeting page.

ACKNOWLEDGEMENTS

Western Vascular Society wishes to thank the following companies for their sponsorship donation in support of the 34th Annual Meeting.

Cook Medical

Monday Breakfast Symposium

Gore & Associates, Inc.

Tuesday Breakfast Symposium

Medtronic

Monday Reception Symposium

Silk Road Medical

Barista

Western Vascular Society wishes to thank the following companies for exhibiting in support of the 34th Annual Meeting.

PLATINUM

Abbott Vascular

Janssen Pharmaceuticals, Inc.

Cook Medical

Medtronic

Gore & Associates

Terumo

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Silk Road Medical

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Boston Scientific

LifeNet Health

Cydar Medical

Penumbra Inc.

Endologix

Walk Vascular



SCHEDULE OF EVENTS

SCHEDULE AT A GLANCE

SATURDAY, SEPTEMBER 28, 2019

12:00 pm – 8:00 pm	Registration , Makai Desk
11:00 am – 4:00 pm	Executive Council Meeting , Lehua Office
4:00 pm – 5:00 pm	Exhibit Set-Up , Pikake & Protea
5:00 pm – 7:00 pm	ePoster Session and Industry Reception , Royal Fountain Terrace
6:30pm	Kilea Eruption Presentation with Dr. Steven Lundblad
7:00 pm – 9:00 pm	Past President's Dinner (Invitation Only), Ko Garden

SUNDAY, SEPTEMBER 29, 2019

6:00 am – 1:00 pm	Registration , Makai Desk
7:00 am – 8:00 am	Breakfast , Pikake & Protea
7:00 am – 11:45 am	Exhibits , Pikake & Protea
7:30 am – 8:00am	Presidential Welcome Address
8:00 am – 12:10 am	Scientific Session I: PAD , Hibiscus
8:00 am – 9:30 am	Companion Breakfast , Lobby Mezzanine
9:30 am – 10:00 am	Coffee Break with Exhibits
10:00 am – 11:00 am	Presidential Guest Lecture Dr. Thomas Forbes: "Evolution of the Vascular Specialist"
11:00 am - 12:10 pm	Scientific Session II: Aortic
12:30 pm – 5:00 pm	Golf Tournament
1:00 pm – 3:30 pm	Tennis Tournament
1:00 pm – 4:30 pm	National Park Geology Tour
6:00 pm – 8:00 pm	Western Family Dinner Buffet , Adult Pool Lawn

SCHEDULE AT A GLANCE continued

MONDAY, SEPTEMBER 30, 2019

6:00 am - 1:00 pm	Registration , Makai Desk
7:00 am – 8:00 am	Breakfast , Pikake & Protea
7:00 am – 7:45am	Cook Medical Breakfast Symposium , Hibiscus
7:00 am – 8:00 am	Group Yoga on Polo Lawn
7:00 am – 11:45 am	Exhibits , Pikake & Protea
7:50 am – 9:30 am	Scientific Session III: Carotid , Hibiscus
9:30 am – 10:00 am	Coffee Break with Exhibits
10:00 am – 11:20 am	Scientific Session IV , Hibiscus
11:20 am – 11:40 am	SVS Update with Dr. Kim Hodgson
11:40 am – 12:30 pm	WVS Business Meeting - Members Only
12:30 pm – 4:00 pm	Snorkeling Tour
5:00 pm – 6:00 pm	Medtronic Reception Symposium , Hibiscus
6:30 pm – 9:00 pm	Presidential Banquet - Adults Only

TUESDAY, OCTOBER 1, 2019

6:30 am – 7:20 am	Gore & Associates Breakfast Symposium , Hibiscus
7:00 am - 11:00 am	Registration , Makai Desk
7:30 am - 9:40 am	Scientific Session V , Hibiscus
9:40 am - 10:10 am	Coffee Break with Exhibits , Pikake & Protea
10:10 am - 11:40 am	Scientific Session VI , Hibiscus
11:40 am - 12:00 pm	Awards and Adjournment , Hibiscus

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.

INSTRUCTIONS TO AUTHORS continued

MANUSCRIPTS

Authors of Full Presentations 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. 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.

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

Saturday, September 28	12:00 p.m. – 8:00 p.m.
Sunday, September 29	6:00 a.m. – 1:00 p.m.
Monday, September 30	6:00 a.m. – 1:00 p.m.
Tuesday, October 1	7:00 a.m. – 11:00 a.m.

NOTES



SCIENTIFIC PROGRAM

SATURDAY, SEPT 28, 2019

12:00 pm - 8:00pm

Registration

11:00 am - 4:00pm

Executive Council Meeting

5:00pm - 7:00pm

ePoster Sessions & Industry Reception

Moderator: Stephen Murray, MD

5:00-5:06pm

P1 Temporal Patterns of Local and Systemic Inflammation Following Vascular Intervention

Thomas A. Sorrentino, MD, University of California San Francisco

5:06-5:12pm

P2 Comparison of Celiac Artery Coverage With Versus Without Revascularization In Thoracic Endovascular Aortic Repair (TEVAR): A Systematic Review and Meta-analysis

Lixin Wang, MD, University of Washington

5:12-5:18pm

P3 Characterization of Non-syndromic Familial Type B Aortic Dissection

Jasmine Rah, BA, University of Washington

5:18-5:24pm

P4 Long Term Results of Endovascular Femoropopliteal Helical Interwoven Nitinol Stents

Yiu Che Chan, MB, BS, BSc. MD, FRCS, University of Hong Kong

5:24-5:30pm

P5 Quantification of Suprarenal Aortic Neck Dilation Following Fenestrated Endovascular Aneurysm Repair

Kenneth Tran, MD, Stanford University Medical Center

5:30-5:36pm

P6 Early Tevar for Acute Type B Dissection is Associated with Increased Complications - Results From The GREAT Registry

Gregory A. Magee, MD MSc, University of Southern California

5:36-5:42pm

P7 Ultrasound-guided Cyanoacrylate Injection for the Treatment of Incompetent Perforator Veins

Alexa Mordhorst, MD, University of British Columbia

5:42-5:48pm

P8 Predictors and Outcomes of Endoleaks After Endovascular Abdominal Aortic Aneurysm Repair (EVAR)

Julia Fayanne Chen, MD, Yale School of Medicine

5:48-5:52pm

P9 The Snuffbox Arteriovenous Fistula: A Single Surgeon Experience

Sitaram V. Chivukula, MD, Rush University Medical Center

5:52-5:58pm

P10 Routine Involvement of Vascular Surgery in an Extracorporeal Membrane Oxygenation (ECMO) Program Decreases Complications

Jason Q. Alexander, MD, Vascular Specialists of Minnesota, Minneapolis Heart Institute

5:58-6:04pm

P11 The New Global Limb Anatomic Staging System (GLASS) for CLTI: Assessment of its Utility in Two Limb Preservation Centers

Thomas A. Sorrentino, MD, University of California San Francisco

6:04-6:10pm

P12 Same Day ICU Discharge is Safe and Feasible in Selected Patients with Severe Submassive Pulmonary Embolism Treated with Catheter-Directed Thrombolysis

Jaideep Das Gupta, MD, University of New Mexico

SUNDAY, SEPT 29, 2019

6:00 am - 1:00pm

Registration

7:00am - 8:00am

Breakfast

7:00am - 11:45am

Exhibits

8:00am - 9:30am

Companion Breakfast

7:30am - 8:00am

Welcome & Orientation

York Hsiang, MB.ChB., MHSc., FRCSC

8:00am - 9:30am

Scientific Session I: PAD

Moderators: York Hsiang, MB.ChB., MHSc., FRCSC, and
Raymond Lee, MD

8:00-8:20am

**1 Natural History of Acute Pediatric Iliofemoral Artery
Thrombosis Treated with Antithrombotic Therapy***

Joel L. Ramirez, MD University of California, San Francisco
Invited Discussant: Vincent Rowe, MD

8:20-8:40am

**2 Outcomes of Femoral Artery Ligation for Treatment of
Infected Femoral Pseudoaneurysms Due to Drug
Injection**

Elina Quiroga, MD, MPH, University of Washington
Invited Discussant: Willis Wagner, MD

8:40-9:00am

3 Characterization and Association with Outcomes of Ischemia-reperfusion Events After Open Mesenteric Bypass for Chronic Mesenteric Ischemia*

Jeffrey D. Crawford, MD, Oregon Health and Sciences University

Invited Discussant: Mark Nehler, MD

9:00-9:20am

4 The Impact of Hemoglobin A1c on Outcomes Following Lower Extremity Bypass*

Ashton Lee, MD, Banner University Medical Center Tucson

Invited Discussant: Greg Moneta, MD

9:20-9:30am

5 Small-caliber Vein Graft Bypass for Achieving Wound Healing in Chronic Limb Threatening Ischemia Patients with High Wif Clinical Stage

Keisuke Miyake, MD, Osaka University Medical School

9:30am - 10:00am

Coffee Break with Exhibits

10:00am - 10:05am

Introduction of the Keynote

WVS President Dr. York Hsiang

10:05am - 11:00am

Presidential Guest Lecturer: "Evolution of the Vascular Specialist"

Thomas L. Forbes, MD, FRCSC, FACS

11:00am - 12:10pm

Scientific Session II: Aortic

Moderators: York Hsiang, MB.ChB., MHSc., FRCSC, and
Venita Chandra, MD

11:00-11:20am

**6 Natural History and Cause-Specific Mortality of Type B
Aortic Dissection***

Lisa Hysa, BS, University of Washington
Invited Discussant: Ali Azizzadeh, MD

11:20-11:40am

**7 Prevalence of Abdominal Aortic Aneurysms in the United
States-Reevaluating the Screening Guidelines***

Kelli L. Summers, MD, Louisiana State University
Invited Discussant: Matthew Mell, MD

11:40-12:00pm

**8 Association of Upper Extremity and Neck Access with Stroke
in Endovascular Aortic Repair***

Anastasia Plotkin, MD, University of Southern California
Invited Discussant: Nikhil Kansal, MD

12:00-12:10pm

**9 Cost-effectiveness Analysis of Fenestrated Endovascular
Aortic Repair Compared to Open Surgical
Repair for Patients with Juxtarenal Abdominal Aortic
Aneurysms**

Elizabeth L. George, MD, Stanford University

12:30pm - 5:00pm

Golf Tournament

1:00pm - 3:30pm

Tennis Tournament

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

SCIENTIFIC PROGRAM continued

SUN, SEPT 29, 2019

1:00pm - 4:30pm

National Park Geology Tour

6:00pm - 8:00pm

Western Family Dinner Buffet

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

MONDAY, SEPT 30, 2019

6:00am - 1:00pm

Registration

6:30am - 7:30am

Industry Sponsored Breakfast Symposium

7:00am - 8:00am

Breakfast

7:00am - 11:45am

Exhibits

7:00am - 8:00am

Group Yoga on Polo Lawn

8:00am - 9:30am

Companion Breakfast

7:50am - 9:30am

Scientific Session III: Carotid

Moderators: York Hsiang, MB.ChB.,MHSc.,FRCSC, and Stephen Murray, MD

7:50-8:00am

10 Bilateral Iliac Branch Endoprosthesis with Ipsilateral Internal Iliac Deployment

Jason Hurd, MD, University of Washington

8:00-8:20am

11 In-Hospital Outcomes of TransCarotid Artery Revascularization with Dynamic Flow Reversal (TCAR) in Patients with Contralateral Carotid Artery Occlusion*

Mahmoud Malas, MD, MHS, RPVI, University of California San Diego

Invited Discussant: Joseph A. Davis, MD

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

8:20-8:40am

12 Delayed Carotid Endarterectomy After Admission in Symptomatic Carotid Artery Disease is Associated with Lower Postoperative Stroke Rates in the Medicare Population*

Nathan Itoga, MD, Stanford University Medical Center

Invited Discussant: Steven Katz, MD

8:40-8:50am

13 Novel Modification to Leaded Eyewear Results in Significant Operator Eye Radiation Dose Reduction Compared to Standard Leaded Glasses During Fluoroscopically-Guided-Interventions

Melissa L. Kirkwood, MD, University of Texas Southwestern

Medical Center

8:50-9:00am

14 The Physical Toll of Working in Operating Rooms: A Survey of the Canadian Society of Vascular Surgery

Gautamn Sarwal, MD, University of British Columbia

9:00-9:10am

15 Virtual Reality can Reduce Anxiety During Office-Based Vascular Procedures

Michael B. Brewer, MD, Kaiser Permanente Innovation Studio

9:10-9:30am

16 Patient Risk Factors Associated with Embolic Stroke Volumes Following Revascularization

Cody Kraemer, MD, University of Arizona

Invited Discussant: Mark Sarfati, MD

9:30am - 10:00am

Coffee Break with Exhibits

10:00am - 11:10am

Scientific Session IV: Other

Moderators: York Hsiang, MB.ChB.,MHSc.,FRCSC, and
Roy Fujitani, MD

10:00-10:20am

17 Five Hundred Rib-sparing Scalenelectomies for the Treatment of Neurogenic Thoracic Outlet Syndrome

Kaj Johansen, MD, PhD, FACS, Swedish Heart & Vascular
Institute

Invited Discussant: Hugh Gelabert, MD

10:20-10:40am

18 Complete Transaxillary Resection of Fully Formed Cervical Ribs is Safe and Effective: Outcomes from 22 Years of Experience with Long Term Follow-up*

Rameen S. Moridzadeh, MD, University of California, Los Angeles

Invited Discussant: Omid Jazaeri, MD

10:40-10:50am

19 The Periumbilical Incision for Anterior Lumbar Interbody Fusions

Sherwin Aboli, MD, Huntington Memorial Hospital

10:50-11:10am

20 Reevaluating the Safety and Effectiveness of the 0.9 Ankle-Brachial Index Threshold in Penetrating Lower Extremity Trauma*

Jake Hemingway, MD, University of Washington

Invited Discussant: Kaj Johanson, MD

11:10-11:20am

21 Retroperitoneal Repair of Suprarenal Abdominal Aortic Aneurysm and Right Common Iliac Artery Aneurysm After Previous Infrarenal Abdominal Aortic Aneurysm Repair

William Quinones-Baldrich, MD, UCLA Medical Center

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

11:20am - 11:40am

SVS Update

Kim Hodgson, MD

11:40am - 12:30pm

WVS Business Meeting

12:30pm - 4:00pm

Snorkeling Tour

5:00pm - 6:00pm

Industry Sponsored General Reception

6:00pm - 7:00pm

Private President's Reception

6:30pm - 9:00pm

Reception & Dinner

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

TUESDAY, OCT 1, 2019

7:00am - 11:00am

Registration

6:30 am

Industry Sponsored Breakfast Symposium

7:00am - 8:00am

Breakfast

7:00am - 11:45am

Exhibits

7:30am - 9:40am

Scientific Session V: Other

Moderators: Benjamin W. Starnes, MD and Vincent Rowe, MD

7:30-7:50am

22 Association of Aberrant Subclavian Arteries with Aortic Pathology and a Novel Classification System

Anastasia Plotkin, MD, University of Southern California

Invited Discussant: Sherene Shalhub, MD

7:50-8:00am

23 Vascular Surgery is Complex but Undervalued by Work Relative Value Units

Joel L. Ramirez, MD, University of California, San Francisco

8:00-8:20am

24 Antegrade Common Femoral Artery Closure Device Use is Safe and Associated with Decreased Complications*

Joel L. Ramirez, MD, University of California, San Francisco

Invited Discussant: Niten Singh, MD

8:20 - 8:40am

25 Medical Complexity of Patients by Surgical Specialty: Who Operates on the Sickest Patients?*

Rameen S. Moridzadeh, MD, University of California, Los Angeles

Invited Discussant: Venita Chandra, MD

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

8:40-8:50am

26 Hospital Volume Impacts the Outcomes of Endovascular Repair of Thoracoabdominal Aortic Aneurysms

Satinderjit Locham, MD, University of California San Diego

8:50-9:10am

27 Anatomic Eligibility for Commercial Branched Endograft Repair of Thoraco-abdominal Aortic Aneurysms*

Natasha I. Edman, MA, University of Washington

Invited Discussant: Jason Faulds, MD

9:10-9:20am

28 Outcomes of Post-stent Ballooning After Transcarotid Artery Revascularization (TCAR)

Hanaa Dakour-Aridi, MD, University of California San Diego

9:20-9:40am

29 Long-term Stroke Risk with Carotid Endarterectomy in Patients with Severe Carotid Stenosis

Kara A. Rothenberg, MD, Stanford University

Invited Discussant: Larry Kraiss, MD

9:40am - 10:10am

Coffee Break with Exhibits

10:10 am - 11:40am

Scientific Session VI: Other

Moderators: Benjamin W. Starnes, MD and Omid Jazaeri, MD

10:10-10:20am

30 Greater Curvature-based Instead of Centerline-based Measurement Improves Endograft Sizing Accuracy for Thoracic Endovascular Aortic Repair in the Aortic Arch

William Yoon, MD, University of California-Davis Medical Center

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

10:20-10:30am

31 Staged Endovascular and Surgical Repair of a Mycotic Descending Thoracic Aortic Aneurysm

William Quinones-Baldrich, MD, UCLA Medical Center

10:30-10:40am

32 Evolving Utility of Endovascular Treatment of Pararenal and Suprarenal Abdominal Aortic Aneurysms Resulting in Higher Mortality

Areg Grigorian, MD, University of California, Irvine

10:40-11:00am

33 Endovascular Repair of Ruptured Abdominal Aortic Aneurysm is Superior to Open Repair: Propensity Matched Analysis in the Vascular Quality Initiative*

Linda J. Wang, MD, MBA, Massachusetts General Hospital

Invited Discussant: Benjamin W. Starnes, MD

11:00-11:10am

34 Partial Resuscitative Endovascular Balloon Occlusion of the Aorta Via the Gore Tri-Lobe Balloon

Daniel Lammers, MD, Madigan Army Medical Center

11:10-11:30am

35 Long Term Outcomes of the Ovation Stent Graft System IDE Trial for Endovascular Abdominal Aortic Aneurysm Repair

Andrew Barleben, MD, University of California, San Diego

Invited Discussant: Christian Bianchi, MD

11:30-11:40am

36 Endovenous Deep Vein Valve Creation for the Treatment of Chronic Venous Insufficiency

Gary K. Yang, PhD, MD, University of British Columbia

11:40am - 12:00pm

Awards and Adjournment

WVS President, Benjamin W. Starnes, MD

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

NOTES

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SCIENTIFIC SESSION ABSTRACTS

SCIENTIFIC SESSION ABSTRACTS

Presentation #1

Natural History of Acute Pediatric Iliofemoral Artery Thrombosis Treated with Antithrombotic Therapy

Joel L. Ramirez, Christina Kurhau, Bian Wu, Devin S. Zarkowsky, Michael S. Conte, Adam Z. Oskowitz, Amar Nijagal, Shant M. Vartanian

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

Objectives: Acute iatrogenic iliofemoral artery thrombosis (IFAT) can occur in critically ill infants who require indwelling arterial cannulas for monitoring or as a consequence of cardiac catheterization. Guidelines suggest treatment with anticoagulation but evidence supporting the optimal duration of therapy and the role of surveillance ultrasonography (US) is weak. The objectives of this study were to characterize the kinetics of thrombus resolution and to define an appropriate duration of anticoagulation and interval for surveillance US.

Methods: Single center analysis of pediatric patients with acute IFAT from 2011 to 2019. Medical records and vascular lab studies were reviewed retrospectively. Patients with ≥ 1 surveillance US were included. Thrombus resolution was defined as multiphasic flow throughout the index limb without evidence of echogenic intraluminal material by US. Time-to-resolution of thrombus was assessed using Kaplan-Meier (KM) analysis.

Results: Fifty-four limbs in 50 patients were identified. The median age was 2.2 mos (IQR: 0.7-4.8) with a median weight of 4.2 kg (IQR: 3.3-5.5). The majority of patients (65%) presented with a diminished pedal doppler, commonly after cardiac catheterization (56%). Forty-eight (89%) limbs had complete arterial occlusion on index US and flow could not be detected below the ankle in 58%. The median number of US per limb was 3 (Range: 2-7) and 39% of limbs had a surveillance US within 7 days of diagnosis. In patients treated with anticoagulation, estimated resolution of thrombus was 46% at 14 days and 75% at 30 days (Figure 1). Eight (15%) patients did not receive anticoagulation and only one of these patients experienced thrombus resolution. At the time of diagnosis, one patient underwent surgical revascularization due to a contraindication to anticoagulation and one patient was treated with thrombolysis. There were no instances of tissue loss or amputation.

Conclusions: Management of IFAT with anticoagulation alone Resulted in successful short-term outcomes. Based on the observed rate of resolution, management should start with anticoagulation followed by surveillance US at 2-week intervals (Figure 2). When treated with anticoagulation, resolution can be expected to occur in 50% of patients every two weeks, with few resolving beyond 4 weeks.

Figure 1.

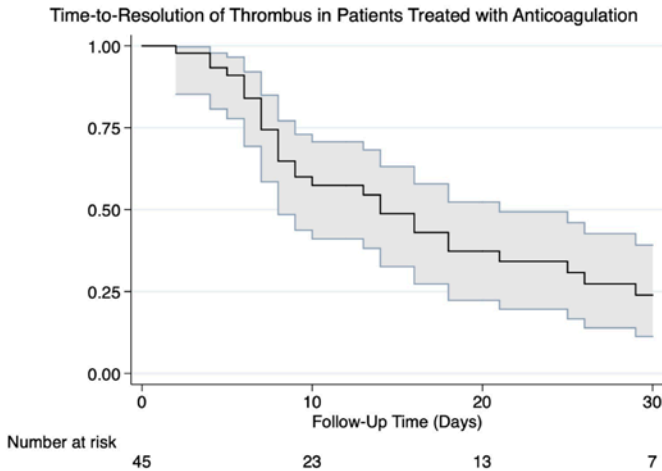
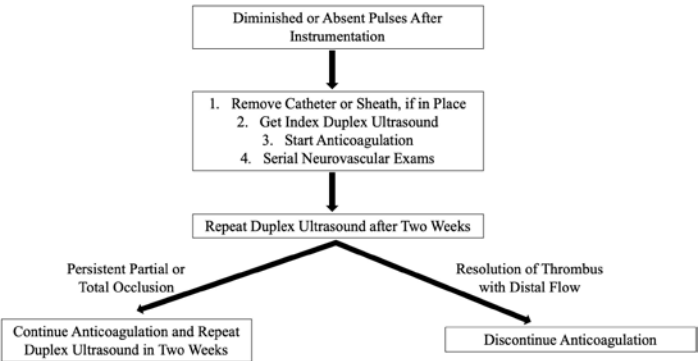


Figure 2. Proposed Management Algorithm of Acute Pediatric Femoral Artery Thrombosis.



Author Disclosures: **J. Ramirez:** Nothing to disclose; **C. Kurhau:** Nothing to disclose; **B. Wu:** Nothing to disclose; **D. Zarkowsky:** Nothing to disclose; **M. Conte:** Nothing to disclose; **A. Oskowitz:** Nothing to disclose; **A. Nijagal:** Nothing to disclose; **S. Vartanian:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #2

Outcomes of Femoral Artery Ligation for Treatment of Infected Femoral Pseudoaneurysms Due to Drug Injection

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

University of Washington, Seattle, WA, USA.

Objectives: Infected femoral artery pseudoaneurysms (IFAPs) are a known complication of illicit intravenous drug injection. As the opioid crisis in our country continues to worsen we will likely see more IFAPs; algorithms for management of these patients will need to be elucidated. The aim of this study is to describe the surgical management and outcomes of patients presenting with IFAPs treated with femoral artery ligation.

Methods: This is a single center, retrospective study of all consecutive patients presenting to our institution with IFAPs associated with illicit drug injection between 2004 and 2017 and treated with primary ligation. Primary endpoints included major adverse limb events (MALE) and death. Baseline demographics, clinical features, and long term outcomes were recorded.

Results: Over the study period 60 IFAPs were managed with arterial ligation in 58 patients. 52% of patients underwent Common Femoral Artery (CFA) ligation, 30% of patients underwent a triple ligation (ligation of the CFA, profunda femoris artery and superficial femoral artery (SFA)) and 18% of patients underwent ligation of the SFA only. The average postoperative ankle-brachial index was 0.47. None of the patients were revascularized at the index procedure. 4 patients (6.6%) underwent later revascularization due to severe ischemia with either a transobturator bypass (3 patients) or an iliofemoral bypass (1 patient). Two of these patients who underwent a bypass became infected and required the only major amputations in the series (both transfemoral amputations, 6 and 13 months after ligation). Mean follow up was 51.3 (6-168) months; 4 patients were lost to follow up. There were no differences in limb viability outcomes between patients undergoing a femoral artery ligation versus a triple ligation. 9 patients (15%) died during the follow up period; death was not related to IFAP treatment. Mean time from procedure to death was 28 months (4-62) (Table 1)

Conclusions: We describe the largest series in the United States of IFAP related to illicit drug use treated with femoral artery ligation and found that ligation is a safe procedure associated with very low MALE. Reconstruction should not be performed and is dangerous due to the high risk of infection. While the mortality in these patients was high it was not related to the ligation procedure.

Table 1: Patient characteristic and outcomes.

		IFAP N=60
Age		36.6 (22-59)
Male		68.4 % (60)
Type of arterial ligation		
	CFA	52% (31)
	Triple Ligation	30% (18)
	SFA	18% (11)
Arterial control with endovascular balloon		28% (17)
Arterial coverage with muscular flap		41.6 (25)
Vascular Reconstruction		6.6 (4)
Iliofemoral bypass	Trans obturator bypass	5% (3)
	1.6 (1)	
Major amputation		3.3% (2 patients)
Post-operative Ankle-Brachial Index		0.47 (0.29-0.81)

Author Disclosures: **E. Quiroga:** Nothing to disclose; **S. Shalhub:** Nothing to disclose; **N. Tran:** Nothing to disclose; **B. Starnes:** Nothing to disclose; **N. Singh:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #3

Characterization and Association with Outcomes of Ischemia-reperfusion Events After Open Mesenteric Bypass for Chronic Mesenteric Ischemia

Jeffrey D. Crawford, Tabassum A. Kahn, Salvatore T. Scali, Kristina A. Giles, Scott A. Berceci, Thomas S. Huber

University of Florida, Gainesville, FL, USA.

Objectives: Significant physiologic perturbations can occur in chronic mesenteric ischemia(CMI) patients undergoing open mesenteric bypass(OMB). Frequently attributed to ischemia-reperfusion(I/R) events, these are directly implicated in multiple organ dysfunction(MOD). The purpose of this study is to describe early physiologic changes after OMB for CMI and determine whether these are predictive of outcomes.

Methods: CMI patients undergoing elective OMB from 2002-2018 at our institution were reviewed. Changes in hemodynamic, pulmonary, hepatic, renal and hematologic parameters in the first 96 hours postoperatively were analyzed. MOD and Sequential Organ Failure Assessment(SOFA) scores were derived. Cox regression was used to determine MODS/SOFA association with outcomes.

Results: OMB was performed in 72 patients(age 66 ± 11 yrs; 68% female; BMI 23.8 ± 6 ; 59% experiencing 48 ± 34 lbs weight loss). History of prior mesenteric stent/bypass was present in 39%(stent-21, bypass-8). Antegrade(93%) configuration was most common with revascularization of the SMA/cealic vessels in 85%(SMA only-15%). Postoperative physiologic and metabolic changes were common (Table 1). Mean MOD and SOFA scores were 3.6 ± 2.4 (range 1-10) and 4.0 ± 2.7 (range 1-13), respectively. Median LOS was 14 days(IQR 9, 21). Thirty-day mortality was 4%(3) and in-hospital morbidity was 53%(38) (cardiac-18%, pulmonary-18%, renal-11%). Follow-up was 16 ± 20 months. MOD/SOFA score was linearly correlated with mortality(MOD-OR 1.4 95%CI 1.2-1.7; $p < .01$; SOFA 1.4, 1.2-1.7; $p < .01$ -per unit) with a score ≥ 5 for either being the inflection point predicting mortality(MOD-OR 3.9; 1.6-9.9; $p < .01$, SOFA-OR 2.8; 1.2-6.6; $p = .02$). One and 3-year primary bypass patency and freedom from re-intervention was $91 \pm 5\%$ and $83 \pm 7\%$, no association to MOD/SOFA. One and 3-year survival was $86 \pm 4\%$ and $71 \pm 6\%$ with significantly worse outcomes in patients with greater MOD/SOFA score (Figure 1).

Conclusions: A majority of CMI patients undergoing OMB experience significant metabolic derangements postoperatively and these can be objectively assessed using simply applied scoring systems that reliably predict outcomes. Derivation of a MODS/SOFA score after OMB for CMI can identify vulnerable patients at greatest risk of death resulting from sequelae of I/R phenomenon.

Figure 1: Association of MOD and SOFA scores with Overall Survival

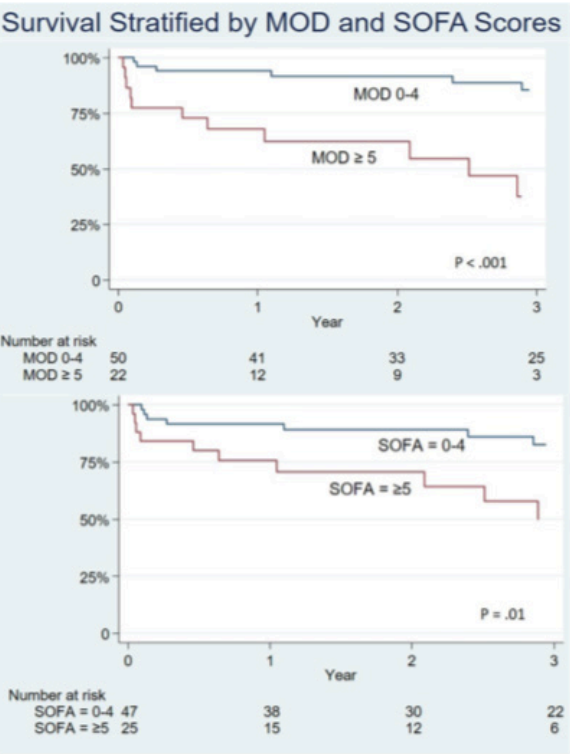


Table 1. Physiologic Changes following OMB, POD 0-4 (n=72)

Physiologic Change	Prevalence (%)
Presence of Fever (T>38.3C)	7 (9.7)
Presence of Hypothermia (T<36C)	13 (18.1)
Presence of sustained tachycardia (HR>90 bpm for 2 consecutive hours)	39 (54.2)
Tachypnea (RR>20 breaths/min)	19 (26.4)
Hyperglycemia (Glucose >140)	39 (54.2)
Leukocytosis (WBC >12)	34 (47.2)
Hypotension (SBP < 90 mm Hg, MAP < 70 mm Hg, SBP decrease >40 mm Hg from baseline)	49 (68.1)
Arterial Hypotension (PaO2/FiO2 < 300)	22 (30.6)
Acute Oliguria (Urine output < 0.5 mL/kg/h for > 2 hours despite resuscitation)	24 (47.5)
Thrombocytopenia (Plt < 100,000)	29 (41.4)

Author Disclosures: **J. Crawford:** Nothing to disclose; **T. Kahn:** Nothing to disclose; **S. Scali:** Nothing to disclose; **K. Giles:** Nothing to disclose; **S. Berceli:** Nothing to disclose; **T. Huber:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #4

The Impact of Hemoglobin A1c on Outcomes Following Lower Extremity Bypass

Ashton Lee¹, David J. Haddad¹, Bo Hu¹, Wei Zhou¹, Scott Berman², Iman Ghaderi¹, Tze-Woei Tan¹

¹University of Arizona, Tucson, AZ, USA, ²Carondelet Medical Group, Tucson, AZ, USA.

Objectives: Diabetes has been shown to be associated with increased risk of postoperative complications following lower extremity bypass (LEB) although it is unclear whether short-term glucose control affects outcomes. This study aims to assess the impact of perioperative hemoglobin A1C (HBA1c) on short and long-term Results following LEB.

Methods: We examined consecutive infrainguinal LEBs for claudication and critical limb ischemia (CLI) using Vascular Quality Initiative (VQI) data over 14 years (2003-2016). Patients without HBA1c information and children were excluded (n=28,259). Perioperative HBA1c levels were stratified into <6.5% (n= 3,701), 6.5%-7.4% (n=3,491), 7.5%-8.4% (n=2,491), and > 8.5% (n=3,871). Primary outcomes were infection, major adverse limb event (MALE), and major amputation over two years. Multivariable analysis was performed using Cox proportional hazard models for survival outcomes and logistic regression for binary outcomes and the association was expressed as adjusted hazard ratio (aHR) with 95% confidence interval (CI).

Results: The study cohort included 13,554 infrainguinal LEBs: 9,683 (71.4%) had HBA1c < 8.5% and 3,871 had HBA1c > 8.5%. Sixty percent (n=8,146) underwent LEBs with autologous conduits and 67% (n= 9,121) were performed for CLI. HBA1c > 8.5% was associated with increased amputation (13.1% vs 18.7%, p<0.001) and MALE (13.2% vs 16.4%, p<.001) in follow up over 2 years. In multivariable analysis, HBA1c > 8.5% was associated with increased risk of major amputation (aHR=1.31, 95%CI=1.12-1.52, p=.001) compared to HBA1c <6.5%. While HBA1c > 8.5% was also associated with increased surgical site infection perioperatively (9.4% vs 12.8%, p=.042) and in long term follow up (5.2% vs 6.9%, p=.014), this was not significant in multivariable analysis.

Conclusions: Poorly controlled diabetes in the perioperative setting is associated with an increased risk of amputation after LEB, but not with increased risk of surgical site infection, mortality, MALE. These outcomes may be more affected by other risk factors. Our findings suggest that aggressive reduction of HBA1c in the preoperative setting may not be warranted as it has little effect on postoperative outcomes.

SCIENTIFIC SESSION ABSTRACTS continued

Author Disclosures: **A. Lee:** Nothing to disclose; **D. Haddad:** Nothing to disclose; **B. Hu:** Nothing to disclose; **W. Zhou:** Nothing to disclose; **S. Berman:** Nothing to disclose; **I. Ghaderi:** Nothing to disclose; **T. Tan:** Nothing to disclose

Presentation #5

Small-caliber Vein Graft Bypass for Achieving Wound Healing in Chronic Limb Threatening Ischemia Patients with High Wifl Clinical Stage

Keisuke Miyake¹, Takashi Nakamura², Takashi Shibuya¹, Hironobu Fujimura³, Yoshiki Sawa¹

¹Osaka University Medical School, Suita, Osaka, Japan, ²Osaka Rosai Hospital, Sakai, Osaka, Japan, ³Toyonaka Municipal Hospital, Toyonaka, Osaka, Japan.

Objective: For treatment of chronic limb-threatening ischemia (CLTI), recent studies have shown that limbs with a higher Society for Vascular Surgery Wound, Ischemia, foot Infection (WIFI) stage gain more benefit from bypass surgery than endovascular therapy, especially in patients with large wounds and infection. However, while bypass surgery may be the sole method available to achieve wound healing in severe CLTI cases, graft unavailability is a major limitation, though not clearly defined. In this study, we aimed to clarify the efficacy of a bypass procedure for achieving wound healing in severe CLTI patients.

Methods: A total of 95 limbs classified as WIFI clinical stage 3/4 in patients who underwent a bypass procedure with vein graft from 2002 to 2016 were enrolled. The limbs were divided into 2 groups based on the inner diameter of the vein graft determined by a preoperative ultrasound; with those with a diameter \leq 2.5 mm classified as poor caliber grafts (PGs, n=28) and those with a diameter \geq 2.5 mm classified as sufficient caliber grafts (SGs, n=67). Graft and limb outcomes were analyzed by calculating graft patency and wound healing rate (WHR). Among the examined limbs that achieved complete wound healing, prognosis after healing was further evaluated by calculating the wound recurrence-free (WRF) rate and wound recurrence-free amputation-free survival (WRAFS).

Results: Sixty-seven grafts were categorized as SGs and 28 as PGs. Limb severity was equivalent in both groups, with 26 and 13, respectively, classified as WIFI clinical stage 4 ($P=0.50$). Although the PGs group showed inferior results for primary patency rate ($P=0.006$), the secondary patency rate ($P=0.51$) and WHR (1-year: 83.8% in PGs, 87.0% in SGs, $P=0.13$) were equivalent. Among the 75 limbs that achieved wound healing, the WRF rate was equivalently high (1-year WRF: 96.1% in SGs, 100% in PGs, $P=0.78$) and the WRAFS rate was also satisfactory (1-year WRAFS: 82.2% in SGs and 77.0% in PGs, $P=0.94$) in both groups.

SCIENTIFIC SESSION ABSTRACTS continued

Conclusions: Although small-caliber vein grafts were shown to be associated with poor primary patency, they were acceptable as bypass conduits to achieve wound healing. A bypass procedure with small-caliber grafts may be an important method to achieve wound healing and limb salvage, even in severe CLTI cases with a high WIfI clinical stage.

Author Disclosures: **K. Miyake:** Nothing to disclose; **T. Nakamura:** Nothing to disclose; **H. Fujimura:** Nothing to disclose; **Y. Sawa:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #6

Natural History and Cause-specific Mortality of Type B Aortic Dissection

Lisa Hysa, Warren B. Chow, Matthew P. Sweet, Jimmy Nguyen, Sara Khor, Benjamin W. Starnes, Sherene Shalhub

University of Washington School of Medicine, Seattle, WA, USA.

Objectives: Natural history studies of type B aortic dissection (TBAD) commonly report all-cause mortality. However, the specific cause of death post TBAD is poorly understood. Our aim is to determine the cause-specific mortality in a large cohort of individuals with TBAD.

Methods: Clinical and administrative records were reviewed for patients presenting to an academic medical system within 14 days of acute TBAD between 1995 and 2017. Patients were excluded if they lived out of state, if TBAD was limited to the abdominal aorta, or if TBAD was chronic or incidentally diagnosed. Patient-level information included demographics, comorbidities, presentation, and initial imaging findings. Cause of death was ascertained through a multiple-modality approach using medical records, publicly-available obituaries, social security death index, and state death records. Deceased individuals were classified by the cause of mortality: aortic or non-aortic related, and compared.

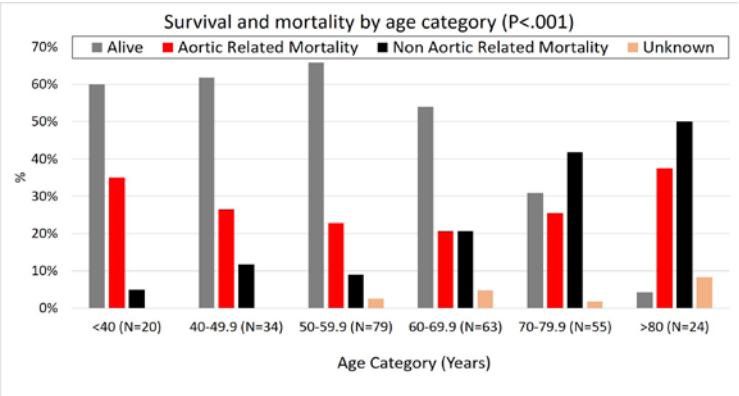
Results: A total of 275 individuals met inclusion criteria (61.1±13.7 years, 70.9% male, 68% Caucasian). Complete follow up was achieved in 244 (88.7%) while 31 (11.3%) had incomplete follow up (mean follow up: 6.2±4.8 years vs. 2.5±3.2 years respectively, $P<.001$). During this period, 138 (50.2%) individuals died (mean age at death 70.1±14.6 years, mean survival post TBAD 9.6±5 years). Cause-specific mortality was 51% aortic-related, 43% non-aortic related, and 6% unknown. Individuals with aortic-related mortality presented at a younger TBAD age than those who died of non-aortic related mortality (61.6±15.5 vs. 69.5±11.2 years respectively, $P=.001$), had more aortic repairs (Table 1), and died at a younger age (64.9±15.4 vs. 75.3±11.5 years respectively, $P=.010$). There was a step wise increase in non-aortic related mortality by age decade (Figure 1).

Conclusions: This large cohort study found that over half of the mortality post TBAD is aortic-related. These individuals are younger at the time of TBAD and also die at a younger age than individuals dying from non-aortic related causes. This natural history data is essential for building predictive models to calculate the individualized risk of subsequent aortic related mortality. Future modeling will direct optimal and individualized surgical and medical management of TBAD.

Table 1. Comparison of characteristics of individuals dying post TBAD from aortic and non-aortic related mortality causes

N (%), Mean (SD)		Aortic related mortality (N=70)	Non-aortic related mortality (N=68)	P-value
TBAD presentation	Descending thoracic aorta diameter (cm)	3.9±0.8	3.7±0.5	.085
	Lower extremity malperfusion	9 (12.9)	2 (2.9)	.032
Comorbid conditions	Coronary artery disease	12 (17.1)	36 (38.2)	.006
	Obstructive sleep apnea	1 (1.4)	7 (10.3)	.026
	Syndromic TBAD	9 (12.9)	1 (1.5)	.010
Aortic Outcomes	Any DTA Repair	28 (40)	14 (20.6)	.013
	TEVAR	24 (34.3)	10 (14.7)	.008
	New Type A Dissection	8 (11.4)	0	.004
Survival (years)		3.4±0.5	5.7±0.5	.028

Figure 1. Percent survival, aortic related mortality, and non-aortic related mortality by age category



Author Disclosures: **L. Hysa:** Nothing to disclose; **W. Chow:** Nothing to disclose; **M. Sweet:** Nothing to disclose; **J. Nguyen:** Nothing to disclose; **S. Khor:** Nothing to disclose; **B. Starnes:** Nothing to disclose; **S. Shalhub:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #7

Prevalence of Abdominal Aortic Aneurysms in the United States- Reevaluating the Screening Guidelines

Kelli L. Summers¹, Edmund K. Kerut², Claudie Sheahan¹, Marie Unruh¹,
Amit Chawla¹, Estela A. Brooke¹, Malachi Sheahan, III¹.

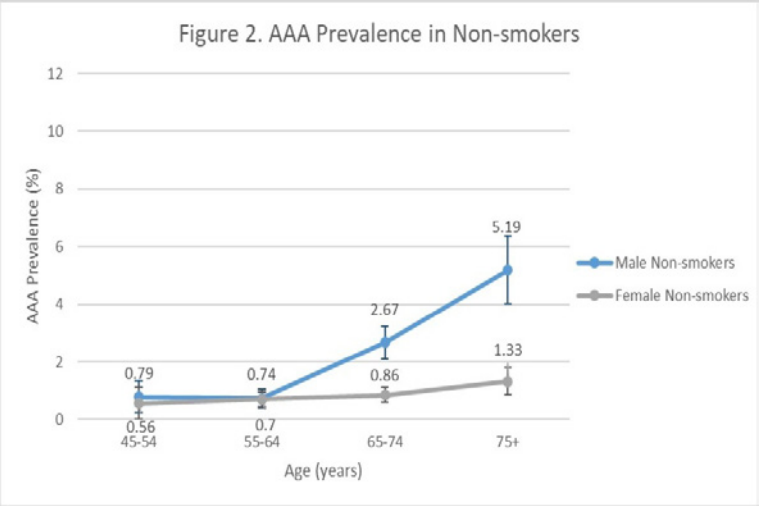
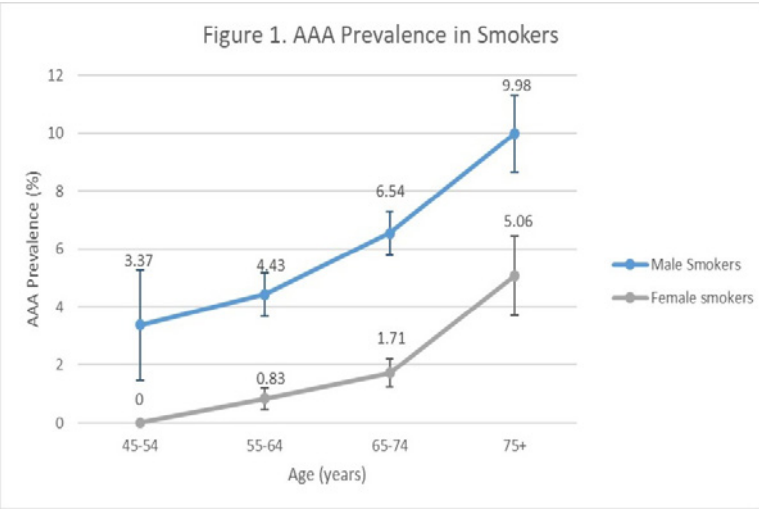
¹Louisiana State University, New Orleans, LA, USA, ²University of Mississippi
School of Medicine, Jackson, MS, USA.

Objectives: The U.S. Preventative Services Task Force guidelines for abdominal aortic aneurysm (AAA) screening are based mainly on studies of older Caucasian males from non-U.S. populations. This study was designed to analyze the findings of a large, all-inclusive AAA screening program in the U.S.

Methods: Screening events were held nationally by a U.S. non-profit organization between 2001 and 2017. AAA screening was offered regardless of risk profile. Participants filled out a demographics form with known co-morbidities. Significant risk factors were determined using logistic regression with backward stepwise variable selection. Odds ratios (OR) reported with 95% confidence intervals.

Results: A total of 9,457 screened participants (47% male) were analyzed. The mean age was 67 ±9 with 40.8% between 65 and 75 years old. Most participants were Caucasian (83.4%), followed by African American (13.1%). Screened risk factors included hypertension (58.1%), hyperlipidemia (54.9%), smoking (52.0%), cardiac disease (29.2%), diabetes mellitus (18.4%), family history of AAA (22.4%) or brain aneurysms (8.6%), and BMI (26.9 ±5.28). Overall, 267 participants (2.82%) were found to have a AAA (>3cm). Ages 65-75 had a prevalence of 2.98%. In a fully adjusted, multivariate logistic regression, there was an increased risk of AAA in males (OR, 3.24; 2.39-4.40), current smokers (OR, 3.28; 2.36-4.54), previous smokers (OR, 1.86; 1.41-2.47), cardiac disease (OR, 1.30; 1.01-1.68), family history of AAA (OR, 1.60; 1.20-2.14), and increasing age (P <.0001). Binary classification trees revealed that smoking was the most important differentiating factor for AAA prevalence. Figures 1 and 2 illustrate AAA prevalence categorized by smoking history. Female smokers 65-75 years old had a prevalence of 1.7%. Male smokers 45-65 years old had a prevalence of 4.3%. Among smokers, increased risk of AAA was found in current smokers (OR, 2.95; 2.10-4.15) and hypertensives (OR, 1.53; 1.11-2.11). There were no additional significant risk factors for non-smokers.

Conclusions: This study shows that there remain high-risk groups outside the current guidelines who would likely benefit from AAA screening, specifically, male smokers 45-65 years old. Risk factors for AAA include male gender, smoking, cardiac disease, family history of AAA and age.



Author Disclosures: **K. Summers:** Nothing to disclose; **E. Kerut:** Nothing to disclose; **C. Sheahan:** Nothing to disclose; **M. Unruh:** Nothing to disclose; **A. Chawla:** Nothing to disclose; **E. Brooke:** Nothing to disclose; **M. Sheahan:** Nothing to disclose

Presentation #8

Association of Upper Extremity and Neck Access with Stroke in Endovascular Aortic Repair

Anastasia Plotkin¹, Li Ding¹, Sukgu M. Han¹, Gustavo S. Oderich², Benjamin W. Starnes³, Jason T. Lee⁴, Mahmoud B. Malas⁵, Fred A. Weaver¹, Gregory Magee¹

¹University of Southern California, Los Angeles, CA, USA, ²Mayo Clinic, Rochester, MN, USA, ³University of Washington, Seattle, WA, USA, ⁴Stanford University, Palo Alto, CA, USA, ⁵University of California San Diego, San Diego, CA, USA.

Objectives: Upper extremity and neck access is increasingly being used for complex endovascular aortic repairs. We sought to compare perioperative stroke and other complications of 1) arm/neck with femoral/iliac access (AN) vs. femoral/iliac access alone (FI), 2) Right vs. Left sided AN, and 3) Arm vs. Neck access sites.

Methods: Patients entered in the TEVAR/complex EVAR registry in the Vascular Quality Initiative from 2009-2018 were analyzed. Patients with a missing access variable were excluded. The primary outcome was perioperative stroke. Secondary outcomes were other postoperative complications and 1-year survival. Kaplan-Meier curves and log-rank test were used for survival analysis.

Results: Of 11,774 patients, 9,229 met criteria for analysis (2,364 AN, 6,865 FI). AN patients had a higher rate of smoking history (77.3% vs. 72.8%, $p<0.0001$), and prior cerebrovascular events (11.8% vs. 9.6%, $p=0.004$). Operative time (250 ± 123 vs. 155 ± 102 min, $p<0.0001$), contrast load (136 ± 77 vs. 105 ± 67 mL, $p<0.0001$), and estimated blood loss (250 vs. 100 mL, $p<0.0001$) were larger in the AN group indicating these were likely more complex cases. Overall, AN had a higher rate of stroke (4.2% vs. 2.8%, $p=0.0005$) compared to FI (Table 1). There was no difference in stroke when comparing right and left AN access (4.9% vs. 3.8%, $p=0.28$) (Table 2). Stroke rates were similar between arm, axillary, and carotid access, but were significantly higher in patients with multiple simultaneous AN access sites (3.9% vs. 4.1% vs. 4.4% vs. 11.4%, $p=0.01$). AN also had higher rates of puncture site hematoma, access site occlusion, arm ischemia, and in-hospital mortality (Table 1). There was no difference in 1-year survival (87.6% vs. 85.9%, $p=0.12$).

Conclusions: Upper extremity and neck access for complex aortic repairs has a higher risk of stroke compared to femoral and iliac access alone. Right-sided access does not have a higher stroke rate than left-sided access. Neck access does not have a higher stroke rate than arm access, but stroke rate is increased when multiple arm/neck sites are used.

SCIENTIFIC SESSION ABSTRACTS continued

Table 1: Postoperative complications in arm/neck access compared to femoral/iliac access			
Complication	Arm/neck access (n=2364)	Femoral/iliac access (n=6865)	P value
Stroke	100 (4.2%)	191 (2.8%)	0.0005
Postop complications	723 (30.6%)	1512 (22%)	<0.0001
Puncture site hematoma	104 (4.4%)	123 (1.8%)	<0.0001
Access site occlusion	29 (1.2%)	31 (0.5%)	<0.0001
Arm ischemia	25 (1.1%)	34 (0.5%)	0.003
In-hospital mortality	338 (4.9%)	156 (6.6%)	0.002

Table 2: Postoperative complications comparing right and left-sided arm/neck access			
Complication	Right (n=427)	Left (n=1826)	P value
Stroke	21 (4.9%)	60 (3.8%)	0.28
Postop complications	143 (33.5%)	544 (29.8%)	0.14
Puncture site hematoma	21 (4.9%)	77 (4.2%)	0.53
Access site occlusion	5 (1.2%)	24 (1.3%)	0.99
Arm ischemia	4 (1%)	21 (1.2%)	0.99

Author Disclosures: **A. Plotkin:** Nothing to disclose; **L. Ding:** Nothing to disclose; **S. Han:** Nothing to disclose; **G. Oderich:** Nothing to disclose; **B. Starnes:** Nothing to disclose; **J. Lee:** Nothing to disclose; **M. Malas:** Nothing to disclose; **F. Weaver:** Nothing to disclose; **G. Magee:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #9

Cost-effectiveness Analysis of Fenestrated Endovascular Aortic Repair Compared to Open Surgical Repair for Patients with Juxtarenal Abdominal Aortic Aneurysms

Elizabeth L. George, Lauren Nardacci, Isabelle Rao, Douglas K. Owens, Jeremy Goldhaber-Fiebert, Manuel Garcia-Toca

Stanford University, Stanford, CA, USA.

Objective: Fenestrated endovascular aortic repair (fEVAR) has emerged as an alternative to open surgical repair (OSR) to treat juxtarenal abdominal aortic aneurysms (jAAA). The clinical effectiveness of the strategy has been well described, but there is a knowledge gap regarding the cost-effectiveness (CE) of this new endograft technology, and thus our goal was to conduct a model-based lifetime CE analysis of fEVAR compared to OSR for patients with jAAA in the U.S.

Methods: A decision-analytic Markov model was constructed from a health care system perspective. Costs were derived from the 2017 Medicare reimbursement schedule and utilities extracted from secondary data. Clinical probabilities of short- and long-term mortality, perioperative complications, and early and late re-interventions were obtained through literature search and input as weighted-averages. A base case CE analysis of a 65-year-old male and one- and two-way sensitivity analyses were conducted.

Results: In the base case, the model demonstrated OSR to dominate fEVAR [net monetary benefit \$124,414 (\$53,437/3.56 QALY) versus \$92,428 (\$57,551/3.0 QALY)] (Figure 1). Sensitivity analyses revealed the model output to be sensitive to rates of early and late reintervention, renal failure requiring long-term dialysis, and perioperative mortality, as well as the cost of the fEVAR device, initial hospitalization, and chronic hemodialysis (Figure 2). When the annual probability of delayed reintervention mirrors the risk observed in published case series, fEVAR becomes cost-effective when the rate of fEVAR reintervention decreases to less than 3.0% annually or OSR reintervention is on average greater than 2.0% annually. fEVAR similarly fails to be cost-effective unless the incidence of postoperative renal failure is reduced from 3.0 to 2.0%, or the incidence of renal failure after OSR rises from 2.4 to 4.0%. Finally, lowering the cost of the fenestrated stent graft by \$5,000 results in fEVAR becoming the cost-effective strategy.

Conclusions: Compared to OSR, fEVAR in its current practice is not a cost-effective approach for treating jAAA. Areas for further study include strategies to decrease the need for early and late reintervention and the incidence of renal failure following fEVAR to improve overall quality of life and lower long-term costs.

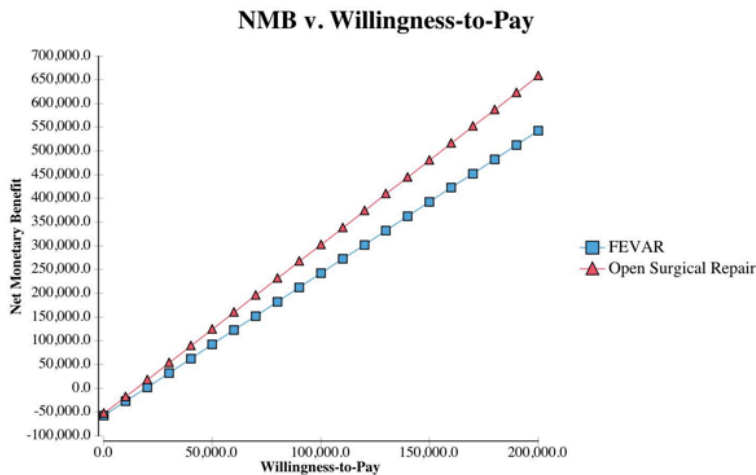


Figure 1. Net monetary benefit (NMB) for each surgical approach at a given willingness-to-pay (WTP) threshold. Open surgical repair dominates FEVAR regardless of the WTP threshold. FEVAR: Fenestrated Endovascular Aortic Aneurysm Repair

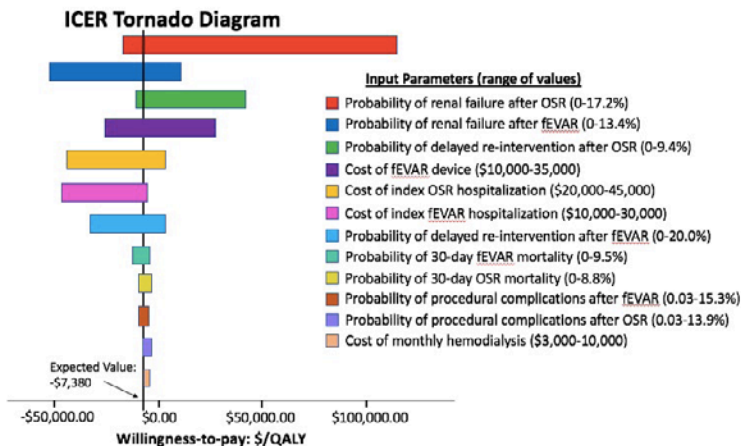


Figure 2. Tornado diagram summarizing one-way sensitivity analyses of parameter inputs that were most influential on model outputs. FEVAR: Fenestrated Endovascular Aortic Aneurysm Repair; ICER: Incremental Cost-Effectiveness Ratio; OSR: Open Surgical Repair

Author Disclosures: E. George: Nothing to disclose; L. Nardacci: Nothing to disclose; I. Rao: Nothing to disclose; D. Owens: Nothing to disclose; J. Goldhaber-Fiebert: Nothing to disclose; M. Garcia-Toca: Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #10

Bilateral Iliac Branch Endoprosthesis with Ipsilateral Internal Iliac Deployment

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Objectives: We present a video detailing our technique of bilateral iliac branch endoprosthesis (IBE) utilizing ipsilateral internal iliac deployment in the setting of prior EVAR and bilateral type 1b endoleak.

Methods: A 79-year-old gentleman with a history of EVAR for ruptured AAA in 2016 was referred to our service for treatment of aneurysm sac enlargement and bilateral type 1b endoleak. Internal iliac preservation was a priority. However, his previous EVAR device had a short main body, making traditional IBE placement utilizing an “up and over” contralateral approach difficult. We elected to pursue bilateral ipsilateral internal iliac artery cannulation and stent deployment.

Results: Starting on the right side, we deployed a bell-bottom iliac limb into the prior EVAR iliac limb to allow for adequate IBE seal. The IBE device was then advanced and deployed with the contralateral gate facing laterally to facilitate passage of the bridging internal iliac stent from the ipsilateral side and avoid jailing of the gate. Using a steerable sheath for support, we cannulated the ipsilateral internal iliac artery. Then, over a buddy Lunderquist wire, a Coda balloon was inflated in the bell-bottom limb. This was used as a backstop to direct an 8Fr sheath over the wire in the ipsilateral internal iliac artery. With our support system in place, we deployed a balloon-expandable stent into the cannulated right internal iliac artery. After ballooning all seal zones, completion arteriogram revealed excellent seal in the internal iliac artery, patent side branches, and no endoleak. The exact same set of steps were then performed on the left. Completion cone beam CT showed an excellent result, utilizing 11.3 minutes of fluoroscopy time on the right, and 28 minutes overall.

Conclusions: When performing iliac branch endoprosthesis in the setting of prior EVAR, ipsilateral internal iliac deployment represents a viable and expeditious technique.

Author Disclosures: **B. Starnes:** Nothing to disclose; **J. Hurd:** Nothing to disclose; **N. Singh:** Nothing to disclose

Presentation #11

In-Hospital Outcomes of TransCarotid Artery Revascularization with Dynamic Flow Reversal (TCAR) in Patients with Contralateral Carotid Artery Occlusion

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Objectives: The outcomes of carotid revascularization in patients with contralateral carotid artery occlusion is controversial. We aim to study the peri-operative outcomes of TCAR in patients with CCO, and to assess the ability of these patients to tolerate flow reversal.

Methods: All patients in the VQI dataset who underwent TCAR with flow reversal (2015-2018) were included. Univariable and multivariable logistic analysis were used to compare in-hospital stroke, death and myocardial infarction (MI) after TCAR in patients with CCO and those without CCO (patent and <99% stenosis). We also compared the in-hospital outcomes after TCAR to those of Transfemoral CAS (TFCAS) and CEA, in patients with and without CCO.

Results: A total of 3,015 TCAR cases were included, of which 310 (10.3%) had CCO. On univariable analysis, there were no significant differences between patients with and without CCO in terms of intraoperative neurologic changes (intolerance to flow reversal) (0.65% vs. 0.74%, $P=1.00$); however, patients with CCO had lower flow reversal times (mean \pm sd: 10.3 \pm 6.2 vs. 11.6 \pm 8.4 minutes, $p=0.01$). In-hospital mortality (0.97% vs. 0.37%, $P=0.14$), stroke (1.6% vs. 1.2%, $p=0.59$), stroke/death (1.6% in both) and stroke/death/MI (2.6% vs. 2.0%, $p=0.52$) were also similar between CCO and no CCO. The Results remained insignificant after adjusting for baseline differences between the two groups (Table 1) and after stratifying with respect to symptomatic status. Compared to patients with CCO who undergoing TFCAS ($n=1,657$), those undergoing TCAR had similar rates of stroke/death (1.6% vs. 2.1%, $p=0.61$) and stroke/death/MI (2.58% vs. 2.6%, $P=0.99$). After adjusting for potential confounders there was a trend towards lower odds of stroke/TIA, stroke/death and stroke/death/MI between the two procedures, however, it was not statistically significant (Table 2). Similarly, there was no significant differences in all outcomes between TCAR and CEA in patients with CCO.

Conclusions: In this analysis, TCAR seems to be a safe in patients with CCO.

SCIENTIFIC SESSION ABSTRACTS continued

However, studies with larger sample size and longer follow-up are needed to assess the peri-operative outcomes of TCAR in patients with CCO, and compare it to other procedures.

Table 1. Perioperative outcomes after TCAR in patients with and without CCO

	Univariable Analysis			Multivariable Logistic Analysis		Weighted Analysis	
	CCO	No CCO		CCO vs. No CCO			
	310 (10.3)	2705 (89.7)					
In-Hospital Outcomes	<i>N</i> (%)	<i>N</i> (%)	<i>P</i> - <i>value</i>	<i>OR</i> (95% <i>CI</i>)	<i>P</i> - <i>value</i>	<i>OR</i> (95% <i>CI</i>)	<i>P</i> - <i>value</i>
Intraoperative neurologic change	20 (0.74)	2 (0.65)	1.00	0.93 (0.21- 4.1)	0.93	1.00 (0.22-4.5)	0.998
Any Neurological Event (Stroke/TIA)	52 (1.9)	8 (2.6)	0.43	1.37 (0.54- 3.44)	0.51	1.46 (0.59- 3.61)	0.41
Stroke/Death	42 (1.6)	5 (1.6)	0.94	1.10 (0.39- 3.1)	0.86	1.33 (0.43-4.1)	0.62
Stroke/Death/MI	55 (2.0)	8 (2.6)	0.52	1.36 (0.64- 2.91)	0.42	1.48 (0.61- 3.56)	0.38

Table 2. Adjusted In-Hospital outcomes after TCAR vs. TFCAS and CEA in patients with and without

In-Hospital Outcomes	TCAR vs. TFCAS					TCAR vs. CEA				
	CCO (310 vs.1,657)		No CCO (2,705 vs.13,008)		P- interaction	CCO (310 vs.3,916)		No CCO (2,705 vs.80,463)		P- interaction
	OR (95%CI)	P- value	OR (95%CI)	P- value		OR (95%CI)	P- value	OR (95%CI)	P- value	
Intraoperative neurologic change	0.81 (0.20-3.23)	0.76	1.46 (0.70-3.02)	0.31	0.46					
Stroke/TIA	0.95 (0.37-2.43)	0.92	0.56 (0.40-0.78)	<0.01	0.29	0.87 (0.35-2.1)	0.76	1.08 (0.80-1.46)	0.61	0.65
Stroke/Death	0.65 (0.20-2.08)	0.47	0.78 (0.50-1.20)	0.26	0.76	0.76 (0.35-1.68)	0.42	1.11 (0.81-1.51)	0.52	0.34
Stroke/Death/MI	0.78 (0.32-1.91)	0.59	0.71 (0.49-1.03)	0.08	0.84	0.76 (0.35-1.68)	0.50	0.89 (0.68-1.15)	0.37	0.71

Author Disclosures: **H. Dakour-Aridi:** Nothing to disclose; **B. Nolan:** Nothing to disclose; **M. Schermerhorn:** Nothing to disclose; **J. Jorgensen:** Nothing to disclose; **J. Lane:** Nothing to disclose; **M. Malas:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #12

Delayed Carotid Endarterectomy After Admission in Symptomatic Carotid Artery Disease is Associated with Lower Postoperative Stroke Rates in the Medicare Population

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Introduction: The appropriate timing of carotid endarterectomy (CEA) in symptomatic carotid artery disease is still controversial. Despite guideline recommendations to perform CEA within 14 days, recent studies have favored delayed CEA to decrease the risk of postoperative stroke. The goal of this study was to evaluate the timing of CEA for symptomatic disease in the Medicare population and its effects on postoperative stroke rates.

Methods: A 20% Medicare sample was queried to identify CEAs performed during inpatient hospitalizations. Patients were considered symptomatic if they had an admitting diagnosis of stroke/ infarct, TIA, or amaurosis fugax according to previously published literature. A post-operative stroke was noted if the patients had an ICD-9 code noting iatrogenic causes. Multivariable logistic regression was used to evaluate risk factors for in-hospital stroke and reported as odds ratios (OR) with 95% confidence intervals (95% CI).

Results: A total of 133,069 CEAs were performed in 120,754 patients. The majority of CEAs were performed for asymptomatic disease (84.1%); with rates increasing for symptomatic disease in recent years, see Table 1. The majority of symptomatic disease were previous stroke/infarct (74.6%); followed by TIA (14.1%) then amaurosis fugax (11.2%). The rates of in-hospital stroke were significantly higher for symptomatic disease compared to asymptomatic disease (6.1% vs. 0.5%, $P < .001$). The majority of CEAs for symptomatic disease were performed within two days of hospitalization (65.9%), followed by 3-7 days (28.3%), 8-14 days (5.2%), and > 14 days (0.7%). Delaying CEA by 3-7 days after hospitalization was associated with lower postoperative stroke (OR 0.43, 95% CI 0.37-0.41); however, waiting > 14 days was not associated with a lower risk, see Table 2. Compared to TIA, amaurosis fugax was associated with a lower rate (OR 0.15, 95% CI, 0.08-0.30); and previous infarct/ stroke was associated with a higher stroke rate (OR - 3.5, 95% CI 2.68-4.51).

Conclusions: Although this study found a significant association between lower postoperative stroke and CEA with delayed timing after admission up to two weeks, further studies including randomized control trials are needed to define the optimal timing of CEA for symptomatic carotid artery disease.

Table 1. Trends in Carotid Endarterectomy (CEA) Indication and In-hospital Stroke

Year	Symptomatic Indication for CEA	In hospital stroke rate	
		Asymptomatic Disease	Symptomatic Disease
2006	14.1%	0.8%	4.8%
2007	13.9%	0.8%	4.9%
2008	14.9%	0.5%	7.3%
2009	15.2%	0.5%	6.6%
2010	15.1%	0.4%	6.6%
2011	16.8%	0.4%	7.1%
2012	17.2%	0.3%	6.1%
2013	17.8%	0.4%	5.6%
2014	18.6%	0.4%	5.2%
Total	15.9%	0.5%	6.1%

Table 2. Factors affecting In-hospital stroke rate for carotid endarterectomies performed for symptomatic disease			
Factor	Odds-Ratio	95% Confidence Interval	P-value
Timing of CEA (compared to HOD 0-2)			
Hospital Day 3-7	.44	.37 - .51	<.001
Hospital Day 8-14	.50	.37 - .67	<.001
Hospital Day > 14	.89	.48 - 1.65	0.71
Female Gender	1.16	1.03 - 1.30	0.01
Type of Symptoms (Compared to TIA)			
Amaurosis Fugax	.15	.08 - .30	<.001
Stroke/ Infarct	3.48	2.68 - 4.51	<.001

Author Disclosures: **N. Itoga:** Nothing to disclose; **P. Tsantilas:** Nothing to disclose; **M. Garcia-Toca:** Nothing to disclose; **J. Harris:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #13

Novel Modification to Leaded Eyewear Results in Significant Operator Eye Radiation Dose Reduction Compared to Standard Leaded Glasses During Fluoroscopically-Guided-Interventions

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Objective: Ocular radiation exposure from fluoroscopically-guided-interventions (FGIs) can cause cataracts. Standard lead-equivalent glasses may not significantly reduce eye radiation dose, as the majority of scattered radiation penetrates the operator's eye obliquely. Our aim was to evaluate the efficacy of standard leaded eyewear and a customized eyewear design in lowering eye radiation dose to vascular surgeons.

Methods: The attenuating efficacy of three forms of leaded eyewear (classic glasses, glasses with built-in leaded side-shields, and our modified glasses) were tested in both a simulated setting and clinical practice. Our design consisted of standard glasses with 0.75 mm of added lead shielding attached to the lateral and inferior borders of the glasses frame to attenuate oblique radiation. We performed simulated experiments using an anthropomorphic head phantom (ATOM model-701:CIRS, Norfolk, VA) positioned to represent a primary operator performing right femoral access. Optically stimulated, luminescent nanoDot detectors (Landauer, Glenwood, IL) were placed inside the phantom's ocular spaces, and at the surface of the left eye within and outside the leaded glasses to measure the eye radiation dose reduction provided by each eyewear type. All 3 glasses types were also tested during clinical FGIs by placing nanoDots below the operator's left eye, inside and outside of the eyewear coverage. Means and standard errors were calculated using a pooled linear mixed model with repeated measurements.

Results: This prospective, single-center study included 60 FGIs; 30 with standard eyewear and 30 with our modified design. There was no significant eye radiation dose reduction ($p>0.05$) with the standard glasses designs in both the simulated and clinical settings. In the simulated environment, our modified design resulted in an 86% radiation dose reduction to the surface of the eye, and an 80% reduction in lens radiation dose ($p<0.0001$). In the clinical FGIs, the modified eyewear led to a 61% ocular radiation dose reduction ($p<0.0001$).

SCIENTIFIC SESSION ABSTRACTS continued

Conclusion: Standard lead-equivalent glasses are ineffective at reducing ocular radiation dose during FGIs. Eyewear modification with lateral and inferior lead shielding significantly decreases eye radiation exposure and improves safety for vascular surgeons.

Author Disclosures: **M. Kirkwood:** Nothing to disclose; **A. Klein:** Nothing to disclose; **J. Guild:** Nothing to disclose; **G. Arbique:** Nothing to disclose; **Y. Xi:** Nothing to disclose; **S. Tsai:** Nothing to disclose; **B. Ramanan:** Nothing to disclose; **C. Timaran:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #14

The Physical Toll of Working in Operating Rooms: A Survey of the Canadian Society of Vascular Surgery

Gautamn Sarwal, Gabriel Tobias, David C. Taylor, York N. Hsiang

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Objective: Occupational injuries and disability is increasingly being recognized as a source of surgeon burnout. The purpose of this study was to assess the physical toll of working in operating rooms by Canadian vascular surgeons in order to assess its implications on surgical practice and occupational longevity.

Methods: We designed and distributed an online survey to members of the Canadian Society of Vascular Surgery targeting, residents, fellows and staff vascular surgeons. The survey was designed to collect data on surgeon demographics, operative volume, technical preferences and work-related musculoskeletal (MSK) symptoms.

Results: An online survey was distributed to 189 surgeons and trainees. After three e-mailings, 110 surveys were returned for a 58% response rate. Of the responders, 87% were male, 50% were 45 years or older, and 55% had been in practice for ten or more years. Work-place MSK symptoms was reported by 83% of the responders; the most common symptom locations were pain in the low back (78%), neck (74%) and shoulder (31%). 80% of the responders believed that these symptoms were directly related to their operative environment. 48% sought medical care for this including physiotherapy (22%), massage therapy (30%) and surgery (7%). As a result of these MSK symptoms, 25% experience chronic pain with 8% requiring analgesics and 7% reporting time off work as a consequence. Another 11% reported an impact on their operative performance with 14% considering early retirement. A lack of operating room system changes in order to prevent workplace injury and disability was noted by 85% of the responders although only 3% reported their disability to their department.

Conclusions: Occupational MSK symptoms and disability is higher amongst Canadian vascular surgeons than other surgical specialties. Aside from raising awareness, further research is needed to design and validate an ergonomics program aimed to preventing these disorders in order to promote surgeon longevity and quality-of-life.

Author Disclosures: **G. Sarwal:** Nothing to disclose; **G. Tobias:** Nothing to disclose; **D. Taylor:** Nothing to disclose; **Y. Hsiang:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #15

Virtual Reality Can Reduce Anxiety During Office-Based Vascular Procedures

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Objectives: Office-based treatment of venous pathology is common, and frequently involves the use of anxiolytic medication to reduce anxiety. Virtual reality (VR) has been shown to effectively reduce anxiety in a variety of settings. The objective of this study was to determine if VR could be smoothly integrated into office-based vascular procedures, and to determine if VR could reduce procedural pain or anxiety.

Methods: 40 patients undergoing an office-based endovenous radio frequency ablation (RFA) procedure were included in the study. 20 were randomized to the VR group and 20 to the control group. Patients in the VR group were equipped with a Samsung GearVR headset and headphones running AppliedVR software, which ran through the duration of the procedure. All patients underwent unilateral greater saphenous vein RFA. After the procedure, patients were surveyed regarding their pre-procedure anxiety as well as their pain and anxiety during the procedure using a Wong-Baker scale.

Results: All procedures were successfully completed, and all patients were generally satisfied with their treatment. Average procedure time was the same between groups at 40 minutes. There was no statistical difference in pre-procedure anxiety or procedural pain between groups. Anxiety level during the procedure, however, was 4.1/10 in the control group and 2.9/10 in the VR group, which was statistically significant using a paired t-test. Further, the anxiety level for the control group increased during the procedure, while that of the VR group decreased. Finally, patients in the VR group were likely to recommend VR at an average of 3.6 out of 4.

Conclusions: VR can be safely and efficiently integrated into office-based vascular procedures. VR was generally well liked and recommended by those who used it. Most importantly, our findings suggest that VR can decrease procedural anxiety. Further research should examine whether this may obviate the need for anxiolytic medication.

Author Disclosures: **M. Brewer:** Nothing to disclose; **D. Lau:** Nothing to disclose; **E. Chu:** Nothing to disclose; **A. Millan:** Nothing to disclose; **J. Lee:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #16

Patient Risk Factors Associated with Embolic Stroke Volumes Following Revascularization

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Objectives: Prior research shows that subclinical, micro-embolic infarcts Results in long term cognitive changes. While both carotid endarterectomy (CEA) and carotid artery stenting (CAS) have potential for micro-embolic events, carotid artery stenting has shown to have larger volume of infarct. What is not known are the independent risk factors that trend towards higher embolic volumes in both procedures.

Methods: A total of 162 patients who underwent carotid revascularization procedures were prospectively recruited. Preoperative and postoperative brain MRI were compared to identify procedure-related micro-infarcts. A novel semi-automated approach was used to define volumes of infarcts for each patient. Patient-related factors including comorbidities, symptomatic status, and medications were analyzed. Tweedie regression analysis was used to identify independent risk factors associated with CEA or CAS. Variable with an unadjusted p-value of ≤ 0.05 were included in the multivariate analysis.

Results: 80 CAS and 82 CEA procedures were performed and analyzed for the data set. 81% of CAS had procedure-related new infarcts with a mean volume of $388.15 \pm 927.90 \text{ mm}^3$ compared to 30% of CEA patients with a mean volume of $74.80 \pm 225.52 \text{ mm}^3$ respectively. Increasing age (adj CI: 0.06 ± 0.02 , $p < 0.01$), obesity (adj CI: 1.14 ± 0.35 , $p < 0.01$), and statin usage (adj CI: 1.31 ± 0.67 , $p = 0.05$) were independent predictor for infarct volume whereas antiplatelet use (adj CI: -1.11 ± 0.33 , $p < 0.001$) was negatively associated with infarct volume in the CAS cohort. For the CEA group, diabetes (adj CI: 1.69 ± 0.65 , $p < 0.01$) was identified as the only positively correlating risk factor for infarct volume whereas increasing age (adj CI: -0.10 ± 0.05 , $p = 0.03$) was negatively associated with infarct volume.

Conclusions: We identified independent risk factors for CAS or CEA-related infarct volumes. while the Results warrants further validation, this study provides the largest cohort of data on volume of micro-infarcts related to carotid interventions and valuable information for procedure-based risk stratification.

Author Disclosures: C. Kraemer: Nothing to disclose; P. Nisson: Nothing to disclose; G. Wheeler: Nothing to disclose; G. Guzman: Nothing to disclose; A. Bernstein: Nothing to disclose; C. Hsu: Nothing to disclose; D. Bock: Nothing to disclose; T. Trouard: Nothing to disclose; W. Zhou: Nothing to disclose

Presentation #17

Five Hundred Rib-sparing Scalenectomies for the Treatment of Neurogenic Thoracic Outlet Syndrome

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Objectives: Neurogenic thoracic outlet syndrome (TOS) is no longer either “controversial” or “disputed”, but its optimal surgical management remains unclear. Most thoracic outlet decompression procedures are carried out by first rib resection, usually via a transaxillary route.

Methods: retrospective review of a prospectively maintained TOS database. Patients with neurogenic TOS associated with a cervical rib were excluded from analysis, as were patients with recurrent neurogenic TOS. All study patients satisfied a five-point clinical diagnostic protocol and experienced a positive response to a local anesthetic scalene block. Surgical decompression included anterior, minimus and middle scalenectomy and brachial plexus neurolysis via a supraclavicular incision and pectoralis minor tenotomy through a small vertical infraclavicular incision. No first ribs were excised. All patients completed a pre-op and 1, 3 and 6 month post-op QuickDASH questionnaire, and operative success was defined as 50% improvement of 6-month post-op vs. pre-op QuickDASH scores.

Results: Between 2011 and 2019 five hundred consecutive thoracic outlet decompression procedures were carried out in 448 patients. Average operative time was 1.15 h and hospital length of stay was 1.05 d. Major complications (serious bleeding, permanent nerve injury, infection) occurred in 7 patients (1.3%). All but two (99.6%) patients improved symptomatically: using the more rigorous definition of operative success noted above, 452 (90.9%) rib-sparing neurogenic TOS operations were successful.

Conclusions: These results suggest that: 1) adherence to a rigorous pre-op diagnostic regimen, including scalene block, assures, at the least, that operation for neurogenic TOS can successfully be restricted to patients actually suffering from the condition; 2) fibrotic, contracted scalene muscles are the cause of neurogenic TOS; 3) the first rib need not be removed for successful surgical treatment of neurogenic TOS; and 4) more than 90% of patients so treated can expect significant medium-term symptomatic and functional improvement.

Author Disclosures: **K. Johansen:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #18

Complete Transaxillary Resection of Fully Formed Cervical Ribs is Safe And Effective: Outcomes From 22 Years of Experience with Long Term Follow-up

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Objectives: Although the supraclavicular approach has been widely adopted for cervical rib resection, the required manipulation of critical nerves and vessels presents a significant risk to this operation. Transaxillary decompression avoids some of these concerns. We reviewed over two decades of experience with decompression of the thoracic outlet in patients with complete cervical ribs using a transaxillary approach with video-assisted endoscopy.

Methods: A prospectively maintained database of patients undergoing operations for thoracic outlet syndrome (TOS) was searched for patients with complete (class 3 and class 4) cervical ribs between 1997 and 2019. Data abstracted included patient demographics, symptoms, surgical details, and complications. Outcomes were contemporaneously assessed clinically as well as with standardized functional tools: Somatic Pain Scale (SPS) and Quick Disabilities of the Arm, Hand, and Shoulder (QUICK DASH). Cervical rib data were organized and reported in accordance with the Society for Vascular Surgery reporting standards.

Results: During the study period 1,461 patients underwent surgical procedures for TOS at our institution. Of these, 37 patients underwent complete transaxillary resection of fully formed cervical ribs (12 class 3, and 25 class 4, Figure 1). Of these patients, 73% were female. Presentations were neurogenic (63%), arterial (32%), and venous (5%). The average initial SPS score was 6.7 and the initial QUICK DASH score was 57.4. Duration of surgery averaged 141 minutes, average blood loss was 52ml and average length of stay was 2.3 days. None of the patients suffered brachial plexus, phrenic, or long thoracic nerve injury. Average follow up period was 25.1 months. Final mean post-operative SPS and QUICK DASH scores (Figure 2) were lower as compared to scores at presentation (SPS: 6.7 vs. 1.8, $p < 0.001$ and QUICK DASH: 57.4 vs. 35.3, $p < 0.001$).

Conclusions: This is the largest reported experience of fully formed cervical ribs, all of which were managed through a transaxillary approach. This technique has proven to be successful with low morbidity and reliable improvement in patient symptom and disability scores. These Results suggest that transaxillary resection of fully formed cervical ribs should be the preferred approach.

Figure 1: Class 4 cervical rib resected through a transaxillary approach.

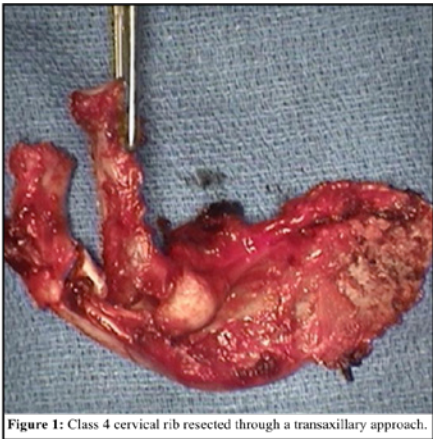
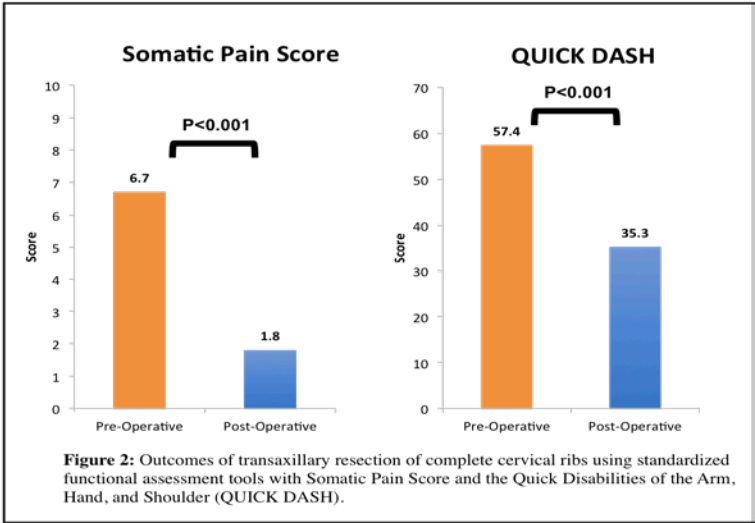


Figure 2: Outcomes of transaxillary resection of complete cervical ribs using standardized functional assessment tools with Somatic Pain Score of the Quick Disabilities of the Arm, Hand and Shoulder (QUICK DASH).



Author Disclosures: R. Moridzadeh: Nothing to disclose; H. Gelabert: Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presnetation #19

The Periumbilical Incision for Anterior Lumbar Interbody Fusions

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Objective: The standard approach for the anterior lumbar interbody fusion (ALIF) involves a paramedian incision. As an alternative, a 270-degree periumbilical incision has been previously described by a single Italian surgeon in conjunction with endoscopic visualization. We have validated the use of the periumbilical approach in multilevel ALIFs without endoscopy across multiple access surgeons.

Methods: Patients undergoing ALIF via a periumbilical incision between 2015 and 2018 were identified. The incision is made 270-degrees around the umbilicus while creating a mound of subcutaneous fat to preserve the vascular supply of the umbilicus. The anterior rectus sheath is then cut in a left paramedian fashion; the rectus muscle is retracted upward and laterally, the arcuate line is cut at its lateral connection, and the peritoneum is medialized.

Results: Thirty patients underwent a periumbilical ALIF by one of four access surgeons. Of these patients 20% received single level fusions, 47% received two level fusions, and 33% received triple level fusions; the mean operative times for these procedures were 134 minutes, 160 minutes, and 172 minutes respectively. (Table 1). Intraoperatively, one patient required an extension of the initial incision, two experienced blood loss in excess of 500 mL, and one suffered a partial venotomy requiring primary repair (Table 2.). Postoperatively, three patients experienced hypotension, two of which had significant intraoperative bleeding requiring postoperative blood transfusion while one responded to intravenous fluids alone. Two patients complained of incisional pain that required an escalation of the pain regimen. Five patients complained of transient inpatient neuropathic pain or weakness. One patient presented to the ED within 30 days and was admitted for pain control, one patient presented with postoperative seroma which was managed conservatively outpatient. No patients experienced complications unique to the periumbilical incision such as umbilical necrosis.

Conclusions: This study further validates the periumbilical approach to multilevel ALIFs by replicating it with multiple surgeons and without endoscopic visualization. The perioperative outcomes following the periumbilical approach were comparable to those seen with a paramedian approach.

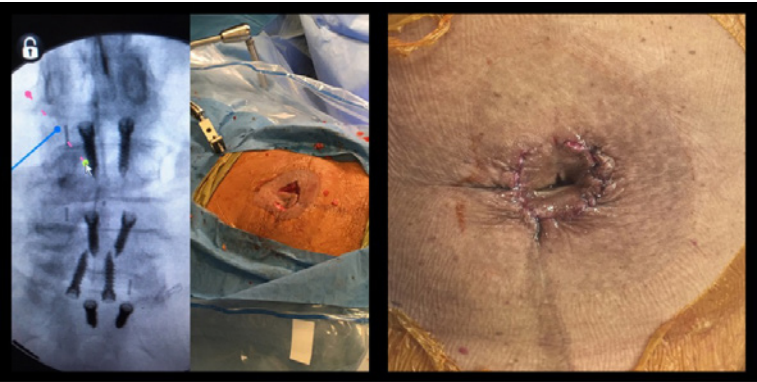


Table 1. Demographics	
Patients	n=30
Average Age (Standard Deviation)	57 (12)
ASA Class 1 (%)	3 (10)
ASA Class 2 (%)	15 (50)
ASA Class 3 (%)	12 (40)
Indication	
Spinal Stenosis (%)	10 (33)
Spondylolisthesis (%)	8 (26)
Neuromacular Pain Condition (%)	11 (36)
Scoliosis (%)	1 (3)

Table 2. Outcomes	
Outcomes	n=30
Levels Fused	
L4-L5	6 (20)
L4-L5, L5-S1	14 (47)
L3-L4, L4-L5, L5-S1	10 (33)
Average Operative Time (Standard Deviation)	159 minutes (48 minutes)
Average Blood Loss (Standard Deviation)	176ml (166ml)
Intraoperative Complications	
Bleeding >500ml (%)	2 (7)
Initial Incision Extended (%)	1 (3)

Author Disclosures: **S. Abdoli:** Nothing to disclose; **J. Sui:** Nothing to disclose; **K. Zeigler:** Nothing to disclose; **W. M. Lee:** Nothing to disclose; **S. G. Katz:** Nothing to disclose; **W. H. Burham:** Nothing to disclose; **C. J. Ochoa:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #20

Reevaluating the Safety and Effectiveness of the 0.9 Ankle-brachial Index Threshold in Penetrating Lower Extremity Trauma

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Objectives: Although current guidelines recommend further imaging when the ankle-brachial index (ABI) is 0.9 or less following extremity trauma, the accuracy of this 0.9 threshold, as compared to others, has not been evaluated. The primary aim of this study was to compare the safety and effectiveness of various ABI thresholds in predicting lower extremity vascular injuries following penetrating trauma. We hypothesized that a lower ABI threshold can safely be used to avoid unnecessary imaging.

Methods: A retrospective cohort study was performed at a single level I trauma center from January 2015-December 2017. All patients who presented with penetrating lower extremity trauma and underwent a CTA were reviewed. Patients taken directly to the operating room without first obtaining a CTA, or those without documented ABIs, were excluded. Demographical information, clinical features of presentation, interventions performed, and outcomes were recorded. P-values were obtained using the Kolmogorov-Smirnov test, and a receiver operator characteristic (ROC) curve was created to compare various ABI thresholds.

Results: A total of 47 patients (81% male), with a mean age of 29 (range 14-59), met inclusion criteria. Of the 17 limbs (36%) with a vascular abnormality seen on CTA, 6 (35%) required an intervention. The distribution of ABIs in injured limbs requiring revascularization is significantly lower ($p=0.006$) than in those that do not require intervention (Figure 1). An ABI threshold of 0.7 is most accurate, with the highest combined sensitivity (83%) and specificity (91%) (Figure 2). Further, the negative predictive value is no different between a threshold of 0.7 (98%) and 0.9 (97%) (Figure 2), with both thresholds missing 1 vascular injury (pseudoaneurysm) requiring repair.

Conclusions: The ABI remains reliable in distinguishing between limbs with and without vascular injury requiring revascularization following penetrating lower extremity trauma. A lower threshold can safely be used without compromising the negative predictive value of a screening ABI. Applying a threshold of 0.7 to our cohort would have avoided 51% (24) of the CTAs obtained without missing additional vascular injuries requiring repair.

Figure 1: Cumulative distribution of ABI values for limbs with (injured) and without (uninjured) vascular injuries requiring repair following penetrating extremity trauma. Limbs with vascular injuries requiring repair are associated with statistically significant lower ABI values ($p=0.006$) based on the Kolmogorov-Smirnov test. The max deviation, or the point at which these two graphs are separated by the greatest distance, occurs at an ABI of 0.7 (red arrow).

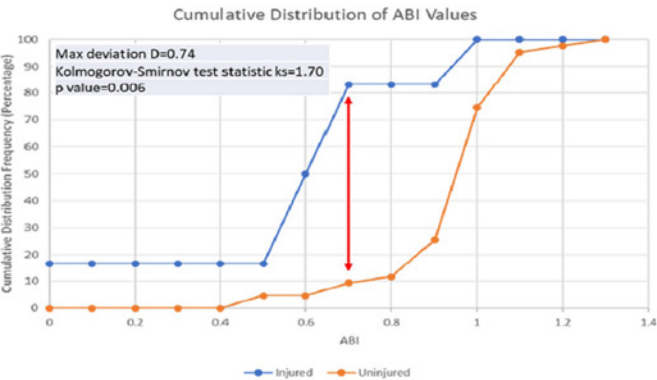
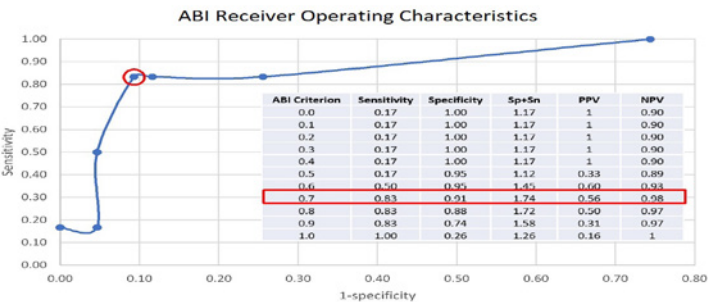


Figure 2: Receiver operating characteristics (ROC) curve with corresponding sensitivity (S_n), specificity (S_p), positive (PPV) and negative (NPV) predictive values of various ABI thresholds. The ABI threshold that provides the highest combined specificity and sensitivity is 0.7. An ABI threshold of 0.7 carries a 56% positive and 98% negative predictive value for detecting vascular injuries requiring repair.



Author Disclosures: J. Hemingway: Nothing to disclose; E. Adjei: Nothing to disclose; S. Desikan: Nothing to disclose; J. Gross: Nothing to disclose; N. Tran: Nothing to disclose; N. Singh: Nothing to disclose; B. Starnes: Nothing to disclose; E. Quiroga: Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #21

Retroperitoneal Repair of Suprarenal Abdominal Aortic Aneurysm and Right Common Iliac Artery Aneurysm After Previous Infrarenal Abdominal Aortic Aneurysm Repair

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Case Study: The patient is a 71-year-old male who presents with a 5.8 cm juxtarenal abdominal aortic aneurysm. The right common iliac artery is aneurysmal at 4.4 cm. Seven years prior, the patient had a tube graft repair of an infrarenal abdominal aortic aneurysm. Clinically the patient is asymptomatic. CT scan reveals a separate origin of the hepatic and splenic arteries. In addition, the hepatic artery origin is within a few millimeters of the superior mesenteric artery origin. The anatomy was thus not suitable for endovascular aneurysm repair. This is a five-minute video of retroperitoneal repair of a suprarenal abdominal aortic aneurysm and right common iliac artery aneurysm after previous infrarenal abdominal aortic aneurysm tube graft repair. Through a left retroperitoneal incision between the 10th and 11th rib, the aneurysm was repaired with a bifurcated Dacron graft. The video highlights the sequential steps for the exposure of the retroperitoneum and perivisceral aorta, control of the right renal artery from the left retroperitoneal approach, revascularization of the left renal artery with a retrograde bypass, and repair of the right common iliac artery aneurysm with an anastomosis of the right limb of the graft to the right iliac bifurcation.

Author Disclosures: W. Quinones-Baldrich: Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #22

Association of Aberrant Subclavian Arteries with Aortic Pathology and a Novel Classification System

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Objectives: Aberrant subclavian artery (aSCA) is a rare anatomical variant whose association with aortic pathology is unknown. Understanding of associated variations and pathology is critical for open and endovascular operative planning. We describe the frequency of aortic pathology, symptoms, and other anatomic variations in a large cohort of consecutive patients with aSCA.

Methods: All thoracic axial imaging studies at a single institution from 2006 to 2018 were queried for presence of aSCA and evaluated for aortic and branch vessel pathology and other variant anatomy. Medical records were reviewed to determine demographics, symptoms, and associated diagnoses.

Results: Of 98,580 studies, 0.82% identified an aSCA with 312 unique patients. Right aSCA (aRSCA) occurred in 90.1%, while left (aLSCA) occurred in 9.9%. aSCA coursed retroesophageal in 100% and 185 (59.3%) had a Kommerell's diverticulum (KD, 56.2% of aRSCA, 83.9% of aLSCA, $p=0.0003$) with an average diameter of 1.67 cm (range 1.2-3.3 cm). aLSCA had larger KD than aRSCA (2.05 cm vs. 1.61 cm, $p<0.0001$) and were more often symptomatic (87.1% vs. 52.3%, $p=0.0003$). (Table 1) Aortic aneurysm or dissection was present in 9.3% (29/312) with no difference between aRSCA and aLSCA (8.4% vs. 16%, $p=0.19$). A novel classification based on aortic arch branching is: Type 1: aRSCA as the 4 arch branch (51%), Type 2: common carotid trunk (CCT) and aRSCA as the 3 branch (27.9%), Type 3: right arch with aLSCA as the 4 arch branch (9.6%), Type 4: right arch with CCT and aLSCA as the 3 branch (0.3%). Subtypes (s, c, a) depend on right (RVA) and left vertebral artery (LVA) origin from the subclavian (s, RVA 90.1%, LVA 96.8%), carotid (c, RVA 9.6%, LVA 0.3%), or arch (a, RVA 0.3%, LVA 2.9%) (Table 2).

Conclusions: aSCAs are frequently symptomatic and commonly associated with aortic pathology. Repair of these pathology can be significantly more complex when an aSCA is present. Our novel classification system depicts all aSCA arch variants, accounts for frequent anomalous vertebral artery origin, and provides a tool for communication between clinicians. Knowledge of these anatomical variations is critical to planning endovascular and open aortic repair and reporting outcomes.

SCIENTIFIC SESSION ABSTRACTS continued

Table 1: Symptoms associated with aSCA

Symptoms	Total (n=312)	aRSCA (n=281)	aLSCA (n=31)	P value
None	138 (44.2%)	134 (47.7%)	4 (12.9%)	0.0002*
Chest pain	26 (8.33%)	19 (6.76%)	7 (22.6%)	0.0073*
Dysphagia	36 (11.5%)	26 (9.25%)	10 (32.3%)	0.0005*
Reflux	100 (32.1%)	84 (29.9%)	16 (51.6%)	0.0240*
Asthma	20 (6.41%)	13 (4.63%)	7 (22.6%)	0.0005*
Cough	35 (11.2%)	30 (10.7%)	5 (16.13%)	0.3795
Pneumonia	26 (8.33%)	24 (8.54%)	2 (6.45%)	1
Esophageal dysmotility	4 (1.28%)	4 (1.42%)	0 (0%)	1
Unknown	13 (4.17%)	10 (3.56%)	3 (9.68%)	0.1280

Table 2: Vertebral artery origin variations associated with aSCA

Vertebral origin	Laterality	Total (n=312)	aRSCA (n=281)	aLSCA (n=31)
Subclavian	RVA	281 (90.1%)	250 (89.0%)	31 (100%)
	LVA	302 (96.8%)	271 (96.4%)	31 (100%)
Carotid	RVA	30 (9.6%)	30 (10.7%)	-
	LVA	1 (0.3%)	1 (0.4%)	-
Aortic arch	RVA	1 (0.3%)	1 (0.4%)	-
	LVA	9 (2.9%)	9 (3.2%)	-

Author Disclosures: **A. Plotkin:** Nothing to disclose; **B. Ng:** Nothing to disclose; **F. Weaver:** Nothing to disclose; **S. Han:** Nothing to disclose; **S. Ham:** Nothing to disclose; **M. Bowdish:** Nothing to disclose; **A. Wilcox:** Nothing to disclose; **G. Magee:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #23

Vascular Surgery Is Complex but Undervalued by Work Relative Value Units

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Objective: Vascular disease has survival rates comparable to many cancers in part due to the morbidity associated with its systemic nature. However, there is little data that compares how patient complexity varies between vascular surgery and other surgical specialties. Information on how surgical populations differ can be used to inform policy decisions about resource allocation and reimbursement. This study identified variation in patient complexity across surgical specialties and assessed correlation with work RVU.

Methods: The 2017 ACS-NSQIP was queried for cases involving general, neurological, vascular, urology, orthopedic, cardiac, thoracic, ENT, and plastic surgery. Ten markers of patient complexity were measured, including: ASA class ≥ 4 , number of major comorbidities, emergent operation, concurrent or additional procedures, LOS, non-home discharge, and 30-day major complication, readmission, and mortality. Specialties were ranked by individual markers of complexity and then summed, creating an overall complexity score and rank that was then compared with general surgery as the referent. The RVU and overall complexity score of the most complex specialty were used to create an observed/expected ratio of RVU.

Results: Overall, 936,496 patients were identified, of which 56,981 (6.1%) underwent a primary operation with vascular surgery. When markers of complexity were considered individually (Figure 1), vascular patients had the highest number of major comorbidities (2.73; 95% CI=2.72-2.74) and proportion of readmission (10.1%; 95% CI=9.8-10.3%). They had the second highest proportion of ASA class ≥ 4 (27.0%; 95% CI=26.7-27.4%), non-home discharge (15.7%; 95% CI=15.4-16.0%), major complication (21.8%; 95% CI=21.5-22.2%), and mortality (2.63%; 95% CI=2.50-2.76%). Vascular patients were overall the second most complex and were 34% more complex than general surgery (Table 1). RVU very weakly correlated with overall complexity score (Spearman's $\rho=0.07$; $p<0.01$). Although vascular patients were the second most complex, they had only the fifth highest median RVU (Table 2).

Conclusions: Vascular surgery patients were the second most complex when compared to other specialties. However, RVU were inadequate in capturing patient complexity and undervalued vascular surgery by 36%.

SCIENTIFIC SESSION ABSTRACTS continued

Figure 1. Specialty rankings by individual markers of complexity highlight that vascular surgery patients are consistently very complex.



Table 1. Surgical Specialties Ranked by Overall Complexity Score

	Overall Complexity Score	Ratio of Complexity Score
1. Cardiac	75	1.42
2. Vascular	71	1.34
3. Thoracic	66	1.25
4. Neurological	57	1.08
5. General	53	1.00 (Referent)
6. Orthopedic	40	0.70
7. Urology	37	0.75
8. Plastics	30	0.57
9. ENT	21	0.40

Table 2. Surgical Specialties Ranked by Work Relative Value Units (RVU)

	Median RVU (IQR)	Observed/Expected Ratio of RVU
1. Cardiac	33.8 (33.1-43.3)	1.00 (Referent)
2. Thoracic	23.5 (14.5-25.8)	0.79
2. Neurological	23.5 (15.4-27.5)	0.91
4. Orthopedic	20.7 (12.4-20.7)	1.15
5. Vascular	20.5 (10.2-22.5)	0.64
6. Plastics	15.9 (10.4-17.1)	1.18
7. Urology	15.3 (8.0-26.8)	0.92
8. General	11.9 (9.5-20.8)	0.50
9. ENT	11.2 (4.4-15.6)	1.18

Author Disclosures: J. Ramirez: Nothing to disclose; W. Gaspar: Nothing to disclose; C. Seib: Nothing to disclose; E. Finlayson: Nothing to disclose; M. Conte: Nothing to disclose; J. Sosa: Nothing to disclose; J. Iannuzzi: Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #24

Medical Complexity of Patients by Surgical Specialty: Who Operates on the Sickest Patients?

Rameen S. Moridzadeh, Yas Sanaiha, Josef Madrigal, James Antonios, Peyman Benharash, Donald T. Baril

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Objectives: Intuitively, the chronic disease burden of surgical patients varies considerably by surgical specialty, though sparse evidence in the literature supports this notion. We sought to characterize the medical complexity of surgical patients by surgical specialty and to quantify the association between medical complexity and outcomes.

Methods: The National Inpatient Sample, an all-payer inpatient database representative of 97% of all US hospitalizations, was used to identify adults undergoing surgery between 2005-14. The most commonly performed operations that constituted 80% of each surgical specialty's practice were abstracted. A weighted composite average Elixhauser Comorbidity Index (ECI) was calculated per year by surgical specialty as a measure of medical complexity. Outcomes and resource utilization were assessed by comparing mortality rate, length of stay (LOS), and cost.

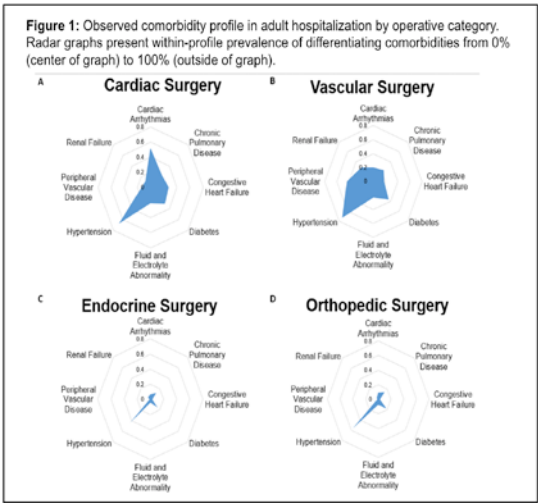
Results: An estimated 51,323,310 patients underwent operations in one of nine surgical specialty categories listed (Table 1). Individual comorbidities contributing to ECI are shown in Figure 1. Surgical specialties were ranked by ECI, with cardiac surgery (3.51), vascular surgery (3.40), and thoracic surgery (2.93) having the highest mean ECI (Table 1). While the high ECI scores in cardiac surgery were driven by arrhythmias and hypertension, vascular patients had a more uniform distribution of comorbidities (Figure 1). The average ECI for all surgical patients increased over the study period from 1.98 in 2005 to 2.60 in 2014 ($P<0.001$), with a similar trend for all specialties considered. Unlike the two specialties with the lowest burden of comorbidities (orthopedic and endocrine surgery), cardiac and vascular surgery exhibited significantly higher inpatient mortality, LOS, and costs.

Conclusions: Although all surgical patients have exhibited an increase in comorbidities over the past decade, candidates for cardiac and vascular operations appear to carry the largest burden of chronic conditions. In-hospital mortality, cost, as well as length of stay were highest for patients undergoing cardiac and vascular surgery. The intensity of care and assumed risk in treating these patients should be taken into consideration when deciding health policy, reimbursement, and hospital resource allocation.

Table 1. Medical complexity represented by Elixhauser Comorbidity Index (ECI) by surgical specialty.

	NUMBER OF PATIENTS (%)	MEAN ECI	P-VALUE
Total Cohort	51,323,310	2.28	
Cardiac Surgery	3,600,745 (7.0%)	3.51	< 0.0001
Vascular Surgery	5,224,952 (10.1%)	3.40	Reference
Thoracic Surgery	2,102,928 (4.1%)	2.93	< 0.0001
Skin/Soft Tissue Surgery	5,820,426 (11.3%)	2.53	< 0.0001
Urology	3,506,188 (6.8%)	2.52	< 0.0001
Neurosurgery	2,033,450 (4.0%)	1.95	< 0.0001
Gastrointestinal Surgery	12,643,185 (24.6%)	1.93	< 0.0001
Endocrine Surgery	773,830 (1.5%)	1.80	< 0.0001
Orthopedic Surgery	15,617,606 (30.4%)	1.73	< 0.0001

Figure 1. Observed comorbidity profile in adult hospitalization by operative category. Radar graphs present within-profile prevalence of differentiating comorbidities from 0% (center of graph) to 100% (outside of graph).



Author Disclosures: **R. Moridzadeh:** Nothing to disclose; **Y. Sanaiha:** Nothing to disclose; **J. Madrigal:** Nothing to disclose; **J. Antonios:** Nothing to disclose; **P. Benharash:** Nothing to disclose; **D. Baril:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #25

Hospital Volume Impacts the Outcomes of Endovascular Repair of Thoracoabdominal Aortic Aneurysms

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Objective: Very few centers in the United States have the expertise to manage patients with Thoracoabdominal aortic aneurysm (TAAA). The purpose of this study is to use a nationally representative vascular database to assess the role of hospital volumes on outcomes in patients undergoing endovascular repair for TAAA.

Methods: All patients undergoing complex endovascular repair (cEVAR) for TAAA were identified in Vascular Quality Initiative (VQI) database (2011-2018). Total mean number of cases per year were identified at each center and were used to group into three quintiles containing equal number of patients (Low [LVH], Medium [MVH], High [HVH]). Standard univariate and multivariable (logistic regression) analysis were performed to evaluate patient's characteristics and short-term outcomes.

Results: A total of 118 centers (Low - 92, Medium - 19, High - 7) were identified in VQI over an 8 year time period. The annual mean (S.D.) number of cases at HVH, MVH, LVH were 22.7 (4.7), 9.6 (3), 3.6 (1.4), respectively. The repair of Type II (43.1% vs. 40.6% vs. 42.0%), Type III (22.5% vs. 21.0% vs. 15.1%) and Type IV (30.8% vs. 26.9% vs. 29.1%) TAAA was slightly higher in HVH vs. MVH vs LVH (P<0.001). Compared to LVH and MVH, patients undergoing TAAA repair at HVH were older (mean age (S.D.): 72(65,78) vs. 69(60,76) and 71(63,77), P<0.001). In univariate analysis, compared to LVH and MVH, HVH were associated with significantly lower mortality (1.3% vs. 3.6% and 4.2%), failure to rescue [FTR] (3.5% vs. 12.8% and 11.1%) and any complication (24.6% vs. 27.1% and 31.2%) (All P<0.001) (table). After adjusting for potential confounders, both LVH and MVH were associated with 4-5 fold increase in the odds of mortality (OR (95% CI): 4.21 (1.57-11.29) and 3.68 (1.37-9.91)) and FTR (OR (95% CI): 5.10 (1.52-17.09) and 3.99 (1.24-12.86)) compared to HVH (figure).

Conclusions: Using a large national database, our study demonstrates significantly lower morbidity and mortality in high volume hospitals performing cEVAR of TAAA, despite operating on older patients with more complex TAAA types. This is likely due to better rescue phenomenon in addition to more experienced operator. Endovascular TAAA repair is one of the most complex procedures in vascular surgery and should be performed in high volume aortic centers of excellence.

SCIENTIFIC SESSION ABSTRACTS continued

Figure. Multivariable logistic regression of in-hospital outcomes following endovascular repair of thoracoabdominal aortic aneurysm (TAAA) between different hospital volumes: High volume Hospitals – HVH (reference) vs. low volume hospitals [LVH] and HVH (reference) versus medium volume hospitals [MVH].

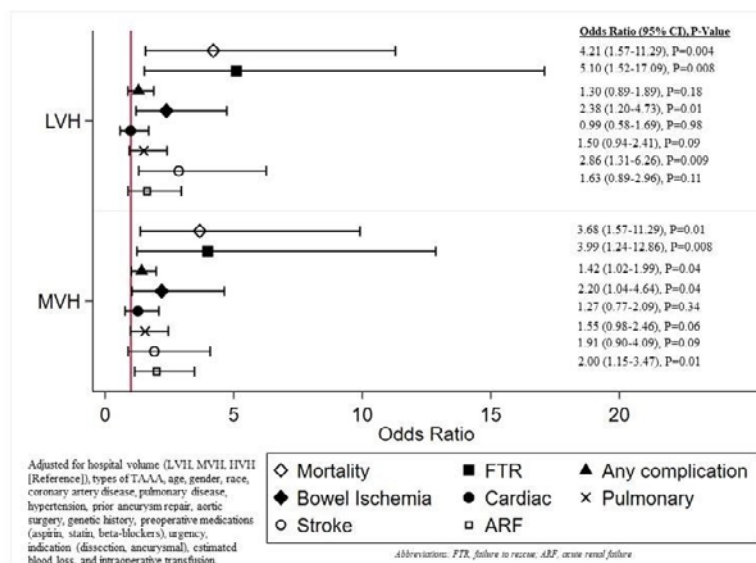


Table 1. In-hospital outcomes of patients undergoing endovascular repair of Thoracoabdominal aortic aneurysms

	LVH n(%)	MVH n(%)	HVH n(%)	P-value
30-day Mortality	26 (3.6)	29 (4.2)	9 (1.3)	0.004
Any complications	195 (27.1)	216 (32.2)	172 (24.6)	0.02
Renal Ischemia	33 (4.6)	25 (3.6)	22 (3.2)	0.35
Acute renal failure	41 (12.4)	42 (14.9)	32 (10.1)	0.21
Any cardiac complications	76 (10.5)	101 (14.6)	87 (12.5)	0.07
Stroke/TIA	31 (4.3)	22 (3.2)	12 (1.7)	0.02
Pulmonary complication	67 (9.3)	74 (10.7)	46 (6.6)	0.02
Dialysis	28 (4.0)	33 (5.0)	18 (2.6)	0.09
Failure to rescue	25 (12.8)	24 (11.1)	6 (3.5)	0.005
Bowel Ischemia	23 (3.3)	25 (3.6)	1 (1.6)	0.046
Transfusion	215 (30.1)	274 (39.6)	296 (42.4)	<0.

Author Disclosures: **S. Locham:** Nothing to disclose; **F. Hussain:** Nothing to disclose; **A. Barleben:** Nothing to disclose; **J. S. Lane:** Nothing to disclose; **R. Veeraswamy:** Nothing to disclose; **M. Malas:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #26

Anatomic Eligibility for Commercial Branched Endograft Repair of Thoraco-abdominal Aortic Aneurysms

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Objectives: First generation “off-the-shelf” branched endovascular stent grafts are in development for treatment of thoraco-abdominal aneurysms (TAAA). Past studies have assessed eligibility rates among highly selected cohorts of patients referred for endovascular treatment, and the broader applicability of these devices is unknown. The aims of this study were to assess the overall suitability of the 3 commercial 4-branched devices with or without adjunct procedure(s) in an unselected cohort of patients with TAAA, and to identify areas for improvement in the next generation of devices.

Methods: A retrospective review of 3D centerline reconstructions of contrast enhanced computed tomography imaging was performed in consecutive patients with TAAA seen between 2013 and 2017. Eligibility for a device was assessed based on instructions for use (IFU) from the device manufacturer along with pre-specified anatomic criteria. Adjunct procedures were defined as subclavian revascularization, target vessel endovascular intervention, and iliac conduit.

Results: Of 145 TAAA patients with imaging, 123 had CT scans adequate for study inclusion. Cohort demographics are shown in Table 1. Seventeen patients (14%) were eligible for at least 1 device by IFU, and 37 (30%) could have been made eligible for at least 1 device by an adjunct procedure. Sixty-nine (56%) were not eligible for any device within IFU even with adjunct procedures, including 31 of 32 patients with TAAA due to dissection (Figure 1). The most common reasons for ineligibility were peri-visceral flow channel diameter <20mm (n=43) and an inadequate proximal seal zone (n=29). Women were more frequently ineligible than men (66% vs. 51%) due to a higher rate of prohibitive features, including small aortic flow channel, decreased infra-celiac aortic length due to prior infra-renal aneurysm repair, and narrow access vessels.

Conclusions: Over half of patients with TAAA could not be made eligible for an off-the-shelf device based on manufacturers’ criteria, even with adjunct procedures. Women and patients with TAAA due to dissection had higher rates of ineligibility. These data demonstrate that fenestrated devices, low profile devices, and devices that accommodate prior infra-renal repair are needed to expand eligibility for endovascular repair of TAAA.

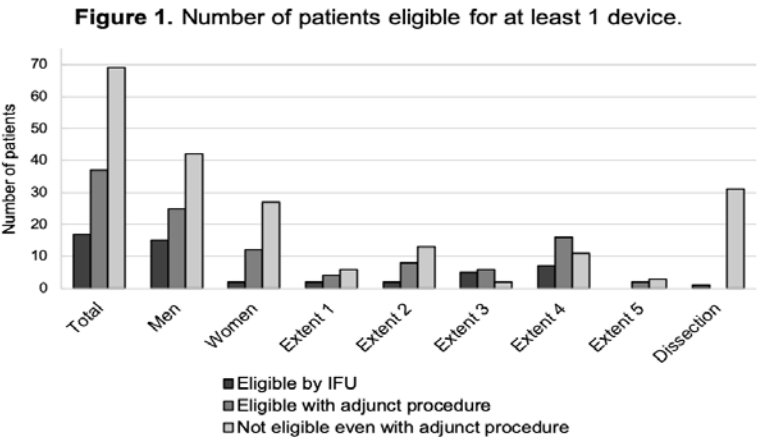


Figure 1. Number of patients eligible for at least 1 device.

Table 1. Characteristics of study population (n=123).		
	n	%
Men	82	66.7
Women	41	33.3
Extent 1	17	13.8
Extent 2	50	40.7
Extent 3	15	12.2
Extent 4	36	29.3
Extent 5	5	4.1
Etiology: degenerative	87	70.7
Etiology: dissection with aneurysmal degeneration	32	26.0
Etiology: other	5	4.1
Connective tissue disease	11	8.9

Author Disclosures: **N. Edman:** Nothing to disclose; **M. Bartek:** Nothing to disclose; **P. C. Kang:** Nothing to disclose; **M. Sweet:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #27

Outcomes of Post-stent Ballooning After Transcarotid Artery Revascularization (TCAR)

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Background: Prior studies have shown an association between post-stent ballooning/angioplasty (post-SB) and increased stroke risk after Transfemoral CAS. The aim of this study is to evaluate the outcomes of post-SB during TransCarotid Artery Revascularization (TCAR) with dynamic flow reversal using data from the SVS TCAR Surveillance Project (TSP).

Methods: Patients undergoing TCAR between 2016 and 2019 (n=3,910) were divided into 3 groups: those who received pre-stent deployment ballooning only (pre-SB, reference group: 30.5%), those who received post-stent deployment ballooning only (post-SB: 30.1%), and those who received both pre- and post-stent ballooning (prepost-SB: 39.4%). Patients who did not receive any angioplasty during their procedure were excluded. Analysis was performed using univariable and multivariable logistic regression models.

Results: Patients undergoing pre-SB only were more likely to be symptomatic (42.0%) vs. those undergoing post-SB (37.1%) and prepost-SB (35.7%, $P < 0.01$) (Table 1). On univariable analysis, no differences in the rates of in-hospital and 30-day stroke, death and stroke/death were observed among the three groups (Table 2). However, patients undergoing post-SB and prepost-SB had higher rates of post-procedural hypotension requiring IV medications and longer operative times vs. those undergoing pre-SB only. After adjusting for age, gender, race, symptomatic status, BMI, CAD, CHF, diabetes, dialysis and prior ipsilateral carotid interventions, there was no increase in the rate of in-hospital stroke/death in post- and prepost-SB (post-SB: OR: 1.18, 95%CI: 0.58-2.41, $P = 0.65$; prepost-SB: OR: 1.30, 95%CI: 0.67-2.53, $P = 0.43$) compared to pre-SB. Symptomatic patients had higher rates of in-hospital stroke/death compared to their asymptomatic counterparts, however, the use of post-SB did not vary with respect to symptomatic status.

Conclusion: Post-stent ballooning was used in 69.5% of TCAR patients and was shown to be safe without an increase in the odds of post-operative stroke/death. This study provides an additional evidence on the benefits and safety of flow-reversal in patients undergoing TCAR and additional advantage compared to TFCAS.

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Table 1. Baseline Characteristics

Pre-SB	Post-SB	PrePost-SB	P-value	
	N=1,193	N=1,177	N=1,540	
Age in years (median, IQR)	74 (66-80)	74 (67-80)	75 (67-880)	0.42
Female Gender	426 (35.7)	422 (35.9)	571 (37.1)	0.71
Non-White Race	138 (11.6)	118 (10.0)	131 (8.5)	0.03
Ipsilateral Symptomatic Status	501 (42.0)	437 (37.1)	550 (35.7)	<0.01
BMI, mean \pm SD	28.2 \pm 5.7	27.8 \pm 5.5	28.8 \pm 8.0	<0.001
HTN	1,068 (89.5)	1,056 (89.8)	1,409 (91.6)	0.14
Diabetes	491 (41.2)	420 (35.7)	591 (38.4)	0.02
Coronary Artery Disease	588 (49.3)	639 (54.3)	836 (54.3)	0.02
CHF	191 (16.0)	228 (19.4)	324 (21.0)	<0.01
Prior CABG/PCI	476 (39.9)	521 (44.3)	626 (40.7)	0.07
COPD	324 (27.2)	328 (27.9)	434 (28.2)	0.83
CKD	443 (37.8)	460 (40.4)	584 (38.8)	0.44
Hemodialysis	15 (1.3)	28 (2.4)	30 (2.0)	0.13
Current Smoker	274 (23.0)	277 (23.5)	333 (21.7)	0.21
Degree of Stenosis >80%	627 (53.6)	614 (54.4)	827 (55.9)	0.49
Prior Ipsilateral CEA	206 (17.3)	210 (17.8)	234 (15.2)	0.15
Prior Ipsilateral CAS	9 (0.8)	20 (1.7)	27 (1.7)	0.06
Preoperative Medications				
Aspirin	1,070 (89.7)	1,044 (88.7)	1,392 (90.4)	0.36
P2Y12-Receptor Antagonists	1,027 (86.1)	1,001 (85.1)	1,338 (86.9)	0.39
Anticoagulants	162 (13.6)	144 (12.2)	232 (15.1)	0.11
Beta Blockers	677 (56.8)	668 (56.7)	921 (59.8)	0.17
ACE Inhibitors	635 (53.2)	613 (52.1)	842 (54.7)	0.40
Statin	1,058 (88.7)	1,021 (86.7)	1,370 (89.0)	0.17
Elective procedures	1,061 (88.9)	1,071 (91.0)	1,391 (90.3)	0.2

Table 2. In-Hospital and 30-day Outcomes

	Pre-SB	Post-SB	PrePost-SB	P-value
In-Hospital Outcomes	N=1,193	N=1,177	N=1,540	
Stroke	11 (0.9)	13 (1.1)	23 (1.5)	0.37
Death	6 (0.5)	5 (0.4)	4 (0.3)	0.52
Stroke/Death	15 (1.3)	17 (1.4)	25 (1.6)	0.73
Myocardial Infarction	7 (0.6)	9 (0.8)	10 (0.65)	0.86
IV meds for hypotension	133 (11.2)	195 (16.6)	244 (15.9)	<0.001
IV meds for hypertension	177 (14.9)	151 (12.9)	194 (12.6)	0.20
Reperfusion Syndrome	5 (0.4)	5 (0.4)	5 (0.3)	0.85
Operative time, mean \pm SD	68.9 \pm 27.4	72.8 \pm 29.0	75.0 \pm 29.3	<0.001
30-Day Follow-up	N=222, 18.6%	N=450, 38.2%	N=293, 19.0%	
Stroke	0	0	1 (0.5)	0.47
Death	3 (1.3)	2 (0.4)	4 (1.4)	0.31
Stroke/Death	3 (1.3)	2 (0.4)	5 (1.7)	0.22

Author Disclosures: **M. Malas:** Nothing to disclose; **H. Dakour-Aridi:** Nothing to disclose; **A. Barleben:** Nothing to disclose; **B. Nolan:** Nothing to disclose; **M. Schermerhorn:** Nothing to disclose; **J. Jorgensen:** Nothing to disclose

Presentation #28

Long-term Stroke Risk with Carotid Endarterectomy in Patients with Severe Carotid Stenosis

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Objectives: Informed debate regarding optimal carotid endarterectomy (CEA) use for severe stenosis requires contemporary assessment of long-term procedural stroke risk reduction with periprocedural risk, and long-term outcome data, particularly for asymptomatic (ASX) stenosis, are lacking. In this study, we report long-term stroke and death risk after CEA in a large integrated healthcare system.

Methods: All patients without prior ipsilateral intervention and with documented severe (70-99%) stenosis from 2008-2012 undergoing CEA were identified and stratified by symptomatic (SX) or ASX stenosis. Patients were followed through 2017 for the primary outcomes of any stroke/death within 30 days of intervention and long-term ipsilateral ischemic stroke, and secondary outcomes of any stroke, and overall survival.

Results: Overall, 2012 patients (63.3% male, mean age 71.3±8.9 years) underwent 2219 primary CEAs; 1064 (48%) for symptomatic stenosis, and 1155 (52%) for asymptomatic stenosis. Mean follow-up was 5.8±2.6 years (SX) and 6.0±2.6 years (ASX). Mean time from study entry to surgery for ASX patients was 257.3±444 days, with 82.5% of all interventions performed within the first 12 months of the index imaging study. Mean age and sex distribution were similar in both groups. Statin adherence by 80% medication possession ratio (19.1% vs 31.7%; $p<0.001$) and controlled blood pressure rates (68% vs 73.1%; $p=0.001$) were lower in the SX group at the time of CEA. Arterial patch use and intraoperative shunt use are shown in Table 1. The crude overall 30-day any stroke/death rates were 1.22% and 0.69% for the SX and ASX groups, respectively. The five-year risk of ipsilateral stroke and combined any

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stroke/death by Kaplan-Meier survival analysis were 1.3% and 28.0% for the SX group, and 2.1% and 25.5% for the ASX group, respectively (confidence intervals in Table). Unadjusted cumulative all-cause survival was 73.1% and 75.9% at 5 years, for SX and ASX groups respectively.

Conclusions: In a contemporary review of CEA, nearly half are performed for SX stenosis. Outcomes for either stenosis show low adverse events perioperatively and low long-term stroke risk up to 5 years. These Results are well within published guidelines and trial outcomes and should help inform the discussion around optimal CEA use for severe carotid stenosis.

Table 1 - Surgical Characteristics and Outcomes for Carotid Endarterectomy

Surgical Characteristics and Outcomes after Carotid Endarterectomy	Asymptomatic N = 1,155 (52%)	Symptomatic N = 1,064 (48%)
Surgical Characteristics		
Shunt, N (%)	544 (47.1%)	572 (53.8%)
Patch, N (%)	1,105 (95.7%)	1,020 (95.9%)
Unadjusted Crude Rates		
Any Stroke/Death within 30 days, N (%)	8 (0.69%)	13 (1.22%)
Annual Risk of Ipsilateral Ischemic Stroke (95% CI)	0.46% (0.07-0.85)	0.26% (0-0.56)
Kaplan-Meier Unadjusted Cumulative Probabilities at 5 years (95% CI)		
Risk of Ipsilateral Ischemic Stroke	2.1% (1.4-3.2)	1.3% (0.7-2.2)
Risk of Any Stroke (Ipsilateral + all other Ischemic Strokes)	2.4% (1.6-3.6)	1.6% (1.0-2.6)
Risk of Any Stroke/Death	25.5% (23.1-28.2)	28.0% (25.3-30.8)
All-Cause Survival	75.9% (73.3-78.3)	73.1% (70.3-75.7)

Author Disclosures: **K. Rothenberg:** Nothing to disclose; **L. Tucker:** Nothing to disclose; **A. Avins:** Nothing to disclose; **H. Kuang:** Nothing to disclose; **R. Faruqi:** Nothing to disclose; **A. Flint:** Nothing to disclose; **M. Nguyen-Huynh:** Nothing to disclose; **R. Chang:** Nothing to disclose

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Presentation #29

Greater Curvature-based Instead of Centerline-based Measurement Improves Endograft Sizing Accuracy for Thoracic Endovascular Aortic Repair in the Aortic Arch

William Yoon, Matthew Mell

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Objective: The preoperative assessment of required endograft size for thoracic endovascular aortic repair (TEVAR) in the aortic arch is challenging. Although a centerline reconstruction is useful for sizing, the path of the device in this tortuous segment does not necessarily follow the centerline. Thus, an endograft estimated in this way may suffer from inadequate size. As a way to overcome this drawback, the greater curvature-based measurement has been suggested in previous studies in the descending part of the aorta. We aimed to investigate the discrepancy between greater curvature- and centerline-based measurements, and the association of this discrepancy with endograft sizing accuracy in patients undergoing zone 1, 2, or 3 TEVAR.

Methods: 56 patients (34 men, 52.6 ± 20 years) who underwent TEVAR in the aortic arch (1 in zone 1, 13 in zone 2, 43 in zone 3; 41 traumatic aortic injury, 15 aneurysm) were enrolled in this retrospective study. The immediate postoperative 3-dimensional reconstructed computed tomography images were evaluated. The greater curvature measurements were obtained using Tera Recon software by moving the centerline to the outer aortic wall. A tortuosity index (TI) was calculated as the ratio of the centerline length to straight line length. The results were examined using two-tailed t-test and Pearson correlation coefficients.

Results: There was a significant difference between the length of the centerlines (CL) and that of the endografts (EL) (96.4 ± 25 mm vs 118.7 ± 29.4 mm, $p < 0.0001$), whereas that of the greater curvatures (GL) and EL was similar (110.4 ± 28.5 mm vs 118.7 ± 29.4 mm, $p = 0.1343$). The mean absolute difference between CL and EL was 22.3 ± 8.5 mm (range, 9.2-57 mm), and this difference correlates with the TI ($r = 0.31$, $p = 0.02$), EL ($r = 0.62$, $p < 0.0001$), and endograft diameter (mean, 30.4 ± 5.8 mm, $r = 0.48$, $p = 0.0002$). The mean absolute difference between CL and GL was 14.0 ± 5.9 mm (range, 6-38 mm). These results were not different for endograft type, nor were they influenced by aortic pathology.

Conclusions: The discrepancy between the length estimated using the centerline and that measured from the greater curvature increases with increase

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in aortic tortuosity, lengthening, or diameter. The greater curvature-based measurement may provide a more accurate estimate for aortic arch TEVAR sizing.

Author Disclosures: **W. Yoon:** Nothing to disclose; **M. Mell:** Nothing to disclose

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Presentation #30

Staged Endovascular and Surgical Repair of a Mycotic Descending Thoracic Aortic Aneurysm

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This 5-minute video highlights the staged endovascular and surgical management of a mycotic descending thoracic aneurysm. The patient is a 77-year-old female presented with severe shortness of breath, dysuria, and a white blood cell count of 23,000. Urine culture was positive for *Escherichia coli* and blood cultures were positive for methicillin sensitive *Staphylococcus aureus*. Five months prior the patient had a normal descending thoracic aorta on a CTA performed for vague abdominal pain. A repeat CTA on admission showed a contained ruptured aortic aneurysm in the mid to distal descending thoracic aorta consistent with a mycotic aneurysm. The patient was taken emergently to the operating room and underwent endovascular repair of the mycotic aneurysm. The patient received intravenous antibiotics for 8 weeks and electively had conversion to surgical repair of the mycotic aneurysm with explantation of the endograft through a left thoracotomy. During aortic crossclamping, distal circulation was maintained using veno-arterial ECMO. The distal perfusion circuit consisted of an atrial venous cannula through the femoral vein and a femoral arterial cannula, both inserted percutaneously. The patient had an uneventful recovery. After 6 weeks of intravenous antibiotics, oral antibiotics are being administered for a period of 1 year. Follow-up CT scan shows no evidence of recurrence of the aortic infection.

Author Disclosures: W. Quinones-Baldrich: Nothing to disclose

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Presentation #31

Evolving Utility of Endovascular Treatment of Pararenal and Suprarenal Abdominal Aortic Aneurysms Resulting in Higher Mortality

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Objective: The continued advancements in endovascular technologies is resulting in lesser numbers of abdominal aortic aneurysms (AAAs) treated by open surgery. Additionally, more complex pararenal and suprarenal AAAs are being managed with endovascular methods. This study evaluates the evolving trends in endovascular aortic aneurysm repair (EVAR) of more complex AAAs and its impact on morbidity and mortality compared to open aortic repair (OAR).

Methods: The 2011-2017 ACS-NSQIP Procedure-Targeted Vascular database was queried for patients undergoing OAR or EVAR for AAAs. A multivariable logistic regression analysis was performed for both infrarenal and juxtarenal/pararenal/suprarenal (JPS) treatments.

Results: 18,661 patients underwent AAA repair with OAR in 3,941 (21.1%) and EVAR in 14,720 (78.9%). The rate of OAR decreased from 29.5% in 2011 to 21.3% in 2017 ($p<0.001$) with a geometric-mean-annual decrease of 27.8%. The rate of EVAR increased from 70.5% to 78.7% during the same time period ($p<0.001$) with a geometric-mean-annual increase of 11.6%. These trends remained true for both infrarenal and JPS AAAs (Figure 1 and 2). After adjusting for covariates, there was no difference in risk of 30-day mortality, renal complications or ischemic colitis for either OAR or EVAR over each incremental year ($p>0.05$) (Table 1 and 2). However, in patients undergoing EVAR for JPS AAAs, the risk of mortality increased with each incremental year (OR 1.30, 1.01-1.69, $p=0.039$). There was no statistical difference in the risk of mortality for OAR in JPS AAAs with each incremental year (OR 1.11, 0.99-1.23, $p=0.067$).

Conclusions: The rate of OAR for AAA has decreased over the past seven years with an increase in EVAR for more complex JPS AAAs. The mortality and morbidity for treatment of infrarenal AAAs was not significantly affected by this increased utility of EVAR. However, as the incidence of EVAR procedures for JPS AAAs have incrementally increased, likely due to availability of more advanced technologies, the associated risk of mortality has significantly

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increased. This mortality trend was not seen with OAR of JPS AAAs. These findings warrant careful prospective analysis, especially the increased mortality with EVAR for JPS.

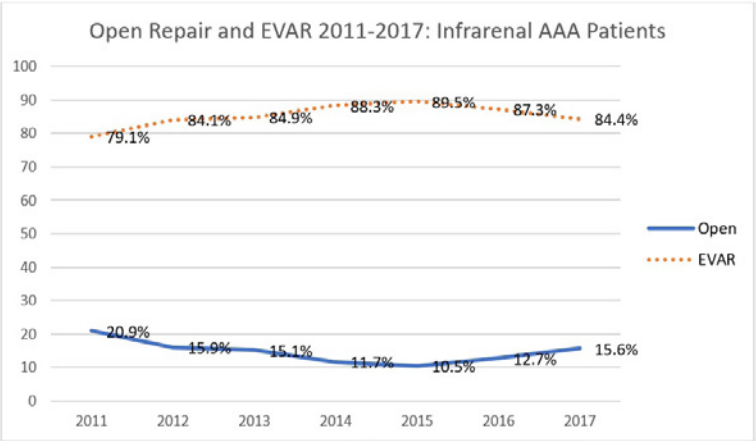


Figure 1. Incidence of open repair and EVAR 2011-2017: Infrarenal AAA Patients ($p<0.001$)

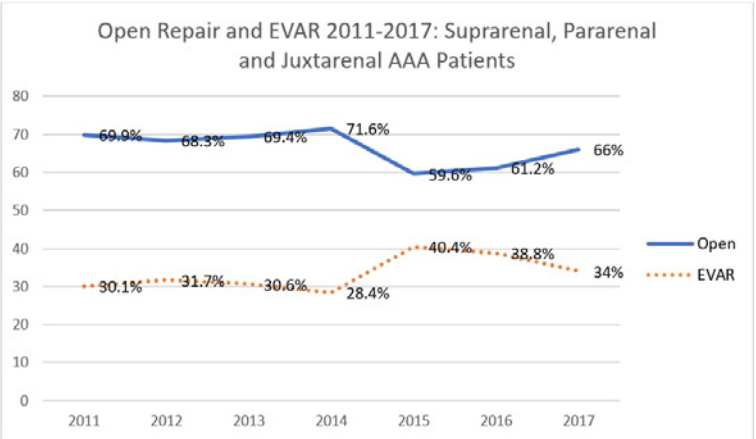


Figure 2. Incidence of open repair and EVAR 2011-2017: Suprarenal, Pararenal and Juxtarenal AAA Patients ($p<0.001$)

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Table 1A. Analysis for risk of outcomes in AAA as each incremental increase in the year of surgery			
Risk Factor	OR	CI	p-value
Mortality¹			
Open repair	1.04	0.97-1.11	0.310
EVAR	0.96	0.88-1.04	0.300
Renal insufficiency^{*,2}			
Open repair	1.02	0.91-1.14	0.769
EVAR	1.07	0.94-1.22	0.331
¹ controlled for: age, history of congestive heart failure, ascites, chronic obstructive pulmonary disease, prior abdominal surgery, shock prior to operation; ² controlled for: age, prior abdominal surgery, shock prior to operation and history of diabetes and hypertension; * patients with history of end-stage-renal disease excluded; EVAR = endovascular aortic repair			

Table 1B. Analysis for risk of outcomes in AAA as each incremental increase in the year of surgery			
Risk Factor	OR	CI	p-value
Renal failure^{*,1}			
Open repair	1.03	0.95-1.11	0.462
EVAR	0.96	0.87-1.05	0.352
Ischemic colitis²			
Open repair	0.93	0.84-1.02	0.133
EVAR	0.93	0.84-1.03	0.153
¹ controlled for: age, prior abdominal surgery, shock prior to operation and history of diabetes and hypertension; ² controlled for: age, prior abdominal surgery, shock prior to operation; * patients with history of end-stage-renal disease excluded; EVAR = endovascular aortic repair			

Author Disclosures: **A. Grigorian:** Nothing to disclose; **R. Fujitani:** Nothing to disclose; **N. Kabutey:** Nothing to disclose; **W. Duong:** Nothing to disclose; **I. Kuo:** Nothing to disclose; **C. de Virgillio:** Nothing to disclose; **M. Lekawa:** Nothing to disclose; **J. Nahmias:** Nothing to disclose

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Presentation #32

Endovascular Repair of Ruptured Abdominal Aortic Aneurysm is Superior to Open Repair: Propensity Matched Analysis in the Vascular Quality Initiative

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Objectives: The three randomized trials comparing endovascular (rEVAR) to open repair (rOSR) of ruptured abdominal aortic aneurysm (rAAA) were poorly designed and heavily criticized. The short- and long-term survival advantages of rEVAR remain unclear. We sought to compare the two treatment modalities using a propensity matched analysis in a real-world setting.

Methods: All rOSR and rEVAR in the Vascular Quality Initiative were analyzed (2003-2018). Raw and propensity matched rEVAR and rOSR cohorts were compared. Primary outcomes included postoperative major adverse events (MAE) (cardiovascular, pulmonary, renal, bowel/limb ischemia, reoperation) and 30-day and 1-year mortality. Univariate, multivariate, and Kaplan-Meier analyses were performed.

Results: 4,929 rAAA repairs were performed: 2,749 rEVAR and 2,180 rOSR. Compared to rEVAR, rOSR had higher myocardial ischemic (MI) events (15%, vs 10%, $p < .001$), MAE (67%, vs 37%, $p < .001$), and 30-day death (34%, vs 21%, $p < .001$) (Table 1). On adjusted analysis, rOSR was predictive of 30-day mortality (odds ratio (OR) 1.9, 95% CI 1.6-2.2). After 1:1 matching, the study cohort consisted of 724 pairs of rOSR and rEVAR. rOSR had twice the length of stay (LOS) (median 10 days [IQR 5,19], vs 5 [IQR 3,10], $p < .001$). Univariate analysis demonstrated persistent increased 30-day mortality following rOSR (32%, vs 18%, $p < .001$) and higher rates of MI (rOSR 14% vs rEVAR 8%, $p = .002$), respiratory complications (38% vs 20%, $p < .001$), and acute kidney injury (42% vs 26%, $p < .001$). Overall MAE rate was higher following rOSR (68%, vs 35%, $p < .001$). Multivariable regression analysis of the propensity matched pairs demonstrated that rOSR was associated with double the 30-day mortality compared to rEVAR (OR 2.1; 95% CI, 1.7-2.8) (Table 2). All-cause 1-year survival was 73% and 59% following rEVAR and rOSR in the propensity-matched cohort, respectively ($p < .001$).

Conclusions: This is the largest study of rAAA demonstrating clear short- and long-term survival benefit of rEVAR over rOSR that persisted after matching on all major demographic, comorbid, and anatomic variables. Furthermore, patients undergoing rOSR had twice the LOS with increased rates of complications compared to rEVAR. These data suggest a more aggressive endovascular approach for rAAA in patients with suitable anatomy.

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	HR (95% CI)	P Value
Model 1: Unmatched cohort^a		
Open operative repair	1.80 (1.49-2.18)	<.001
Age ≥ 60 years	1.59 (1.01-2.51)	.047
Female gender	1.37 (1.10-1.70)	.01
Smoking history	0.71 (0.57-0.89)	.003
Congestive heart failure	1.48 (1.13-1.94)	.01
Model 2: Propensity-matched cohort^b		
Open operative repair	2.16 (1.64-2.86)	<.001
Age ≥ 80 years	3.02 (1.53-5.96)	.001
Obesity	1.34 (1.02-1.77)	.04
Smoking history	0.73 (0.53-0.99)	.047
Hypertension	0.62 (0.46-0.83)	.001
Congestive heart failure	1.60 (1.08-2.38)	.02

Table. Predictors of 30-day mortality following rAAA repair in both unmatched (model 1) and matched (model 2) cohorts. HR, hazards ratio; CI, confidence interval.

^a Adjusts for: type of repair, age, gender, race, obesity, smoking history, coronary artery disease, congestive heart failure, maximal aortic diameter, iliac aneurysmal disease. Regression p-value <.001.

^b Adjusts for: type of repair, age, gender, obesity, smoking history, hypertension, preoperative medications, congestive heart failure, maximal aortic diameter, iliac aneurysmal disease. Regression p-value <.001.

	<i>Non-Matched</i>			<i>Matched</i>		
	rEVAR n (%) n=2749	rOSR n (%) n=2180	P	rEVAR n (%) n=724	rOSR n (%) n=724	P
Demographics						
Age, years, median (IQR)	73 (66,81)	72 (66-79)	<.001	72 (66,80)	72 (66,79)	.79
Sex, female	586 (21%)	475 (22%)	.68	127 (19%)	162 (22%)	.10
Caucasian race	2392 (87%)	1984 (91 %)	<.001	653 (90%)	660 (91%)	.53
Comorbidities						
Smoking history	2083 (77%)	1761 (84%)	<.001	590 (82%)	579 (80%)	.46
CHF	337 (13%)	196 (9%)	<.001	59 (8%)	67 (9%)	.46
COPD	780 (29%)	705 (33%)	.002	217 (30%)	224 (31%)	.69
ESRD	45 (2%)	16 (1%)	.01	1 (0.1%)	1 (0.1%)	1
Anatomic						
Prior AAA repair	73 (3%)	217 (10%)	<.001	17 (2%)	19 (3%)	.74
Max AAA diameter, mm, median (IQR)	71 (60,85)	77 (64,90)	<.001	75 (63,89)	75 (63,89)	1
Iliac aneurysmal disease	615 (24%)	476 (23%)	.23	179 (26%)	159 (22%)	.12

Table 1. Demographics of matched and non-matched patients undergoing endovascular (rEVAR) or open (rOSR) repair of ruptured abdominal aortic aneurysm. IQR, interquartile range; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ESRD, end-stage renal disease; AAA, abdominal aortic aneurysm.

Author Disclosures: **L. Wang:** Nothing to disclose; **S. Locham:** Nothing to disclose; **M. Eagleton:** Nothing to disclose; **W. D. Clouse:** Nothing to disclose; **M. Malas:** Nothing to disclose

Presentation #33

Partial Resuscitative Endovascular Balloon Occlusion of the Aorta via the Gore Tri-Lobe Balloon

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Objective: Resuscitative endovascular balloon occlusion of the aorta (REBOA) provides an alternative to resuscitative thoracotomy for hemorrhage control. The morbidity and mortality associated with prolonged aortic occlusion have given rise to the concept of partial REBOA (pREBOA). pREBOA attempts to limit reperfusion injury via allowance of marginal distal aortic blood flow. While promising, this technique is in its infancy. Currently, only one purpose-built prototype device exists for pREBOA. We evaluated the novel use of the Gore® tri-lobe balloon catheter (Gore, Fig.1), otherwise used for endovascular graft placement, as a functional pREBOA catheter in a porcine hemorrhagic shock model.

Methods: Fifteen swine were subjected to 20% controlled hemorrhage with solid organ injury by partial liver lobectomy. Subjects received standard REBOA or partial occlusion with either prototype pREBOA or Gore catheter. Aortic zone 1 catheter placement was utilized. The standard REBOA was inflated to complete occlusion, while the pREBOA and Gore catheters were inflated to target a distal flow rate of 0.5L/min. Balloons remained inflated for 120 minutes from onset of hemorrhage or death. Continuous invasive monitoring and laboratory values were analyzed every 30 minutes using analysis of variance with post hoc pairwise comparison.

Results: One Gore animal was excluded due to early demise from non-study factors. Survival to 120mins was comparable between all study groups: REBOA resulting in 40% survival (2/5), pREBOA 60% (3/5), and Gore 50% (2/4). There was no significant difference in markers of ischemia between the three groups at all measured time points. However, trends towards reduced lactate (8.1 v. 12.8mg/dL, $p=0.093$ and 9.8 v. 16.9mg/dL, $p=0.051$) at both 60 and 120mins, as well as towards significantly higher (more physiologic) pH (7.33 v. 7.09, $p=0.082$) between Gore and REBOA groups at 120mins were noted (Fig.2).

Conclusions: The Gore® tri-lobe catheter represents a potentially viable and commercially available alternative device for partial REBOA. The unique construct may achieve survivable hemorrhage control while maintaining

SCIENTIFIC SESSION ABSTRACTS continued

adequate distal flow to limit reperfusion injury. Further studies should be performed following instrument refinement with larger study populations to confirm this potential.

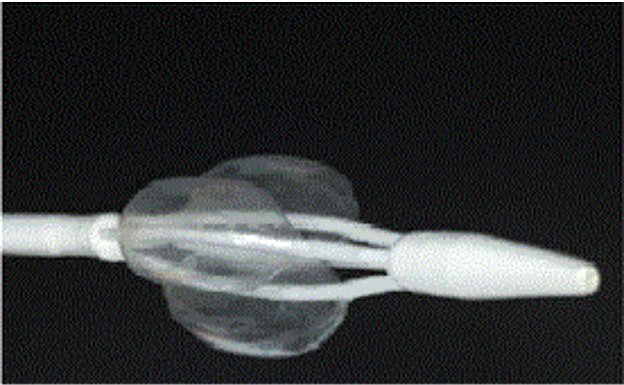


Fig. 1) Gore® tri-lobe catheter

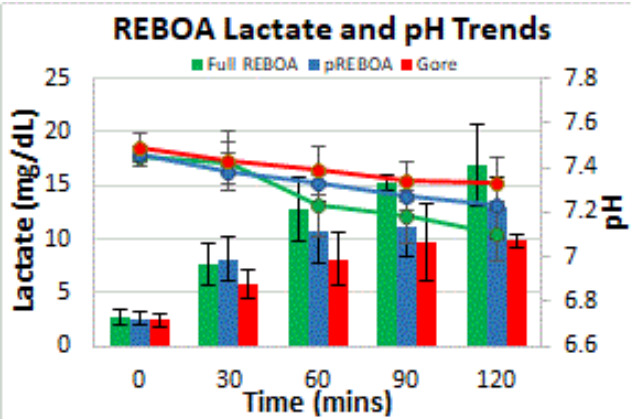


Fig. 2) Lactate (bars) and pH (lines) trends per arm

Author Disclosures: D. Lammers: Nothing to disclose; C. Marengo: Nothing to disclose; D. Forte: Nothing to disclose; J. Kuckelman: Nothing to disclose; K. Morte: Nothing to disclose ; C. Anderson: Nothing to disclose; J. Bingham: Nothing to disclose; M. Eckert: Nothing to disclose; J. Perry: Nothing to disclose

Presentation #34

Antegrade Common Femoral Artery Closure Device use is Safe and Associated with Decreased Complications

Joel L. Ramirez¹, Devin S. Zarkowsky¹, Thomas A. Sorrentino¹, Caitlin W. Hicks², Shant M. Vartanian¹, Warren J. Gasper¹, Michael S. Conte¹, James C. Iannuzzi¹

¹University of California, San Francisco, San Francisco, CA, USA, ²Johns Hopkins University, Baltimore, MA, USA.

Objectives: Antegrade access (AA) of the common femoral artery (CFA) is often utilized for ipsilateral infrainguinal PVI. However, the use of closure devices (CD) for AA is still considered off IFU. We hypothesized that CD use for AA would not be associated with an increased odds of access site complications.

Methods: The VQI was examined from 2010 to 2019 for infrainguinal PVIs with CFA AA. Patients who had a cutdown or multiple access sites were excluded. Cases were then stratified into whether a CD was utilized or not. Hierarchical multivariable logistic regressions controlling for hospital level variation were used to examine the independent association between CD use and access site complications while controlling for confounders meeting <0.01 on univariate analyses for the outcome. A sensitivity analysis using coarsened exact matching (CEM) was performed using factors different between treatment groups to reduce residual confounding.

Results: Overall, 11,562 cases were identified, and 5,693 (49.2%) utilized a CD. Patients treated with a CD were less likely to be white (74.1% vs 75.2%), have CAD (29.7% vs 33.4%), use aspirin (68.7% vs 72.4%), and be reversed with protamine (15.5% vs 25.6%; all <0.05). CD patients were more likely to be obese (31.6% vs 27.0%), have an elective operation (82.6% vs 80.1%), ultrasound guided access (75.5% vs 60.6%), and a larger access sheath (6.0±1.0 vs 5.5±1.0 Fr; <0.05 for all). CD cases were less likely to develop any access site hematoma (2.55% vs 3.53%; <0.01) or a hematoma requiring reintervention (0.63% vs 1.26%; <0.01) and had no difference in access site stenosis or occlusion (0.30% vs 0.22%; =0.47) compared to no CD. On multivariable adjusted analysis, CD cases had significantly decreased odds of developing any access site hematoma (OR=0.75; 95% CI=0.59-0.95) and a hematoma requiring intervention (OR=0.56; 95% CI=0.38-0.81) (Table 1). A sensitivity analysis after CEM confirmed these findings (Table 2).

Conclusions: In this nationally representative sample, off IFU CD for AA were

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safe and associated with lower odds of hematoma. CD for AA may improve AA outcomes with a potential to decrease healthcare utilization associated with sheath removal.

Table 1. Unmatched Multivariable Analysis of Access Complications Comparing the Use of Closure Devices			
Complication	OR	95% CI	P Value
Any Hematoma ^a	0.75	0.59-0.95	0.02
Hematoma Requiring Intervention ^b	0.56	0.38-0.81	<0.01
Stenosis or Occlusion ^c	1.43	0.60-3.39	0.41
^a Adjusted for age, gender, elective operation, volume of contrast used, history of diabetes, prior major amputation, prior inflow stent or angioplasty, and prior infrainguinal bypass.			
^b Adjusted for age, gender, elective operation, CHF, and prior infrainguinal bypass.			
^c Adjusted for elective operation and history of CABG or PCI.			

Table 2. Matched ^a Multivariable Analyses			
Complication	OR	95% CI	P Value
Any Hematoma ^b	0.74	0.54-1.00	0.05
Hematoma Requiring Intervention ^c	0.54	0.29-0.99	0.05
Stenosis or Occlusion ^d	0.97	0.28-3.42	0.96
^a Matched for white, obese, CAD, CHF, aspirin use, history of CABG or PCI, prior major amputation, prior inflow stent or angioplasty, prior infrainguinal bypass, elective operation, ultrasound guided access, largest access sheath used, and heparin reversal with protamine.			
^b Adjusted for age, gender, elective operation, volume of contrast used, history of diabetes, prior major amputation, prior inflow stent or angioplasty, and prior infrainguinal bypass.			
^c Adjusted for age, gender, elective operation, CHF, and prior infrainguinal bypass.			
^d Adjusted for elective operation and history of CABG or PCI.			

Author Disclosures: **J. Ramirez:** Nothing to disclose; **D. Zarkowsky:** Nothing to disclose; **T. Sorrentino:** Nothing to disclose; **C. Hicks:** Nothing to disclose; **S. Vartanian:** Nothing to disclose; **W. Gasper:** Nothing to disclose; **M. Conte:** Nothing to disclose; **J. Iannuzzi:** Nothing to disclose

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Presentation #35

Long Term Outcomes of the Ovation Stent Graft System IDE Trial for Endovascular Abdominal Aortic Aneurysm Repair

Andrew Barleben¹, Asma Mathlouthi¹, Manish Mehta², Thomas Nolte³, Francisco Valdes⁴, Mahmoud B. Malas¹

¹University of California, San Diego, San Diego, CA, USA, ²Albany Medical College, Albany, NY, USA, ³The Heart and Vascular Center, Bad Bevensen, Germany, ⁴Instituto Vascular De Santiago, Santiago, Chile.

Objectives: To report the 5-year outcomes of the FDA-IDE clinical trial of EVAR with the Ovation stent graft for elective treatment of AAA.

Methods: The study comprised 161 patients who underwent EVAR as part of the prospective international multicenter pivotal Ovation stent graft trial. The main inclusion criteria were AAA diameter ≥ 5 cm, proximal neck length ≥ 7 mm, neck angulation $\leq 60^\circ$ and bilateral iliac fixation length ≥ 10 mm. The primary end-point was a composite outcome of primary clinical success at 5 years. Primary clinical success was defined in accordance with SVS guidelines as successful aneurysm exclusion without aneurysm-related death, type I or III endoleak (EL), graft infection or thrombosis, aneurysm expansion, aneurysm rupture, graft migration or conversion to open repair. Secondary end-points included freedom from reintervention, all-cause mortality (ACM) and aneurysm-related mortality (ARM).

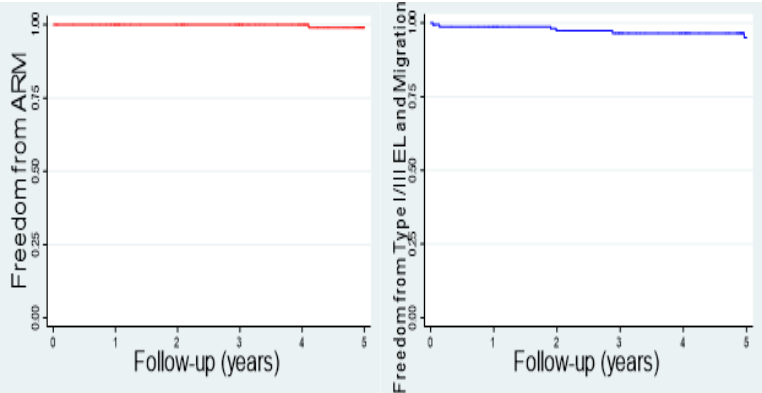
Results: Patients were predominantly male (87.6%), elderly with a mean age of 73 ± 0.6 years. Almost half the patients (66 patients, 41%) had a challenging anatomy and would be considered outside the instructions for use (IFU) with other stent grafts, 26 patients (16.2%) had a proximal neck length < 10 mm and 53 (33%) had a minimum access vessel diameter < 6 mm. Technical success was 100%. Of 126 surviving patients, 84 (66.7%) completed 5-year follow-up with a mean follow-up of 54 ± 1 months. The 5-year primary clinical success rate was 78%, ARM was 1% (1 patient) and ACM was 25% (Figure1). The AAA-related death Resulted from AAA post-EVAR rupture at 49 months in a patient who refused treatment for a type Ib EL. Freedom from type I and III EL was 95.1%. Freedom from secondary interventions was 80.2%. Most of the reinterventions were performed for type II EL (15, 55.6%) or for limb thrombosis or stenosis (7, 25.9%). Throughout the 5 years, there were no migrations or open conversions.

Conclusions: Five-year results from the Ovation pivotal IDE trial demonstrate excellent long-term durability of this endograft despite challenging anatomy in 41% of patients. There were no migrations or conversions to open and 99%

SCIENTIFIC SESSION ABSTRACTS continued

freedom from aneurysm related mortality. These Resultss suggest a less invasive on-label endovascular option for patients with challenging anatomy who may otherwise require open repair.

Figure 1: Freedom from ARM, Type I/III EL and Migration



Author Disclosures: **A. Barleben:** Nothing to disclose; **A. Mathlouthi:** Nothing to disclose; **M. Mehta:** Nothing to disclose; **T. Nolte:** Nothing to disclose; **F. Valdes:** Nothing to disclose; **M. Malas:** Nothing to disclose

SCIENTIFIC SESSION ABSTRACTS continued

Presentation #36

Endovenous Deep Vein Valve Creation for the Treatment of Chronic Venous Insufficiency

Gary K. Yang, Jerry Chen, Joel Gagnon, Lindsay Machan

University of British Columbia, Vancouver, BC, Canada.

Objectives: To assess the safety and efficacy of endovenous formation of autogenous neo deep vein valves in patients with chronic venous insufficiency secondary to deep vein reflux.

Methods: Patients with deep vein reflux and CEAP classification C4-C6 were treated with the BlueLeaf® endovenous valve formation system in 5 centres in New Zealand, Australia and Canada. Retrograde access to the common femoral vein was obtained followed by contrast venography and intravascular ultrasound to assess suitability of treatment sites. Suitable candidates will then have the valve creation device inserted to form monocuspid valves in the femoropopliteal vein segments spanning 7-11 mm in diameter. Successful valve creation was confirmed by intraoperative imaging. Patients were placed on 6 months of anticoagulation. Clinical outcomes include duplex ultrasound, physical exam and patient questionnaires.

Results: A total of 12 patients have been treated with CEAP classifications in C4 (n=2), C5 (n=5) and C6 (n=5) for both primary (n=8) and secondary (n=3) etiology and 1 undetermined. Successful valve creation occurred in 11/12 patients. Single valve formation was done in 5 patients, 2 valves in 5 patients and 3 valves in on patient. Present follow up ranges from 7 days to 1 year. During this period no occlusive DVT were reported. Access site complications were noted in 8 cases that were self-limiting. Mural thrombus was seen in 3 patients that all resolved by 90 days. Of the subject that reached at least 210 days follow up, 7/9 patients had ≥ 4 point improvement on the venous clinical severity score.

Conclusion: Preliminary data suggest that endovenous deep valve creation is a novel technique that shows promise in treating deep venous insufficiency.

Author Disclosures: **G. Yang:** Nothing to disclose; **J. Chen:** Nothing to disclose; **J. Gagnon:** Cook Medical Consultant; **L. Machan:** Boston Scientific – Medical Advisory Board

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,

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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.

CONSTITUTION & BYLAWS continued

4. The President shall preside at meetings of the Society and the 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.

CONSTITUTION & BYLAWS continued

9. The Recorder shall ensure receipt of all papers and reports of 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.

CONSTITUTION & BYLAWS continued

5. The Chairman of the Local Arrangements Committee for the 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.

CONSTITUTION & BYLAWS continued

6. The Executive Session of the Society, attendance at which shall be limited to active, senior and honorary members, shall be held 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

CONSTITUTION & BYLAWS continued

above. The Secretary-Treasurer shall, within thirty-(30) days after revocation of active membership pursuant to this section, send 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.

CONSTITUTION & BYLAWS continued

ARTICLE X – FEES AND DUES

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

CONSTITUTION & BYLAWS continued

ARTICLE XIII – PROCEDURE

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

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

CONSTITUTION & BYLAWS continued

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



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