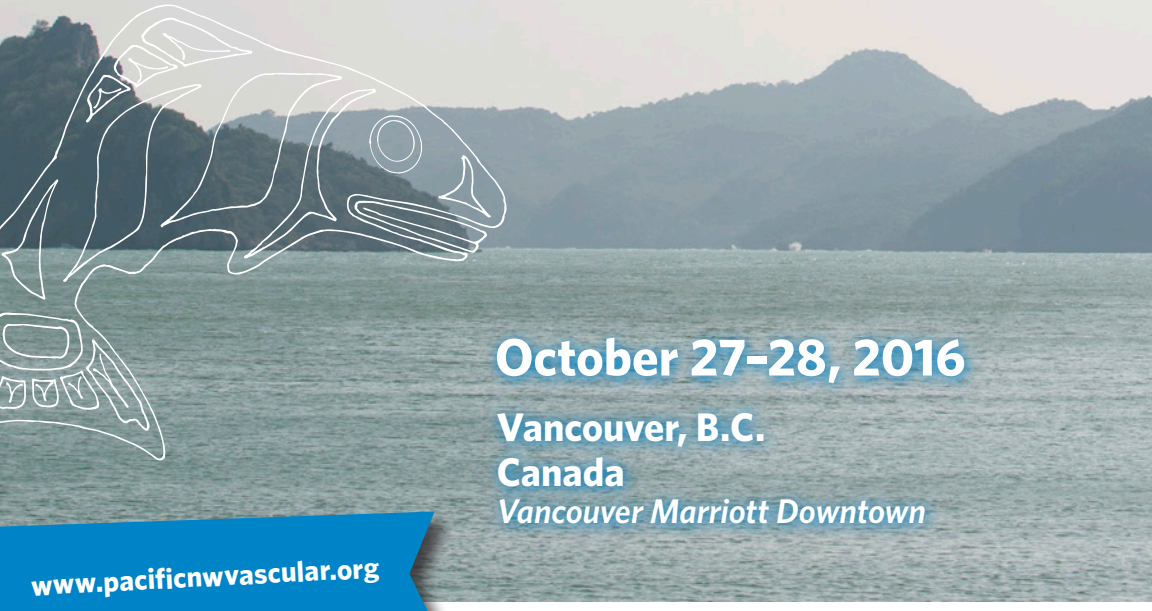
PNWVS 2016 ANNUAL MEETING

FINAL PROGRAM



October 27–28, 2016

Vancouver, B.C.
Canada
Vancouver Marriott Downtown

www.pacificnwvascular.org

PACIFIC NORTHWEST VASCULAR SOCIETY

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2016 Annual Meeting

Vancouver, B.C.
Canada
Vancouver Marriott Downtown

CONTACT INFORMATION

Pacific Northwest Vascular Society
1411 5th Street
Anacortes, WA 98221

(T) 360-420-6906
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pnwvascular@gmail.com
pacificnwvascular.org

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Nam Tran, MD	Program Chairman, Senior Councilor
Keith Baxter, MD	Middle Councilor
Glen Roseborough, MD	Middle Councilor
Charles McQuinn, MD	Junior Councilor
Christian Hamlat, MD	Junior Councilor

MEETING AT A GLANCE

Thursday, October 27

3:00 – 8:00 p.m.	**Registration Open**
4:00 – 5:30 p.m.	**Executive Council Meeting**
6:00 – 7:00 p.m.	**Business Meeting** *(Members Only)*
7:00 – 9:00 p.m.	**Welcome Reception with Industry Technology Showcase & Digital ePoster Session**
7:00 – 9:00 p.m.	**Innovation Lab**

Friday, October 28

6:00 a.m. – 12:30 p.m.	**Registration Open**
6:00 – 7:15 a.m.	**Group Bike Tour of Stanley Park**
7:00 – 8:00 a.m.	**Breakfast Buffet with Educational Exhibitors**
7:00 a.m. – 3:00 p.m.	**Exhibits and Innovation Lab Open**
7:45 – 8:00 a.m.	**Presidential Welcome — Erica Mitchell, MD**
8:00 – 9:30 a.m.	**Scientific Session I: Aortic Disease I**
9:30 – 10:00 a.m.	**Resident Debate**
10:00 – 10:30 a.m.	**Coffee Break with Educational Exhibitors**

MEETING AT A GLANCE

10:30 a.m. – 12:00Noon	**Scientific Session II: Peripheral Vascular Disease**
12:00Noon – 12:30 p.m.	**Invited Lecturer — Bruce Perler, MD**
12:30 – 1:00 p.m.	**Box Lunch with Educational Exhibitors**
1:00 – 3:00 p.m.	**Scientific Session III: Aortic Disease II**
3:00 – 3:30 p.m.	**Coffee Break with Educational Exhibitors**
3:30 – 4:00 p.m.	**Scientific Session IV: The Vascular Laboratory**
4:00 – 5:00 p.m.	**Scientific Session V: Vascular Potpourri**
5:00 p.m.	**Meeting Adjourns**
5:00 – 6:00 p.m.	**Closing Reception and Awards**
7:00 – 9:00 p.m.	**Hockey Night in Vancouver — Canucks vs. Oilers**

WELCOME TO THE 2016 PNWVS NEW MEMBERS

Jason Faulds

Daniel Kopac

Nathan Aranson

Craig Seidman

Steven Johnson

James Roberts

Joe Haydu

LeAnn Chavez

Learn more and apply for membership here.

PAST MEETINGS

Seattle, WA	1984
Portland, OR	1985
Tacoma, WA	1986
Vancouver, BC	1987
Coeur D'Alene, ID	1988
Victoria, BC	1989
Seattle, WA	1990
Portland, OR	1991
Tacoma, WA	1992
Vancouver, BC	1993
Coeur D'Alene, ID	1994
Victoria, BC	1995
Seattle, WA	1996
Portland, OR	1997
Tacoma, WA	1998
Vancouver, BC	1999
Coeur D'Alene	2000
Victoria, BC	2001
Seattle, WA	2002
Portland, OR	2003
Tacoma, WA	2004
Vancouver, BC	2005
Spokane, WA	2006
Victoria, BC	2007
Portland, OR	2008
Seattle, WA	2009
Kelowna, BC	2010
Seattle, WA	2011
Vancouver, BC	2012
Coeur D'ALene, ID	2013
Portland, OR	2014
Seattle, WA	2015

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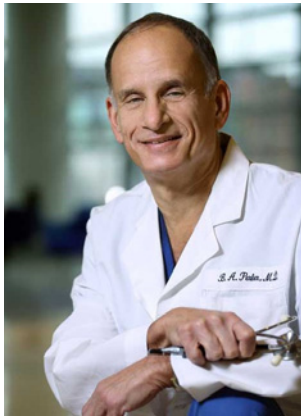
Benjamin Starnes, MD, President Erica Mitchell, MD, Secretary-Treasurer Nam Tran, MD, Program	2015

INVITED LECTURER



Evidence Based Medicine & the Management of Asymptomatic Cariod Disease: What Should We Do Before We Complete CREST 2

Bruce A. Perler, M.D., M.B.A.

Dr. Perler is the Julius H. Jacobson II, M.D. Professor of Surgery, the Johns Hopkins University School of Medicine, and Vice-Chair for Clinical Operations and Finance, Department of Surgery, and Chief Emeritus, Division of Vascular Surgery & Endovascular Therapy, and Director of the Vascular Noninvasive Laboratory, The Johns Hopkins Hospital. He is the Co-Editor of *Rutherford's Textbook of Vascular Surgery and Endovascular Therapy, 9th Edition,* and served as the Senior Editor of the *Journal of Vascular Surgery* publications from 2009- 2016. He has held many leadership positions in vascular surgery, and is the immediate Past President of the Society for Vascular Surgery.

PAST GUEST LECTURERS

Robert Barnes, MD, University of Arkansas	1986
K. Wayne Johnston, MD, University of Toronto	1987
Richard Kempczinski, MD, University of Cincinnati	1988
Brian L. Thiele, MD, Pennsylvania State University	1989
Jonathan B. Towne, MD, Medical College of Wisconsin	1990
Paul M. Walker, MD, University of Toronto	1991
Dennis F. Bandyk, MD, University of South Florida	1992
Robert L. Kistner, MD, Straub Clinic, Honolulu	1993
Allan R. Downs, MD, University of Manitoba	1994
Ralph B. Dilley, MD, Scripps Clinic, La Jolla	1995
Peter Gloviczki, MD, Mayo Clinic, Rochester	1996
Frank Veith, MD, Montefiore Medical Center, Bronx	1997
Kenneth Cherry, MD, Mayo Clinic, Rochester	1998
Robert Zwolak, MD, Dartmouth-Hitchcock, Lebanon	1999
Jerry Goldstone, MD, Case Western Reserve, Cleveland	2000
Carlos Donayre, MD, Harbor UCLA, Torrance	2001
Ronald Dalman, MD, Stanford University	2002
Dennis Bandyk, MD, University of South Florida	2003
Thomas Lindsay, MD, University of Toronto	2004
Joseph L. Mills, MD, University of Arizona	2005
Wesley Moore, MD, UCLA School of Medicine	2006
David Gillespie, MD, Walter Reed Medical Center, Bethesda	2007
David Cossman, MD, Cedar-Sinai Medical Center, Los Angeles	2008
Cherrie Z. Abraham, MD, McGill University, Montreal	2009
Mark Fillinger, MD, Dartmouth-Hitchcock Medical Center, Hanover	2010
Joseph L. Mills, MD, University of Arizona	2011
Daniel F. Bandyk, MD, University of California - San Diego School of Medicine	2012
Thomas L. Forbes, MD, Professor of Surgery, Western University, Chief of Vascular Surgery, London Health Sciences Centre	2013
Donald Trunkey, MD, Oregon Health and Science University	2014
Bruce Gewertz, MD, Cedars Sinai Health System	2015

INTENDED AUDIENCE

The PNWVS meeting is designed for:

- Vascular surgeons
- Fellows/residents in vascular surgery and general surgery programs
- Physicians in related specialties
- Interventional radiologists working in the vascular imaging and intervention field
- Physician assistants and nurses involved in the care of vascular surgical patients
- Vascular technologists and vascular lab administrators
- Medical students interested in vascular surgery or vascular surgery related research

PROGRAM LEARNING OBJECTIVES

At the end of this program, participants should be able to:

SCIENTIFIC SESSION I: Cerebrovascular Disease

- Describe the clinical and technical management principles for asymptomatic carotid artery disease
- Describe the clinical and technical management principles for symptomatic carotid artery disease
- Describe current management principles for carotid and vertebral artery dissection
- Identify new methodologies for the diagnosis and treatment of vascular disease as it relates to cerebrovascular disease

SCIENTIFIC SESSION II: Peripheral Vascular Disease

- Describe the clinical and technical management principles for patients with Peripheral Artery Disease and claudication
- Identify useful adjunctive treatment modalities to assist in wound healing chronic wounds associated with Peripheral Artery Disease
- Analyze opportunities for system improvement in managing patients with vascular disease and chronic wounds to improve limb preservation

SCIENTIFIC SESSION III: Aortic Disease

- Describe the clinical and technical management principles for thoracic aortic aneurysms and great branch vessels
- Describe the clinical and technical management principles for abdominal aortic aneurysms and visceral vessels
- Describe the clinical and technical management principles for aortic and branch vessel dissection
- Identify key features in the clinical and technical management of complications related to repair of thoracic and abdominal aortic aneurysms
- Explain the surgical approaches for both occlusive and aneurysmal visceral artery disease
- Identify new methodologies for the diagnosis and treatment of vascular disease as it relates to aortic aneurysm disease
- Analyze opportunities for system improvement in managing patients with acute and chronic aortic syndromes

SCIENTIFIC SESSION IV: The Vascular Laboratory

- Describe ultrasound findings associated with deep venous thrombosis
- Use the vascular laboratory as a resource to diagnose and manage nutcracker syndrome
- Compare CT scan and ultrasound for evaluation of the aorta

SCIENTIFIC SESSION V: Vascular Potpourri

- Evaluate various quality of life measures and calculate what is most meaningful for their practice
- Describe the current therapy for management of digit ischemia
- Identify the role of vascular surgery in the management of intestinal malignancy
- Apply techniques of fistula creation to their current practice
- Describe factors influencing surgical and endovascular outcomes after fistula creation
- Identify new methodologies for the diagnosis and treatment of vascular disease as it relates to end-stage renal disease
- Describe new technologies for dialysis access
- Analyze opportunities for system improvement in managing patients with dialysis access needs

ACCREDITATION STATEMENT

Canadian Society for Vascular Surgery
Société canadienne de chirurgie vasculaire
P.O. Box 58062, Ottawa ON K1C 7H4
Tel : (613) 286-7583 Email : info@canadianvascular.ca

This program has been reviewed and approved under Section 1 (Accredited Group Learning Activities) of the Framework of CPD Options of the Maintenance of Certification program for a total of 9.50 hours. (Thursday poster session 2.0 hours, Friday AM 4:00 hours, Friday PM 3.50 hours)

"This event is an Accredited Group Learning Activity (Section 1) as Defined by the Maintenance of Certification program of The Royal College of Physicians And Surgeons of Canada" "This activity has been approved by the Canadian Society For Vascular Surgery".

In addition, in order for your participants to convert their Royal College MOC credits to *AMA PRA Category 1 Credits,* you are required to also include the following statement in all printed conference materials including the Final Program and Certificate of Attendance:

"*Through an agreement between the Royal College of Physicians and Surgeons of Canada and the American Medical Association, physicians may convert Royal College MOC credits to AMA PRA Category 1 Credits™. Information on the process to convert Royal College MOC credit to AMA credit can be found at* **www.ama-assn.org/go/internationalcme."**

Self-assessment question links will be emailed to you post meeting for completion. Meeting evaluations can be completed online using this link: www.pacificnwvascular.org

Scientific Session Agenda

THURSDAY OCTOBER 27, 2016

4:00 pm – 5:30 pm
Council Meeting

7:00 pm – 9:00 pm
Innovation Lab Open

6:00 pm – 7:00 pm
Business Meeting

7:00 pm – 9:00 pm
Welcome Reception & ePoster Session

7:00pm – 8:00pm

ePoster Session Agenda

POSTER #1 **An Unusual Case of Aortic and Medium Vessel Vasculitis**
TL Repella, E Jung, CZ Abraham, AF Azarbal, TK Liem, GJ Landry, GL Moneta, EL Mitchell
Presenter: Tana Repella, MD, PhD – Oregon Health & Science University

POSTER #2 **Novel Technique for Repair of Arteriovenous Fistula Aneurysms**
MA Bartek, AL Rodriguez, MH Meissner
Presenter: April Rodriguez, MD – University of Washington

POSTER #3 **Technique for Compartment Release in Chronic Exertional Compartment Syndrome**
Authors: SK Desikan, N Singh
Presenter: Sarasi Desikan, MD – University of Washington

POSTER #4 **Use of Intravascular Ultrasound And Endovascular Stenting for a Malpositioned Pedicle Screw Penetrating the Abdominal Aorta in an 11-Year-Old**
A Chopra, J Kaufman, T Liem
Presenter: Atish Chopra, MD – Oregon Health and Science University

POSTER #5 **Endovascular Total Arch Repair Using In Situ Laser Fenestration**
TL Repella PhD, OK Alabi, S Nazaretyan, JA Kaufman, VM Rodriguez
Presenter: Tana Repella, MD, PhD – Oregon Health & Science University

POSTER #6 **Open Surgical Conversion for EVAR Failure: What to do about Transrenal Fixation Endograft**
S Desikan, B Starnes, NT Tran
Presenter: Sarasi Desikan, MD – University of Washington

FRIDAY, OCTOBER 28, 2016

6:00 am – 12:30 pm
Registration Open

7:00 am – 5:00pm
Innovation Lab and Exhibits Open

7:00 am – 8:00am
Breakfast with Exhibitors

7:45 am – 8:00am
Presidential Address/Welcome – Erica Mitchell, MD

8:00 – 9:30am

SCIENTIFIC SESSION I: Aortic Disease

Moderator: Erica Mitchell, MD – PNWVS President, Professor of Surgery, OHSU

8:00 – 8:15am
#1*: **Family History of Aortic and Arterial Aneurysms and Dissections is Associated With Type B Aortic Dissection: Preliminary Data**
R Campbell, MA Bartek, M Pepin, A Cecchi, S Dadashazar, P Byers, DM Milewicz, S Shalhub
Presenter: Rebecca Campbell, BS – University of Washington

8:15 – 8:30am
#2*: **Preliminary Experience With the Squid-Capture Technique for In-Situ Fenestration in TEVAR**
J Misskey, J Gagnon, K Baxter, J Faulds, J Chen
Presenter: Jonathan Misskey, MD – Vancouver General Hospital

8:30 – 8:45am
#3*: **Gastrointestinal Complications Predict Near And Long-Term Mortality After Repair Of Aorto-Enteric Fistula**
A Chopra, L Cieciura, JG Modrall, RJ Valentine, J Chung
Presenter: Atish Chopra, MD – Oregon Health & Science University

8:45 – 9:00am
#4: **Endovascular Thoracic Aortic Repair In Patients With Genetically Triggered Thoracic Aortic Dissection**
S Shalhub, FM Asch, SA LeMaire, KA Eagle, NL Pugh, DM Milewicz, The GenTAC Investigators
Presenter: Sherene Shalhub, MD – University of Washington

9:00 – 9:15am
#5*: **Pediatric Blunt Abdominal Aortic Injury (BAI)**
A Chopra, L Cieciura, JG Modrall, RJ Valentine, S Josephs, BJ Naik-Mathuria, J Chung
Presenter: Atish Chopra, MD – Oregon Health and Science University

9:15 – 9:30am
#6: **Correlates of Utilization of Hypothermic Circulatory Arrest and Risk of Operative Mortality in Thoracoabdominal Aortic Repair**
J Faulds, H Sandhu, A Tanaka, R Afifi, C Miller III, A Estrera, H Safi
Presenter: Jason Faulds, MD – Vancouver General Hospital

9:30 – 10:00am
Vascular Fellow Debate – All Uncomplicated Type B Aortic Dissection Should be Treated (10 minutes presentation, 2 minutes rebuttal)
For: Olamide Alabi, MD, Oregon Health and Science University
Against: Prince Esiobu, MD, University of Washington

10:00 – 10:30am
Coffee Break and Exhibits

10:30 – 12:00pm

SCIENTIFIC SESSION II: Peripheral Vascular Disease

Moderators: *Glen Roseborough, MD* – *Middle Councilor, Advanced Vascular Therapy, Salem, OR.*

10:30 – 10:45am

#7*: **Diabetic Foot Ulcer Location Affects Rates of Major Amputation**
Nasibeh Vatankhah, Cherrie Abraham, Gregory Landry, Gregory Moneta, Amir-Farzin Azarbal
Presenter: Nasibeh Vatankhah MD – Oregon Health & Science University

10:45 – 11:00am

#8*: **Femoral Vein Conduits Have Superior Patency Compared to Prosthetic Grafts for Femoral–Femoral Bypass**
KP Nguyen, TL Repella, K Perrone, AF Azarbal, EL Mitchell, TK Liem, GL Moneta, GJ Landry
Presenter: Tana Repella, MD, PhD – Oregon Health & Science University

11:00 – 11:15am

#9*: **Functional Electrical Stimulation Reduces Intermittent Claudication and Enhances Quality of Life for Patients With Peripheral Arterial Disease**
AL Rodriguez, DG Embrey, FG Vladimir
Presenter: April Rodriguez, MD – University of Washington

11:15 – 11:30am

#10*: **Autogenous Alternative Vein Bypass Remains the Preferred Conduit When Saphenous Vein is not Available**
D Wilson, J Wagner BS, S Harris, A Azarbal, E Mitchell, G Landry, G Moneta, E Jung
Presenter: Dale Wilson, MD – Oregon Health & Science University

11:30 – 11:45am
#11*: **Tibial Artery Duplex Derived Peak Systolic Velocities are an Objective Performance Measure After Endovascular Therapy for Arterial Stenosis**
D Wilson, J Crawford, C Barton, S Harris, A Azarbal, E Mitchell, E Jung, G Moneta, G Landry
Presenter: Dale Wilson, MD – Oregon Health & Science University

11:45 – 12:00pm
#12*: **Risk Factors for Surgical Site Infection in Groin Wounds in Lower Extremity Revascularization Post Hospital Discharge**
Kevin Lee, Bill Huang, Audra Duncan, Luc Dubois, MSc, Guy DeRose, Adam Power, MPhil
Presenter: Bill Huang, B.Sc. - Western University

12:00 – 12:30pm
Evidenced Based Medicine & The Management of Asymptomatic Carotid Disease: What Should We Do Before We Complete CREST 2
Invited Lecturer: Bruce A. Perler, MD, MBA, Julius H. Jacobson II, M.D., Professor of Vascular Surgery; vice chair for clinical operations and financial affairs for the Department of Surgery; and chief emeritus of the Division of Vascular Surgery and Endovascular Therapy, Johns Hopkins Hospital, Baltimore, MD

12:30 – 1:00pm
Lunch

1:00 – 3:00pm

SCIENTIFIC SESSION III: Aortic Disease II

Moderators: *Chuck McQuinn, MD –* *Junior Councilor, Group Health, Seattle, WA*

1:00 – 1:15pm

#13: **Early Results with the use of a Patient-Specific Three Dimensional Printed Fenestration Template in a Physician Sponsored Investigational Device Exemption Clinical Trial to Treat Juxtarenal Aortic Aneurysms**

B Starnes

Presenter: Benjamin Starnes, MD – University of Washington

1:15 – 1:30pm

#14*: **Transapical Delivery of a Custom Branched Aortic Arch Endograft in an Animal Model**

S MacDonald, J Misskey, M Robinson, R Sidhu, B Munt, J Clement

Presenter: Jonathan Misskey, MD – Vancouver General Hospital

1:30 – 1:45pm

#15*: **Institution of a Reboa (Resuscitative Endovascular Balloon Occlusion of the Aorta) Protocol at a Level 1 Trauma Center**

S Aarabi, EM Bulger, E Quiroga, N Singh, BW Starnes, NT Tran

Presenter: Shahram Aarabi, MD – University of Washington

1:45 – 2:00pm

#16*: **Standard TEVAR Compared to Petticoat Technique in Aortic Dissection***

KA Arsenault, D Klass, J Price, MT Janusz, J Gangon, J Chen, J Faulds

Presenter: Kyle Arsenault, MD – University of British Columbia

2:00 – 2:15pm

#17*: **Uncertain Patency of Covered Stents Placed for Traumatic Axillo-Subclavian Artery Injury**

A Chopra, JG Modrall, M Knowles, HA Phelan, RJ Valentine, J Chung

Presenter: Atish Chopra, MD – Oregon Health & Science University

2:15 – 2:30pm
#18*: **Management of the Left Subclavian Artery During Thoracic Endovascular Aortic Repair**
KA Arsenault, J Faulds, D Klass, J Price, MT Janusz
Presenter: Kyle Arsenault, MD – University of British Columbia

2:30 – 2:45pm
#19*: **Establishing Branch Angle Boundary Conditions In Fenestrated-Branched Endografts**
JA Matthews, MP Sweet
Presenter: Jamil Matthews, MD – University of Washington

2:45 – 3:00pm
#20: **Endovascular Repair of Extend II-IV Thoracoabdominal Aortic Aneurysms**
J Faulds, J Misskey, J Gagnon, K Baxter, J Chen, D Klass, J Price, M Janusz
Presenter: Jonathon Misskey, MD

3:00 – 3:30pm
Coffee Break

3:30 – 4:00pm
Scientific Session IV: The Vascular Laboratory
Moderator: *Thomas Hatsukami, MD,* *University of Washington*

3:30 – 3:45pm
#21*: **Characterization of Profunda Femoris Vein Thrombosis**
TL Repella, O Britantchouk, TK Liem, EL Mitchell, GJ Landry, GL Moneta, E Jung
Presenter: Tana Repella, MD, PhD – Oregon Health & Science University

3:45 – 4:00pm
#22: **Duplex Ultrasound for the Diagnosis of Nutcracker Phenomenon**
SM Skjonsberg BS RVT RPhS
Presenter: Sara Skjonsberg, RVT, RPhS – University of Washington

4:00 –5:00pm

Scientific Session V: Vascular Potpourri

Moderators:

Nam T. Tran, MD – *Program Chair, Associate Professor Surgery, UW*

Brian Ferris, MD *– Secretary Treasurer, Lake Washington Vascular*

4:00 – 4:15pm

#23*: **Interhospital Vascular Surgery Transfers at a Tertiary Care Hospital**

S Harris, D Wilson, E Jung, G Moneta, E Mitchell

Presenter: Sheena Harris, MD

4:15 – 4:30pm

#24*: **Causes And Outcomes Of Finger Ischemia In Hospitalized Patients In The Intensive Care Unit**

CJ Mostul, DS Ahn, BJ McLafferty, TK Liem, EL Mitchell, E Jung, CZ Abraham, AF Azarbal, GL Moneta, GJ Landry

Presenter: Courtney Mostul – Oregon Health & Science University

4:30 – 4:45pm

#25*: **Cryopreserved Vein Versus Autogenous Vein in Portomesenteric Reconstruction During Pancreaticoduodenectomy**

O Alabi, S Harris, S Roy, S Madison, T Liem, G Landry, E Jung, G Moneta, E Mitchell

Presenter: Olamide Alabi, MD – Oregon Health & Science University

4:45 – 5:00pm

#26*: **Hemodialysis for Elderly Renal Failure Patients: An Age-based Comparison of Fistula Location, Patency, Maturation and Patient Survival**

Authors: J Misskey, J Faulds, R Sidhu, K Baxter, J Gagnon, Y Hsiang

Presenter: Jonathan Misskey, MD – Vancouver General Hospital

Abstracts

POSTER #1 AN UNUSUAL CASE OF AORTIC AND MEDIUM VESSEL VASCULITIS

Presenter: Tana Repella, MD, PhD - Oregon Health & Science University

Authors: TL Repella MD PhD, E Jung MD, CZ Abraham MD, AF Azarbal, MD, TK Liem MD, GJ Landry MD, GL Moneta MD, EL Mitchell MD

Background: Here we present the case of a 65-year-old female with progressive abdominal pain and CT findings of aortic and medium vessel vasculitis.

A previously healthy 65-year-old female presented to an outside hospital with a one week history of abdominal pain. Workup was significant for a CT concerning for bilateral pyelonephritis with possible abscess and she was admitted for treatment with antibiotics for suspected pyelonephritis. Three days post discharge she returned to the outside hospital with worsening back pain and new onset emesis. CT scan was repeated and was concerning for possible mycotic aneurysm of the abdominal aortic bifurcation with dye extravasation into the soft tissue concerning for leak. The patient remained hemodynamically stable and she was transferred to our institution for further management. As she remained afebrile throughout her course with negative cultures and negative infectious workup an infectious etiology was deemed unlikely and Rheumatology was consulted for further workup due to concern for vasculitis. Workup revealed elevated ESR and CRP while antibodies against proteinase-3 (ANCA) were negative. Angiogram was performed which showed major extensive medium vessel abnormalities including the hepatic, gastroduodenal, peripancreatic, superior mesenteric artery (SMA), inferior mesenteric artery (IMA), and renal vessels. There was a pseudoaneurysm in the aorta at the branch point with irregularities of the right external iliac artery.

Method: Treatment was initiated with a 3-day pulse of methylprednisolone after which she was transitioned to daily prednisone. She was also started on monthly cyclophosphamide infusions. CTA on discharge showed a slight decrease in size of the known aortic bifurcation pseudoaneurysm; patent celiac artery with moderate narrowing at the transition from the common hepatic to proper hepatic artery; and luminal irregularities of the SMA, IMA, left renal, and right renal arteries.

Results: At follow up one month post discharge abdominal pain had resolved and the patient was experiencing bilateral knee and ankle pain. Follow up CTA showed resolution of the abdominal aortic pseudoaneurysm. There was also a new occlusion of the hepatic artery pseudoaneurysm. Luminal irregularities of the SMA, IMA, left renal, and right renal arteries were stable when compared to CTA prior to discharge.

Conclusion: The extent of disease involvement in this case was atypical as there was multisystem involvement affecting the renal, hepatic, and mesenteric vessels in addition to involvement of the aorta. Thus this case details an unusual presentation of vasculitis in a 65-year-old female involving both medium and large vessels.

POSTER #2 NOVEL TECHNIQUE FOR REPAIR OF ARTERIOVENOUS FISTULA ANEURYSMS

Presenter: April Rodriguez, MD - University of Washington

Authors: MA Bartek MD, AL Rodriguez MD, MH Meissner MD

Background: Permanent vascular access for hemodialysis is needed in many patients with end-stage renal disease. The creation of an arteriovenous fistula (AVF) for hemodialysis can lead to a variety of thrombotic, non-thrombotic and infectious complications. One of these complications is aneurysmal dilatation, which can further lead to rupture, infection and erosion of the overlying skin. Aneurysmal dilatation is estimated to occur in approximately 5-6% of AVF's. Plication is a quick and effective intervention that entails joining the excess walls of the aneurysm to narrow its lumen. Staple plication or aneurysmorrhaphy, using an Endo GIA stapler, has been described as a safe and effective technique for management of AVF aneurysms.

Method: We describe a novel approach to treatment of AVF aneurysms via staple plication, coupled with the use of an angioplasty balloon (6mm x 80mm), and a Medistim flow probe (Medistim, Plymouth, MN). We describe the surgical technique and include its advantages over other staple plication methods. Our practice is to access the fistula aneurysm and place an angioplasty balloon as a mandrel to guide the use of an Endo GIA stapler (Covidien, Mansfield, MA) with a vascular load for plication of the aneurysm. After staple plication, the staple line is over-sewed with a running 5-0 prolene suture. At the conclusion of the repair, we use a Medistim probe to obtain flow volumes for intraoperative decision-making; if the flow volume remains inappropriately elevated, we plicate further using the technique above. A retrospective review of over 50 patients who have undergone plication using this technique is forthcoming. To our knowledge this will be the largest report of patients who have undergone staple plication and we aim to show that this is a feasible approach to treating this potentially devastating complication.

Results: The above technique has been used in over 50 cases and is safe and effective. Data reporting on the longevity of the repair will be appear in a future analysis.

Conclusion: Staple plication of AVF aneurysms using an Endo GIA stapler is safe and effective. We improve upon prior techniques with the use of an angioplasty balloon (6mm by 80mm) which is used as a guide for the desired lumen diameter of the plicated aneurysm and a Medistim flow probe to obtain flow volumes to aid with intraoperative decision-making.

POSTER #3 TECHNIQUE FOR COMPARTMENT RELEASE IN CHRONIC EXERTIONAL COMPARTMENT SYNDROME

Presenter: Sarasi Desikan, MD - University of Washington

Authors: SK Desikan MD, N Singh MD

Background: Chronic exertional compartment syndrome (CECS) is a non-atherosclerotic cause of claudication in young, active patients. This video presents one technique for performing compartment release in patients with CECS.

Methods: We report a case of a 17-year-old athletic female who initially presented with reproducible paresthesias and cramping of bilateral calves with activity. She underwent extensive noninvasive and invasive workup, which demonstrated occlusion of both popliteal arteries with forced plantarflexion of the feet. As a result, she underwent bilateral popliteal release. Despite treatment, her symptoms persisted. Further workup revealed compartments pressures of the anterior and lateral compartments >20 mm Hg following exercise. Given these findings and her desire to continue participation in sports, she elected to undergo bilateral anterolateral compartment release.

Results: Ultrasound was used to mark the intermuscular septum between the anterior and lateral compartments of both legs. The proximal incision was centered 11 cm below the patella and approximately 5 mm lateral to the edge of the tibia bilaterally. The distal incision was then created approximately 12 cm below, again using ultrasound to mark the intermuscular septum. The fascia of the anterior and lateral compartments was visualized through the transverse incisions, and subcutaneous tunnels were created bluntly. Mayo scissors were then used to perform the fasciotomy of the anterior and then lateral compartments. This was done bilaterally, with good release of the muscles. The wounds were then approximated and dressings were placed.

Conclusions: Chronic exertional compartment syndrome is an unusual cause of claudication in young, active patients. Vascular surgeons should be knowledgeable with regards to presentation, diagnosis and techniques for treatment of CECS.

POSTER #4 USE OF INTRAVASCULAR ULTRASOUND AND ENDOVASCULAR STENTING FOR A MALPOSITIONED PEDICLE SCREW PENETRATING THE ABDOMINAL AORTA IN AN 11-YEAR-OLD

Presenter: Atish Chopra, MD - Oregon Health and Science University

Authors: A Chopra MD, J Kaufman MD, T Liem MD

Background: Pedicle screw instrumentation has been increasingly used in the past 20 years, and malpositioned pedicle screws have been reported in the literature, with up to 0.3% requiring revision or removal. Aortic injuries have been described, but are rare.

Method: We present a case of an 11-year-old female with a history of severe scoliosis who underwent T4-L4 posterior spinal fusion. She presented 3 months later with transient symptoms of back pain and bilateral thigh numbness. A CT scan demonstrated a malpositioned left T12 pedicle screw with possible aortic penetration. A repeat CT-angiogram was not able to delineate whether the screw was adjacent to and compressing the aorta or penetrating the aortic wall.

Results: The patient underwent intravascular ultrasound confirming penetration of the adventitia and 75% of the media with an intact intima. A self-expanding 16 x 55 mm Cook Zenith graft limb was successfully placed above the celiac artery under fluoroscopic guidance. The left common femoral artery access was maintained as the patient was subsequently repositioned to the right lateral decubitus position for manual extraction of the left T12 pedicle. A completion angiogram demonstrated the stent in good position without evidence of extravasation. The patient tolerated the procedure well and was discharged on post-operative day 3 with normal motor function.

Conclusion: This case demonstrates the utility of intravascular ultrasound in determining penetration of the aortic wall. Additionally, the use of endovascular stenting and maintaining vascular access during manual extraction of the pedicle screw) affords a safe and controlled environment without the need for thoracotomy.

POSTER #5 ENDOVASCULAR TOTAL ARCH REPAIR USING IN SITU LASER FENESTRATION

Presenter: Tana Repella, MD, PhD - Oregon Health & Science University

Authors: TL Repella MD PhD, OK Alabi MD, S Nazaretyan, JA Kaufman MD, VM Rodriguez MD

Background: Thoracic aortic arch repairs are morbid and technically difficult procedures which often include the need for hypothermic circulatory arrest. In situ fenestration of aortic stent grafts with temporary cerebral perfusion can provide an alternative minimally invasive approach to complex aortic repairs with reduced morbidity and mortality as well as faster recovery.

We present the case of a 45-year-old male who underwent prior open repair of Type A aortic dissection. He presented acutely with chest pain and was found to have a residual dissection involving the aortic arch. Despite optimal medical management of shear stress and pain, the patient's symptoms did not abate. Given the risk of open surgical intervention, including redo median sternotomy and hypothermic circulatory arrest for total arch replacement, he elected for thoracic endovascular aortic repair (TEVAR).

Method: Temporary antegrade carotid artery perfusion was achieved through a left common femoral to bilateral carotid artery circuit. TEVAR of the dissection was accomplished with a 32 mm x 32 mm x 150 mm Medtronic Thoracic Valiant endograft. Retrograde in-situ laser mediated fenestration of ostia of the left subclavian, left common carotid, and brachiocephalic arteries was performed with successful placement of balloon expandable stents in each great vessel thereafter.

Results: Completion angiogram demonstrated successful endovascular exclusion of aortic dissection with contrast opacification of all great vessels and no demonstrable endoleak. The patient suffered no neurologic sequelae and safely reached hospital discharge by post-operative day three. Follow up CTA at one month demonstrated good stent positioning with a possible small endoleak which had resolved on follow up CTA at eight months.

Conclusion: This case details the successful endovascular total arch repair of a residual arch dissection via in situ laser fenestration of the supra-aortic trunks while maintaining cerebral perfusion and avoiding the morbidity associated with hypothermic circulatory arrest. As branch thoracic endografts are not commercially available, in situ laser fenestration provides a safe and reliable adjunct in the setting of urgent or emergent need for extending the proximal landing zone during thoracic endograft repairs.

POSTER #6 OPEN SURGICAL CONVERSION FOR EVAR FAILURE: WHAT TO DO ABOUT TRANSRENAL FIXATION ENDOGRAFT

Presenter: Sarasi Desikan, MD – University of Washington

Authors: S Desikan, B Starnes, NT Tran

Video Abstract Submission

#1 FAMILY HISTORY OF AORTIC AND ARTERIAL ANEURYSMS AND DISSECTIONS IS ASSOCIATED WITH TYPE B AORTIC DISSECTION: PRELIMINARY DATA

Presenter: Rebecca Campbell, BS - University of Washington

Authors: R Campbell BS, MA Bartek MD, M Pepin MS CGC, A Cecchi MS, S Dadashazar MD, P Byers MD, DM Milewicz MD PhD, S Shalhub MD

Background: A positive family history is a known risk factor for developing thoracic aortic disease. In type A aortic dissections, up to 25% of non-syndromic cases have a positive family history of aortic aneurysms/dissections. In contrast, the relationship between family history and type B aortic dissection (TBAD) is not well established. We sought to determine if patients with TBAD have a positive family history.

Methods: This was a case series study whereby patients with TBAD at the University of Washington and the University of Texas at Houston were interviewed to obtain detailed family pedigrees. We queried patients about family history of aortic/arterial dissection/aneurysms at any age, sudden death, and premature vascular disease. Premature vascular disease was defined as arterial occlusion or stenosis, coronary artery disease, or cerebrovascular accident at <55 years old for males and <60 years for females. Analysis focused on whether a positive family history of the above conditions was present in first degree relatives (FDRs), and second degree relatives (SDRs).

Results: A total of 74 patients with TBAD were interviewed. (72% male, median age at TBAD 55 years, range 33-89 years). A family history of aortic/arterials aneurysms/dissection in a FDR, a SDR, or both was ascertained in 30% of the patients. Among those, 13.5% specifically recalled aortic aneurysm/dissection. When sudden death and premature vascular disease were included, 57% of patients with TBAD had a positive family history. Of interest, patients with TBAD occurring at a younger age (age 55 years or younger), had a higher percentage of positive family history (64%) when compared to older patients (52%) though this was not statistically significant.

Conclusion: These preliminary data are the first to specifically demonstrate a heritable component of TBAD. While a family history of aortic disease specifically was not as prevalent as in type A aortic dissections, there was a significant correlation between TBAD and aortic/arterial aneurysms/dissections, sudden death, and premature vascular disease. Understanding the heritable component of TBAD will yield insights into the pathophysiology underlying the disease.

#2 PRELIMINARY EXPERIENCE WITH THE SQUID-CAPTURE TECHNIQUE FOR IN-SITU FENESTRATION IN TEVAR

Presenter: Jonathan Misskey, MD - Vancouver General Hospital

Authors: J Misskey, J Gagnon, K Baxter, J Faulds, J Chen

Background: In the absence of readily available off-the-shelf branched TEVAR stent grafts, in-situ fenestration has been proposed as a customizable endovascular method to achieve revascularization of left subclavian in TEVAR. Numerous techniques including laser catheter, radiofrequency ablation, and bare needle puncture have been described. However, tortuous or hostile anatomy can result in unpredictable or unintended fabric defects that may increase rates of endoleak. We describe a novel modification for left subclavian artery revascularization based on the "squid-capture" technique that addresses these issues.

Methods: From Jan 1, 2015 to Jan 1, 2016 a total of 29 TEVARs were performed at our facility, with 4 selected for in-situ fenestration (Zenith Alpha thoracic). Transbrachial access into the thoracic aorta was obtained and using a 300 cm 0.018 hydrophilic wire bent in half a large loop was created and placed into the descending aorta. This loop was used to ensnare the TEVAR from the femoral arteries to bring the stent-graft and long brachial sheath into direct apposition. The fenestration was created with the back end of a standard 0.035 starter wire applied to monopolar cautery. Fenestrations were serially dilated to 8 mm and stented with an Atrium V12 balloon expandable covered stent.

Results: Technical success was achieved in 3 out of 4 cases. In the single case of technical failure the brachial loop wire was unable to successfully snare the femoral wire and the procedure was converted to a carotid subclavian transposition. There were no fenestration related complications, postoperative strokes, or perioperative deaths. At mean follow-up of 11.1 months (range 7– 15 months) there was no evidence of fenestration-associated endoleak or endograft associated complication.

Conclusions: The squid capture technique is a technically feasible alternative to open surgical revascularization of the left subclavian with acceptable preliminary results.

#3 GASTROINTESTINAL COMPLICATIONS PREDICT NEAR AND LONG-TERM MORTALITY AFTER REPAIR OF AORTO-ENTERIC FISTULA

Presenter: A Chopra MD

Authors: A Chopra MD, L Cieciura MD, JG Modrall MD, RJ Valentine MD, J Chung MD

Background: Aorto-enteric fistulae (AEF) represent a subset of aortic graft infections that are particularly morbid and lethal. Data regarding the optimal management of AEF remain unclear due to the low frequency and limited follow up in the literature. We therefore aimed to identify predictors of morbidity and mortality after AEF repair.

Method: We performed a single-center retrospective review of consecutive AEF reconstructions. Demographics, co-morbidities, intra- and post-operative variables were obtained. Descriptive statistics of the median and interquartile range (IQR) and frequencies and percentages were utilized where appropriate. Chi-squared, Kruskall-Wallis, and Cox proportional-hazards modeling were utilized to quantify outcomes stratified by baseline variables.

Results: Between June 1995-March 2014, 49 consecutive patients (male 29; 59%) presented with AEF, with an overall median age of 69 (IQR 61, 75) years. The most frequent co-morbidities were hypertension (39, 80%), hyperlipidemia (38, 78%), and peripheral arterial disease (33, 67%). 26 (53%) patients presented with AEF after prior aorto-femoral bypass, 10 (20%) after prior tube graft, 6 (12%) after prior endovascular repair and 5 (10%) after prior aorto-infrainguinal bypass. Median follow-up for the entire cohort was 150 (IQR 26, 570) months. 34 (69%) underwent aortic reconstruction with femoral vein, 3 (6%) were repaired with rifampin-soaked Dacron graft. 12 (24%) subjects underwent extra-anatomic bypass and aortic ligation. The duodenum was the most common location of the enteric defect (39, 80%), followed by the jejunum (8, 16%), colon (1, 2%), and esophagus (1, 2%). Duodenal leak or re-infection complicated 5 (10%) of the primary enteric repairs but none of the complex enteric repairs performed with resection and/or bypass. 12 patients (49%) died by 60 days. The presence of advanced age, coronary artery disease, chronic renal insufficiency, urgent or emergent operative intervention, gastrointestinal complications (12, 24%), and pulmonary insufficiency/pneumonia (4, 8%) were all associated with an increase in overall mortality on univariate analysis ($p<0.05$). Cox proportional-hazards regression models were used to estimate AEF-mortality association with specific causes of overall and 60-day mortality. Gastrointestinal complication was the only independent predictor of overall (relative risk [RR], 3.99; 95% CI, 1.55 to 10.26; $p=0.004$) and 60-day (RR, 4.67; 95% CI, 1.26 to 17.23; $p=0.02$) mortality.

Conclusion: Our series represents the largest series of AEF repairs with long-term follow up showing that approximately 50% of AEF repairs die within the first two months of surgery. Gastrointestinal complications increase the risk of mortality by 4-5-fold. Methods to decrease gastrointestinal may prove most impactful at improving mortality rates for this lethal pathology.

#4 ENDOVASCULAR THORACIC AORTIC REPAIR IN PATIENTS WITH GENETICALLY TRIGGERED THORACIC AORTIC DISSECTION

Presenter: Sherene Shalhub - University of Washington

Authors: S Shalhub MD MPH, FM Asch MD, SA LeMaire, KA Eagle, NL Pugh, DM Milewicz MD PhD, The GenTAC Investigators

Background: Consensus statements recommend against the use of endovascular repair with stent grafts (TEVAR) in patients with connective tissues disorders due to concern for failure. The aim of this study was to investigate TEVAR outcomes in patients with confirmed or suspected genetically triggered thoracic aortic dissection.

Methods: We analyzed data for patients with descending thoracic aortic (DTA) dissection treated with TEVAR from the Cardiovascular Conditions (GenTAC) Registry. Patients have confirmed or suspected genetically triggered thoracic aortic disease and enrolled between 2006 and 2014.

Results: DTA dissection was documented in 371 patients. Of those, 33 (9%) were treated with TEVAR (54.5% male). The mean age at TEVAR was 46.3 years (range 21.3-65.6). The indication was acute aortic dissection in 17 cases (5 Type A, 12 Type B) and chronic dissection aneurysmal degeneration in 16 cases (6 Type A, 10 Type B). Mean follow up post TEVAR was 28 months (range 0.4-84). Retrograde dissection occurred in 3 (50%) patients treated with TEVAR for acute type B dissection (one case with an ACTA2 mutation, and two with aortic dissection at age younger than 50 years old). Stent graft explantation and thoracoabdominal repair was performed in 2 (12%) of the cases treated with TEVAR for acute dissection and 4 (25%) treated for chronic dissection aneurysmal degeneration. There were no perioperative deaths.

Conclusions: TEVAR use in patients with genetically triggered aortic dissections can be lifesaving in the acute setting though associated with high risk of retrograde aortic dissection. For chronic dissection aneurysmal degeneration, TEVAR potentially be lifesaving in patients deemed at too high risk for open surgical repair. Close post-operative surveillance is mandatory given the risk of subsequent device failure and need for re-intervention. Because these circumstances are rare, multicenter prospective enrollment of patients with confirmed or suspected genetically triggered disease is essential to delineate the indications and risks of TEVAR. This also has implication for device design.

#5 ESTABLISHING BRANCH ANGLE BOUNDARY CONDITIONS IN FENESTRATED-BRANCHED ENDOGRAFTS

Presenter: Jamil Matthews, M.D., M.S. - University of Washington School of Medicine-Division of Vascular Surgery

Authors: JA Matthews MD, MP Sweet MD

Background: Branched thoracic endovascular aneurysm repair (B-TEVAR) is an evolving technique for the repair of thoraco-abdominal aneurysms. B-TEVAR use an axially oriented cuff (branch) or a reinforced fenestration (fenestrated-branch) to mate to the branching stent. The devices are subject to longitudinal and rotational forces at this juncture that impact wall shear stress, device integrity, and ultimately, branch patency. Boundary conditions of branch angulation have not been defined. The purpose of this study was to assess branch angulation of fenestrated-branched endografts.

Methods: This study was a retrospective review of post-operative CT scans from 30 patients treated with a physician modified fenestrated-branched endograft from December 2012 to December 2015 within an FDA approved IDE study. The degree of branch deviation for the celiac, superior mesenteric and bilateral renal arteries (n = 120) relative to the vertical and horizontal axis of the main body were using Tera Recon software (Foster City, CA). The angle of deviation was obtained by calculating the arc angle between the axis extending from the main body centerline through the center of the fenestration to the center axis of the branch stent. Statistical analysis was performed using Stata.

Results: The mean rotational and vertical deviations for the celiac, superior mesenteric, left renal and right renal arteries are 27.7, 16.7, 15.6, 30.6 and 28.1, 33.5, 18.9, 24.7 degrees respectively. 117 branches (98%) were successfully implanted. Three renal branches could not be successfully implanted. In 2 cases the angle of deviation exceeded 90 degrees in at least 1 plane, and in the other case, the target vessel was 4mm and severely tortuous with a deviation of 38 degrees. One other branch with a 90 degree deviation dislodged immediately post-operation. 21 branches (18%) had angles of deviation exceeding 40 degrees with successful branch implantation. Over a mean 12 month follow up (range 1-36) no branches have fractured, migrated, or occluded.

Conclusion: Fenestrated-branched endografts tolerate a wide range of branch angle deviation. Extremes of deviation were associated with failure of branch implantation, although this was also impacted by target vessel anatomy. These data contribute to establishing boundary conditions of branched and fenestrated-branched endografts, and demonstrate

#6 CORRELATES OF UTILIZATION OF HYPOTHERMIC CIRCULATORY ARREST AND RISK OF OPERATIVE MORTALITY IN THORACOABDOMINAL AORTIC REPAIR

Presenter: Jason Faulds, MD

Authors: Jason Faulds, Harleen Sandhu, Akiko Tanaka, Rana Afifi, Charles Miller III, Anthony L Estrera, Hazim J Safi

Purpose: Utilization of hypothermic circulatory arrest (HCA) as a surgical adjunct in descending thoracic and thoracoabdominal repair (D/TAAA) is associated with variable results. We reviewed our experience using HCA during D/TAAA.

Methods: Data were collected from medical records by faculty and trained staff into an IRB-approved longitudinal clinical research database. Univariate and multivariable analyses were conducted by standard methods for frequency, continuous and failure-time data using SAS 9.4. Preoperative characteristics and in-hospital and long-term outcomes were analyzed to identify correlates of HCA and determine risk factors for early and long-term mortality.

Results: Between 1999 and 2014, 1183 patients underwent 1251 thoracic or thoracoabdominal aortic repair. Hypothermic circulatory arrest was required in 33 patients (2.6%). 23 were men, 10 were women, and the median age was 60 (range, 50 to 68 years). 29 (88%) patients had repair of the distal arch and descending thoracic and 4 (12%) for thoracoabdominal aorta. Median pump time and circulatory arrest time were 136 (IQR 111-153) and 18 (13-25), respectively. The perioperative stroke rate was (4/33) 12%. 3 patients (9.1%) had spinal cord ischemia. Post-operative hemodialysis was required in 9.1% of patients. Overall, 30-day mortality was 8 (24%). Long-term survival over a median follow-up period of 1.4 (IQR .01-5.2) years, was 47.4% at 5 years. Previous DTA repair, previous arch repair, prior TEVAR, history of coarctation, and emergent presentation had increased propensity for HCA utilization (Table 1). Intraoperative coagulopathy commonly complicated the operative repair in those who required HCA (48.5% vs 13.9%, P<.001). HCA did not increase the risk for any post-operative major complications. Although long-term survival between D/TAAA repairs with and without HCA was not statistically different (47.4% vs 58.5% at 5-years, P=.069, Figure1), HCA itself was a significant risk-factor for overall mortality (hazard ratio 1.8, 95% CI 1.0-2.9, P=.034).

Conclusion: Hypothermic circulatory arrest was significantly associated with intraoperative coagulopathy and mortality, but did not increase the risk for postoperative morbidity or mortality.. Careful surgical planning with judicious application of HCA may be associated with acceptable outcomes especially in patients when proximal aortic control is not easily accessible.

#7 DIABETIC FOOT ULCER LOCATION AFFECTS RATES OF MAJOR AMPUTATION

Presenter: Nasibeh Vatankhah, MD - Division of Vascular Surgery, Oregon Health and Science University

Authors: Nasibeh Vatankhah MD, Cherrie Abraham MD, Gregory Landry MD, Gregory Moneta MD, Amir-Farzin Azarbal MD

Background: Diabetic foot ulcer (DFU) can present on different locations. We sought to determine whether differences in DFU location are associated with differences in patient outcomes.

Method: From February 2008 to December 2014, 190 subjects with diabetic foot ulcers were followed until wound healing, amputation or no healing at the last visit. Data about the patients' demographics, wound characteristics, and outcome were collected. Outcomes were classifies as: major amputation, minor amputation, chronic wound, or complete healing.

Results: A total of 238 wounds were evaluated in 190 patients. Median age was 60.2 years (range: 25.1-90.1) and 129 (67.9%) cases were males. Toe (68.9%) was the most prevalent ulcer type. Metatarsal head (21.8%) and heel (9.2%) ulcers were less prevalent. The rate of major amputation, minor amputation, chronic wound and complete healing in toe wounds were 11%, 62.2%, 14.0% and 12.8%. The respective rates were 7.7%, 40.4%, 19.2% and 32.7% for metatarsal, 31.8%, 0%, 31.8% and 36.4% for heel. There was no significant difference between rates of major amputation between toe and MTH ulcers (p=0.49). Heel ulcers are significantly more likely to progress to major amputation compared to toe and MTH ulcers (p=0.01 and p=0.01, respectively).

Conclusion: Diabetic foot ulcers have low complete healing rates. Toe and MTH ulcers progress to major amputation at similar rates, while heel ulcers progress to major amputation at a higher rate than both toe and MTH ulcers.

#8 FEMORAL VEIN CONDUITS HAVE SUPERIOR PATENCY COMPARED TO PROSTHETIC GRAFTS FOR FEMORAL-FEMORAL BYPASS

Presenter: Tana Repella, MD, PhD - Oregon Health & Science University

Authors: KP Nguyen MD, TL Repella MD PhD, K Perrone, AF Azarbal MD, EL Mitchell MD, TK Liem MD, GL Moneta MD, GJ Landry MD

Background: Traditionally, trans-abdominal subcutaneously tunneled femoro-femoral bypass grafts were created with externally supported prosthetic polytetrafluoroethylene graft (PTFE). However, femoral vein conduit (autogenous or cryopreserved) can be useful in the setting of infection. While our clinical and anecdotal experience has suggested that the patency of femoral vein grafts is superior to PTFE this has never been formally studied. The objective of this study is to compare the patency of femoro-femoral bypasses created with femoral vein conduit vs. PTFE.

Method: This is a retrospective review of all femoro-femoral bypasses at our tertiary care university hospital that were performed from 2005-2016. Demographics of the two patient groups were compared and the indication for bypass was reviewed as well as length of procedure, intraoperative blood loss, transfusion requirement, hospital length of stay, and complications. Outcomes measured included primary assisted patency, survival, and amputation free survival.

Results: There were a total of 120 femoro-femoral crossover grafts performed during this period with 89 (74%) being performed with PTFE and 31 (26%) being performed with femoral vein (19 autogenous (16%) and 12 cryopreserved (10%)). There was a significantly greater number of prior vascular interventions (93% vs. 63% p=0.006) in the femoral vein group vs. PTFE as well as greater operative time in the femoral vein group (6.7 h +/- 3.3 vs. 5.1 h +/- 2.9 p=0.015). A greater proportion of patients in the femoral vein group (70% vs 35% p=0.001) received a blood transfusion however there was no significant difference in the number of units transfused.

PTFE was used most often in the setting of chronic limb ischemia (95% PTFE vs. 5% femoral vein) and acute limb ischemia (91% PTFE vs. 9% femoral vein) while femoral vein was used most often in the setting of infection (17% PTFE vs. 83% femoral vein). There were no significant differences in complications among the two groups (overall complication rate 36% PTFE vs. 47% femoral vein) with the most frequent complication being wound infection in both groups (15% PTFE, 23% femoral vein).

Median follow up was 9.8 months (range 0-107). Overall patency at 1 and 2 years for PTFE bypasses was 87.6 % and 80.1% versus 100% and 100% for venous grafts respectively (log rank, p=0.026). Survival at 1 and 2 years was 82% and 76.4% for patients with PTFE grafts versus 76.7% and 73.3% for vein grafts respectively (log rank, p=0.167).

Conclusion: This is the first study to characterize patency of femoral vein conduits for femoro-femoral bypass and demonstrates that femoro-femoral bypasses created with a femoral vein conduit have superior patency as compared to those created with PTFE graft with similar complication rates. This data suggests that the use of femoral vein conduit for femoro-femoral bypasses is a suitable option especially in the setting of infection.

#9 FUNCTIONAL ELECTRICAL STIMULATON REDUCES INTERMITTENT CLAUFICATION AND ENHANCES QUALITY OF LIFE FOR PATIENTS WITH PERIPHERAL ARTERIAL DISEASE

Presenter: April Rodriguez, MD - University of Washington

Authors: AL Rodriguez MD, DG Embrey PhD, FG Vladimir MD

Background: Over 8 million adults in the U.S. suffer from lower extremity peripheral arterial disease (PAD). The most frequent clinical manifestation of PAD is intermittent claudication, defined as leg pain with exertion that improves with rest. This study was designed to test if functional electrical stimulation (FES) will reduce intermittent claudication (IC) and enhance quality of life for adults with peripheral arterial disease (PAD). It was hypothesized that patients who walked with FES (FES+Walk) for eight weeks would show significant improvements in these variables and maintain these improvements for eight additional weeks, compared to patients who walked without FES (WALK).

Methods: A single blind, randomized block, two factorial design compared outcomes for FES+Walk vs. WALK patients in an ambulatory clinic. Patients were 58-79 years old and the two groups did not statistically differ in ABI tests, co-morbidities, smoking status, and Cilostzol treatment. Physician referrals and recruitment letters generated 27 patients who completed the study (13 FES+Walk and 14 WALK). FES+Walk patients were asked to walk using FES to stimulate the dorsiflexors (DF) and plantar flexors (PF) one hour/day, six days/week for eight weeks, keep daily logs, and attend weekly meetings. WALK patients received similar intervention without FES. During follow-up, all patients were asked to continue their walking program but without weekly visits, daily log, or FES. Outcome measures were taken at baseline (T0), after intervention (T1), and after follow-up (T2). Primary measures included Perceived Pain Intensity (PPI), 6-Minute-Walk (6MW), and Peripheral Arterial Disease Quality of Life (PADQOL). Secondary Measures included Intermittent Claudication Questionnaire (ICQ) and Timed-Up-and-Go (TUG). A 2 x 3 (group x time) mixed ANOVA examined first order interactions.

Results: The two groups did not differ at baseline for any measure. The mean difference in PPI was 27.9 points at T1 and 36.9 points at T2 ($P < .001$) favoring the FES+Walk group. Symptoms and Limitations in Physical Function of the PADQOL reached significance ($P = .007$). For the secondary outcome measures, the ICQ reached significance ($P = .003$). Improvements in the PPI, PADQOL, and ICQ continued at follow-up.

Conclusions: Combining one hour of walking with FES applied bilaterally to the DF and PF significantly reduced walking pain and enhanced quality of life for patients with PAD. Persistence of these improvements through eight weeks at follow-up suggests that this approach may offer an effective treatment option for this population.

#10 AUTOGENOUS ALTERNATIVE VEIN BYPASS REMAINS THE PREFERRED CONDUIT WHEN SAPHENOUS VEIN IS NOT AVAILABLE

Presenter: Dale Wilson, MD - OHSU

Authors: D Wilson MD, J Wagner BS, S Harris MD, A Azarbal MD, E Mitchell MD, G Landry MD, G Moneta MD, E Jung MD

Background: Saphenous vein is the gold standard for infrainguinal bypass. When a saphenous vein is not available there is debate as to whether autogenous alternative vein (AAV) or prosthetic graft is the better alternative conduit. Our preference has been alternative vein graft over prosthetic for infrainguinal bypass. We report our experience with (AAV) grafts using both composite and single segment arm vein in infrainguinal bypasses.

Methods: We conducted a Retrospective EMR chart review of 107 lower extremity bypasses for critical limb ischemia (CLI) using autogenous composite vein, or single segment arm vein between the years of 2005-2015 at our tertiary care university hospital. We examined primary, primary assisted, and secondary patency rates, as well as amputation free survival. Patients were followed with duplex ultrasound surveillance post operatively.

Results: 98 (107 limbs) patients underwent lower extremity bypass with AAV during the study period. All patients had CLI with rest pain, and/or lower extremity ischemic wounds. 61 patients had composite, and 46 patients had single segment arm vein grafts. Composite grafts were comprised of autogenous veins from either the great saphenous, small saphenous, basilic or cephalic veins. The mean follow up was 24 months 4 26 months and patients were seen an average of every 2.5 months 4 2.2 months for follow up. 93% (100 limbs) of bypasses were to below knee targets. Primary, primary assisted and secondary patency rates at 2 years for composite and single arm veins were 46%, 70%, 79%, and 42%, 71%, and 78% respectively which was not statistically different (p=>0.05). At 5 years, primary, primary assisted and secondary patency rates were not statistically different with rates of 37%, 70%, 79%, and 37%, 65%, and 73% respectively (p=>0.05). Amputation free survival at two years was 91% for composite and 95% for single arm vein.

Conclusions: Composite and single segment arm vein grafts are durable conduits and should be the first option for infrainguinal bypass when saphenous vein is not available.

#11 TIBIAL ARTERY DUPLEX DERIVED PEAK SYSTOLIC VELOCITIES ARE AN OBJECTIVE PERFORMANCE MEASURE AFTER ENDOVACULAR THERAPY FOR ARTERIAL STENOSIS

Presenter: Dale Wilson, MD - OHSU

Authors: D Wilson MD, J Crawford MD, C Barton MD, S Harris MD, A Azarbal MD, E Mitchell MD, E Jung MD, G Moneta MD, G Landry MD

Background: The ankle-brachial index (ABI) is a well-established measure of distal perfusion in lower extremity ischemia however ABI is of limited value in patients with non-compressible lower extremity arteries. We sought to demonstrate if duplex scan determined tibial artery velocities can be used as an alternative to ABI as an objective performance measure following endovascular treatment of above knee arterial stenosis.

Methods: Thirty-six patients undergoing above knee endovascular intervention had pre and post procedure duplex ultrasound within 6 months of intervention. Pre vs. post procedure changes in tibial artery peak systolic velocity (PSV) were compared with changes in ABI and a reference (control) cohort of 68 patients without peripheral vascular disease (PAD).

Results: Thirty-six patients (41 limbs) had an above knee endovascular intervention and had pre and post duplex ultrasounds of the ipsilateral extremity including the tibial arteries. Pre-procedure, mean tibial artery PSVs in the 36 patients undergoing intervention were outside (<) the 95% confidence intervals for the control patients. Post procedure tibial artery PSVs increased between 91%-117% from pre-procedure. Comparing pre and post procedure PSVs the mean anterior tibial (p=<0.001), mean peroneal (p=0.007), and mean posterior tibial (p=<0.001) PSVs all increased and correlated with an increase in ABI (p=<0.001). PSV increases were similar in patients with and without non-compressible vessels, 112%-149% vs. 91%-117%), respectively.

Conclusions: Tibial artery PSVs increase, correlates with an increase in ABI, and fall within or near confidence intervals for normal controls following above knee endovascular interventions. Following endovascular intervention tibial artery PSVs can supplement ABI as an objective performance measure in patients with, and in particular, without compressible tibial arteries.

#12 RISK FACTORS FOR SURGICAL SITE INFECTION IN GROIN WOUNDS IN LOWER EXTREMITY REVASCULARIZATION POST HOSPITAL DISCHARGE

Presenter: Bill Huang, B.Sc. - Western University

Authors: Kevin Lee MD, Bill Huang MD, Audra Duncan MD, Luc Dubois MD, MSc, Guy DeRose MD, Adam Power MD, MPhil

Background: There is a high rate of surgical site infection (SSI) in groin wounds after lower extremity revascularization in vascular surgery. The majority of SSI develops post hospital discharge and can result in readmission, reoperation, limb loss or even death. The objective of this study was to identify the risk factors for SSI that develop post hospital discharge following lower limb revascularization.

Methods: We performed a retrospective review of prospectively collected vascular surgery database at a university affiliated medical center to identify all patients undergoing lower limb revascularization requiring groin incision between January 2014 to January 2016. We excluded patients with a diagnosis of hospital groin SSI. Preoperative, intraoperative and postoperative variables were compared between groups with and without SSI 90 days from hospital discharge.

Results: A total of 250 patients underwent lower extremity revascularization during the study period. There were 5 (2%) in hospital SSI and these patients were excluded. From 245 patients who were discharge home without SSI, 44 (18%) patients were diagnosed with SSI within 90 days of hospital discharge. There was one in hospital death due to pneumoniae and no other death within 90 days of discharge. Patients with SSI had higher body mass index (BMI, 29.7 4 6.9 kg/cm2 vs 26.1 4 4.6 kg/cm2, $p<0.01$), higher incidence of diabetes mellitus (26.7% vs 14.1%, $p=0.02$) and chronic obstructive pulmonary disease (29.3% vs 14.4%, $p=0.01$) compared with patients that did not have SSI. A greater proportion of patients in SSI group had previous groin incision for revascularization (44.4% vs 16.9%, $p=0.04$) than non-SSI group. There was no difference in sex, age, smoking status or coronary artery disease between the two groups. There was more SSI with oblique incisions compared to vertical (27.5% vs 15.5%, $p=0.05$). Patients who experience SSI had a 22.7% readmission rate and 6.8% reoperation rate for the treatment of SSI.

Conclusion: Our study showed a high incidence of groin SSI post hospital discharge in vascular surgery. Patients with risk factors for SSI may benefit from close monitoring post hospital discharge with early antibiotic treatment to prevent readmissions or reoperations.

#13 EARLY RESULTS WITH THE USE OF A PATIENT-SPECIFIC THREE DIMENSIONAL PRINTED FENESTRATION TEMPLATE IN A PHYSICIAN SPONSORED INVESTIGATIONAL DEVICE EXEMPTION CLINICAL TRIAL TO TREAT JUXTARENAL AORTIC ANEURYSMS

Presenter: Benjamin Starnes, MD - University of Washington

Authors: Benjamin W. Starnes, MD

Objective: To validate the use of complex AAA planning software and a patient-specific 3D printed aortic fenestration template as a surgical planning tool to accurately determine fenestration locations on physician modified endovascular grafts.

Methods: The fenestration planning software and template were introduced into an ongoing IDE clinical trial to demonstrate planning simplicity. To create a template, a baseline CT scan is loaded into a proprietary software package. The centerline of flow is automatically calculated and adjusted to account for the interaction between the endograft delivery system and the angulated aorta, based on the planning method of an experienced vascular surgeon. Clock face positions are automatically determined for branch artery ostia. Final diameters and predicted locations of fenestrations are computed and loaded into a digital file. A stereolithography printer generates a transparent cylindrical fenestration template. The sterilized cylinder slides over a partially deployed endograft on the surgical back table and is manipulated to find fenestration locations free from competing stent graft struts. Fenestrations are marked and the template is removed. Reinforced fenestrations are created with gold markers, optional temporary constraining ties are added and the graft is reconstrained in the delivery system. During delivery, the SMA fenestration is aligned with the SMA ostium resulting in alignment of the remaining fenestrations.

Results: Ten subjects have been treated with patient-specific grafts made using the fenestration template. All grafts had three fenestrations, one for the SMA and one for each renal artery. One patient had a dual right renal artery and a single fenestration accommodated both vessels. The main body endograft was successfully deployed in all patients and all target vessels were patent at the end of each procedure. SMAs were not typically stented while renal arteries were always stented except for the dual renal. Average graft modification time was 54 4 6 min, average procedure time was 149 4 45 min, average fluoroscopy time was 37 4 18 min, average contrast use was 105 4 30 ml and included a completion cone-beam CT in most cases. One patient required a secondary procedure to stent the left renal artery. There have been no deaths, target vessel occlusions, type 1a or type 3 endoleaks.

Conclusion: We report on the use of a fenestration planning technology which precisely determines fenestration locations from a CT scan. The technology is currently being used to demonstrate proof of concept for physician modified endografts but could also be applied to the direct manufacture of patient-specific endografts. Following validation, this simple and accurate planning technology could bring fenestrated endografts to many more patients harboring juxtarenal abdominal aortic aneurysms.

#14 TRANSAPICAL DELIVERY OF A CUSTOM BRANCHED AORTIC ARCH ENDOGRAFT IN AN ANIMAL MODEL

Presenter: Jonathan Misskey, MD - Vancouver General Hospital

Authors: S MacDonald, J Misskey, M Robinson, R Sidhu, B Munt, J Clement

Background: Long working distances, unfavorable anatomy, and aortoiliac occlusive disease can make transfemoral TEVAR in the aortic arch difficult or impossible. This study aims to assess the physiologic feasibility of the transapical deployment of a custom branched aortic arch endograft in a swine model.

Methods: 6 female adult cross Yorkshire-Landrace pigs (5143kg) were selected for endograft implantation. Following median sternotomy, transapical access through the left ventricle was obtained into the aortic arch and a 20 Fr introducer carrying a 20x78mm endograft with a single 6x18mm brachiocephalic branch was inserted and deployed. Antegrade branch cannulation was achieved through the left ventricular introducer sheath, and an 8x38mm balloon expandable covered stent (BECS) was deployed. Left ventricular function and aortic valve integrity were assessed in all animals via left ventricular angiography, at necropsy, and 3 were selected for dynamic intracardiac echocardiography (ICE) during the entire procedure.

Results: Transapical deployment of the branched endograft was successful in all animals (6/6). 1 pig developed ventricular fibrillation prior to side-branch cannulation and was euthanized. Antegrade brachiocephalic trunk cannulation was successful in the remaining 5 animals. Mean blood pressure decreased from 41.849.4 to 38.749.6 mm Hg ($P<0.001$) with sheath crossing of the aortic valve, and returned to baseline following sheath removal (40.4416 mm Hg). Mean heart rate rose throughout the procedure from 67413 to 95 436 ($p <0.001$) and remained elevated at experimental completion. ICE demonstrated no abnormalities in pre or post-implantation cardiac function in the surviving 5 animals, and mild to moderate aortic regurgitation (AR) with sheath crossing that returned to baseline post sheath removal. Ventricular closure was hemostatic in 5/5 pigs, and postoperative necropsy demonstrated no gross damage to the aortic valve, myocardium or aorta in any of the 6 animals.

Conclusion: Transapical branched endograft delivery with antegrade branch cannulation is feasible, well tolerated and does not significantly influence hemodynamic or cardiac parameters in an animal model.

#15 INSTITUTION OF A REBOA (RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA) PROTOCOL AT A LEVEL 1 TRAUMA CENTER

Presenter: Shahram Aarabi, MD - University of Washington

Authors: S Aarabi, EM Bulger, E Quiroga, N Singh, BW Starnes, NT Tran

Background: There is a complex algorithm for the identification and control of exsanguinating hemorrhage in blunt trauma patients. In situations where hemorrhage has an intraabdominal or pelvic source, significant resuscitation may be required before bleeding is controlled in the operating room (OR) interventional radiology (IR) suite. In extreme situations, emergency department (ED) thoracotomy can performed as life-saving measure but is associated with high morbidity and mortality. As an alternative to ongoing blood loss or ED thoracotomy, we have developed an algorithm for placement of a endovascular device, an intra-aortic occlusion balloon, to control hemorrhage temporarily until definitive control is obtained in the OR or IR suite.

Methods: All patients >18 years of age who underwent placement of REBOA at our level 1 trauma center since institution of our protocol in September 2014 are included. A total of five patients were identified and their data were reviewed through the institutional electronic medical record.

Results: Five patients underwent REBOA over the 22 month period since institution of our protocol. The first patient having REBOA performed under our protocol was nine months after institution of the protocol. The median age of our patients was 44 years (range 25-83), 4 of 5 of patients were male, and 3 of 5 patients had blunt trauma mechanism while 2 of 5 patients had penetrating trauma mechanism. 2 of 5 patients (the only patients >60 years of age) died on comfort care shortly after their injuries. 1 of 5 patients was declared brain dead within the first week after his injuries. 2 of 5 patients survived and are alive and functional. The total complication rate for the procedure was 40%; the two complications were and iliac artery rupture requiring massive transfusion and stenting in one patient, as well as a femoral artery transection and limb ischemia requiring multiple operations in another patient.

Conclusion: We review our experience introducing REBOA at a high-volume level 1 trauma center. Our protocol has been slow to enroll patients due to multiple factors. Our complication and mortality rates for patients undergoing this procedure have been high. This is likely due to the severity of patient illness at presentation, technical factors introducing a new procedure, and logistical factors introducing a new protocol. REBOA has potential as a life-saving

#16 STANDARD TEVAR COMPARED TO PETTICOAT TECHNIQUE IN AORTIC DISSECTION

Presenter: Kyle Arsenault, MD - University of British Columbia

Authors: KA Arsenault MD, D Klass MD, J Price MD, MT Janusz MD, J Gangon MD, J Chen MD, J Faulds MD

Objectives: TEVAR in aortic dissection has been shown to promote favourable aortic remodelling, preventing late aneurysmal degeneration and its associated mortality. The PETTICOAT (provisional extension to induce complete attachment) technique is a modification of TEVAR that utilizes bare metal stents to scaffold open the true lumen of the thoracoabdominal aorta and preferentially direct blood flow. This technique has been shown to be technically feasible but there are few studies reporting the influence on aortic measurements.

Methods: We performed a retrospective chart review of all patients receiving TEVAR for aortic dissection at our centre between Mar 2005 and Feb 2016. We collected data from paper charts, electronic medical records, and an imaging database. Our primary outcome was aortic remodeling, including false lumen thrombosis, and true and false lumen diameters at both the point of maximum aortic diameter and the diaphragmatic hiatus. Continuous variables were analyzed using the Student's t-test or the Mann-Whitney U test, as appropriate. Categorical variables were analyzed with the chi-squared test. A p value of less than 0.05 was considered statistically significant.

Results: Thirty-nine patients met the inclusion criteria, 23 of whom received a PETTICOAT repair. Baseline characteristics and aortic morphology were similar between the two groups. Approximately half of cases were elective, while half were urgent or emergent. Mean length of follow-up was 1.1 years in the PETTICOAT group and 2.9 years in the Non-PETTICOAT group. There was no significant difference in maximum aortic diameter at baseline compared to follow-up for the PETTICOAT (median 52.1 vs. 46.2mm; p=0.07) or the Non-PETTICOAT groups (51.3 vs. 44.5; p=0.39). This was similar at the diaphragmatic hiatus (36.1 vs. 38.9; p=0.34 for PETTICOAT; 41.9 vs. 40.7; p=0.39 for Non-PETTICOAT). At follow-up, the maximum true lumen diameter was significantly increased in both groups (19.7 vs. 31.6; p<0.00001 for PETTICOAT; 21.0 vs. 34.5; p=0.0019 for Non-PETTICOAT). However, at the diaphragmatic hiatus, the true lumen was significantly increased at follow-up for the PETTICOAT group (13.4 vs. 24.0; p<0.00001) but not for the Non-PETTICOAT group (15.1 vs. 27.6; p=0.30). Twelve (52.2%) patients in the PETTICOAT group had at least thrombosis of the thoracic component of false lumen, compared to 10 (40.0%) in the Non-PETTICOAT group (p=0.36). A greater proportion of patients in the PETTICOAT group remained free from reintervention during follow-up (73.9% vs. 62.5%) but this was not statistically significant (p=0.39).

Conclusions: While this cohort study is limited by a small sample size and a lack of long-term follow-up, it does present encouraging results with the use of the PETTICOAT technique in TEVAR. Longer-term follow-up is key to determining the success of this technique and identifying the factors that may predict aneurysmal degeneration in aortic dissection.

#17 UNCERTAIN PATENCY OF COVERED STENTS PLACED FOR TRAUMATIC AXILLO-SUBCLAVIAN ARTERY INJURY

Presenter: Atish Chopra, MD - Oregon Health and Science University

Authors: A Chopra MD, JG Modrall MD, M Knowles MD, HA Phelan MD, RJ Valentine MD, J Chung MD

Background: Traumatic axillo-subclavian artery injuries (ASAIs) are uncommon but devastating. There is increasing acceptance of covered stent use for ASAIs. However, epidemiologic and long-term outcome data are limited. We investigated national trends in ASAI management and our institutional outcomes after emergent covered stent placement and open surgical repairs for ASAIs.

Method: A review of the National Trauma Data Bank (NTDB) from 2010-2012 was performed for epidemiologic data. International classification of diseases and procedure codes were used to identify ASAIs and therapy type. A single-center, retrospective review of consecutive patients with ASAIs between January 2010-August 2014 was also performed.

Results: NTDB review included 511,286 patients with 520 ASAIs, yielding an incidence of 0.1%. Endovascular therapy was used in 76 patients (14.7%) vs. open repair in 280 patients (53.8%). Non-operative or unknown treatment was used in 164 (31.5%). From 2010-2012, endovascular interventions increased from 11.3% to 17.2% ($p < 0.05$). Endovascular therapy was more frequently used in blunt, compared with penetrating trauma (59.2% vs. 40.8%, $p < 0.005$). Our institutional review identified 10 ASAIs treated with covered-stents with a median follow-up of 117 days (IQR 13, 447) and 70% lost to follow-up. No treatment-related mortality or amputation occurred. Stent occlusion occurred in 30% at a median of 132 (IQR 30, 223) days. 3 ASAIs were initially treated with open surgery, 2 of whom died and the third required ligation.

Conclusion: Covered stents are being increasingly utilized for ASAIs nationwide despite variable reports of durability. Follow-up is poor in urban trauma centers, and may be responsible for the variable patency. Population-based efforts to improve compliance among trauma patients may help improve covered stent patency in ASAI.

#18 MANAGEMENT OF THE LEFT SUBCLAVIAN ARTERY DURING THORACIC ENDOVASCULAR AORTIC REPAIR

Presenter: Kyle Arsenault, MD - University of British Columbia

Authors: KA Arsenault MD, J Faulds MD, D Klass MD, J Price MD, MT Janusz MD

Background: Management of the left subclavian artery (LSA) during Zone 2 or more proximal thoracic endograft deployment remains controversial. We sought to review our experience and outcomes with LSA revascularization during thoracic endovascular aortic repair (TEVAR).

Methods: We performed a retrospective chart review of all TEVARs at our institution from Mar 2005 to Feb 2016. We included all patients that had a Zone 2 or more proximal landing zone. Data were collected from paper charts, electronic medical records and an imaging database. We compared methods of LSA revascularization for the outcomes of mortality, stroke, spinal cord ischemia, endoleak, and need for re-intervention. A composite endpoint of stroke, spinal cord ischemia, Type Ia or Type II endoleak, need for re-intervention due to the LSA, occlusion of the left vertebral artery, and thrombosis of the LSA revascularization was used to compare methods of proximal LSA control. Continuous variables were analyzed using the Student's t-test or the Mann-Whitney U test, as appropriate. Categorical variables were analyzed using the chi-squared test. A p value of less than 0.05 was considered statistically significant.

Results: Eighty-five patients met inclusion criteria. Thirty-two (37.6%) procedures were for aneurysmal disease and 32 for aortic dissection. Eighteen patients (21.2%) had TEVAR for traumatic aortic injury while 3 had repair of other aortic pathologies. Thirty-day mortality was 5.9%. Median followup was 21.6 months [IQR: 6.2-55.9]. Management of the LSA included: no revascularization in 16 (18.8%), carotid-subclavian bypass in 65 (76.5%), subclavian-carotid transposition in 1 (1.2%) and in-situ fenestration in 3 (3.5%). There was no significant difference in the rate of mortality, stroke, spinal cord ischemia, endoleak or the need for revascularization between these groups. Of the patients undergoing carotid-subclavian bypass, control of the proximal LSA included: no occlusion in 8 (12.3%), surgical tie in 5 (7.7%), suture ligation in 10 (15.4%), neurosurgical aneurysm clip in 4 (6.2%), locking Hemoclip in 18 (27.7%) and Amplazter plug in 20 (30.8%). The composite endpoint was reached in 6 patients with no proximal LSA occlusion (75.0%), 2 patients with surgical ties (40.0%), 2 patients with suture ligation (20.0%), 3 patients with neurosurgical aneurysm clips (75.0%), 4 patients with locking Hemoclips (22.2%) and 10 patients with Amplatzer plugs (50.0%).

Conclusions: This retrospective cohort study demonstrates no significant differences in outcomes between different methods of revascularization of the LSA. However, there were few events overall and the non-bypass groups had small sample sizes. There is a trend towards an increase in the composite outcome with LSA control with neurosurgical aneurysm clips and Amplazter plugs compared to suture ligation or locking Hemoclips. This study provides vascular surgeons some guidance in management of the LSA during TEVAR.

#19 PEDIATRIC BLUNT ABDOMINAL AORTIC INJURY (BAI)

Presenter: Atish Chopra, - Oregon Health and Science University

Authors: A Chopra MD, L Cieciura MD, JG Modrall MD, RJ Valentine MD, S Josephs MD, BJ Naik-Mathuria MD, J Chung MD

Background: Pediatric traumatic blunt abdominal aortic injury (BAI) is rare, but dangerous, presenting a management conundrum. Data regarding the epidemiology, contemporary management, and outcomes of these injuries are scarce. We reviewed national epidemiological data and management trends as well as our institutional cohort.

Method: A review of the National Trauma Data Bank (NTDB) for patients aged <18 years from 2007-2012 was performed. International classification of diseases and procedure codes were used to identify BAI and therapy type. A concurrent single-center, retrospective review of patients aged <18 years with BAI from Oct 2004-May 2015 was also performed. Descriptive statistics of the median and interquartile range (IQR) and frequencies and percentages were utilized with linear regression to evaluate trends.

Results: NTDB review included 564,593 patients with 261 aortic injuries, 57 of which were BAIs yielding an incidence of 0.01%. The median age was 15 (IQR 12, 16) and 38 (67%) were male. Open repair was performed in 12 patients (21%) vs. endovascular therapy in five (9%) vs. non-operative treatment in 40 (70%). There was an overall mortality of 14% with a non-significant trend towards reduced mortality over time (p=0.28). Our institutional review identified 5 patients with BAI associated with lap belt use in a motor-vehicle collision. The median age was 12.6 (11, 13), 3 were males (60%) and the median injury severity score was 42.4 (34, 43). All had associated lap belt use and suffered injuries immediately above the aortic bifurcation diagnosed with computed tomography imaging. Four (80%) patients had associated vertebral fractures. One patient with a grade III BAI was managed conservatively with anti-impulse therapy and aspirin with spontaneous resolution at 4 months. However, another patient with a grade III BAI developed circumferential aortic dissection with associated stenosis and reduction in ankle-brachial index. He is planned for open repair given the risk of aortic occlusion. One patient with a grade II BAI underwent aortic endarterectomy with bovine patch for the development of an intimal flap after initial conservative management. Another patient with a grade III BAI underwent initial heparin therapy and endovascular aortic repair with a Gore Excluder device (16x14.5x70mm) for an enlarging pseudoaneurysm. The last patient had a grade II BAI developed an enlarging right common iliac artery aneurysm and underwent an open repair with hypogastric artery. All repairs have remained patent with no mortalities. Median hospital stay was 25 days (10, 44) with an ICU stay of 8.4 days (5, 12). Median follow-up was 330 days (185, 416).

Conclusion: Pediatric abdominal BAI is associated with a 14% in-hospital mortality. No uniformly accepted management algorithm currently exists, though not all injuries mandate urgent therapy. Further multicenter prospective studies are needed to clarify the natural history and operative indications.

#20: Endovascular Repair of Extend II–IV Thoracoabdominal Aortic Aneurysms

Presenter: Jonathon Misskey, MD

Authors: J Faulds, J Misskey, J Gagnon, K Baxter, J Chen, D Klass, J Price, M Janusz

Objectives: Open surgery provides a safe and durable reconstruction for patients with Extent II-IV thoracoabdominal aortic aneurysms. For patients unable to tolerate open repair due to extreme physiologic risk, endovascular repair has been utilized using either custom-made or off-the-shelf branched devices. This report describes our initial experience with endovascular branched graft repair of Extent II-IV thoracoabdominal aortic aneurysms in patients unfit for open repair.

Methods: Retrospective analysis of all patients undergoing endovascular treatment of extent II-IV thoracoabdominal aortic aneurysms. Pre-operative patient characteristics, as well as aneurysm etiology, size and extent were recorded. Endovascular graft configuration and number of branches were recorded. Intraoperative details and follow up to a mean of 22 months was available.

Results: Twenty-two patients underwent endovascular repair of extent II (54.5%), III (18.8%) and IV (27.2%) thoracoabdominal aortic aneurysms from 2009 to 2015. Graft configuration was 4 branched devices in 18 (81.8%) and three branches in 4 (18.2%). Grafts were Custom made in 10 patients and off the shelf in 12 patients. Three patients were treated with a planned perfusion branch. Median age was 9 years and 14 patients (64%) were male. There were 2 ruptures (9.1%) with all other patients having elective repair. There were no intraoperative deaths and 3 patients (13.6%) died prior to discharge. There were 2 (9%) conversions to open repair and 2 (9%) cases of paraplegia. There were 11 (50%) patients with post operative endoleak of which 8 required an intervention for an endoleak at the site of a branch. Seven patients (31.8%) were noted to have ongoing aneurysm sac enlargement on follow up imaging.

Conclusion: Endovascular repair is an evolving treatment modality for patients with thoracoabdominal aortic aneurysms and has allowed treatment to be extended to those considered unfit for open surgery. A trend towards decreased perioperative morbidity with endovascular repair will continue to force surgeons to determine if the less definitive nature of the treatment is worth the benefit, and whether endovascular repair should be offered to patients suitable for open repair.

#21 CHARACTERIZATION OF PROFUNDA FEMORIS VEIN THROMBOSIS

Presenter: Tana Repella, MD PhD - Oregon Health & Science University

Authors: TL Repella MD PhD, S Afrose, CZ Abraham MD, AF Azarbal MD, E Jung MD, GJ Landry MD, TK Liem MD, EL Mitchell MD, GL Moneta MD

Background: The profunda femoris vein (PFV) drains blood from the inner thigh traveling superiorly and medially to join the femoral vein. Despite evidence that PFV thrombosis can lead to pulmonary embolism, there have been few studies detailing the incidence of PFV thrombosis. We sought to characterize the anatomic distribution of thrombus in patients with PFV thrombosis as well as their demographic characteristics.

Method: This is a retrospective chart review of patients at our tertiary care university hospital that were found to have deep vein thrombosis (DVT) via ultrasound (US) between June 2014-June 2015. Patients were categorized as to whether or not they had PFV involvement and the anatomic distribution was further stratified to determine whether there was external iliac vein (EIV), common femoral vein (CFV), femoral vein (FV), or popliteal vein (PV) involvement. Demographics were compared between groups.

Results: There were a total of 4,584 ultrasound scans performed during this period with 398 (8.7%) positive for DVT. 22% of DVT (88 of 398 scans) involved the PFV. There were 111 patients with CFV DVT and of those patients 53 (47.7%) also had involvement of the PFV. Of the 60 patients with PFV DVT 54 (90%) also had involvement of the CFV. There was no significant difference in the laterality of DVT between the PFV and control groups (35% vs. 41.5% respectively for the left and 35% vs. 33.5% respectively for the right p=0.619). 25% of the control group had bilateral DVT as compared to 30% of the PFV group.

In terms of anatomic distribution there was a higher proportion of PFV DVT with EIV involvement (21.7%) as compared to control (2.5%) ($p<0.00001$). There was also a higher proportion of patients in the PFV group with distal involvement (FV or PV) as compared to control (68.3% vs. 19% respectively $p<0.00001$).

Patients in the PFV group were more likely to have a history of a hypercoagulable disorder as compared to controls (26.7% vs. 14.5% p=0.029). There was also a significantly higher proportion of patients in the PFV group with a history of immobility as compared to controls (58.3% vs. 42% p=0.026). There were no significant differences in terms of smoking history, recent surgery, personal history of DVT, family history of DVT, or other medical comorbidities.

Conclusion: Our preliminary results suggest that patients with PFV thrombosis tend to have more thrombus burden with involvement of the iliac veins as well as distal deep veins. Patients with PFV thrombosis are also more likely to have a history of hypercoagulable disorder and immobility. Characterization of this process is important as there is currently scant data concerning PFV thrombosis despite it being a recognized source of pulmonary embolism. Formalized protocols for US do not routinely include examination of the PFV thus characterization of the natural history of PFV thrombosis may lead to the need for development of new DVT screening protocols.

#22 DUPLEX ULTRASOUND FOR THE DIAGNOSIS OF NUTCRACKER PHENOMENON

Presenter: Sara Skjonsberg, RVT, RPhS - University of Washington Medical Center

Authors: SM Skjonsberg BS RVT RPhS

Background: Nutcracker phenomenon is a rare condition which results in renal venous hypertension due to left renal vein compression between the superior mesenteric artery and the aorta. Traditional diagnostic imaging with CT or contrast venography is expensive, requires exposure to contrast and ionizing radiation, and is unsuitable as a screening test. Duplex ultrasound of the left renal vein with B-mode diameter measurements and Doppler peak systolic velocities is a useful tool in this situation. A comparative, retrospective, review of the ultrasound data from our vascular laboratory was completed in order to validate the diagnostic ultrasound protocol used by our lab and test the sensitivity of criteria which we use.

Method: A retrospective review of the ultrasound results using AP diameter ratios (DR) and peak systolic velocity ratios (VR), were compared to venography with intravascular ultrasound and computed tomographic venography (CTV) from April 2013 to May 2016. VR is calculated by dividing the peak systolic velocity at the narrowed segment by the peak systolic velocity in the distended segment. Conversely, DR is calculated by dividing the diameter at the distended segment by the diameter at the narrowed segment. Diagnostic criteria for the nutcracker phenomenon were considered to be a VR and DR of 5. Discrepancies were evaluated and analyzed.

Results: A total of 60 examinations were completed by our ultrasound laboratory from 4/2013 to 6/2016; 32 of those ultrasound examinations had comparative imaging (venography or CTV). 21 examinations correlated with comparative imaging, 9 positive and 12 negative. 6 examinations were not included due to limited visualization on ultrasound or incomplete examination on comparative imaging; ultimately resulting in an 81% overall accuracy. 2 of the 9 positive patients met both the threshold of 5 for DR and VR. 5 of the 9 positive patients met only 1 of the thresholds for DR or VR. 2 of the 9 positive patients did not meet either threshold which was thought to be in part due to protocol development and limited visualization on ultrasound.

Conclusion: Duplex ultrasound is a non-invasive, inexpensive and powerful diagnostic tool for the detection of Nutcracker phenomenon. Our data shows that criteria based in both DR and VR of 5 would result in false negatives leading to misdiagnosis and under treatment of our patient population. Rather, the use of a VR or DR of 5 may be useful in diagnosis due to the minimal changes in peak systolic velocity on a patient with adequate collaterals and diameter variability during the respiratory cycle in a dynamic vein (resulting in diameters being obtained at different times in the respiratory cycle). Further studies investigating patient outcome after treatment would be helpful in developing ultrasound criteria which is sensitive for symptomatic Nutcracker syndrome and could result in better patient outcomes.

#23 INTERHOSPITAL VASCULAR SURGERY TRANSFERS AT A TERTIARY CARE HOSPITAL

Presenter: Sheena Harris, MD - Oregon Health and Science University

Authors: S Harris MD, D Wilson MD, E Jung MD, G Moneta MD, E Mitchell MD

Background: Interhospital transfers (IHT) to tertiary care centers are linked to lower operative mortality in vascular surgery patients. However, IHT incurs great healthcare costs, and some transfers may be unnecessary or futile.

In this study, we characterize the patterns of IHT at a tertiary care center to examine appropriateness of transfer for vascular surgery care.

Methods: A retrospective review was performed of all IHT requests made to our institution July 2014-October 2015. Interhospital physician communication and reasons for not accepting transfers were reviewed. Diagnosis, intervention, referring hospital size, and mortality were examined. Follow-up for all patients was reviewed.

Results: 235 IHT requests for vascular surgical care involving 210 patients over 15 months were reviewed. 33% of requested transfers did not occur, most commonly following physician communication resulting in reassurance (35%), clinic referral (30%), or further local workup obviating need for transfer (11%).

67% of requests were accepted. Accepted transfers generally carried life- or limb-threatening diagnoses (70%). Next most common transfer reasons were infection/nonhealing wounds (7%) and nonurgent post-operative complications (7%). 72% of accepted transfers resulted in operative or endovascular intervention: 20% were performed < 8 hours of arrival, 12% < 24 hours, and 68% during hospital admission (average 3 days). 28% of accepted patients received no intervention. Small hospitals (< 100 beds) were more likely to transfer patients not requiring intervention compared to large hospitals (>300 beds) (47% v 18%, P = 0.005), and for infection/nonhealing wounds (30% v 10%, P = 0.013).

Based on referring hospital size, there was no difference in IHTs requiring emergent, urgent, or nonurgent operations. There was also no difference in transport time, time from consult to arrival, or patient mortality according to hospital size. Overall patient mortality was 17%.

Conclusions: Expectedly, most vascular surgery IHTs are for life- or limb-threatening diagnoses, and most of these patients receive an operation. Transfer efficiency and surgical case urgency is similar across hospital sizes. Nonoperative IHTs are sent more often by small hospitals, and may represent a resource disparity which would benefit from regionalizing non-urgent vascular care.

#24 CAUSES AND OUTCOMES OF FINGER ISCHEMIA IN HOSPITALIZED PATIENTS IN THE INTENSIVE CARE UNIT

Presenter: Courtney Mostul - Oregon Health and Science University

Authors: CJ Mostul, DS Ahn MS, BJ McLafferty, TK Liem MD, EL Mitchell MD, E Jung MD, CZ Abraham MD, AF Azarbal MD, GL Moneta MD, GJ Landry MD

Background: Vascular surgeons are frequently consulted to evaluate hospitalized patients in the intensive care unit (ICU) with finger ischemia. We sought to characterize causes and outcomes of finger ischemia in hospitalized patients.

Method: All ICU patients who underwent evaluation for finger ischemia from 2008-2015 were reviewed. All were evaluated with finger photoplethysmography (PPG). Patient demographics, comorbidities, ICU care (ventilator status, arterial lines, use of vasopressors), finger amputations, and survival were recorded.

Results: 97 patients (54 male, 43 female) were identified. Mean age was 57.3416.8. 42 (43%) were in the surgical ICU and 55(57%) in the medical ICU. 70 (72%) had abnormal finger PPGs, 40 (69%) unilateral and 30 (31%) bilateral. 36 (37%) had ischemia associated with an arterial line. 12(13%) had concomitant toe ischemia. 76 (78%) were on vasopressors at the time of diagnosis, with the most frequent being phenylephrine (55%), norepinephrine (47%), ephedrine (30%), epinephrine (26%), vasopressin (25%), dopamine (7%), and dobutamine (6%).Treatment was with therapeutic anticoagulation in 46 (47%), aspirin in 50 (52%), and clopidogrel in 15 (16%). Other frequent associated conditions included mechanical ventilation at time of diagnosis (37%), diabetes (33%), history of peripheral vascular disease (32%), dialysis dependence (31%), cancer (24%) and sepsis (20%). Only five patients (5%) within the ICU ultimately required finger amputation. 30 day, one and two year survival was 85%, 73% and 65%.

Conclusion: Finger ischemia in ICU patients has a variety of causes but is frequently associated with the presence of arterial lines and the use of vasopressor medications, of which phenylephrine and norepinephrine are the most frequent. Either anticoagulation or antiplatelet therapy is appropriate treatment. While progression to amputation is rare, patients with finger ischemia in the ICU have a high rate of mortality.

#25 CRYOPRESERVED VEIN VERSUS AUTOGENOUS VEIN IN PORTOMESENTERIC RECONSTRUCTION DURING PANCREATICODUODENECTOMY

Presenter: Olamide Alabi, MD - Oregon Health and Science University

Authors: S Roy BS, S Madison, S Harris MD, O Alabi MD, A Azarbal MD, G Moneta MD, E Mitchell MD

Background: As of 2016, cancer of the pancreas is the fourth leading cause of cancer death in the United States among both men and women. Margin-negative surgical resection offers the only potential for cure. Tumor resectability is determined by examining involvement of surrounding vessels, and only 15-20% of patients have resectable disease. Resecting tumors with portal or mesenteric vein involvement expands the number of patients able to achieve curative surgical therapy. It has been shown that femoral and saphenous vein can be used with good result in porto-mesenteric reconstruction during pancreaticoduodenectomy; however, femoral vein harvest is associated with complications such as deep venous thrombosis and chronic venous insufficiency. Cryopreserved femoral vein is an alternative to autogenous vein and has none of the morbidity of vein harvest. In this study, we compare the outcomes of autogenous and cryopreserved femoral vein in patients undergoing porto-mesenteric reconstruction during pancreaticoduodenectomy.

Methods: This is a retrospective review of an institutional NSQIP database including all patients undergoing pancreaticoduodenectomy with portomesenteric vein reconstruction from January 2010 to July 2016. Patient demographics including age, sex, and comorbidities were examined. Tumor stage was assessed. Post-operative complications, patency, and mortality were compared between autologous and cryopreserved vein groups.

Results: Of 117 patients, 65 underwent reconstruction with autogenous vein and 62 with cryopreserved vein. Demographics were similar between groups, though the autogenous vein group consisted of significantly more patients with diabetes (46% v 16%, P = 0.023) . Tumor stage did not differ significantly between groups. Surgical site infection did not differ between autogenous and cryopreserved vein (7.1% v 0%, P = 0.238), but there was significantly more deep venous thrombosis in the autogenous vein group (57% v 10%, P = 0.003). Patency did not differ significantly between the autogenous vein and cryopreserved vein group (Kaplan Meier analysis, Log Rank test, P = 0.237). Survival also did not differ significantly between the autogenous vein and cryopreserved vein group (Figure 2) (Kaplan Meier analysis, Log Rank test, P = 0.315).

Conclusion: Patients undergoing pancreaticoduodenectomy with autogenous vein versus cryopreserved vein as the conduit for venous reconstruction do not have significantly different patency or survival rates. However, autogenous vein harvest was associated with significantly higher rates of deep venous thrombosis. Cryopreserved vein is an acceptable alternative to autogenous vein for pancreaticoduodenectomy with porto-mesenteric vein reconstruction.

#26 HEMODIALYSIS FOR ELDERLY RENAL FAILURE PATIENTS: AN AGE BASED COMPARISON OF FISTULA LOCATION, PATENCY, MATURATION, AND PATIENT SURVIVAL

Presenter: Jonathan Misskey, MD - Vancouver General Hospital

Authors: J Misskey, J Faulds, R Sidhu, K Baxter, J Gagnon, Y Hsiang

Background: In many centers elderly patients (>65 years) comprise a significant proportion of renal replacement therapy patients. Current KDOQI guidelines, however, do not incorporate age in determining optimal fistula placement, and controversy exists regarding the optimal access type and configuration in elderly patients. We compared patency, maturation rates, survival and complications between several age cohorts (80) to determine if current access protocols should be modified to account for advanced age

Methods: Data were retrospectively analyzed from a prospectively maintained database. All patients at 2 teaching hospitals undergoing a first ipsilateral autogenous arteriovenous fistula creation between 2007 and 2013 were considered eligible for inclusion. Kaplan Meier survival estimates and Cox proportional hazards models were used to compare fistula patency and risk factors for fistula failure.

Results: A total of 941 patients had a first arteriovenous fistula placed during the study period and were eligible for inclusion. Of this cohort, 152 (15.3%) fistulas were in patients 80 or older, 397 were aged 65-79 (42.2%), and 392 (41.8%) were < 65. Mean follow-up for all groups was 26.0 419.8 months (Range 0 – 89 months). Primary patencies between patients >80, 65-79 and < 65 were 40 44%, 3843% and 5143% at 12 months, 2244%, 2143% and 33 43% at 24 months and 12 45%, 1343% and 27423% at 36 months (P

Constitution & Bylaws

Bylaws of Pacific Northwest Vascular Society

A Washington Nonprofit Corporation

(Revised 10/19/2012)

ARTICLE I
NAME OF CORPORATION

The name of the corporation shall be the "Pacific Northwest Vascular Society," and it may sometimes be referred to in these Bylaws as the "Corporation."

ARTICLE II
PURPOSES

The purposes for which the Corporation is formed are those set forth in its Articles of Incorporation.

ARTICLE III
PRINCIPAL OFFICE

The principal office of the Corporation shall be the office of the current secretary-treasurer. The Corporation may have such other offices as may, from time to time, be designated by its Board of Directors.

ARTICLE IV
MEMBERSHIP

A. VOTING RIGHTS. Each active member in good standing shall be entitled to one vote on each matter submitted to a vote of the members.

B. MEMBERSHIP. Membership shall be limited to physicians having an active practice in vascular disease. Members must meet one of the following requirements

1. Be certified by The American Board of Surgery.
2. Be a Fellow of The American College of Surgeons, or of the Royal College of Surgeons of Canada.
3. Hold a Certificate of Added Qualifications in Vascular and Interventional Radiology from the American Board of Radiology (or Canadian equivalent.
4. Be a member of the Society of Interventional Radiology.

5. Hold a Subspecialty Certificate in Cardiovascular Disease from the American Board of Internal Medicine (or Canadian equivalent).
6. Be a Fellow of the American College of Cardiology or the Society for Vascular Medicine and Biology.

Additionally, members must meet the requirements of one of the four classes of membership set out below.

C. CLASSIFICATION OF MEMBERSHIP. The members of the Corporation shall be divided into the following classes and shall be selected for membership based upon the criteria set out in connection with each class.

1. ACTIVE MEMBERS. All active members shall be physicians fulfilling membership requirements residing in the States of Alaska, Idaho, Washington, Oregon, Hawaii, and Montana, or the provinces of Alberta, British Columbia, and Saskatchewan, Canada.

   Active members must fulfill at least one of the following criteria:

   a. Hold a certificate of competence in general vascular surgery, vascular and interventional radiology, or cardiology as recognized in the United States or Canada;
   b. Previous major contribution to the field of vascular disease;
   c. Membership in the Society for Vascular Surgery, the International Society for Cardiovascular Surgery, the Society of Interventional Radiology, or the Society for Vascular Medicine and Biology;
   d. Should a person desiring membership meet none of the above criteria, that person may submit a list a major vascular reconstructions or interventions which have been performed, and which should include, but need not be limited to, at least fifty (50) consecutive major vascular reconstructions or interventions, which list will be reviewed by the Membership Committee of the Corporation and if approved by the Membership Committee, the applicant's name shall be in turn approved by the Board of Directors of the Corporation and the membership, pursuant to Paragraph D. of this Article.

2. ASSOCIATE MEMBERS. Associate membership shall be available to those who do not qualify for active membership, but who have an interest in vascular diseases. Candidates for such membership shall be proposed in writing to the Membership Committee through the Secretary-Treasurer and shall be selected pursuant to Paragraph D. of this Article.

3. SENIOR MEMBERS. Senior membership status shall be granted to active members who have retired from the active practice of medicine who have requested transfer of their membership status to senior status by submission of such request in writing to the Board of Directors. Senior members shall be excused from paying corporate dues.
4. HONORARY MEMBERS. Honorary members shall consist of individuals who have made significant contributions to the discipline of vascular disease or to the Corporation. Candidates for honorary membership shall be proposed in writing to the Membership Committee of the Corporation through the Secretary-Treasurer and shall be approved by the Board of Directors and the general membership pursuant to Paragraph D. of this Article. Honorary members shall be excused from paying corporate dues and shall not be required to meet the minimum annual meeting attendance requirements.
5. FOUNDING MEMBERS. All members joining the Corporation in the 1983 and 1984, shall be additionally classified as founding members.

D. SELECTION OF MEMBERSHIP. Any physician meeting the general membership requirements for membership may submit an application for membership in the Corporation, which shall be available from the Secretary-Treasurer of the Corporation upon request of any member. Completed application forms signed by the individual requesting membership, one sponsor member and two endorser members shall be delivered to the Secretary-Treasurer of the Corporation at least four (4) months prior to the annual meeting, provided however, the signatures of a sponsor member and two endorser members shall not be required on founding members' applications. A non-refundable application fee determined by the Board of Directors shall be assessed each applicant. Applications received by the Secretary-Treasurer shall be reviewed by the Membership Committee of the Corporation which shall recommend acceptance or denial of the applicant's request for membership in the Corporation. The names of all individuals who are recommended for membership by the Membership Committee shall be submitted to a vote of the Board of Directors and, if approved by the Board of Directors, shall in turn be submitted to a vote of the membership at the Corporation's annual meeting, and shall be accepted as members upon receipt of a three-quarters (3/4) affirmative vote of the members present at the annual meeting.

E. CERTIFICATES OF MEMBERSHIP. Certificates or other evidence of membership in the Corporation may be issued. They shall exhibit the member's name, his class of membership, and shall be signed by the President and Secretary-Treasurer of the Board of Directors of the Corporation.

F. STATUS OF MEMBERSHIP. Membership in the Corporation shall be personal, shall not survive the death of any individual member, and may not be transferred by any means. A member may resign at any time by written notice to the Corporation.

A member may be expelled for unprofessional or unethical conduct under the following circumstances. Charges of unprofessional or unethical conduct against any member of the Corporation which challenge that physician's right to continued membership may be submitted by any member to the Board of Directors of the Corporation. Such charges must set forth specific grounds for such unprofessional or unethical conduct and must be in writing. The member whose conduct is being challenged shall be notified of the charge in writing and shall be provided with an opportunity to reply to the charge. Both the challenge and the member's response shall be submitted to a vote of the Board of Directors who may expel such member by the affirmative vote of two-thirds (2/3) or more of the Directors. The Board of Directors' vote shall be announced at the next annual meeting and may be overruled by a three-fourths (3/4) vote of those members present at the annual meeting.

In the event any active member's dues shall remain unpaid for a period of one (1) year, such member shall be dropped from membership after giving notification to that member at least three (3) months prior to the effective date of lapse of such member's membership.

G. ANNUAL MEETING. The annual meeting of the members shall be held at such time and at such place as shall be determined by the Board of Directors and shall be announced to the membership by written or printed notice stating the place, day and hour of any meeting, which shall be delivered either personally or by mail to the members not less than ten (10) nor more than thirty (30) days prior to the date of such meeting.

The deliberations of the Board of Directors shall be reported by the Secretary-Treasurer to the membership at the annual meeting. The reports of the Nominating Committee and Membership Committee as well as other committees shall also be presented to the membership during the annual meeting.

H. MEMBERSHIP ACTION WITHOUT MEETING. From time to time, other business may be transacted by ballot of the membership tabulated one month from date of mailing, subject to ratification by the full membership at the next annual meeting.

I. SPECIAL MEETINGS. Special meetings of the membership may be held at such time and at such place as shall be determined by the Board of Directors and shall be announced to the membership by written or printed notice stating the place, day and hour of any meeting which shall be delivered either personally or by mail to the members not less than ten (10) nor more than thirty (30) days prior to the date of such meeting.

J. QUORUM. The members present at a meeting shall constitute a quorum to transact the business of a meeting of the membership except as otherwise provided in the Articles of Incorporation or these Bylaws.

K. DUES. Initiation fees, dues and assessments shall be levied by the Board of Directors and approved by the membership at the annual meeting of the Corporation provided, however, honorary members and senior members shall be exempt from the payment of dues.

L. SCIENTIFIC SESSIONS. Corporation may, from time to time, sponsor scientific meetings, which may be attended by any physician, whether or not such physician is a member of the Corporation.

ARTICLE V

BOARD OF DIRECTORS

A. GENERAL POWERS. The affairs of the Corporation and its business and property shall be managed by its Board of Directors.

B. NUMBER AND QUALIFICATION OF BOARD OF DIRECTORS. The number of Board of Directors shall be not less than four (4) nor more than ten (10) and shall consist of the President, the President-Elect, the immediate Past President, the Secretary-Treasurer, and six (6) Directors who shall be elected at large from the membership.

C. TERM OF OFFICE. The members of the Board of Directors who are members by virtue of their office in the Corporation shall serve a term coincident with their term of office. The members of the Board of Directors who are Directors-at-large shall be elected to three-year terms. Initially, three-at-large members of the Board of Directors shall be elected, one to serve a three-year-term, one to serve a two-year-term, and one to serve a one-year-term. Due consideration shall be given to regional representation in electing such Directors. :

D. REGULAR MEETINGS. The Board of Directors shall hold an annual meeting at the annual meeting of the membership of the Corporation, which shall be held without any other notice than this Bylaw. The Board of Directors may provide, by resolution, the time and place for holding additional regular meetings without other notice than such resolution. Financial support will be provided for active duty members of American and Canadian Armed Forces. The amount of support will be determined by the Executive Committee.

E. SPECIAL MEETINGS. Special meetings of the Board of Directors may be called at the discretion and pleasure of the President or upon written notice of any two (2) members of the Board of Directors. Such meetings shall be held at the principal office of the Corporation or at such other place as the director or directors calling the meeting of the Board of Directors shall be limited to the purpose or purposes stated in the notice of the meeting provided, however, if all members of the Board of Directors are present, other matters may be taken up by unanimous consent.

F. NOTICE. Notice of all meetings of the Board of Directors, with the exception of the regular annual meeting, shall be given to the Board members and Advisory Board members at least two (2) days before the meeting by written notice delivered either personally or sent by mail or electronic communication to each director at his address as shown on the records of the Corporation. Any director may waive notice of any meeting. The attendance of a director at any meeting shall constitute a waiver of notice of such meeting, except where a director attends a meeting for the express purpose of objecting to the transaction of any business to be transacted at the meeting need not be specified in the notice or waiver of notice of such meeting unless specifically required by law or by the Bylaws.

G. QUORUM. A minimum of one half (1/2) of the Board of Directors shall be required to constitute the quorum for transaction of business at any meeting of the Board of Directors. If less than this number of directors is present at any meeting, the majority of the directors present may adjourn the meeting from time to time without further notice.

H. BOARD DECISIONS. The act of a majority of the directors present at a meeting at which a quorum is present shall be the act of the Board of Directors.

I. COMPENSATION. Members of the Board of Directors shall not receive any stated salaries for their services. Nothing herein contained however shall be construed to preclude any director from serving the Corporation in any other capacity and receiving compensation therefor. By resolution of the Board of Directors, a fixed sum and expenses of attendance, if any, may be allowed for attendance at any regular or special meetings of the Board of Directors.

J. MINUTES. Minutes of all proceedings of the Board of Directors shall be maintained by the Secretary of the Corporation.

K. COMMITTEES. The President, upon the advice of the Board of Directors, may designate and appoint such committees as he may deem necessary, either as special or permanent committees, to assist him. The following committees shall be permanent committees: Membership Committee, Nominating Committee, Program Committee, Committee on Arrangements for the Annual Meeting, Auditing Committee and Bylaws Committee.

The Membership Committee shall consist of one (1) of the senior-at-large directors, who shall serve as chairman, and one (1) of the junior-at-large directors plus one (1) other member of the Corporation. The Secretary-Treasurer shall be an ex-officio member. The Committee shall recommend individuals to be proposed as members of the Corporation to the Board of Directors.

The Nominating Committee shall consist of the immediate Past President and the one (1) member of the Corporation appointed by the incoming President and shall nominate corporate officers to be submitted to a vote of the membership at the annual meeting. The Secretary-Treasurer shall be an ex-officio member.

The Program Committee, the Committee on Arrangements for the Annual Assembly, and the Auditing Committee shall be appointed annually by the incoming President with the advice of the Board of Directors, and shall serve a term which coincides with the term of the incoming President.

The Auditing Committee shall audit the books of the Corporation and present its report to the Corporation's membership during the business portion of each annual meeting.

The Bylaws Committee shall consist of one (1) of the senior-at-large directors who shall serve as chairman, and one (1) of the junior-at-large directors plus one (1) member of the Corporation. The Secretary-Treasurer shall be an ex-officio member.

All committees shall be chaired by a member appointed by the President with the advice of the Board of Directors.

Chairman of the Membership Committee and the Bylaws Committee shall be appointed by the President from those members of the Board of Directors required by the Bylaws to be members of the respective committee.

I. GIFTS. The Board of Directors may accept, on behalf of the Corporation, any contributions, gift, bequest, or device for any purpose of the Corporation.

ARTICLE VI

OFFICERS

A. OFFICERS. The officers of the Corporation shall be a President, President-Elect, and Secretary-Treasurer. Such officers shall have the authority and perform the duties as prescribed from time to time by the Board of Directors.

B. ELECTION AND TERM OF OFFICE. The Nominating Committee shall submit a slate of proposed officers to the membership at the annual meeting and nominations may also be made by active members from the floor of the annual meeting. The officers of the Corporation shall be elected by majority vote of the active members from the active members of the Corporation at the annual meeting of the membership provided a quorum is present. The President-Elect shall be elected for a one (1) year term, and thereafter shall fulfill the office of the President for a one (1) year term. The Secretary-Treasurer shall be elected for a three (3) year term. Each such officer shall hold office until his successor has been duly elected and qualified.

C. POWERS AND DUTIES OF OFFICERS. The President shall supervise all activities of the Corporation, execute all instruments on its behalf, and preside at all meetings of the Corporation and the Board of Directors at which he may be present. He shall have such powers and shall perform such duties as may, from time to time, be specified in these Bylaws or in resolutions or other directives of the Board of Directors. He shall coordinate the work of the officers and committees of the Corporation in order that the purposes of the Corporation may be promoted and shall perform such duties as are usually inherent in such office. The President shall appoint the members of all standing and ad-hoc committees not otherwise appointed by those Bylaws, and shall serve as an ex-officio member of such committees. Successors to vacated offices of the Corporation shall be appointed by the President until the position is filled at the next annual meeting.

The President-Elect shall perform the duties of the President in the absence of the President, or in the case of the inability of the President to act, and shall perform such other duties as the President may designate. In the absence or incapacity of both the President and the President-Elect, the position shall be assumed by a President Pro-Term, elected by those members of the Board of Directors present at the meeting.

The Secretary-Treasurer shall keep the minutes of all meetings of the Corporation and of the Board of Directors and shall keep all other records of the Corporation. S/he shall be primarily

responsible for giving notice of all meetings held by the Corporation or the Board of Directors, shall conduct all correspondence of the Corporation, and shall issue written reports of the preceding year's transactions to all members which shall be read to the Board of Directors and to the membership at the annual meeting. The Secretary-Treasurer shall have custody of all funds of the Corporation and shall keep a full and accurate account of the receipts and expenditures of the Corporation; shall make disbursements in accordance with the approved budget as authorized by the Corporation, the Board of Directors, or any committee; shall maintain bank accounts in the name of the Corporation in depositories designated by the Board of Directors; and shall render periodic financial annual Treasurer's report for the membership and for audit by the Auditing Committee. The Secretary-Treasurer shall have such other powers and shall perform such other duties as may, from time to time, be specified in resolutions or other directives of the Board of Directors.

D. REMOVAL. Any officer may be removed by the Board of Directors whenever, in its judgment, the best interests of the Corporation would be served thereby.

E. VACANCIES. A vacancy in any office because of death, resignation, removal, disqualification, or other cause may be filled by the President of the Corporation for the unexpired portion of the term.

ARTICLE VII

BOOKS AND RECORDS

The Corporation shall keep correct and complete books of all proceedings of its membership, Board of Directors and committees having and exercising any of the authority of the Board of Directors, and shall keep, at the principal office of the Corporation, a recording giving the names and addresses of the members of the Corporation entitled to vote.

ARTICLE VIII

FISCAL YEAR

The fiscal year of the Corporation shall begin on the 1st day of January of each year and end at midnight on the 31st day of December of such year.

ARTICLE IX

SEAL

The Board of Directors shall provide a corporate seal which shall be a standard form with the name of the Corporation: "Pacific Northwest Vascular Society."

ARTICLE X

INDEMNIFICATION

The Corporation shall indemnify any present or former director, officer, employee, or agent of the Corporation for expenses and costs (including attorney's fees), actually and necessarily incurred by him in connection with the defense or settlement of any pending or threatened action, suit, or proceeding to which he is made a party by reason of his being or having been such official, except in relation to matters as to which he shall be finally judged to be liable for willful misconduct amounting to bad faith. Such indemnification shall not be deemed exclusive of any other right to which such indemnified person may be entitled under the Articles of Incorporation of Bylaws or under any agreement or vote of directors, insurance purchased by the Corporation, or other rights.

ARTICLE XI

CONSTRUCTION OF TERMS AND HEADINGS

Words used in these Bylaws shall be read as masculine or feminine gender and as the singular or plural, as the context requires. The captions or headings in these Bylaws are for convenience only and are not intended to limit or define the scope of effect of any provision of these Bylaws.

ARTICLE XII

WAIVER OF NOTICE

Whenever any notice is required to be given under the provisions of RCW Section 24.03 et seq., or under provisions of the Articles of Incorporation or the Bylaws of the Corporation, 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. All such waivers shall be filed with the corporate records or be made a part of the minutes of the relevant meeting.

ARTICLE XIII

AMENDMENTS

The Bylaws and the Articles of Incorporation of the Corporation may be amended, altered, or repealed at the annual meeting of the Corporation by a two-thirds (2/3) affirmative vote of the members present, provided there is a quorum of the membership present at such meeting. For the purpose of amending, altering, or repealing the Bylaws, a quorum shall consist of one-third (1/3) of the Active members of the Corporation.

KNOW ALL MEN BY THESE PRESENTS: The undersigned Secretary of Pacific Northwest Vascular Society does hereby certify that the above and foregoing Bylaws of said Corporation were duly adopted by the Board of Directors as the Bylaws of the Pacific Northwest Vascular Society and that the same do now constitute the Bylaws of said Corporation.

Dated this 19th day of October, 2012

Benjamin W. Starnes, MD
Secretary-Treasurer

2016 Membership

Bruce A. Adye, MD (Active)
520 Mary Street
Suite 520
Evansville, IN 47724-1682
Tel: 812-424-8231
Fax: 812-464-8352
Email: b80@insightbb.com

Charles A. Andersen, MD, FACS (Active)
Madigan Army Medical Center
Chief, Vascular Surgery
1302 28th Ave. Ct.
Milton, WA 98354
Tel: 253-968-2290
Fax: 253-952-8816
Email: cande98752@aol.com

John S. Arthur, MD, FACS (Retired)
1205 Ioka way NW
Silverdale, WA 98383
Tel: 360-479-2400
Fax: 360-479-2401
Email: jsamdps@msn.com

James W. Asaph, MD, FACS (Senior)
4401 S.W. Westdale Drive
Portland, OR 97221-3158
Tel: 503-215-2300
Fax: 503-215-2333
Email: mrnous@aol.com

Amir-Fasin Azarbal, MD (Active)
Oregon Health & Science University
3181 S.W. Sam Jackson Park Road
OP-11
Portland, OR 97239
Tel: 503-494-7593
Fax: 503-494-4324
Email: azarbala@ohsu.edu

Keith Baxter, MD (Active)
Vancouver General Hospital
Room 4211
2775 Laurel St
Vancouver, BC V5Z 1M9
CANADA
Tel: 604-875-5538
Fax: 604-875-5542
Email: keith.baxter@vch.ca

Roger P. Bernard, MD (Senior)
45 High Oak Drive
Medford, OR 97504
Tel: 541-779-0293
Fax: 541-779-0293
Email: rolabern@aol.com

George A. Berni, MD (Active)
Harrison Memorial Hospital
1225 Campbell Way, Suite 101
Bremerton, WA 98310
Tel: 360-479-4203
Fax: 360-478-7240
Email: ggberni@wavecable.com

Jeffrey D. Bernstein, MD, FACS (Active)
The Polyclinic
1145 Broadway
Seattle, WA 98122
Tel: 206-860-2204
Fax: 360-830-1289
Email: jeffreybernstein@mac.com

Duane S. Bietz, MD (Senior)
1221 SW 10th Avenue
Suite 901
Portland, OR 97205
Tel: 503-296-4136
Fax: 503-233-1602
Email: heartbietz@comcast.net

David H. Bingham, MD (Associate)
Bryan/LGH Hospital
1500 South 48th Street
Suite 400
Lincoln, NE 68506
Tel: 402-481-8500
Fax: 402-481-8501
Email: user238815@aol.com

Milton Brinton, MD (Active)
The Woodlands Vein & Laser Center
6627 Pinebrook Bridge Lane
Spring, TX 77379
Tel: 281-885-9207
Email: brintonmh@gmail.com

James D. Buttorff, MD, FACS (Active)
Multicare Medical Association
409 South L
Suite 204
Tacoma, WA 98405
Tel: 253 403 8410
Fax: 253-572-7876
Email: cvajdb@harbornet.com

Jerry C. Chen, MD (Active)
University of British Columbia
2775 Laurel Street
Suite 4203
Vancouver, BC V5Z 1M9
CANADA
Tel: 604-875-5535
Fax: 604-875-5542
Email: jerry.chen@vch.ca

James M. Cook, MD (Active)
Radia
1330 Rockefeller Avenue
Suite 520
Everett, WA 98201
Tel: 425-297-5200
Fax: 425-297-5210
Email: jcook@radiax.com

Joseph A. Davis, MD (Active)
Sacred Heart Medical Center
122 West 7th Avenue
Suite 420
Spokane, WA 99204
Tel: 509-626-9440
Fax: 509-625-1888
Email: josephadavis@comcast.net

Robert DeFrang, MD (Active)
Radia
1330 Rockefeller Avenue, Suite 520
Everett, Washington 98201
Tel: 425-297-5200
Email: defrang@mac.com

David M. Deitz, MD, FACS (Active)
South Sound Surgical Associates
3920 Capital Mall Drive SW
Suite 203
Olympia, WA 98502-8702
Tel: 360-754-3507
Fax: 360-236-1457
Email: femtib@aol.com

William C. Duncan, III, MD, FACS (Senior)
5400 Menefee Drive
Portland, OR 97239
Tel: 503-246-5333
Email: william.duncan@comcast.net

Brian L. Ferris, MD (Active)
Lake Washington Vascular, PLLC
1135 116th Avenue N.E.
Suite 305
Bellevue, WA 98004
Tel: 425-453-1772
Email: drferris@lkwv.com

George S. Fortner, MD (Active)
Peace Health St. John Medical Center
1615 Delaware Street
Suite 200
Longview, WA 98632
Tel: 360-425-5160
Email: gfortner@peacehealth.org

Gerald E. Gibbons, MD (Senior)
2642 School Street
Wenatchee, WA 98801
Tel: 509-663-8711
Email: gegibbons@nwi.net

Kathleen D. Gibson, MD, FACS (Active)
Lake Washington Vascular, PLLC
1135 116th Avenue N.E.
Suite 305
Bellevue, WA 98004
Tel: 425-453-1772
Fax: 425-453-0603
Email: drgibson@lkwv.com

Jeffrey J. Gilbertson, MD (Active)
St. Lukes Cardiothoracic and Vascular Associates
333 N. First Street
Suite 280
Boise, ID 83702
Tel: 208-345-6545
Fax: 208-345-1213
Email: jjon@cardvasc.com

George W. Girvin, MD, FACS (Senior)
105 W. 8th Avenue
Suite 7060
Spokane, WA 99204

Roger W. Hallin, MD, FACS (Senior)
12080 S.W. Terwilliger
Portland, OR 97219
Fax: 503-635-7688
Email: rhallin58@gmail.com

Christian Hamlat, MD (Active)
St. Lukes Cardiothoracic & Vascular Associates
333 N. First Street, Ste. 280
Boise, ID 83702
Tel: 206-744-000
Email: cahamlat@gmail.com

Thomas Hatsukami, MD (Active)
University of Washington
325 9th Avenue
Box 359908
Seattle, WA 98104
Tel: 206-744-8041
Fax: 206-744-6794
Email: tomhat@uw.edu

Annette M. Holmvang, MD (Active)
Richmond Hospital
6051 Gilbert Road
Suite 207
Richmond, BC V7C 3V3
CANADA
Tel: 604-276-0952
Fax: 604-231-0583
Email: aholmvang@shaw.ca

Gord T.M. Houston, MD (Active)
7031 Westminster Highway
Suite 307
Vancouver, BC V6X 1A3
CANADA
Tel: 604-270-2726
Fax: 604-270-1434
Email: ghrh@telus.net

York Nien-Hsiung Hsiang, MB ChB MHSc FRCSC
University of BC
943 West Broadway, #510
Vancouver, BC V5Z 1K3
CANADA
Tel: 604-876-5882
Fax: 604-878-8085
Email: ynhsiang@yahoo.ca

Toshio Inahara, MD, FACS (Senior)
1115 S.W. Summit View Drive
Portland, OR 97225
Fax: 503-297-6817

Kenneth A. Janoff, MD, FACS (Active)
Mt. Hood General & Vascular Surgeons
5050 N.E. Hoyt Street
Suite 411
Portland, OR 97213
Tel: 503-239-4324
Fax: 503-239-5572
Email: kathyp411@hotmail.com

Kaj H. Johansen, MD, FACS (Active)
Swedish Heart & Vascular Institute
600 Broadway #112
Seattle, WA 98122
Tel: 206-420-3119
Fax: 206-453-9512
Email: kaj.johansen@swedish.org

Enjae Jung, MD (Active)
3181 SW Sam Jackson Park Rd
Portland, OR 97239
Tel**:** 503-494-7593
Email: junen@ohsu.edu

Andris Kazmers, MD, FACS (Associate)
521 Monroe Street
Suite 140
Petoskey, MI 48770-2266
Tel: 231-348-9129
Fax: 231-348-1074
Email: akazmers@excite.com

John W. Kenagy, MD, FACS (Senior)
Kenagy and Associates, LLC
3 Indian Hill Road
Belmont, MA 2478
Tel: 617-489-3937
Email: JOHN@JOHNKENAGY.COM

Todd K. Kihara, MD, FACS (Active)
Franciscan Vascular Associates - Tacoma
1802 S. Yakima Avenue, Suite 204
Tacoma, WA 98405
Tel: 253-382-8540
Fax: 253-382-8545
Email: toddkihara@fhshealth.org

James King, Jr. (Senior)
4135 Riva De Tierra Lane
Las Vegas, Nevada 89132
Email: macriv@attbi.com

John Kingsley, MD FACS (Active)
Alabama Vascular & Vein Center
700 Montgomery Hwy
Birmingham, AL 35216
Tel: 205-802-6959

Richard N Kleaveland, MD (Senior)
175 Eighth Ave.
Spokane, WA 99204
Tel: 509-838-8286

Ted R. Kohler, MD, FACS (Active)
Puget Sound Healthcare System 112V
Department of Veteran Affairs
1660 South Columbian Way
Seattle, WA 98108
Tel: 206-764-2245
Fax: 206-764-2529
Email: kohler@u.washington.edu

David Kopriva, MD (Active)
Regina General Hospital/University of Saskatchewan
1440 14th Avenue
Regina, SK S4P 0W5
CANADA
Tel: 306-766-6900
Fax: 306-766-6920
Email: dkopriva@sasktel.net

Peter Kreishman, MD (Active)
Madigan Army Medical Center
9040 -A- Fitzsimmons Drive
Tacoma, WA 98431-1100
Tel: 253-968-2290
Fax: 253-968-5997

Richard Merle Kremer, MD, FACS (Retired)
PO Box 33330
Seattle, WA 98133
Tel: 425-744-1405
Fax: 425-744-1405
Email: rmkmd@prodigy.net

Greg J. Landry, MD, FACS (Active)
Oregon Health & Science University
3181 SW Sam Jackson Park Road
OP-11
Portland, OR 97239-3098
Tel: 503-494-7593
Fax: 503-494-4324
Email: landryg@ohsu.edu

Brian Lange, MD, FACS (Active)
Swedish Medical Center Seattle
801 Broadway
Seattle, Washington 98122
Tel: 206-682-6087

Benjamin Lerner, MD (Active)
1560 N. 115th Street
Seattle, WA 98133
Tel: 206-368-1070
Email: benjamin.lerner@nwhsea.org

Timothy K. Liem, MD, FACS (Active)
Oregon Health & Science University
3181 SW Sam Jackson Park Road
OP-11
Portland, OR 97239-3098
Tel: 503-494-7593
Fax: 503-494-4324
Email: liemt@ohsu.edu

Brian D. Matteson, MD, FACS (Active)
St. Lukes Cardiothoracic and Vascular Associates
333 N. First Street
Suite 280
Boise, ID 83702
Tel: 208-345-6545
Fax: 208-345-1213
Email: bmatteson@slhs.org

Robert McAlexander, MD, FACS (Senior)
Tacoma General Hospital
17404 Meridian E.
Puyallup, Washington 98375
253-884-2433

William McQuinn, Jr., MD (Active)
Group Health Cooperative
2347 34th Ave. S
Seattle, Washington 98144
206-612-2876
cmcquinn@comcast.net

Mark H Meissner, MD, FACS (Active)
University of Washington
1959 NE Pacific Street
Dept. of Surgery, Box 356410
Seattle, WA 98195
Tel: 206-221-7047
Fax: 206-598-1466
Email: meissner@u.washington.edu

Erica Leith Mitchell, MD (Active)
Oregon Health & Science University
Division Vascular Surgery
3181 SW Sam Jackson Park Road
OP-11
Portland, OR 97239
Tel: 503-494-8311
Fax: 503-494-4324
Email: mitcheer@ohsu.edu

Gregory L. Moneta, MD, FACS (Active)
Oregon Health & Science University
3181 SW Sam Jackson Park Road
OP-11
Portland, OR 97239
Tel: 503-494-8311
Fax: 503-494-4324
Email: monetag@ohsu.edu

Stephan C. Mostowy, MD, FRCS (Active)
Kelowna General Hospital
3001 Tutt Street
Suite 201
Kelowna, BC V1Y 2H4
CANADA
Tel: 250-762-7731
Fax: 250-762-7502
Email: stephan.mostowy@gmail.com

Thomas O. Murphy, MD, FACS (Senior)
161 Maple Lane NW
Gig Harbour, WA 98335-5949
Tel: 253-265-3661
Fax: 253-265-3498
Email: sundance@harbornet.com

Stephen P. Murray, MD (Active)
Providence Inland Vascular Institute
122 West 7th Avenue, Suite 420
Spokane, WA 99204
Tel: 509-626-9440
Fax: 509-625-1888
Email: stephen.murray@providence.org

Ryan Nachreiner, MD (Active)
Sacred Heart Medical Center
122 West 7th Avenue
Suite 420
Spokane, WA 99204
Tel: 509-838-8286
Fax: 509-625-1888
Email: rnachreiner@inlandvascular.com

Daniel F. Neuzil, MD, FACS (Active)
Virginia Mason Medical Center
816 E. Shelby
Seattle, WA 98102
Tel: 206-223-6637
Fax: 206-625-7245
Email: daniel.neuzil@vmmc.org

Alexander D. Nicoloff, MD (Active)
501 N. Graham Street, #415
Portland, OR 97227-2006
Tel: 503-413-3580

Aksel G. Nordestgaard, MD, FACS (Active)
NW Vein & Aestetic Center, PS
7502 Ford Drive
Gig Harbor, WA 98335
Tel: 253-857-8346
Fax: 253-572-7875
Email: a.nordy@comcast.net

Mark Ombrellaro, MD, FACS (Senior)
12303 N.E. 130th Lane
Kirkland, Washington 98034
Tel: 425-450-7007

Robert W. Osborne, MD (Active)
Eterna Vein & Medical Aesthetics
1803 So Meridian
Puyallup, WA 98371
Tel: 253-279-0254
Fax: 253-572-7875
Email: osborne.rw@gmail.com

Jeff Pasenau, MD (Active)
Kelowna Vascular Associates
3001 Tutt Street
Suite 201
Kelowna, BC V1Y 2H4
CANADA
Tel: 250-762-7731
Fax: 250-762-7502
Email: jeff@pasenau.com

James J. Peck, MD, FACS (Active)
Oregon Medical Board
1500 SW 1st Avenue, 620 Crown Plaza
Portland, OR 97225
Tel: 503-679-2988
Fax: 503-297-3138
Email: jamesjpeck@gmail.com

Thomas R. Pellow, MD, FACS (Active)
Sacred Heart Medical Center
122 West 7th Avenue, Suite 420
Spokane, WA 99204
Tel: 509-626-9440
Fax: 509-625-1888
Email: thomas.pellow@providence.org

Daniel Pepper, MD (Active)
Lake Washington Vascular, PLLC
1135 116th Avenue N.E., Suite 305
Bellevue, WA 98004
Tel: 425-453-1772
Fax: 425-453-0603
Email: drpepper@lkwv.com

Damien Pierce, MD (Active)
Virginia Mason Medical Center
1100 Ninth Ave.
Seattle, Washington 98101

Rick D. Pittman, MD (Active)
Salem Vein & Aesthetics Center
1535 Liberty Street SE
Salem, OR 97302-4345
Tel: 503-370-8346
Fax: 866-371-8334
Email: drrick@salemvascular.com

Terence M. Quigley, MD. FACS (Active)
Seattle Pacific Surgeons
1560 N. 115th Street
Suite 102
Seattle, WA 98133
Tel: 206-368-1070
Fax: 206-303-4172
Email: Tquigley@NWHSEA.org

Elina Quiroga, MD (Active)
University of Washington
325 9th Avenue
Seattle, WA 98104
Tel: 206-744-3033
Fax: 253-968-0232
Email: elinaq@uw.edu

Edmond J. Raker, MD (Active)
Virginia Mason Medical Center
1100 9th Avenue, BUCK 6
Seattle, WA 98101
Tel: 206-223-6950
Fax: 206-341-0049
Email: gtsejr@vmmc.org

M. Kathleen Reilly, MD (Active)
Sacred Heart Medical Center
122 West 7th Avenue
Suite 420
Spokane, WA 99204
Tel: 509-838-8286
Fax: 509-625-1888
Email: kreilly@inlandvascular.com

Adnan (Addi) Z. Rizvi, MD (Active)
Providence Vascular Institute
122 W. 7th Avenue
Suite 420
Spokane, WA 99204
P: (509) 626-9440
F: (509) 626-9475
Email: adnan.rizvi@providence.org

Justin A. Robinson, MD, FACS (Senior)
Yakima Vascular Associates
4606 Fechter Road
Yakima, WA 98908
Tel: 509-972-5484
Fax: 509-248-9964
Email: spaderbay@hotmail.com

Anthony J. Roon, MD, FACS (Senior)
4014 Mission Beach Drive
Tulalip, WA 98271
Tel: 360-653-6673
Fax: 425-261-3030
Email: ajrfacs@aol.com

Glen S. Roseborough, MD (Active)
Advanced Vascular Therapy, LLC
2480 Liberty St. NE #110
Salem OR 97301
Tel: 503-371-1756
Fax: 503-584-7971
Email: glen@advancedvascular.org

Stanley Ruff, MD, FACS (Retired)
360 S. Garden Way
Eugene, Oregon 97401
Tel: 541-687-7793
Email: stanruff@gmail.com

Anthony Salvian, MD (Active)
Pacific Vein Clinic
1214-750 Broadway W.
Vancouver, British Columbia V5Z 1J2
Tel: 604-874-0532
Email: salvian@pop.interchange.ubc.ca

Richard A. Schwartz, MD, FACS (Active)
29555 Bates Toad
Perrysburg, OH 43551
Tel: 360-779-2965

Sherene Shalhub, MD (Active)
University of Washington
325 9th Street
Seattle, WA 98104
Tel: 205-744-3370
Fax: 253-968-0232
Email: shalhub@uw.edu

Niten Singh, MD (Active)
University of Washington
325 9th Avenue
Seattle, WA 98104
Tel: 206-744-3370
Email: singhn2@uw.edu

Christopher Stahler, Jr., MD, FACS (Senior)
Wenatchee Valley Clnic
820 North Chelan Avenue
Wenatchee, WA 98801
Tel: 509-663-8711
Fax: 509-664-7178
Email: skylineMC@aol.com

Benjamin W. Starnes, MD, FACS (Active)
University of Washington
325 9th Avenue
Seattle, WA 98104
Tel: 206-744-3033
Fax: 253-968-0232
Email: starnes@uw.edu

David L. Street, MD, FACS (Active)
Oregon Surgical Specialists, PC
520 Medical Center Drive
Suite 300
Medford, OR 97504-4316
Tel: 541-779-0837

Leonard T. Su, MD (Active)
Lake Washington Vascular, PLLC
1135 116th Avenue N.E.
Suite 305
Bellevue, WA 98004
Tel: 425-453-1772
Fax: 425-453-0603
Email: drsu@lkwv.com

Matthew Sweet, MD (Active)
University of Washington
1959 NE Pacific Street
Box 356410
Seattle, WA 98195
Tel: 206-598-1059
Fax: 206-598-1466
Email: mpsweet@uw.edu

Swee Lian Tan, MD, PhD, FACS (Active)
Vascular and Surgical Care Northwest
600 Broadway, Suite 112
Seattle, WA 98122
Tel: 206-420-3119
Fax: 206-453-5912
Email: sweelian.tan@swedish.org

Gale Lynn Tang, MD (Active)
University of Washington
Surgical Services 112, VA PSHCS
1660 S. Columbian Way
Seattle, WA 98115
Tel: (206) 764-2245
Fax: (206) 764-2529
Email: gtang@u.washington.edu

David C. Taylor, MD (Active)
University of British Columia
2775 Laurel Street
Suite 4213
Vancouver, BC V5Z 1M9
CANADA
Tel: 604-875-5540
Fax: 604-875-5542
Email: dctaylor@interchange.ubc.ca

Lloyd Taylor, MD (Retired)
Oregon Health & Science University
0340 SW Idaho Street
Portland, OR 97239
Tel: 503-929-3369

Roy A. Taylor, MD (Active)
4540 Cordata Pkwy, Suite 201
Bellingham, WA 98226
Tel: 360-676-1225
Fax: 360-734-5947
Email: rataylor@hinet.org

Des Teso, MD (Active)
Southwest Washington Medical Center
14615 NE 11th Street
Vancouver, WA 98684
Tel: 360-514-1854
Fax: 360-514-6063
Email: dteso@swmedicalcenter.org

George Thomas, MD (Senior)
1600 E. Jefferson Street
Seattle, Washington 98122
Tel: 206-860-5945

Nam T. Tran, MD (Active)
University of Washington
325 9th Avenue, Box 359980
Seattle, WA 98104
Tel: 206-744-8041
Fax: 206-744-6794
Email: nam@uw.edu

Michael J. Tullis, MD, FACS (Active)
St. Luke's Clinic – VeinCare
3277 E. Louise Drive
Suite 150
Meridian, ID 83642
Tel: 208-706-8346
Fax: 208-706-8347
Email: mjtullis@slhs.org

Robert G. Turnbull, MD (Active)
Professional Corporation
205 Tawa Centre
3017 - 66 Street
Edmonton, AB T6K 4B2
CANADA
Tel: 780-461-6012
Fax: 780-461-5442
Email: rgturnbull@surgicorp.ca

R. Mark Vetto, MD, FACS (Senior)
3330 SW Fairmount Boulevard
Portland, OR 97239
Tel: 503-233-3337
Fax: 503-291-4059
Email: rmarkvetto@aol.com

Felix G. Vladimir, MD (Active)
Univeristy of Washington
1959 NE Pacific St
Seattle, Washington 98195
Tel: 646-784-6861
Email: felixvladimir@gmail.com

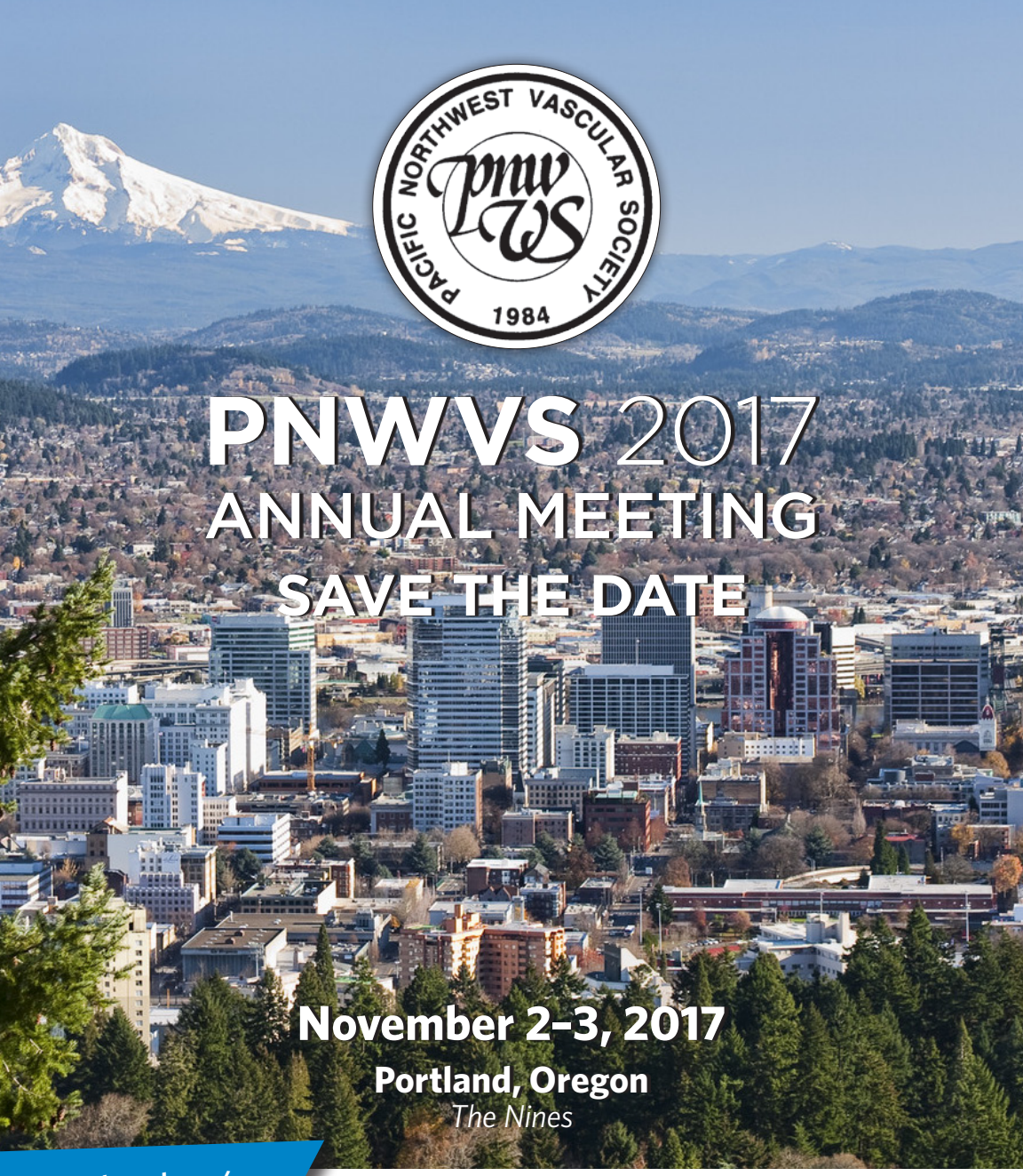
Jim C. Watson, MD, FACS (Active)
7808 SE 28th St.
Apt B305
Mercer Island, WA 98040
Email: watsjc1@comcast.net

John W. Wiest, MD, FACS (Active)
Pacific Vascular Specialists
9155 SW Barnes Road
Suite 321
Portland, OR 97225
Tel: 503-292-0070
Fax: 503-292-7731
Email: john.wiest@providence.org

W. Kent Williamson, MD (Active)
Pacific Vascular Specialists
9155 SW Barnes Road
Suite #321
Portland, OR 97225
Tel: 503-292-0070
Fax: 503-292-7731
Email: weldon.williamson@providence.org

Gerrit B. Winkelaar, MD, MSc (Active)
University of Alberta
3017 66 Street
Suite 205
Edmonton, AB T6K 4B2
CANADA
Tel: 780-461-6012
Fax: 780-461-5442
Email: gbwinkelaar@shaw.ca

R. Eugene Zierler, MD (Active)
University of Washington
Dept. of Surgery
Box 356410
Seattle, WA 98195-6410
Tel: 206-598-9851
Fax: 206-598-1466
Email: gzierler@u.washington.edu



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NOTES