FINAL PROGRAM

American Venous Forum

28th Annual Meeting

Buena Vista Palace Hotel • Orlando, Florida • February 24-26, 2016

AVF-0216-018

About AVF

The American Venous Forum (AVF) is dedicated to improving the care of patients with venous and lymphatic disease. Founded in 1987, AVF fosters cutting edge research and clinical innovation and educates health care professionals, patients and policy makers about venous and lymphatic diseases. AVF's leadership and membership are recognized internationally as thought leaders, expert investigators and clinicians in venous and lymphatic health care.

Program Objectives

The objective of this comprehensive meeting is to provide attendees with knowledge of current thinking in effective clinical management of venous disease and insight into the future directions from critical analysis of investigative findings.

Accreditation Statement

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the Institute for the Advancement of Human Behavior (IAHB) and American Venous Forum (AVF). IAHB is accredited by the ACCME to provide continuing medical education for physicians.

Credit Designation Statement

IAHB designates this live activity for a maximum of 22.25 *AMA PRA Category 1 Credits*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Of the *AMA PRA Category 1 Credits*™ listed above, a maximum of 17.0 credits meet the requirements for Self-Assessment.

Evaluations

Please take time to complete the Annual Meeting evaluation form provided by Amedco. Your input and comments are essential in planning future educational events. *Evaluations must be completed in order to claim CME credit hours for this program.*

To access the American Venous Forum 28th Annual Meeting Evaluations:

Go to AVF.CmeCertificateOnline.com

If you need SAM credit, choose the appropriate SAM title, complete the posttest and get your certificate.

If you need additional SAM credit, go back to AVF.CmeCertificateOnline.com and choose the next SAM title and so forth.

If you need only CME credit, or need the balance of CME credit after claiming your SAM credit, choose the CME Credit Only evaluation at the bottom of the list.

Disclosure Information

All attendees will receive the disclosure statement at the registration desk.

Grant Acknowledgement

The American Venous Forum wishes to recognize and thank the following companies for their ongoing support through the Annual Meeting educational grants: Boston Scientific, BTG International, Cook Medical, Medtronic, Vascular Insights, and Volcano.

Marketing and Exhibitor Acknowledgement

The American Venous Forum wishes to recognize and thank the following exhibiting companies for their ongoing marketing support: ACI Medical, LLC; American College of Phlebology; American Venous Forum; AngioDynamics, Inc.; Boston Scientific; BSN medical; BTG International; Carolon; Center for Vein Restoration; Cook Medical; Covidien/Medtronic; Crystal Clear Digital Marketing; DJO Global; Hokanson; Intersocietal Accreditation Commission; Juzo; LeMaitre Vascular; Lohmann and Rauscher; medi USA/circaid; Medstreaming; Merz Aesthetics; Osborn Medical; Penumbra, Inc., Primus Pharmaceuticals, Inc.; Signature Forum; SIGVARIS, Inc.; Sonosoft/Empower Technologies Inc.; Tactile Medical; Translite, LLC; Vascular Insights; Vascular News; VEIN Magazine; Vein Specialists of America; Vein Therapy News; Venous Symposium; Volcano Corporation.

Day of Innovation and Science Support Acknowledgement

AngioDynamics, BTG International, Cook Medical, Medtronic, Vascular Insights, and Volcano.

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Message from the President

Dear AVF Members and Meeting Attendees,

Welcome to the American Venous Forum's 28th Annual Meeting in Orlando, Florida!

Over the past year AVF leadership and the Program Committee have recruited experts from the venous and lymphatic community as well as thought leaders from other societies, the insurance sector and representatives from government agencies to speak at our meeting.

I am excited to share with you a few highlights of the meeting:

- Day of Innovation and Science, AVF's first non-CME program, to be held on Tuesday February 23 from 1:00-6:00 pm, will bring together all major stakeholders in the field of venous and lymphatic disease to identify current research priorities.
- Six Specialty Symposia developed in coordination with the Symposium on Advanced Wound Care, Society of Interventional Radiology, American College of Phlebology, International Union of Phlebology, Polish Society of Phlebology and the AVF International and Program Committees.
- David S. Sumner Venous Summit, presented by AVF President-Elect Lowell Kabnick, MD will address the past, present and future of superficial and deep venous procedures. The program will include an exciting and valuable session on local carrier policies versus national carrier policies.
- Villavicencio Symposium, co-chaired by AVF Vice President Marc Passman, MD and David Gillespie, MD will discuss controversies in IVC filter utilization and will incorporate the FDA perspective and an update on the PRESERVE study.
- D. Eugene Strandness Memorial Lecture, presnted by Professor Alun Huw Davies, the Professor of Vascular Surgery at Imperial College London. During his lecture and following discussion, we will learn about evidence based venous disease interventions.
- Scientific Sessions featuring abstracts from leading scientists on topics including Chronic Venous Obstruction; Venous Thromboembolism and IVC Filters; Superficial Venous Disease; Diagnostic Testing and Imaging; and Lymphedema, Compression/Wound Care, and Anticoagulation.
- E-posters designed by authors of this year's exceptional poster presentation and poster display abstracts will be digitally displayed in the Exhibit and Poster Hall for the first time.
- Unveiling of the new *Vein Specialist* newsletter and the newly redesigned AVF website.

The American Venous Forum could not be the leader in fostering cutting edge research, clinical innovations, and education in venous and lymphatic diseases without the support of industry. Therefore, during the designated exhibit hall hours, I encourage you to take the time to visit our many exhibitors to learn about their products and services.

For the second year, the AVF Foundation has organized several fundraising events, the proceeds of which aid the AVFF and ultimately the AVF in meeting our mission and strategic goals. Please browse and bid in the silent auction, play golf on Thursday afternoon, purchase new AVF swag and play the fun "heads and tails game" at the Friday night Gala dinner and dance. It's never too late to purchase your tickets for the Gala, so I hope you will join me and your friends, new and old, at the culminating event of our 2016 Annual Meeting.

Finally, I would like to thank the AVF Board of Directors, the Foundation Board of Directors and all AVF members and speakers for their hard work and dedication this year. It has been a pleasure and an honor to serve the AVF as your President and I look forward to continue being a part of the exciting future of the American Venous Forum.

Sincerely,

John Blebea, MD, MBA
AVF President

Meeting at a Glance

Tuesday, February 23, 2016		
12:00 pm – 6:00 pm	Registration Open	Great Hall Booth
1:00 pm – 6:00 pm	Day of Innovation and Science (By separate subscription, non-CME)	Great Hall East
3:00 am – 3:40 pm	Coffee Break	
Wednesday, February 24, 2016		
6:30 am – 7:00 pm	Registration Open	Great Hall Booth
6:30 am – 7:30 am	Industry Appreciation Breakfast	Great Hall East
6:30 am – 7:30 am	Continental Breakfast	Great Hall Foyer
7:30 am – 11:50 am	David S. Sumner Venous Summit	Great Hall North/Center
8:00 am – 11:00 am	Guest Hospitality Breakfast	20Seven
9:30 am – 9:50 am	Coffee Break	Great Hall North/Center
11:30 am – 8:00 pm	Exhibit and Poster Hall Open	Event Center
11:50 am – 1:00 pm	Lunch Buffet	Event Center
11:50 am – 1:00 pm	Industry Lunch Symposium*	Great Hall West
12:55 pm – 1:00 pm	President and President-Elect Welcome	Great Hall North/Center
1:00 pm – 2:40 pm	Scientific Session 1: Conic Venous Obstruction I	Great Hall North/Center
2:50 pm – 4:20 pm	Specialty Symposia	
	Wound Care and Compression	Great Hall East
	Unique Venous Issues (Pregnancy, Pediatric and Geriatric)	Great Hall West
	Deep Venous Disease	Great Hall North/Center
4:20 pm – 4:40 pm	Coffee Break	Event Center
4:40 pm – 5:40 pm	Villavicencio Symposium: Controversies in IVC Filter Utilization: The Pendulum Sings	Great Hall North/Center
5:50 pm – 6:50 pm	Poster Presentations	Great Hall North/Center
7:00 pm – 8:30 pm	Welcome Reception & Poster Display	Event Center
Thursday, February 25, 2016		
6:15 am – 12:50 pm	Exhibit and Poster Hall Open	Event Center
6:30 am – 2:00 pm	Registration Open	Great Hall Booth
6:30 am – 7:20 am	New Member Breakfast with the Board	Pavillion
6:30 am – 7:20 am	Continential Breakfast	Event Center
6:30 am – 7:20 am	Industry Breakfast Symposium*	Great Hall West
7:20 am – 9:10 am	Ralph G. DePalma Scientific Session 2: Venous Thromboembolism/IVC Filters	Great Hall North/Center
8:00 am – 11:00 am	Guest Hospitality Breakfast	20Seven
9:10 am – 9:40 am	Best Paper Session	Great Hall North/Center
9:40 am – 10:00 am	Coffee Break	Event Center
10:00 am – 11:00 am	D. Eugene Strandness Memorial Lecture Evidence Based Venous Disease Interventions	Great Hall North/Center
11:10 am – 12:50 pm	Scientific Session 3: Superficial Venous Disease	Great Hall North/Center
12:50 pm	Open Afternoon	

Meeting at a Glance

1:00 pm	Venous Open Golf Tournament	Disney's Lake Buena Vista Golf Course
Friday, February 26, 2016		
6:15 am – 1:20 pm	Exhibit and Poster Hall Open	Event Center
7:00 am – 5:30 pm	Registration Open	Great Hall Booth
6:30 am – 7:30 am	Continential Breakfast	Event Center
7:30 am – 8:50 am	Scientific Session 4: Diagnostic Testing and Imaging	Great Hall North/Center
8:00 am – 11:00 am	Guest Hospitality Breakfast	20Seven
9:00 am – 9:40 am	Top Abstract Session	Great Hall North/Center
9:40 am – 10:00 am	Coffee Break	Event Center
10:00 am – 12:00 pm	President's Session	Great Hall North/Center
12:10 pm – 1:10 pm	Member Business Luncheon	Pavillion
1:20 pm – 2:50 pm	Specialty Symposia	
	International	Great Hall North/Center
	Tell Me Why I'm Wrong: Superficial Disease Dilemmas	Great Hall East
	Latest in Novel Anticoagulants/Setting up Practice in Venous Disease	Great Hall West
3:00 pm – 4:20 pm	Scientific Session 5: Lymphedema, Compression/Wound Care, Anti-Coagulation	Great Hall North/Center
4:20 pm – 4:40 pm	Coffee Break	Great Hall Foyer
4:40 pm – 6:00 pm	Scientific Session 6: Chronic Venous Obstruction II	Great Hall North/Center
7:00 pm – 11:00 pm	Forum Finale	Great Hall East/West

General Meeting Information

Meeting Overview

The 28th Annual Meeting of the American Venous Forum spotlights recent advances and research in venous disease through expert presentations that are relevant and innovative. The scientific program will provide panel presentation and discussions on all aspects of venous disease, diagnosis, pathology, and treatment.

Target Audience

The target audience for AVF Annual Meetings includes vascular and general surgeons, interventional radiologists, interventional cardiologists, phlebologists, plastic surgeons, physician assistants, vascular nurse practitioners, technicians, technologists and other medical professionals who are currently treating venous disease. Each year, AVF also welcomes hundreds of representatives from leading vascular healthcare companies that share the vision of improving patient outcomes and quality of care for individuals with venous disease.

Abstracts

Oral presentations will be given by the authors of the highest scoring abstracts. Abstracts presented at the AVF 28th Annual Meeting are published in the January 2016 issue of the *Journal of Vascular Surgery: Venous and Lymphatic Disorders*, the official journal of the AVF. AVF is pleased to provide a yearly subscription to the journal to active members.

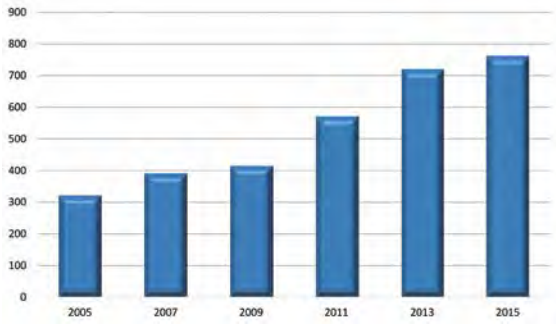
Poster Presentations and Displays

The top 10 posters will be presented in the Great Hall North/Center on Wednesday evening from 5:50 pm – 6:50 pm. Abstracts selected as poster presentations and displays will be viewable electronically in the Event Center Wednesday afternoon through Friday morning.

Poster Display Hours

Wednesday, February 24	Poster Hall Open	11:30 am – 8:30 pm	Event Center
Thursday, February 25	Poster Hall Open	6:15 am – 12:50 pm	Event Center
Friday, February 26	Poster Hall Open	6:15 pm – 1:30 pm	Event Center

Membership



The AVF continues to grow and now includes close to 800 influential leaders, expert investigators and clinicians in the field of venous and lymphatic healthcare. Membership in the AVF is a mark of professional distinction and denotes a dedication to understanding and treating the entire spectrum of venous and lymphatic disorders. All non-members are invited to complete a membership application available online at www.veinforum.org.

New AVF members, who have joined since the 2015 Annual Meeting, are invited to attend the New Member Breakfast with the Board on Thursday morning to give new AVF members an opportunity to learn more about the association and engage with some of the AVF Board of Directors and leadership.

General Meeting Information

Registration

Registration packets are ready for pick up at the AVF Registration Desk located in the Great Hall Booth for those pre-registered for the Annual Meeting. Onsite registration for the AVF Annual Meeting is accepted, space permitting.

Annual Meeting Registration: Registration includes all Scientific Sessions, David S. Sumner Venous Summit, Specialty Symposia, continental breakfasts, coffee breaks, lunch buffet, Exhibit Hall and Welcome Reception, and all other sessions in the general session room.

Spouse/Guest Registration: The spouse/guest registration fee includes daily breakfast in the Hospitality Suite, Welcome Reception, and access to the Exhibit Hall. This does not include access to the scientific sessions or the Forum Finale.

Forum Finale: The Forum Finale on Friday evening will feature a cocktail reception, awards ceremony, dinner, live entertainment and an exclusive silent auction. Tickets are available for Annual Meeting registrants and their guests for $75.00 each. Tickets for corporate guests and industry representatives are $175.00. Tickets to the Forum Finale are available for purchase during advance registration and onsite but cannot be guaranteed same-day. The Forum Finale will be held in the Great Hall East and West.

Registration Desk Hours

The Registration Desk will be located in the Great Hall Booth and will be open for the following hours:

Tuesday, February 23	12:00 pm - 6:00 pm
Wednesday, February 24	6:30 am - 7:00 pm
Thursday, February 25	6:30 am - 2:00 pm
Friday, February 26	7:00 am - 5:30 pm

Hotel Information

Buena Vista Palace
1900 Buena Vista Dr,
Orlando, FL 32830, United States
Phone: (407) 827-2727

Transportation Options

The Buena Vista Palace Hotel is located less than 20 miles from the Orlando International Airport (MCO). Major airlines like Alaska Airlines, American Airlines, Delta Airlines, Frontier Airlines, Southwest Airlines, United Airlines, US Airways and Virgin America fly into MCO. Non-stop routes include Calgary, Chicago, Dallas/Fort Worth, Denver, New York (JFK), Seattle and other airports across the U.S. and Canada. To arrange transportation to the Buena Vista Palace Resort, please call (866) 397-6516 for assistance.

Hotel Dining

One80 SportGrill and Bar
One80 SportGrill offers an energized atmosphere with a menu of American favorites, family games and a network of over 40 TV's broadcasting. Enjoy craft beers and handmade cocktails, amazing appetizers, crisp salads, grilled entrees, and decedent desserts.

Cuisine: American
Hours: Monday thru Friday from 5:00 pm-1:30 am. Saturday and Sunday from 12:00 pm-1:30 am

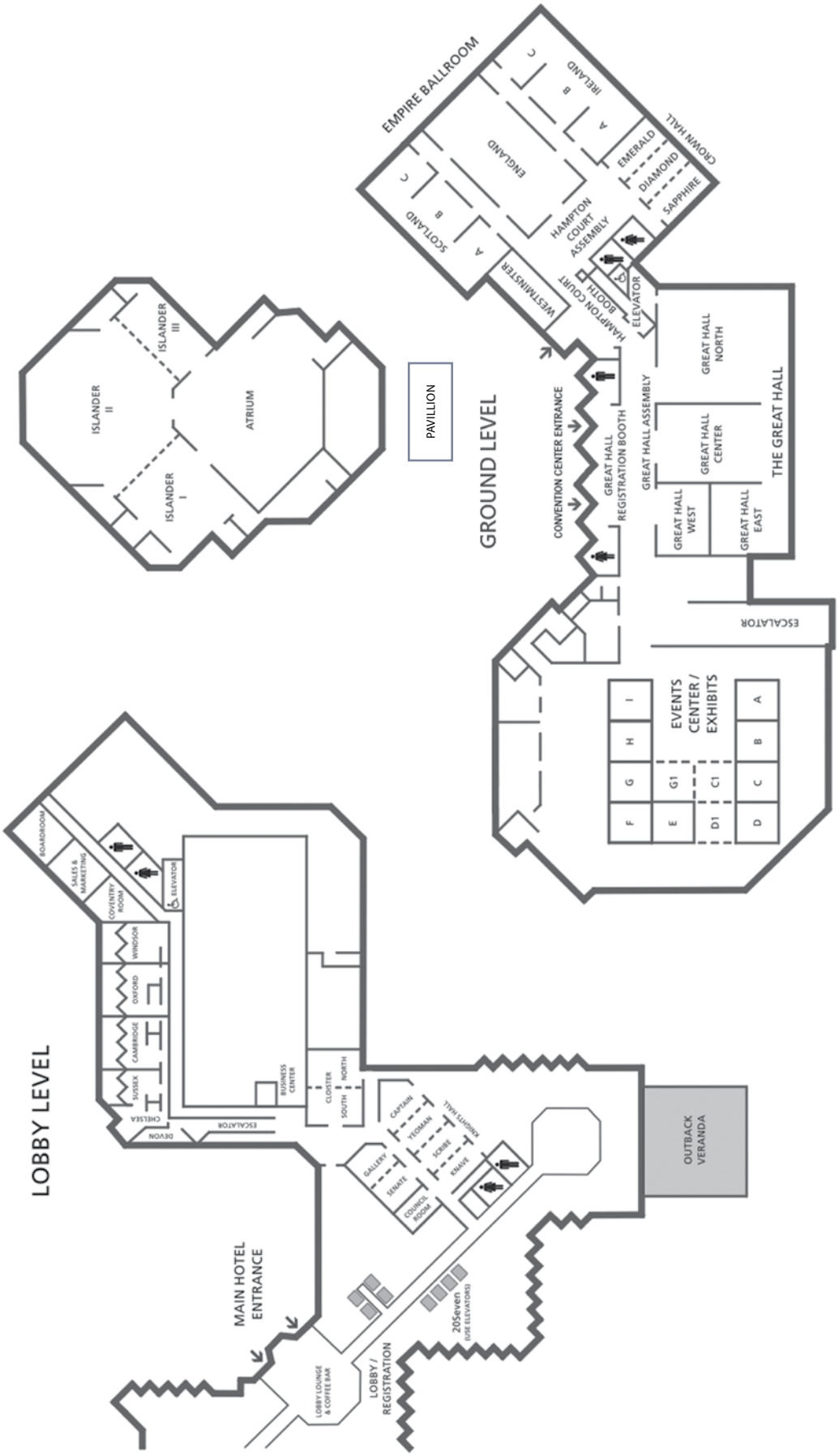
Sunday Disney Character Brunch
On Sundays, take the kids to Covington Mill, located inside Hilton Orlando Lake Buena Vista, for our Disney Character Breakfast in Orlando. This is a great opportunity to get autographs and take pictures with your favorite Disney friends! The kids will love this unforgettable breakfast, complete with a made-to-order omelet station and waffles shaped like a very special Disney friend!

Hours: Sunday's Only from 8:30 am-11:00 am. Please call for current hours.

The 24-hour Mini Market
Have a seat and relax at the Mission Hills Market & Cafe. Proudly brewing Starbucks Coffee you may also enjoy fresh pastries, salads, and sandwiches are prepared daily by our very own Executive Chef, Joel Delmond. The Market is fully stocked with newspapers, magazines, sundries and more for your ultimate shopping experience.

Hours: Daily from 6:00 am-11:00 pm

Hotel Map


EMPIRE BALLROOM
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SCOTLAND
EMERALD
DIAMOND
SAPPHIRE
CROWN HALL
HAMPTON COURT ASSEMBLY
WESTMINSTER
HAMPTON COURT BOOTH
ELEVATOR
ISLANDER III
ISLANDER II
ISLANDER I
ATRIUM
PAVILLION
GROUND LEVEL
CONVENTION CENTER ENTRANCE
GREAT HALL REGISTRATION BOOTH
GREAT HALL ASSEMBLY
GREAT HALL NORTH
GREAT HALL CENTER
GREAT HALL WEST
GREAT HALL EAST
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ESCALATOR
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LOBBY LEVEL
BOARDROOM
SALES & MARKETING
COVENTRY ROOM
ELEVATOR
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OXFORD
CAMBRIDGE
SUSSEX
CHELSEA
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ESCALATOR
BUSINESS CENTER
CLOISTER
NORTH
SOUTH
CAPTAIN
YEOMAN
SCRIBE
KNAVE
KNIGHTS HALL
GALLERY
SENATE
COUNCIL ROOM
OUTBACK VERANDA
MAIN HOTEL ENTRANCE
LOBBY LOUNGE & COFFEE BAR
LOBBY / REGISTRATION
20seven
(USE ELEVATORS)

About American Venous Forum

The American Venous Forum (AVF) is dedicated to improving the care of patients with venous and lymphatic disease. Founded in 1987, AVF fosters cutting edge research and clinical innovation and educates health care professionals, patients and policy makers about venous and lymphatic diseases. AVF's leadership and membership are recognized internationally as thought leaders, expert investigators and clinicians in venous and lymphatic health care.

As the field of venous and lymphatic disease grows, the AVF continues to lead by:

- Providing interactive and hands-on education to physicians and fellows
- Building multi-specialty coalitions to advocate for improvements in venous and lymphatic disease
- Increasing its patient outreach through expansion of its screening program

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AVF PAST PRESIDENTS & ANNUAL MEETING LOCATIONS

2016 Orlando, FL	John Blebea, MD, MBA
2015 Palm Springs, CA	Fedor Lurie, MD, PhD
2014 New Orleans, LA	Peter K. Henke, MD
2013 Phoenix, AZ	Robert B. McLafferty, MD
2012 Orlando, FL	Seshadri Raju, MD
2011 San Diego, CA	Peter J. Pappas, MD
2010 Amelia, FL	Joseph A. Caprini, MD
2009 Phoenix, AZ	Joann Lohr, MD
2008 Charleston, SC	Mark H. Meissner, MD
2007 San Diego, CA	Michael C. Dalsing, MD
2006 Miami, FL	Thomas W. Wakefield, MD
2005 San Diego, CA	Bo G. Eklöf, MD
2004 Orlando, FL	Frank T. Padberg, MD
2003 Cancun, Mexico	Peter Gloviczki, MD
2002 La Jolla, CA	Gregory L. Moneta, MD
2001 Fort Myers, FL	Anthony J. Comerota, MD
2000 Phoenix, AZ	David S. Sumner, MD
1999 Dana Point, CA	Thomas F. O'Donnell, Jr., MD
1998 Lake Buena Vista, FL	D. Eugene Strandness, Jr., MD
1997 San Antonio, TX	James S. T. Yao, MD
1996 San Diego, CA	Robert L. Kistner, MD
1995 Fort Lauderdale, FL	Robert Hobson, MD
1994 Maui, HI	James A. DeWeese, MD
1993 Orlando, FL	George Johnson, Jr., MD
1992 Coronado, CA	Michael Hume, MD
1991 Fort Lauderdale, FL	Lazar J. Greenfield, MD
1990 Coronado, CA	Norman M. Rich, MD
1989 New Orleans, LA	John J. Bergan, MD

2015 BEST PAPER WINNER
Brahman Dharmarajah, MRCS

2015 BEST POSTER WINNER
Maxim Shaydakov, MD, PhD

D. EUGENE STRANDESS, JR., MD MEDICAL LECTURE

On January 7, 2002, the American Venous Forum was saddened by the passing of one of its founding members and past presidents, Dr. D. Eugene Strandness, Jr. Dr. Strandness was a friend, mentor, colleague and leader in all aspects of vascular surgery. He held several NIH grants and wrote numerous publications on the etiology and non-invasive diagnosis of deep vein thrombosis. One of his most notable accomplishments was the development of duplex ultrasound scanning. His tireless pursuit of knowledge led to a better understanding of the natural history of venous disease and its diagnosis and treatment, for which our patients and we are forever indebted to him.

Each year, the D. Eugene Strandness, Jr., MD Memorial Lecture recognizes the significant contributions of an individual in research, education or clinical investigation in the field of venous diseases. Chosen by the president of the American Venous Forum and confirmed by the Forum's Executive Committee, the 2016 recipient of this distinctive honor is Professor Alun H Davies, who is currently the professor of Vascular Surgery at Imperial College London and a Consultant Surgeon whose NHS practice is based at Charing Cross and St Mary's Hospital, London.

Professor Alun H. Davies, MA, DM, DSc, FRCS, FHEA, FEBVS, FACPh
Professor of Vascular Surgery
Imperial College London/
Charing Cross Hospital
London, UK

Professor Davies is Professor of Vascular Surgery at Imperial College London and a Consultant Surgeon whose NHS practice is based at Charing Cross and St Mary's Hospital, London. Professor Davies trained in Cambridge, Oxford, Plymouth, Boston (USA) and Bristol, prior to taking up a Consultant appointment in Charing Cross in 1994. Professor Davies is regarded as a world expert in the management of venous disorder. He is the Editor in Chief of Phlebology, past President of the European Venous Forum & The Venous Forum at The Royal Society of Medicine. He is a Member of the American Venous Forum (Distinguished), the American College of Phlebology, Vascular Surgical Society of Great Britain and Ireland, European Society of Vascular Surgery, Venous Association of India and the Society of Academic Research Surgeons. He has been a Hunterian Professor at the RCS, England and is an Emeritus Fellow of the Australasian College of Phlebology. He was the Chairman of the Varicose Vein Guideline Group for the NICE (National Institute of Clinical Excellence) and a member of the Quality Standards Group. He is a director of the European College of Phlebology and has co-chaired the ESVS guidelines group on the management of varicose veins. He has also written extensively on many aspects of vascular disease, writing over 370 peer reviewed manuscripts and runs a large research group.

About American Venous Forum Foundation

The American Venous Forum Foundation was organized in 1987 to support the charitable, educational and scientific purposes of the American Venous Forum. The Foundation provides the BSN-Jobst Research Grant, Servier Traveling Fellowship Award and other significant educational grants to stimulate and recognize excellence in published writing on laboratory and clinical research in the study of venous diseases.

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Awards & Recognition

BSN-Jobst Research Grant in Venous And Lymphatic Disease

In 1995, the American Venous Forum Foundation announced the establishment of the BSN-Jobst Research Grant in Venous and Lymphatic Disease. From 1995-2014 the grant provided a one-year, $50,000 grant to residents, fellows, and young faculty of less than 5 years from the end of their vascular training chosen through a competitive selection process. In 2016 the BSN-Jobst Research Grant awarded a two-year, $100,000 grant to the winning recipient. The AVF Research Committee scores the applications to determine the grant recipient and announces its selection during the Annual Meeting.

BSN-Jobst Research Grant Recipients:

2015 Andrew Kimball, MD, University of Michigan
2014 Harry Ma, MD, University of Oklahoma
2013 Xzabia Calista, MD, University of Rochester
2012 Rabih Chaer, MD, University of Pittsburgh
2011 Marlene Matthews, MD, University of Rochester
2010 Yanjie Qi, MD, University of Rochester
2009 Carolyn Glass, MD, University of Rochester
2008 K. Barry Deatrick, MD, University of Michigan
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2002 Susan O'Shea, MD, Duke University Medical Center
2001 Brajesh K. Lal, MD, UMDNJ New Jersey Medical School
1999 Joseph D. Raffetto, MD, Boston Medical Center
1998 Klaus See-Tho, MD, Stanford University Medical Center
1997 Andrew C. Stanley, MD, Burlington, VT
1996 Jae-Sung Cho, MD, Mayo Clinic, Rochester, MN
1995 Peter J. Pappas, MD, UMDNJ New Jersey Medical School

Servier Traveling Fellowship

The Servier Traveling Fellowship provides two fellows an opportunity to travel to the European Venous Forum to present his or her scientific research. Four finalists are identified through a competitive peer-review process, and are invited to present their science during the AVF Meeting. Travel and accommodations for the four finalists are reimbursed as part of the grant. The finalists are judged by an appointed AVF committee. Two winners will be selected to present their work at the 2016 European Venous Forum Annual Meeting in London, UK.

The following outstanding Servier Traveling Fellowship Recipients:

2015 Nathan Liang, MD, University of Pittsburgh
Georgios Spentzouris, MD, Stony Brook University Hospital
2014 Rafael Malgor, MD, Stony Brook University Medical Center
Adam Ring, MD, Penn State University
2013 Carson Oostra, MD, University of Toledo College of Medicine
Andrea Obi, MD, University of Michigan
2012 Frank Vandy, MD, University of Michigan
Emily Wood, MD, Stony Brook University
2011 Faisal Aziz, MD, Jobst Vascular Center
Robert Meisner, MD, Stony Brook University Hospital
2010 K. Barry Deatrick, MD, University of Michigan
Christopher Pannucci, MD, University of Michigan
2009 Atul Rao, MD, University of Pittsburgh Medical Center
Axel Thors, MD, Good Samaritan Hospital
2008 David Paolini, MD, Toledo Hospital
Jorge Martinez, MD, Toledo Hospital
2007 Brian Knipp, MD, University of Michigan
Reagan Quan, MD, Walter Reed Army Medical Center
2006 Charles Stonerock, MD, Indiana University School of Medicine
Gustavo Oderich, MD, Mayo Clinic

David S. Sumner Venous Summit: Past, Present, Future.

Chair: Lowell Kabnick, MD

We are fortunate to have as speaker's luminaries who will talk about the past, present and future of superficial and deep venous procedures. In addition, there will be an exciting and valuable session on local carrier policies versus national carrier policies. During the David S. Sumner Venous Summit, a panel of world-renowned experts and physicians experienced in venous interventions will review the procedures and the current literature.

Presentations will be followed by question and answer sessions to allow audience the opportunity to ask more detailed questions. The goal of the Summit will be to provide attendees with practical and proven strategies that they can implement immediately in their own practices.

D. Eugene Strandness Memorial Lecture

Professor Alun H. Davies, MA, DM, DSc, FRCS, FHEA, FEBVS, FACPh
Evidence Based Venous Disease Interventions

The burden of venous disease is increasing worldwide. Healthcare resources are becoming challenged, therefore the need for medical practice to be based on good clinical outcomes and cost effectiveness.

Professor Davies will review key areas of venous intervention and highlight the need for reporting outcomes of interventional therapy. The role of international guidelines will be discussed as well as what influence they have in altering clinical practice.

Villavicencio Symposium: Controversies in the IVC Filter Utilization: The Pendulum Swings

Chairs: Marc Passman, MD and David Gillespie, MD

Controversies in inferior vena cava filter utilization continues related to volume trends, gaps in evidence based guidelines, and variability in filter retrieval rates. With issues related to filter design issues leading to filter related complications, questions are being raised regarding relative safety and efficacy of current available inferior vena cava filters. This session will highlight these current controversies regarding inferior vena cava filters, review filter designs challenges, provide FDA perspectives on safety and efficacy, and address current prospective data collection efforts on filters.

Specialty Symposia

The 28th Annual Meeting will feature six Specialty Symposia sessions, three on Wednesday, February 24 from 2:50 pm – 4:20 pm and three on Friday, February 26 from 1:20 pm – 2:50 pm. Attendees will have the opportunity to attend two Specialty Symposia sessions. Attendees may select Specialty Symposia at the time of registration. The Specialty Symposia will be incorporated into the Annual Meeting schedule and cannot be exclusively attended at a separate fee.

Wednesday, February 24 from 2:50 PM – 4:20 PM
(A) Wound Care & Compression
(B) Unique Venous Issues (Pregnancy, Pediatric and Geriatric)
(C) Deep Venous Disease

Friday, February 26 from 1:20 PM – 2:50 PM
(D) International
(E) Superficial Venous Disease
(F) Latest in Novel Anticoagulants / Setting up Practice in Venous Disease

(A) Wound Care & Compression

Organized by the Symposium on Advanced Wound Care
Chair: William Marston, MD

The Wound Care and Compression Specialty Symposium in 2016 will focus on wound-specific treatments designed to work with compression or corrective venous procedures to accelerate wound healing. Dr. Gregory Schulz from the University of Florida will review current thinking on inflammatory pathways linking venous hypertension with ulceration and critical shifts required to promote healing. Dr. Robert Kirsner, Chairman of the department of Dermatology and Cutaneous Surgery at the University of Miami will discuss current clinical therapies available to accelerate venous ulcer healing.

(B) Unique Venous Issues (Pregnancy, Pediatric and Geriatric)

Organized by the Society of Interventional Radiology
Chairs: Suresh Vendantham, MD and Neil Khilnani, MD

In this symposium, the AVF will welcome leaders from the interventional radiology community who will address Unique Venous Issues that can perplex venous clinicians. The topics will include deep and superficial venous interventions in special populations including children, adolescents, and patients with cancer. Innovative solutions to particularly challenging problems including right atrial thrombus, pediatric DVT, and pelvic-derived varicosities, will be presented.

(C) Deep Venous Disease

Chair: Paul Gagne, MD
Interventions for deep vein disease have become an accepted and effective treatment for patients suffering from both extensive symptomatic acute lower extremity DVT and chronic venous hypertension (i.e. CEAP 3-6) due to deep vein occlusive disease. The rapid expansion of intervention in this area of vascular disease has led to efforts to improve both techniques and tools used for these procedures. New tools such as the TriForce catheter system (Cook Medical) have been created to simplify interventions, and new venous stents (Cook Medical, Veniti Endovenous Therapies) are in US trials. Furthermore, changes in health economics have created the move to Office Based Labs, where many endovascular interventions are now regularly and safely performed.

The goal of this Deep Venous Specialty Session is to provide an overview of the disease and the exciting work being done in this area of vascular intervention. The talks will be presented by practitioners with extensive experience in their respective areas and will provide an overview of each topic as well as details of technical tips to help other interventionalists expand their treatment options and improve their outcomes. Presentations will include how to identify

patients with advanced venous disease, and not a pretender, a discussion of IVUS guided treatments, the timing of and techniques for venous stenting, considerations regarding vascular access options, and treatment options for chronic DVT from the knee to the IVC. Finally, speakers will discuss how to stay out of trouble and have successful outcomes.

Finally, we will discuss devices not yet available in the US but used in Europe, in anticipation of what is down the round for US interventionalists, as well as some economic considerations for the Office Based lab and deep vein interventions.

(D) International

Organized by the AVF International Committee, International Union of Phlebology, and the Polish Society of Phlebology
Chairs: Patrick Muck, MD and Enrico Ascher, MD

The International Committee was created in the fall of 2015. It is a committee under the the division of the Education Council of the AVF. The overall purpose of this committee is to promote worldwide collaboration between specialties treating venous disease. The committee understands the more we interact with other societies the better the AVF can reach venous professionals globally. The International Symposium will offer attendees presentations from venous experts from around the world. Topics for this year's symposium include varicose vein management, perforator treatment as well as sclerotherapy. In addition, venous hemodynamics and chronic venous disease will also be discussed.

(E) Superficial Venous Disease: Tell Me Why I'm Wrong

Chair: Steve Elias, MD

This session covers specific areas of controversy and challenge when physicians manage superficial venous disease issues. Each segment involves a presentation and then audience/faculty discussion. The question: "Tell me why I'm wrong." Will be answered by attendees and other faculty. The presenter will need to defend their conclusions. Talks will be data driven with analysis by each presenter. Topics covered involve technique issues, patient management issues, industry driven controversies, and physician education dilemmas facing all vein specialists today. This specialty symposium addressing superficial venous disease will encourage interchange and interaction. Attendees should come prepared to challenge, question and participate. This session is structured for dialogue and discussion with minimal passive learning. Not the usual "sit and listen" session.

(F) Latest in Novel Anticoagulants / Setting up Practice in Venous Disease

Organized by the American College of Phlebology
Chair: Mark Forrestal, MD

Past and present uses of anticoagulation and the role of new oral anticoagulants will be reviewed in this session. In addition, an economic view of the new oral anticoagulants will be presented, offering insight to opportunities for patients in need of prophylaxis, acute management, and long-term care. The development of reversal agents will also be covered, along with the current recommendations for emergent anticoagulation reversal if a specific reversal agent is not yet available.

There will be three speakers for this section, and each will focus on a different aspect of setting up a vein practice. We will cover how to set up and run a vascular laboratory: including space requirements, equipment needs, personnel, training, and accreditation issues. Then we will present a useful overview of space requirements for consultation and procedure rooms, some suggestions on practical organization, and a review of accreditation requirements for setting up a superficial venous center. This will also cover emergency preparedness, staffing/ training and other issues associated with a venous practice. Finally, a summary of practical, regulatory, and accreditation issues associated with fluoroscopy and the performance of in-office deep vein procedures will be reviewed. This information will be helpful for those planning on expanding their outpatient vein center's functions to treat the deep venous system.

The Day of Innovation and Science

Tuesday, February 23
1:00 pm – 6:00 pm | Great Hall West
Chair: Fedor Lurie, MD, PhD

Celebrating its inaugural year at the 28th Annual Meeting, the Day of Innovation and Science is a highly informative, all-inclusive (non-CME) forum designed to identify current research priorities in the area of venous and lymphatic diseases. This day-long forum will have two extremely valuable plenary sessions, each concluding with a half-hour, interactive structured discussion among the panelists and attendees. The Day of Innovation and Science program is not accredited, and attendance is by separate subscription.

The first plenary session (1:00 pm-3:30 pm) will focus on the recurrence and management of venous thromboembolism. Individual talks will explore whether recurrent VTE is a problem, challenges of treatment with medication and implantable devices, and gaps in knowledge and how new data can impact treatment.

The second plenary session (4:00 pm-5:30 pm) will focus on superficial venous disease. This session will delve into challenges in defining primary CVD, treatment options, unmet clinical needs of CVI patients and new technologies, and gaps in knowledge.

The AVF Day of Innovation and Science aims to bring together all major stakeholders in the field of venous and lymphatic disease including representatives of industry, government agencies such as NIH, FDA, and CMS, private payers, basic scientists, clinical researchers and practitioners. Through participation in the Day of Innovation and Science, the representatives of these different sectors will address the state of the field, discuss next steps for closing knowledge gaps in the two highlighted areas, discover the role data can plan in influencing positive changes in coverage and ultimately identify what is needed to improve medical treatment of patients with venous and lymphatic disease.

Non-CME Industry Symposia

Wednesday, February 24, 2016
Covidien/Medtronic Lunch Symposium
11:50 am - 1:00 pm

Thursday, February 25, 2016
AngioDynamics Breakfast Symposium
6:30 am - 7:20 am

Meeting Program—Tuesday, February 23

12:00 pm – 6:00 pm

Annual Meeting Registration Open

Great Hall Booth

1:00 pm – 6:00 pm

Day of Innovation and Science

Great Hall West

Chair: Fedor Lurie, MD, PhD

Introduction: Statement of the Vision, Plan, Outcomes and Measures of Success.
Fedor Lurie, MD, PhD

Is Recurrent VTE A Problem
Anthony Comerota, MD, FACS, RVT

DVT: Challenges of the Extended Treatment with Medications
John R. Bartholomew, MD

Ileo-Femoral DVT – Do Interventions (Angioplasty, Stenting, CDT) Prevent Recurrences?
Mark J. Garcia, MD, MS, FSIR

Challenges in Medical Management after Placing Implantable Devices
David Williams, MD

Femoro-Popliteal DVT: Is Extended Treatment Necessary?
Thomas W. Wakefield, MD

PE: Do IVC Filters Prevent Recurrences?
Jennifer M. Brown

Basic Science Of Recurrence – What Are The Gaps In Knowledge?
Jose A. Diaz, MD

Structure Discussion

3:10 pm – 3:40 pm

Coffee Break

Great Hall East

Challenges in Defining Primary CVD
Mark Meissner

Is Treatment Of Saphenous Relux Necessary In C2s And C3s Patients?
Seshadri Raju, MD

Unmet Clinical Needs of CVI Patients and New Technologies. (What Ablations Do Not Achieve?)
Peter M. Lawrence, MD

When Treating Superficial System Is Not Enough? (Challenges in Indications for Deep Valve Reconstruction and the Treatment of Deep Venin Obstruction).
Peter M. Gloviczki, MD

Basic Science: Gaps in Knowledge-From Etiology to Progression to Ulcer
Alun Davies

Structured Discussion
Monte Madson
Sean Chambers
Keith Jansen

What Can Help Regulatory Agencies to Make a Right Decision?
Jose Pablo Morales, MD

What Can Help Regulatory Agencies to Make a Right Decision? CMS Perspective
Adi Renbaum, MBA

Ways to Go Forward: Registries (VQI), Rcts, or Real-World Studies?
Larry W. Kraiss, MD

What NIH Funding Opportunities Available for VTE/Vascular/Lymphatic Research?
Andrei Kindzelski, MD, PhD

Final Remarks

Meeting Program—Wednesday, February 24

6:30 am – 7:00 pm
Registration Open — **Great Hall Booth**

6:30 am – 7:30 am
Industry Appreciation Breakfast – For all exhibitors and supporters — **Great Hall East**
Continental Breakfast — **Great Hall Foyer**

7:30 am – 11:50 pm
DAVID S. SUMNER VENOUS SUMMIT
Past, Present, Future. — **Great Hall North/Center**
Chair: Lowell S. Kabnick, MD

Welcome and Introduction
Lowell S. Kabnick, MD

Pharmomechanical Therapy – ACUTE DVT
Introduction to Pharmomechanical Therapy
Peter Goviczki, MD

Attract Trial Suresh
Suresh Vedantham, MD

Review of the Literature
Mark Meissner, MD

Panel and Questions
Peter Goviczki, MD

Venous Obstruction Pathophysiology and Evolution Of Iliac Stenting
Summary of Current Knowledge and Introduction to Stent Trials
Seshadri Raju, MD

Cook Trial
Paul Gagne, MD

Veniti Trial
William Marston, MD

Panel and Questions
Seshadri Raju, MD

Truncal Thermal Ablation Past, Present, Future
Introduction
Fedor Lurie, MD, PhD

Laser
Jose Almeida, MD

Radiofrequency
Peter Lawrence, MD

Panel and Questions
Fedor Lurie, MD, PhD

9:30 am – 9:50 am
Coffee Break — **Great Hall North/Center**

Non-Thermal Non-Tumescent
Introduction
Thomas O'Donnell, MD

MOCA
Steven Elias, MD

Proprietary Foam
Kathleen Gibson, MD

Cyanoacrylate Advanced Medical Adhesive
Ian Franklin, MD

Adoption and Economics
Thomas O'Donnell, MD

Panel and Questions
Thomas O'Donnell, MD

Medicare Policy Inequalities
Introduction
Lowell Kabnick, MD

Why LCDs are not Effective
Harold Welch, MD

The Medicare Coverage Process: NCDs and LCDs
Louis Jacques, MD

Panel and Questions
Lowell Kabnick, MD

8:00 am – 11:00 am
Guest Hospitality Breakfast — **20Seven**

11:50 am – 1:00 pm
Industry Lunch Symposium — **Great Hall West**
Lunch Buffet — **Event Center**

11:30 pm – 8:00 pm
Exhibit Hall and Poster Hall Open — **Event Center**

12: 55 pm – 1:00 pm
President & President-Elect Welcome — **Great Hall North/Center**

1:00 pm – 2:40 pm
SCIENTIFIC SESSION 1
Chronic Venous Obstruction — **Great Hall North/Center**
Moderators: John Blebea, MD, MBA and Harold Welch, MD
Discussants: 1-1 Anili Hingorani, MD; 1-2 Patrica Thorpe, MD; 1-3 Windsor Ting, MD

1:00 pm – 1:18 pm

1-1 Venogram versus intravascular ultrasound for diagnosing and treating iliofemoral vein obstruction (vidio): report from a multi-center, prospective study of iliofemoral vein interventions

P. J. Gagne[1], R. Tahara[2], C. Fastabend[3], L. Dzieciuchowicz[4], W.Marston[5], S. Vedantham[6], W. Ting[7], M. Iafrati[8], M. Lugli[9], A. Gasparis[10], S. Black[11], P. Thorpe[12], M. Passman[13]; [1] Norwalk Hospital, [2]Allegheny Vein & Vascular Bradford PA, [3]Imperial Health Lake Charles, LA, [4]Szpital Kliniczny Przemienienia Panskiego Uniwersytetu Medycznego w Poznaniu Poznan, Poland, [5]University of North Carolina Chapel Hill, NC, [6]Washington University St Louis, MO, [7]Mt. Sinai Hospital, New York, NY, [8]Tufts Medical Center Boston, MA, [9]Hesperia Hospital Clinic Modena, Italy, [10]Stony Brook Medicine, Stony Brook, NY, [11]St. Thomas Hospital London, UK, [12]Arizona Heart Phoenix, AZ, [13]University of Alabama, Birmingham, AL.

OBJECTIVE: Iliac/Common Femoral Vein obstruction (ICFVO) can cause both severe venous insufficiency and significant patient morbidity. When identified, treatment with percutaneous angioplasty and stent can be life changing. Both multi-planar venography and intravascular ultrasound are used to diagnose ICFVO and to guide intervention. This

study was designed to a) prospectively compare the diagnostic performance of conventional multiplanar venography vs. intravascular ultrasound (IVUS) for diagnosing and treating ICFVO; and b) to characterize the patient response to iliofemoral vein intervention (i.e. clinical improvement, Quality of Life (QoL)) over six months of follow-up.

METHODS: In a prospective, multi-center, single-arm study, patients (clinical class CEAP C4-C6) underwent invasive assessment for ICFVO and possible endovascular intervention. In patients with bilateral disease, the more severely effected leg was designated the study limb. Exclusion criteria were prior venous stents, venovenous bypass surgery, known chronic total occlusion; severe superficial venous reflux; acute deep vein thrombosis, history of thrombophilia; and elevated serum creatinine. All patients underwent multiplanar (i.e. AP, RAO, LAO) venography of the study leg and a treatment strategy based on the venograms was documented. All patients then underwent IVUS evaluation of the study leg, and the final treatment strategy was documented. Completion multiplanar venography and IVUS was performed following any intervention. Significant ICFVO was a) 50% diameter stenosis on venogram, b) 50% cross-sectional area stenosis on IVUS, c) webs or collaterals. Duplex ultrasound, CEAP class, Venous Clinical Severity Score (VCSS), quality of life (QoL) questionnaires (i.e. SF 36v2 , CIVIQ 14), and ulcer measurements were performed at baseline, 1 month and 6 month follow-up visits.

RESULTS: Between July, 2014 and July, 2015, 100 patients were enrolled at 11 US and 3 European centers. Median age was 63 years (range, 30-85 years); 43% were women; left-right study leg distribution was 63:37. Baseline parameters were CEAP: C4 (35%), C5 (15%), C6 (50%); VCSS (scale 0-30) 14.5 ± 4.8 (mean ±SD); CIVIQ 14 (scale 0-100) 54.9 ± 23.9 (mean ± SD). Table 1. summarizes lesion detection by modality; IVUS detected significantly more lesions than multiplanar venography, $p<0.0001$ (Wilcoxon signed-rank test). No adverse device effects were reported. Six month follow up for clinical outcomes and QoL data will be completed in December, 2015.

CONCLUSIONS: This is the first prospective, multi-center study comparing venography versus IVUS for diagnosing venous outflow obstruction. IVUS detected nearly twice as many ICFVO than multiplanar venography ($p < 0.0001$) in a cohort of patients with advanced venous insufficiency. Data regarding lesion characteristics, stent sizing, treatment plan changes based on venogram vs. IVUS, and clinical/QoL response to intervention will be available for report at the end of 2015.

Table 1: Significant Iliofemoral Vein Stenosis/Obstruction

Lesion Detection (N=100 patients)	IVUS	Multiplanar Venography
No. of lesions detected, total	124	66
No. of patients with:		
0 lesions detected	19	48
1 lesion detected	46	40
2 lesions detected	27	10
3 lesions detected	8	2

1:18 pm – 1:36 pm

1-2 Deep venous thrombosis associated with caval extension of iliac stent

E. Murphy, B.Johns, M. Alias, W. Crim, S. Raju; The RANE Center.

OBJECTIVE: It is generally difficult to place an iliac vein stent "precisely" at the iliac caval junction with venographic control or even with IVUS guidance. This is because the anatomic junction is not circular but a tilted oval and the lesion whether primary or post-thrombotic may variably encroach on the vena cava. We have advocated extending the stent 3-5 cm into the cava to prevent the lesion squeezing the stent distally or compressing the end into a cone. This suggestion has met with resistance due to concerns of jailing contralateral iliac flow and subsequent deep venous thrombosis (DVT). We analyzed DVT incidence following placement of Wall-stent with caval extension as well as a modification where a Z stent on top of the Wall-stent stack was used for the extension. With widely spaced struts, contralateral jailing was less likely to occur in addition to other technical benefits.

METHODS: 755 limbs with consecutive Wall-stent caval extensions (2007 to 2011) and 982 limbs with Z stent extensions (2011 to 2015) were analyzed for DVT incidence. Fisher exact test was used for statistical comparison.

RESULTS: Patient demographics were similar for both groups. The mean age was 58 years old, 68% female and 32% being male; 61% of patients left side, and 39% right side. Patient pathology: 52% PTS only, 35% MTS only, 13% had both MTS and PTS. DVT incidence is shown in the following table:

Left sided DVT was more common overall and in either group (P-value < 0.003).

CONCLUSIONS: DVT incidence overall, ipsilateral DVT and contralateral DVT were all significantly lower with the Z-stent modification. (P-value < 0.0001). In addition, the Z-stent modification provides greater radial strength at the iliac-caval choke point and enormously simplifies simultaneous or sequential bilateral stenting.

Table 1: Comparison of DVT Incidence among Wall-Stent and Z-Stent Patients

	Contralateral DVT (<30 days)	Contralateral DVT (≥30 days)	Total Contralateral DVTs	Ipsilateral DVT (<30 days)	Ipsilateral DVT (≥30 days)	Total Ipsilateral DVTs	Total DVTs
Wall-Stent (n=755)	5	14	19	26	12	38	57
Z-Stent (n=982)	2	1***	3***	6***	3**	9***	12***

Note: NS (>0.05), * (<0.05), ** (<0.01), *** (<0.001).

1:36 pm – 1:54 pm

1-3 Cost and benefit analysis of stenting versus compression therapy for patients with chronic total venous occlusion

E.Tangney, T. O'Donnell, M. Iafrati; Tufts Medical Center.

OBJECTIVE: In C6 patients with Proximal Chronic Total Venous Occlusion / Severe Stenosis Venous angioplasty and stent recanalization are recommended strongly (GRADE -1) by the SVS/AVF guidelines, but with a low level of evidence (C),due to the lack of RCTs. The new forms of reimbursement require that selection of a therapeutic-strategy for venous leg ulcers (VLU), a prevalent, resource intensive and costly condition, should be evidence-based showing superiority of cost and benefit over time. The purpose is to compare the cost and benefit of stenting of iliac veins + compression (S) versus Compression alone (C) for treating VLU.

METHODS: Cost and quality of life data were examined in the two therapeutic-strategies for 26 C 6 patients; S (N=9) and C (N=17), including patient-oriented outcomes, such as ulcer-healing, functional outcomes (QoL), and quality-adjusted life-years (QALYs). Actual costs (not charges) for these patients were obtained over a 378-day mean follow-up period and extrapolated for each group over an additional two-year period. Health state utility weights (CIVIQ) were derived from previous studies directly comparing open venous ulcers to healed ulcers before and after stenting. The long term benefits of either strategy over three years were measured in ulcer-free time (UFT). The 9 S patients were followed for over 3 years and UFT was calculated directly from follow up and expressed as a percentage of that 3 year period, while for C UFT was derived from our study and years 2-3 of the ESCHAR study. The quality adjusted life years was calculated as (% mean UFT) (utility weight for healed ulcer) + (% mean time with an unhealed ulcer) (utility weight for an unhealed ulcer).

RESULTS: In the S group 7/9 VLUs healed within the 1st year and 0 recurred in years 2-3. In group C three never healed and 7 recurred in the 1st year.

QALYs were calculated for the two therapeutic-strategies as follows:

(S) [n=9]: (.71) (.53) + (.29) (.47) = 0.5132

(C) (n=21): (.54) (.53) + (.46) (.47) =0.5022

The benefit to stenting is reflected in the 0.011 improvement in QALYs over 3 years compared to compression alone (C).

CONCLUSIONS: In this small series, iliac stenting for VLU resulted in less cost ($1,913/patient) and an increase in quality of life during 3 year follow-up compared to compression alone. This intervention appears to meet the mandate of clinical and cost effectiveness.

1:54 pm – 2:12 pm

1-4 Gravitational venous drainage improves significantly after iliac venous stenting but this may result in faster venous filling

C. R. Lattimer[1], E. Kalodiki[2], M. Azzam[2], P. Schnatterbeck[3], G. Geroulakos[2]; [1]Josef Pflug Vascular Laboratory & Imperial College London, UK, [2]Ealing Hospital & Imperial College, London, UK, [3]Ealing & Northwick Park Hospitals, London, UK.

OBJECTIVE: Venous stenting for iliac lesions have increased because of improvements in diagnosis and the recognition that patients following the deployment of a stent can be alleviated of disability. However, there is lack of information on the hemodynamic impact of stenting in terms of venous drainage and filling. Both of these parameters can be quantified in mL/s with air-plethysmography (APG) using the venous drainage index (VDI) and the venous filling index (VFI), respectively. The aim was to assess the haemodynamic impact of stenting on symptomatic iliac venous lesions.

METHODS: Fourteen legs (Left:10) in 10 patients (Male:9, 56 [26-81] years) were successfully stented. The clinical CEAP was: C_0=1; C_3=1; C_{4a}=4; C_{4b}=3; C_5=3; C_6=2. Thirteen legs had a non-thrombotic iliac vein lesion (NIVL) and one had a post-thrombotic iliac occlusion with huge collaterals. Great saphenous vein reflux was present in 7/14 legs, with concurrent femoral-popliteal reflux in 3. Computerised tomographic venography (CTV) was used for screening. The clinical decision for stent placement was made on >50% area reduction by intravenous ultrasound (IVUS) during the procedure. The minor diameter on CTV was expressed as a percentage stenosis in relation to the minor diameter of a "normal" adjacent iliac segment.

RESULTS: The median (inter-quartile range) stenosis was estimated at 68 (51-80) %. One patent had a parachute balloon rupture during angioplasty requiring open retrieval and subsequent thrombolysis. One patient without symptoms was stented because of an unsuspected 80% contralateral stenosis revealed using IVUS. The follow up was 26 (11-56) days. All legs improved clinically, except for the incidental contralateral stent leg which remained without symptoms. Patients reported that their leg(s) was lighter in colour and felt softer with a reduction in swelling as the commonest symptom of improvement (10/14). The VCSS improved from 11 (7-12) to 5 (4-8), P=.001 (Wilcoxon). The VDI improved in 10/14 legs with 5 legs recording more than a 2 fold increase in the rate of drainage, P=.022 (Figs 1 & 2). The VFI became faster in 10/14 legs which suggests a reduction in global competence, but this did not reach statistical significance, P=.064 (Fig 1). Meaningful relationships were not observed between the pre-procedural degree of stenosis and the improvement in the venous drainage (Fig 2). This implies that percentage stenosis may not be the only factor in determining the impediment to drainage as this does not take into account the hemodynamic significance of collateral pathways or the collapsibility of iliac veins.

CONCLUSIONS: The venous drainage index is an emerging parameter of APG in the investigation of impaired venous drainage. This study has demonstrated that it is responsive to stenting. Clinical improvement on successful intervention occurs in spite of the trend of an increase in global filling. This may indicate that obstruction is more important than reflux in the causation of symptoms.

Figure 1. Effect of iliac stenting on gravitational venous filling and drainage in mL/s. VFI, venous filling index; VDI, venous drainage index.

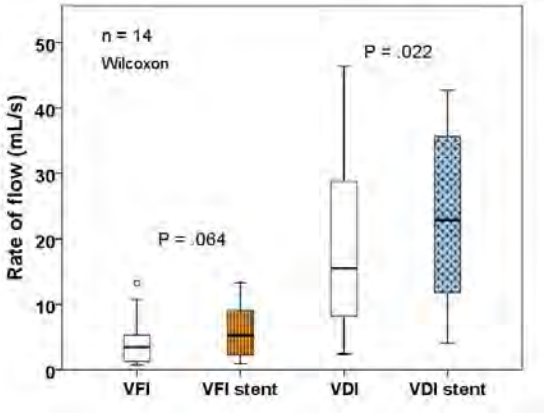
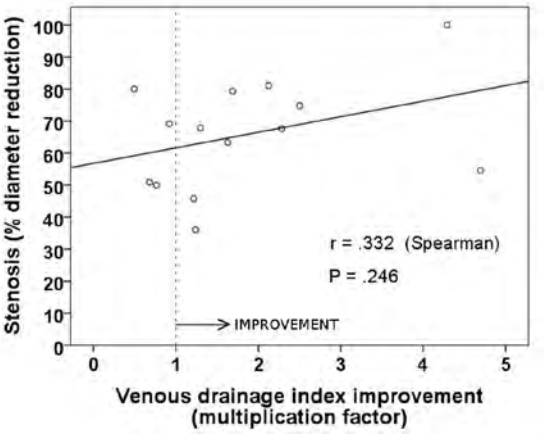


Figure 2. Lack of relationship between the percentage stenosis on pre-procedural CTV and the factor of hemodynamic improvement in drainage with the VDI after iliac venous stenting.



2:12 pm – 2:30 pm

1-5 Hyperdilatation for iliac vein stent compression and in-stent restenosis

E. Murphy, S. Raju, B. Johns, M. Alias; The RANE Center.

OBJECTIVE: Approximately 25% of iliac vein stents require reintervention to correct stent compression (unique to iliac venous stents) and/or in-stent restenosis (ISR). Wall-stents are most commonly used in this location often with slight oversizing (2 mm) at their initial placement. Redilatation to a nominal diameter yields satisfactory resolution of ISR but stent compression less so. We investigated if hyperdilatation by 2 mm beyond the original diameter would yield better results, particularly with that of stent compression. It is difficult to hyperdilate a fresh Wall-stent without immediate recoil of the braided structure to native dimensions. It was however found that this is possible after the stent has been in residence for 3-6 months as incorporation of the stent in surrounding tissue prevents recoil.

METHODS: 210 consecutive limbs that underwent hyperdilatation of a resident Wall-stent by 2-4 mm beyond original diameter over a 3-year period were analyzed for clearance of stent compression and ISR. 18% had compression only, 55% had ISR only, 22% had both compression and ISR, and 5% had other pathology (shelving, etc.). IVUS planimetry was used intraoperatively to calculate stent compression, ISR and subsequent clearance. These can be calculated from area within the stented perimeter (stent area) and the flow channel area (lumen area); the difference represents ISR (data not shown). Lumen area is the ultimate critical measure. Data for both the common iliac and external iliac veins are separately presented. Duplex data of these parameters pre-stent and post-stent (< 6 months and ≥6 months) were available as well for analysis. With Duplex, areas were calculated from diameter measurements of the stent and lumen, respectively. IVUS and Duplex values are expressed as percentage change (±) from area values at the time of stent insertion. Two-tailed paired T-tests were used for statistical comparisons, as well as a Pearson Correlation Test (r^2).

RESULTS: Hyperdilatation results pertaining to stented perimeter and flow channel area, as well as percent improvement are shown in Tables 1 and 2, respectively. The correlation (r^2) between IVUS and Duplex in pre-dilatation area measurements was 0.875 for CIV and 0.957 for EIV.

CONCLUSIONS: Hyperdilatation appears to be a useful technique to correct stent malfunction for stent compression and ISR. Lumen size improves significantly after hyperdilatation. Percentage improvement appears to be sustained without degradation up to 6 months or more after hyperdilatation. Improvement in stent compression is only modest compared to the improvement in ISR and overall lumen size. Stent area actually worsened (-4%) after hyperdilatation of the external iliac vein stent.

Table 1: Stent and Lumen Areas Before and After Hyperdilatation Procedure (n=113 Limbs)

	STENT AREA				LUMEN AREA			
	Pre-Hyperdil. IVUS	Post-Hyperdil. IVUS	Post-Hyperdil. DUPLEX (<6 Months)	Post-Hyperdil. DUPLEX (≥6 Months)	Pre-Hyperdil. IVUS	Post-Hyperdil. IVUS	Post-Hyperdil. DUPLEX (<6 Months)	Post-Hyperdil. DUPLEX (≥6 Months)
CIV	177	193***	186*	195*	141	199***	186***	195***
EIV	148	168***	159*	166**	106	161***	159*	166**

Note: *Hyperdil.* =Hyperdilatation Procedure. NS (>0.05), * (<0.05), ** (<0.01), *** (<0.001); compared to IVUS area before hyperdilatation.

Table 2: Stent Area and Lumen Area Improvement (%) After Hyperdilatation (n=122 Limbs)

	Stent Area Improvement (%)			Lumen Area Improvement (%)		
	Immediate Post-Procedure	Post-Op <6 Months	Post-Op ≥6 Months	Immediate Post-Procedure	Post-Op <6 Months	Post-Op ≥6 Months
CIV	+11 ***	+ 10 ***	+ 15 ***	+ 51 ***	+ 51 ***	+ 58 *
EIV	- 4 ***	- 5 ***	- 1NS	+ 48 ***	+ 58 ***	+ 65 ***

Note: NS (>0.05), * (<0.05), ** (<0.01), *** (<0.001); compared to IVUS area before hyperdilatation.

2:30 pm – 2:35 pm

Q1-1 **New insight into venous valve physiology: Gene expression analysis of human deep veins**

F. Lurie[2], M. E. Shaydakov[1], A. Comerota[2], T. Wakefield[1], J. Diaz[1]; [1]University of Michigan, Ann Arbor, MI, [2]Jobst Vascular Institute, Toledo, OH.

OBJECTIVE: Autopsy findings, experimental data, and cumulative clinical experience suggest the venous valve to be the anatomical origin of deep vein thrombosis. Cyclic valve motion and vortex flows in valve sinuses are considered to be protective against thrombosis (Fig. 1A). However, the exact mechanisms involved in the initiation of venous thrombosis at the site of the venous valve are unknown. The aim of the study is to evaluate whether there is differential gene expression of anti-thrombotic, pro-thrombotic, pro-inflammatory, and hypoxia-related markers in the vein wall and valve cusps in normal human deep veins.

METHODS: Normal valve-containing segments of deep veins were harvested frompatients who signed informed consent to undergo above-the-knee amputation. Preoperative venous duplex confirmed normal deep vein valve function. Samples were separated into 4 zones (Fig. 1B): post-valve (zone 1) and pre-valve (zone 3) vein wall, valve cusp (zone 2), and vein wall within the valve sinus (zone 4) and analyzed by the reverse transcription real-time polymerase chain reaction (RT-qPCR) for anti-thrombotic: (PROCR, THBD), pro-thrombotic (SERPINE1, VWF), pro-inflammatory (IL1A, IL6, TNF, SELP) and hypoxia-related genes (SLC2A1, SLC5A1, VEGFA). HPRT1 was used as reference gene. Gene names are provided in accordance with guidelines of the HUGO Gene Nomenclature Committee.

RESULTS: Fifteen deep vein valve-containing segments were analyzed. Statistically significant ($p < .05$) up-regulation of anti-thrombotic (PROCR, THBD), pro-thrombotic (VWF, SERPINE1), and SELP genes was found in the valve cusp, compared to the vein wall. PROCR was overexpressed in 100%, SELP in 100%, THBD in 93%, VWF in 73%, and SERPINE1 in 60% of valve cusps. A higher transcriptional activity for the anticoagulant genes (PROCR, THBD) compared to procoagulant genes (VWF, SERPINE1) were observed. Specifically, PROCR was 12-times (12.2±12.7) and THBD was 8-times (8.4±6.7) overexpressed in the valve cusp; while SERPINE1 and VWF were only 7-times (7.1±9.4) and 3-times (3.1±2.1) up-regulated, respectively. Messenger-RNA composition in the vein wall within the valve sinus was similar to the pre-valve and post-valve vein wall for all studied genes. The activity of pro-inflammatory genes was equivalent in all zones (Fig. 1C).

CONCLUSIONS: The endothelium of the valve cusp has a higher transcriptional activity compared to the vein wall. Up-regulation of anti-thrombotic genes overcomes the activity of pro-thrombotic genes suggesting an anti-thrombotic phenotype at baseline state. Endothelium of the vein wall within the valve sinus is functionally similar to the pre-valve and post-valve vein wall. This is the first analysis of endothelial phenotype performed in human deep veins.

Figure 1: Sample harvest technique and main study results

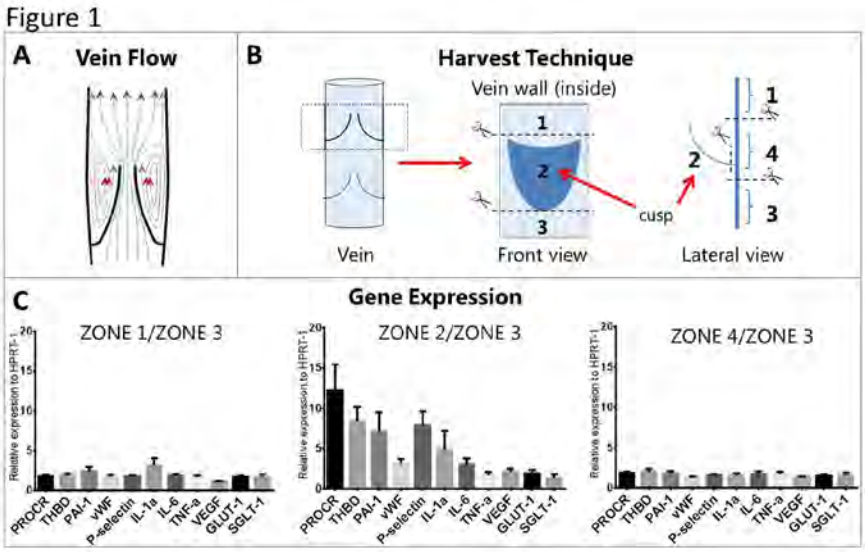


Figure 1 legend:
A. Normal flow pattern across the vein valve.
B. Vein valve harvesting technique: zone 1 (vein wall downstream), zone 2 (valve cusps), zone 3 (vein wall upstream), zone 4 (vein wall within the valve sinus).
C. Results of RT-qPCR, ΔΔ-CT method using zone 3 as a reference.

2:35 pm – 2:40 pm

Q1-2 Nutcracker syndrome: video presentation of an innovative hybrid technique

A. Rathore, P. Gloviczki, M. Kalra, T. Bower, A. Duncan, G. Oderich, M. Fleming. R. De Martino; Mayo Clinic, Rochester, MN.

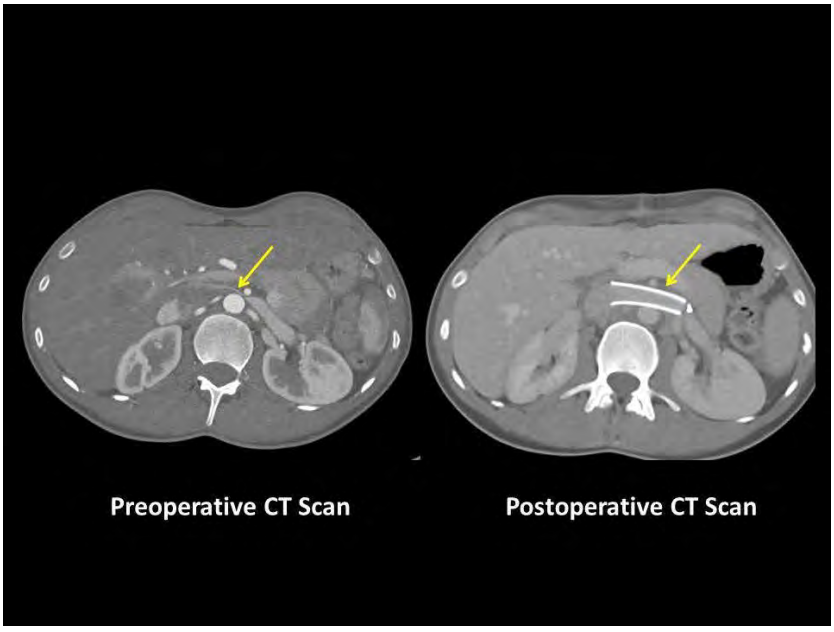
OBJECTIVE: Stent migration in nutcracker syndrome treated with left renal vein stent is noted in up to 7% cases. Aim of this presentation is to describe a novel technique for surgical treatment for Nutcracker Syndrome with renal vein stenting and transfixation of the renal vein stent, with use of adjuncts to address potential stent migration.

METHODS: Case description: A 28 years old female presented with six years history of left flank and pelvic pain. She also experienced 30 lbs weight loss due to early satiety and postprandial pain. Her physical exam was within normal limits with exception of a single left calf varicose vein and mild epigastric tenderness. Gynecologic evaluation was negative. Abdomen-pelvis ultrasound revealed compression of left renal vein between aorta and SMA and dilation of left gonadal vein with flow reversal. CT abdomen confirmed these findings along with posteriorly placed left kidney. In addition, prominent pelvic collaterals related due left renal vein outflow obstruction, suggesting a diagnosis of nutcracker syndrome associated with pelvic congestion. She also underwent extensive GI workup including esophagogastroscopy, colonoscopy, MR Enterography, and small bowel bacterial overgrowth studies for early satiety which was all negative.

RESULTS: Surgical Management: Surgical treatment involved mini laparotomy (9 cm) under general anesthesia. The left renal vein was noted to be severely compressed between the aorta and SMA, and it was associated with dilated left gonadal vein up to 10 mm. The selective venogram as well as intravascular ultrasound confirmed severe extrinsic compression of left renal vein and flow reversal in gonadal vein, draining into IVC via pelvic collaterals. Pullback pressure measurement showed a gradient for 5 mm Hg. The gonadal vein was then ligated and the left renal vein was transposed onto the IVC about 1 cm inferior to the LRV IVC confluence. A 40 mm long, 14 mm Wallstent was then deployed in the LRV across the area of compression. Post-stent venogram and IVUS demonstrated significantly improved LRV diameter and resolution of venous outflow obstruction. The Wallstent was then transfixed through the LRV wall using 5-0 Prolene suture to prevent future migration. Abdomen was then close in standard fashion. She had uneventful recovery postoperatively and was discharged home on POD 3 with oral anticoagulation. She noted improvement in the pelvic and flank pain postoperatively. Postoperative abdomen CT scan demonstrated widely patent LRV stent with resolution of nutcracker pathophysiology (see figure 1). We have successfully performed this procedure in 4 patients with excellent results.

CONCLUSIONS: Left renal vein stent with external transfixation represents a true hybrid vascular approach for treatment of nutcracker syndrome. Pullback pressure measurement, contrast venography and intravascular ultrasound provide important intraoperative diagnostic tools. With appropriate use of adjuncts like renal vein translocation and patch venoplasty, it can be performed safely and effectively.

Figure 1 title: Computed Tomography (CT) scan showing the successful treatment of Nutcracker syndrome with left renal vein transposition and stent placement



2:50 pm – 4:20 pm

SPECIALTY SYMPOSIA

(A) Wound Care and Compression — Great Hall East

Organized by the Symposium on Advanced Wound Care
Chair: William Marston, MD

Case Presentations
William Marston, MD

Current Strategies for Evidenced-Based Management of Venous Ulcers in Addition to Compression and Venous Intervention
Robert Kirsner MD, PhD

Recent Advances in our Understanding of Wound Healing Mechanisms and How They are Affected by Venous Disease
Gregory Shultz, MD

Discussion

(B) Unique Venous Issues (Pregnancy, Pediatric, and Geriatric) — Great Hall West

Organized by the Society of Interventional Radiology
Chair: Suresh Vedantham, MD and Neil Khilnani, MD

Treatment of Cancer-Related DVT
Robert Siegelbaum, MD

Pelvic-Derived Lower Extremity Varicosities
Melvin Rosenblatt, MD

Pediatric DVT Thrombolysis
Charles Ray, MD

Right Atrial and Caval Thrombus
John Moriarty, MD

Patterns of Recurrent Varicose Veins
Neil Khilnani, MD

(C) Deep Venous Disease — Great Hall North/Center

Chair: Paul Gagne, MD

Acute DVT Thrombolysis and Stents for Outflow Obstruction: What is the Best Sequence for Intervention?
Akhilesh Sista, MD

Identifying Patients with Symptomatic Venous Outflow Obstruction - Evaluation and Diagnostic Workup
Nicos Labropoulos, MD

IVUS Evaluation of the Deep Venous System for Outflow Obstruction: Pathology, Tips and Caveats to Know!
Carl Fastabend, MD

Which Stent, When and How do They Perform: Issues to be Considered When Placing Venous Stents
Stephen Black, MD

Economics of Venous Stent Procedures in the Office Based Lab
Paul Gagne, MD

New Ideas and Innovations for Treating "Chronic" DVT in Symptomatic Post-Thrombotic Patients
Mark Garcia, MD

Discussion and Q&A

4:20 pm – 4:35 pm

Coffee Break — Event Center

4:35 pm – 5:40 pm

VILLAVICENCIO SYMPOSIUM

Great Hall North/Center

Controversies in IVC Filter Utilization: The Pendulum Swings

Chairs: Marc Passman, MD; David Gillespie, MD

J. Leonel Villavicencio Award Presentation by John Blebea, MD, MBA

Introduction - Scope of the IVC Filter Problem
Marc Passman. MD

Why are Current IVC Filter Designs Developing Problems?
John Rectenwald, MD

FDA Perspective - Are Current IVC Filters Safe and Effective?
Jose Pablo Morales, MD

Update on the PRESERVE Study - A Better Evaluation of Current IVC Filter Utilization?
David Gillespie, MD

5:50 pm – 6:50 pm

POSTER PRESENTATIONS

Great Hall North/Center

Moderators: Joseph Raffetto, MD and Apostolos Tassiopoulos, MD

5:50 pm – 5:55 pm

P01 Randomised controlled trial comparing mechanochemical ablation to radiofrequency ablation: the multicentre venefit versus clarivein® for varicose veins (VVCVV) trial
R.Bootun; Imperial College London, UK.

OBJECTIVE: Endovenous techniques are currently the recommended choice for truncal vein treatment1. However, thermal techniques require tumescent anaesthesia, which can be uncomfortable during administration2. Non-tumescent non-thermal techniques would therefore have potential benefits. This randomised controlled trial was carried out mainly to compare the degree of pain patients experience while receiving mechanochemical ablation (MOCA) or radiofrequency ablation (RFA). An early pilot report of this trial has previously been published3. The 6 months clinical outcomes are reported here.

METHODS: Patients attending for primary varicose vein treatment were randomised to receive MOCA (ClariVein®) or RFA (Covidien® Venefit™). The most symptomatic limb was randomised. The primary outcome measure was intra-procedural pain using a validated visual analogue scale. Secondary outcome measures were change in quality of life and clinical scores, time to return to normal activities as well as the occlusion rate.

RESULTS: One hundred and seventy patients were randomised (51% in the MOCA group). Baseline characteristics, including demographics, CEAP classification, clinical scores and quality of life (QoL) scores were similar.

The maximum pain score was significantly lower in the MOCA group (24.3mm±22mm) compared to the RFA group (34.8mm±24mm; p=0.005). Average pain score was, however, similar in the MOCA group (17.8mm±21mm) and the RFA group (24.0mm±18mm; p=0.053).

Seventy-six percent of the patients attended follow-up at one month and 71% attended at six month. The VCSS score at 1 month was 2.7 for the MOCA group compared to 3.3 for the RFA group (p=0.279), while, at 6 months, the corresponding scores were 2.5 for MOCA and 2.7 for RFA (p=0.571). The EQ-5D scores were 0.807 for MOCA at 6 months compared to 0.691 for RFA (p=0.039). The disease specific AVVQ scoring system was, however, not significantly different between the two groups at 6 months (12.9 for MOCA compared to 16.3 for RFA; p=0.247).

The time to return to normal activities and to work was again comparable between the two groups. The complete or proximal occlusion rate at 6 month was 87.1% for the MOCA group and 93.2% for the RFA group (p=0.483).

CONCLUSIONS: The results show that MOCA is less painful than RFA procedure. However, at 6 months, the clinical and specific quality of life scores showed similar improvement in both treatment groups, with comparable occlusion rates at 6-month

5:56 pm – 6:01 pm

P02 EVRA (Early Venous Reflux Ablation) ulcer trial: The issues of recruiting to a multicentre trial in patients with venous ulceration

F. Heatley; Imperial College London, UK

OBJECTIVE: The timing of offering superficial venous intervention to patients, in terms leg ulcer healing is controversial, with the AVF Guidelines giving only a 2C recommendation in favour of ablation in terms of ulcer healing despite the RCT evidence that there is no benefit. A trial has been designed to clarify this issue.

METHODS: This is a multi-centre, prospective, randomised controlled trial funded by the National Institute for Health Research (NIHR HTA) Programme (project number 11/129/197). According to the published literature, the 24-week healing rate in patients randomised to compression alone is approximately 60%, for a meaningful clinical difference it is estimated that a 15% improvement in ulcer healing is required from early intervention.Patients are randomised to either early endovenous treatment of superficial venous reflux in addition to standard care compared to standard care alone. All patients are examined clinically at 6 weeks, with monthly telephone follow-ups to document resource use and monitor patient safety. 4, weekly ulcer healing verification visits are performed upon notification of healing. Quality of life is measured at baseline, 6 weeks, 6 and 12 months.

RESULTS: The primary endpoint of this study is time from randomisation to ulcer healing. Over 3500 patients (51% men; 49% women, mean age 71) have been screened, with a 9% inclusion rate (55% men; 45%women, mean age 68). 30% of patients screened were ineligible with respect to ulcer duration and 6% declined to take part. To date 285 patients have been randomised, the pattern of venous incompetence in these patients was: - 53% had GSV incompetence alone, 12% had SSV incompetence alone and 26% had both GSV and SSV incompetence combined; 28% had evidence of deep venous incompetence. In the early arm, the interventional treatment strategy employed was: - 52% were foam alone, 33% with endothermal ablation alone and 15% by a combination of therapies.

CONCLUSIONS: This study will be the first large randomised multicentre trial to report on the clinical, quality of life and cost effectiveness of treating patients with venous ulcers by early superficial venous intervention. This screening data illustrates issues with respect to timely patient referral.

6:02 pm – 6:07 pm

P03 Independent predictors of venous thromboembolism following total hip arthroplasty

K. Nagarsheth N. Nassiri, R. Shafritz, R. Rahimi; Rutgers - Robert Wood Johnson Medical School, New Brunswick, NJ

OBJECTIVE: Patients who develop venous thromboembolism (VTE) following total hip arthroplasty (THA) incur up to a 10-fold increase in healthcare costs, double the average length of hospital stay and have a significantly increased risk of mortality. Our goal was to determine the pre- and post-operative risk factors that predispose patients to developing VTE after THA.

METHODS: The National Surgical Quality Improvement Program (NSQIP) database was queried, from the years 2006 to 2011, to identify patients who underwent THA. The presence or absence of post-operative VTE, patient demographics, comorbidities, perioperative data, and outcomes were collected and analyzed.

RESULTS: There were a total of 17,707 THA performed between 2006 and 2011. There were 134 patients who had VTE (VTE group) and the remainder did not have VTE (N-VTE group). The incidence of VTE after THA was 0.76%. The VTE group was significantly older (68.8±2.0 years v. 65.0±0.2 years, $p < 0.01$), had a history of CHF (1.49% v. 0.04%, p=0.02), COPD (8.96% v. 4.32%, $p < 0.01$) and pre-operative shortness of breath (13.4% v. 6.84%, $p < 0.01$). A higher proportion of the VTE group also had a documented bleeding disorder (6.72% v. 2.82%, p=0.02), recent chemotherapy for malignancy (1.49% v. 0.18%, $p < 0.01$) and a history of stroke with subsequent neurological deficits (3.73% v. 0.73%, $p < 0.01$). Multivariate regression analysis demonstrated that recent chemotherapy and history of stroke pre-operatively, were most significantly associated with VTE after THA. Post-operative events such as return to the operating room, urinary track infections and new stroke were all considered statistically significant. Table 1 lists relative odds ratios with respective 95% confidence intervals and p-values.

CONCLUSIONS: Recent pre-operative chemotherapy for malignancy, return to the operating room, post-operative urinary tract infections and strokes are independent risk factors for the development of post-operative VTE in patients undergoing THA. Particular attention should be given to pre- and post-operative VTE prophylaxis in patients with these risk factors.

6:08 pm – 6:13 pm

P04 Functional protection of platelets by tri-block polymer (Poloxamer-188) as studied in agonist induced platelet aggregation systems

E. Kladoki, S. Abro, M. Emanvale, O. Iqbal, D. Heppensteat, J. Fareed; Loyola University Medical Center, Chicago, IL.

OBJECTIVE: Platelets gradually lose their functionality during storage. Poloxamer-188 (P188) is an amphiphilic, non-ionic, tri-block copolymer surfactant, shown to be effective in the repair/recovery of damaged cell membranes. P188 is an attractive and promising agent for enhancing the blood cell viability and functions during prolonged storage in blood banking. The aim of the study is to test the protective effect of P188 on platelet function.

METHODS: Blood samples were collected in 3.2% sodium citrate from 20 healthy volunteers. (1) P188 was added to citrated whole blood (wb) in a 1:10 ratio at a final concentration of 10 mg/mL. Saline was used in the same manner as control. Saline and P188 containing tubes were centrifuged to collect platelet rich plasma (PRP) and platelet poor plasma (PPP). These were referred to 'saline-wb-preparation (saline-WBP)' and 'P188-wb-preparation (P188-WBP)'. (2) Citrated wb was centrifuged to obtain PRP and PPP. P188 was added to PRP at a concentration of 10mg/mL. Saline was used as control. These were referred to saline-PRP-preparation (saline-PRPP) and 'P188-PRP-preparation (P188-PRPP). Similar procedures were repeated at a lower concentration of 2mg/mL. Agonist induced aggregation (AIA) studies were performed at 30, 180 and >300 minutes at all different concentrations utilizing a PAP-8 aggregometer (Biodata Corporation). Such agonists as ADP, Arachiconic Acid (AA), Collagen and Epinephrine were used.

RESULTS: In the saline supplemented systems all agonists showed a time dependent decrease in platelet aggregation. In the P188 supplemented systems there was no protective effect of P188 on AA and Epinephrine induced aggregation. However, there was a protective effect on ADP and Collagen induced aggregation except at 10mg-WBP. After 300 min, the observed protective effect of ADP induced aggregation was found to be 50.2% higher versus saline control in 2mg-WBP. This protective effect was found to be 43.13 % at 10mg-PRPP and 10.4% at 2mg-PRPP. After 300 min, protective effect on Collagen induced aggregation was 65.9% versus saline control in 2mg-WBP. This protective effect was 42.74 % at 10mg-PRPP and 11.42% at 2mg-PRPP. The aggregation values were lower in platelets recovered from P188-WBP versus P188-PRPP with the exception of Epinephrine induced aggregation.

CONCLUSIONS: Protective effects of P188 were observed on ADP and collagen induced platelet aggregation while decrease aggregation was noted with AA and Epinephrine. This suggests that P188 modulates specific receptors on platelet surface. Thus P188 supplementation to storage platelets may be useful in prolonging the functionality of platelets used for therapeutic purposes.

6:14 pm – 6:18 pm

P05 The anatomy and valve function of healthy pediatric patients

S. Stapler, K. Zurales, A. Mazurek, B. Otemuyiwa, M. Knol, T. Wakefield, D. Coleman; Assistant Professor, University of Michigan, Ann Arbor, MI.

OBJECTIVE: The spectrum of chronic venous insufficiency (CVI) in adults is well documented while there is a paucity of data published commenting on pediatric CVI. We previously identified that there is often venous reflux present in cases of pediatric lower extremity edema despite an alternate confirmed diagnosis. To further assess the clinical significance of this venous reflux, this study aims to elicit venous parameters in healthy pediatric controls.

METHODS: Healthy pediatric volunteers aged 5-17 years were recruited for venous reflux study. A comprehensive venous reflux study was performed with the patient standing. Vein diameter, patterns of valvular reflux, and accessory venous anatomy were examined in the deep and superficial venous systems.

RESULTS Eighteen children were studied including 10 boys and 8 girls. Five volunteers were aged 5-8 years, 6 volunteers were aged 9-12 years, and 7 volunteers were aged 13-17years. Great saphenous vein diameter at the saphenofemoral junction significantly increased with age (Figure 1A). Deep vein valve closure time (VCT) did not differ significantly between groups measuring 430 +/- 209.7 cm/s in the 5-8 year group, 559 +/- 835.7 cm/s in the 9-12 year group, and 442 +/- 504.7 cm/s in the 13-17 year group. GSV VCT was significantly higher in the 9-12 year age group (Figure 1B). Incidental venous insufficiency was identified in 60% of children aged 5-8 (N=3), 50% of children aged 9-12 (N=3) and 57% of children aged 13-17 (N=4) including 6 boys and 4 girls. All superficial venous reflux was confined to the great saphenous vein; there were no cases of isolated deep venous reflux. Table 1 depicts the patterns of venous insufficiency; interestingly all deep venous reflux was identified in males. Reflux was identified at multiple GSV stations in 60% of children. There was no significant difference in incompetent GSV VCT when comparing children with and without deep venous reflux (1083 +/- 538 cm/s in the absence of deep venous reflux v. 1543 +/- 1283cm/s in the presence of deep venous reflux; P=0.1971). Accessory superficial veins were identified in 20% of children aged 5-8 years (N=1), 50% of children aged 9-12 (N=3) and 43% of children aged 13-17 (N=3). The presence of an accessory saphenous vein was not

associated with deep venous reflux in any patient and only 29% of those with accessory saphenous venous anatomy had evidence of superficial venous (GSV) reflux.

CONCLUSIONS: The GSV continues to grow in diameter through the teenage years. Incidental valvular incompetence and GSV reflux is common. The presence of accessory saphenous veins is similarly common and not associated with venous reflux. The clinical significance and natural history of this incidental venous reflux remains unclear. Future research should determine if these changes seen in the pediatric age group lead to CVI during later years of life.

6:19 pm – 6:24 pm

P06 Prospective randomized multi-center pilot study comparing a dual action pneumatic compression device to 30-40 mm hg graduated compression stockings in patients with c3-6 chronic venous disease.

F. Lurie, M. Stanbro, T. Carman, A. Gasparis, A. Tallis, J. Chiriano, M. Allison, I. Gordon, R. Kolluri, M. Melin, C. Bianchi, A. Comerota; Group of Investigators for multi-center RCT.

OBJECTIVE: The ACTitouch® device represents a new generation of pneumatic compression device that combines intermittent pneumatic compression (IPC) with sustained compression (SC). SC provides automatic adjustment of pressure every 30 minutes, ensuring consistent pressure regardless of leg volume changes and environmental influences. This ambulatory device is designed for mobile patients but has not been studied in comparison to standard compression (stockings).

METHODS: This is a two-arm, prospective, randomized, multi-center pilot study. Patients with chronic venous disease (CVD), C3-6 clinical class, and ABI≥0.8 with a documented history of low adherence to compression therapy were randomized at 10 centers to use the ACTitouch device or 30-40 mm Hg graduated compression stockings (GCS). Primary endpoints were patient comfort and ease of use as reported by study subjects. Secondary endpoints included compliance (measured by a device meter and patients diaries), limb volume change (water displacement and circumferences), and change in disease severity (VCSS, VEINES-QOL, VEINES-sym, EQ-5D-3L). Patients were assessed at 15 and 30 days after randomization.

RESULTS: Eighty-nine patients (136 limbs) received either ACTitouch (66 limbs) or GCS (70 limbs). Fifteen-day and 30-day follow up was completed. Seventy-one percent of patients in the ACTitouch group found it easy to put on (compared to 37.5% in the stocking group, p=0.0001), 89% of patients found ACTitouch easy to doff (compared to 59% in the stocking group, p=0.0001), and 71% found it comfortable to wear (compared to 58% in the stocking group, p=0.125). Both groups demonstrated high compliance with compression. High variability in limb volume measurements partially explains the lack of statistical significance in volume decrease despite the apparent advantage of the ACTitouch device.

CONCLUSIONS: This is the first multi-center RCT comparing a dual-action compression device to GCS in initially non-compliant patients with C3-6 PCVD. It demonstrated that even within limitations of a pilot project the ACTitouch device is comparable to GCS in patient acceptance and compliance. Clinical efficacy of ACTitouch requires further analysis and investigation.

6:25 pm – 6:30 pm

P07 Venous thromboembolism risk assessment – what's the score in patients having varicose vein interventions?

S. Onida; Imperial College London, UK.

OBJECTIVE: Venous Thromboembolism (VTE) is a major cause of preventable hospital death; its prevalence is projected to increase as a function of an increasingly elderly and obese population. Surgery, hospitalisation, and the presence of varicose veins (VV) have been described as risk factors for the development of VTE. The need for VTE prophylaxis in patients undergoing VV interventions is controversial.

Patients undergoing surgical procedures are routinely assessed on admission to stratify VTE risk and determine the most appropriate mode of thromboprophylaxis (mechanical and/or pharmacological). The Department of Health (DoH) and the Caprini scores are widely used for this purpose in the UK and US, respectively. These assessment tools have been validated but important differences exist, particularly in terms of the parameters assessed and the level of risk stratification. Both scoring systems advise pharmacological thromboprophylaxis at a "medium" risk level. The aim of our study was to identify the predicted risk of VTE using both scoring systems in a cohort of VV patients, compare the results and examine levels of agreement.

METHODS: This was a prospective cohort study of consecutive patients attending for day-case procedures for the management of superficial venous disease. Procedures included endovenous ablation, foam sclerotherapy and phlebectomies. Patients were stratified according to the DoH (low/medium/high) and Caprini (low/medium/high/highest) risk assessment scores.

RESULTS: 146 patients (57% female) were included, mean age was 53 years. According to the DoH score, the most common risk factors were: age > 60 (37.5%), comorbidities (29%) and BMI >30 (24.5%). The Caprini score identified minor surgery (97%), the presence of visible varicose veins (95%) and BMI >25 (57.5%) as the most prevalent risk factors.

The pre-procedural risk distribution using the DoH score was: 31.5% (46/146) low risk (score 0), 33% (48/146) medium risk (score 1), and 35.5% (52/146) high risk (score >1). According to the Caprini scoring system, 8.2% (12/146) were identified as having a low risk (score 0-2), 39% (57/146) medium risk (score 3-4), 46.5% (68/146) high risk (score 5-8), and 6.3% (9/146) highest risk (score >8). According to the DoH score, 31.5% of the patients did not require pharmacological thromboprophylaxis, compared to 8.2% as assessed by the Caprini score.

The level of agreement between the two scoring systems was estimated as fair (Cohen Kappa statistic; Kappa 0.294, $p < 0.05$).

CONCLUSIONS: The DoH and Caprini risk assessment scores have significant differences in their risk stratification of patients undergoing interventions for venous disease, particularly in their identification of low risk patients. However, if these scoring systems are of value in this cohort, this data suggests we should be offering more aggressive VTE prophylaxis to these patients. This finding has important clinical and cost-related implications. The impact of this difference and the role of these scoring systems in this patient cohort require further evaluation.

6:31 pm – 6:36 pm

P08 Gender differences in may-thurner syndrome: a systematic review of the literature

C. Kaltenmeier[1], Y. Erben[2], J. Indes[2], A. Lee[2], A. Dardik[2], T. Sarac[2], C. Ochoa Chaar[2]; [1]University of Pittsburgh, PA; [2]Yale University School of Medicine, New Haven, CT.

OBJECTIVE: May-Thurner Syndrome (MTS) is increasingly recognized as a frequent source of leg swelling and a precipitating factor for venous thromboembolism. This paper is a systematic review of the English literature on MTS with an analysis focusing on gender differences in presentation and treatment.

METHODS: A systematic review of the English literature was performed up to December 2014 using the following terms: "May-Thurner Syndrome", "Cockett Syndrome" and "Iliac Vein Compression Syndrome". After review, there were 174 articles in the analysis. Only case reports and case series that had detailed descriptions were included. A comparison of presentation and treatment between women and men was performed based on analyses of the papers containing the relevant information. Statistical differences between data sets were assessed using Chi-Square- and Students T-Test.

RESULTS: There were 1458 patients with MTS. The female to male ratio was 2:1 [978 (67.1%) vs 480 (32.9%)]. Women presented at a younger age compared to men (38.7 ± 14.0 years vs 46.2 ± 16.9 years, p= 0.02). On presentation men had significantly more reported leg swelling (92.7% vs 80.8%, p=0.037) and more leg pain (88 % vs 74.3%, p=0.045) compared to women. There was no difference in the reported proportion of patients presenting with deep vein thrombosis (DVT) between the 2 groups (88.9% vs 81.7%, p=0.14). However, women were significantly more likely to have a pulmonary embolus (PE) on presentation compared to men (9.9% vs 1.6%, p=0.035). (Table 1). In addition, 2.3% (34/1458) of patients presented with a critical limb condition such as phlegmasia cerulea dolens or compartment syndrome. There were no associated reports of limb loss.

The most common diagnostic modalities were Computerized Tomographic Venogram (44.8%) and Venography (38.7%) followed by Magnetic resonance imaging (6.56%). Intravascular Ultrasound was used in only 8.8% of cases. Treatment modalities included: medical management (6.9%), open surgery (7.5%) and endovascular interventions with thrombolysis (33.0%) or without thrombolysis (52.6%). Endovascular treatment was more common compared to surgical or medical treatment ($p < 0.001$).

The overall complication rate was 2.1% and mortality rate 0.07%. Perioperative complications included perioperative bleeding (n=11), Re-thrombosis (n=15), Heparin induced thrombocytopenia (n=1), and intraoperative perforation of external iliac vein (n=1) and one case of mortality. There was no statistically significant difference in complication rate between men and women based on the articles that provided that information (p=0.34). The mean reported follow-up time was 25.8 ± 16.4 months, and 20 patients had to undergo reinterventions, following open (3.2%, n = 3/94) or endovascular treatment (1.6%; n = 17/1067).

CONCLUSIONS: Based on the reported literature, there are significant gender differences in presentation of patients with MTS. Males tend to have more pain and swelling in the legs while females tend to be younger and more likely to have a PE.

6:37 pm – 6:42 pm

P09 Commercial stockings' durability after usage and washing

H. Ma, J. Blebea; The University of Oklahoma, Tulsa, OK.

OBJECTIVE: The use of compression stockings is a first-line treatment for lower extremity edema and venous insufficiency. Most physicians recommend that such stockings be replaced after six months of use. There is no data available, however, to document the durability of compression provided various brands of stockings, especially the low-cost brands directly available to consumers on the internet. We examined the durability of compression provided by stockings after six months of simulated use and washings.

METHODS: A total of 72 class 2 (20-30mmHg) men's medium size below knee compression stockings from six different manufacturers (n=12 of each brand) with approximately the same quality and materials were chosen. Identifying brand names were removed and the stockings were divided into two groups, Baseline and Usage. The Usage group was subjected to 90 stretch cycles on a custom-designed device, followed by 90 wash and dry cycles at a commercial laundromat, to simulate 6 months of clinical wear. The Baseline group of stockings was neither stretched nor washed. All stockings were randomly and blindly tested utilizing a calibrated constant rate of extension tensile instrument (Zwick Z010, Germany). Testing

was done in duplicate and pressures at the ankle and calf expressed as mean + standard error of the mean.

RESULTS: There were baseline differences in compression pressures generated by the stockings (Table 1 and Graph 1). More importantly, one brand had significantly lower pressures generated after usage while two others exhibited higher pressures after stretching and washing. Furthermore, the pressure gradient from the ankle to the calf increased by up to 7% in two brands after usage ($P < 0.05$) while another brand developed significantly increased stiffness after stretching and washing ($P< 0.001$).

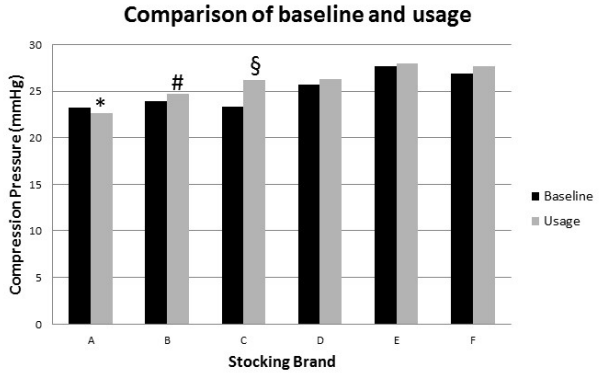
CONCLUSIONS: Most stockings provided continued compression durability at the ankle compression after six months of simulated usage with the discount stockings providing similar results as the more expensive brands. There were significant differences in induced pressures after usage, however, suggesting that variability may also affect clinical efficacy.

Table 1.

Brand	*Baseline* Minimal Ankle Circ. (mmHg)	*Usage* Minimal Ankle Circ. (mmHg)	*Baseline* Average Ankle Circ. (mmHg)	*Usage* Average Ankle Circ. (mmHg)
A	18.9 ± 0.3	**18.3 ± 0.3***	23.2 ± 0.3	**22.6 ± 0.2***
B	21.3 ± 0.3	22.0 ± 0.2	23.9 ± 0.3	**24.7 ± 0.2#**
C	22.3 ± 0.3	**25.0 ± 0.3§**	23.3 ± 0.3	**26.2 ± 0.3§**
D	24.5 ± 0.2	**25.1 ± 0.3†**	25.7 ± 0.2	26.3 ± 0.3
E	24.9 ± 0.3	25.3 ± 0.4	27.7 ± 0.3	28.0 ± 0.4
F	25.4 ± 0.4	26.4 ± 0.5	26.9 ± 0.4	27.7 ± 0.5

Baseline vs Usage: * $P < 0.03$; # $P < 0.04$; § $P<0.001$; † $P < 0.001$.

Graph 1: Comparison of Baseline and Usage



6:43 pm – 6:48 pm

P10 Divergent post thrombotic vein wall injury responses in experimental deep vein thrombosis with partial and complete stasis mechanisms

A. Obi, P. Henke, M. Elfline, C. Luke, A. Kimball, T. Wakefield; University of Michigan, Ann Arbor, MI

OBJECTIVE: Venous thrombosis (VT) may occur as total (complete blood stasis) or partially occlusive in humans, often both. Experimentally, the vein wall response occurs independent of thrombus size, but dependent upon the local mediators of thrombus resolution, vein wall remodeling, inflammation and fibrosis. For the first time we delineate the natural history of post thrombotic vein wall response under conditions of complete ("stasis") compared to partial ("stenosis") blood stasis.

METHODS: Wild type C57BL/6 mice underwent induction of VT via either inferior vena cava (IVC) stenosis (partial stasis) or IVC ligation (complete stasis). Vein wall and thrombus were harvested at 4, 8 and 21d and analyzed by PCR or western blot for inflammatory and fibrinolytic mediators as well as markers for endothelial to mesenchymal transformation.

RESULTS: Venous thrombi were larger at all time points in stasis compared to stenosis thrombosis ($n=11\text{-}12$, $p < 0.05$). Stenosis associated thrombi ($n=4\text{-}6$, $p=0.02$) and vein wall ($n=6$, $p < 0.001$) had a lower TGF-β at 8 days compared to stasis. Activated TGF-β/activin signaling pathway cytoplasmic signaling molecule pSMAD3 was elevated in both models compared to sham ($n=6$, $p < 0.01$) at day 4, but significantly greater in stasis model compared to stenosis ($p=0.03$). TGF-β induces PAI-1, slows VT resolution and mediates endothelial to mesenchymal transformation (EndMT). Congruently, PAI-1 levels were elevated in the stasis model at 4 ($n=6$, $p=0.05$) and 8 ($n=6$, $p < 0.0001$) days. PAI-1 co-factor vitronectin (Vn) was elevated in stenosis model compared to stasis at early ($n=6$, $p < 0.0001$) and mid ($n=6$, $p =0.02$) time points. Vn binds the uPA receptor on monocytes, and accordingly, monocytes (CD68) were elevated in the late vein wall in the stenosis model (114.8 ± 23.6 v. 77.8 ± 11.1; $n=5$, $p=0.21$) As a marker of EndMT, myofibroblast marker FSP-1 was elevated in both models compared to sham, but markedly in stasis ($n=6$,$p=0.004$) as compared with stenosis.

CONCLUSIONS: Stasis thrombosis is associated with increased thrombus and vein wall TGF-β/activin/SMAD pathway upregulation compared to thrombi formed under partial stasis. PAI-1 and Vn levels vary according to model, as does vein wall monocyte recruitment, potentially impacting long-term vein wall remodeling. The vein wall response is thus dependent upon the mechanism of thrombosis and may have implications for potential therapies; future efforts may be directed towards correlating these animal model responses to human tissue and further studying thrombotic mechanisms

7:00 pm – 8:30 pm

Welcome Reception & Poster Display — **Event Center**

6:15 am – 12:50 pm
Exhibit and Poster Hall Open — **Event Center**

6:30 am – 2:00 pm
Registration Open — **Great Hall Booth**

6:30 am – 7:20 am
New Member Breakfast with the Board — **Pavillion**
Continental Breakfast — **Event Center**

7:20 am – 9:10 am
RALPH G. DEPALMA SCIENTIFIC SESSION 2
Venous Thromboembolism/IVC Filters — **Great Hall North/Center**
Moderators: Marc Passman, MD and Aikilesh Sista, MD
Discussants: 2-7 Kelly Brown, MD; 2-9 Mark Iafrati, MD; 2-10 Anthony Comerota, MD

7:20 am – 7:30 am
Ralph G. DePalma Award Presentation by Seshadri Raju, MD

7:30 am – 7:48 am

2-6 Efficacy of apixaban on thrombus resolution and anti-inflammation in a murine model of acute deep venous thrombosis

D. Coleman, S. Stapler, D. Farris, C. Luke, J. Diaz, P. Henke, T. Wakefield, N. Ballard-Lipka; University of Michigan, Ann Arbor, MI.

OBJECTIVE: Deep venous thrombosis (DVT) is associated with significant morbidity related to post-thrombotic syndrome (PTS), the development of which is dependent on processes of acute thrombosis, inflammatory mediators acting on the vein wall and venous recanalization. Heparins, including low molecular weight heparin (LMWH), have anti-inflammatory effects that modulate interactions between inflammatory leukocytes and the vascular endothelium. Newer targeted anticoagulants including Apixaban (direct factor Xa inhibitor) are non-inferior to heparin in the treatment of DVT, with limited data published on thrombus resolution. This study aims to determine the relative effects of LMWH and factor Xa-inhibition on local (vein wall) and systemic acute inflammatory markers and thrombus resolution in a murine model of DVT.

METHODS: Mice (20-25 grams) underwent the electrolytic inferior vena cava model (EIM) procedure. On closure of the laparotomy incision, they subsequently received treatment with Apixaban (gavage, 30mg/kg daily), Enoxaparin (subcutaneous, 6mg/kg daily) or Saline control for 2 days (acute DVT) or 14 days (chronic DVT) at which time they were euthanized for further histologic assessment. Tissue analysis included immunohistology, ELISA, and gene expression (PCR).

RESULTS: Two-day total thrombus weights were reduced by 46% in the Enoxaparin group as compared to controls, while the total thrombus weights were only reduced by 25% in the Apixaban group as compared to controls (Figure 1A). As compared with Enoxaparin, vein wall proinflammatory cytokine gene expression of IL-6, IL-8, MCP-1 and TNFα were elevated while the anti-inflammatory cytokine IL-13 was decreased (Table 1). Circulating levels of the anti-inflammatory IL-10 were significantly increased in the Enoxaparin group (N=5; mean 1.677 +/-0.9144 pg of IL-10/mg of total protein) in comparison to both Saline controls (N=5; mean 0.1443 +/- 0.02228 pg/mg; P=0.006) and Apixaban (N=3; mean 0.1669 +/- 0.1123 pg/mg; P=0.01). Additionally, Ly6G staining of the IVC revealed a significant increase in the number of activated neutrophils present in the vein wall of Apixaban-treated mice (199 cells/5 hpf, N =5) in comparison to both Enoxaparin (mean 127 cells/5hpf; N=5; P=0.0427) and Saline (mean 125 cells/5hpf; N=5; P=0.0427). Finally, 14-day total thrombus weights (calculated to reflect chronic thrombus burden with IVC) were reduced by 45% in the Enoxaparin group and by 25% in the Apixaban group as compared to controls (Figure 1B). Notably, there was larger thrombus burden in the Apixaban group as compared to Enoxaparin by ANOVA.

CONCLUSIONS: Apixaban is less effective in reducing thrombus burden than Enoxaparin at 2 and 14 day time points in this non-stasis murine model of DVT. This may be due to anti-inflammatory pleotropic effects of Enoxaparin that Apixaban may not have in acute DVT. Further study is ongoing to determine if vein wall remodeling is affected by Xa inhibition and if this is an effect of Apixaban itself or a class effect of anti-Xa inhibitors.

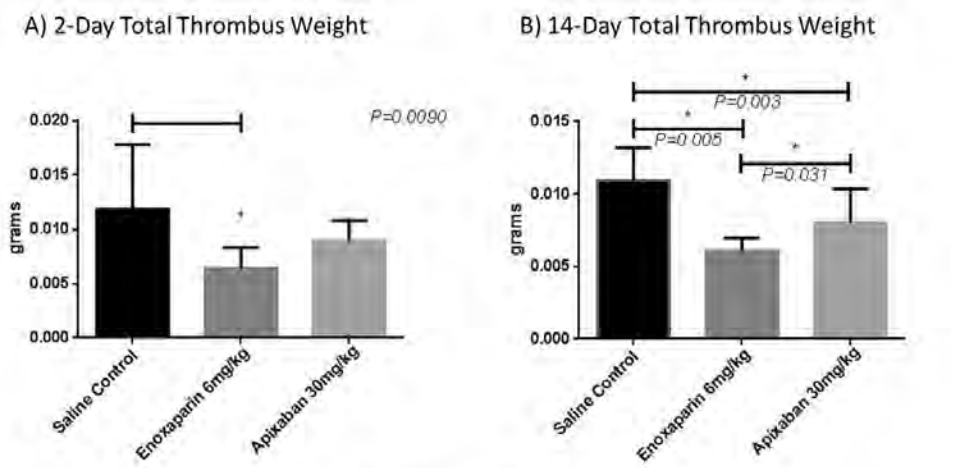


Table 1: Local (vein wall) Gene Expression (PCR) of Acute (2-day) Inflammatory Cytokines
(statistical significance highlighted; defined as P<0.05)

	Cytokine	Saline Control (N=8) *(relative expression 10^-3)*	Enoxaparin (N=8) *(relative expression 10^-3)*	Apixaban (N=8) *(relative expression10^-3)*	P-value
Pro-inflammatory	IL-6	9.586	4.454	9.512	*0.0764*
	IL-8	5.765	4.047	9.331	**0.0222*
	MCP-1	65.07	46.97	110.1	**0.0055*
	TNF-α	0.1925	0.167	0.3367	**0.0175*
Anti-inflammatory	IL-13	0.061	0.201	0.1578	**0.0155*

7:48 am – 8:06 am

2-7 The 2005 caprini score predicts both baseline vte risk and effectiveness of chemoprophylaxis: a meta-analysis of 13,412 surgical patients

C. Pannucci[1], L. Swistun[1], J. MacDonald[1], B. Brooke[1], P. Henke[2]; 1University of Utah, Salt Lake City, UT, 2University of Michigan, Ann Arbor, MI.

OBJECTIVE: The relative merits of "group" versus "individual" VTE risk stratification are often debated. The 2005 Caprini score is the most widely recognized method to perform individual VTE risk stratification. Here we sought to examine the predictiveness of the 2005 Caprini score in surgical patients for 1) the incidence of VTE in patients who receive no chemoprophylaxis, 2) the effectiveness of VTE chemoprophylaxis and 3) variation in peri-operative bleeding risk.

METHODS: We performed a systematic review and meta-analysis of MEDLINE, EMBASE, and the Cochrane Library between January, 2005 and August, 2015. Inclusion criteria were 1) adult patients, 2) reported 2005 Caprini score, 3) patients who did and did not receive peri-operative chemoprophylaxis, and 4) reported on at least one primary outcome. Primary outcomes included VTE or bleeding complications deemed significant by the authors. For each primary outcome, data were pooled and forest plots were created. The primary outcomes were stratified within forest plots by both receipt of chemoprophylaxis and 2005 Caprini score.

RESULTS: We identified 3,374 abstracts and manuscripts. Fifty five met criteria for full-text review and 9 met final inclusion criteria and had usable data. Collectively, this included 13,412 patients. The 2005 Caprini score identified a 22-fold variation in VTE risk among 5,216 surgical patients who received no chemoprophylaxis. Patients at each ascending risk level were significantly more likely to have a VTE event than patients at lower risk levels (Figure 1 and Table 1). For the VTE outcome (n=13,360), patients risk-stratified into higher risk groups received a differential benefit from chemoprophylaxis. Patients with 2005 Caprini scores of >8 were significantly less likely to have VTE when chemoprophylaxis was provided (OR 0.43, 95% CI 0.25-0.73), and a trend toward significance was seen in patients with Caprini scores of 7-8 (OR 0.62, 95% CI 0.36-1.05) who received chemoprophylaxis. Chemoprophylaxis did not benefit patients with Caprini scores of 3-4 (OR 1.55, 95% CI 0.59-4.10) or 5-6 (OR 0.88, 95% CI 0.53-1.53) (Figure 2). There was no apparent correlation between risk for peri-operative bleeding events and 2005 Caprini score in patients who did or did not receive chemoprophylaxis (n=7,297) (Figure 3).

CONCLUSIONS: The 2005 Caprini score predicts post-operative VTE events in surgical patients who do not receive chemoprophylaxis. The 2005 Caprini score identifies patients who will and will not benefit from chemoprophylaxis in

the peri-operative period. There is no association between 2005 Caprini score and risk for peri-operative bleeding when chemoprophylaxis is provided.

Figure 1: Rate of VTE stratified by 2005 Caprini score in patients who did not receive chemoprophylaxis

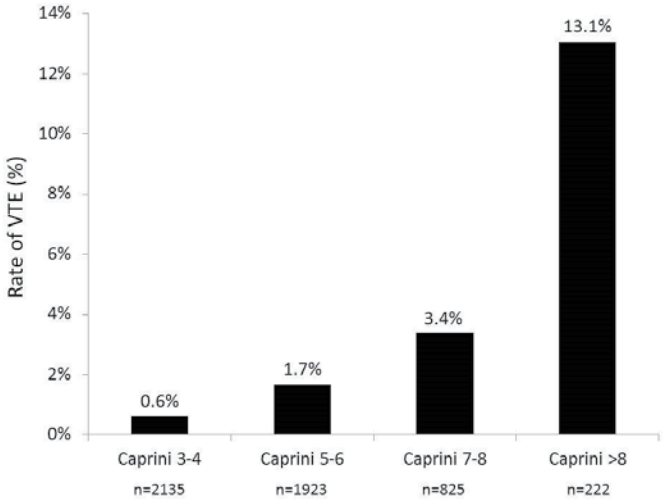


Table 1: Comparison of observed VTE rates between 2005 Caprini risk subgroups

Score	Caprini 5-6	Caprini 7-8	Caprini >8
Caprini 3-4	1.7% vs. 0.6% p=0.002	3.4% vs. 0.6% p<0.001	13.1% vs. 0.6% p<0.001
Caprini 5-6	-----	3.4% vs. 1.7% p=0.01	13.1% vs. 1.7% p<0.001
Caprini 7-8	-----	-----	13.1% vs. 3.4% p<0.001

Figure 2: Forest plot examining VTE risk reduction with chemoprophylaxis when stratified by 2005 Caprini score

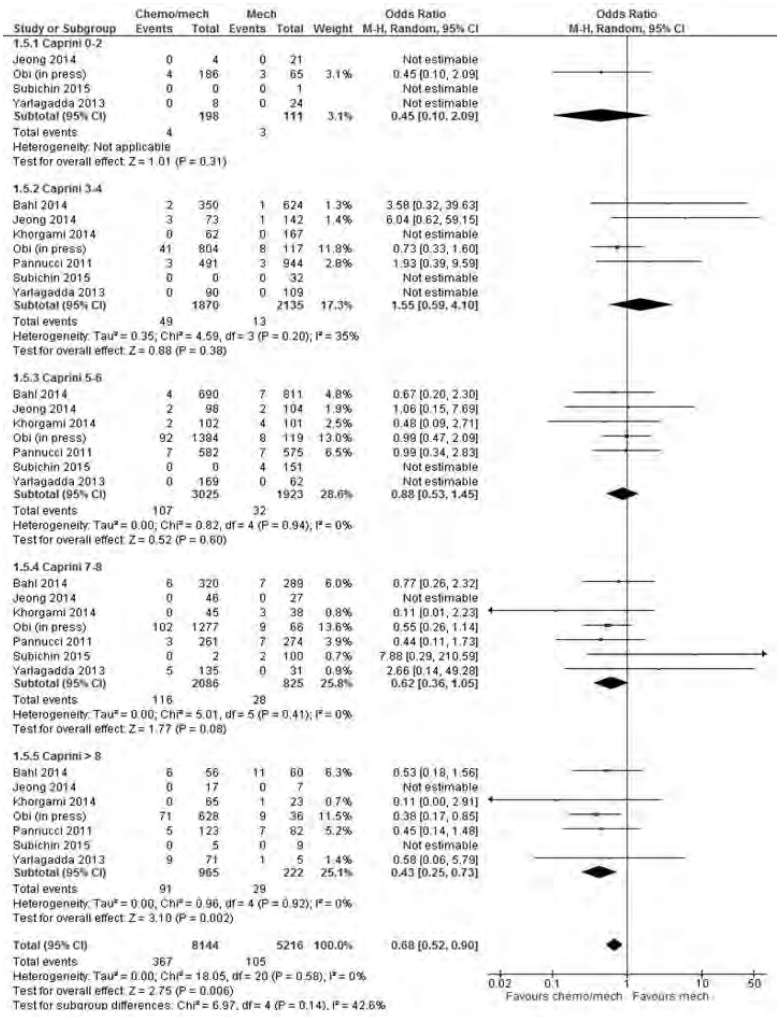
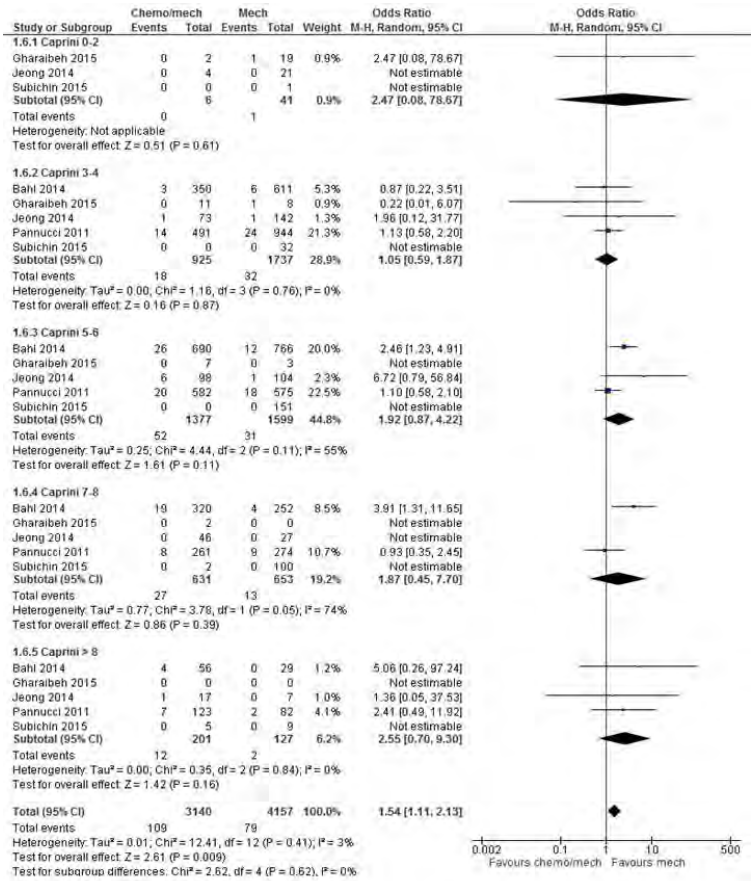


Figure 3: Forest plot examining re-operative hematoma with chemoprophylaxis when stratified by 2005 Caprini score



8:06 am – 8:24 am

2-8 Systemic thrombolysis increases hemorrhagic stroke risk without survival benefit compared to catheter-directed intervention for the treatment of acute pulmonary embolism

N. L. Liang, E. Avgerinos, M. Singh, M. Makaroun, R. Chaer; University of Pittsburgh Medical Center, Pittsburgh, PA.

OBJECTIVE: Systemic thrombolysis (ST) and catheter-directed intervention (CDI) are both used in the treatment of acute pulmonary embolism (PE), but the comparative outcomes of these two therapies remain unclear. The objective of this study was to compare short-term mortality and safety outcomes between the two treatments using a large national database.

METHODS: Patients presenting with acute PE were identified in the National Inpatient Sample from 2009-2012. Comorbidities, clinical characteristics, and invasive procedures were identified using International Classification of Diseases version 9 (ICD-9) codes and the Elixhauser comorbidity index. To adjust for anticipated baseline differences between the two treatment groups, propensity score matching was used to create a matched ST cohort with clinical and comorbid characteristics similar to the CDI cohort. Subgroups of patients with and without hemodynamic shock were analyzed separately. Primary outcomes were in-hospital mortality, overall bleeding risk, and hemorrhagic stroke risk.

RESULTS: Of 263,955 subjects with acute PE, 1.63% (n=4272) received ST and 0.55% (n=1455) received CDI. ST subjects were older, had more chronic comorbidities, and higher rates of respiratory failure (ST: 27.9%, n=1192; CDI: 21.2%, n=308; $p < 0.001$) and shock (ST: 18.2%, n=779; CDI: 12%, n=174; $p < 0.001$). CDI subjects had higher rates of concurrent deep venous thrombosis (ST: 35.8%, n=1530; CDI 45.9%, n=668; $p < 0.001$) and vena cava filter placement (ST: 31.1%, n=1328; CDI: 57%, n=830; $p < 0.001$). In the unmatched cohort, ST subjects had higher in-hospital mortality (ST: 16.7%, n=714; CDI: 9.4%, n=136, $p < 0.001$) and hemorrhagic stroke rates (ST: 2.2%, n=96; CDI: 1.4%, n=20; p=0.041). After propensity matching, 1434 patients remained in each cohort; baseline characteristics of the matched cohorts did not differ significantly using standardized difference comparisons. Analysis of the matched cohorts did not demonstrate a significant effect of CDI on in-hospital mortality or overall bleeding risk but did show a significant protective effect against hemorrhagic stroke offset by an increased risk of procedural bleeding compared to SL (Table). Subgroup analysis

showed decreased odds of hemorrhagic stroke for CDI in the non-shock subgroup, and increased procedural bleeding for CDI but no difference in hemorrhagic stroke risk in the shock subgroup.

CONCLUSIONS: Systemic thrombolysis for acute pulmonary embolism may not improve in-hospital mortality but increases the overall risk of hemorrhagic stroke compared to catheter-directed intervention. Further prospective studies should examine the comparative effectiveness and safety of these two treatments.

Table 1

Outcome	Total Cohort			Subgroup: Shock			Subgroup: Non-Shock		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Mortality	0.88	[0.69, 1.13]	0.3	1.11	[0.71, 1.75]	0.6	0.78	[0.57, 1.08]	0.1
Overall Bleeding	0.96	[0.74, 1.24]	0.7	1.77	[0.97, 3.26]	0.1	0.88	[0.65, 1.18]	0.4
Hemorrhagic Stroke	0.47	[0.27, 0.82]	0.01	0.66	[0.11, 4.09]	0.7	0.48	[0.27, 0.86]	0.01
GI Bleed	1.22	[0.86, 1.73]	0.3	1.98	[1.03, 3.79]	0.04	0.97	[0.62, 1.52]	0.9
Procedural Hematoma	1.56	[1.01, 2.41]	0.04	3.48	[0.92, 13.2]	0.07	1.65	[1.01, 2.70]	0.04

* Odds Ratio (OR) < 1 favors CDI

8:24 am – 8:42 am

2-9 Predictors of failure and complications of catheter directed interventions for pulmonary embolism

E. Avgerinos, A. Abou Ali, N. Liang, E. Genovese, M. Makaroun, R. Chaer; University of Pittsburgh Medical Center, Pittsburgh, PA.

OBJECTIVE: Catheter Directed Interventions (CDIs) are increasingly performed for acute Pulmonary Embolism (PE) as they are presumed to provide similar therapeutic benefits to systemic thrombolysis, while decreasing the dose of thrombolytic required and the associated risks. This study aims to identify predictors of CDIs failure and describe anticipated complications.

METHODS: Consecutive patients who underwent CDIs for massive or submassive PE between 2009 and 2015 were identified and complications were retrospectively collected. CDI clinical failure was defined as major bleeding, perioperative stroke or other major adverse procedure-related event, decompensation for sub-massive or persistent shock for massive PE, need for surgical thromboembolectomy, or in-hospital death. Multivariate logistic regression was used to determine predictors of failure.

RESULTS: 102 patients received a CDI (36 standard catheter thrombolysis, 60 ultrasound assisted, 6 other) during the study period: age 59.2±15.9 years, males 50(49.0%), massive PE 14 (13.7%). Five (4.9%) patients had a major and 15 (14.7%) had a minor contraindication for systemic thrombolysis, Mean alteplase dose was 28.2±18.8mg (range 0-123, 3 patients received prior systemic lysis). Ten (9.8%) patients had minor bleeding events (4 access-related). Clinical failures and major complications are summarized in the table. CDI failure occurred in 15 patients (14.7%; 7 in massive PE, 8 in submassive PE). Predictors of failure included massive PE (OR=20.2, P < 0.001), pulmonary disease (OR=7.7, P=.012) and pre-existing major contraindication to thrombolytics (OR=31.6, P=.006). Failure was independent of age, lysis dose, CDI technique and number of procedures performed (learning curve).

CONCLUSIONS: CDIs for acute PE are not risk-free procedures and their use should be individualized based on a risk-benefit ratio. For patients with major contraindications for systemic thrombolytics CDIs should be used very selectively. Lytic dose, within the low volume range administered in CDIs and CDI technique seem to have no impact on adverse events.

Table 1

	Total	Massive PE	Submassive PE
Total CDIs	102	14	88
CDI Failures	15(14.7%)	7(50%)	8(9.1%)
Major Bleed	7(6.9%)	3(21.4%)	4(4.5%)
Gusto Severe	2(2%)	--	--
Hemorrhagic Stroke	--	1(7.1%)	--
Hemopericardium	--	--	1(1.1%)
Gusto Moderate	5(4.9%)	2(14.3%)	3(3.4%)
Perioperative Stroke (Hemorrhagic)	1(1%)	1(7.1%)	0(0%)
Decompensation	8(7.8%)	--	3(3.4%)
Persistent Shock	--	5(35.7%)	--
Surgical Thrombectomy	3(2.9%)	2(14.3%)	1(1.1%)
Other Major Adverse Event (Tricuspid Valve Rupture)	1(1%)	0(0%)	1(1.1%)
Death	4(3.9)	3(21.4%)	1(1.1%)

8:42 am – 9:00 am

2-10 Hybrid operative thrombectomy demonstrates non-inferiority versus percutaneous techniques for the treatment acute iliofemoral deep vein thrombosis

L. E. Rodriguez, R. Figueroa-Vicente, A. Aboukheir-Aboukheir, L. Torruella-Bartolomei, J. Martinez-Trabal; St. Lukes Memorial Hospital, Utica, NY.

OBJECTIVE: Hybrid operative thrombectomy (HOT) is a novel technique for the treatment of iliofemoral deep vein thrombosis (IFDVT) which is distinguished by retrograde access (via femoral venotomy) to the distal venous segments. In this study, we compare perioperative and intermediate outcomes of hybrid operative thrombectomy versus percutaneous techniques (PT) in the setting of IFDVT.

METHODS: From August 2008 to May 2014, 64 consecutive patient were treated with either PT (n=36) or HOT (n=28) for acute IFDVT (single limb). The HOT consisted of surgical thrombectomy, with balloon angioplasty +/- stent. PT included catheter directed thrombolysis (CDT) +/- pharmacomechanical thrombectomy (PMT). Perioperative outcomes, technical success (>50% thrombus resolution), and thrombus resolution (partial vs. complete) were analyzed between the two treatment groups. CEAP classification and venous duplex at intermediate follow up were also analyzed.

RESULTS: The left limb was the most common site of the IFDVT in both groups. Technical success was 100% in both groups, and at least 80% thrombus resolution was achieved in both treatment arms. There was a trend towards a greater postoperative percent drop in Hgb in the PT group (18.3% vs. 23.4%, p=0.09) which did not reach statistical significance. PT patients were transfused more PRBC units postoperatively than HOT (p=0.046). PT patients had a significantly longer length of stay (9.7 vs. 13.4 days, p=0.028) when compared to HOT. At intermediate follow up there was no difference between HOT vs. PT in mean reflux times (1.56 vs 1.51 sec, p=0.81) at the femoral-popliteal segment. At a mean follow up time of 1.5 years the clinical CEAP classification at the surgical limb was 3 or less in the majority of patients in both groups.

CONCLUSIONS: In our experience, PT and HOT have demonstrated very good outcomes in the perioperative and intermediate periods. HOT is non-inferior to PT as a technique for early thrombus removal, and has the advantage that thrombolytic therapy is not required, thrombus resolution is established in one operation, and length of stay is significantly decreased.

9:00 am - 9:05 am

Q2-3 Below knee dvt: clinically silent is not clinically insignificant

E. Coll[4], D. O'Connor[1], S. Kaul[2], S. Limo[3], M. Blatt[3], T. Nyirenda[3], S. Mathus[3], T. Zielonka[3], E. Ceballos[3]; [1]Bergen Surgical Specialists, Hackensack, NJ, [2]North Jersey Trauma/Critical Center, Hackensack, NJ, [3]Hackensack University Medical Center, Hackensack, NJ, [4]General and Vascular Surgical Associates, Clifton, NJ.

OBJECTIVE: Blunt trauma patients are at high risk for deep vein thrombosis (DVT) and subsequent pulmonary embolism (PE). Traditionally, only symptomatic patients or those clinically suspected of having DVT had venous duplex ultrasound (VDU) imaging performed. However, many trauma centers now perform screening VDU on all moderate to high-risk patients. While this remains a controversial practice, it has led to a significant increase in the number of diagnosed DVTs and an opportunity to examine the impact of clinically silent DVT. Current American College of Chest Physician (ACCP) guidelines for the management of VTE recommend against therapeutic anticoagulation of asymptomatic below knee deep vein thrombosis (BKDVT). BKDVT has historically been characterized as "not clinically significant". However, in a recent study by Olson et al (2014), BKDVT was associated with a higher incidence of PE than above knee DVT (6.1% vs. 1.1%). The authors attributed this to the fact that patients with BKDVT were not therapeutically anticoagulated. They

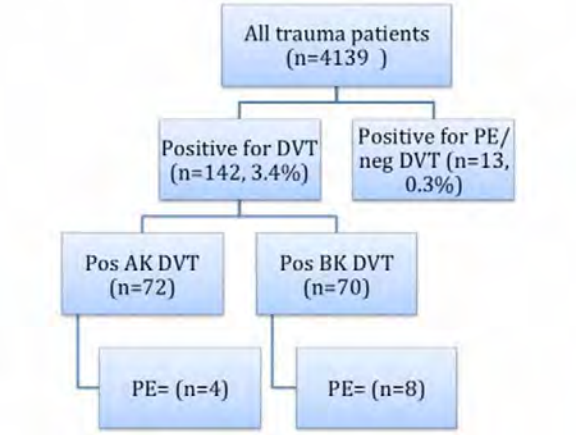
cited the conservative use of pharmacologic prophylaxis as a limitation of their study. At our institution, surveillance VDU is performed on all moderate to high-risk trauma patients and we employ an aggressive DVT prophylaxis protocol. Patients with asymptomatic BKDVT are not routinely therapeutically anticoagulated, however, as per current ACCP guidelines. The purpose of this study was to evaluate the incidence of BKDVT in our moderate to high-risk blunt trauma patients who receive aggressive DVT prophylaxis and to assess the rate of associated PE.

METHODS: A retrospective analysis of all moderate to high-risk blunt trauma patients presenting to our university affiliated medical center between May 2010 and March 2015, ≥ 18 years of age, LOS ≥ 48 hours, who screened positive for DVT within 30 days of admission.

RESULTS: Of the 4,139 patients attended by our trauma service, 1068 were categorized as moderate to high risk and were screened for DVT. The overall DVT rate was 3.4% (n=142) with 72 positive for AKDVT and 70 positive for BKDVT. The overall rate of PE was 0.6%. Those in the BKDVT group had twice the rate of PE as those in the AKDVT group (n=8 vs. 4) despite aggressive DVT prophylaxis (see Figure 1). A multivariate logistic regression analysis failed to reveal any statistically significant difference between those in the BKDVT vs. the AKDVT group.

CONCLUSIONS: Our findings support those of recent studies and suggest that clinically silent BKDVT is significant and that these patients should be considered for therapeutic anticoagulation or IVC filter placement when not contraindicated. The absence of statistically significant differences between those with AKDVT vs. BKDVT begs the question "Why do we continue to treat these patients differently?"

Figure 1. Incidence of PE with and without DVT.



9:05 am – 9:10 am

Q2-4 Venous thromboembolic complication after endovenous thermal ablation for varicose veins and role of duplex scan: reports from japanese endovenous ablation committee for varicose veins

M. Mo, H. Nemoto; T. Ogawa; T. Yamaki; Department of Cardiovascular Surgery, Yokohama Minami Kyosai Hospital, Yokohama City, Kanagawa.

OBJECTIVE: Endovenous thermal ablation for varicose veins (EVTA) is currently one of the primary treatment for varicose veins of legs. However incidence and importance of venous thromboembolic (VTE) complication of EVTA is not clear, yet. Japanese Endovenous Ablation Committee for Varicose Veins (JEVA) which authorize license of EVTA procedure for all physicians and institutions performed national-wide survey of VTE complication after EVTA.

METHODS: Data of VTE complication after EVTA were collected for all cases from January 2011 to December 2013. Details were also obtained for the cases with endovenous heat induced thrombosis (EHIT) class 3, 4, any deep vein thrombosis (DVT) or pulmonary embolism (PE).

RESULTS: Data of 43203 cases was obtained from 213 institutions. Most of EVTA was performed by ELVeS 980nm (biolitec Germany) which is the only approved device for Japanese insurance system. Precise incidence including EHIT 2 in the institutions was reported from 118 institution which performed 30007 cases of EVTA.Total reported VTE were EHIT2: 318 cases, EHIT3: 51 cases, EHIT4: 7 cases, PE: 3 cases, any other DVT: 24 cases. Incidence was 1.0% in EHIT 2, 0.10% in EHIT3, 0.013% in EHIT4, 0.0067% in PE, and 0.063% in any other DVT.Three patients with PE were 46 to 68 y/o females. Two cases were massive PE with hypotension and hypoxia developed at POD #1 and another was non-massive PE with dyspnea at POD# 4. All EVTA was performed inpatient setting. Origin of varices were left GSV in 1 case and bilateral GSV in 2 cases. Duplex scan before onset of PE was performed only one case resulting negative duplex for DVT. All cases were treated mainly by anticoagulation with uneventful course.In seven cases with EHIT4, origin of varices were GSV in

6 cases and SSV in 1 case. Onset was from POD #4 to # 45 days (average 15.8days). Duplex scan before onset of EHIT4 was performed in 6 cases, demonstrating no EHIT in 3 cases, EHIT2 in 2 cases and EHIT3 in 1 case. In 51 cases with EHIT 3, origin of varices were GSV in 46 cases and SSV in 4 case. Onset was from POD #1to # 14 days (average 6.8days). Duplex scan before onset of EHIT3 was performed in 15 cases, demonstrating no EHIT in 5 cases, EHIT 1 in 8 cases and EHIT2 in 2 cases. Majority received anticoagulation and only 1 case progressed to EHIT4/DVT even with anticoagulation.

CONCLUSIONS: VTE complication after EVTA was rare. Postoperative venous duplex scan can predict occurrence of EHIT4 to some extent, but not PE nor EHIT3. Role of routine serial duplex is not clear.

8:00 am – 11:00 am

Guest Hospitality Breakfast — 20Seven

9:10 am – 9:40 am

Best Paper Session — Great Hall North/Center

Organized by the AVF Research and Annual Program Committees

Moderators: Faisal Aziz, MD and Jose Diaz, MD

9:10 am – 9:20 am

Pulmonary embolism response to fragmentation, embolectomy, and catheter thrombolysis (perfect): initial results from a prospective multicenter registry

W. Kuo[1]; A. Banerjee[1]; P. S. Kim[2]; F. J. DeMarco, Jr[3]; J. R. Levy[4]; F. R. Facchini[5], K. Unver[1]; M. J. Bertini[5]; A. K. Sista[6]; M. J. Hall[7]; J. K. Rosenberg[1], M. A. DeGregorio[8]; [1]Stanford University Medical, Stanford, CA; [2]Spectrum Medical Group, South Portland, ME; [3]Northside Hospital, Cumming, GA; [4]Northside Radiology Associates, Atlanta GA; [5]Adventist Midwest Health, Hinsdale, IL; [6]Weill Cornell Medical College, New York, NY; [7]Memorial Hospital of South Bend, South Bend, IN; [8]Minimally Invasive Techniques Research Group (GITMI), University of Zaragoza, Zaragoza, Spain.

OBJECTIVE: Systemic thrombolysis for acute PE carries up to a 20% risk of major bleeding, including a 2-5% risk of hemorrhagic stroke. We evaluated the safety and effectiveness of catheter-directed therapy (CDT) as an alternative treatment for acute PE.

METHODS: One hundred one consecutive patients receiving CDT for acute PE were prospectively enrolled in a multicenter registry. Massive PE (n=28) and submassive PE (n=73) were treated with immediate catheter-directed mechanical or pharmacomechanical thrombectomy and/or catheter-directed thrombolysis via low-dose hourly drug infusion with tPA or urokinase. Clinical success was defined as meeting all criteria: stabilization of hemodynamics, improvement in pulmonary hypertension and/or right heart strain, and survival to hospital discharge. Primary safety outcomes were major procedure-related complications and major bleeding events.

RESULTS: There were 53 men and 48 women with average age of 60 years (range, 22-86 years) and mean BMI of 31.03±7.20 kg/m2. The average thrombolytic doses were 28.0±11 mg tPA (n=76) and 2,697,101±936,287 IU for urokinase (n=23). Clinical success was achieved in 24/28 (85.7%)(95% CI, 67.3%-96.0%) patients with massive PE and

71/73 (97.3%)(95% CI, 90.5%-99.7%) with submassive PE. The mean PA pressure improved from 51.17±14.06 mmHg to 37.23±15.81 mmHg (n=92)(P<0.0001). Among patients monitored with follow-up echocardiography, 57/64 (89.1%) (95% CI, 78.8%-95.5%)(p<0.0001) showed improvement in right heart strain. There were no major procedure-related complications, no major hemorrhages, and no hemorrhagic strokes.

CONCLUSIONS Catheter-directed therapy improves clinical outcomes in acute PE patients while minimizing the risk of major bleeding. At experienced centers, CDT is a safe and effective treatment for both acute massive and submassive PE.

9:20 am – 9:30 am

Statins improve the resolution of established murine venous thrombosis: reductions in thrombus burden and vein wall scarring

C. W. Kessinger[1], J. Won Kim[1,2], P. K. Henke[3], B. Thompson[1], J. R. McCarthy[1], T. Hara[1], M. Sillesen[7], R. J. P. Margey[1], P. Libby[4], R. Weissleder[1], C. P. Lin[1], F. A. Jaffer[1]; [1]Harvard Medical School, Boston, MA; [2]Korea University Guro Hospital, Seoul, Republic of Korea; [3]University of Michigan, Ann Arbor, MI; [4] Brigham and Women's Hospital, Boston, MA.

OBJECTIVE: Despite anticoagulation therapy, up to one-half of patients with deep vein thrombosis (DVT) will develop the post-thrombotic syndrome (PTS). Improving the long-term outcome of DVT patients at risk for PTS will therefore require new approaches.

METHODS: Here we investigate the effects of statins—lipid-lowering agents with anti-thrombotic and anti-inflammatory properties—in decreasing thrombus burden and decreasing vein wall injury, mediators of PTS, in established murine

stasis and non-stasis chemical-induced venous thrombosis (N = 282 mice). Treatment of mice with daily atorvastatin or rosuvastatin significantly reduced stasis venous thrombus burden by 25% without affecting lipid levels, blood coagulation parameters, or blood cell counts. Statin-driven reductions in VT burden (thrombus mass for stasis thrombi, intravital microscopy thrombus area for non-stasis thrombi) compared similarly to the therapeutic anticoagulant effects of low molecular weight heparin.

RESULTS: Blood from statin-treated mice showed significant reductions in platelet aggregation and clot stability. Statins additionally reduced thrombus plasminogen activator inhibitor-1 (PAI-1), tissue factor, neutrophils, myeloperoxidase, neutrophil extracellular traps (NETs), and macrophages, and these effects were most notable in the earlier timepoints after DVT formation. In addition, statins reduced DVT-induced vein wall scarring by 50% durably up to day 21 in stasis VT, as shown by polarized light microscopy of picrosirius red-stained vein wall collagen.

CONCLUSIONS: The overall results demonstrate that statins improve VT resolution via profibrinolytic, anticoagulant, antiplatelet, and anti-vein wall scarring effects. Statins may therefore offer a new pharmacotherapeutic approach to improve DVT resolution and to reduce the post-thrombotic syndrome, particularly in subjects who are ineligible for anticoagulation therapy.

9:30 am – 9:40 am

The role of galectin-3 and galectin-3–binding protein in venous thrombosis
J. A. Diaz, E. P. DeRoo, S. K. Wrobleski, E. M. Shea, R. K. Al-Khalil, A. E. Hawley, P. K. Henke, D. D. Myers Jr., T. W. Wakefield; University of Michigan, Ann Arbor, MI.

OBJECTIVE: Galectin-3-binding protein (gal3bp) and its receptor/ligand, galectin-3 (gal3), are secreted proteins that initiate signaling cascades in several diseases, and recent human proteomic data suggest they may play a role in venous thrombosis (VT). We hypothesized that gal3bp and gal3 may promote VT.

METHODS: Using a mouse stasis model of VT, we found that gal3bp and gal3 were localized on vein wall, red blood cells, platelets, and microparticles, whereas leukocytes expressed gal3 only. Gal3 was dramatically increased during early VT and gal3bp:gal3 colocalized in the leukocyte/endothelial cell interface, where leukocytes were partially attached to the vein wall. Thrombus size correlated with elevated gal3 and interleukin-6 (IL-6) vein wall levels.

RESULTS: Recombinant gal3 promoted VT and increased vein wall IL-6 mRNA. Although recombinant gal3 restored the VT size in gal3(-/-) mice, it had no effect on IL6(-/-) mice, suggesting that gal3:gal3bp promotes VT through IL-6. Moreover, significantly fewer activated neutrophils were present in the gal3(-/-) vein walls. In a group of human patients, elevated circulating gal3bp correlated with acute VT.

CONCLUSIONS: In conclusion, gal3bp:gal3 play a critical role in VT, likely via IL-6 and PMN-mediated thrombotic mechanisms, and may be a potential biomarker in human VT.

9:40 am – 10:00 am
Coffee Break — **Event Center**

10:00 am – 11:00 am
D. EUGENE STRANDNESS MEMORIAL LECTURE
Evidence Based Venous Disease Intervention — **Great Hall North/Center**
Keynote Speaker: Professor Alun Huw Davis, MA, DM, DSc, FRCS, FHEA, FEBVS, FACPh

11:10 am – 12:50 pm
SCIENTIFIC SESSION 3:
Superficial Venous Disease — **Great Hall North/Center**
Moderators: Glenn Jacobowitz, MD and Elna Masuda, MD

Discussants: 3-11 Peter Hanke, MD; 3-12 Julianne Stoughton, MD; 3-13 Joseph Raffetto, MD; 3-14 Dan Monahan, MD; 3-15 Mark Meissner, MD

11:10 am – 11:28 am

3-11 Improvements of deep vein reflux following radiofrequency ablation for saphenous vein incompetence
S. Kim, J. K. Chung, I. M. Jung; SMG-SNU Boramae Medical Center, Seoul, South Korea.

OBJECTIVE: Deep vein reflux is frequently combined with superficial venous reflux, however, the clinical significance of deep vein reflux is not well described. The aim of this study was to describe the changes of deep vein reflux after saphenous vein ablation.

METHODS: A total of 100 patients with 139 limbs were included and treated with radiofrequency ablation (RFA) of great saphenous veins from January to December 2014. The data on the demographics, duplex study, and clinical outcomes were prospectively collected and reviewed.

RESULTS: Of the 139 limbs, reflux in the deep veins was present in 43 limbs (30.9%). The distribution of deep vein reflux involved the popliteal vein in 23 limbs (53.5%) and both femoral and popliteal veins in 20 limbs (46.5%).The CEAP classification, venous clinical severity score (VCSS) and Aberdeen varicose vein symptom score (AVSS) were similar between the limbs with and without deep vein reflux. There were no significant differences in the rate of successful closure and the incidence of procedure-related complications regardless of the presence of deep vein reflux. With a mean follow-up of 5.9 months, the mean VCSS and AVSS improved regardless of the presence of deep vein reflux. In 43 limbs with deep vein reflux, the peak reflux velocity and duration of reflux were improved in all the patients, and deep vein reflux was completely corrected in 13 limbs (30.2%) after RFA.

CONCLUSIONS: The presence of deep vein reflux did not affect the treatment outcomes of RFA for saphenous vein incompetence. The PRV and duration of reflux improved in all the patients, and about 30% of them were completely corrected after RFA. Deep vein reflux associated with saphenous vein incompetence is not a barrier to performing RFA.

11:28 am – 11:46 am

3-12 VQI varicose vein registry – first six months results

A. T. Obi[1], D. Neal[1], J. Almeida[2], L. Kabnick[3], J. Cronenwett[1], C. Stabler[1], C. Bosela[1], T. Wakefield[1]; [1]University of Michigan, Ann Arbor, MI, [2]Miami Vein Center, Miami, FL, [3]NYU Langone Medical Center, Morisstown, NJ.

OBJECTIVE: Since the VQI VVR launched in January 2015, 13 centers have reported data on 826 patients and 844 limbs.

METHODS: The VQI VVR captures procedural data, CEAP, VCSS, and patient-reported outcomes (PROs) in prospective fashion. Descriptive statistics and pre and post procedural comparisons were performed.

RESULTS: Mean age was 56, 70% women, 79% white, 7% African American, of mean weight 192 lbs (30.3 BMI). Patients presented with prior varicose vein treatment (39%), history of phlebitis (10%), prior RFA in treated leg (10%), prior surgery in treated leg (7%), prior EVLA in treated leg (4%), and history of DVT (7%). Ten percent were on anticoagulants (7% continued during treatment). Daily compression in the treated leg was used by 56%. Reflux was documented as GSV thigh (80%), calf (42%), SSV (30%), deep veins (27%) and AASV thigh (11%).

826 patients were treated, 49% right leg, 49% left leg, and 2% both legs. These patients presented with C2 (23%), C3-4 (70%), and C5-6 (7%) disease and were treated in the office (46%), hospital outpatient center (44%), or ambulatory surgery center (10%). Anesthesia was tumescent in 71%, general in 19%, local in 4% and sedation in 2%. In 1239 individual venous interventions, 66% involved only 1 treatment on one vein while 34% had > 1 treatment on one or multiple veins. Of patients with more than 1 treatment, 18% had only truncal treatment, 4% had only cluster treatment, while 77% had both truncal and cluster veins treated. Type of procedure performed was RFA in 47%, surgery in 28%, EVLA in 21%, chemical in 4%, and mechanicochemical in 1%. The majority of patients had 1 truncal vein ablated (65%), while 23% had 2, 10% had 3, and 1% had >= 4. Cluster veins were treated by stab phlebectomy (72%), Transilluminated Powered Phlebectomy (TIPP) (19%), or stipping and/or ligation (9%). Post-procedure, 49% of patients wore stockings while 50% used compressive bandages. No systemic complications were reported.

To date, 324 (39%) of treated patients have been seen in follow-up, at mean time of 31 days post-op. Mean number of lost work days was 3. At follow-up, 82% of patients were wearing stockings and only 2 had recanalyzed veins (0.3%). CEAP had improved compared to pre-treatment with C0-2 (36%), C3-4 (57%), and C5-6 (7%). Pre-treatment VCSS scores averaged 9.0, and decreased on average by 4.2 points ($p < .0001$). Regarding PROs, improvements were found in: Achiness ($p < .0001$); Swelling ($p < .0001$); Throbbing ($p < .0001$); Itching ($p < .0001$); Appearance ($p < .0001$); and Work Impact ($p < .0001$) . Few complications were reported: paresthesias (2.9%), pigmentation (2.3%), skin blistering (1.1%), thrombophlebitis (1.1%), DVT (0.6%), hematoma (0.6%), proximal thrombus extension (0.6%), and wound infection (0.6%).

CONCLUSIONS: The VQI VVR provides complete assessment of varicose vein interventions, and is useful for monitoring changes after treatment. Modern day varicose vein surgery is characterized by predominately endovenous treatment of axial vein reflux, phlebectomy of clusters, and dramatic improvements in both VCSS and PROs.

11:46 am – 12:04 pm

3-13 Impact of uk national institute of health and care excellent (nice) clinical guidelines (cg 168) on the referral and management of leg ulcers

A. H. Davies, M. Popplewell, L. Kelly, G. Bate, K. Darvall, A. Bradbury; Birmingham University Department of Vascular Surgery, Heart of England NHS Foundation Trust, UK.

OBJECTIVE: UK NICE Clinical Guidelines CG 168 published in July 2013 recommended that venous leg ulcers (defined as break in the skin below the knee that has not healed within 2 weeks) be referred for specialist vascular assessment.

Aim: To determine the impact of NICE CG 168 on referrals to our leg ulcer clinic.

METHOD: Comparison of prospectively gathered data on patients referred to clinic prior to (January 2011 to June 2012) and after (January 2014 to June 2015) NICE CG 168.

RESULTS: There was a 2-fold increase in referrals (181 patients, 220 legs vs. 385 patients, 453 legs) but no change in mean age (75, range 23-104, years), gender (45% men), duration of ulcer at referral (median 16, range 7-46 weeks), or at first clinic appointment (median 20, IQR 12-36 vs. median 23, IQR 12-52 weeks). Mean time from referral to clinic increased (4.8 vs. 6 weeks, p=0.0001), as did the proportion with superficial venous insufficiency (SVI) (35.5% vs. 43.7% legs, p=0.05). There was an increase in ulcers due solely to SVI that had been present for less than 6 months (15.0% vs. 23.0% legs, p = 0.02). There was no change in deep venous disease (8.2% vs. 8.8% legs) or pure arterial ulcers (9.5% vs. 11.7% legs) but there was a significant reduction in arterio-venous ulcers (5.9% vs. 1.3% legs, p = 0.0018) and also a significant reduction non-vascular ulceration (47.7% vs. 34.4% legs, p=0.0012). No patient underwent traditional venous surgery. There was a non-significant increase in ulcerated legs undergoing endovenous intervention (34.4% vs. 43.2% legs, p=0.271) but a significant increase in endothermal ablation (2 vs. 32 legs, p = 0.001) with no change in ultrasound-guided foam sclerotherapy (24 vs. 51 legs) or compression (62.8% vs. 63% legs). There was a significant reduction in those treated conservatively with simple dressings (26% vs. 15% legs, p = 0.0006).

CONCLUSION: Since publication of NICE CG 168 there has been a doubling of patients referred with leg ulceration. However, many are still not being referred until they have had an ulcer for many months. Although many ulcers are multi-factorial and the mainstay if treatment remains compression, there has been an increase in the use of endovenous intervention. Further efforts are required to persuade family doctors and community nurses to refer patients earlier for specialist vascular assessment as recommended by NICE CG 168

12:04 pm – 12:22 pm

3-14 A novel, simple and secure percutaneous occluder for the treatment of varicose veins

A. Miller, N. Lilach[1], R. Miller[2], L. Kabnick[3]; [1]Eliachar Technologies Development Ltd, [2]Amsel Medical Corporation, [3]NYU Langone Medical Center, New York, NY.

OBJECTIVE: Secure, permanent occlusion of the saphenous vein, its tributaries, and perforators, is critical for the successful treatment varicose veins. Current minimally invasive methods replacing surgery are all endoluminal, and involve heat (radio-frequency or laser) and/or chemicals (sclerosants and glues). The objective of this study was to evaluate in a porcine model, the performance of a percutaneous delivery of the Amsel™ Vessel Occluder (AVO) utilizing ultrasound guidance. The AVO has previously received FDA pre-market 510(k) clearance for use in open surgical procedures for tubular structures ranging in diameter from 2-7mm.

METHODS: The AVO, a novel mechanical occlusion clip similar to a transfixion suture, is delivered through an 18G hypodermic needle, which transfixes the targeted vessel. The AVO is subsequently expanded on either side of the vessel wall, collapsed and locked together to effect secure vascular occlusion. Under general anesthesia, the targeted vessels in five swine, weighing >60 kilograms, were identified and vessel size measured. Patency of the targeted vessels was confirmed on duplex ultrasound (DUS). Each animal provided multiple vessels for percutaneous AVO occlusion. Occlusion was confirmed by DUS and by direct examination of the occluded vessel after open surgical exploration.

RESULTS: 30 vessel occlusions were performed percutaneously including the common and superficial femoral arteries and veins (n=25), the carotid artery (n=3) and the external jugular veins (n=2). Measured vessel sizes ranged from 1.8-12.7mm. Following vessel transfixion, occlusion was achieved in less than 30 seconds. A second AVO, if necessary, was employed to completely occlude the targeted vessel where the vessel was larger than 7mm diameter (n=2; external jugular vein 12.7mm and carotid artery 7mm), or where the initial AVO did not occlude the vessel due to non-transfixion (n=1). Post-occlusion surgical exposure confirmed that all targeted vessels were successfully occluded and demonstrated no evidence of injury to any of the adjacent structures.

CONCLUSIONS: This study confirms that the AVO can be effectively delivered percutaneously in the porcine model to occlude blood vessels under ultrasound guidance. The AVO provides a mechanical means of permanent, secure vessel

occlusion, similar to a transfixion suture, thus eliminating the problem of recanalization which may occur following thermal or chemical vessel occlusion methods. This method of permanent, percutaneous occlusion may be a useful, time-saving and cost-effective adjunct to current primary methods of treating reflux in the saphenous veins, their tributaries or perforators, for the treatment of symptomatic varicose veins. In addition, in the event of other treatment method failures (thermal or chemical), the AVO provides a simple alternative.

12:22 pm – 12:40 pm

3-15 Sclerotherapy use for chronic venous insufficiency across the united states: a report from the venous patient outcome registry

U. Onyeachom[1], J. Isobe[2], R. Taylor[3], S. Dimitropoulos[4]; [1]Heart and Vascular Outcomes Research Institute, Beverly, MA; [2]Alabama Vascular and Vein Center, Birmingham, AL, [3]Bayside Vein and Laser Center, Bellingham, WA, [4]University Dermatology, Darien, IL.

OBJECTIVE: Sclerotherapy is a minimally invasive procedures for the treatment of symptomatic saphenous vein reflux have been rapidly adopted across clinical centers in the United States during the past decade. There is limited information however, on the proportionate use of sclerotherapy methods. We analyzed data from the Varicose Vein (VV) module of the Venous Patient Outcome Registry (VPOR) to identify the relative frequency of sclerotherapy techniques used for the treatment of symptomatic varicose veins

METHODS: We abstracted data from the VV module of the VPOR was reviewed on patients treated by 30 physicians from 19 sites in a web-based registry and database. The frequency of sclerotherapy either as a stand-alone procedure or in combination with other techniques was recorded. Isolated sclerotherapy was used in 824 limbs, surgery/sclerotherapy in 58 limbs, Laser/sclerotherapy/ in 580 Limbs and Radiofrequency/Sclerotherapy in 428 limbs

RESULTS: A total 2553 procedures were entered into the database between 2014-2015, on patients; of which a sclerosant was injected in 1,307. In sclerotherapy procedures, 92.4% of injections were ultrasound guided, and sodium tetradecyl sulphate (STS) was the sclerosant of choice. Most foam was created in a 1:3 or 1:4 ratio of sclerosant: gas predominantly (58.9%) using a CO2 or O2 variation for the gas. Almost two-thirds of sclerotherapy injections (64.9%) were performed with the patient's leg elevated. In 35% of treatments 16 ml was utilized in a single session

CONCLUSIONS: Sclerotherapy is performed in 46.5% of procedures for the treatment of symptomatic varicose veins either as a stand-alone technique, or in conjunction with other techniques such as radiofrequency or laser ablation and phlebectomy. The patients with treatment had lower VCSS score and better quality of life an indication that sclerotherapy is an effective treatment option.

12:40 pm – 12:45 pm

Q3-5 A novel view to the pathogenesis of varicose veins: what proteins are talking?

S. Urbonavicius[1], G. Urbonaviciener[2], J. Cicenas[3], A. Hoegh[4], J. Sandermann[4], M. Valius[5]; [1]Department of Vascular surgery, Viborg and Institute of Clinical medicine Aarhus, Denmark, [2]Lithuania Consultant Cardiologist, Center of Excellence, Silkeborg Hospital, Denmark, [3]Swiss Institute of Bioinformatics, Geneve, Switzerland, [4]Surgeon, Department of Vascular Surgery, Viborg Hospital, Senhed Midt, Denmark, [5]Head of Department, Proteomic Center Institute of Biochemistry, Vilnius University.

OBJECTIVE: The advent of proteomic techniques allows large-scale studies of gene expression at the protein level. Although morphological and anatomical studies indicate that venous wall weakening and subendothelial fibrosis characterize varicose veins, the pathogenesis of varicose veins remains poorly understood. The aim of this study is to obtain protein expression profiles in patients with varicose veins. The identification of possible biomarkers may open possibilities for pharmacological inhibition of the disease progression.

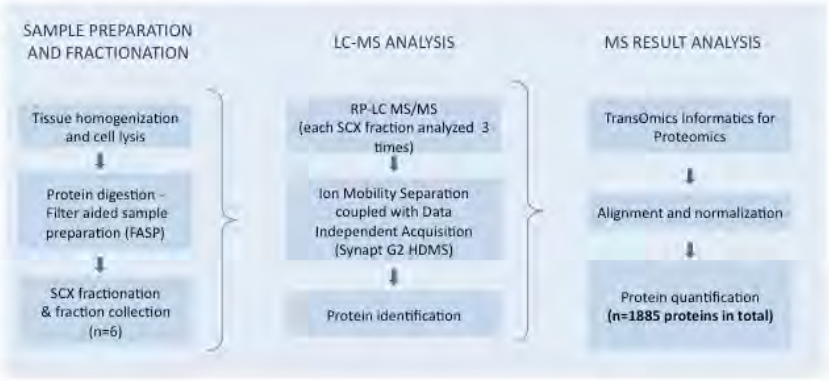
METHODS: Varicose saphenous veins removed during phlebectomy and normal saphenous veins obtained during vascular surgery were collected for proteomics analysis. The same layers of venous wall from varicose and non-varicose veins were lysed, and extracted proteins were analyzed by LC-MS/MS using Synapt G2 (Waters).

RESULTS: Proteomic analysis of the human veins resulted in 1885 proteins in total. Approximately 200 proteins demonstrated significant differences in their expression levels (more than 1.5 fold) between varicose and non-varicose venous tissue ($p < 0.05$) Among the most differentially expressed proteins, the expression of 10 was significantly decreased in the varicose vein tissue, and the expression of two proteins was increased. CXXC-type zinc finger protein was most prominent (38- fold down regulated). This protein is known as receptor for vascular endothelial growth factor. The functional annotations, involvement in signaling oathways, coexpression and physical interactions of differentially expressed proteins were analyzed using GeneMANIA and AmiGO tools as well as Gene Ontology and BioGrid databases.

CONCLUSIONS: This study provides novel insights in the biochemical mechanisms of varicose disease and provides a basis for further studies. Our proteomics findings suggest that extracellular matrix degradation play a pivotal role in the pathogenesis. The identified proteins show that the varicose venous wall responds to a stressful condition and that

proteolytic degradation of the cytoskeleton, inflammation and apoptosis of smooth muscle cells may be part of the response. However, more detailed studies are required to confirm the potential and clinical role of the identified proteins.

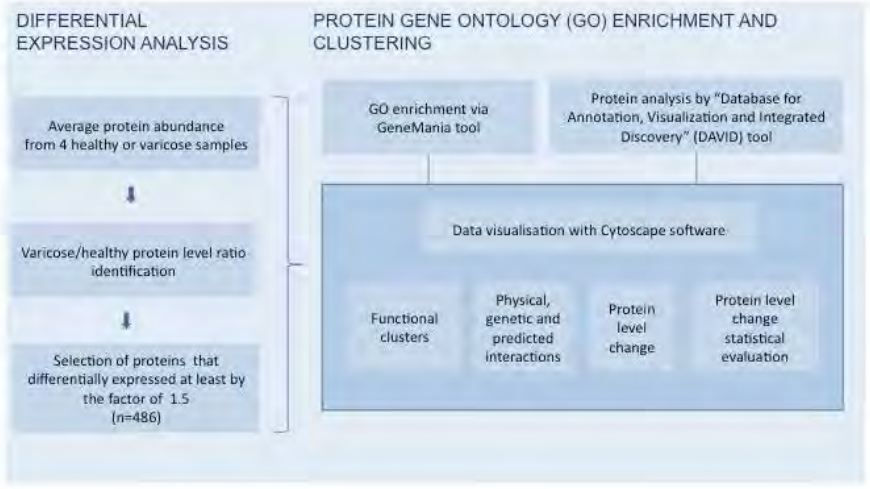
Protein identification workflow

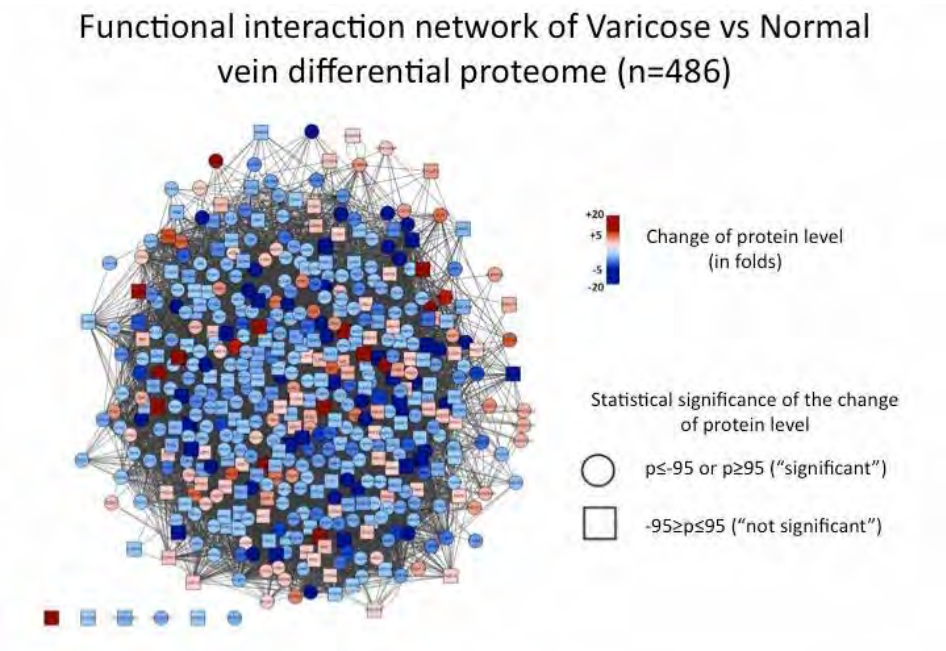


Sample analys:
10 patients (5 control healthy, 5 varicose)

Peptides from each sample were separated into 6 SCX fractions, each fraction was analysed three times by RP-LC directly coupled to Synapt G2 HDMS

Bioinformatic analysis workflow





Proteins				
Description	T-test (p)	Anova (p)	Max fold change	Protein regulation
Keratin, type I cytoskeletal 19	0,05	0,00	1,47	up
Membrane-associated progesterone receptor component 2	0,03	0,00	2,74	up
CXXC-type zinc finger protein	0,05	0,01	37,68	down
Nucleoporin SEH1	0,04	0,00	3,46	down
Olfactomedin-like protein 3	0,05	0,00	2,80	down
HLA class II histocompatibility antigen	0,03	0,00	2,26	down
Emerin	0,03	0,00	2,15	down
Beta-centractin	0,05	0,01	2,07	down
Transmembrane protein 43	0,04	0,00	1,84	down
Myelin regulatory factor	0,04	0,00	1,72	down
Erlin-1	0,02	0,00	1,63	down
Cell surface glycoprotein	0,04	0,00	1,60	down
Keratin, type I cytoskeletal 19	0,05	0,00	1,41	down

12:45 pm – 12:50 pm

Q3-6 Preoperative ultrasound analysis can predict endovenous heat-induced thrombosis in patients candidates for endovenous treatment of superficial vein insufficiency.

C. Lomazzi, V. Grassi, S. Segreti, D. Bissacco, M. Cova, S. Trimarchi; Policlinico San Donato, Milan, Italy.

OBJECTIVE: To identify by preoperative color duplex ultrasonography (CDUS) analysis what are risk factors predictive of postoperative endovenous heat-induced thrombosis (EHIT) in patients undergoing radiofrequency (RFA) or endovenous laser therapy (EVLT) of the great saphenous vein (GSV) and RFA of the small saphenous vein (SSV).

METHODS: Patients undergoing GSV RFA or EVLT were measured the diameter of saphenous-femoral junction (dSFJ), the distance between epigastric vein and SFJ (dEV-SFJ), the maximum GSV diameter (mdGSV) and the average GSV diameter (adGSV); patients undergoing RFA SSV were calculated the diameter of the saphenous-popliteal junction (dSPJ) and the SSV average diameter (adSSV). For categorical variables Chi-square test was used while Anova test was used for comparison of continuous variables. Receiver operator curve (ROC) was plotted for selected variables and Youden's index was calculated to determine significant cut-offs.

RESULTS: From December 2010 to February 2015, data of 363 procedures were collected. Among these, 293 (80.7%, group 1) underwent to GSV RFA, 35 (9.6%, group 2) to GSV EVLT and 35 (9.6%, group 3) to SSV RFA. There were 23 (6.34%)

cases of post-procedural EHIT: 16 (5.46%) in group 1, 1 (2.86%) in group 2 and 6 (17.14%) in group 3 (p = .018). Patients with EHIT compared with those without EHIT had, prior to the procedure, dSFJ (mm, 11.40 vs 8.72), mdGSV (mm, 12.56 vs 8.80), adGSV (mm, 10.70 vs 7.44) and dEV-SFJ (mm, 9.77 vs 3.6) significantly higher (p

CONCLUSIONS: Preoperative long distance between the SFJ and the EV, large average and maximum VGS diameter and large SFJ diameter are risk factor for postoperative EHIT in patients undergo GSV RFA or EVLT. In patients undergo SSV RFA the lack of collateral at SPJ could represents an increased risk of EHIT, although SPJ diameter and SSV average diameter are considerably increased in patients with EHIT. These findings are useful tools to identify preoperatively patients at increased risk and to intensify monitoring and prevention of postoperative complications.

12:50 pm

Open Afternoon

1:00 pm – 6:00 pm

Venous Open Golf Outing

Register to play in the Venous Open golf outing at the AVF registration desk. Spend the afternoon with colleagues, friends and golf professionals on the beautiful Disney's Lake Buena Vista Golf Course. Golfers of all levels are welcome.

Prizes will be awarded in several categories.
Golf Outing: Thursday, February 25, 2016, 1:15 pm - 6:30 pm
Dinner: Boxed Lunch
Tee Time: 1:00 pm set up; 1:30 pm tee time sharp (shotgun start, you will have your choice to play best ball or match play)
Post Golf Reception: Immediately following completion of play at the Buena Vista Palace Hotel in the Pavillion.

Support for the 2016 Venous Open provided by BTG International, Juzo, Merz Aesthetics, Monahan Vein Clinic, SIGVARIS, Tacktile Medical, and Vascular Insights.

6:15 am – 1:30 pm
Exhibit and Poster Hall Open — **Event Center**

7:00 am – 5:30 pm
Registration Open — **Great Hall Booth**

6:30 am – 7:30 am
Continental Breakfast — **Event Center**

11:10 am – 12:50 pm
SCIENTIFIC SESSION 4
Diagnostic Testing and Imaging — **Great Hall North/Center**
Moderators: Steven Elias, MD and Brajesh Lal, MD
Discussants: 4-16 Michael Dalsing, MD; 4-17 Jose Diaz, MD; 4-18 Haraldur Bjarnason, MD; 4-19 Armen Roubenian, MD

7:30 am – 7:48 am

4-16 Times taken for the maximum increase in oxygenated hemoglobin level in calf muscle as a predictor of post-thrombotic syndrome in patients with a first episode of deep vein thrombosis
T. Yamaki, H. Konoeda, A. Osada, Y. Hasegawa, H. Sakurai; Tokyo Women's Medical University.

OBJECTIVE: Early detection of deep vein thrombosis (DVT) is important for decreasing the risk of post-thrombotic syndrome (PTS). However, it is difficult to reliably predict which patients are likely to develop PTS in acute phase of DVT. Near-infrared spectroscopy (NIRS) provides continuous noninvasive monitoring of changes in tissue oxygenated hemoglobin (O_2Hb) and deoxygenated hemoglobin (HHb) levels, and can identify the severity of chronic venous diseases. Therefore, we investigate the indicative parameters reflecting the progression of PTS using NIRS in patients with a first episode of DVT.

METHODS: One-hundred and twenty-nine patients with a first episode of unilateral DVT were enrolled. The patient's risk factors were assessed at presentation. Venous abnormalities were evaluated at 6 months using duplex ultrasound. NIRS was used to measure changes in the levels of O_2Hb and HHb in calf muscle at 6 months after DVT (Fig.1). On standing, increases in O_2Hb and HHb were calculated by subtracting the baseline value from the maximum value (ΔO_2Hb_{st} and ΔHHb_{st}). The times taken for the O_2Hb and HHb concentrations to become maximal ($_TO2Hb_{st}$, and $_THHb_{st}$) were also measured. During 10 tiptoe movements, the relative change in O_2Hb was calculated by subtracting the value measured at the end of exercise from the value measured at the beginning of exercise (ΔO_2Hb_{ex}). On the other hand, 10 tiptoe movements produced venous expulsion ($\Delta HHbE_{ex}$) and a subsequent retention ($\Delta HHbR_{ex}$). The oxygenation index (HbD; $HbD=O_2Hb-HHb$) was also calculated at the end of standing and at the end of 10 tiptoe movements (ΔHbD_{st} and ΔHbD_{ex}). Final clinical manifestations were evaluated at 6 years after a diagnosis of DVT, and post-thrombotic syndrome (PTS) was considered to be present if the Villalta score was >5.

RESULTS: Thirteen patients were excluded from the study due to inadequate follow-up or inadequate data acquisition. Thus, 116 patients were finally included. Of these, 19 (16%) developed PTS. Among various duplex- and NIRS-derived parameters, $_TO2Hb_{st}$ (Fig.2) had the highest under area curve (0.88, 95% confidence interval (CI) 0.80-0.93, $p < 0.0001$) with the best cut-off value ($_TO2Hb_{st} \leq 48$). Using univariate analysis, variables associated with greater risk factors for development of PTS were ilio-femoral DVT at initial presentation (odds ratio (OR) 4.31 CI 1.48-12.60, p=0.005), venous occlusion combined with reflux (OR 4.24 CI 1.50-12.0, p=0.004) and NIRS-derived $_TO2Hb_{st} \leq 48$ at 6 months (OR 43.03 CI 9.04-204.82, $p < 0.001$). Multivariate logistic regression analysis finally revealed venous occlusion combined with reflux (OR 4.38 CI 0.92-20.86, p=0.039) and NIRS-derived $_TO2Hb_{st} \leq 48$ (OR 53.21 CI 9.36-302.44, $p < 0.001$) as independently associated with progression of PTS.

CONCLUSIONS: NIRS-derived $_TO2Hb_{st} \leq 48$ is a promising time-course predictor of PTS progression

Figure 1: NIRS examination

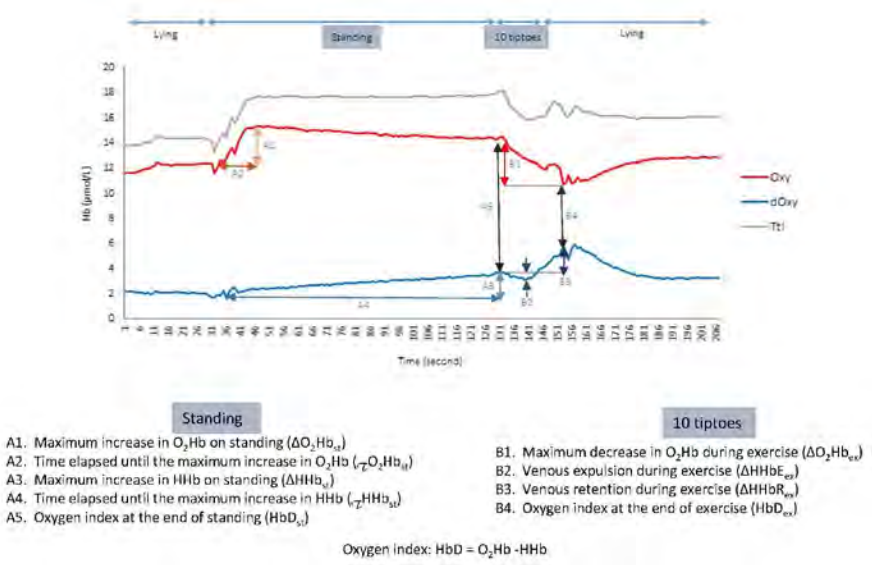
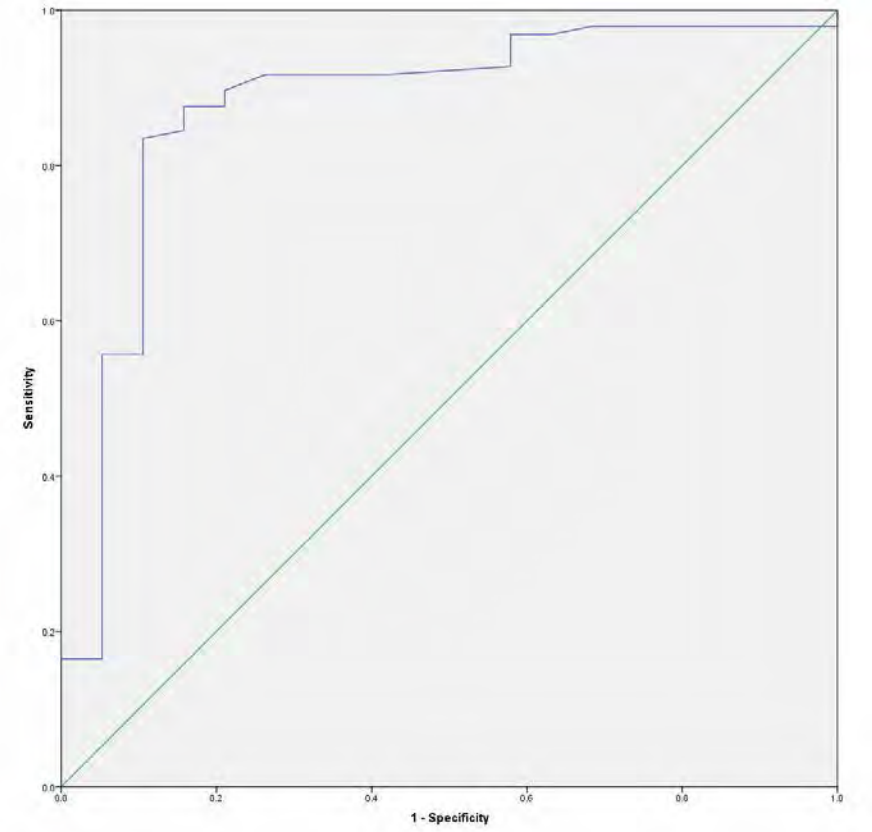


Figure 2: Ability of NIRS-derived TO2Hbst to predict PTS



7:48 am – 8:06 am

4-17 Efficacy of Computed Tomography Venography (CTV) screening compared to Duplex Ultrasound (DU), Multiplanar Venography (MV) and Intravascular Ultrasound (IVUS) in Iliac Vein Compression Syndrome (IVCS)

F. H. Rossi, A. Kambara, I. Pinto, P. Metzger, C. Betelli, B. Almeida, C. Rossi, N. Izukawa, A. Sousa, P. Thorpe; Dante Pazzanese Cardiovascular Institute.

OBJECTIVE: No prior study has prospectively evaluated the efficacy of CTV for identifying IVCS in Chronic Venous Disease (CVD). It has never been compared to DU, MV and IVUS before. The purpose of this study was to describe CTV findings and ability to detect and classify the degree of IVCS when compared to DU, MV and IVUS.

METHODS: Patients with advanced CVD (CEAP C3-6) and Visual Analogue Scale for pain (VASP) ≥ 3, plus failure to respond to standard medical treatment were included. Patients underwent DU, CTV, MV and IVUS (NCT02149212). The obstructions were classified the same way by the different methods: Group 1: 0-49% and Group 2: 50 -100%. CTV findings, Sensitivity, Specificity, Positive Predictive Value and Negative Predictive Value of DU, CTV and MV in identifying ≥ 50% iliac vein obstruction when compared to IVUS (gold standard) were defined (N=100 limbs).

RESULTS: From February 2013 to March 2104, 207 patients with CVD (CEAP C1-6) were evaluated, 58 (28%) were eligible and 8 excluded. Of the 50 studied patients (100 limbs), 70% had bilateral CEAP C3-6 (85 limbs), and 51 (60%) of these were found to have iliac venous obstruction ≥ 50% on IVUS. The point of maximum compression was: Proximal common left iliac vein – 70%; Distal left common iliac vein – 15%; Right proximal common iliac vein – 9%; Left external iliac vein – 4%; and distal portion of inferior vena cava – 2% of the cases. The screening power of CTV and the different studied methods are shown in the table below:

CONCLUSION: Highly symptomatic CVD patients have a significant prevalence of iliac venous outflow obstruction. The obstruction may occur in various pelvic vein segments. CTV demonstrates greater sensitivity although less specificity in screening venous compression compared to DU and MV.

Obstruction ≥ 50% on IVUS	Sensitivity %	Specificity %	PPV %	NPV %	Accuracy	Kappa
Doppler Ultrasound	78.0	91.7	90.0	80.0	84.7	0.695
Computed Tomography Venography*	94.0	79.2	82.5	92.7	86.7	0.734
Multiplanar Venography	76.0	95.7	95.0	78.9	84.7	0.713

*Interobserver agreement: 92.1% (95% CI: 87.1-97.7) (Kappa: 0.899)

8:06 am – 8:24 am

4-18 The utility of non contrast multisequence mri to identify venous thrombi suitable for lysis

P. Saha[2], A. Phinikaridou, M. Andia, B. Modarai, S. Black[1], A. Patel, R. Botnar, A. Smith; [1]St. Thomas' Hospital, London, UK, [2]King's College London, London, UK.

OBJECTIVE: Non-contrast MRI using magnetisation transfer rate (MTR), apparent diffusion coefficient (ADC) and T1 mapping can characterise the organisation of a resolving venous thrombus. We now investigate whether the combination of these non-contrast agent MRI sequences can be used to identify thrombi suitable for lysis in an experimental model. We further examine the translation of this technique to help guide interventional therapy in man.

METHODS: Magnetisation transfer, diffusion weighted images and T1 mapping were measured at days 2, 4, 7, 10, 14, 21 and 28 after venous thrombus induction in 8-10wk old male BALB/C mice (n=8/gp). Tissue plasminogen activator (10mg/kg) was administered through tail vein injection immediately after imaging at each time point and mice scanned 24hrs later to evaluate the effect of lysis. Murine imaging sequences were combined and optimised to image the pelvic veins in man using healthy volunteers in order to produce a clinically useable imaging card. MSTI sequences were validated using phantoms before application to 10 patients with ilio-femoral deep vein thrombosis (DVT) undergoing lysis and or venous stenting.

RESULTS: ROC curve analysis shows that the combination of MTR smaller than 2,900(%/cm^3), ADC larger than 0.93(x10^{-3} mm^2/s) and T1 shorter than 784ms has a sensitivity of 88% and specificity of 97% to identify experimental thrombi amenable to lysis. MSTI is feasible in man, with optimisation leading to successful characterisation of ilio-femoral DVT in under 25mins. In all patients, MSTI was able to accurately predict which segments of the deep venous system would respond to lysis compared with those that required venous stent placement ($P < 0.001$).

CONCLUSIONS: Non-contrast MR imaging, using a combination of MTR, ADC and T1 mapping, accurately identifies experimental venous thrombi susceptible to lysis. These MSTI sequences can also be readily translated to man where may find utility in stratifying patients suitable for venous thrombolysis and/or the need for a venous stent.

8:24 am – 8:42 am

4-19 Lack of symmetry in the major veins of the lower limbs

A. Chandrashekar, J. Garry, A. Duke, N. Labropoulos; Stony Brook University Hospital, Coram, NY.

OBJECTIVE: Contemporary texts frequently present the venous system of the lower limb as a prime example of bilateral symmetry. However, overt bilateral asymmetry may be noted. This study was designed to examine and quantify the level of symmetry in the lower extremity veins.

METHODS: This prospective cohort study evaluated major anatomic differences between right and left lower extremity veins in adult patients. Two hundred patients presenting with signs and symptoms of Cardiovascular Disease (CVD class 2-6) and venous reflux on duplex ultrasound were examined. A second group of 25 healthy volunteers without reflux or obstruction were used as controls. Those with conditions that could potentially alter vasculature including vascular malformation, lower extremity trauma, and previously documented surgery for venous disease or bypass operations were excluded. Only overt changes in the main superficial (great saphenous vein: GSV and small saphenous vein: SSV) and deep veins (common femoral, femoral, popliteal, peroneal and tibial veins) of the lower extremities were examined for symmetry. The level of SSV termination and thigh extension veins were also included. Location and extent of hypoplasia/aplasia and venous duplication or triplication were noted for all venous segments. The deep femoral vein, all muscular veins, small differences in diameter, and focal dilatations of the axial veins were excluded from analysis.

RESULTS: Of the 100 patients (200 limbs) with CVD 2-3 (age: 49 years, range 21-78), the extent of asymmetry in the superficial system, deep system and combined was 84%, 86%, and 100% respectively. Comparing diseased limb segments (n=44 limbs) with patient-specific contralateral healthy segments presented asymmetry in the superficial system (87%), deep system (85%) and combined (100%). Similarly, of the 100 patients (200 limbs) with CVD 4-6 (age: 56 years, range 28-84), the level of asymmetry in the superficial system, deep system and combined was 83%, 84%, and 100% respectively. Within this cohort, comparing diseased limb segments (n=31 limbs) with patient-specific contralateral healthy segments presented similar levels of left-right asymmetry (superficial: 83%, deep: 84%, both; 100%). Twenty-five (50 limbs) healthy volunteers (age: 46 years, range 18-72) also presented similarly elevated levels of asymmetry compared to both cohorts of differing CVD class severity (superficial: 78%, deep: 84%, both: 100%). The most common reason for asymmetry in the GSV was hypoplasia/aplasia while duplication was rare. In the SSV, the level of termination, thigh extension, and hypoplasia were the more frequent reasons. In the deep veins, duplication of the femoral and popliteal veins at different locations and extents were the most common findings for asymmetry. These findings remained consistent for all patient subgroups and healthy controls.

CONCLUSIONS: Despite the perceived resemblance of symmetry between the right and left lower extremities, there are significant overt differences between lower limb veins. A nearly complete lack of symmetry is consistently seen in CVD patients and healthy subjects. Asymmetry in the veins of the lower extremities appears to be the norm. This is true despite examining only overt changes and excluding multiple veins from the comparison.

8:42 am – 8:47 am

Q4-7 Unusual presentation of nutcracker syndrome in patient with prior gonadal vein embolization for pelvic congestion syndrome

T. L. Weis Sadoski, A. Bunnell; J. Robison; J. Adams; Medical University of South Carolina.

OBJECTIVE: Pelvic Congestion Syndrome may present as chronic pelvic pain, dyspareunia, and/or pelvic varicosities. Initial steps in diagnosis typically include gynecologic evaluation and advanced imaging to exclude pelvic tumors, and treatment often involves venography with gonadal vein embolization. However, intervention without comprehensive assessment of the patient's venous outflow may fail to identify Nutcracker Syndrome. We describe the unusual presentation of a patient who had undergone previous left gonadal vein embolization for vulvar swelling and ulceration and our use of intravascular ultrasound (IVUS) as an adjunct to diagnosis.

METHODS: A 45 year-old female with a history of Crohn's disease presented to our institution following referral from an outside interventionalist. The patient had undergone pelvic magnetic resonance imaging (MRI), which demonstrated numerous left-side dominant pelvic varicosities, and ultimately led to placement of thirty-three coils in her left gonadal vein. Her symptoms, periodic labial swelling and clitoral ulceration, resolved for nine months following intervention yet ultimately recurred, prompting referral to a vascular specialist. Computed tomography (CT) revealed left renal vein compression and the patient underwent venography with IVUS for diagnosis and intervention.

RESULTS: Venography of the left renal vein demonstrated reflux into multiple collateral vessels, despite obliteration of the gonadal vein by previously deployed coils. IVUS illustrated renal vein collapse as it coursed between the aorta and superior mesenteric artery (SMA), corroborating the diagnosis of Nutcracker Syndrome. A self-expanding, nitinol stent was placed with extension into the inferior vena cava and completion venography confirmed brisk venous return without evidence of collateral filling. During follow-up at one and four months, the patient reported 80% improvement in her symptomatology.

CONCLUSIONS: Nutcracker Syndrome is the rare compression of the left renal vein between the SMA and aorta and can present with flank pain, hematuria, and/or Pelvic Congestion Syndrome. Complete evaluation of a patient's venous outflow is necessary and may spare patients from premature procedures. Intravascular ultrasound is a useful adjunct for diagnosing venous outflow obstruction and may serve to limit contrast and radiation delivery in this younger subset of patients.

8:00 am – 11:00 am

Guest Hospitality Breakfast — 20Seven

9:00 am – 9:40 am

Top Abstract Session — Great Hall North/Center

9:00 am – 9:10 am

American College of Phlebology Top Abstract

Use of cyanoacrylate adhesive for treatment of incompetent Great saphenous veins: 12month results

N. Morrison; Morrison Vein Institute, Scottsdale, AZ.

OBJECTIVE: The VeClose trial sought to demonstrate noninferiority of a novel treatment modality using cyanoacrylate embolization (CAE) agent compared with radiofrequency ablation (RFA) for the treatment of refluxing great saphenous veins (GSV).

METHOD: 222 patients with symptomatic GSVs were randomly assigned to treatment with either the VenaSeal™ closure system (CAE; n=108) or ClosureFast™ ablation catheter (RFA; n=114). The primary endpoint of the study was complete closure of the target GSV at 3 months as assessed by duplex ultrasound and adjudicated by an independent core laboratory. Secondary endpoints included periprocedural pain, ecchymosis at 3 days, and adverse event rate. Followup assessments occurred at 3 days, 1, 3, 6 and 12 months post treatment. No adjunctive therapy was allowed for 3 months.

RESULTS: Complete vein closure at 3 months was 95.4% RFA and 98.9% CAE (p<.0001; noninferiority); at 6 months was 94.3% RFA and 98.9% CAE (p<.0001) and at 12 months 96.8% RFA and 96.8% CAE. Periprocedural pain was similar between the groups. Significantly less ecchymosis was observed in the CAE group than RFA (p=.0013) at day 3. Serious adverse events were observed in 2.8% CAE versus 3.5% RFA treated subjects none of which were deemed related to the index device or procedure.

CONCLUSIONS: Noninferiority of closure rates for CAE compared to RFA at 12 months was demonstrated. Twelve month results of the VeClose trial demonstrate safety and effectiveness for treatment of incompetent saphenous veins with CAE.

9:10 am – 9:20 am

European Venous Forum Top Abstract

Clinical and technical five year outcomes of a randomised clinical trial comparing evla vs surgery for varicose veins.

J. El-Sheikha, S. Nandhra, D. Carradice, T. Wallace, N. Samuel, I. Chetter; Hull York Medical School / Hull University, Hull Royal Infirmary, UK.

OBJECTIVE: Little is currently known about the long term consequences of superficial venous insufficiency (SVI) treatment using Endovenous Laser Ablation (EVLA) or conventional surgery. The aim of this study was to investigate the clinical and technical outcomes of a large randomised trial comparing these two methods

METHODS: Some 280 patients with primary, symptomatic, unilateral superficial venous insufficiency, due to isolated saphenofemoral junction incompetence, and great saphenous vein reflux were randomised equally to receive EVLA or surgery. Outcomes included clinical recurrence, duplex ultrasound recurrence and Quality of Life (AVVQ). Assessments were at 1, 6, 12, 52, 104 and 260 weeks.

RESULTS: Of 218 (79%) patients followed up at five years, 152 (69.7%) patients were free of any clinical recurrence at five years. The five-year recurrence rate was higher after surgery (Surgery 37.3% vs EVLA 23.1% P=0.027), with a relative risk of 0.620 (95% confidence interval 0.408-0.946 P=0.264). The underlying cause of recurrence on duplex ultrasound was different between the groups with neovascularisation in the groin detected more frequently after surgery (Surgery 42%

vs EVLA 0% P<0.001) and recurrent SFJ incompetence detected more after EVLA (Surgery 3% vs EVLA 44% P<0.001). Disease progression in the upper thigh was high in both groups, with incompetent groin tributaries seen in about half of the clinical recurrences (Surgery 49% vs EVLA 52% P=1.000) and the Anterior Accessory Saphenous Vein (AASV) involved in a third of cases (Surgery 20% vs EVLA 40% P=0.091). Disease progression distal to the knee was also significantly associated with clinical recurrence (Surgery 59% vs EVLA 48% P=0.452) although this was often related to recurrent upper thigh disease. The estimated number of patients needed to treat with EVLA to avoid one recurrence at five years was 8 (95% CI 3.8-47.9). In addition, clinical recurrence was associated with a significantly worse patient Quality of Life (AVVQ: Recurrence 7.858 (3.106 -13.970) vs No recurrence 4.000 (0.172-8.874) P=0.001).

CONCLUSIONS: In avoiding the long term complications of recurrent venous disease this study supports the recent NICE guidance placing EVLA above conventional surgery.

9:20 am – 9:30 am

European Venous Forum Top Abstract

Increasing thigh compression pressure correlates with a reduction in the venous drainage index of air-plethysmography

C. R. Lattimer, s. Doucet, E. Kalodiki, M. Azzam, V. Ibegbuna, G. Geroulakos; Ealing Hospital & Imperial College, London, UK.

OBJECTIVE: Venous drainage from the leg is poorly understood and measuring it is difficult to implement in haemodynamic terms. Attempts have been made using duplex scanning and venous occlusion air-plethysmography (APG). However, they have limited value in day-to-day clinical practice. This is because venous drainage measurements have never been validated successfully against increasing obstruction pressures. The hypothesis is that the novel venous drainage index (VDI) in mL/s reduces in response to increasing venous obstruction, and the aim was to measure this, using step-wise inflations of a thigh-cuff.

METHODS: Venous drainage tracings were obtained with APG using a dependency to elevation manoeuvre on the right legs of 21 volunteers (9 female) without venous disease. The test was performed once without a thigh-cuff, and then with the contoured thigh-cuff (18 cm wide) inflated in steps at 20, 30, 40 & 50 mmHg just prior to elevation. The drainage volumes were obtained once the tracing from the elevated cuffed leg decreased to a steady baseline when arterial inflow = venous outflow. The VDI was calculated in the same way the venous filling index (VFI) is obtained from the venous filling tracing (elevation to dependency manoeuvre). Namely VDI = 90% venous drainage volume (90VDV)/venous drainage time to 90% (VDT90). The drainage reserve volume (DRV) represents the undrained volume at each inflation pressure. Significant change in the VDI and DRV from the previous inflation step was assessed using the Wilcoxon test.

RESULTS: The median (inter-quartile range) age, height, weight, mid-thigh circumference and VFI were 30(22-47) years, 173(168-182) cm, 75(64-87) kg, 51(48.3-55.8) cm and 1.4(0.9-2.1) mL/s, respectively. The VDI and DRV correlated significantly (P <.0005) with increasing obstruction pressure at r =-.69 and r =.793, respectively (Spearman). Results displayed in Table 1.

CONCLUSIONS: The VDI and DRV are novel APG parameters derived from a dependency to elevation manoeuvre. They are responsive to and correlate with increasing venous obstruction pressures. They may have clinical value in assessing the haemodynamic significance of an iliac/femoral stenosis thereby reducing the number of invasive investigations in the screening and selection of patients requiring iliac stenting and follow-up.

Table 1.

Pressure (mmHg)	Median VDI (mL/s)	P value (Wilcoxon)	Median DRV (mL)	P value (Wilcoxon)
0	26.1 (17.8-44.8)	--	0	--
20	24.1 (16.9-31.1)	.027	5.3 (-4.6-11.3)	.305
30	12.1 (8.4-19.6)	<.0005	15.4 (9.3-38)	<.0005
40	7.8 (3.5-13.5)	.004	45.5 (23.2-66)	<.0005
50	5.4 (3.4-11.4)	.131	62.6 (42.7-81.6)	<.0005

9:30 am – 9:40 am

United Kingdom Venous Forum Top Abstract
Analysis of the biological effect of the 1920nm laser on the great saphenous vein wall, using immunohistochemical analysis of the expression of VCAM-1 and p-P53, when treated with various LEED's.
H. Ashpitel, M. S. Whiteley; University of Surrey, Guildford, UK.

OBJECTIVE: Endovenous Laser Ablation (EVLA) with the 1920nm claims to be able to ablate the great saphenous vein (GSV) with Endovenous Energy Density (LEED) as low as 20J/cm. We have previously shown that this cannot be due to a physical effect of the laser. The aim of this study is to examine the biological effects this treatment.

METHODS: Four sections of ex-vivo extra-fascial GSV were treated with 1920nm laser using LEED of 20, 40, 60 and 80J/cm. One further section was untreated as a control. Veins were mounted in OCT and sections taken onto slides. These were double stained - 1st primary antibody was VCAM-1 αGoat 1:100, 2nd primary antibody being, p-p53 αMouse 1:100. Immunofluorescence was measured using a fluorescence microscope and quantified.

RESULTS: There was no significant difference in the levels of VCAM-1 and p-p53 between control and 20 and 40J/cm. Levels of VCAM-1 and p-p53 were significantly increased at 60J/cm and even more in the 80J/cm sample. Expression of VCAM-1 and p-p53 was also seen to be more concentrated on the endothelium of the GSV.

CONCLUSIONS: We found no evidence of damage at 20 and 40J/cm but significant damage at 60 and 80J/cm, by increased expression of VCAM-1 and p-p53. We also found deeper penetration of the apoptosis related p-p53 gene. We could find no evidence to support the claims that EVLA with 1920nm could ablated veins with low LEED in the region of 20J/cm.

9:40 am – 10:00 am
Coffee Break — Event Center

10:00 am – 12:00 pm
Presidents Session — Great Hall North/Center

2015 Servier Travelling Fellowship Reports
Nathan Liang, MD and Georgios Spentzouris, MD

2014 BSN Jobst Research Grant - Final Report
Harry Ma, MD

2015 BSN Jobst Research Grant - Interim Report
Andrew Kimball, MD

AVFF Update
Fedor Lurie, MD, PhD

VQI Update
Jose Almeida, MD

JVS: Venous and Lymphatic Disorders Status Report
Lois Killewich, MD

Handbook of Venous Disorders: Guidelines of the American Venous Forum
Peter Gloviczki, MD

The Atlas of Intravascular Ultrasound
Carlos Donayre, MD

History of the AVF
J. Leonel Villavicencio, MD

Layman's Handbook of Venous Disease
John Blebea, MD, MBA

Vein Specialist
Steven Elias, MD

Presidential Address Introduction
Lowell Kabnick, MD

Presidential Address
John Blebea, MD, MBA

12:10 pm – 1:10 pm
Member's Business Luncheon — **Pavillion**

1:20 pm – 2:50 pm
SPECIALTY SYMPOSIA

(D) International — **Great Hall North/Center**

Organized by the AVF International Committee, International Union of Phlebology, and the Polish Society of Phlebology
Chairs: Patrick Muck, MD and Enrico Ascher, MD

Introduction
Patrick Muck, MD

Varicose Veins Treatment's Evolutions: Are We at the End of the History for the Surgery?
Paul Pittaluga, MD

Percutaneous Endoablation of Perforator Veins with Radiofrequency
Alvaro Orrego, MD

Evaluation of Chronic Venous Diseases Using Near-Infrared Spectroscopy
Takashi Yamaki, MD

Tumescence Assisted Sclerotherapy: A Valuable and Economically Effective Method of Large Vessel Sclerotherapy
Aleksandra Jaworucka, MD

IUP Consensus Report on Venous Hemodynamics
Byung-Boong Lee, MD

Catheter Directed Sclerotherapy – An Assessment of the Clinical Efficacy of the Novel Minimally Invasive Mechano-Chemical Method of the Saphenous Vein Ablation
Marek Iłżecki, MD

Panel Discussion

(E) Tell Me Why I'm Wrong: Superficial Disease Dilemmas — **Great Hall East**

Chair: Steven Elias, MD

What this World Needs is More Saphenous Stripping
Mark Meissner, MD

For Advanced Disease, Treating the Superficial System is Worthless
Seshari Raju, MD

Don't Even Talk to Me About Closure Rates
Peter Pappas, MD

In 2016 the Use of Thermal Tumescent Techniques is Patient Cruelty
Steven Elias, MD

Good News: The Treatment of Superficial Disease is So Easy, Everyone Should Do It
Thomas O'Donnell, MD

Technology Specific Codes: They've Got Us Convinced
Jose Almeida, MD

(F) Latest in Novel Anticoagulants / Setting up Practice in Venous Disease — **Great Hall West**

Organized by the American College of Phlebology
Chair: Mark Forrestal, MD

Regulations and Issues Surrounding Superficial Venous Practice Set Up
Julianne Stoughton MD

Practical, Regulatory, and Accreditation Issues in Vein Centers Providing Deep Vein Procedures
Stephen F. Daugherty, MD, FACS, FACPh

How to Incorporate a Vascular Lab into your Venous Practice
Diana L. Neuhardt RVT RPhS FSVU

The Economics of Direct Oral Anticoagulants
Lisa Amatangelo, MD

VTE Treatment Paradigms from Past to Present
Saundra Spruiell MD

Update on Reversal Agents for TSOACs
Marlin W. Schul, MD

3:00 pm – 4:20 pm

SCIENTIFIC SESSION 5 — Great Hall North/Center

Lymphedema, Compression/Wound Care, Anti-Coagulation

Moderators: Ruth Bush, MD and Angela Kokkosis, MD

Discussants: 5-20 Lori Pounds, MD

3:00 pm – 3:18 pm

5-20 Compression stockings during pregnancy: essential or superfluous? A pilot study

J. Heller, J. Canner, Y. Wei Lum, K. Tsuchiya; Johns Hopkins Medical Institutions, Lutherville, MD.

OBJECTIVE: Parity, particularly multiparity, is an established risk factor for development of venous insufficiency. Conservative management of lower extremity venous disease in the pregnant population consists of varied regimens as there is no established standard of care. The objective of this study was to evaluate the influence of compression stocking use in pregnancy.

METHODS: A randomized controlled clinical study was designed and IRB approved. Patients were randomized to the treatment group (20-30mmHg maternity pantyhose) or the control group (no stockings). Each patient was evaluated at 3 visits: #1: 8-20 weeks, #2: 32 weeks +/- 4 weeks, and #3: 8 weeks postpartum +/- 2 weeks. At each visit, the following data was accrued: CEAP, distal calf circumference, and bilateral lower extremity photographs. Additionally, the VCSS, SF-36, compression stocking use form, and VEINES questionnaires were completed. At visits #1 and #3, a bilateral venous reflux exam was performed.

RESULTS: A total of 44 patients enrolled and completed the study: 21 in the Treatment (compression stocking group) and 23 in the Control (no compression stocking group). Patients were entered in a consecutive randomized fashion. Patients aged 30-40 showed a very large and significant benefit to compression stocking use. Due to the small pilot sample size, ethnicities were limited to Caucasian and African Americans. Caucasians demonstrated a significant treatment benefit and African Americans showed a similar benefit but was not statistically significant. There was a direct correlation between improved VCSS and stocking compliance. BMI did not affect outcome.The subgroup analyses for VCSS showed a fairly consistent trend amongst all subgroups: small non-significant improvements were realized with treatment.Women aged 30-34 and Caucasians had significant improvements in venous edema with treatment. All other subgroups showed small non-significant improvements. In most cases (both parity groups, low and high BMI, low and high age, and race) demonstrated improvements in the SF-36 pain component, but were not statistically significant. There was no incidence of thrombophlebitis or DVT demonstrated on any of the duplex exams. Although superficial axial veins developed reflux as pregnancy progressed, the incidence of these findings was similar among both the Control and Treatment groups.

CONCLUSIONS: Compression stockings appear to improve lower extremity symptoms associated with venous insufficiency during pregnancy. In this study, pregnant patients reported a superior quality of life with their use. However, further study is required to determine if compression stockings impact the natural history of venous insufficiency in pregnancy, associated morbidity, and incidence of thromboembolic events.This pilot study underscores the scarcity of data currently available

3:18 pm – 3:36 pm

5-21 Practice patterns of adjunctive therapy for venous leg ulcers

F. Aziz[1], J. Raffetto[2], J. Diaz[3], D. Myers, Jr[3], K. Ozsvath[4], B. K. Lal[5]; [1]Pennsylvania State University, Penn State Hershey Heart & Vascular Institute, [2]VA Boston Healthcare System,[3]University of Michigan, Ann Arbor, MI, [4]The Vascular Group, Albany, NY, [5]University of Maryland Medical Center, Baltimore, MD.

OBJECTIVE: Venous Leg Ulcers (VLU) are the most severe clinical sequelae of venous reflux and post thrombotic syndrome. There is a consensus that ablation of refluxing vein segments and treatment of significant venous obstruction can heal VLUs. However, there is wide disparity in the use and choice of adjunctive therapies for VLUs. The purpose of this study was to assess these practice patterns among members of the American Venous Forum (AVF).

METHODS: The AVF Research Committee conducted an online survey of its own members, which consisted of 16 questions designed to determine the specialty of physicians, location of treatment, treatment practices and reimbursement for treatment of VLUs.

RESULTS: The survey was distributed to 667 practitioners and a response rate of 18.6% was achieved. A majority of respondents (49.5%) were vascular specialists and the remaining were podiatrists, dermatologists, primary care doctors and others. 85.5% were from within the US, while physicians from 14 other countries also responded. Most of the physicians (45%) provided adjunctive therapy at a private office setting and 58% treated less than 5 VLU patients per week (Figure 1). Multilayer compression therapy was the most common form of adjunctive therapy used (58.8%, Figure 2) and over 90% of physicians started additional modalities (biologics, negative pressure, hyperbaric oxygen and others) when VLUs failed compression therapy, with a majority (65%) waiting less than three months to start them (Figure 3). A majority (76.6%) continued adjunctive therapies until the VLU was completely healed. Medicare was the most common source of reimbursement (52.4%).

CONCLUSIONS: Physicians from multiple specialties treat VLU. While most physicians use compression therapy, there is wide variation in the selection and point of initiation for additional therapies once compression fails. There is a need for high quality data to help establish guidelines for adjunctive treatment of VLUs and to disseminate them to physicians across multiple specialties to ensure standardized high-quality treatment of patients with VLUs.

Figure 1

Figure 2

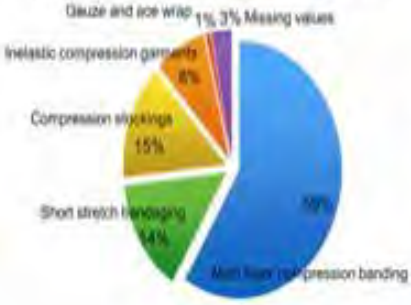


Figure 3

3:36 pm – 3:54 pm

5-22 Thrombus resolution as guide to anticoagulation therapy for provoked deep vein thrombosis – trudvt pilot study

C. I. Ochoa Chaar, K. Brownson, S. Satoskar, J. Reynolds, B. Sumpio, T. Sarac, L. Scoutt, A. Lee; Yale School of Medicine.

OBJECTIVE: Thrombus resolution on ultrasound (US) after deep vein thrombosis (DVT) is widely reported in the literature. However, the significance of thrombus resolution has not been studied. This is a prospective pilot study assessing the feasibility of using thrombus resolution on ultrasound as an endpoint for anticoagulation in patients with provoked DVT.

METHODS: All consecutive adult patients (>18 years) with newly diagnosed lower extremity DVT at a tertiary care center were screened between January 2013 and August 2014. Patients who developed a provoked DVT after a transient precipitating factor such as surgery, trauma, long travel, short term immobilization (< 14 days) were included. Patients with associated pulmonary embolus (PE), pregnancy, cancer, hypercoagulable disorder, prior venous thromboembolism (VTE), and prolonged immobilization (> 14 days) were excluded. The patients who consented to enroll presented for follow up after one month of anticoagulation. Patients underwent clinical assessment with Villalta scoring, as well as repeat US and D-Dimer. Anticoagulation was stopped on patients who had complete resolution of thrombus on US at one months and was continued to 3 months on patients with persistent thrombus. Patients were followed at 2 and 3 months and one year after initial diagnosis. This paper compares outcomes between proximal (PDVT) and distal DVTs (DDVT) at 3 months with respect to thrombus resolution and recurrence of VTE.

RESULTS: There were 879 patients with newly diagnosed DVT and 92 were eligible. Only 28 patients enrolled in the study. There were 14 (50%) DDVT. Patients with DDVT were significantly younger than PDVT (51.4 ± 11.2 vs 62.44 ± 14, p=0.0305) but there was no difference in gender (p=0.1266), or laterality (p=0.7064). There were no differences in risk factors or Caprini score between the 2 groups and surgery (79%) was the most common risk factor. There was no difference in the type of anticoagulation between the 2 groups. (Table) At 1 month, DDVT had significantly higher rate of complete resolution than PDVT (78.57% vs 21.43%, p=0.0043) and there was a trend for lower D-Dimer (1.05 ± 1.53 vs 2.44 ± 2.44, p=0.1134). At 3 months, all DDVT were completely resolved while only 42.86% of PDVT had completely

resolved (p=0.0019). There were no significant differences in Villalta scores at 1 and 3 months between the 2 groups. One patient in the PDVT had asymptomatic recurrent thrombus on US at 2 months and was restarted on anticoagulation. The rate of recurrent VTE was not significantly different between the 2 groups at 3 months (7.14% vs 0, p =1). There were no other recurrent VTE in either group with mean follow up of 7.24 ± 5.77 months.

CONCLUSIONS: Thrombus resolution occurs at high frequency after one month of anticoagulation in provoked DDVT with transient risk factors. Anticoagulation for one month seems to be a reasonable alternative to anticoagulation for 3 months in provoked DDVT. A prospective randomized trial in this study population is

Table: Characteristics of patients with provoked PDVT and DDVT

Characteristics	PDVT n (%)	DDVT n (%)	P Value
Age (years)	62.44 ± 14.01	51.45 ± 11.23	0.0305
Female Gender	8 (57.14)	4 (28.57)	0.1266
Laterality			
Right	6 (42.86)	8 (57.14)	0.7064
Left	7 (50.0)	6 (42.86)	
Bilateral	1 (7.14)	0 (--)	
Risk Factor			
Recent Surgery	12 (85.71)	10 (74.43)	0.6483
Recent Trauma	2 (14.29)	2 (14.29)	1
Short term immobilization	0 (--)	2 (14.29)	0.4815
Recent Long Travel	3 (21.43)	1 (7.14)	0.5956
Caprini Score	5.57 ± 2.59	5.14 ± 2.76	0.676
Anticoagulation Agent			
Coumadin	8 (57.14)	8 (57.14)	0.5988
Rivaroxaban	5 (35.71)	4 (28.57)	
Apixaban	1 (7.14)	0 (--)	
Enoxaparin	0 (--)	2 (14.29)	
Baseline Villalta Score	11.92 ± 6.73	9.14 ± 5.23	0.2324
Follow up at 1month			
Villalta Score	4.57 ± 2.68	2.85 ± 2.31	0.0818
D-Dimer Level	2.44 ± 2.44	1.05 ± 1.53	0.1134
DVT Completely Resolved	3 (21.43)	11 (78.57)	0.0043
Follow up at 3 months			
Villalta Score	3.07 ± 2.05	1.92 ± 2.40	0.1877
D-Dimer Level	1.65 ± 1.65	1.38 ± 2.30	0.7702
DVT Completely Resolved	6 (42.86)	14 (100)	0.0019
Recurrence of VTE	1 (7.14)	0 (--)	1

3:54 pm – 4:12 pm

5-23 The functional examination of lymphedema. – Advantage and limitation of spect/ct lymphoscintigraphy and near-infrared fluorescence lymphography

S. Matsubara, J. Maegawa, T. Mikami, Y. Yabuki; Department of PRS, Yokohama City University.

OBJECTIVE: The evaluation of the lymphatic function and existence of the lymphatic vessels in lower limb lymphedema patient is important. We investigate them usually by the lymphoscintigraphy (LS) and near-infrared fluorescence lymphography (NIF). However, the detected lymph vessels ware different according to the point, that tracers or indocyanine green were injected. This is a preliminary study to understand the dynamics of lymphatic flow, using SPECT/CT lymphoscintigraphy (SPECT) and NIF.

METHODS: From 2013 to 2014, 248 patients who were examined their lymphedema of the lower extremities by SPECT and/or NIF, were evaluated in outpatient or in operation room. In two-dimensional images of LS, we define co-lateral lymphatic flow as unusual linear uptake of isotope on the out of medial side of the lower extremities. In SPECT, the uptake of isotope was colored by gradation and fused with CT images. We define deep lymphatic flow as uptake of isotope under the fascia in axial images. The percentage of co-lateral lymphatic flow and deep one were investigated. In NIF, the dye was injected each interdigital space and checked by PDE camera. The linear pattern and dermal back flow (DBF) were detected real time fashion. In some cases, their clinical findings were different from SPECT images, the dye was injected in paramalleolar area.

RESULTS: There is co-lateral lymphatic flow in 66% patients on the lateral superficial area or deep area. 71% of limbs, in which there is no symptom of lymphedema, have co-lateral lymphatic flow. In axial images of SPECT, 80% limbs have the deep lymphatic flow. There are 9% limbs without superficial lymphatic flow and 20% limbs without deep one. In NIF, the linear pattern and DBF was easily detected below knee. However in the low lymphatic function of dorsum, the linear pattern was checked under injection into paramalleolar area.

CONCLUSIONS: Our LS and SPECT are useful to detect the functional lymphatic vessels. NIF is also useful to repeat exam for search them. To understand their correct location makes it possible to improve both the conservative and surgical treatment of the lymphedema.

4:12pm – 4:17 pm

Q5-8 Resourcing of heparin and low molecular weight heparins from bovine, ovine, and porcine origin. Studies to demonstrate the biosimilarities.

E. Kalodiki, D. Hoppensteadt, P. Maia, A. Silva de Castro, E. Kumar, N. Guler, W. Jeske, D. Kahn, J. Walenga, E. Coyne, J. Fareed; Loyola University Medical Centre, Chicago, IL.

OBJECTIVE: The currently used unfractionated heparin (UFH) and low molecular weight heparins (LMWH) are mostly derived from porcine mucosal tissue, but a shortage of their supply is anticipated. Resourcing of heparins utilizing bovine (cow) and ovine (sheep) tissues is discussed at regulatory and pharmaceutical levels. The aim of the study is to compare 5 individual batches of UFH obtained from porcine, bovine, and origin and their depolymerized products, enoxaparins.

METHODS: The molecular profile of the heparins and enoxaparins from various sources were determined using the size exclusion method. A narrow range calibration method was used for comparing the molecular weight of heparin, whereas the EP method was used to cross-reference the molecular weight of enoxaparins. Activated partial thromboplastin time (aPTT) and Thrombin Time (TT) measured the anticoagulant potency. Anti-Xa and anti-IIa activities (Hyphen Biomedical, Ohio, USA) determined the USP potency. The interaction between AT and heparins/enoxaparin were investigated in a purified biochemical system, using AT supplemented buffered assay. Thrombin Generation inhibition was studied with flourometry (Technoclone, Vienna, Austria). The relative interaction of heparins/enoxaparins with heparin induced thrombocytopenia (HIT) antibody induced aggregation of platelets were investigated using serum pool obtained from clinically confirmed HIT cases using aggregometry.

RESULTS: The molecular profile of bovine, ovine, porcine heparins and enoxaparin were almost identical. Porcine and ovine heparin produced consistently comparable anticoagulant effects with PT and aPTT, which were stronger versus the bovine. In contrast, the enoxaparins derived from these three sources showed minimal differences.

In the anti Xa and IIa assays both ovine and porcine heparins produced similar inhibition, whereas the bovine heparin exhibited lower activity. In the purified system the porcine and ovine preparations consistently showed lower IC50 values for both the thrombin and Xa inhibition in contrast to bovine heparin. The USP potency of the porcine and ovine heparins ranged from 180 to190u/mg, whereas the bovine was 130 to 140u/mg. The anti-Xa – IIa ratio for the heparins were comparable. The ovine and porcine enoxaparin exhibited comparable potencies which ranged from 94 to 110u/mg whereas bovine enoxaparin was slightly lower, 80 to 87u/mg. However the antiXa and anti-IIa ratios were comparable. The AT mediated inhibition of factor Xa and anti-IIa was stronger with heparins versus enoxaparins. Similarly heparins produced stronger inhibition of thrombin generation versus enoxaparin. In the HIT screening there was no difference between the HIT responses in the heparins or enoxaparins from different species.

CONCLUSIONS: While bovine, ovine, porcine heparins and enoxaparins exhibit comparable molecular profiles. in some of the functional assays bovine heparin and enoxaparin exhibited somewhat lesser potencies especially in the pharmacopeial assays. No differences were noted in the HIT antibody interactions among heparins and enoxaparins from different species. These studies demonstrate that ovine and porcine heparins are biosimilar and can be developed as such for clinical purposes. The bovine derived heparins exhibit slightly weaker potencies in functional assays despite comparable molecular profile. Potency adjustment for in vivo usage may be required to obtain comparable anticoagulant responses for the bovine heparin and enoxaparin.

4:20 pm – 4:40 pm

Coffee Break — **Great Hall Foyer**

4:40 pm – 6:00 pm

SCIENTIFIC SESSION 6

Great Hall North/Center

Chronic Venous Obstruction II

Moderators: Lowell Kabnick, MD and Suresh Vendantham, MD

Discussants: 6-25 Kathleen Ozsvath, MD; 6-26 Mikel Sadek, MD

4:40 pm – 4:58 pm

6-24 Hemodynamic effect of stenting in post-thrombotic iliofemoral venous obstruction

R. L. M. Kurstjens, M. de Wolf, I. Toonder, R. de Graaf, C. Wittens; Maastricht University Medical Center, Netherlands.

OBJECTIVE: Good clinical success can be achieved when treating post-thrombotic iliofemoral deep venous obstruction by percutaneous transluminal angioplasty and stenting. Whilst research has shown that intravenous pressures are significantly elevated in post-thrombotic limbs, little is known about the hemodynamic effect of stenting. The aim of this study was to determine whether venous hypertension can be reduced by stenting of iliofemoral deep venous obstruction.

METHODS: Twenty-two patients with unilateral post-thrombotic iliofemoral venous obstruction were included. Common femoral vein and dorsal foot vein pressures were invasively and continuously measured whilst subjects underwent a standardized treadmill test the day before treatment. Three months after treatment this test was repeated.

RESULTS: Mean age was 43±12 years, 19 subjects were female and 20 subjects had left-sided obstruction. Venous claudication was present in all subjects. Three patients decided not to undergo the second treadmill test and pressure measurements in three patients could not be obtained during the second treadmill test as it was decided to stent into the deep femoral vein. After stenting, common femoral vein pressure during the treadmill test was reduced by 22.3±24.8 mmHg in diseased limbs (p=0.003, Paired-Samples T-Test). No difference in effect of stenting was observed between diseased and control limbs at the level of the dorsal foot vein (p=0.940). Pain-free walking distance increased by 224±283 meters (p=0.014) and maximum walking distance increased by 235±245 meters (p=0.001).

CONCLUSIONS: Common femoral vein pressure is significantly reduced by stenting in patients with post-thrombotic deep venous obstruction of the iliofemoral tract. Additionally, walking distance significantly increases; suggesting an association between venous claudication and venous hypertension

4:58 pm – 5:16 pm

6-25 Is routine follow-up surveillance of iliac vein stents for iliocaval venous obstruction necessary?

R. Abdul-Haqq, Z. Novak, B. Pearce, T. Matthews, M. Patterson, W. Jordan, M. Passman; University of Alabama, Birmingham, AL.

OBJECTIVE: While iliac vein stenting has emerged as effective treatment for iliocaval venous obstruction (ICVO), the role of surveillance imaging remains unclear. The purpose of this study is to evaluate outcomes of iliac vein stents placed for ICVO and to determine if routine follow-up surveillance is warranted based on timing of stent failure.

METHODS: All patients who underwent iliac vein stenting from 2003-2015 were identified from a prospectively maintained registry. Patient demographics, venous risk factors, prior venous interventions, indications, imaging, operative findings, procedural success, complications, and clinical follow-up were recorded. Ultrasound surveillance was performed at first postoperative follow-up and at routine subsequent intervals. Continuous data was analyzed with Student *t*-tests or Mann Whitney U test, and frequency data was analyzed with chi squared analysis or Fisher's exact test where appropriate. Life-table analysis was used to determine primary patency.

RESULTS: Seventy patients (74 limbs) were identified who underwent iliac vein stenting for ICVO. Thirty-six limbs (48.6%) were stented for nonthrombotic venous compression (Stent-VC), and 38 limbs (51.4%) were stented for venous thrombosis (Stent-VT). Twenty-four limbs (63.2%) of the Stent-VT group were treated for acute venous thrombosis requiring lysis with stent for underlying venous lesions. The median number of follow-up visits for the Stent-VC and Stent-VT groups were 2 (IQR=1-4) and 2 (IQR=1-3), while the mean length of follow-up was 19.6 ± 29.5 months and 19.8 ± 26.5 months (P=0.972), respectively. During the first 6 months, one limb (3.1%) in the Stent-VC group occluded, while 42.8% of the limbs in the Stent-VT group occluded. Fifty-seven percent of patients in the Stent-VT group with acute venous thrombosis requiring thrombolytic therapy had limb occlusion at greater than 6 months (median 59.1 months, IQR 34.1-107.2). Overall primary patency for the Stent-VC and Stent-VT groups were 96.9% and 68.7% at 36 months (S.E.≤10%, P=0.001), respectively.

CONCLUSIONS: Patients with iliac vein stents placed for nonthrombotic iliac vein compression had statistically higher patency than those placed for venous thrombosis, with all stent failures occuring within 6 months. Iliac vein stents placed for venous thrombosis continued with stent failure after 6 months and may benefit from extended surveillance.

5:16 pm – 5:34 pm

6-26 Stent patency in patients with advanced chronic venous disease and nonthrombotic iliac vein lesions

S. Ali Rizvi, E. Ascher, J. Eisenberg, A. Hingorani, N. Marks; NYU Lutheran Medical Center, Brooklyn, NY.

OBJECTIVE: Midterm patency results of iliac vein stents placed for nonthromobic iliac vein lesions (NIVL) are not known. Two published large series of patients with iliac vein stent placement have not differentiated the outcomes between thrombotic and nonthrombotic lesions. To further study this issue, we reviewed our series of 170 iliac vein stents placed for NIVL.

METHODS: Retrospective analysis was performed of 126 patients that underwent common or external iliac vein angioplasty and stent placement between January 2013 and December 2014. Only patients with CEAP scores of C3, C4, or C5 were included. Patients were excluded if they had either active ulcer disease or signs of post thrombotic lesions at initial venography. Duplex was performed post operatively and at follow-up visits. Length of follow-up and stent patency were based on last previous duplex available.

RESULTS: 170 procedures were performed in 126 patients. Stent placement was needed in bilateral lower extremities in 122 patients. 112 of 170 (66%) procedures were performed on female patients. The average age of our patients was 72 (SD ± 13.4) years. 90 of 170 (53%) procedures were performed on the left lower extremity. CEAP classification of lower extremity venous disease was 59%, 31% and 9% for C3, C4 and C5, respectively. Our average follow-up period was 437 days (median = 460 days, range = 1 to 943 days). We had a post procedure follow-up time of greater than six months, one year and two years of 70%, 52% and 22%, respectively. During this period, 4 of 170 (2.35%) limbs experienced in-stent thrombosis. Primary stent patency of 99.4%, 98.8%, and 97.6% was noted at 6 months, 1 year, and 2 years follow-up, respectively.

CONCLUSIONS: The midterm patency results for iliac vein stents placed in patients for advanced chronic venous disease is excellent (97%).

5:34 pm – 5:52 pm

6-27 Simultaneous air-plethysmography and duplex scanning on a tilt-table in assessing gravitational venous drainage

C. R. Lattimer, E. Mendoza; Josef Pflug Vascular Laboratory & Imperial College London, London, UK.

OBJECTIVE: Gravitational venous drainage can be assessed by elevating the leg and recording the rate of reduction in calf volume with air-plethysmography (APG), termed the venous drainage index (mL/s). The response of the femoral vein to postural alterations can be measured by recording the minor diameter with duplex ultrasound. The aim was to investigate the responses of the calf and femoral vein, as described above, using tilt-table angulations.

METHODS: Three groups of subjects were compared: Control (Legs:11; Male:6; Left:5, Age:39[19-74]), without clinical or duplex evidence of venous disease; Obstruction (L:11; M:6; L:10, Age:53[40-75]), from a past ilio-femoral deep vein thrombosis; Reflux (L:11; M:5; L:4, Age:70[36-75]), from primary varicose veins. Each subject walked onto the foot platform of a manually operated tilt-table with the backs of both heels against a foam support. This ensured that both calves were free from pressure and allowed placement for the APG sensor cuff. From this position of -70 degrees (almost standing) the table was tilted up with the leg elevated to -45 degrees until the new calf volume equilibrium point. The table was then tilted up further in 2 seconds with the leg from -45 dependency to 40 degrees elevation until the new elevation equilibrium was reached when inflow=outflow. This was repeated 3 times per subject. The minor diameter of the femoral vein was recorded at each of the three tilt positions.

RESULTS: The median (inter-quartile range) VDI in the obstructed group was significantly reduced at 7(6-9.6), compared to controls at 17.4(13.9-27.2), $P < .0005$ and the legs with primary varicose veins at 28.1(25.4-34.4), $P < .0005$ (Fig 1). This indicates that iliofemoral obstruction slows the rate of drainage on leg elevation. Venous volume was significantly reduced in patients with obstruction compared to reflux at 117(80-154) versus 202(180-240), $P < .0005$. Though the percentage reduction from -45 to 40 was about 80% as expected, there was also a significant reduction in leg volume from -70 degrees to -45 degrees in all subjects (Fig 2). This indicates that even a small manoeuvre to lift the leg can have a significant impact in reducing volume. The minor diameter of the femoral vein reduced also in response to elevation, with the greatest change observed from -45 to 40 (Fig 3). This suggests that the minor femoral vein diameter in the groin may reflect the state of the venous volume in the leg.

CONCLUSIONS: This study has revealed 3 interesting observations. Firstly, the VDI is significantly reduced in patients with ilio-femoral obstruction with a cut point of about 11 mL/s. Secondly, dependent angulations of only 25 degrees may reduce the venous volume by 20%. Thirdly, confirms the femoral vein is a collapsible tube highly sensitive to changes in posture but with reduced responsiveness in obstruction.

Figure 1. Boxplots comparing the VDI of legs from 3 groups of subjects on a tilt-table. The dashed line represents a cut-off point of 11 mL/s (Mann-Whitney U-test). VDI, venous drainage index.

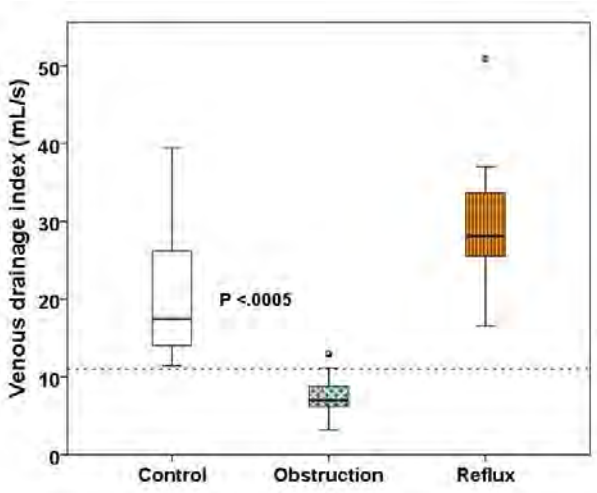


Figure 2. Boxpots comparing the effect of 3 different tilt-table position changes on reducing the volume of the calf measured using air-plethysmography. -45 represents -45 degrees legs down measured from supine/horizonal. 40 represents 40 degrees legs up from supine.

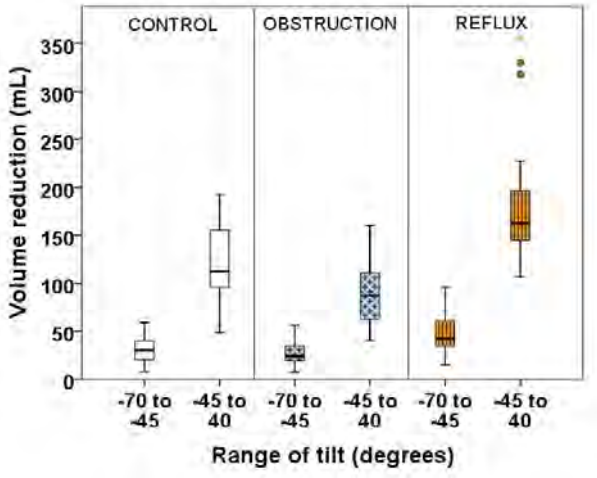
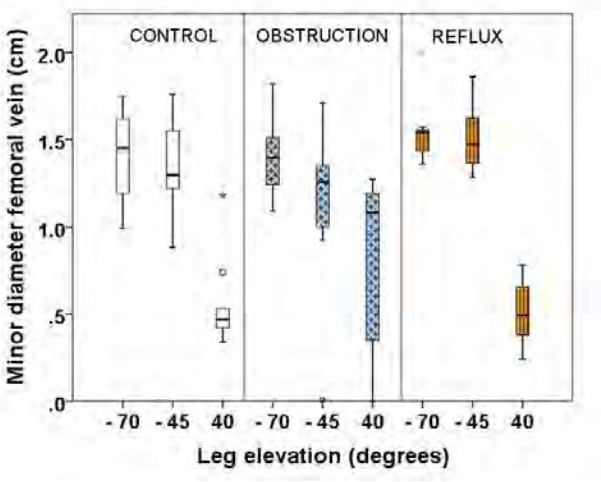


Figure 3. Boxplots comparing the effect of 3 tilt-table positions (degrees from horizontal) on the responsiveness of the minor diameter of the femoral vein measured using duplex ultrasound.



5:52 pm – 5:57 pm

Q6-9 One year clinical outcomes following deep venous reconstruction using dedicated venous stents

P. Saha, N. Karunanithy, A. Cohen, B. Hunt; K. Breen, S. Black, St. Thomas' Hospital and King's College London, London, UK.

OBJECTIVE: Evaluate one-year clinical outcomes following endoluminal stenting using first-generation dedicated venous stents.

METHODS: All patients undergoing deep venous reconstruction either following lysis for venous thrombosis or stenting of a chronic venous obstruction using dedicated venous stents between 2012-2015 at a single centre were identified. Duplex ultrasonography was used to assess sent patency at 1d, 2wks, 3mths, 6mths and yearly following intervention. Venous Disability Scores (VDS) and Villalta Scores (VS) taken before intervention and during routine clinical follow-up (6wks, 6mths and yearly thereafter) were analysed.

RESULTS: 347stents were placed in 140pts (median age 39yrs, 80 female) with median follow-up 18mths (1-40mths). Overall 1yr primary, primary-assisted and secondary patency rates were 67%, 80% and 82%. 57pts had stenting of residual stenoses after catheter-directed-thrombolysis for acute iliofemoral DVT. Pre-operative VDS scores were 3 in all patients. Median post-operative VDS and VS in this sub-group were 0 ($P < 0.001$). 81pts had stenting for chronic outflow obstruction. The median pre-operative VS was 14 (4-23), with an additional 9pts having an ulcer. Median post-operative VS was 4 (0-22, $P < 0.001$). Ulcer healing was achieved in 67% (n=6/9).

CONCLUSIONS: Deep venous reconstruction using the first-generation dedicated venous stents show promise at providing symptom relief at one year. Regular surveillance is, however, required to maintain stent patency and factors that influence occlusion warrant further investigation. Long term data are required to ensure that these early clinical benefits can be maintained.

7:00 pm – 11:00 pm

Forum Finale — **Great Hall East/West**

PD1 A comparative study on the histopathological difference after endovenous laser, radiofrequency and steam ablation

U. Bengisun, A. Cetinkaya, C. Cansiz Ersoz, O. Bozdemir; University of Ankara, Ankara, Turkey.

OBJECTIVE: In the last decade, treatment of varicose veins has changed with the introduction of new endovenous techniques. Nowadays endovenous laser and radiofrequency (RF) are the most commonly preferred endovenous thermal ablation methods. Endovenous steam ablation is a new thermal ablation technique for the treatment of saphenous trunk and large varicose tributaries.

We aimed to compare the histological change after three different thermal ablations including laser, RF and steam with high energy levels than usually recommended.

Endovenous steam ablation is a new thermal ablation technique for the treatment of saphenous trunk and large varicose tributaries.

METHODS: We performed 32 stripping procedures in patients with saphenous varicose vein between 7-12 mm in diameter following the approval of the ethics committee. Removed veins were immediately divided into three parts of about 10 centimetre (cm) long segments and we had one control sample of about 1 cm long. Laser (radial fiber and 980-nm Biolitec, Germany), RF (ClosureFast catheter, VNUS, California) and steam (Cermavein, France) ablations were performed using 100 joule per cm for laser, two cycles of 20 sec for segmental RF and five pulses of steam per cm ex-vivo settings respectively. After thermal ablations were completed, the fixed veins and control samples were evaluated and scored for vein wall damage from 0 to 4 by an experienced pathologist in a blinded fashion. SPSS 11.5 was used to analyse the results.

RESULTS: Histological evaluation of 96 vein segments after ablation of laser, RF and steam revealed significant vein wall destruction on the intima, media and adventitia layers of vein. Although RF induced slightly higher damage, no significant difference among the groups was found. The evaluation of perivascular tissue damage showed no significant difference among the groups. However steam ablation caused less perivascular damage. Table below shows the scores of damage after laser, RF and steam ablations

CONCLUSION: The steam ablation of saphenous vein is as effective as laser and RF which are the most commonly preferred endovenous ablation methods in many countries. In general steam ablation induces less medial, adventitial and perivascular damage even when using high energy levels. Nevertheless steam induced limited perivascular damage could offer more patient satisfaction and less pain post-procedurally.

PD2 A safe, innovative, and cost-effective approach to deep vein thrombosis therapy

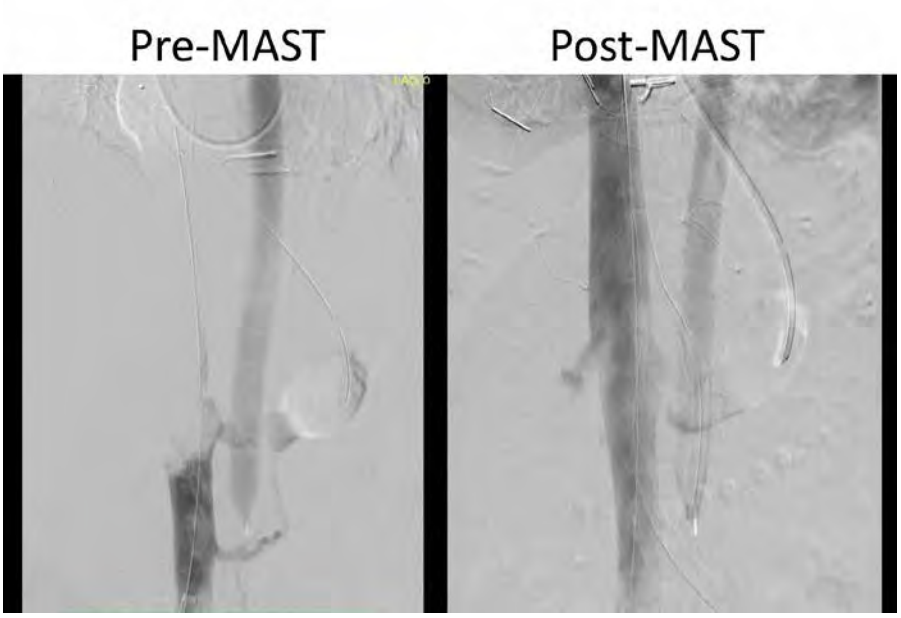
S. P. Steenberge, D. Clair, S. Lyden; Case Western Reserve University, Cleveland, OH.

OBJECTIVE:Endovascular acute deep vein thrombosis (DVT) therapy is commonly performed transluminally via pharmacologic thrombolysis(PT), mechanical thrombectomy, or some combination of the two approaches. The use of PT and commercial devices incurs a substantial cost to DVT therapy. Also, PT may be contraindicated for clinical reasons due to elevated bleeding risk. To establish a therapy paradigm for DVTs that minimizes risk and cost while achieving optimal outcomes, we used only mechanical, aspiration via sheath thrombectomy using large diameter sheaths. We evaluated the short term outcomes in patients treated with mechanical, aspiration sheath thrombectomy (MAST) for large vessel DVT at our institution.

METHODS: Medical records for patients treated with MAST for DVTs from March 2013- August 2015 were reviewed. Each patient's operative report was read, and the completion angiogram was scored via the SVS scoring system for DVTs for immediate post-operative success. In hospital morbidity and mortality, and available follow-up data were reviewed. The commercial price for the devices, commercial mechanical thrombectomy, and tissue plasminogen activator were collected and a comparison of direct costs for performance of these varied procedures was calculated.

RESULTS: From March 2013 to August 2015, 13 patients had MAST without PT or commercial mechanical thrombectomy device use for upper or lower extremity DVTs. For subclavian vein DVT, 8 French sheaths were the most commonly used while 18 French sheaths were most commonly used in the femoral or ileocaval systems. 69% of patients had complete removal of the thrombus while 31% had subsegmental, nonocclusive thrombus remaining. Two patients had non-occlusive thrombus noted by ultrasound evaluation during the index admission, both of which resolved spontaneously with anticoagulation alone. There were no significant adverse events post-operatively or 30-day mortalities. There were follow-up images on 85% of patients with an average follow-up of 79 days. There was 92% primary patency and 100% secondary patency upon follow-up imaging. Finally, the use of MAST instead of commercial devices or PT results in a significant decrease in direct cost.

CONCLUSIONS: MAST is a safe and effective option for large vessel DVT therapy. Avoiding the use of commercial mechanical thrombectomy devices and PT significantly decreases both therapeutic cost and bleeding risk in this patient population. Furthermore, MAST achieves similar outcomes to current DVT therapies, and is applicable to a patient population where typical thrombolysis could not be considered, such as recent operative intervention, traumatic injury or neurologic intervention.



PD3 A systematic review of venous thromboembolism and bleeding in patients with calf deep venous thrombosis

J. Garry, A. Duke, N. Labropoulos; Stony Brook University School of Medicine, Stony Brook, NY.

OBJECTIVE: A large number of studies have examined the potential complications of calf deep venous thrombosis (C-DVT). However, there is no clear consensus on when or how to treat patients to prevent these complications. This systematic review assessed the rates of proximal propagation, PE, recurrence, and major bleeding in C-DVT patients as well as the associated risk factors.

METHODS: Database searches of MEDLINE, the Cochrane Library, Scopus, CINAHL, and Web of Science along with extensive cross-referencing were conducted. The search terms "calf," "deep venous thrombosis," and "outcomes" or "anticoagulant therapy" were utilized. Two independent reviewers screened the papers using stringent inclusion and exclusion criteria. Randomized controlled trials and prospective cohort studies with and without controls were included. Studies with fewer than 25 patients, PRISMA guidelines were followed. The MOOSE and STROBE guidelines could not be followed due to the clinical and methodological heterogeneity among the studies examining C-DVT. The included studies were graded on six methodological standards modified from previous systematic reviews of C-DVT. The NOS and ACROBAT-NSRI could not be employed due to the inclusion of prospective studies without a control group. Risk factors to be analyzed were selected from the ACCP guidelines for the treatment of C-DVT. Data on propagation, pulmonary embolism (PE), recurrence, major bleeding, and associated risk factors was abstracted.

RESULTS: The database searches and extensive cross-referencing yielded 4197 unique papers for review. There were 16 studies that met the inclusion criteria. Six were randomized controlled trials and 10 were prospective cohort studies. The propagation rate to the popliteal vein or above was near 10%. No studies found anticoagulant therapy to reduce the rate of C-DVT complications. The major reason for this is trial design and the significant heterogeneity of patients. Risk factor prevalence was frequently reported, but the contribution of each of the factors has not been estimated. Malignancy and unprovoked etiology were the only factors found to be associated with an increased rate of C-DVT complications. Of the 16 papers, 9 reported major bleeding with a range of 0 to 4.1% in treatment groups. The CACTUS trial on low risk patients found that the risk of bleeding (4.1%) outweighed the small benefit of decreasing proximal propagation from anticoagulation therapy.

CONCLUSIONS: The literature on C-DVT complications exhibits extensive heterogeneity limiting any robust conclusions to be drawn from data analysis. None of the risk factors suggested to be associated with C-DVT complications have yet been effectively proven. Further studies must be completed to determine the ideal method of managing patients with C-DVT and the impact of various risk factors. It would seem the type of treatment and its duration may vary for the different groups of patients and thus must be studied separately.

PD4 Coil embolization for treatment of pelvic venous insufficiency

S. A. Harlin, S. Pouliot, S. Harlin Coastal Vascular and Interventional, FL.

OBJECTIVE: Insufficiency (PVI) causes a myriad of symptoms which are frequently under diagnosed. These include chronic pelvic pain and varicose veins, both primary and recurrent. Patients with recurrent varicose veins after previous endovenous ablation have a high incidence of PVI.

METHODS: 10 patients were retrospectively reviewed in an IRB adjudicated trial for treatment of PVI with Medusa® Multi-Coil (MMC) (EndoShape, Inc., Denver, CO). All patients had varicose veins and/or pelvic pain. All underwent diagnostic venography follow by separate treatment of the refluxing pelvic vein with the Medusa device

RESULTS: All patients had immediate closure of the refluxing vein with a single Medusa device. There was no rupture, migration or other procedural complications. There were no post-operative complications on any patients. Patients with symptomatic varicose veins underwent successful adjunctive therapy of the varicose veins

CONCLUSIONS: PVI represents a myriad of symptoms including chronic pelvic pain and varicose veins. Previous treatments focused on placing multiple coils into refluxing veins to affect closure. This novel device results in immediate closure of all refluxing veins with a single device. This greatly reduces radiation exposure and contrast use for patients needing this treatment, when compared with using multiple coils. In addition, its proprietary nonmetallic matrix eliminates scatter seen when using traditional metal coils. This represents a novel treatment for patients with this vexing problem.

PD5 Compliance with mechanical venous thromboembolism prophylaxis

P. Kim, K. Probeck, D. Elitharp, A. Gasparis, N. Labropoulos; Stony Brook University School of Medicine, Stony Brook, NY.

OBJECTIVES: Little work has been done on assessing the utilization of sequential compression devices (SCDs). We evaluated the accuracy of assessment and compliance with the proper use of SCDs

METHODS: This study was conducted in two parts. First, a prospective analysis of 100 randomly selected adult patients admitted to our tertiary care center was performed. Observation of proper use of SCDs was done via random visual inspections. Assessment of VTE risk was determined by utilization of our VTE advisor through the electronic medical record of our institution. This is a risk stratification and prophylaxis recommendation tool based on the 2009 ACCP guidelines. Patients underwent two independent VTE risk assessments; first by the admitting service (AS), followed by a dedicated VTE consult service (CS). SCD orders were then reviewed. After this, we implemented additional education for VTE awareness, alerts, accountability and oversight measures for nurses and practitioners. One year later, we performed another prospective analysis of 100 randomly selected patients.

RESULTS: In the first group of patients, random inspection found that 24 patients had SCDs applied and functioning correctly, while 76 patients either did not have SCDs or were not properly applied. Evaluating the VTE risk assessments, 64 patients needed mechanical prophylaxis based on CS assessment, while 54 patients were found to require SCDs based on AS assessment ($p = .1956$). Of the patients who needed SCDs, 23 (36%) had them correctly applied, and 41 (64%) did not. Overall, 1 patient received over-prophylaxis, and 41 patients were under-prophylaxed. In the second group of patients, random inspection found that 26 patients had SCDs applied and functioning correctly, while 74 patients either did not have SCDs or were not properly applied. Evaluating the VTE risk assessments, 69 patients needed mechanical prophylaxis based on CS assessment, while 68 patients were found to require SCDs based on AS assessment ($p = 1.000$). Of the patients who needed SCDs, 23 (33%) had them correctly applied, and 46 (67%) did not. Overall, 3 patients received over-prophylaxis, and 46 patients were under-prophylaxed. The practice patterns in patients receiving appropriate mechanical prophylaxis were similar between the two groups ($p = .8555$).

CONCLUSIONS: Despite the use of clinical decision support tools, a number of patients do not receive accurate mechanical prophylaxis. However, even with implementation of nursing and practitioner based interventions to increase VTE awareness, accurate assessment and application of SCDs remains an issue.

PD6 Costs and complications of advanced endovascular techniques for ivc filter retrieval

A. Brahmandam, L. Skrip, H. Mojibian, J. Aruny, B. Sumpio, A. Dardik, T. Sarac, C. I. O. Chaar; Yale University, New Haven, CT.

OBJECTIVE: Advanced endovascular techniques are frequently used for challenging Inferior Vena Cava Filter (IVCF) retrieval. However, the costs of IVCF retrieval have not been studied. This study compares IVCF retrieval techniques and estimate procedural costs.

METHODS:Consecutive IVCF retrievals performed at a tertiary center between 2009 and 2015, were retrospectively reviewed. Procedures were classified as Standard Retrieval (SR), if they only required a vascular sheath and a snare device and as Advanced Endovascular Retrieval (AER) if additional endovascular techniques were used for retrieval. Cost data was based on hospital bills for the procedures. Patient characteristics, IVCF dwell time, retrieval procedural details, complications and costs were compared between the groups. All statistical comparisons were performed using SAS 9.3 software.

RESULTS: There were 190 IVCF retrieval procedures (SR=157 vs AER=33) in 182 patients (mean age = 55, 51 % Males). Fourteen IVCF (7.4%) were placed at an outside hospital. The indications for placement of the IVCF were mostly therapeutic (76% vs 24% for prophylaxis). All IVCF were retrievable with Bard-Eclipse (33%) and Cook-Gunther Tulip (24%) the most common. Venous ultrasound of the lower extremities was obtained on 133 patients (70%) prior to retrieval while only 4 patients (2.1%) received a CT scan of the abdomen. There was no difference in the mean dwell time of IVCF in the 2 groups (SR = 147.90 ± 146.11 days vs AER = 161.78 ± 92.75 days, p=0.49). AER were more likely to have had prior attempts at retrieval (21.2%) compared to SR (1.9%) (p < 0.001). The most common AER techniques used were the stiff wire displacement (45.5%) and the wire loop and snare sling (45.5%). Bronchoscopy forceps was used in 4 cases (12.1%) and was the only off-label device used. AER were more likely to require more than one venous access site for the retrieval procedure (21.2% vs 0%, p < 0.001). AER were significantly more likely to have longer fluoroscopy time (33.65 ± 18.24 vs 8.05 ± 7.97 minutes, p < 0.001) and longer total procedural time (96.45 ± 48.62 vs 41.15 ± 25.01 minutes, p < 0.001) compared to SR. The complication rate was higher with AER (18.1%) compared to SR (5.1%) (p=0.018). Most complications were abnormal radiological findings that did not require additional intervention. (Table 1) The total procedural cost of AER was significantly higher ($43,404 ± $16,665 vs $23,786 ± $8,744; p < 0.001) than SR.

CONCLUSIONS: Advanced Endovascular techniques provide a feasible alternative when standard IVCF retrieval techniques do not succeed. However, these procedures come at a higher cost, higher rate of complications and radiation exposure to the patient and operator.

PD7 Early outcomes in stenting for percutaneous endovascular iliocaval reconstruction (speir) in the setting of chronic inferior vena cava filter occlusion

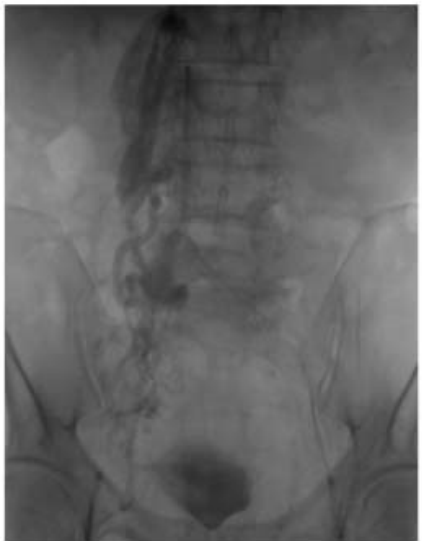
K. D. Cobourn, J. Brooks, T. Massimi, E. Woo, S. Abramowitz; MedStar Washington Hospital Center, Washington, DC.

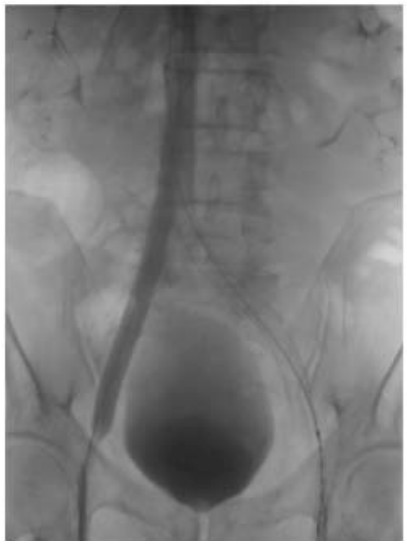
OBJECTIVES: The purpose of the study is to describe the technique and early results of Stenting for Percutaneous Endovascular Iliocaval Reconstruction (SPEIR) in patients with chronically occluded IVC filters.

METHODS: A prospectively maintained retrospective single-institution database was queried to identify patients with chronically occluded inferior vena cava (IVC) filters resulting in iliocaval occlusion. Patients with asymptomatic iliocaval occlusion, patients with an anticipated life expectancy of less than five years and non-ambulatory patients were excluded from the study due to a lack of indication for intervention. The Villalta clinical scoring system for post-thrombotic syndrome was used to assess symptom improvement postoperatively.

RESULTS: Sixteen patients with symptomatic chronic inferior vena cava filter occlusion who underwent SPEIR were identified from June 2014 through July 2015. Technical success was 100% with primary patency achieved in all patients. There were no intra-operative complications and 30-day mortality was zero. Complications included acute kidney injury in one patient as a result of pharmacomechanical thrombolysis and pulmonary embolism in one patient. Both patients recovered with no negative clinical sequelae. There were no thrombotic events or in-stent restenoses within the first 30 days. Symptomatic improvement was seen in all patients as measured by the Villalta clinical scoring system for postthrombotic syndrome, with an average decrease in Villalta score of 16.46 ± 3.89.

CONCLUSIONS: SPEIR appears to be a safe and effective approach for the treatment of chronic iliocaval occlusive disease in the setting of occluded IVC filters. These procedures can be performed with excellent patency and minimal morbidity. Treatment results in improved Villalta scores and improved quality of life.





PD8 Effective use of polidocanol endovenous microfoam (Varithena®) in treatment of severe chronic venous insufficiency (CEAP 4, 5 and 6) and venous ulcers refractory to thermal ablation therapy

P. S. Chorpa; Midwest Institute for Minimally Invasive Therapies (MIMIT) / RUSH University, Chicago, IL.

OBJECTIVE: Thernal Tumescent (TT) ablation of truncal insufficiency has been the mainstay of treatment of axial incompetence. Often, as a late sequale, collaterals may develop within the saphenous fascial sheath and fill from perforators or pelvic collaterals contributing to significant venous hypertension and venous ulcerations refractry to treatment. Nonthermal nontumescent (NTNT) such as Polidoconol endovenous microfoam (Varithena, BTG International Inc., West Conshohocken, PA) have recently become available in the USA as a treatment option

METHODS: Fifteen patients with Refractory Chronic venous insufficiency (CVI) (C4b C5 & C6) were treated with Varithena over a 7 month period. All patients had previosly, undergone multiple prior treatments with thermal ablation of refluxing axial veins and perforators over several years. Although initially improved, over time their venous insufficiency reoccured and the venous hypertension ensued from large refluxing tortuous collaterals veins or varicosities. These patients had recurrence of their symptoms, pain, swelling, varicosities, pigmentation and venous ulcers refractory to conventional wound care treatment. Ultrasound examination showed the incompetent refluxing veins, the source of the reflux and partially occluded / recanalized truncal axial veins

RESULTS: A total of 15 patients ranging from CEAP C4 to C6 were treated. 6 patients had venous ulcers (C6) and 5 patients had healed venous ulcers (C5) and 4 patients with hyperpigmentation and atrophie Blanche (C4b). Large collaterals in the saphenous sheath were noted in 6 patients. One patient had large branches in upper thigh with reflux feeding from pelvic veins.Varicose veins and refluxing draining veins causing venous hypertension in the area of the ulcer and lower leg were noted in all patients. All patients were treated with the Polidoconol endovenous microfoam. An average of 12 cc was used in these patients (6 cc - 18cc). Ultrasound Access was obtained in the lower thigh and the lower leg with a 4 Fr micropuncture kit or a 20 G butterfly needle. The leg was elevated to drain the blood. The foam was spread along the path of the veins, noting the venospasm. Compression of the sapheno fmoral junction or perforators were performed as needed to prevent reflux into the deep system. Compression dressing was applied as per the instruction for use, with the leg in the elevated position. Patients were advised compression stocking for 2 weeks. All patients had complete resolution of symptoms and ulcer healing.Two patient had painful thrombus within the branches due to early removal of compression garment. Relief of symptoms was obtianed by expression of thrombus from vein in painful site. No major compications were noted. All patients to date have no evidence of recurrence of their symptoms or recanalization of the occluded veins.

CONCLUSIONS: Polidocanol endovenous microfoam (Varithena®) is effective in the treatment of venous insufficiency in patients with CEAP 4, 5, 6 refactory to Thermal tumsecent treatment and with tortuous saphenous sheath collaterals and branch varicosities. Relief of the venous hypertension around the local wound site expedites healing of the wounds.

PD9 Endovenous ablation of accessory saphenous vein for recurrent varicose vein is safe and effective

A. Rathore, M. Kalra, A. Duncan, T. Bower, G. Oderich, M. Fleming, R. De Martino, H. Verma, R. Tellez, P. Gloviczki; Mayo Clinic, Minneapolis, MN.

OBJECTIVE: Accessory saphenous vein (ASV) is found in 10-20% of general population. During the evaluation of patients for varicose veins, the presence of ASV is not routinely sought. This is despite the fact that missed ablation of a refluxing ASV is one of the known mechanisms for recurrent varicose veins. However, proportion of recurrent varicose vein attributable to ASV is unknown. Nevertheless, evaluation for and treatment of a refluxing ASV provides an opportunity for prevention of a fraction of recurrent varicose veins. The aim of this study is to evaluate the safety of endovenous ablation of anterior accessory saphenous vein (ASV) for the treatment of refluxing ASV in patients with chronic venous insufficiency.

METHODS: Data from consecutive patients treated with ASV endovenous ablation over a 10 years period from January 2004 until December 2014 at a single institution was retrospectively reviewed. Demographic, procedural and complication data were analyzed.

RESULTS: A total of 958 patients were treated with superficial venous ablation during the study period. Of there, 123 patients (140 limbs), M:F 98:42 were underwent ASV endovenous ablation during the study period; including VenaCure EVLT™ laser vein treatment (AngioDynamics, Queensbury, NY) (n=77, 57.0%) and RFA (radiofrequency ablation) with ClosureFAST® system (VNUS Medical Technologies, San Jose, CA) (n=58, 43.0%). There were 50 limbs with recurrent varicose veins (RVV) and 90 with primary varicose veins (PVV). Median CEAP score was C3. ASV reflux was identified in 66% of the limbs on preoperative venous duplex ultrasound. Ambulatory avulsion phlebectomy of branch varicose veins was performed in 96% of the limbs. (Table 1) Technical success was 97.1%, with inability to percutaneously access ASV in 6 limbs (4PVV and 2RVV). Length of ablation and energy usage data was available in 63.0 % and 53.4% of the remaining 134 limbs, respectively. Median length of ablation of ASV was 15 cm with mean energy with EVLA 70.0 Joules per cm. Point of access for ASV was available in 53% (n=71/134) limbs and was equally distributed between proximal-, mid- and distal- thigh (21, 26 and 24, respectively). All veins treated were evaluated with

venous duplex US on post procedure day 1; complete ablation in 97.0 % and partial ablation in 1.5% was demonstrated with no evidence of endovenous heat induced thrombosis (EHIT) in any limb. Minor complications (mild pain, erythema and/or swelling) were noted in 17.0%. Postoperative DVT (1.5%) and paraesthesia (1.5%) were rare and were seen only in the patients who had a concomitant GSV ablation.

CONCLUSIONS: Presence of and incompetence in accessory saphenous vein (ASV) is frequently not evaluated in detail during the preoperative duplex ultrasound prior to endovenous therapy for varicose veins. Endovenous ablation can be performed safely with excellent technical success and should be considered when ASVs are identified

PD10 Histologic and sonographic features of holmium laser in chronic venous disease treatment

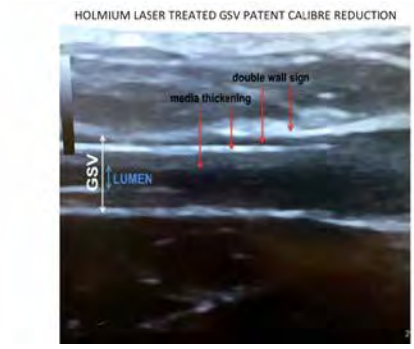
S. Gianesini, R. Gafa, S. Occhionorelli, R. Menegatti, G. Lanza, P. Zamboni; Vascular Disease Center-University of Ferrara, Italy.

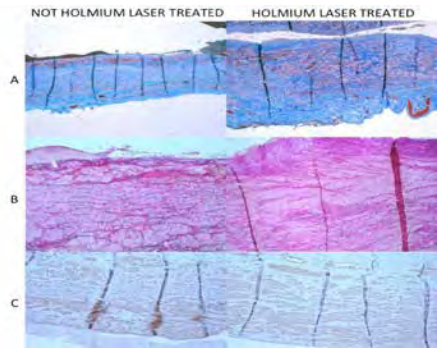
OBJECTIVE: A new holmium laser (HOL) has recently been introduced to the European and American market, being CE registered and accepted for importation by the FDA as an investigational device (approved by Allendale IRB). HOL eliminates venous reflux by reducing the saphenous calibre without tumescence (Fig. 1). In case a saphenous ablation is indicated a sclerosing agent can be injected through the same introducer, after the HOL has properly reduced the vessel, even in case of large calibres. The aim of the present investigation is to provide the never previously reported ex-vivo evidences of the HOL effect on great saphenous vein (GSV) histology.

METHODS: Six chronic venous disease (C2-5EpAsPr, VCSS:6±1) patients (M/F:1/1; Age:57±8, BMI:24±2) underwent a single procedure that included a HOL-assisted calibre reduction of the GSV from 3 cm below the sapheno-femoral junction to the lower third of the thigh, a high-tie and a flush ligation of the incompetent saphenous tributaries along the leg. During the high ligation, 3 cm of proximal GSV not treated by laser and 3 cm of a contiguous segment that was just previously treated by HOL were harvested. Histological assessments were performed by Masson Trichrome, Factor VIII, Actin and Orcein staining. Patent GSV lumen calibre was assessed at the mid-thigh right before and after the procedure in the supine position. Peri-procedural pain was graded by a 100 mm Visual Analogue Scale ranging from 0 (no pain) to 100 mm (unbearable pain). At 2 months, GSV calibre evaluation was repeated in the supine position.

RESULTS: On gross examination, the GSV samples after HOL showed conspicuous thickening of the wall with a decreased, yet patent lumen. Factor VIII immunostaining demonstrated intact endothelial lining in both the HOL treated and not treated segments. Expansion of collagen fibers was observed only in the HOL treated segments. The collagen appeared more homogeneous than in controls, with an amorphous appearance and loss of the normal fibrillar structure (Masson Trichrome staining) (Fig. 2 A). The laser treated veins showed a reduction in elastic fibers with greater fragmentation and loss of the normal weave (Orcein staining) (Fig. 2 B). Smooth muscle cells appeared swollen (Actin immunostaining) (Fig. 2 C). Right after HOL use, mean calibre of the patent mid-thigh GSV lumen decreased from 8.1 mm ± 0.8 to 3.9 ±0.2 mm ($p < .0001$). The average peri-procedural pain was 10 ± 0.6 mm. At the 2-month follow-up, the mean calibre was 4 ± 0.3 mm, VCSS was 1.3±0.5 ($p < .0001$), CEAP was C1 in all cases excluding one C4 and one C5 patients that were included in the study population.

CONCLUSIONS: HOL significantly reduces the calibre of the great saphenous vein by a tumescentless and painless procedure. The endothelial lining is spared, while the remaining wall is thickened by a hyalinization-like process (Fig. 3). The reported data pave the way for future basic science researches on histologic changes following different lasers use, together with clinical investigations regarding this innovative tumescentless therapeutic option.





PD11 Initial outcomes using VeinCLEAR catheter for radiofrequency ablation in the treatment of lower extremity superficial venous insufficiency

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OBJECTIVE: Radiofrequency ablation (RFA) is a widely accepted alternative to high ligation with proximal stripping of the great saphenous vein (GSV) and short saphenous vein (SSV) in the treatment of lower extremity superficial venous insufficiency. This study investigated the effectiveness of a new RFA catheter, VeinCLEAR™ (Frontière Médicale), in venous closure

METHODS: All RFA procedures using the VeinCLEAR™ catheter consecutively performed in single institution were analysed. The length of the catheter used, number of treatment cycles and RFA times were prospectively collected. Duplex ultrasonography was performed 3 months after surgery to assess vein patency.

RESULTS: A total of 44 legs in 41 patients (49% female) were treated using the VeinCLEAR™ catheter over a 4-month period. A total of 4 70 mm catheters and 40 100 mm catheters were used. The median number of transmission pulse cycles used was 6 (2-10). The median RFA time was 01:46 min (00:40 – 03:20 min). GSV occlusion rates were 97.4% (n=38/39), while SSV occlusion was 100% (n=5/5). There were no complications identified.

CONCLUSIONS: VeinCLEAR™ catheters are effective at venous closure during RFA procedures in the short-term. Long-term evaluation of this device is now needed to ensure that these encouraging early results are maintained

PD12 Magnetic resonance venography and 3D image fusion provide a novel paradigm for endovascular recanalization of chronic central venous occlusion

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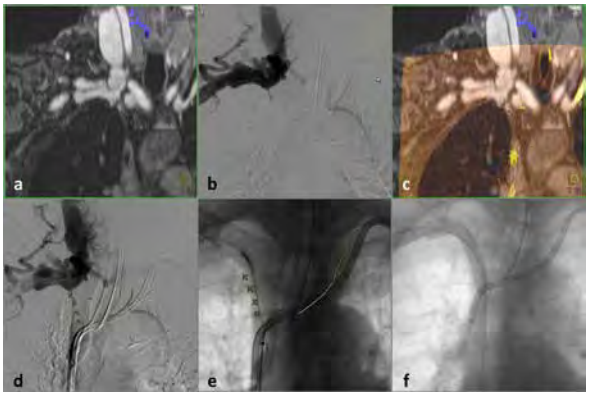
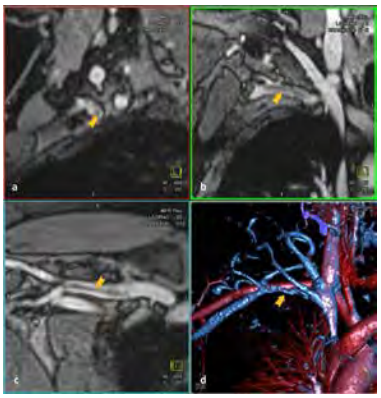
OBJECTIVE: Endovascular recanalization is considered the first-line therapy for central venous occlusion. Success rate of wire traversal of the occluded segment varies from 50% to 93%. Endovascular navigation inside fragile and sclerotic veins without known vascular branching patterns or wall calcification is challenging and mostly relies on intuition and general anatomical knowledge. Magnetic resonance venography (MRV) can be performed safely, especially in patients with end-stage renal disease. From previous studies, it has been observed that the boundaries of occluded veins may be highlighted on contrast enhanced MRV. Intraoperative image fusion has become more and more used to guide complex arterial endovascular procedures. We describe in our work an innovative technical combination of MRV and 3D image fusion in order to improve intraoperative guidance for endovascular central venous occlusion recanalization.

METHODS: Contrast enhanced MRV images performed in patients with central venous occlusion were reviewed by an expert who evaluated the quality of visualization of the boundaries of the occluded segment. During endovascular recanalization, preoperative MRV images were co-registered with intraoperative cone beam CT images and the pathway of the occluded segment was electronically marked and projected on real time fluoroscopic images (Figure 1). Technical success, time for lesion catheterization and total fluoroscopy time were recorded.

RESULTS: Between January and June 2015 two patients underwent endovascular recanalization of their central venous occlusion using guidance from pre- and intraoperative image fusion. The boundaries of the vessel were precisely seen on two MRV sequences: T1 VIBE (equilibrium phase) (Figure 2), and Ti600 MAG (direct thrombus imaging). Both patients had previous unsuccessful standard recanalization attempts. The occlusion concerned the right subclavian vein in one patient and the right brachiocephalic vein in the other. The lesion was successfully crossed in both cases without complications. Fluoroscopy times for lesion catheterization were 5.8 and 12.5 minutes. Total fluoroscopy times were 21.7 and 20.9 minutes respectively.

CONCLUSIONS: MRI image fusion for central venous occlusion is feasible and may significantly improve success, safety and surgeon confidence during venous endovascular navigation. In our two cases, the visualization of contrast enhancement around the occluded venous segment was crucial in understanding the extent and pathway of the occlusion. Because both used blood pooled contrast agents remain strictly within the intravascular space, we believe that this hyper-intensity could result in the visualization of contrast in the vasa vasorum of the occluded vein. This is the first true imaging innovation in venous interventions, which has the potential to impact a great number of patients. More studies are needed to assess the nature of the wall vessel hyper-signal at the level of the venous occlusion.





PD13 Postural orthostasis tachycardia syndrome (pots) cured by treatment of venous insufficiency

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OBJECTIVE: Postural orthostasis tachycardia syndrome (POTS) is a syndrome consisting of a 30 point increase in heart rate going from a supine to standing position without an associated drop in blood pressure. Associated symptoms are typical of orthostasis and can include syncope. We present the case of a 38 year old female with long standing and severely symptomatic POTS, who coincidentally had extensive lower extremity superficial venous reflux (VR). She underwent several procedures to treat the VR, and unexpectedly had complete resolution of the symptomatic and hemodynamic manifestations of the POTS.

METHODS: The patient was initially diagnosed in her teens with POTS and was treated with calcium channel blockers and beta blockers for symptom control. Comorbidities included migraine headaches, polycystic ovary syndrome and type 2 diabetes (DM). Despite intensive medical management, the POTS symptoms were moderately limiting and prevented regular exercise, although she was able to work as a respiratory technician. She also had symptoms of venous inusfficiency involving both lower extremities. Noninvasive testing revealed significant venous reflux (VR) in both greater saphenous veins in their entirety, the left small saphenous veins, extensively in the deep systems bilaterally and in multiple perforators. She underwent endovenous laser ablation (EVLA) of the left GSV 12/4/2012, EVLA of the left SSV 1/8/13, and EVLA of the right GSV 2/12/13. The patient reported complete resolution of her symptoms after the last ablation and promptly stopped all medications and was able to begin a regular exercise regimen.

RESULTS: Orthostatic vital signs

6/5/2010: supine BP 116/80 HR 79 BPM, standing 120 BPM (on metoprolol, 50 mg BID)

3/4/2014: supine BP 108/78 HR 72 BPM standing 83 BPM (off medication).

Stress test (Bruce protocol)

6/5/2010: 6:20, 7 METS

3/4/2014: 7:42, 8.9 METS

CONCLUSIONS: The etiology of POTS is unclear, but several pathophysiological mechanisms have been postulated, to include hypovolemia, hyperadrenergic states and autonomic neuropathy involving the lower extremities. POTS can also be secondary, with DM being reported as a common cause. We were unable to find any reference associating POTS with VR. The temporal association of the resolution of the patient's symptoms, hemodynamics and functional capacity after treatment of the VR, strongly suggests that VR was the cause of the POTS. Although withdrawal of the medical therapy occurred subsequent to the treatment of the VR, this was due to symptom improvement, and would not explain the findings as the expected hemodynamic response to beta and calcium channel blocker withdrawal would be further tachycardia. Although DM has been reported as a secondary cause of POTS, it is unlikely that ablation would have had any reversal of the contribution of diabetes to the POTS. A plausible mechanism for VR causing POTS would be a rapid shift of blood into the lower extremities on standing producing a decrease in blood return to the right heart. This case suggests that VR may be an etiologic mechanism for POTS, and that treatment of the VR may relieve the symptom and hemodynamic manifestations of POTS. Further studies should be conducted to clarify the relation between VR and POTS.

PD14 Preservation of the great saphenous vein in the treatment of varicose veins by ASVAL: 10 years of follow-up

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OBJECTIVE: We perform the treatment of varicose veins by preservation of the saphenous vein in selected indications following the principle of the ASVAL method (Ambulatory Selective Ablation of Varices under Local anesthesia) since 2003. The results of this treatment have been published at mid-term but we wanted to evaluate the outcomes at longer term.

METHODS: We have retrospectively included the patients who underwent in our institute an ASVAL treatment for varicose veins with a refluxing great saphenous vein (GSV) between September 2003 and September 2005. We gathered the preoperative clinical and hemodynamic data and the preoperative diameter of the GSV at the saphenofemoral junction and at the thigh. The hemodynamic evolution, the varicose vein recurrence, the outcomes on symptoms and esthetics and the need of a redo surgical treatment were reviewed.

RESULTS: A total of 359 ASVAL procedures have been performed in 264 patients from 21 to 85 yrs (average 52,9 yrs) on 360 limbs. The limbs treated were classified C0 in 0 cases, C2 in 303 cases (84.2%), C3 in 24 cases (6.7%), C4 in 33 cases (9.2%), and C5 and C6 in 0 cases in the CEAP class C Classification. Preoperative symptoms were present in 63.3% of the cases. The GSV was refluxing in all cases preoperatively with an average diameter at 6.8 mm (median 6.5, ranged 3 to 15 mm). The average follow-up duration was at 59.8 months (median 46 months). The number of limbs available for follow-up was 211, 157, 130 and 89 at 24, 60, 84 and 120 months respectively. A redo surgical treatment was performed in 24 cases (at a mean time of 61.3 months) and consisted in a redo phlebectomy in 15 cases and a secondary stripping/ablation of the GSV in 9 cases. At 24, 60, 84 and 120 months after life table analysis, we observed freedom of GSV reflux in 71%, 69.7%, 68.5% and 64.4% respectively, freedom of redo surgical treatment in 96.9%, 90%, 83.6%, and 76.7% respectively, improvement of symptoms in 86.7%, 83.8%, 78% and 69.9% respectively, and improvement of esthetics in 92.2%, 86%, 77.2%, and 65.7% respectively.

CONCLUSIONS: The ASVAL treatment for varicose veins gives good clinical and hemodynamic outcomes at long term in selected patients, with a limited number of cases that needed a secondary surgical procedure, in accordance with the mid term results of ASVAL previously reported. However, the clinical improvements seem to decrease after 5 years of follow-up, especially for esthetics, which could reflect the natural evolution of the venous insufficiency.

PD15 Recurrent compression of the common iliac vein after stenting in post-thrombotic and may-thurner syndrome

M. A.F. de Wolf[1], T. van Vuuren[1], R. Kustjens[1], J. van Laanen[1], M. Barbati[2], H. Jalaie[2], R. de Graff[1], C. Wittens[1]; [1]Maastricht University Medical Centre, Netherlands; [2]University Hospital RWTH Aachen, Germany.

OBJECTIVE: PTA and stenting has been shown to be effective in both May-Thurner syndrome and iliofemoral post-thrombotic vein obstruction. Most patients show quick clinical improvement of symptoms, however a minority does not. Reasons for non-response to therapy can be a persistent venous outflow obstruction: stent re-occlusion, persistent residual compression of the stent itself or recurrent compression just proximally of the stent. In contrast to woven stents which are placed well into the vena cava, nitinol stents are generally placed exactly at the iliac confluence. Although placed accurately, recurrent obstruction can occur, due to the fact that the common iliac artery (CIA) "rolls" over the proximal edge of the stent. In this study we retrospectively assess the incidence of this phenomenon and its treatment options.

METHODS: Out of 517 patient's stented for chronic iliofemoral venous obstructive disease, 56 showed a non-complete stenosis resolution during standardized follow-up duplex ultrasonography (DUS) and were retrospectively evaluated. Patients with recurrent compression proximally to the CIV stent by the CIA were identified for further analysis. All patients were treated with self-expandable nitinol stents. Restenting was performed in patients who did not show a significant clinical improvement. Per-intervention images (multi-plane phlebography, IVUS, and cone-beam CT) and reports were reanalyzed to evaluate the cause of persistent compression.

RESULTS: A total of 13 out of 56 patients showed recurrent compression proximally to the CIV stent by the CIA during the follow-up period. Average age was 43±9 years, and 6 were female. Routine ultrasonography 1 day post-intervention had shown accurate stent position. The residual compression was diagnosed within a median of 28 days (0-544). Ten patients showed no clinical improvement after the primary stenting, none showed worsening of complaints. In 9 patients restenting was performed, which was technically successful in all cases. One patient refused further treatment. After restenting, 6 patients clinically improved. No stent thrombosis occurred due to the initial residual compression or after restenting.

CONCLUSIONS: Recurrent compression proximally to the CIV stent by the CIA is a relatively infrequent complication after deep vein stenting, using self-expandable nitinol stents. However, if present it can cause non-responsiveness to treatment. We recommend special attention is given to this clinical entity, using ultrasonography or other diagnostic means during follow-up. Alternative stent design might be indicated to counter this problem.

PD16 Some like it hot!

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OBJECTIVE: We sought to determine the optimal temperature at which to conduct radio frequency-stylet (RFS) ablation in incompetent perforating veins of the lower extremity, by comparing the success using three different temperatures; 85 degrees, 90 degrees, 95 degrees. With increasing temperature, the duration of the protocol was reduced.

METHODS: A retrospective study examined 639 procedures of incompetent perforator vein (IPV) closures in 255 patients with varying degrees of venous insufficiency that underwent radio frequency ablation from 2009 to 2015. Of the 255 patients who underwent office-based RFS ablation, 138 were female and 117 were male, with a mean age of 65 years. These patients had CEAP classifications ranging from C1-C6 (with 1-C1;5-C2; 57-C3; 119-C4; 4-C5; 75-C6). The location of the 639 IPVs was distributed between 485 in the calf and 154 in the ankle. 316 of these were done of the right leg. Patients who underwent the 85 degree centigrade temperature protocol during the first three years of the study had the RFS probe inserted into the perforator vein under ultrasound guidance. The probe was turned at 90 degree angles every 90 seconds for a total of 6 minutes of exposure time. For the next twelve months of the study, patients underwent the 90 degree centigrade protocol, which consisted of the RFS probe being turned every 60 seconds, for a total of 4 minute exposure time. For the next seventeen months of the study, patients underwent the 95 degree centigrade protocol, which consisted of turning the RFS probe every 45 seconds, for a total of 3 minute exposure time. All patients had comparative pre-operative and post-operative duplex scans. Post-operative duplex scans were performed three to five days after the procedure to determine the patency of the IPV. Successful obliteration was defined as lack of color flow on post-operative duplex scanning.

RESULTS: Table 1 demonstrates the results of the 85, 90, and 95 degree protocols. There were no statistical differences in age and gender distribution, CEAP, and diameter between successful and unsuccessful IPV closures

Conclusions: This study shows no significant difference exists in success rate with raising the temperature and shortening the time of the procedure. Thus, using the 95 degree centigrade protocol cuts treatment time in half.

PD17 Stent extension into a single inflow vessel is a valuable option after endophlebectomy

T. van Vuuren, R. Kurstjens, M. de Wolf, J. van Laanen, C. Wittens, R. de Graaf; Maastricht University Medical Center, Netherlands.

OBJECTIVE: Venous stenting in combination with endophlebectomy and creation of an arterio-venous fistula (AVF) can be performed in patients with severe post-thrombotic changes to facilitate inflow and optimize durable patency. Nevertheless, hybrid procedures suffer from restenosis, which might require re-intervention and stent extension into a single inflow vessel in certain cases. The aim of this study was to investigate whether venous stenting into one inflow vessel distal of the common femoral vein is safe and feasible.

METHODS: All patients with venous hybrid interventions performed between January 2011 and May 2015 were analyzed. Six weeks after intervention all patients were planned for temporary balloon occlusion of the AVF to evaluate venous inflow. When inflow was deemed insufficient, the AVF was not closed and additional stenting was performed into the dominant inflow vessel below the sapheno-femoral junction. Patency rates, complication rates, Venous Clinical Severity Score (VCSS) and Villalta scale were analyzed preoperatively and after additional stenting.

RESULTS: In our database 84 patients with a hybrid intervention were retrospectively assessed. Eight (10%) of these patients showed inadequate inflow to occlude the AVF and had additional stenting (mean age 45 years, 88% female). The primary patency rate of all additional stented patients was 63 % with a median follow up of 147 days. After stenting a 2 points median improvement of VCSS score and a 5 point reduction on the Villalta scale was seen. Minor complications e.g. post-procedural hematoma did occur in 2 patients.

CONCLUSION: Stenting below the femoral confluence into a single inflow vessel is a feasible bailout option if primary hybrid intervention fails. This additional treatment shows an acceptable patency and moderate to good improvement of clinical complaints. Future research should determine if primary stenting into a single inflow vessel below the femoral confluence might be a valuable alternative for endophlebectomy in a selective group of patients.

PD18 Structural characteristics of varicose widened gsvs in patients of different age groups

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OBJECTIVE: The aim of this study is to describe the varicose transformation of the venous wall in patients of different age groups.

METHODS: We studied 32 fragments of the GSV junction section, all of which had been taken during crossectomy and stripping of patients suffering from varicose veins. Group "A" consisted of 18 patients aged 60 and younger, group "B" comprised 14 patients older than 60. The study uses immunohistochemical research methods. We analyzed the following: smooth muscle fasciles for alpha actin after marking them, elastic elements after marking them with orcein, vasa vasorom (v.v.) for CD31, nervi vasorum (n.v.)

for CD31 after marking them, nervi vasorum (n.v.) after marking for synaptophysin immunopositive terminals. The results were analyzed expositorily on a 0-10 digital rating scale. Statistically we analyzed the results using the Spearman correlation coefficient and the Mann–Whitney U test.

RESULTS: In the "A"-group the median relative thickness (ME) of the internal layer of the smooth muscle fasciles was 2.9, with an interquartile range (IR) of 2.9-3.8, while in the group "B" ME was 9, IR ranging from 7 to 9. In the "A" group, the median relative thickness of the outer layer of the smooth muscle fasciles was 6.4, IR being 4-5, $p < 0,05$ The results regarding the orientation of the smooth muscle fasciles in the vein`s middle layer deviate from the data presented in today`s literature, according to which the internal layer of the smooth muscle fasciles of both normal and varicose veins is always longitudinal, whereas the outer layer is always circular [Handbook of venous disorders, 2009]. Our results suggest that in some cases the inner layer of smooth muscle fasciles may be transverse, longitudinal or oblique, while its outer layer may completely waste away. We established a moderate linear proportional feedback between a patient`s age and the relative quantity of elastic elements of their venous wall ($r=-0.49$, $p < 0,05$). In the "A"-group: ME = 4.5 with IR = 4-5, in the "B" group: Me = IR = 4.0, $p = 0.23$. In the "B"-group there is a tendency of increasing quantities and diameters of the v.v., mainly as a result of widened venules and venous capillaries. In the "A"-group Me = 2, IR being 1.25-2, in the "B"-group Me = 3, IR being 2-3, $p = 0.19$. The specimens show both longitudinal and transverse sections of synaptophysin immunopositive terminal groups ranging from 5 to 400 µM. This attribute shows a linear proportional feedback between the patient`s age and the duration of his disease ($r=-0.51,-0.49$, $p < 0,05$).

CONCLUSIONS: Elderly and old Patients suffering from varicose GSV`s show progressing hypertrophy of the inner circular layer of the smooth muscle fasciles and atrophy of the outer layer of the tunica media`s smooth muscle fasciles; only one or two types of three specific muscle layer veins can remain; the number of elastic fibers decreases; the number of v.v. increases at the expense of tunica externa venules and venous capillaries; the densitiy of nerve structures in the adventia and media decreases.

PD19 Therapeutic education combined with balneotherapy in lymphedema patients

P. H. Carpentier, B. Satger, D. Poensin; Grenoble University Hospital, France.

OBJECTIVE: Lymphedema is a chronic disabling condition whose prognosis strongly depends upon the ability of the patient to actively participate in his care. Our experience with therapeutic education in patients with advanced chronic insufficiency showed a synergistic effect with balneotherapy resulting in substantial improvement of health related behaviors, quality of life and health status [1, 2]. We report here the first results obtained with a similar program developed for patients with lymphedema

METHODS: The education program includes two education consultations before and after a course of three interactive workshops in small groups aiming at improving the knowledge and motivation of the patients, and six training session for auto-bandaging and auto-drainage. It is organized during a traditional thermal spa treatment course of 18 days with four balneotherapeutic sessions per day the patient attend for the treatment of their disease. It includes a systematic evaluation of the achievement of changes in health related behaviors, quality of life through a Lickert scale, and multi-level limb mensurations allowing the calculation of the limb volume. Subjects included in this study were the patients with ISL stage 2 or 3 lymphedema of upper or lower limbs, who volunteered to participate in the therapeutic education program on the occasion of their thermal spa treatment course.

RESULTS: Forty-four patients participated (42 women, 2 men, median age 65 years) were enrolled. At the end of the program, 96% of the patients thought it would help them deal better with their lymphedema. The mean reduction of limb volume was 151 (+26) ml. Three months after the treatment course, 87% had fully achieved at least one objective regarding their health behaviors and only 4% did not achieve any behavioral improvement; the quality of life was significantly improved (P).

CONCLUSIONS: These results are promising but have to be confirmed in a controlled study with longer follow-up.

PD20 Venous outflow obstruction as a major cause of pelvic congestion syndrome

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OBJECTIVE: The pelvic congestion syndrome (PCS) is widely seen as a synonym of ovarian veins(OV) reflux and as cause of chronic pelvic pain and dyspareunia. But these disease is more complex and present more overlooked and common signs and symptoms that together with a high variability in the anatomy of the valves and anastomosis of the pelvic veins make that the ovarian vein reflux become a marginal cause of the syndrome and the main cause is the hypogastric reflux due to venous outflow obstruction.

METHODS: Since April 2008 to August 2015 we diagnosed and treated 225 patients with PCS, 217 females and 8 males. The patients were evaluated with iliac and pelvic venography, 3D color RMI or Tomography and we record the clinical signs and symptoms and compare them between female patients with outflow obstructions or OV reflux by Chi square homogeneity test. The patients with (OV) reflux was treated with coils and foam embolization and the patients with obstruction with extended angioplasty without stenting that includes both iliocaval junctions and endovascular treatment of the leg varicose veins that includes a retrograde foam embolization of the pelvic floor veins trough the perineal branches, only in patients in those the symptoms remain we use coils embolization.

RESULTS: Of the total patients 198 present venous outflow obstructions (88%) and 27 OV reflux (12%) and if we take only the female 190 have venous outflow obstruction (87.6%) and 27 OV reflux (12.4%).After the treatment and with a follow up of 12 to 36 months the symptoms disappear un 92% of patients and improve in 4%.

CONCLUSION: The presence of chronic pelvic pain, dysmenorrhea and dyspareunia is highly associated with OV reflux as cause of PCS but if those symptoms are associated with the presence of "pelvic floor symptoms" or atypical leg varicose veins the origin of the disease is mainly a venous flow obstruction and this clinical presentation is present in 87.6 % of our female patients and in 100% of our male patients. Is accepted that the PCS incidence is around 8-10% of women taken the chronic pelvic pain as marker, but in our series just 54% of our patients present this symptom, in other words the real incidence of PCS maybe be the double. So the search and treatment of patients with PCS is not only a matter of relief symptoms but in addition is indicated because the venous outflow obstructions are highly associated with thromboembolic disease.

PD21 Venous wall remodeling in patients with deep vein thrombosis

A. J. Duke, A. Chandrashekar, J. Gerry, A. Gasparis, N. Labropoulos; Stony Brook University Hospital, Stony Brook, NY.

OBJECTIVE: Limited work exists on venous wall remodeling in patients with acute vein thrombosis. This study was designed to determine venous wall changes during acute deep vein thrombosis (DVT) and at a later postthrombotic stage of the lower extremities.

METHODS: This is a prospective controlled study of adult patients with acute DVT diagnosed by duplex ultrasound within a week of clinical presentation. A second group of postthrombotic patients that had an acute DVT >6 months prior were examined as well. Those with recurrent DVT in the ipsilateral limb, cardiorespiratory problems, terminal cancer, penetrating trauma, or significant inflammation affecting venous architecture were excluded. Venous wall thickness was measured using real time high definition zoom in all thrombosed venous segments and their corresponding contralateral limb segments with strict quality and selection criteria. Normal ipsilateral segments adjacent to the thrombosed ones were also included as control measurements. Venous segments at right angles with sharp wall definition using only a high resolution linear array transducer were included. The best acoustic window to give the sharpest wall image was obtained using multiple angles, heel-toeing the transducer, applying optimal pressure without reducing the lumen diameter, and avoiding slice thickness and off axis beam artifacts. In every venous segment, 3 different measurements were taken and the average value was used. The authors have previously performed extensive reproducibility studies on the venous wall measurements with low variability in healthy controls and those with chronic venous disease. This work is currently ongoing in patients with DVT

RESULTS: Fifteen patients (75 segments) with acute DVT and 8 postthrombotic patients (52 segments) were evaluated. Control measurements were obtained from 18 patients (100 segments). When compared to controls, venous wall thickness was greater in both the acute (0.640 vs 0.361 mm, $p < 0.001$) and postthrombotic (0.805 vs 0.361 mm, $p < 0.001$) vein segments. On average, acutely thrombosed segments were 1.77x thicker (range 1.62-1.97x) while those with chronic changes were 2.23x (range 1.75-2.94x) thicker than controls. Postthrombotic segments had a thicker vein wall compared to those with acute DVT (0.805 mm vs 0.640 mm, $p < 0.01$). The lumen/blood or thrombus interface was smooth in the acute DVT and mostly irregular with various degrees of thickening in the postthrombotic segments

CONCLUSIONS: Venous wall thickness increases significantly in all venous segments with acute DVT and at the postthrombotic stage. In the latter, the lumen/blood interface is more often irregular. Further work is needed to establish the time at which these changes occur, to determine if treatment affects venous wall remodeling, and to clarify whether such venous wall changes affect the patients' clinical outcome.

PD22 Modification of electronic medical records facilitates venous ulcer healing

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OBJECTIVE: Venous ulcers are painful, recurrent, and difficult to heal. Electronic medical records (EMR) often are not suited for wound care. Specialized wound care programs may not interface with office-based records, creating a need to standardize the process of venous ulcer measurement and dressing documentation within existing systems. This work describes creation of an EMR protocol to track venous ulcer size, standardize dressings, address related health issues, improve patient education, and then assess global wound healing.

METHODS: Retrospective review of a prospective database from 9/2014 to 6/2015 was performed. During this time we partnered with the institution to modify our Epic outpatient office record and create a venous ulcer patient list, a dressing tracker, calculation of ulcer area and graphic representation of the wound area. Patient education materials were created and loaded into an automatic end-visit print out. Quarterly meetings (3) with the supervising physician were established to review each patient's wound progress, target areas for improvement and document in Epic. Collaborations with internal medicine, bariatric surgery, plastic surgery, and vascular surgery were formed, and patients were referred to these providers through Epic.

RESULTS: Prior to the EMR advancements, 114 chronic CEAP 5 and 6 patients started the program 9/2014 (Q1) and this increased to 127 patients by 6/2015 (Q3). Enhancements in EMR were generated through 8 hours of vascular surgery and 50 hours of Epic support time. 17% of patients quit smoking and 28% decreased tobacco use. 15 were referred for nutrition counseling and weight loss, one was referred and one patient is scheduled for bariatric surgery. 15 underwent advanced arterial evaluation. Sclerotherapy procedures increased from 14% of patients (Q1) to 27% (Q3), ablations increased from 9% (Q1) to 15% (Q3). Patients with healed venous ulcers improved from 55% (Q1) to 74% (Q3).

CONCLUSIONS: A care model through internal EMR modification is possible and may be more comprehensive than wound care software. This enhanced patient care, increased communication between providers and facilitated patient tracking to improve ulcer healing. This work can serve as a model for cost-conscious improvement in overall patient health.

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