



WESTERN VASCULAR SOCIETY

27TH ANNUAL MEETING - PARK CITY, UT

SUNDAY, SEPTEMBER 23, 2012

7:15 a.m. CONTINENTAL BREAKFAST WITH EDUCATIONAL EXHIBITORS

7:45 a.m. **Call to Order and Announcements**
William J. Quinones-Baldrich, MD, President

8:00 a.m. **SCIENTIFIC SESSION I**
Presiding: William J. Quinones-Baldrich, MD

8:00 a.m. 1. **Results of a Prospective, Multicenter Trial with the Ventana Fenestrated System for Endovascular Repair of Juxtarenal and Pararenal Aortic Aneurysms**

William Quinones-Baldrich, MD¹, Andrew Holden², Renato Mortens³, Matt Thompson⁴, Alan Sawchuck⁵, Mathew Eagleton, MD⁶ and Daniel Clair, MD⁶

From: ¹Division of Vascular Surgery, UCLA Medical Center, Los Angeles, CA, ²Auckland City Hospital, Auckland, New Zealand, ³Escuela de Medicina, Pontificia Universidad Católica de Chile, Santiago, Chile, ⁴St. George's Institute, London, United Kingdom, ⁵Methodist Hospital, Indianapolis, IN and ⁶Cleveland Clinic Foundation, Cleveland, OH

Discussant: Timothy A. M. Chuter, San Francisco, CA

OBJECTIVE: Assess early and mid-term safety and efficacy of an off the shelf endovascular graft system (Ventana) in patients with para or juxtarenal aneurysms.

METHODS: After institutional review board approval, patients with infrarenal aneurysms adjacent to or involving the origin of one or both renal arteries were evaluated. Selection criteria included adequate access, non-aneurysmal infra-SMA neck length ≥ 15 mm, and renal stenosis $\leq 70\%$. Evaluation was done at discharge, one, six months, one year, and annually to five years. Core laboratory evaluation (CT) was done for assessment of device integrity, patency, migration, endoleak, renal perfusion, and aneurysm morphology.

RESULTS: Between 2010 and 2012, 6 centers enrolled 30 consecutive patients with juxta or pararenal aortic aneurysm. Patients (90% male, mean age 73 yrs.) had mean aneurysm sac diameter 5.8cm, infrarenal neck length 6mm, and infra-SMA neck diameter and length 24 and 26mm, respectively. A Ventana graft system with covered renal stents was implanted, preserving all visceral arteries. Complications included a compressed renal stent due to re-ballooning, and one extended renal cannulation time due to renal stenosis not seen on CT scan. Procedure time averaged 2 ± 1.5 hours. Mean hospital stay was 3.8 days. There was no (0-30 days) mortality. One intervention on day 26 for limb occlusion

was due to device kink. During follow-up (mean 8 months [1-16 months]), 3 non-aneurysm related deaths occurred. No rupture, conversion, stent fracture, migration, type 3 endoleak, or sac expansion was observed. Small type II endoleak are observed in 6 patients at 1 month and 3 patients at 6 months. One reintervention for renal stenosis due to initial renal stent under sizing was done at 7 months. A type IA endoleak and renal occlusion secondary to procedural device damage, lead to reintervention on day 52 and dialysis at five months.

CONCLUSIONS: The multicenter experience of the Ventana Fenestrated System supports its safety and mid-term effectiveness for the endovascular repair of juxtarenal and pararenal aortic aneurysm. This off-the-shelf, integrated system permits endovascular treatment of juxta or para-renal aortic aneurysms; however, further expanded clinical experience and longer-term follow-up are needed to more fully assess this device system.

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8:15 a.m. 2. **“Preloaded” Modification to the Trifurcated Technique for Hypogastric Preservation during Aortoiliac EVAR without Device Alteration**

Jason T. Lee, MD¹, Joshua I. Greenberg, MD¹, E. John Harris, Jr., MD¹ and Mark A. Farber, MD²

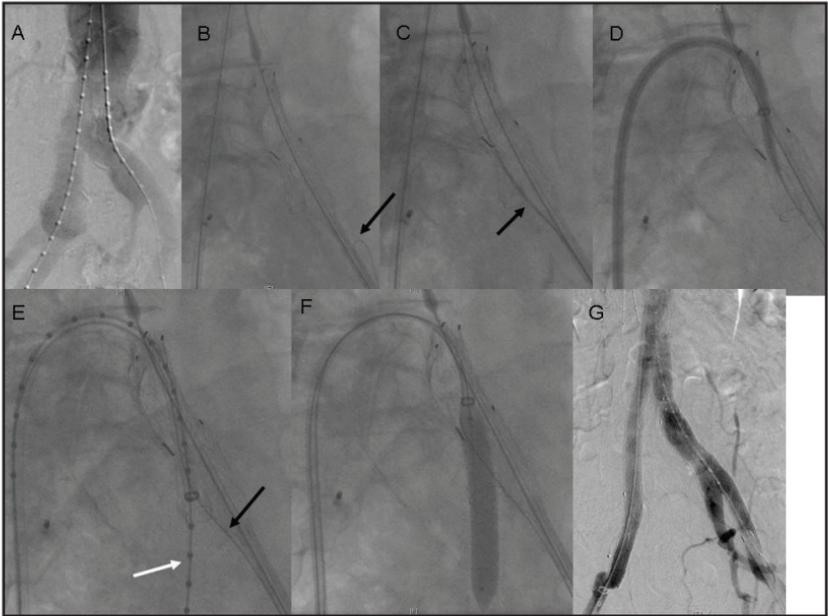
From: ¹Division of Vascular Surgery, Stanford University Medical Center, Palo Alto, CA and ²Univeristy of North Carolina, Chapel Hill, Chapel Hill, NC

OBJECTIVE: Due to lack of commercially available iliac branched devices, there have been descriptions of trifurcated techniques, homemade branch devices, and the double barrel/snorkel approach to preserve hypogastric flow during EVAR. We describe a novel technique mimicking a “preloaded” catheter to provide through-and-through wire access that eliminates the anatomic length restrictions of the aforementioned techniques, obviates the need for arm access, and can be performed without device modification.

METHODS: A 78 yo male with comorbid factors of prior stroke after an emergent CABG was found to have a 5cm AAA with bilateral 4cm iliac aneurysms and desired an endovascular solution (FIGURE A).

RESULTS: After R hypogastric embolization, a Gore C3 main body (23x12x120) was deployed into the left common iliac (B). The introducer sheath was doubly accessed, and a 4F glide catheter/wire was advanced alongside the distal portion of the undeployed ipsilateral limb into the left iliac aneurysm (BLACK ARROW). The contralateral gate of the C3 was catheterized to mimic a “preloaded” catheter (C). The wire was snared from the right and pulled out the right femoral sheath, providing through-and-through wire stability over the aortic bifurcation. A 12F sheath could then be easily advanced up and over and out the contralateral gate of the C3 device, pointed at the hypogastric origin (D). Leaving the through-and-through wire and 12F sheath in place, a shaped 7F sheath was advanced via a buddy wire/catheter (WHITE ARROW) into the left hypogastric (E). This triaxial strategy allowed easy advancement, positioning, and molding of a 10x59 iCast stent with a 14x40 balloon spanning the contralateral gate to the distal hypogastric landing zone (F). Once this “iliac branch device” was in place, a main body C3 was deployed infrarenal from the right side, and a bridging 27mm limb from the left joined the two main bodies. Completion angio confirmed no endoleak (G) and post-op CT-A demonstrated complete exclusion.

CONCLUSIONS: The modification of placing a “preloaded” catheter through the contralateral gate of the C3 repositionable main body deployed in the common iliac effectively creates an iliac branch device. Long-term followup will be necessary to confirm that this approach is durable and effective without the need for 2nd interventions.



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8:25 a.m. 3. **Physician Modified Endovascular Grafts: Early Report from an Investigator-Initiated Investigational Device Exemption (IDE) Clinical Trial**

Benjamin W. Starnes, MD and Billi Tatum, RN

From: Department of Surgery, University of Washington, Seattle, WA

Discussant: Stephen Cheng, MD, Hong Kong, China

OBJECTIVE: To determine whether a Physician Modified Endovascular Graft (PMEG) is a safe and effective method for treating patients with juxta-renal aortic aneurysms who are deemed unsuitable for open surgical repair.

METHODS: This is a non-randomized, prospective, consecutively enrolling IDE clinical trial approved by the U.S. Food and Drug Administration. Data collected on patients treated with PMEG between the initiation of the study in April 2011 and January 2012 were analyzed. All patients met strict inclusion / exclusion criteria as defined by the study protocol. All patients underwent pre-operative CTA and Visceral Duplex exams. Subjects were followed with CT, Visceral Duplex and 4-view X-Ray at 30 days, 6 months, 1 year and annually out to 5 years. The primary safety endpoint was defined as the proportion of subjects who experienced a major adverse event within 30 days of the procedure. The primary effectiveness endpoint was defined as the proportion of subjects experiencing treatment success.

RESULTS: During the eight month study period, 21 patients were consented and 18 underwent the PMEG procedure. 18 patients had 30 day follow up, 8 patients had 6 month follow up and none had one year follow up. 74% of the subjects were male. Anatomic, operative details and length of stay are listed in the table below.

	Aneurysm Diameter	Prox Neck Length	Manufacture Time	Procedure Time	Fluoro Time	Total Contrast	EBL	Length of Stay
Mean	65mm	4.8mm	59 min	166 min	45 min	65 cc	200cc	5.8 d
Range	55-91mm	2-11mm	31-78 min	96-378 min	19.7-164 min	30-120 min	20-1000cc	1.3-23.7d

There were 47 fenestrations created for 34 renal arteries and 13 superior mesenteric arteries (SMA). Renal artery fenestrations were stented whenever possible (94%) and SMA fenestrations were all left un-stented. There were no unanticipated adverse device events, no major adverse device events and only a single minor adverse device event treated with a successful re-intervention. At 30 days, there were no Type 1 or 3 endoleaks and only two Type 2 endoleaks. Two patients died during the study period, one at day 23 from respiratory failure and one at day 210 from urosepsis and CHF.

CONCLUSIONS: These preliminary data suggest that PMEG is a safe and effective procedure for managing patients with juxta-renal aortic aneurysms. PMEG has acceptable early rates of morbidity, mortality and endoleak. This endovascular aortic strategy is particularly appealing for those patients presenting with symptomatic or ruptured aortic aneurysms until reliable off-the-shelf solutions become widely available.

8:40 a.m. 4. **Endoleaks After Endovascular Repair of Ruptured Abdominal Aortic Aneurysm: Should They Be Treated?**

Brandon Tyler Garland, Elina Quiroga, Benjamin Starnes, MD,
Thomas Hatsukami and Nam T. Tran

From: Department of Surgery, University of Washington, Seattle, WA

OBJECTIVES: The management of ruptured abdominal aortic aneurysm (rAAA) has undergone significant changes within the last decade with endovascular repair now the preferred operative approach. We hypothesized that some endoleaks after endovascular repair of rAAA can be managed expectantly while others require urgent intervention to due to ongoing hemorrhage.

METHODS: In an IRB approved study, all patients admitted with the diagnosis of rAAA from July 2007 to December 2011 were entered into a prospectively maintained database. Patients with ruptured endovascular aneurysm repair (rEVAR) and computer tomographic angiography (CTA) performed within the first 30 days of repair were included in the analysis. Images were analyzed by attending radiologists for presence and type of endoleak as well as aneurysm size. Relevant patient's data such as hemodynamic status, hematocrit level, transfusion requirement, hospital length of stay, and outcome were analyzed.

RESULTS: 63 patients were identified who had undergone rEVAR with 34 of those patients having CTA performed within 30 days of the procedure. The mean age was 74.5 years with 79% males. Four type I endoleaks, one type III endoleak, and 7 type II endoleaks were identified. The overall endoleak rate was 35.2%(12/34). Two out of four type I endoleak required urgent re-intervention due to hemodynamic instability. The patient with type III endoleak was stable but had an increased in size of retroperitoneal hematoma and sac diameter on follow up imaging and thus underwent re-intervention. No type II endoleak required further intervention. At two years, all endoleaks except 2 out of 7 type II have resolved.

CONCLUSIONS: The rate of endoleak after rEVAR is higher than that reported for elective EVAR. Type II endoleak resolved spontaneously over time and should be managed conservatively. Conversely, type I and III endoleak can lead to continual rapid hemorrhage and should be intervene on. CTA should be performed on all patients that underwent rEVAR prior to discharge.

8:50 a.m. 5. **Determinants of Abdominal Aortic Aneurysm Sac Enlargement following EVAR with a Long-Term Follow-Up to 15 Years**

Carlos E. Donayre, MD, Faidzal Othman, MD, George E. Kopchok, BS, Ali Khoynzhad, MD and Rodney A. White, MD

From: Department of Surgery / Division Vascular Surgery, Harbor / UCLA, Torrance, CA

Discussant: Linda M. Reilly, MD, San Francisco, CA

OBJECTIVE: Studies have documented abdominal aortic aneurysm (AAA) enlargement in up to 41% of patients 5 years after endovascular repair (EVAR). Noting limitations of patient selection and length of follow-up, the current analysis was undertaken to assess AAA enlargement in an unselected patient cohort with followed for up to 15 years after repair.

METHODS: Between 1996 and 2011, 586 consecutive patients (mean age 73.9 ±9.0 years, 89.5% male, mean AAA diameter 58±12mm) underwent EVAR as part of an investigational device exemption study (“IDE”, 196 patients, 59%) or with a commercially available device (“CAD”, 137 patients, 41%). Centralized 3D imaging computed tomographic (CT) surveillance (M2S, West Lebanon, NH) was available in 333 (56%) of the patients over a median follow-up of 36 months (range 1 - 180 months). Multivariate and univariate Cox regression models were used to assess time to AAA enlargement (≥5 mm vs. baseline), estimating the hazard ratio (HR) and 95% confidence intervals (95%CI) for AAA enlargement compared to baseline.

RESULTS: The proportion of patients who developed AAA enlargement at 1, 3, 5, and 8 years after repair was 4.5%, 12.5%, 21.6%, and 31.7%, respectively (Figure), with a mean time to enlargement of 42 ± 38 months. Multivariable analysis identified age (HR 1.045; 95%CI 1.011-1.081; P=0.01) and common iliac diameter (HR 1.047; 95%CI 1.016-1.078; P=0.002) as predictors of enlargement. At 15 years, enlargement occurred in 57 (17.1%) patients with secondary interventions required in 25 (endovascular in 22 / open conversion in 3), and only 1 rupture occurred in this group of patients. Outcome in the IDE and CAD groups did not differ with respect to AAA enlargement or the frequency of secondary interventions.

CONCLUSION: This single-center, unselected patient cohort with long-term CT follow-up documented AAA enlargement in a smaller proportion of patients than has been reported in other series. Certain baseline patient characteristics can be identified that are associated with AAA enlargement, but the risk of enlargement did not differ in IDE versus CAD groups.

9:05 a.m. 6. **Case-Specific EVAR Simulation: A Pilot Comparison of Simulated Aneurysm Repair with Actual Live Cases**

Venita Chandra, MD², Robert Gowing, MD¹, Amy Peruzarro, BS² and Jason T. Lee, MD²

From: ¹Vascular Surgery, McMaster University Medical Center, Hamilton, ON, Canada and ²Stanford University Medical Center, Stanford, CA

OBJECTIVE: Patient-specific EVAR simulation has the potential to allow the operative team, particularly trainees, to rehearse an entire case on the patient's actual anatomy prior to performing the actual procedure. To better understand how closely outcomes of live cases measured up to simulated ones, we analyzed the operative metrics of EVAR simulations compared to previously performed cases.

METHODS: Four completed actual EVAR cases were selected at random to be "simulated". DICOM data from preoperative CTs were rendered into the PROCEDURE Rehearsal Studio system, and the simulated cases were performed by a similarly experienced operative team of faculty and fellows. In both the actual and simulated cases, interval times to critical steps were recorded as well as device components, repeat interventions, contrast amounts, and fluoroscopy times.

RESULTS: Compared to the actual live cases, metrics of the simulated cases including mean total OR time (69 min), fluoro time (22.8 min), and contrast usage (83.5mL) were similar. Using deployment of the contralateral limb was used as a surrogate for cannulation complexity, these times were significantly faster in the simulation group (completed at 39min vs 50.5min). Total number of device components utilized was similar, however main body and iliac limb diameters were frequently different, with iliac limb lengths equivalent. There was a higher incidence of type 1a endoleak in the simulated cases that required additional proximal ballooning (no cuffs) compared to the actual cases.

CONCLUSIONS: Rehearsal of actual EVAR cases is feasible using current simulation technology, with standard operative metrics replicated accurately in the simulation group. Certain steps were easier on the simulator indicating room for improvement in simulation technology, but overall procedural conduct of the cases was similar to live case timelines. The potential educational benefits and increased procedural efficiency to both trainees and experienced EVAR users requires further investigation.

9:15 – 9:45 a.m. COFFEE BREAK WITH EDUCATIONAL EXHIBITORS

11:15 a.m. §7. **An 18 year Experience Utilizing Distal Revascularization with Interval Ligation (DRIL) as the Primary Treatment for Hand Ischemia Following Dialysis Access Creation**

Rahim Aimaq, MD and Steven Katz, MD

From: Vascular Surgery, Huntington Memorial Hospital, Pasadena, CA

Proposed Discussant: Scott S. Berman, MD, Tucson, AZ

BACKGROUND: Arterial steal syndrome following angioaccess surgery can lead to potentially devastating complications. Past treatments either ensured loss of the newly created access by ligation or attempted salvage by increasing resistance within the fistula. None of these treatments proved to be entirely satisfactory. In 1994, we began to employ distal revascularization with interval ligation (DRIL) as our primary method of relieving hand ischemia following dialysis access creation. The following manuscript describes our experience with this procedure.

METHODS: After IRB approval, the charts of all patients undergoing the DRIL procedure for relief of hand ischemia following dialysis access surgery were reviewed. Patient demographics, risk factors, type of fistula and indications for operation were recorded. The clinical results of DRIL surgery as well as fistula and bypass graft patency were noted.

RESULTS: Between May 1994 and August 2011, 81 DRIL procedures were performed on 77 patients whose age ranged from 37 to 91 years (mean, 64 years). Thirty-two were male and 45 were female with diabetes present in 77.6%. DRIL procedures were performed for ischemic symptoms following 37 autogenous brachiocephalic, 30 prosthetic conduit and 14 autogenous brachiobasilic fistulas. Fistulas had a patency rate of 60.5% after the DRIL procedure with median follow up of 9.5 months. The DRIL bypass had a patency rate of 96.3% with median follow up of 12.4 months. Thirty-eight DRILs were performed for patients with ischemic pain, 20 for development of digital ulcers, 16 for development of hand neurologic symptoms, and 7 for digital gangrene. Complete resolution of symptoms was noted after 31 (81.6%) DRILs performed for ischemic pain, 18 (90%) for ulcers, 9 (56.3%) for neurologic deficits and 3(42.9%) for gangrene. No patient died within 30 days of operation.

CONCLUSION: The DRIL procedure is an effective treatment for symptomatic steal syndrome that preserves fistula patency and is associated with low peri-operative mortality. It is extremely effective in treating digital ulceration and ischemic rest pain, but is less successful in treating finger gangrene and neurologic deficits.

11:30 a.m. 8. **Placement of a Brachial-Accessory Hemiazygous AV Graft for Using the Gore Hybrid Graft**

Swee Lian Tan, MD PhD and Robert B. Osnis, MD

From: Department of Vascular Surgery, Swedish Medical Center, Seattle, WA

OBJECTIVES: To develop additional options for hemodialysis access after common sites for arterio-venous fistulae and grafts have been exhausted, but before resorting to higher risk sites, such as the vena cava and right atrium, we report on the use of a new hybrid stent-graft to access and secure an AV graft to a traditionally difficult-to-expose and fragile vein.

METHODS: We identified a patient suffering from end-stage renal disease with a failing cross-pubic femoral artery-to-external iliac vein graft with a history of multiple failed AV grafts and central venous occlusions. The patient was no longer a candidate for either peritoneal dialysis or renal transplant. A 9-mm Gore Hybrid graft was introduced into the hemiazygous vein percutaneously through a site at the base of the neck. After the stent portion of the graft was deployed in the vein, the graft was placed in a subcutaneous tunnel from the neck to the left brachial artery, where a conventional anastomosis was performed. In another patient, the same technique was used to implant an AV graft between the subclavian vein and the brachial artery.

RESULTS: The graft was successfully placed without complication, and dialysis pump speeds of 400 cc/min were achieved.

CONCLUSIONS: The Gore Hybrid graft has been primarily used to simplify and speed placement of AV grafts using conventional vessels. However, on patients where those vessels are no longer available, it can also be used on vasculature that has been considered too difficult or risky to use as a graft site using traditional surgical techniques.

11:40 a.m. 9. **Routine Genetic Testing Should Be Standard Of Care For Patients Receiving Oral Anticoagulants**

Karthik Kasirajan, MD¹ and Stephen Murray, MD²

From: ¹NMTC, Walnut Creek, CA and ²Providence Hospital, Spokane, WA

Discussant: Timothy K. Liem, Portland, OR

PURPOSE: A significant number of patients who receive anticoagulants experience major or minor bleeding events or continue to experience thrombotic complications. Boxed warning to the label of the two most commonly prescribed oral anticoagulants (clopidogrel and warfarin) inform physicians that genetic differences can reduce or augment drug effectiveness. They additionally include information on the available genetic tests; CYP2C19 status for clopidogrel and CYP2C9/VKORC1 status for warfarin. This study was undertaken to assess the incidence of gene variations that may influence patient response to both drugs.

METHODS: Molecular lab analysis was performed from 4 buccal swabs done on each patient. CYP2C19 (n=6664) test subjects were classified as normal, normal intermediate, intermediate, poor, rapid or ultrarapid metabolizers. CYP2C9 (n=6073) test subjects classified as normal, intermediate or poor metabolizers. VKORC1 (n=6066) test subjects were classified as low, intermediate, or high sensitivity.

RESULTS: Overall genetic variations that would affect clopidogrel efficacy were more common (n=4054[60.8%]) compared to normal metabolizers (n=2610[39%]). Poor and ultrarapid metabolizers accounted for 3% and 4% respectively. Genetic variations that would affect warfarin metabolism in the CYP2CP assay were noted in 1700 patients (28%). VKORC1 assay was non-intermediate (low and high sensitivity) in 3424 patients (56.5%).

Conclusion: A significant percentage of the patients on oral anticoagulants, especially clopidogrel have genetic variations that determine drug efficacy. Based on our study we would recommend that patients receiving drugs with a narrow therapeutic margin should have mandatory molecular profiling to best determine a safe, effective and individualized drug dosage.

Phenotype of genetic assay			
	normal	Poor/intermediate	Rapid/ultrarapid
CYP2C19	2610 (39.2%)	1954 (29.3%)	2100 (31.5%)
	normal	intermediate	poor
CYP2CP	4373 (72%)	1552 (25.6%)	148 (2.4%)
	low	intermediate	high
VKORC1	2672 (44%)	2642 (43.6%)	752 (12.4%)

11:55 a.m. 10. **Importance of Intravascular Ultrasound during Percutaneous Treatment of May-Thurner Syndrome**

Brian G. DeRubertis, MD, Wesley Lew, MD, Sinan Jabori, Andy Barleban, MD, Juan Carlos Jimenez, MD and Peter F. Lawrence, MD
From: Division of Vascular Surgery, UCLA School of Medicine, Los Angeles, CA

OBJECTIVE: May-Thurner (MT) compression of the left common iliac (LCIV) vein can present as unilateral leg swelling with or without associated DVT. This report describes our diagnostic approach (with emphasis on the importance of intravascular ultrasound), management, and outcome in these ptsBR>

METHODS: Retrospective analysis of all patients evaluated for MT from 2006-2011BR>

RESULTS: Twenty-seven pts who presented with unilateral left leg swelling were diagnosed with MT with (n=15, thrombotic) or without (n=12, non-thrombotic) associated DVT. All pts underwent duplex & contrast angiography, while IVUS was performed in 11 pts (83% of those with non-thrombotic MT). Mean age 42.9 yrs; 63% female; prior DVT, PE, and hypercoaguable state were each present in 25% of non-thrombotic pts and in 80%, 33%, and 53% of thrombotic pts, respectively. Pain & swelling were present in all pts, and venous claudication was present in 63%. At presentation, all non-thrombotic pts were CEAP class 3; thrombotic pts were class 3 (86.7%) or 6 (13.3%). Of the non-thrombotic pts, 4 were treated conservatively; 8 underwent LCIV stenting, leading to reduction/amelioration of symptoms in 87.5% & decreased CEAP score in 75%. For thrombotic pts, all but one underwent LCIV stenting (+/- lysis), resulting in alleviation/amelioration of symptoms in 100% and decreased CEAP score in 85.7%. Angiographic findings in non-thrombotic pts included LCIV stenosis, collateralization, and contrast stagnation in 91.7%, 83.3%, and 75% respectively. However, contrast angiography overestimated LCIV minimum diameter by 61% (7.0mm vs 4.2mm) and cross-sectional area 2-fold (104cm² vs 53cm²) relative to IVUS. Correction of LCIV compression in non-thrombotic pts was associated with a 3-fold increase in mean cross sectional area (53cm² to 166cm²). One-year primary patency (mean f/u 9.7mo) was 100% for non-thrombotic pts and 78.6% for thrombotic pts, with 100% secondary patency for both. Complications included two early re-occlusions (treated with re-intervention), no PEs or mortalityBR>

CONCLUSIONS: Excellent 1-year patency rates & significant reduction in symptoms and CEAP class can be attained with percutaneous intervention for MT syndrome. IVUS is essential for accurate diagnosis and stent sizing in pts with non-thrombotic MT syndrome.

12:05 p.m. Q & A Discussion

MONDAY, SEPTEMBER 24, 2012

7:30 a.m. CONTINENTAL BREAKFAST WITH EDUCATIONAL EXHIBITORS

8:00 a.m. SCIENTIFIC SESSION

Presiding: Joseph L. Mills, Sr., MD

8:00 a.m. §11. **Comparative Effectiveness of Endovascular and Open Surgical Revascularization in Diabetic Patients with “Critical Limb Ischemia” (Rutherford 5 And 6) Due To Severe Tibial Artery Occlusive Disease**

Luke X. Zhan, MD, PhD, Magdiel Trinidad-Hernandez, MD, David G. Armstrong, MD, PhD, DPM and Joseph L. Mills, Sr., MD

From: Department of Surgery, University of Arizona, Tucson, AZ

Discussant: Gregory J. Landry, MD, Portland, OR

OBJECTIVE: The original 1982 definition of “critical limb ischemia” (CLI) excluded patients with diabetes. While endovascular therapy (ENDO) has become the dominant revascularization method, its effectiveness for tibial disease compared to bypass surgery (OPEN) in diabetics with CLI is unclear. Assessment of revascularization outcomes is difficult in diabetics due to neuropathy, wounds and infection. We evaluated and compared outcomes in such patients using validated risk stratification schemes (Prevent III and FinnVasc) and the SVS Objective Performance Goals (OPGs).

METHODS: We studied 94 consecutive tibial/pedal interventions in 70 limbs of 59 diabetics with CLI who initially underwent either ENDO (n=37) or OPEN (n=33). Mean age was 69 yrs (Men: 64%), and all had tissue loss (Rutherford 5-6). We evaluated Prevent III and Finnvasc scores in both groups. We compared wound healing time (WHT) and major SVS OPGs, including 1-year amputation-free survival rate (AFS), major adverse limb events (MALE), and major adverse cardiac events (MACE).

RESULTS: Prevent III and Finnvasc pre-intervention risk scores were similar in both groups. Limb salvage rates and WHT were also comparable, but there was a trend toward faster WHT for OPEN. There were no significant differences between groups regarding AFS, MALE and MACE.

CONCLUSIONS: This is the 1st study to assess outcomes of tibial revascularization in diabetics with CLI using current risk stratification schemes and SVS OPGs. Both ENDO and OPEN met the target 1-year AFS SVS OPG of 70%, suggesting that with proper selection, each therapy is efficacious. Existing risk factor stratification scores are suboptimal predictors of amputation and major adverse events in such a heterogeneous group of patients. Important variables that influence therapy and outcomes such as patient factors (functional status, life expectancy), wound factors (presence, depth and location), infection (presence, severity and extent), conduit availability, target availability and outflow are lacking, suggesting the need for a new classification system for “CLI” in this growing subgroup.

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Risk stratification and comparison of outcomes with SVS Objective Performance Goals

	ENDO (N=37)	OPEN (N=33)	P value
Prevent III	5.39±1.97	5.24±1.87	0.7457
FinnVasc	2.16±0.83	2.52±0.91	0.088
1 year AFS	83.8%	69.7%	0.25
WHT (days, 95% CI)	227.4 (177.3 to 277.5)	174.6 (132.3 to 216.9)	0.18
MALE	43.2%	45.5%	1
MACE	2.7%	3.0%	1

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8:15 a.m. 12. **Axillary Branch Artery Aneurysms: A Rare Cause of Upper Extremity Ischemia in High Performance Athletes**

Jason T. Lee, MD, Venita Chandra, MD, Timothy McAdams, MD and Cornelius Olcott, IV, MD

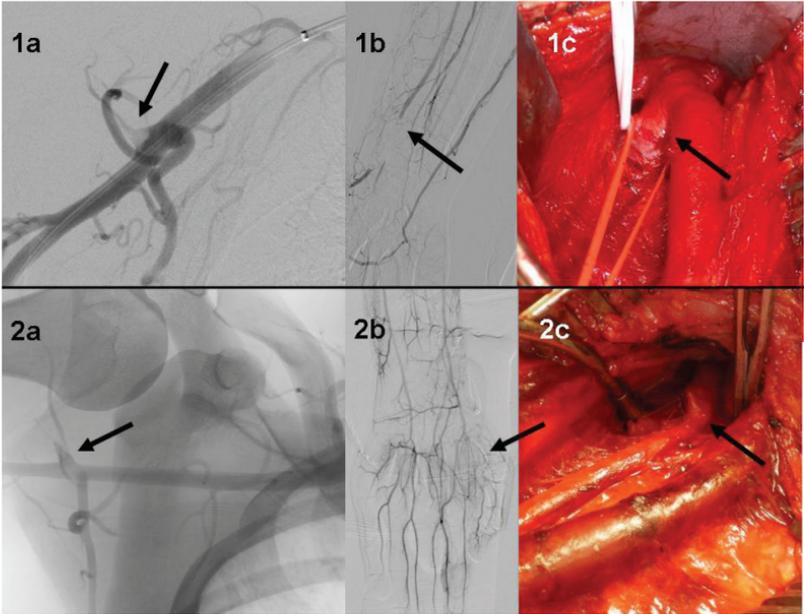
From: Division of Vascular Surgery, Stanford University Medical Center, Palo Alto, CA

OBJECTIVE: Axillary artery branch aneurysms (AABA) occur due to extreme repetitive upper extremity effort and can result in hand ischemia from embolic occlusion. Because these are found in otherwise healthy high performance athletes, the diagnosis is often missed or delayed. We describe two cases of AABA resulting in thromboembolism and hand ischemia in two nationally competitive athletes.

METHODS: Preoperative imaging and perioperative findings were reviewed in two cases.

RESULTS: A 57-year old senior USTA player in the national finals presented with right upper extremity paresthesias associated with diminished pulses and weakness after a vigorous match. The patient underwent upper extremity angiography and subsequent thrombolysis demonstrating a posterior circumflex humeral AABA (1a) that had embolized to his wrist (1b). Treatment with suture ligation (1c) and anticoagulation allowed him to recover without recurrent ischemia and he played in the national finals. A 17-year old starting quarterback for a Division I football program noted progressive thumb pain and ischemia over the last four games of his freshman season, necessitating wearing gloves and placing his hand in warm water after games. Angiography and CT-A confirmed a similar AABA (2a), and angiography confirmed embolization to digital arteries of the thumb (2b). He was treated with anticoagulation and similar ligation to prevent future embolic events (2c). He has returned to starting quarterback for his sophomore season.

CONCLUSIONS: These cases highlight axillary branch artery aneurysms resulting from recurrent upper extremity trauma and subsequent thrombosis and embolism to the hand/wrist. Treatment entails thrombolysis/anticoagulation and then ligation of the branch to prevent future embolic potential. A high index of suspicion for axillary artery pathology should be present when high performance athletes with repetitive overhead motions present with upper extremity arterial insufficiency.



NOTES

8:25 a.m. §13. Endoscopic Vein Harvest for Infra-inguinal Arterial Bypass

Sarah Wartman, MD, Gabriel Herscu, MD, Karen Woo, MD, Michael Morell, Vahagn Nikolian, Miguel Manzur and Fred Weaver, MD

From: Keck Medical Center of USC, Los Angeles, CA

Discussant: Juan Carlos Jimenez, MD, Los Angeles, CA

OBJECTIVE: Endoscopic harvest (EH) of saphenous vein for lower extremity bypass decreases length of incisions and was initially thought to decrease wound complication rates without adversely affecting patency. However, recent studies have shown lower patency without a wound complication benefit. We sought to further study the wound complication and patency rates of EH as compared to open harvest (OH) techniques in infra-inguinal arterial bypass procedures.

METHODS: Infra-inguinal bypasses performed between 2000 and 2011 were analyzed. Only procedures utilizing a single segment of great saphenous vein were included. Cases were grouped according to EH or OH. The two groups were frequency matched for body-mass-index (BMI) and diabetes. Baseline characteristics were compared. Univariate and multivariate analysis was performed as appropriate to determine correlation of baseline data and harvest method on patency.

RESULTS: Seventy-six bypasses were included in the study. Thirty-five were in the EH group and 41 in the OH group. Baseline characteristics between the OH and EH groups were not significantly different. Mean age was 72 in the EH group and 67 in the OH group. There was no significant difference in sex between the two groups. Mean follow up was 747 days. There was no significant difference between the EH and OH groups in 30-day wound complication rates (29% vs. 27%; $p = 0.86$), 3 year primary patency rates (47% vs. 49%, $p=0.82$) or 3 year primary assisted patency rates (88% vs. 76%, $p=0.2$). There was a trend towards increased secondary patency in the EH group (92% vs. 73%, $p = 0.053$). High BMI improved primary patency (HR 0.89; 95% CI 0.82, 0.97). Patients requiring hemodialysis had increased risk for loss of primary assisted patency (HR 12.05; 95% CI 3.19, 45.57) and secondary patency (HR 5.27; 95% CI 1.60, 17.34). This remained significant on multivariate analysis when accounting for type of vein harvest.

CONCLUSIONS: Overall, endoscopic vein harvest for infra-inguinal arterial bypass confers no additional benefit in wound complication or bypass patency rates when compared to open vein harvest. However, the possibility that bypass patency may be enhanced by EH in the non-hemodialysis population deserves further study.

8:40 a.m. 14. Outpatient Common Femoral Artery Stenting: Midterm Outcomes

Sam S. Ahn, MD, Monica J. Uceda, MD, Kenneth R. Kollmeyer, MD,
Craig A. Ferrara, DO and Pablo V. Uceda, MD

From: DFW Vascular Group, Dallas, TX

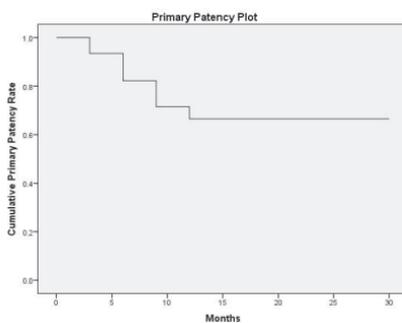
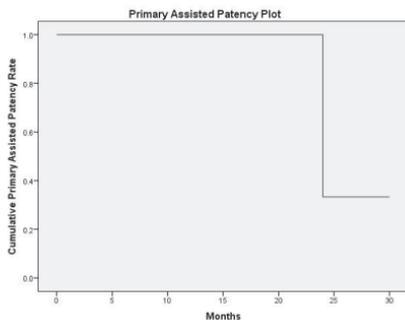
OBJECTIVE: Stenting of CFA lesions is controversial. The purpose of this study was to demonstrate the safety, efficacy and midterm outcomes of CFA stenting.

MATERIALS AND METHODS: From January 2009 to December 2011, 61 patients (mean age 67.28 ± 9.85) underwent CFA stenting in our outpatient office angi suite. From them, 29 (48%) were males and 32 were females (52%). The most common comorbidities were hypertension (91.8%), smoking (59%), hyperlipidemia (59%) and diabetes (39.34%). Indications for the procedure were moderate claudication (4.35%), severe claudication (50.72%), ischemic rest pain (37.68%) and nonhealing ulcer (7.25%). We retrospectively analyzed the outcomes of 69 CFA lesions by evaluating clinical improvement and patency.

RESULTS: Follow-up for clinical improvement showed 30 cases (44.12%) achieved the “markedly improved” Rutherford classification, 14 cases (20.59%) were “moderately improved” and condition worsened in 7 cases (10.29%).

The cumulative primary patency rate was 94% at 3 months, 82% at 6 months, 71% at 9 months and 67% at 12 months, remaining the same over 24 months. Cumulative primary assisted patency was 100% at 21 months. 13 (19%) cases were considered as failures. Concomitant vascular stenting in other vessels was performed in 58 cases (83.82%). Postoperative complications were present in only 1 (1.47%) case (groin hematoma). 20 stents (29.41%) subsequently were punctured without complications in order to achieve access for other endovascular procedures.

CONCLUSION: Stenting of CFA lesions with self-expandable stents is safe and effective in the outpatient office setting. Puncturing the CFA stent for subsequent endovascular access is also safe and effective.



8:50 a.m. 15. Clinical Consequence of Bare Metal Stent and Stent Graft Failure in Femoropopliteal Occlusive Disease

Shant M. Vartanian¹, Paul J. Johnston², Joy P. Walker¹, Sara J. Runge¹, Jade S. Hiramoto¹, Linda M. Reilly¹, Charles M. Eichler¹ and Michael S. Conte¹

From: ¹University of California, San Francisco, San Francisco, CA,

²Colorado Permanente Medical Group, Denver, CO

Discussant: Daniel M. Ihnat, MD, Salt Lake City, UT

OBJECTIVE: The optimal role for bare metal stents (BMS) and stent grafts (SG) in treating FPOD is as of yet undefined. Understanding the clinical consequences of failure can help guide initial treatment decisions. The goal of this study was to define the nature and frequency of adverse clinical events related to bare metal stent (BMS) and stent-graft (SG) failure in FPOD.

METHODS: This is a single institution retrospective review of the primary endovascular intervention for FPOD, treated with either a BMS or SG from 9/2007 through 10/2011. Patient demographics, indications for intervention, anatomic characteristics, procedural details, clinical outcomes and re-intervention details were reviewed. Patients were excluded if they had any previous lower extremity interventions or inadequate follow-up.

RESULTS: Of the 127 limbs from 97 patients that met the inclusion criteria, 67 were treated with BMS and 60 with SG. Follow up averaged 551 and 690 days for each group, respectively. The indication for intervention was similar between groups (% claudication 49% vs 68%, $p = 0.15$). Baseline patient characteristics were similar between groups, with the exception of more TASC D lesions (9/67 vs 26/60, $p < 0.01$) and CTO (18/67 vs 35/60, $p < 0.01$) in the SG group. Freedom from re-intervention of the index procedure was more likely with SG (28/67 vs 40/60, $p = 0.01$). For both groups, the indications for re-intervention of the index procedure were prompted by changes in symptoms or physical exam findings, rather than by abnormal findings on a surveillance ultrasound (9/39 vs 3/20). Only patients in the SG group presented with acute limb ischemia (0 vs 6, $p < 0.01$), however MALE was not different between groups (11 vs 10, $p = 0.9$). A total of 96 primary and secondary interventions were needed for the 127 limbs over the course of the study. Including both primary and secondary interventions, only patients treated with SG presented with ALI (0 vs 11, $p < 0.1$).

CONCLUSIONS: Re-interventions are common in both groups, however SG failure is more likely to present with ALI than BM stent failure. These observations should be carefully considered when treating femoropopliteal occlusive disease with either BMS or SG.

9:05 a.m. 16. Surgical Treatment of Lower Extremity Venous Aneurysms

Grant T. Fankhauser, MD¹, William M. Stone, MD¹, Richard J. Fowl, MD¹, Manju Kalra, MBBS², Peter Gloviczki, MD², W. Andrew Oldenburg, MD³ and Samuel R. Money, MD¹

From: ¹Division of Vascular Surgery, Mayo Clinic Arizona, Phoenix, AZ, ²Mayo Clinic, Rochester, MN and ³Mayo Clinic Florida, Jacksonville, FL

OBJECTIVE: Lower extremity venous aneurysms are rare. Their symptoms, diagnosis, and treatment are varied. The purpose of our study was to review our contemporary experience in managing these unusual entities and define the treatment options.

METHODS: A retrospective review from 1994 - 2011 was conducted at three geographically separate institutions. Basic demographics, diagnostic work-up, treatment, and follow-up were reviewed.

RESULTS: Fourteen patients with lower extremity venous aneurysms were identified and included for review. There were 4 male patients (29%) and 10 female patients (71%) with a mean age of 46 years (range 14 - 74). Of these 14 aneurysms, 7 (50%) were popliteal vein aneurysms, 3 (21%) great saphenous vein, 2 (14%) small saphenous vein, 1 (7%) common femoral vein (CFV), and 1 (7%) femoral vein (FV). Symptoms that led to diagnosis included pain (n=6, 43%), deep vein thrombosis (DVT) (n=4, 29%), palpable mass (n=2, 14%), aneurysm rupture (n=1, 7%), and knee injury (n=1, 7%). IVC filters were placed preoperatively in 2 patients with pulmonary embolism from popliteal DVT. All 5 patients with great/small saphenous vein aneurysms underwent excision. The 10 patients with popliteal, FV, or CFV aneurysms underwent aneurysmectomy with venorrhaphy (n=4), aneurysmectomy with interposition saphenous vein graft (n=4), or aneurysm excision with end-to-side anastomosis to the great saphenous vein (femoral vein, n=1). Surgical complications include 3 patients (21%) with hematomas requiring surgical evacuation, 2 (14%) post-operative thromboses requiring anticoagulation, and 2 patients (14%) with post-operative edema. 8 of 9 (89%) patients with venous reconstruction underwent imaging at a mean of 292 days postoperatively and all reconstructions were patent. There have been no recurrences to date after a mean follow-up of 483 days (range 6 - 3800). All patients with PE were anticoagulated for 6 months and those with DVT were anticoagulated for 3 - 6 months.

CONCLUSIONS: Lower extremity venous aneurysms are infrequently encountered and most often present with symptoms of pain or DVT. Rupture is rare but possible. Popliteal and saphenous vein aneurysms can present with DVT. Surgical options vary depending on aneurysm location and need for maintenance of vessel patency.

9:15 a.m.-9:45 a.m. COFFEE BREAK WITH EDUCATIONAL EXHIBITORS

9:45 a.m. 17. **Factors Impacting Follow-up Care After Placement Of Temporary Inferior Vena Cava Filters**

Elsie Gyang, MD, MSc, Mohamed Zayed, MD, PhD, E. John Harris, MD, Jason Lee, MD, Ronald Dalman, MD and Matthew Mell, MD, MS

From: Vascular Surgery, Stanford University, Stanford, CA

Discussant: Mark Sarfarti, MD, Salt Lake City, UT

OBJECTIVE: Rates of inferior vena cava filter (IVCF) retrieval have remained suboptimal, in part due to poor follow-up. The goal of our study was to determine demographic and clinical factors predictive of IVCF follow-up care in a university hospital setting.

METHODS: We reviewed 250 consecutive IVCFs placed with the intention of subsequent retrieval between March 2009 and October 2010. Patient demographics, clinical factors, and physician specialty were evaluated. Multivariate logistic regression analysis was performed to identify variables predicting follow-up care.

RESULTS: Of our cohort, 54% received follow-up care; of those, 95% had IVCF retrieval. Major indications for IVCF placement included: 1) prophylaxis for high risk surgery (49%) and 2) venous thromboembolic event with contraindication and/or failure of anticoagulation (42%). Follow-up care was less likely for patients discharged to acute rehabilitation or skilled nursing facilities ($p<0.001$), those with central nervous system (CNS) pathology (e.g. cerebral hemorrhage or spinal fracture) ($p<0.001$), and for those whose IVCF was not placed by a vascular surgeon ($p<0.001$). In a multivariate analysis, discharge home (odds ratio [OR], 4.0; 95% confidence interval [CI], 1.99-8.2; $p<0.001$), CNS pathology (OR, 0.46; 95% CI, 0.22-0.95; $p=0.036$), and IVCF placement by the vascular surgery service (OR, 4.7; 95% CI, 2.3-4.9; $p<0.001$) remained independent predictors of follow-up care. Trauma status and distance of residence did not significantly impact patient follow-up.

CONCLUSIONS: Service-dependent practice paradigms play a critical role in patient follow-up and IVCF retrieval rates. Nevertheless specific patient populations are more prone to having poorer rates of follow-up. Such trends should be factored into institutional quality control goals and patient-directed care.

10:00 a.m. 18. **The Efficacy of a Shortened Duration of Propranolol Therapy in the Treatment of Infantile Hemangioma**

Jason Q. Alexander, MD, Stephen Nelson, MD, Anna C. Griffin

From: Vascular Specialists of Minnesota, Minneapolis Heart Institute, Minneapolis Children's Hospital and Minneapolis Heart Institute Foundation at Abbott Northwestern Hospital, Minneapolis, MN

OBJECTIVES: Propranolol has been shown to be an effective treatment for symptomatic hemangioma of infancy. Current treatment regimens extend the duration of therapy from initial dosing until the patient reaches twelve months of age. Unfortunately, the side effects from treatment are common and often extend throughout the duration of treatment. Our goal is to determine if shortening the duration of treatment will be effective in managing infantile hemangioma.

METHODS: All patients under the age of thirteen months who presented to a multidisciplinary vascular anomalies center with a diagnosis of infantile hemangioma over an eighteen month period of time were prospectively treated with a shortened duration of therapy using oral propranolol. Patients were treated for sixteen to twenty weeks. If the hemangioma remained evident at the 16 or 20 week check, therapy was continued until the hemangioma was no longer evident.

RESULTS: Forty-nine patients were treated (33 female and 16 male). The average age at onset of treatment was 14 weeks (range 3-56). Average duration of treatment was 23 weeks (range 8-56). Twenty-three patients had treatment extended beyond 20 weeks because of failure of hemangioma resolution. Nine of the 49 patients (18%) developed recurrences. Four of the recurrences occurred in 26 patients treated for twenty weeks or less (15%). All of these patients responded to a second course of treatment extended to the patient reaching 12 months of age. Three of the 49 patients (6%) ultimately did not respond to propranolol treatment.

CONCLUSIONS: This study once again demonstrates the effectiveness of propranolol in the treatment of infantile hemangioma. In addition, a shortened duration of treatment, less than 20 weeks of therapy, is effective in patients who clinically resolve their hemangiomas during that time period. The recurrence rate for these patients is low. Those patients that do recur respond well to a second course of treatment. Shortening the course of treatment in these patients minimizes the impact of the side effects from propranolol.

10:10 a.m. §19. **Geometric Changes of the Inferior Vena Cava (IVC) in Trauma Patients Subjected to Volume Resuscitation - Insight into Dynamic Stresses Placed on IVC Filters**

Samuel L. Chen, MD, Thangavijayan Bosemani, MD, Sumudu Dissayanake, MD, Mayil S. Krishnam, MD, John S. Lane, III, MD and Roy M. Fujitani, MD

From: Department of Surgery, Division of Vascular and Endovascular Surgery and Division of Cardiovascular & Thoracic Imaging University of California, Irvine School of Medicine, Orange, CA

Discussant: Mark H. Meissner, MD, Seattle, WA

OBJECTIVE: Dynamic changes in the anatomic geometry of the IVC from changes in intravascular volume status may cause passive stresses on IVC filters. This study is to quantify the variability in IVC dimensions & anatomic orientation as influenced by intravascular volume changes to determine how it may impact complications of IVC filter placement including migration, tilting & perforation.

METHODS: Retrospective CT measurements of major & minor axis, and horizontal diameter of IVC at 1cm and 5 cm below the lowest renal veins(RV) in 58 adult trauma patients in hypovolemic and post-resuscitative states were assessed. IVC perimeter area and volumetric measurements were calculated and correlated with caval orientation.

RESULTS: The mean volumes of the IVC segment on initial & follow-up scans were 9.34 ml & 11.52 ml, respectively, with a mean increase of 51.5% ($p < 0.01$). At both 1 & 5cm below the RV, the IVC expanded anisotropically, with the minor axis expanding by an average of 53.3% ($p < 0.001$) & 31.3% ($p < 0.01$) respectively, while the major axis only changed by 4.9% ($p = 0.15$) & 6.8% ($p = 0.025$). Surface area & perimeter at 1cm below the lowest RV expanded by 67.5% ($p < 0.001$) & 11.2% ($p < 0.01$). At 5cm below, the expansion of surface area & perimeter was 44.2% ($p < 0.01$) & 11.4% ($p = 0.001$). The IVC orientation was left antero-oblique(LAO) in all patients. There was significant underestimation of IVC maximal diameter by horizontal measurement. With hypovolemia, at 1 & 5cm below the lowest RV, the discrepancy between the horizontal & major axis diameter was 2.60 ± 1.27 mm ($p < 0.001$) & 2.13 ± 1.35 mm ($p < 0.001$), respectively, while the post-resuscitation CT showed the same underestimation at 1cm & 5cm below the lowest RV, at 2.56 ± 1.25 mm ($p < 0.01$) & 2.38 ± 1.15 mm ($p < 0.01$), respectively.

CONCLUSIONS: There is significant anisotropic variability of the infrarenal IVC geometry with significantly greater expansive and compressive forces in the minor axis. There can be significant volumetric changes in the IVC with associated perimeter changes but the LAO caval configuration is always maintained. These significant dynamic forces is likely to impact IVC filter stability after implantation. The consistent obliquity may lead to underestimation of the IVC diameter used in anteroposterior venography and may influence initial filter selection.

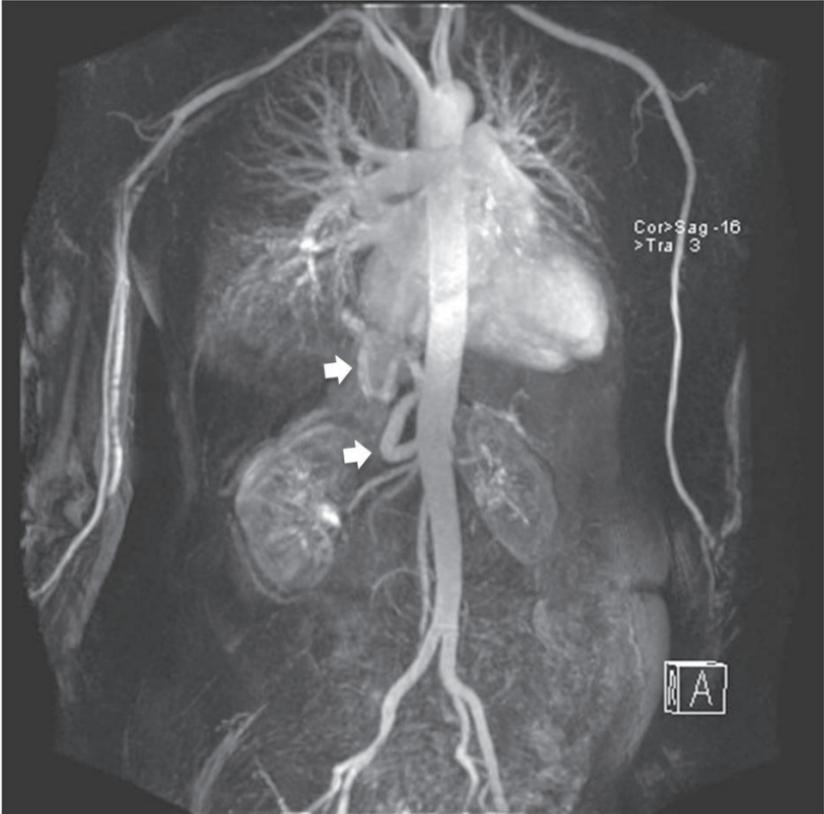
10:25 a.m. 20. Congenital, Meandering Transdiaphragmatic Aortocaval-Right Atrial Arteriovenous Fistula

Roy M. Fujitani, MD, Samuel L. Chen, MD, John S. Lane, III, MD and Mayil S. Krishnam, MD

From: Division of Vascular/Endovascular Surgery, University of California, Irvine School of Medicine, Orange, CA and School of Medicine, Division of Cardiovascular & Thoracic Imaging, Orange, CA

We present a unique case of a high flow, congenital aortocaval-right atrial arteriovenous vascular anomaly, which remained undetected until late adulthood. The patient is 66 year old white female with chronic, intractable rate controlled atrial fibrillation who presented with a chief complaint of new onset, nonfocal abdominal pain and fatigue. A CT angiogram subsequently demonstrated a large, tortuous, arterial conduit which originated in the paravisceral abdominal aorta just above the right native renal artery, traversing through the right hemidiaphragm and emptying into the suprahepatic inferior vena cava near its insertion into the right atrium. The vessel was further evaluated with Gadolinium-enhanced 3-dimensional magnetic resonance angiography (MRA), which measured the anomalous vessel to be 11mm at its aortic origin; averaging 10mm throughout its course with focal aneurysmal dilatation to 17mm at the focus of emptying into the IVC. Time-resolved MRA demonstrated 2.2L/min flow through the fistula, with a Qp/Qs ratio of 1.2. Chest radiography and echocardiography demonstrated marked cardiomegaly. Due to the high flow nature of the vessel and associated symptomatology, percutaneous transaortic and transcaval arteriovenous fistulography was performed. Test balloon occlusion of the conduit did not result in any adverse hemodynamic changes. The conduit was occluded with endovascular Amplatzer Vascular Plugs resulting in complete cessation of blood flow. Follow-up evaluation at one year found the patient to have full resolution of her atrial fibrillation and decreased pulmonary artery pressures.

To the best of our knowledge, this is the first description of a well-developed, congenital, high flow, trans-diaphragmatic, meandering arteriovenous conduit connecting between the paravisceral abdominal aorta and thoracic inferior vena cava-right atrium. The etiology of this anomalous vessel may be due to the failure of regression of a renal artery connecting the aorta to the embryologic mesonephros, which otherwise degenerated normally.



NOTES

10:35 a.m. 21. **Segmental Thermal Ablation of the Small Saphenous Vein (ssv) Using an Endovenous Heat Induced Thrombus (ehit) Classification System and Treatment Algorithm**

Juan Carlos Jimenez, MD, Peter F Lawrence, MD, Michael Harlander-Locke, BS, Brian G. DeRubertis, MD, David A. Rigberg, MD, Hugh A. Gelabert, MD and Steven A. Farley, MD

From: Vascular Surgery, UCLA, Los Angeles, CA and University of San Diego, San Diego, CA

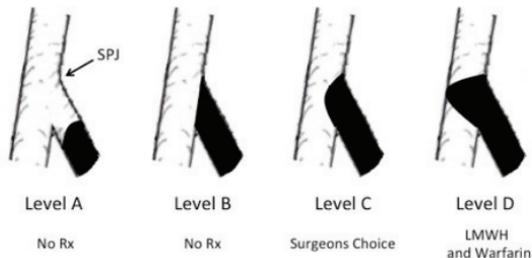
Discussant: Kathleen D. Gibson, MD, Bellevue, WA

OBJECTIVES: We evaluated our experience with segmental radiofrequency ablation (RFA) of the SSV, a less common procedure than great saphenous ablation, and developed a classification system and algorithm for EHIT, based on modifications of our prior algorithm of EHIT following great saphenous ablation.

METHODS: Endovenous ablation was performed on symptomatic patients with incompetent small saphenous veins following a minimum of 3 months of compression therapy. Demographic data, risk factors, CEAP classification, procedure details, and follow-up data were recorded. A 4-tier classification system and treatment algorithm was developed, based on EHIT proximity to the popliteal vein.

RESULTS: Sixty-two consecutive patients (23 M:39 F) (CEAP 3 = 38 limbs, 4 = 2 limbs, 5 = 3 limbs, 6 = 26 limbs) underwent RFA of the SSV between 10/2008 and 3/2012. Duplex ultrasound was performed between 24-72 hours post-procedure in all patients. Ablation was successful in 100% (69/69) of procedures. Fifty (81%) patients had level A closures, 10 patients (16%) had level B closures and were observed. Two patients (3%) had EHIT extending into the popliteal vein (level C) and were treated with outpatient LMWH anticoagulation. Thrombus retracted to the level of the saphenopopliteal junction (SPJ) in both patients at a mean of 12 days. No patient developed a deep vein thrombosis (DVT) (level D). Mean follow-up time was 7 months; no patient had small saphenous recanalization or DVT.

CONCLUSION: RFA of the SSV in symptomatic venous patients has a high success rate with a low risk of DVT. A classification system based on the level of EHIT in relationship to the SPJ is useful in managing patients. The approach to patients with thrombus flush with the popliteal vein or bulging has not been previously defined; our outcomes were excellent, using our treatment algorithm.



TUESDAY, SEPTEMBER 25, 2012

7:00 a.m. CONTINENTAL BRAKFAST WITH EDUCATIONAL EXHIBITORS

7:30 a.m. SCIENTIFIC SESSION

Presiding: Benjamin W. Starnes, MD

7:30 a.m. §22. **Custom Fenestrated Stent Graft Experience of Juxtarenal Abdominal Aortic Aneurysms at Two Canadian Teaching Hospitals**

Daniel Kopac, MD FRCSC and Joel Gagnon, MD FRCSC

From: Department of Surgery, University of British Columbia, Vancouver, BC, Canada

Discussant: Benjamin W. Starnes, MD, Seattle, WA

OBJECTIVE: To review the outcomes of fenestrated endovascular abdominal aortic aneurysm repairs using the Cook custom fenestrated endograft

METHODS: All patients between January 2005 and Dec 2011 and with short-necked or juxtarenal AAA treated with a fenestrated endovascular aneurysm repair (FEVAR) at two tertiary center teaching hospitals were retrospectively reviewed.

RESULTS: Twenty-five patients (23 male/2 female) with a mean age of 75 (S.D. 5.82) were included in the study. The thirty day mortality was 0%. A total of 69 fenestrations (44 renal artery, 19 SMA, 6 celiac artery) were required. There was a total of eight intraoperative complications with two type 1 endoleaks (one proximal and one distal), two type 3 endoleaks, and an unplanned occlusion of the right internal iliac artery. Two target vessels in separate patients (left renal artery, right renal artery) proved unable to be cannulated resulting in the occlusion of the left renal artery and a separate operation with brachial artery access to successfully cannulate and stent the right renal artery. One renal artery was perforated with a wire intraoperatively requiring coil embolization. The visceral vessel perfusion rate was 91% (63/69). The median follow-up time was 28.5 months (range 3-75 months). A total of twelve peri-operative complications were seen: five NSTEMI's, three episodes of worsening congestive heart failure, two instances of acute kidney injury responding to conservative therapy with intravenous fluid therapy, one incident of left limb occlusion at 20 days post-operatively treated with a femoral-femoral crossover graft, and one incident of bilateral groin wound infection treated with antibiotics. Three patients died during the follow-up period unrelated to their aneurysm. Four patients were lost to follow-up. Late complications were seen in five patients and included a recurrent type 1 endoleak requiring multiple interventions and eventual conversion to open repair with graft explantation.

CONCLUSIONS: Use of FEVAR for short-neck and juxtarenal abdominal aortic aneurysm repair appears safe with low morbidity and mortality in moderate volume centers.

7:45 a.m. 23. **Endovascular Treatment of Bilateral Carotid Artery Dissections Progressing to Pseudoaneurysms after Blunt Carotid Injury: A Case Report and Review of the Literature**

Danielle E. Cafasso, Stacey Wolfe, Tony Katras, Dwight Kellicut and Scott Golarz

From: Tripler Army Medical Center, Honolulu, HI

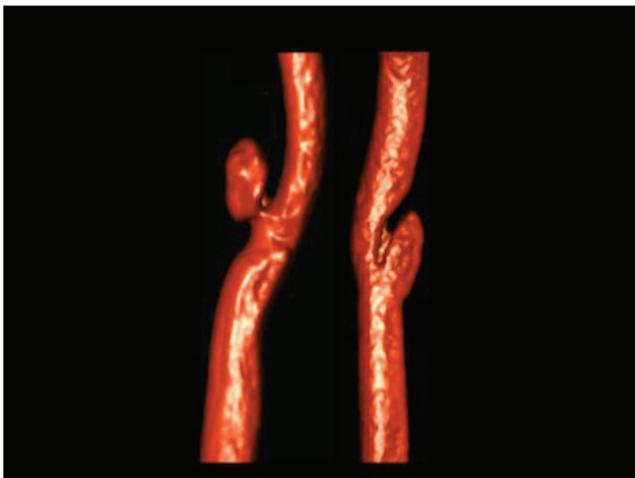
Sponsored by: Peter A. Schneider, MD, Honolulu, HI

OBJECTIVE: Recognition of carotid dissection after blunt carotid artery injury is increasing due to more aggressive screening protocols. Treatment of carotid dissections depends on the grade of the injury; however, controversy exists over appropriate treatment of concomitant pseudoaneurysms.

METHODS: We report a case of bilateral carotid artery pseudoaneurysms which developed 6 months after bilateral carotid artery dissection from a military helicopter crash, despite warfarin anticoagulation. Both pseudoaneurysms were located in the high cervical region, at C1. The left pseudoaneurysm was broad-based with 50% carotid stenosis, while the right was saccular. Anatomic location of the pseudoaneurysms made an open surgical approach extremely challenging; and expectant management in this young soldier was felt to carry significant risk.

RESULTS: After carefully weighing the risks and benefits to treatment, the patient was managed with a staged endovascular intervention using a covered Viabahn stent on the left side to occlude the aneurysm and reverse the stenosis, and coil embolization on the right side. Immediate and follow-up imaging shows no evidence of residual or recurrent aneurysm or stenosis.

CONCLUSIONS: We describe the treatment algorithm of this challenging case as well as present a review of the literature on pseudoaneurysms presenting after carotid artery dissection, to better delineate suggested management and endovascular options.



7:55 a.m. §24. **Compliance with Long-term Surveillance Recommendations Following Endovascular Aneurysm Repair or Type B Aortic Dissection**

Marcus R. Kret, MD, Amir F. Azarbal, MD, Erica L. Mitchell, MD, Timothy K. Liem, MD, Gregory J. Landry, MD and Gregory L. Moneta, MD

From: Department of Surgery, Oregon Health & Science University, Portland, OR

Discussant: Carlos E. Donayre, MD, Rancho Palos Verdes, CA

OBJECTIVE: Lifelong surveillance is recommended for both endovascular aneurysm repair (EVAR) and acute, uncomplicated type B thoracic aortic dissection, though compliance remains a significant challenge. We sought to determine factors associated with failure to obtain recommended surveillance.

METHODS: Patients surviving to discharge who received EVAR for thoracic or abdominal aortic aneurysms or medical management for type B dissections from 2004-2011 were reviewed. Primary endpoints were compliance with follow-up and need for re-intervention. Co-morbidities included coronary artery disease, CHF, hypertension, COPD, diabetes, and chronic kidney disease. Socioeconomic factors examined were age, gender, distance from hospital, discharge destination (i.e. home with or without home-health/family assistance, or skilled nursing facility), and insurance type. Complications included endoleak, sac expansion, endograft migration, infection or thrombosis, and aneurysm degeneration.

RESULTS: 157 patients, median age 72.5 years, were identified; 127 had EVAR and 30 had type B dissection. Median follow-up was 34 months. Overall, 48% were lost to follow-up, while 9% never returned for surveillance after initial hospitalization. Follow-up was compared for each of the co-morbidities and socioeconomic factors; none were found to significantly affect follow-up. The known complication rate was 31% (n=49), with re-intervention performed in 21% of EVAR patients, and crossover to intervention in 33% with dissection. All-cause mortality was 20% as determined by the Social Security Death Index.

CONCLUSIONS: Despite a significant rate of re-intervention in patients with EVAR and type B dissection, long-term compliance with surveillance is limited. In addition, predicting who is at risk of being lost to follow-up remains difficult. Coordinated protocols to capture EVAR and type B dissection patients for surveillance studies are needed to ensure optimal follow-up for these patients.

8:10 a.m. 25. **Creation of a Cross-pubic Venous Bypass in a Seven Year Old for Venous Claudication**

Edward Kang, Jason Q. Alexander

From: University of Minnesota, Minneapolis, MN

OBJECTIVE: Ameliorating venous hypertension in the pediatric patient population is complicated by a variety of factors. Non autogenous material is usually not favored as these materials do not allow for subsequent patient growth. Unfortunately, the patient's vessels are small and prone to spasm potentially leading to decreased patency. Here we demonstrate techniques used in a seven year old with severe venous claudication to combat these issues.

METHODS: A seven year old was referred to our Vascular Anomalies center due to worsening symptoms of venous claudication. Imaging suggested congenital absence of the right external iliac venous system. The patient was initially treated with aggressive compression therapy. Despite excellent compliance, the patient continued to have severe pain that prevented him from participating in daily school activities, notably physical education class. Because of these continued symptoms, autogenous venous reconstruction was offered in the form of cross pubic venous bypass.

Prior to operative intervention, non invasive vascular lab studies were performed demonstrating a 3mm, competent greater saphenous vein in the left leg. Prior experience with small veins in young patients prompted the use of a number of techniques to prevent vasospasm and maintain patency of the bypass. These techniques include soaking the vein with dilating agents, maintaining heparinized saline instillation within the vein throughout the course of the operation and placement of an arteriovenous fistula.

RESULTS: In three month follow up the patient's bypass graft remains patent and he is symptom free. The patient has since returned to school and is participating in usual activities including physical education class.

CONCLUSIONS: Cross-pubic venous bypass can be performed in the pediatric patient population even with a small greater saphenous vein. A number of adjunctive techniques may be beneficial in improving patency of the bypass.

8:20 a.m. §26. **Current Trends in Abdominal Aortic Aneurysms and the Impact of Trainees**

Marlin Wayne Causey, MD, Thomas Curry, Reagan Quan, Charles Andersen and Niten Singh

From: Surgery Residency, Madigan Army Medical Center, Ft. Lewis, WA

Discussant: Erica L. Mitchell, MD, Portland, OR

OBJECTIVE: The purpose of our study was to describe recent trends in abdominal aortic aneurysm repair, outcomes, and resident experience using a large population database.

METHODS: We queried the American College of Surgeons National Surgical Quality Improvement Program database (ACS-NSQIP, 2005-2010) for all open or endovascular repairs of abdominal aortic aneurysm. We analyzed current trends, 30-day outcomes, and the impact of trainees on these outcomes.

RESULTS: 13,681 patients met our inclusion criteria (81.5% male; mean age 73.6 years). 1368 repairs were open, 1580 (11.5%) were for rupture, and 31.1% of ruptures were repaired via endovascular approach (N=482). Trainees were present for 60.7% of cases and they were much more likely to be present for open (69.1%) repairs than EVARs (59.7%, $P<0.001$, Figure 1). In non-ruptured cases, the overall mortality was 1.6% and much higher with open than EVAR (9.3 vs. 1.4%, $P<0.001$). Complication and mortality rate however was unaffected by trainee involvement in nonruptured EVAR (12% and 1.4%; $P=0.69$ and 0.20 respectively) and with REVAR (50.8% and 21% vs. 28%, $P=0.91$ and $P=0.06$ respectively). On multivariate analysis, rupture was associated with a 2.5 fold increased risk of complication and 4.1 fold risk of death ($P<0.001$), EVAR had a protective effect (0.313, 0.396; $P<0.001$), and resident involvement had no impact on mortality ($P=0.45$) but was associated with a protective effect (0.702 95% CI [0.57- 0.86], $P=0.001$). With elective cases, mean operative time for EVAR was 155.6 minutes and was 23 minutes longer with a trainee involved in the case ($P<0.001$) and open repair averaged 267 minutes and was 41.8 minutes longer with trainees ($P=0.052$, Figure 2).

CONCLUSIONS: Current trends for AAA repair reveal an expected but remarkable increase in endovascular repair and higher mortality in open repair than historical series. Trainee involvement was associated with increased operative time and lower mortality in REVAR.

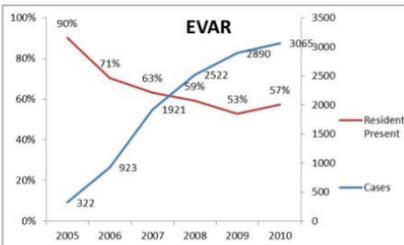


Figure 1. Endovascular Aneurysm Repair trend by year and percentage of resident participation.

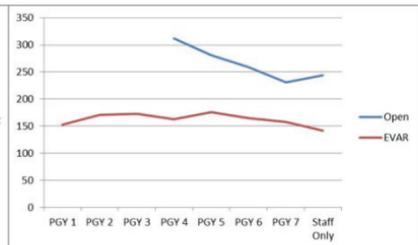


Figure 2. Operative time stratified by level of trainee involvement.

8:35 a.m. 27. Emboli Arising from Mural Thrombus on Dacron Grafts after Open Repair of Traumatic Thoracic Aortic Injury

Sharon Shiraga, MD and William Pevec, MD

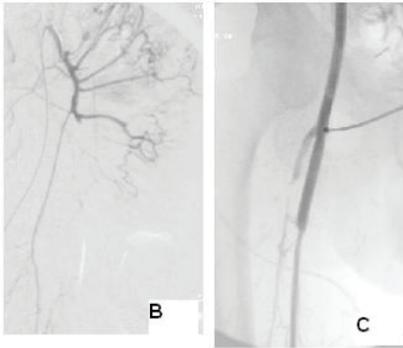
From: Department of Surgery, UC Davis Medical Center, Sacramento, CA

INTRODUCTION: Thoracic aortic thrombus is rare and can cause visceral and lower extremity thromboemboli. Thrombus of the thoracic aorta has been associated with atherosclerotic disease, hypercoagulable states, steroids, tumors, and aortic injury. There is no consensus on therapy. Thrombus on a Dacron interposition graft (DIG) after reconstruction of the thoracic aorta for blunt thoracic aortic injury (BTAI) has not been described. We present two patients whom we treated with thoracic aortic stent endografts and anticoagulation.

CASE 1: 27 year old man presented with abdominal pain, nausea, vomiting, and claudication. He was involved in a motor vehicle crash (MVC) 19 months prior when his BTAI was repaired with a DIG in the proximal descending thoracic aorta. His work up revealed ulcerated mural thrombus in the thoracic aortic graft (Image A) with emboli to the SMA (Image B) and lower extremities. Via a conduit sewn to the distal aorta exposed with a retroperitoneal approach, a Talent thoracic endograft was deployed across the DIG, covering the thrombus. The SMA embolism was treated with catheter directed thrombolysis, and the occluded lower extremity arteries were bypassed (Image C). Warfarin anticoagulation was initiated. Due to poor outflow, he required a left BKA at 3 months. He is doing well at 3 years.

CASE 2: 42 year old man developed sudden abdominal pain, 17 years after a MVC with a BTAI repaired with a DIG. His work up showed pedunculated mural thrombus in the thoracic aortic graft (Image D), with emboli to the spleen (Image E) and right kidney. A Cook TX2 endograft was deployed across the thrombus. Warfarin anticoagulation was initiated, with no further emboli at 5 months.

DISCUSSION: Thromboembolization after open repair of BTAI has not been described. Most patients with traumatic injuries lack long-term follow-up; the true incidence of this complication is unknown. Although anticoagulation alone has successfully treated embolizing thoracic aortic thrombus, recurrent emboli can be devastating. Endografts can prevent recurrent emboli, but risk intraprocedural emboli. When deploying the stent graft, manipulation of wires and catheters should be minimized, and post-dilation avoided. Adjuvant anticoagulation was used to prevent future thrombus, since the cause of thrombus formation was unclear.



8:45 a.m.-9:15 a.m. COFFEE BREAK WITH EDUCATIONAL EXHIBITORS

NOTES

9:15 a.m. §28. **Aortic Diameter Varies in Trauma Patients, a Function of Hemodynamic Status**

Venita Chandra, MD, Joshua I. Greenberg, MD, Paul Maggio, MD, Matthew W. Mell, MD and Jason T. Lee, MD

From: Vascular Surgery, Stanford Hospital and Clinics, Stanford, CA

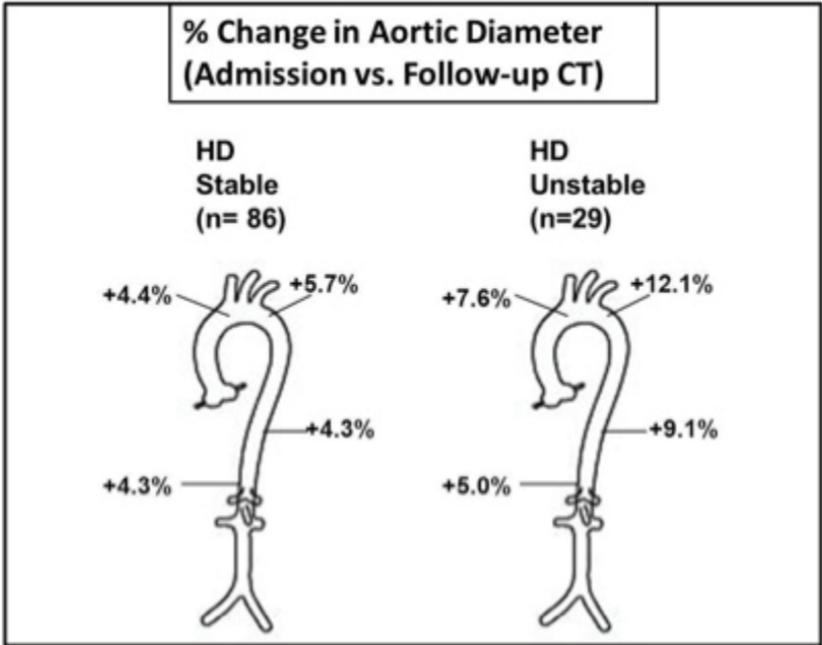
Discussant: Nam T. Tran, MD, Seattle, WA

OBJECTIVE: Accurate aortic measurements necessary for optimal EVAR and TEVAR can be affected by hemodynamic alterations. We analyzed aortic morphology in trauma patients during and after resuscitation to determine diameter differences and its association with hemodynamic status.

METHODS: An IRB-approved query of a Level I trauma registry identified all patients from 2008-2009 with an aortic CT-A on admission. Follow-up CT-As during the same hospitalization or in the midterm followup were compared. Orthogonal diameters were measured at four standardized levels: at the takeoff of the innominate (I), distal to the left subclavian (S), at the diaphragm (D), and at the celiac axis (C).

RESULTS: Out of 979 trauma patients with admission aortic CT-As, 115 patients (69% male, average age 47, average ISS 17) also had a follow-up CT-A after resuscitation to constitute the study population. Average admission aortic diameters were 28.9mm (I), 25.6mm (S), 21.7mm (D), and 20.3mm (C). Hemodynamic instability, defined as SBP110 or MAP<70, was present in 29 patients (25%) with a mean ISS of 27 (p<.001). The remaining 86 hemodynamically stable patients had a mean ISS of 12.0 (p<.001) On follow-up CT-A (median time to 2nd CT-A was 96 hours), significant differences in aortic diameters were found at each level in all patients (hemodynamically stable and unstable combined), with a mean change of +5.5% at the innominate, +8% distal to the left subclavian, +5.4% at the diaphragm, and +4.5% at the celiac trunk when compared to their admission CT (all p<.001). In the hemodynamically unstable patients, the follow-up aortic diameters demonstrated an even larger change at each level as compared to hemodynamically stable patients (FIGURE).

CONCLUSIONS: Significant differences exist between measurements taken at standardized locations of the aorta in trauma victims before and after their initial resuscitation. Worsening hemodynamics accentuate these differences, and can have important implications for endograft sizing. The timing of the trauma CT-A performed during a patient's workup and the expected diameter increases should be taken into consideration for appropriate oversizing of endografts during traumatic EVAR and TEVAR planning and execution.



NOTES

9:30 a.m. §29. **Midterm Outcome of Endovascular Repair of Ruptured Abdominal Aortic Aneurysm: What Happened to Patients That Survive?**

Gabriel Wallace, Elina Quiroga, Benjamin Starnes, Thomas Hatsukami and Nam T. Tran

From: Department of Surgery, University of Washington, Seattle, WA

Discussant: Steven W. Merrell, MD, Salt Lake City, UT

OBJECTIVES: Endovascular repair of ruptured abdominal aortic aneurysm (rEVAR) has been showed to improve operative outcomes as compared to open surgical repair. Follow up of these patients, however, is lacking. We aim to characterize the midterm outcome of ruptured abdominal aortic aneurysm (rAAA) patients who have been managed with endovascular techniques as compared to open surgical repair.

METHODS: In an IRB approved prospective study, we evaluated all patients with rAAA admitted from July of 2007 to February 2012 that survive to hospital discharge. Outcome data such as hospital length of stay, destination at discharge, survival, type of surgical procedure, present of hypotension, and demographics were evaluated using linear regression and multivariable analysis models.

RESULTS: A total of 118 patients were admitted to our facility with the diagnosis of rAAA. 8 patients underwent comfort care and 4 died in the operating room prior to repair. Of the remaining 106 patients, 43 patients had open repair and 63 were done with endovascular technique. 72 patients survived to discharge with 48% (21/43) in the open surgical group and 81% in the endovascular group (51/63). Average length of stay (LOS) was 12.3 days for the endovascular group and 24.6 days for the open group ($p=0.002$). Of those that survive to discharge, 51% (37/72) went home and 49% (35/72) were discharge to a skilled nursing facility. The majority of endovascular patient were discharged to home at 65% (33/51) versus only 19% (4/21) in the open repair group. 20 patients died since their discharge from the hospital with 7 out of those 20 patients died within 30 days after discharge. Overall, the follow up rate was 72% (59/72) with 13 patients lost to follow up with an average length of follow up of 22.8 months. Multivariable regression analysis showed that only the type of procedure performed (endovascular) is predictive of the discharge destination. Survival at midterm follow up was independent of types of procedure performed and discharge destination.

CONCLUSIONS: The introduction of rEVAR has resulted in improvement of the in hospital survival of patients with rAAA with more patients able to be discharge to home as compared to open surgical repair. At midterm follow-up, however, the survival rate of rAAA patients was comparable between rEVAR and open surgical repair.

9:45 a.m. 30. **Ten-year Results of Endovascular Abdominal Aortic Aneurysm Repair (EVAR) from a Large Multicenter Registry**

Robert Chang, MD¹, Philip Goodney, MD², Lue-Yen Tucker³, Steven Okuhn, MD⁴, Hong Hua, MD⁴, Ann Rhoades, RN⁵, Nayan Sivamurthy, MD⁶, Bradley Hill, MD⁶

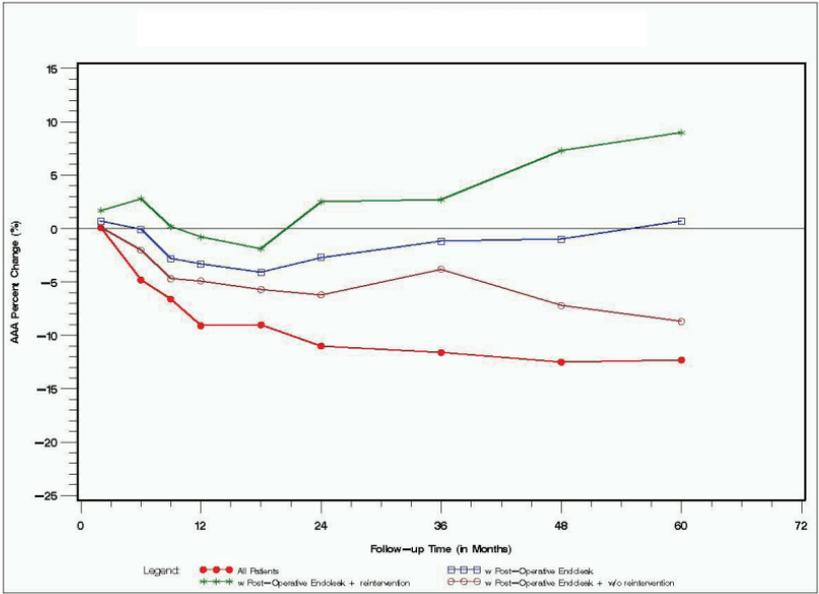
From: ¹Vascular Surgery, The Permanente Medical Group, South San Francisco, CA, ²Dartmouth-Hitchcock Medical Center, Lebanon, NH, ³Division of Research, The Permanente Medical Group, Oakland, CA ⁴The Permanente Medical Group, San Francisco, CA, ⁵Kaiser Permanente, Oakland, CA, and ⁶The Permanente Medical Group, Santa Clara, CA
Discussant: Fred A. Weaver, MD, Los Angeles, CA

OBJECTIVE: To assess long-term outcomes after EVAR in an integrated health care system

METHODS: Between 2000 and 2010, 1736 patients underwent EVAR at 17 centers. Demographic data, comorbidities and outcomes of interest were collected. Primary outcomes were mortality and aneurysm-related mortality (ARM). Secondary outcomes were change in aneurysm sac size, endoleak status, major adverse events and reintervention.

RESULTS: Overall, mean age was 75 years, 86% were male and 82% were Caucasian. 90% of cases were elective, and urgent use of EVAR increased from 7% in the first five years to 12% in the latter five years of the study period. Mean aneurysm size was 5.8 cm. Patients were followed for an average of 3 years (range 1-11 years); 8% were lost to follow up. Intraoperatively, 5% of patients required adjunctive maneuvers for endoleak, fixation or flow-limiting issues. The 30-day mortality rate was 1.2%, and the perioperative morbidity rate was 6.6%. Intraoperative type I and II endoleaks were uncommon (2.3% and 9.3%, respectively.) Life-table analysis at 5 years demonstrated excellent overall survival (66%) and freedom from ARM (97%). Postoperative endoleak was seen in 30% of patients and was associated with an increase in sac size over time (Figure). Finally, the total reintervention rate was 15% including 91 (5%) revisional EVAR. The overall major adverse event rate was 8% and decreased significantly from 12.3% in the first five years to 5.6% in the second five years of the study period ($p < .001$). Overall ARM was worse in patients with postoperative endoleak (4.1 % vs.1.8%, $p < .01$) or undergoing reintervention (7.6% vs. 1.6%, $p < .001$).

CONCLUSIONS: Results from a real-world EVAR registry in an integrated health care system demonstrate favorable perioperative outcomes and excellent long-term clinical efficacy. However, postoperative endoleak and need for reintervention continue to be challenging problems for patients after EVAR.



NOTES

10:00 a.m. 31. **Intra-Procedural and Post-Procedural Transarterial Sac Embolization for Type 2 Endoleak**

William Quinones-Baldrich, MD, Wesley Lew, MD and Andrew Barleben, MD MPH

From: Vascular Surgery, UCLA, Los Angeles, CA

OBJECTIVES: Persistent type 2 endoleaks (T2E) affect up to one-third of patients undergoing EVAR and one-third or more of these patients will require intervention. We present a novel technique available both intra-procedurally and post-procedurally in order to prevent or treat persistent type 2 endoleaks.

METHODS: This cohort represents a single-center and single-surgeon experience where trans-arterial sac embolization (TASE) for T2E was performed. Patients upon completion angiogram for EVAR with a large T2E, or for T2E's noted on surveillance CT scan with enlarging aneurysms had placement of a catheter beyond the iliac limb of a deployed endograft from groin access. Contrast was then infused into the sac to corroborate the presence of a T2E and subsequently a thrombin and gelfoam slurry with contrast was infused into the aneurysm sac. Since 2006, a total of thirteen patients have undergone TASE for both intra-procedural and post-procedural T2E.

RESULTS: Eight patients (61.5%) underwent intra-procedural TASE and 5 (38.5%) patients have undergone post-procedural treatment. The median follow-up is 12 months (0.0 - 51.3 months); 11.0 months for the intra-procedural arm (0.5 - 30.6) and 13.6 months for the post-procedural group (0.0 - 51.3). No patients have had further growth of their aneurysm. Three (23.1%) patients had stable aneurysm size, seven (53.8%) patients have had decrease in aneurysm diameter, one patient had continued aneurysm growth but was found to have a type 4 endoleak upon re-exploration, one patient had a recent TASE and one patient was lost to follow-up. No spinal embolization, distal embolization, ruptures, or systemic complications occurred during TASE.

CONCLUSIONS: We present an innovative technique of sac access and embolization during and post EVAR placement to treat intra-procedural and post-procedural endoleaks. Further study is required to evaluate safety, efficacy and potential cost-savings.

10:10 a.m. 32. Failure to Prevent Aneurysm Rupture Despite Early Diagnosis

Matthew W. Mell, MD, Mark A. Hlatky, MD, Jacqueline B. Shreibati, MD and Laurence Baker, Ph.D.

From: Department of Surgery, Stanford University, Stanford, CA

OBJECTIVE: Screening and surveillance is paramount in the management of small abdominal aortic aneurysms (AAA). Gaps in surveillance after early diagnosis may lead to unrecognized AAA growth, rupture, and death. This study investigates the prevalence and factors associated with rupture of previously diagnosed AAA.

METHODS: Data was extracted from Medicare claims for patients who underwent AAA repair from 2006 to 2009. All relevant preoperative abdominal imaging exams were tabulated 5 years prior to AAA repair. Repair for ruptured AAA was compared with repair for intact AAA for those with early diagnosis, which was defined as at least one image greater than six months prior to surgery. Gaps in surveillance were defined as no image within one year of surgery or no imaging for more than a two-year time span. Hierarchical logistic regression was used to examine independent predictors of rupture despite early diagnosis.

RESULTS: Of 15,770 patients who underwent AAA repair, 1272 (8.1%) had repair after rupture. Of those with ruptured AAA, more than one-third (34.7%) had abdominal imaging greater than six months prior to rupture, compared with 61.1% for intact repair. For patients with early diagnosis, those with ruptured AAA were older (80.2 +/- 6.9 vs. 77.6 +/- 6.2, $p < .0001$), received fewer images prior to repair (5.7 +/- 4.1 vs. 6.5 +/- 3.5, $p = .0001$), were less likely to be treated in a high-volume hospital (45.4% vs. 59.5%, $p < .0001$), and were more likely to have had gaps in surveillance (47.4% vs. 11.8%, $p < .0001$) compared with those with intact repair. After adjusting for medical co-morbidities, gaps in surveillance remained the strongest predictor of rupture by multivariate analysis (OR 5.97, 95% CI 4.77 - 7.48, $p < .0001$) (TABLE).

CONCLUSIONS: Despite early diagnosis of AAA, many operative candidates go on to rupture prior to repair. Improved mechanisms for surveillance are needed to prevent rupture and assure timely repair for patients with AAA.

Predictors of Rupture Despite Early Diagnosis

Variable	OR	95%CI	p-value	
Female gender	1.12	0.88–1.43	0.36	
Age at repair (per decade)	1.65	1.36–1.98	<0.0001	
Gaps in surveillance	5.97	4.77–7.48	<0.0001	
Hospital AAA volume	Low	2.60	1.41–4.81	0.002
	High	0.68	0.54–0.86	0.002
	Moderate	1.0	Referent	
Rural residence	1.14	0.89–1.44	0.30	
Medicaid-eligible	1.37	0.93–2.00	0.12	
Congestive heart failure	0.94	0.57–1.53	0.79	
Chronic lung disease	0.86	0.67–1.10	0.22	
Diabetes	0.64	.043–0.96	0.03	
Cancer	1.04	0.52–2.10	0.91	

Adjusted for race, teaching hospital status, medical co-morbidity, and year of repair.

10:20 a.m. 33. **Multi-branched Endovascular Repair of Thoracoabdominal Aortic Aneurysm: Broadly Applicable or Niche Technique?**

Warren J. Gasper, MD¹, Linda M. Reilly, MD¹, Joseph H. Rapp, MD², S. Marlene Grenon, MD², Jade S. Hiramoto, MD¹, Julia D. Sobel, BS¹ and Timothy A. M. Chuter, DM¹

From: ¹University of California, San Francisco, San Francisco, CA and ²San Francisco Veterans Affairs Medical Center, San Francisco, CA

Discussant: Jerry Chu-Lih Chen, MD, Vancouver, BC, Canada

PURPOSE: To estimate the prevalence of anatomy appropriate for multi-branched endovascular repair (MBEVAR) of thoracoabdominal aortic aneurysm (TAAA) as an indication of the potential scope of the technique.

METHODS: Review of 3-dimensionally reconstructed (TeraRecon® software) computed tomographic angiograms (CTA) of a consecutive series of patients referred for treatment in a prospective trial of MBEVAR for TAAA.

RESULTS: CTA images from 253 potential patients were reviewed. 50 TAAA did not meet minimum diameter inclusion criteria. 23 (11%) were anatomically unsuitable due to uncorrectable access issues and/or issues with the renal/visceral branches (aneurysm, dissection, multiplicity). Few patients were excluded for a single anatomic finding. 138 (68%) were anatomically suitable. 42 (21%) were made anatomically suitable using a variety of open and endovascular adjunctive procedures, performed at the time of definitive repair (n=6) or staged (N=36), mean interval 38±24 days. 26 patients required iliac conduits, either alone (N=22), or in combination with another adjunctive procedure (N=4). 12 patients required renal artery stenting (4 unilateral, 5 bilateral) and/or visceral artery stenting (N=4), alone (N=8) or in combination with other adjunctive procedures (N=4). 3 patients each underwent carotid-subclavian bypass, endovascular TAA repair or complex multi-component procedures. Of the 180 (89%) who were anatomically suitable or were made to be so, 101 patients have been treated, 88 using the down-going branch technique, 13 with a combination of down-going and up-going branches, and/or fenestrations. 91 procedures were performed using standard profile devices (22 Fr); 10 recent procedures utilized low profile devices (18Fr). All procedures were technically successful, with the sole exception of one renal branch that could not be inserted, confirming the determination of appropriate anatomy. The remaining 79 patients await treatment, declined treatment after complete assessment, or never completed physiologic assessment.

CONCLUSIONS: Very few patients lack or cannot be provided with the anatomic substrate for successful MBEVAR of TAAA. The most common adjunctive procedure (iliac conduit) has become less frequent since the development of low-profile devices.

10:35 a.m. Q & A Discussion

10:45 a.m. Meeting Adjourns