



WESTERN VASCULAR SOCIETY

26TH ANNUAL MEETING - KAUAI, HI

SUNDAY, SEPTEMBER 18, 2011

- 7:15 a.m. CONTINENTAL BREAKFAST WITH *Kauai Ballroom*
EDUCATIONALS PONSORS *Promenade*
- 7:45 a.m. Call to Order and Announcements
Ronald L. Dalman, MD, President
- 8:00 a.m. SCIENTIFIC SESSION I *Kauai Ballroom*
Presiding: Ronald L. Dalman, MD
- 8:00 a.m. 1. Gender-based Differences in the Inflammatory Profile of
Peripheral Arterial Disease and their Association with
Outcomes of Lower Extremity Vein Bypass
Jade S. Hiramoto, MD¹, Christopher D. Owens, MD², Ji Min Kim²,
Michael Belkin, MD³, Mark A. Creager, MD³, Michael S. Conte, MD²
¹Division of Vascular Surgery, UCSF, San Francisco, CA, ²San Francisco,
CA, ³Boston, MA
Discussant: Michelle Mueller, MD, Salt Lake City, UT

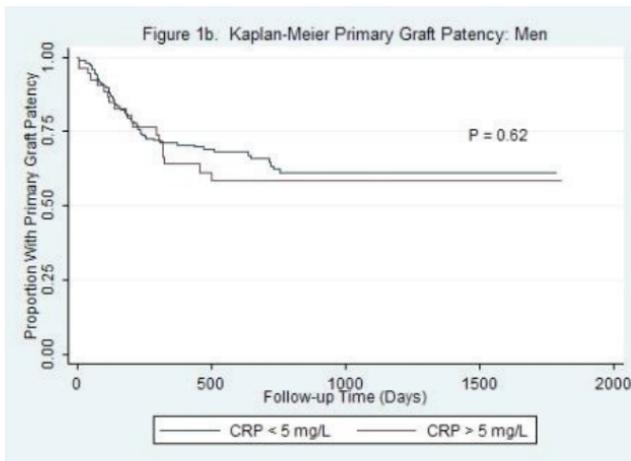
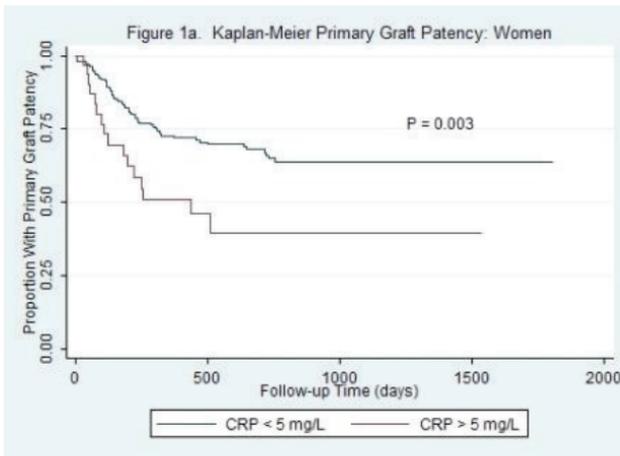
OBJECTIVE: To determine if there are gender-based differences in the inflammatory phenotype of patients undergoing lower extremity bypass surgery (LEB), and if they correlate with clinical outcomes.

METHODS: 225 patients (161 men and 64 women) underwent LEB using autogenous vein between 2/2004 and 5/2008. Fasting baseline blood samples of inflammatory and prothrombotic biomarkers were obtained prior to surgery. All patients underwent ultrasound graft surveillance. High-sensitivity C-reactive protein (CRP) levels were dichotomized at 5mg/L, and fibrinogen levels were dichotomized at 500mg/dL. All patients were followed for a minimum of 1 year; median follow-up was 893 days (IQR:539-1315 days).

RESULTS: There were no significant differences in age, race, hypertension, diabetes mellitus, and coronary artery disease between male and female subjects. Men were more likely to be smokers ($p=0.003$), hyperlipidemic ($p=0.02$) and taking statins ($p=0.02$). Women were more likely to present with critical limb ischemia ($p=0.03$) and had higher baseline CRP levels (median:5.15 mg/L; IQR:1.51-18.62mg/L) compared to men (median:2.70; IQR:1.24-6.98mg/L) ($p=0.03$). In a multivariable analysis, female gender ($p=0.03$), hypertension ($p=0.01$), eGFR ($p=0.02$), and critical limb ischemia ($p<0.001$) were associated with log-transformed CRP levels. In a multivariable Cox Proportional Hazards model for primary vein graft patency, there was a significant interaction between both gender and CRP ($p=0.03$) as well as gender and fibrinogen ($p=0.08$). Women with CRP>5mg/L were significantly more likely to lose primary vein

graft patency compared to women with $CRP < 5 \text{ mg/L}$ ($p=0.003$) (Figure 1a), while there was no such difference seen in men ($p=0.62$) (Figure 1b). Women with fibrinogen $> 500 \text{ mg/dL}$ were also more likely to lose primary graft patency compared to women with fibrinogen $< 500 \text{ mg/dL}$ ($p=0.04$), but again, this pattern was not evident in men ($p=0.66$).

CONCLUSIONS: Women undergoing LEB for advanced PAD have an elevated inflammatory phenotype compared to men. Elevated baseline levels of CRP and fibrinogen are associated with inferior vein graft patency in women, but not in men. These findings suggest an important interaction between gender and inflammation in the healing response of lower extremity vein bypass grafts.



8:20 a.m. 2. Viabahn Treatment for Femoropopliteal Occlusive Disease (FPOD): Relationship between Implant Length and Clinical Outcomes

Paul C. Johnston, MD^{1,2}, Sara J. Runge, MD³, Linda M. Reilly, MD³, Jade S. Hiramoto, MD³, Charles M. Eichler, MD³, Christopher M. Owens, MD³, Darren B. Schneider, MD^{3,4}, Michael S. Conte, MD³

¹Vascular Surgery, University of California San Francisco, San Francisco, CA, ²Vascular Surgery, Kaiser Permanente Medical Group, Denver, CO, ³San Francisco, CA, ⁴New York, NY

Discussant: Gregory L. Moneta, MD, Portland, OR

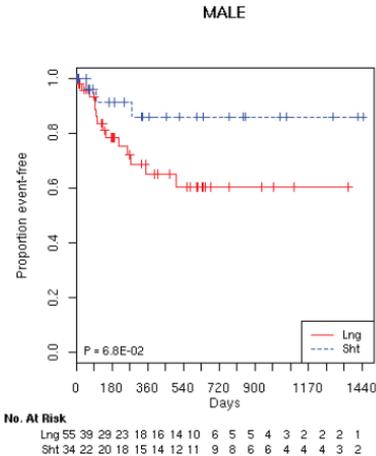
OBJECTIVE: Optimal patient selection for revascularization approaches in FPOD remains controversial. Covered stent placement in the FP segment has become increasingly prevalent. There is little information regarding the influence of implant length on the clinical performance of these devices.

METHODS: This was a retrospective, single-center study of 89 consecutively treated limbs (78 patients) that underwent Viabahn stent-graft placement for FPOD from 2005 to 2010. Procedures were dichotomized according to the total length of the implanted devices using a cutpoint of 20cm. Freedom from reintervention, thrombolysis, open bypass surgery and composite major adverse limb events (MALE = major amputation, thrombolysis/thrombectomy or open bypass surgery) were compared by log-rank analysis. Logistic regression was used to model clinical endpoints.

RESULTS: 38% of grafts were placed for critical limb ischemia, 51% in diabetics, and 31% were reinterventions. Total implant length was >20cm in 55 (62%). Estimated one-year event rates for the two groups (20cm) were as follows: any reintervention (40% vs 50%, P=0.7), thrombolysis (0% vs 27%, P=0.014), open bypass (13% vs 22%, P=0.33), and MALE (14% vs 35%, P=0.068). Implant length

was independently predictive of need for thrombolysis (P<0.01) and MALE (P=0.053) on multivariate logistic regression. Indication (claudication vs CLI) was not predictive of thrombolysis or MALE.

CONCLUSIONS: Rates of reintervention following Viabahn treatment for FPOD are considerable. The risk of major adverse limb events is strongly associated with total implant length and is driven by thrombolysis. These data have implications for surgical decision-making in FPOD.



8:40 a.m. 3. **Comparing Patency and Salvage Rates Between Multiple Ipsilateral Iliac Artery Stents and Isolated Iliac Artery Stents: Beyond TASC II**

Rachel C. Danczyk, MD¹, Erica L. Mitchell, MD², Sharon G. Kryger², Chad Burk², Sarguni Singh², Timothy K. Liem, MD², Gregory J. Landry, MD², James M. Edwards, MD², Bryan D. Petersen, MD², Gregory L. Moneta, MD²

¹Division of Vascular Surgery, Oregon Health and Science University, Portland, OR, ²Portland, OR

Discussant: Mark R. Nehler, MD, Aurora, CO

OBJECTIVES: Endovascular stents are accepted therapy for TASC A, B and some C lesions. Surgery is the recommended therapy for patients with TASC D lesions including those with both ipsilateral common iliac (CIA) and external iliac artery (EIA) stenoses/occlusion. This study compares anatomic patency and operative salvage rates for combined ipsilateral CIA and EIA stenting (TASC D) versus CIA or EIA stents alone (TASC A, B or C).

METHODS: All patients (n=588) who underwent iliac artery stenting at two institutions between 1998 and 2010 were identified. Patient comorbidities and outcomes were retrospectively reviewed and analyses were performed using multivariate regression and Kaplan-Meier methods.

RESULTS: There were 436 extremities with CIA stents, 195 with EIA stents, and 157 with both CIA and EIA stents. There was no significant difference in demographics, comorbidities, or treatment indications between groups. During follow-up, 183 patients died, 95 underwent endovascular reintervention, and 48 required salvage operation. Mean times to follow-up, death, reintervention, and operative salvage were 2.2±0.1, 5.6±0.3, 7.2±0.6, and 9.6±0.5 years, respectively. CIA and EIA stenting in combination was not a predictor of death, reintervention, or salvage operation. Survival, reintervention-free survival, and salvage operation-free survival were similar between those who had CIA or EIA stents alone and those with both CIA and EIA stents (all p>0.05).

CONCLUSIONS: CIA stents, EIA stents, and the combination of ipsilateral CIA and EIA stents have similar outcomes. Salvage operations for iliac artery stent failure are uncommon and not influenced by the location or extent of iliac artery stent placement. This study suggests that a more aggressive approach with total endovascular management for some TASC D lesions is acceptable. TASC II recommendations for endovascular therapy for aorto-iliac disease should be extended to consider selected patients with ipsilateral CIA and EIA stenoses/occlusion.

9:00 a.m. 4. **The Number of Patent Tibial Vessels Does Not Influence Primary Patency Following Nitinol Stenting of the Femoral and Popliteal Arteries**

Jenny Lee, MD³, Steven G. Katz, MD^{1,2}

¹Vascular Surgery, USC Surgeons, Pasadena, CA, ²Medical Education, Huntington Hospital, Pasadena, CA, ³Surgery, Huntington Hospital, Pasadena, CA

Discussant: Ahmed M. Abou-Zamzam, Loma Linda, CA

OBJECTIVE: Initial TASC II classification has been shown to influence the patency of stented femoral and popliteal arteries. While several studies have shown the effect of the number of runoff vessels on the durability of infrainguinal angioplasty without stenting, the influence of tibial vessel runoff on the patency of primarily stented femoral and popliteal arteries has not been as well defined. It is the purpose of this study to determine whether the number of patent tibial vessels affects primary patency following primary stenting of the femoral and popliteal arteries.

METHODS: The records of all patients undergoing angioplasty and primary nitinol stenting of the femoral and popliteal arteries by or under the supervision of a single vascular surgeon were reviewed. Results were analyzed by the number of patent tibial vessels documented on peri-procedural angiography and TASC II classification. Kaplan - Meier survival curves were plotted and differences between groups tested by log rank method. Fisher's exact and Chi square tests were used to compare categorical factors.

RESULTS: During a seven year period, 316 limbs in 262 patients underwent primary stenting of the femoral and popliteal arteries. Overall primary patency was 71% at 12 months, 51.6% at 24 months, and 39.5% at 36 months. Limbs classified as TASC A or B had significantly better patency rates than those classified as TASC C or D ($p < .001$). While the number of runoff vessels decreased with worsening of the TASC classification ($p = 0.024$), overall ($p = 0.355$), and within individual TASC classes ($p > 0.126$ for each), there was no difference in the primary patency of stented segments with two or three patent tibial arteries and those with one or no vessels continuous to the ankle. Limbs with poor runoff (one or no vessels) were no more likely to fail with occlusion than their counterparts with two or three patent tibial vessels ($p = 0.383$). The number of patent tibial vessels at the time of initial stenting did not impact ultimate limb salvage ($p = 0.32$).

CONCLUSIONS: The number of patent tibial vessels does not influence the primary patency of primarily stented femoral and popliteal arteries. TASC II classification would appear to be significantly more predictive of initial failure following angioplasty and stenting of these vessels.

10:50 a.m. 5. Validation of Simulation as a Tool for Assessing Endovascular Procedural Competency

David L. Dawson, MD¹, Erica L. Mitchell, MD², Jason T. Lee, MD³, Joseph L. Mills, Sr., MD⁴, John R. Laird, Jr., MD², Nasim Hedayati, MD², Eugene S. Lee, MD⁵, William C. Pevec, MD⁵

¹Department of Surgery, University of California, Davis, Sacramento, CA, ²Portland, OR, ³Stanford, CA, ⁴Tucson, AZ, ⁵Sacramento, CA

Discussant: Peter F. Lawrence, MD, Los Angeles, CA

OBJECTIVE: Tests to determine technical competency must be validated as reliable and reproducible. This study evaluated the use of high-fidelity procedural simulation as a method to assess endovascular skills and knowledge of vascular surgery fellows.

METHODS: As part of an endovascular skills course, vascular surgery fellows individually performed a simulated renal artery stenting case. The simulator recorded procedural metrics. Video of 8 participants, simulated angiographic images, and physiologic information were recorded on DVD for subsequent review. Evaluations were done by 6 board certified vascular surgeons and an interventional cardiologist. Raters used an Objective Structured Assessment of Endovascular Technical Skills (OSAETS). Ten areas of performance were scored using a Global Rating Scale (1 = clear fail, 2 = substandard, 3 = competent, 4 = exceeds minimal passing, 5 = superior). An overall composite score was then assigned, with passing requiring no critical errors.

RESULTS: The time used to complete the simulated case ranged from 15.6 to 51.8 min. Composite scores using the OSAETS Global Rating Scale correlated well with procedural time ($r = 0.90$). Overall performance on the task was judged failing by all reviewers for 2, there was less than unanimous agreement for 4, and all reviewers agreed on a passing performance for 2. Overall performance scores for the low, intermediate, and high level performance were (mean \pm SD): 1.36 ± 0.50 , 2.46 ± 0.88 , and 3.79 ± 0.43 ; demonstrating low inter-observer variability. Completion time correlated with passing or failing ($p < 0.05$). Subjects that were unambiguously failed by evaluators had the longest procedure times (mean 47.4 min) and the subjects that unambiguously passed completed the procedure in the shortest times (mean 19.8 min).

CONCLUSIONS: Evaluators consistently distinguished low, intermediate, and high physician performance with a simulated endovascular procedure, which reflected subjects' composite scores on the OSAETS Global Rating Scale and their time completing a simulated endovascular procedure. This validation study shows that performance on a simulated endovascular cases can identify individuals who do not meet a minimal performance standards for independent practice or progression in a competency-based training program.

11:10 a.m. 6. Who is Applying to Vascular Surgery? A Comparison of Demographics of 0+5 Versus 5+2 Applicants

Mohamed A. Zayed, MD¹, Ronald L. Dalman, MD², Jason T. Lee, MD²
¹Surgery, Stanford University Medical Center, Stanford, CA, ²Stanford, CA
 Discussant: Fred A. Weaver, MD, Los Angeles, CA

OBJECTIVES: The new integrated 0+5 vascular surgery (VS) training paradigm introduced in 2007 required program directors and faculty to reconsider recruiting strategies and exposure to VS during medical school. The purpose of this study was to compare demographics and medical school performance of applicants to our integrated 0+5 program and our traditional independent 5+2 program.

METHODS: Review of demographic data from the ERAS system and background questionnaires were collected from all 0+5 and 5+2 applicants over the same time period at a single institution. Foreign medical graduates were excluded from the analysis.

RESULTS: From 2009-2011, there were 190 applicants to our 0+5 program and 161 applicants to our 5+2 program, with 127 (66.8%) and 122 (75.8%) being US medical graduates, respectively. Annual application volume to our programs over these years remained stable (range 39-49 for 0+5, 39-43 for 5+2) indicating steady interest in both training pathways. Nationally, applications to 0+5 have increased six-fold over the same time period (52 to 340 applicants, $p < 0.001$), far exceeding the available training positions. The table below summarizes differences in demographics, clinical background, and scholarly achievements during medical school between the 0+5 and 5+2 cohorts.

CONCLUSIONS: Significant differences exist between integrated 0+5 and independent 5+2 applicants for VS training. Applicants to the 0+5 are more likely to be female, slightly older, have additional postgraduate degrees and publications, have higher USMLE test scores, and are more likely to be in the top quartile of their medical school class. To attract the most qualified trainees and meet the surging demand in the 0+5 VS pathway, program directors and medical school curricula should focus on developing programs that offer research mentorship, scholarly opportunities, and additional degree pathways.

2009-2011 Residency and Fellowship U.S. Medical School Applicants

	0+5 Program (n=127)	5+2 Program (n=122)	P Value
% Female	36.2%	25.4%	0.07
Age When Completing Medical School	28.8	26.9	<0.001
Additional Degrees (PhD, MPH, MS, MBA, JD)	29.9%	18.0%	0.038
AOA Membership	26.8%	20.5%	NS
Honors On Surgery Rotation	48.0%	40.2%	NS
% Top Quartile Of Class On Dean's Letter	40.3%	27.9%	0.06
# Of Publications Through Medical School	3.6	1.3	<0.001
Mean USMLE Step 1/2/3 Score	226	219	0.004

11:30 a.m. 7. The Next Generation of Academic Vascular Surgeons: Factors Influencing Career Choice

Rachel C. Danczyk¹, Nick Sevdalis², Gregory J. Landry³, Timothy K. Liem³, Gregory L. Moneta³, Erica L. Mitchell³

¹Division of Vascular Surgery, Oregon Health and Science University, Portland, OR, ²London, United Kingdom, ³Portland, OR

Discussant: Niten Singh, MD, Tacoma, WA

OBJECTIVE: Few studies have examined factors that influence the decision to enter an academic medical career after residency training. We sought to evaluate whether gender, ethnicity, child care issues, and debt burden influenced residents' choice for a career in academic vascular surgery.

METHODS: A 39-item Web survey, designed to elucidate which factors motivated residents to seek a career in academic vascular surgery, was sent to 295 vascular surgery residents currently enrolled in ACGME-accredited training programs.

RESULTS: A total of 131 responses were received (44%; 35 women, 96 men). 53% of respondents were White, 26% Asian/Indian, 10% Hispanic/Latino, and 4% African-American. 65% of women, 52% of men, and 55% of minorities anticipate a career in academic vascular surgery. There were no statistical differences between gender and ethnicity for factors influencing career choice including: training paradigm, presence of a life partner or dependents; mentorship role; participation in research, service and teaching; anticipated salary; and debt burden ($p>0.05$). 78% of respondents carry significant debt (81% owe > \$100,000, 40% owe >\$200,000). Respondents planning an academic career cited procedural variation, breadth and depth of practice/tertiary referral experience, and research opportunities as the most important drivers of career choice. Income potential, strength of the job market, and child care needs were deemed less important.

CONCLUSIONS: This study shows that academic vascular surgery is a popular career option for current vascular surgery trainees. Choosing a career in academic vascular surgery appears not to be influenced by gender, ethnicity, child care concerns, salary expectations, or debt burden even though the majority of trainees carry enormous debt. The data imply future academic vascular surgeons will likely have greater gender and ethnic variability than is currently seen.

MONDAY, SEPTEMBER 19, 2011

- 7:30 a.m. CONTINENTAL BREAKFAST WITH *Kauai Ballroom*
 EDUCATIONAL SPONSORS *Promenade*
- 8:00 a.m. SCIENTIFIC SESSION *Kauai Ballroom*
 Presiding: William Quinones-Baldrich, MD
- 8:00 a.m. 8. Long-term Results after Accessory Renal Artery Coverage
 During Endovascular Aortic Aneurysm Repair
 Joshua I. Greenberg, MD¹, Chelsea Dorsey, MD², Ronald L. Dalman,
 MD², Jason T. Lee, MD², Mathew W. Mell, MD²
¹Surgery, Stanford University Medical Center, Stanford, CA ²Stanford, CA
Discussant: Jeffrey L. Ballard, MD, Orange, CA

OBJECTIVE: Current information regarding coverage of accessory renal arteries (ARA) during EVAR is based on small case series with limited follow-up. This study evaluates the mid-term outcomes of ARA coverage in a large contemporary cohort.

METHODS: Consecutive EVAR data from January 2004 to August 2010 was collected in a prospective database at a University hospital. Patient and aneurysm-related characteristics, imaging studies, and ARA coverage versus preservation were analyzed. Volumetric analysis of 3-D reconstruction CT scans was used to assess renal infarction volume extent. Long-term renal function and overall technical success of aneurysm exclusion was compared.

RESULTS: A cohort of 426 EVARs was identified. ARAs were present in 69 patients with a mean follow-up of 27 (1-60) months. At least one ARA was covered in 40 patients; 29 patients had intentional ARA preservation. Patient and anatomic characteristics were similar between groups (Table 1). Renal infarctions occurred in 84% of kidneys with covered ARAs. There was no significant deterioration in long-term GFR when compared to patients in the control group. No difference in the rate of endoleak, secondary procedures, or the requirement for anti-hypertensive medications was found.

CONCLUSIONS: This study is the largest to date with the longest follow-up relating to ARA coverage. Contrary to previous reports, renal infarction after ARA coverage is common. Nevertheless, coverage is well tolerated based upon preservation of renal function without additional morbidity. These results support the long-term safety of ARA coverage for EVAR when necessary.

Table 1

	ARA Coverage (n=40)	ARA Preservation (n=29)	
ARA diameter (mm)	2.93 +/-0.14	2.95 +/-0.11	p=0.7
Infarction volume (% of ipsilateral kidney)	12.1 +/-1.3	0.5 +/-0.5	p<0.0001
Early endoleak (%)	32.5	37.9	p=0.7
Late endoleak (%)	15.0	7.0	p=0.5
Secondary procedures (%)	15.0	17.2	p=1.0
Change in GFR at last follow-up (mL/min)	-4.3 +/-2.9	-0.7 +/-3.3	p=0.4
Anti-hypertensive agents (n)	1.7 +/-0.2	1.8 +/-0.2	p=0.6

8:20 a.m. 9. **Branched Thoracoabdominal Aortic Aneurysm Repair: Efficacy and Durability of the Caudally-Directed Cuff Technique**

Linda M. Reilly, MD¹, Joseph H. Rapp, MD², Marlene Grenon, MD², Jade S. Hiramoto, MD², Timothy A. M. Chuter, MD²

¹Vascular Surgery, University of California, San Francisco, San Francisco, CA, ²San Francisco, CA

Discussant: William J. Quinones-Baldrich, MD, Los Angeles, CA

To determine early and intermediate results of multi-branched endovascular thoracoabdominal aortic aneurysm (endoTAAA) repair using a standard operative technique.

69 patients (mean age=73±7 years, 18 women) underwent elective endoTAAA repair in a prospective trial, using our preferred technique_self-expanding covered stents connecting caudally-directed cuffs to target aortic branches. Mean aneurysm diameter was 67±9 mm. 34 TAAA (49%) were Type II/III/V; 35 (51%) were Type IV/pararenal. 24 procedures (35%) were staged. Aortic components were inserted transfemorally (20 conduits); all branches were inserted transbrachially. Follow-up assessment (mean=20.5 mos), including imaging, was performed at 1, 6, 12 months, then yearly.

All devices and branches (N=263) were successfully deployed. Related mortality was 7.2%. Permanent paraplegia (SCI) occurred in 3 (4.3%) patients; transient SCI occurred in 14 (20.3%). 4 patients (5.8%) required periop dialysis. Women patients account for 67% of the paraplegia, 75% of the periop dialysis, and 60% of the deaths. Of the 4 patients starting dialysis during follow-up, 2 resulted from renal branch occlusion. 14 branches either occluded (7 renal, 2 celiac) or developed stenoses requiring reintervention (4 renal, 1 SMA)_primary patency=94.6%, primary-assisted patency=96.7%. 8 patients required early reintervention (≤45 days) to optimize the initial repair. 11 patients required late reintervention: 5 for branch stenosis (above), 2 for aneurysm growth.

Total endovascular TAAA repair using caudally-directed cuffs is safe, effective and durable, preventing aneurysm growth and rupture, in the intermediate term. Improved renal branch devices would enhance overall durability and reduce late reintervention rates. Outcome in women needs further study.

TABLE 1

	Related Mortality	SCI	New Onset Dialysis	Branch Occlusion	Branch Stenosis	Aneurysm Rupture	Aneurysm Growth	Reintervention*
Periop	3 (4.3%)	3 (4.3%)	4 (5.8%)	5 (1.9%)				6 (8.7%)
Early	2 (2.9%)	0	0	1 (0.4%)	0	0	0	4 (5.8%)
Late	0	0	3 (4.3%)	3 (1.1%)	5 (1.9%)	0	3 (4.3%)	11 (15.9%)
Total	5 (7.2%)	3 (4.3%)	7 (10.1%)	9 (3.4%)	5 (1.9%)	0	3 (4.3%)	18 (26.1%)

*2 patients with >1 reop

8:40 a.m. 10. Results of a Double-Barrel Technique with Commercially Available Devices for Hypogastric Preservation during Aortoiliac EVAR

Brian G. DeRubertis¹, William J. Quinones-Baldrich, MD², Josh Greenberg, MD³, Juan Carlos Jimenez, MD², Jason T. Lee, MD³

¹Division of Vascular Surgery, UCLA School of Medicine, Los Angeles, CA, ²Los Angeles, CA, ³Palo Alto, CA

Discussant: Nikhil Kansal, MD, San Diego, CA

OBJECTIVES: Assess technical feasibility and outcome of a novel hypogastric preservation technique in patients with aortoiliac aneurysms using commercially available endografts without device modification.

METHODS: Multi-institution review of prospectively acquired database of patients undergoing double-barrel endograft repair of aortoiliac aneurysms.

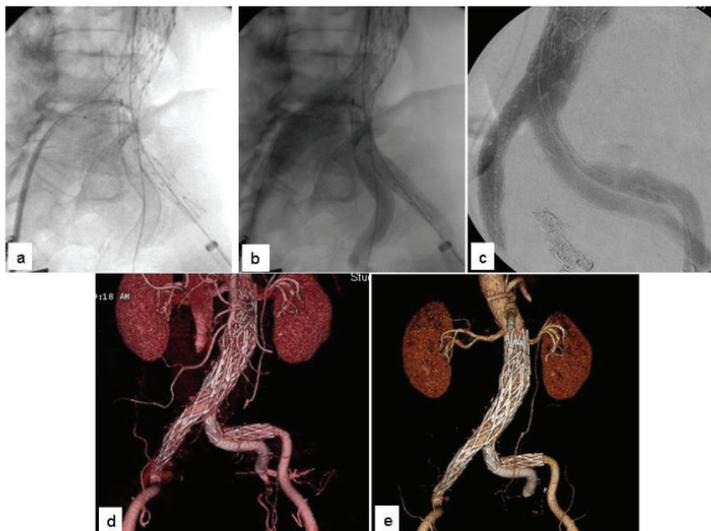
RESULTS: Eighteen patients underwent EVAR for aortoiliac aneurysms from 2010-11, with 19 hypogastric preservation procedures successfully completed in 17 patients. The technique involved bifurcated main body placement followed by simultaneous deployment of parallel endograft limbs into the external iliac (ipsilateral approach) and hypogastric (contralateral or brachial approach) arteries. Bilateral hypogastric branches were performed in 2 patients, and unilateral branches with and without contralateral coil embolization were performed in 8 and 6 patients, respectively. Technical success rate was 95%, access was fully-percutaneous in 82%, and perioperative metrics are shown in Table 1. Two Type III endoleaks between branch components were noted on completion angios, but both resolved spontaneously on follow-up CT. Four Type II endoleaks (24%) without sac expansion were noted on postop imaging, as was one Type Ib (contralateral to hypogastric branch, repaired with limb extension). Early (<2wks) limb occlusion (1 external iliac, 2 hypogastric) occurred in 2 patients, though no late occlusions have occurred (mean f/u 4 months, range 1-12 months). Primary patency for external iliac and hypogastric limbs at 6 months was 90.9% and 87.2%, respectively. There were no deaths; minor complications (groin hematoma) occurred in 10%. Buttock claudication has only occurred in four patients (all with coil embolization and/or early hypogastric limb occlusion), compared to 0% in those with patent hypogastric grafts ($p<0.05$).

CONCLUSION: The double-barrel technique for hypogastric preservation is technically feasible across multiple interventionalists using commercially available endografts without device modification. These procedures are associated with minimal morbidity, acceptable short-term limb-patency rates, and reduced buttock claudication compared to those involving contralateral hypogastric embolization.

Table 1. Operative Variables by Aneurysm and Treatment Type

Aneurysm Type	Treatment	#	OR Time (min)	Fluoro Time (min)	Contrast (ml)	EBL (ml)	# of Components
Bi-iliac Involvement (n=10)	Bilateral Hypogastric Branches	2	243	68	191	600	8.0
	Unilateral Hypogastric Branch (+contral embolization)	8	265	76	137	346	5.9
Uni-iliac Involvement (n=6)	Unilateral Hypogastric Branch	6	248	56	138	275	5.2
Total (mean)		16	262	70	148	380	6.1

Figure 1. Deployment of Viabahn covered stent into left hypogastric artery through contralateral femoral access (a-c), and postoperative CT angiogram following branched endograft aortoiliac aneurysm repair (d-e).



9:00 a.m. 11. Early Experience with the Snorkel Technique for Juxtarenal Aneurysms: The Preferred Off-the-Shelf Solution for Challenging EVAR Anatomy?

Jason T. Lee, MD¹, Joshua I. Greenberg, MD², Ronald L. Dalman, MD²

¹Division of Vascular Surgery, Stanford University Medical Center, Stanford, CA, ²Stanford, CA

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

OBJECTIVE: The lack of readily available branched and fenestrated EVAR options for most centers has created an opportunity for creative deployment of endograft components to treat juxtarenal aneurysms. We sought to examine our early experience with “snorkel” or “chimney” techniques in the endovascular management of complex aortic aneurysms.

METHODS: Retrospective review of a single-center series of planned snorkel utilization for juxtarenal aneurysms. Standardized technique included axillary or brachial cutdown for delivery of covered snorkel stents and percutaneous femoral access for the main body endograft.

RESULTS: 42 snorkel grafts were placed in 23 consecutive patients (mean age 75y) with prohibitive operative risk treated over the past two years. Aneurysm morphology and perioperative outcomes are listed in the TABLE. The snorkel configuration extended the proximal seal zone from an unsuitable infrarenal neck (mean diameter 33mm, mean length 0.9mm) to a favorable neck (25mm diameter, 18mm length). To achieve this result, thirteen patients had bilateral renal snorkels, six had unilateral renal snorkels, and three had celiac/SMA/renal combinations, and one had a single SMA snorkel with 95% technical success. 30-day mortality was 4.3%, occurring in one patient readmitted with pneumonia that ultimately died of sepsis. Other major complications included two perinephric hematomas from wire manipulation (8.7%) and one axillary nerve injury (4.3%). Mean follow-up was 13 months (range 1-24). Follow-up imaging revealed one renal snorkel graft occlusion (97.6% primary patency) at six months in an asymptomatic patient without change in renal function. Four (17.4%) early endoleaks were noted (two type I, one type II, one type III) leading to two secondary interventions (8.7%) including proximal balloon molding (type I) and extender cuff placement (type III). One patient with a small type I endoleak at 1-month CT resolved at the 6-month scan. Mean sac diameter for the group decreased from 65.0 mm to 63.0 mm, and no aneurysm enlarged in follow-up.

CONCLUSIONS: Early success with the snorkel technique for juxtarenal aneurysms has rapidly made it our procedure of choice for complex EVAR. Although long-term follow-up is needed, the flexibility of the snorkel technique and lack of requirement for custom built devices may make this approach more attractive than branched or fenestrated stent-grafts.

9:20 a.m. 12. Patient Outcomes and Thoracic Aortic Volume and Morphologic Changes following TEVAR in Patients with Complicated Type B Aortic Dissection

Iden D. Andacheh¹, Carlos Donayre, MD², Karen Kim, MD², George Kopchok², Irwin Walot, MD², Rod White, MD²

¹Surgery, Harbor UCLA Medical Center, Los Angeles, CA, ²Los Angeles, CA

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

OBJECTIVE: True and false lumen changes and patient outcomes following thoracic endovascular aortic repair (TEVAR) for patients with stable Type B dissection have been described by the INSTEAD trial. However, these changes have not been described in TEVAR patients treated for complications of chronic dissection.

METHODS: A total of 73 patients with complicated Type B dissection were treated from 2002 to 2010. Indications included: aneurysmal enlargement (n=62), failure of medical management (n=7), and perforation with hematoma (n=4). Spiral CT reconstructions using M2S were analyzed for sequential changes in aortic volume and diameter during patient follow-up.

RESULTS: TEVAR was successfully performed in 72 out of the 73 patients (99%). The 30-day procedure-related mortality rate was 14%; causes included retrograde dissection with tamponade (n=4), cardiac-related (n=4), rupture (n=2). In the mean patient follow-up of 18 months, 11 out of the 72 (15%) patients required a secondary procedure for endoleak (n=7) and persistent distal perfusion (n=4).

Expansion of the true lumen was noted during the follow-up period: 38%, 46%, 71%, 114% at 1-month, 3-month, 6-month, and 12-month, respectively, with concomitant regression of the false lumen of -65%, -68%, -84%, -84% at the same intervals, respectively. Patients with an initial extension of the thoracic dissection into the infrarenal aorta (n=46) had an increase in aortic diameter and volume to 21% and 17% at one-year, respectively. In contrast, in patients without infrarenal dissection (n=13), the infrarenal aortic diameter and volume remained unchanged at 3% and -0.9%, respectively, at one-year post-surgery.

CONCLUSIONS: TEVAR is an appropriate treatment strategy for patients with complicated chronic Type B dissection. During follow-up, there is a predictable expansion of the true lumen and regression of the false lumen. These findings correlate with those of the INSTEAD trial, which demonstrated false lumen regression and true lumen expansion in a cohort of patients with stable Type B dissection. Patients with extension of thoracic dissection into the infrarenal aorta demonstrate continued aortic dilation and occasionally need for secondary intervention for persistent distal perfusion. Further device development and potential use of bare metal stents are options to treat infrarenal aortic expansion.

9:40 a.m.-10:10 a.m.

COFFEE BREAK WITH EDUCATIONAL SPONSORS

10:10 a.m. 13. **A Morphologic Study of Chronic Type B Aortic Dissections and Aneurysms After Thoracic Endovascular Stent Grafting**

David KX Qing, MD², Stephen Cheng, MD¹, Wai-ki Yiu, MD²

¹Surgery, The University of Hong Kong, Hong Kong, ²Hong Kong

Discussant: Vincent L. Rowe, MD, Los Angeles, CA

OBJECTIVE: The long term results of treating chronic aortic dissections and dissecting aneurysms with thoracic endovascular aortic repair (TEVAR) are unknown, and the timing for intervention uncertain. We aim to evaluate the morphology of stent graft and aorta remodeling, and the volumetric changes in these patients after successful TEVAR.

METHODS: Serial CT scans of 32 patients who had TEVAR for uncomplicated chronic dissections (Group A, n=17) and dissecting aneurysms (Group B, n=15) were analyzed at 1, 6, 12, and 36 months. Stent graft diameter changes and positional migration were assessed three-dimensionally using Mimics 14.0 (Materialise, Leuven, Belgium). Volumetric data for true lumen, false lumen, thrombus load, and aortic size were measured by Aquarius iNtuition 4.4 (TeraRecon, San Mateo, CA). Results were compared between the two groups and with stent graft diameter, length and oversizing.

RESULTS: Aortic stent graft remodeled progressively with inlet area increased 4.4%, 10.1%, 14.2% and outlet area increased 42.6%, 67.2%, 72.3% at 6, 12, and 36 months. True lumen volume increased progressively in both Group A (114 ml to 174 ml), and Group B (124 ml to 190 ml) from baseline to 36 months. False lumen volume decreased in Group A (150 ml to 88 ml) and Group B (351 ml to 250 ml) respectively; while total thrombus load in the false lumen increased from 73% to 80% for Group A and 84% to 87% in Group B in three years.

Eight patients (four in each group) showed an increase in total aortic volume of >10%. Twelve patients showed a static volume and 12 a shrinkage. Aortic volume change had no relationship to pathology, stent graft sizing and thrombus load, but was positively associated with the placement of a longer graft. There was a small, but progressive distal migration of stent grafts in all patients (3.1, 4.5 and 4.6mm at 6, 12, and 36 months), more prominent in shorter stent grafts (<160mm). No mortality, rupture, or secondary interventions occurred during follow up.

CONCLUSIONS: Aortic remodeling after TEVAR in chronic dissection is a continuous process. There were no significant differences between chronic dissections and aneurysms in all volumetric parameters. Treating chronic dissections early before aneurysm formation did not appear to have a morphological advantage.

10:30 a.m. 14. **Readmissions After AAA Repair: Differences Between Open Repair and EVAR**

Kevin M. Casey, MD¹, Tina Hernandez-Boussard², Weesam K. Al-Khatib, MD², Matthew W. Mell, MD², Jason T. Lee, MD² –

¹Naval Medical Center, San Diego, CA, ²Stanford University Hospital, Stanford, CA,

Discussant: Michael T. Caps, MD, Honolulu, HI

OBJECTIVE: Reintervention rates are higher for endovascular aneurysm repair (EVAR) compared with open repair (OR) due to endoleak treatments, while surgical reoperations for bowel obstruction and abdominal hernias are higher following OR. However, readmission rates for non-operative conditions following aneurysm repair are not well documented. We sought to determine reasons for statewide non-operative readmissions within the first year following open AAA repair and EVAR.

METHODS: Patients who underwent an elective AAA repair in California over a four-year period were identified from the Office of Statewide Health Planning and Development (OSHPD) administrative database. All patients who had a readmission within one year were included for evaluation. Readmission rates as well as diagnoses associated with each readmission were analyzed and recorded.

RESULTS: From 2005-2008, there were 22,972 operations for elective aneurysm repair, 13,454 EVAR (59%) and 9,518 OR (41%). Postoperatively, there was a 30% readmission rate following OR and a 28% readmission rate following EVAR ($p=.02$). The most common principle diagnoses associated with readmission after either type of AAA repair were infection (14.5%), cardiac problems (13.7%), and failure to thrive (12.7%). Patients who underwent OR were more likely to be readmitted with diagnoses associated with failure to thrive ($p<.0001$), GI complications ($p<.0001$), wound infection ($p=0.04$), and SBO ($p<.0001$). Those who underwent EVAR were more likely to be readmitted with diagnoses of cardiac conditions ($p<.0001$), device related complications ($p<.0001$), CVA ($p=.011$), and renal complications ($p<.0001$).

Conclusion: Non-operative readmission rates within one year of elective AAA repair are greater following OR compared with EVAR. Reasons for readmission vary significantly between the two cohorts. Systems-based analysis of these causes of readmission can potentially improve patient expectations and care following elective aneurysm repair.

10:50 a.m. 15. **Characterization of Thoracic Aortic Arch Anatomy in the Asian Elderly Population**

Jackie P. Ho, MD¹, Peixuan Chiu², Heow Pueh Lee, PhD², Sudhakar K. Venkatesh, MD²

¹Surgery, National University of Singapore, Singapore, ²Singapore

Discussant: Edmond J. Raker, MD, Seattle, WA

OBJECTIVE: Endovascular repair of the aortic arch is often unsatisfactory due to poor stent-vessel conformity and inadequate landing zones. This study aims to characterize the structural dimensions of aortic arch so as to facilitate the development of arch-specific endovascular devices.

METHODS: Three dimensional models were reconstructed in Mimics (an image segmentation software) from CT aortograms of 120 Asian elderly patients using manual segmentation. Centerlines of each 3D aortic model were calculated using a repulsive force field method. Following which, measurements of the aorta and supra-aortic branches were obtained and analyzed in Patran (a Finite Element software). A statistical aortic arch shape model was built using Principal Component Analysis (PCA).

RESULTS: Average diameters of the ascending, descending aorta, origin of the innominate, left common carotid and left subclavian artery were 39.4 ± 6.7 mm, 34.5 ± 7.9 mm, 18.0 ± 3.8 mm, 12.6 ± 2.7 mm and 14.1 ± 2.5 mm respectively. Length of the ascending aorta, innominate to left common carotid artery, and left common carotid to left subclavian artery were 62.6 ± 11.4 mm, 12.0 ± 5.6 mm and 18.7 ± 5.6 mm along the centerline. Type II and type III arches were more prevalent than type I. Mean angle of curvature was 103.8 ± 25 degrees. PCA of the 3D centerlines derived three main modes of variation which could account for 61% of the overall shape range.

CONCLUSIONS: Aortic arch anatomical information from the Asian elderly population can be used as reference for the development of future endovascular devices.

TUESDAY, SEPTEMBER 20, 2011

7:00 a.m. CONTINENTAL BRAKFAST WITH *Kauai Ballroom*
EDUCATIONAL SPONSORS *Promenade*

7:30 a.m. SCIENTIFIC SESSION *Kauai Ballroom*
Presiding: William Quinones-Baldrich, MD

7:30 a.m. 16. **Inferior Vena Cava Resection and Reconstruction for Retroperitoneal Tumor Excision**
William Quinones-Baldrich, MD¹, Ali Alktaifi MD², Fritz Eilber, MD³, Frederick Eilber, MD³
¹UCLA Division of Vascular Surgery, Los Angeles, CA ²UCLA Division of Vascular Surgery, Los Angeles, CA, ³UCLA Division of Oncology, Los Angeles, CA
Discussant: Gregory J. Landry, MD, Portland, OR

OBJECTIVE: Review results of resection and reconstruction of the inferior vena cava (IVC) for en-block malignant tumor excision

METHODS: Retrospective review of all patients having IVC resection for en-block malignant tumor excision. IVC resection was categorized as suprarenal, perirenal, infrarenal or extensive (> 1 segment resected). Repairs were divided into primary, patch or circumferential. Tumor type, perioperative morbidity, mortality, clinical graft patency and survival (social security death index) were recorded.

RESULTS: Between 1992 and 2010, 48 patients (24 female) had IVC resection for tumor en block excision. Sarcomas were most common (33; 69%: 5(10%) primary IVC). Thirteen patients had primary IVC repair, 9 patch repair (1 autogenous) and 26 had circumferential replacement with PTFE ringed graft (12-16mm). Extensive IVC reconstruction were performed in 17 cases of which 7 involved the entire IVC with renal (RV) and hepatic veins reimplantation, 6 were supra & peri renal (7 RV reimplanted), 4 were infra & peri-renal (4 RV reimplanted). All single segment (9) repairs were infrarenal. Overall morbidity was 6% (1 bowel obstruction requiring surgery, 1 chyle leak resolved with medical therapy, and 1renal failure with complete recovery [L RV reimplant, R nephrectomy]). There was no difference in morbidity between primary, patch, circumferential, and extensive reconstruction. There was no mortality. One IVC graft thrombosis was documented on follow up (after chemo/sepsis). There were 2 graft stenosis associated with tumor recurrence. Lower extremity edema was universally avoided. Mean long term survival was 3.34 years (4mo to 11 years) with a significant difference between primary or patch (mean 66.7 mo) and circumferential or extensive repair (mean 39.7 mo; p<.005). There was no survival difference between single segment and extensive IVC repair (36.7 vs. 42.8 mo; p>.12)

CONCLUSIONS: IVC resection and reconstruction for enblock tumor excision is safe even when extensive repairs are necessary. Replacement of the IVC with prosthetic graft avoids extremity venous complications and likely contributes to quality of survival. Survival is dependant on tumor behavior and degree of IVC involvement where primary and patch repair has a better prognosis than circumferential resection.

7:50 a.m. 17. Under-utilization Of Transfer For Ruptured Abdominal Aortic Aneurysm (rAAA) In The Western United States

Matthew W. Mell, MD¹, Rachael A. Callcut, MD², Fritz Bech, MD², Kit Delgado, MD², Kristan Staudenmayer, MD², David A. Spain, MD², Tina Hernandez-Boussard, PhD²

¹Stanford University, Stanford, CA, ²Stanford, CA

Discussant: John S. Lane, III, MD, Orange, CA

OBJECTIVE: The utility of transferring patients with rAAA remains controversial. Previous studies have examined rAAA only after transfer has occurred. The goals of this study were to determine the incidence of transfer and identify factors associated with transfer compared with local care for patients presenting to emergency departments (ED) with rAAA.

METHODS: Data for patients presenting with ICD-9-CM codes for rAAA from 2006 - 2008 were extracted from the National Emergency Department Sample (NEDS), developed as part of the Healthcare Cost and Utilization Project (HCUP). The NEDS is the largest stratified weighted sample of US hospital-based ED visits with links to inpatient files. We compared those transferred to those admitted and treated. Sample weights were applied to produce nationally representative estimates. Patient and hospital factors associated with transfer were identified using multivariate logistic regression. These factors were then analyzed for a relationship with ED death.

RESULTS: A total of 18,363 patients were evaluated for rAAA. Of these, 7% (1201) died in the ED, 8% (1511) were admitted and died without a procedure, 40% (7379) were admitted and died after repair, and 41% (7479) were admitted, treated and survived. Transfers accounted for only 4% (793) of all ED visits for rAAA. Transfer was more likely for patients seen in non-metropolitan hospitals (25.6%) vs. metropolitan non-teaching (5.4%) or metropolitan teaching hospitals (0.4%, $p < 0.0001$), low volume EDs (24.7% vs. 3.8%, $p = 0.0001$), and non-trauma centers (7.5% vs. 0.2%, $p < 0.0001$). On multivariate analysis the strongest independent predictor for transfer remained non-metropolitan hospital (TABLE). The West had the lowest likelihood of transfer compared to other regions and the highest likelihood of ED death (OR 1.91, 95% CI 1.19 - 3.08, $p = 0.008$).

CONCLUSIONS: Transfer is rarely utilized for treatment of rAAA. Higher ED deaths at hospitals with lower likelihood of transfer suggest that better transfer protocols may improve survival for patients who present to hospital EDs with insufficient resources to provide local care.

Predictors of Transfer for rAAA				
Factor		Adjusted OR	95% CI	p-value
Non-metropolitan hospital		24.4	9.6 - 62.5	<0.0001
Non-trauma hospital		10.0	4.9 - 20.7	<0.0001
Region	East	4.1	1.3 - 12.6	0.0002
	South	6.8	2.5 - 18.0	0.0001
	Midwest	6.4	2.4 - 17.2	0.0003
	West	1.0	n/a	Referent
Age (per decade)		0.72	0.58 - 0.88	0.002

8:10 a.m. 18. **The Use of Sartorius Muscle Rotational Flaps for Groin Complications After Vascular Reconstruction**

Christian Ochoa, MD¹, Vahagn Nikolian Nikolian², Sarah Wartman, MD², William Lee, MD², Fred A. Weaver, MD², Vincent Rowe, MD²

¹Vascular Surgery, University of Southern California, Los Angeles, CA,

²Los Angeles, CA

Discussant: Joseph L. Mills, Jr., MD, Tucson, AZ

OBJECTIVES: Sartorius myoplasty has been shown to be an adequate adjunct for soft tissue coverage in vascular groin infections. However, in the era of antibiotic resistant bacterial infections, the durability of the sartorius myoplasty has been questioned. It is the purpose of this study to determine whether sartorius myoplasty is a durable option for wound complications following vascular reconstruction.

METHODS: The records of all patients undergoing sartorius myoplasty from 1997-2010 were reviewed. Failure of sartorius myoplasty was defined as operative re-intervention for bleeding, persistent wound drainage and infection. Chi-Squared and Mann-Whitney U statistics were performed, with a $p < 0.05$.

RESULTS: A total of 69 patients underwent sartorius myoplasty during the study period. Forty-two patients were female and 27 were male and the average age was 68 years. Fifty-four percent of the patients had previous infrainguinal reconstruction. Presenting symptoms included fever in 19%, sepsis in 8%, pseudoaneurysm in 15%, acute leg ischemia in 22% and presence of a foot wound in 25%. Fifty-nine percent presented with wound drainage. Intraoperative wound cultures consisted of methicillin sensitive *Staphylococcus* (39%), methicillin resistant *Staphylococcus* (34%), *Enterococcus* (35%), *Pseudomonas aeruginosa* (13%), *E. Coli* (15%), and polymicrobial (32%). The failure rate for sartorius myoplasty was 10.1%. For those patients who failed, a total of 4 had persistent bleeding, 2 patients had recurrent wound infections requiring redebridment and 1 patient had necrotizing fasciitis. Univariate analysis found that admission white blood cell count to be significant factor in those patients who failed sartorius myoplasty (Failed-WBC 18 vs. non-failure WBC 10.2, $p=0.027$). The presence of wound drainage and microbacteria did not have significant effect on the failure of sartorius myoplasty.

CONCLUSIONS: In the current setting, sartorius myoplasty provides reliable soft tissue coverage for vascular groin infections.

ACCME: The data presented in this abstract demonstrates that in patients with groin infections, the placement of a muscle flap can impact wound healing and prove to be durable method. The treatment gap in this setting is between wound vac placement versus muscle flap coverage.

- 8:30 a.m. 19. **No Increased Mortality With Early Aortic Aneurysm Disease**
Matthew Mell, MD¹, Julie J. White, BS², Bradley B. Hill, MD², Ronald L. Dalman, MD²
¹Surgery, Stanford University, Stanford, CA, ²Stanford, CA
Proposed Discussant: TBD

OBJECTIVE: In addition to increased risks for aneurysm-related death, previous studies have determined that all-cause mortality in abdominal aortic aneurysm (AAA) patients is excessive and equivalent to that associated with coronary heart disease (CHD). These studies largely preceded the current era of CHD risk factor management, however, and no recent study has examined contemporary mortality associated with early AAA disease (aneurysm diameter between 3 and 5 cm). As part of an ongoing natural history study of AAA, we report the mortality risk associated with presence of early disease.

METHODS: Participants were recruited from three distinct health care systems in Northern California between 2006 and 2011. Aneurysm diameter, demographic information, co-morbidities, medication history, and plasma for biomarker analysis were collected at study entry. Survival status was determined at follow-up. Data were analyzed with t- or chi-square tests where appropriate. Freedom from death was calculated via Cox proportional hazards modeling; the relevance of individual predictors on mortality was determined by log-rank test.

RESULTS: The study enrolled 645 AAA patients; age 76.5+/- 8.0 years, aortic diameter 3.9+/- 0.7 cm. Participants were mostly male (88.8%) non-smokers (81.8%) and taking statins (76.7%). Mean follow-up was 2.1 +/- 1.0 years. Estimated 1- and 3-year mortality was only 1.7 and 5.3%, respectively. Factors independently associated with mortality included larger aneurysm size (HR 2.67, 95% CI 1.26 - 5.70 for diameter >4.0 cm) and diabetes (HR 2.75, 95% CI 1.30 - 5.82). After adjusting for patient-level factors, health care system independently predicted mortality: institution 2 vs. 1 HR 2.34 (95% CI 0.93 - 5.90); institution 3 vs. 1 HR 2.61 (95% CI 1.13 to 6.06) (FIGURE).

CONCLUSIONS: Contemporary all-cause mortality for patients with early AAA disease is lower than that previously reported, and currently approximates adjusted mortality for the population at large. Despite this overall improvement, however, mortality rates for similar patients vary between different health care systems within the same region. Further research is warranted to determine institutional factors that contribute to disparate survival in early AAA disease.

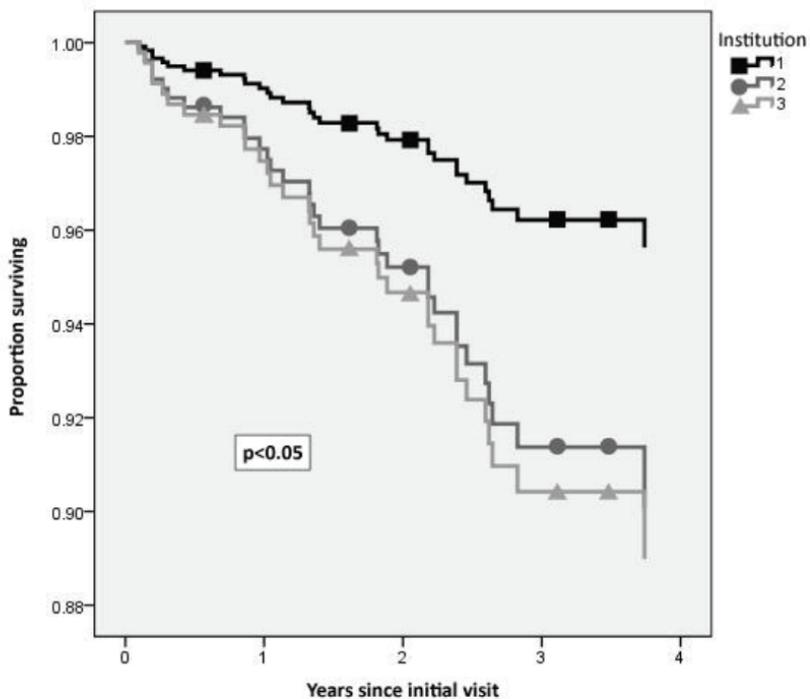


Figure: Survival by institution

NOTES

8:50 a.m. 20. Correlation of CEAP clinical class, Venous Clinical Severity Scores (VCSS), Vein Diameter, and Reflux Time in the Great Saphenous Vein (GSV) in Patients with Superficial Venous Insufficiency

Matthew M. Wise, BS, RVT¹, Kathleen D. Gibson, MD²

¹Lake Washington Vascular Surgeons and Vascular Laboratories, Bellevue, WA, ²Bellevue, WA

Discussant: Juan Carlos Jimenez, MD, Orange, CA

OBJECTIVE: With the advent of minimally invasive techniques to treat superficial venous insufficiency, the volume of varicose vein procedures performed in the United States has increased substantially. Insurers are starting to utilize specific duplex-derived measures (specifically GSV diameter and reflux time) to approve or deny coverage of these procedures. The aim of this study was to assess the relationship between physician derived CEAP clinical class, VCSS and quantitative data obtained from duplex ultrasound.

METHODS: A retrospective analysis was performed on all patients who underwent a duplex ultrasound for venous reflux/venous stasis disease over a 7-month period (n=739) at a single outpatient vascular laboratory. For the purposes of this study, we included only those patients with documented saphenofemoral junction reflux. Patients with extensive deep vein reflux, deep vein thrombosis, and superficial thrombophlebitis were also excluded. 370 patients met this criteria, and all had diameter and reflux times measured at the saphenofemoral junction/proximal thigh. 239 out of the 370 patients had documented CEAP and VCSS scores. Pearson correlation coefficients were used to assess the correlation between GSV diameter, reflux time, CEAP class and VCSS.

RESULTS: The average patient age was 51 and were 81% were female. VCSS scores ranged from 2-15 and CEAP between 2-6. Mean reflux time was 5.9 seconds (0.9-12) and the GSV diameter mean was 7.7 mm (2.6-19). Statistical analysis showed there was no significant relationship between reflux time and vein diameter ($r = 0.148$). A moderate correlation existed between vein diameter and both CEAP and VCSS scores ($r = 0.382$ and 0.419 respectively, $p 0.01$). No correlation existed between reflux time and CEAP/VCSS scores ($r = -0.103$ and -0.082 respectively).

CONCLUSIONS: In our population there was no relationship between reflux time and CEAP/VCSS scores, and only moderate relationship between GSV diameter and these physician derived scores. Using GSV diameter and/or reflux times alone as surrogate markers for disease severity may be inappropriate.

This abstract addresses the relationship between ultrasound findings and CEAP/VCSS scores. Patient outcome can improve if we fully understand the criteria used to measure disease severity.

- 9:10 a.m. 21. **Black Patients are Less Likely to Receive First Time Arteriovenous Fistulas: A Question of Smaller Vein Diameters**
 Brandon Ishaque¹, Mohamed A. Zayed, MD, PhD², Jessica Miller³, Amy H. Kaji, MD, PhD³, Jason T. Lee, MD², Jessica O'Connell, MD³, Christian de Virgilio, MD³
¹Department of Surgery, UCLA, Los Angeles, CA, ²Stanford, CA, USA, ³Los Angeles, CA
Discussant: Roy M. Fujitani, MD, Orange, CA

OBJECTIVE: The National Kidney Foundation has recommended utilizing autogenous arteriovenous fistulas (AVF) in at least 50% of all new ESRD patients. Some studies suggest that black patients are less likely to receive first time AVF than other ethnicities, though the reason for this disparity is unclear. The purpose of our study is to determine whether racial differences influence AVF preference over grafts and whether this may be related to differences in vein diameters.

METHODS: Consecutive patients undergoing first-time hemodialysis access from 2006-2010 at two institutions were retrospectively reviewed. Data collected included age, sex, ethnicity, weight, height, body surface area (BSA), diabetes, hypertension, congestive heart failure, smoking history, intravenous drug abuse, need for temporary access placement, and preoperative venous ultrasound measurements. Categorical variables were compared using chi-square and odds ratios, whereas the Wilcoxon-rank sum test was used to compare continuous variables.

RESULTS: 280 patients (99 black) were identified for the study. Median age in black and non black patients was 63. All patients underwent preoperative duplex, and blacks demonstrated statistically significant, smaller median basilic and cephalic vein diameters at all measured sites except at the cephalic vein distal forearm and proximal upper arm. Overall, 249 patients (90 %) underwent AVF first. AV graft was created in 18% of black patients versus only 7% of non blacks (OR = 2.9, 95% CI 1.3-6.1, p = 0.0005). Weight and BSA were statistically significantly different between black and non black patients, whereas the need for temporary access prior to hemoaccess was similar between the cohorts. After adjusting for weight and BSA, black patients were still more likely to undergo AV graft (OR = 2.9, 95% CI 1.3-6.6, p = 0.007).

CONCLUSIONS: Black patients are less likely to undergo AVF during first time hemodialysis access surgery, likely due to their smaller preoperative measurements in basilic and cephalic vein diameters.

10:00 a.m. 22. Duplex Ultrasound Criteria for Re-intervention after Mesenteric Artery Revascularization

Aaron C. Baker¹, Victoria Chew², Chin-Shang Li, PhD², Tzu-Chun Lin², David L. Dawson, MD¹, William C. Pevec, MD¹, Nasim Hedayati, MD¹

¹Department of Surgery, University of California Davis Health System, Sacramento, CA, ²Sacramento, CA

Discussant: R. Eugene Zierler, MD, Seattle, WA

OBJECTIVE: Currently, there are no well established duplex ultrasound (DUS) criteria for the evaluation of the superior mesenteric artery (SMA) after stenting for occlusive disease. Previous studies suggested DUS velocity criteria in native SMA overestimate stenosis in stented arteries, but no study has evaluated DUS following SMA stenting longitudinally. This study was undertaken to determine the accuracy of DUS in evaluation of SMA in-stent restenosis.

METHODS: We identified all patients who underwent SMA/cealic artery stenting and mesenteric bypass grafting from January 2004 to December 2010.

RESULTS: Twenty-seven patients with symptomatic mesenteric ischemia were treated with mesenteric stenting and 15 patients with mesenteric bypass grafting. Eighteen pre-stent DUS showed SMA peak systolic velocity (PSV) of 471 ± 118 cm/s. Pre-stenting angiography revealed SMA stenosis of $72 \pm 15\%$. Completion angiography revealed $<15\%$ residual stenosis. No significant correlation was identified between SMA PSV and angiographic stenosis pre and post stenting. Follow up SMA DUS showed a PSV of 365 ± 130 cm/s at 2 ± 5 months, PSV of 377 ± 145 cm/s at 5 ± 3 months, and a PSV of 375 ± 103 cm/s at 15 ± 4 months. A significant difference existed between pre-stenting and the first post stenting SMA PSV (p -value < 0.05), but no significant difference existed between each post stenting interval (Figure 1). Six patients (5 asymptomatic, 1 symptomatic) had repeat mesenteric angiography for elevated SMA stent PSV of 490 ± 87 cm/s (vs. 343 ± 146 cm/s in patients who did not undergo re-intervention). Angiography demonstrated $57\% \pm 13$ stenosis of the SMA. Four patients underwent re-stenting and one patient had angioplasty. PSV decreased to 380 ± 57 cm/s post procedure. In the patients who had SMA bypass grafting, DUS did not show a change in PSV over time (Figure 2).

CONCLUSION: As has been previously shown in DUS studies of carotid and renal artery stents, our data demonstrate that PSV in successfully stented SMAs is higher than the PSV of 275 cm/s used for diagnosing stenosis of non-stented SMAs. More importantly, PSV of stented SMAs do not significantly change over time. DUS should be considered early after mesenteric intervention to identify significant residual stenosis that may need early re-intervention and to provide a baseline for future follow-up.

Figure 1: Pre and Post Stented SMA PSV

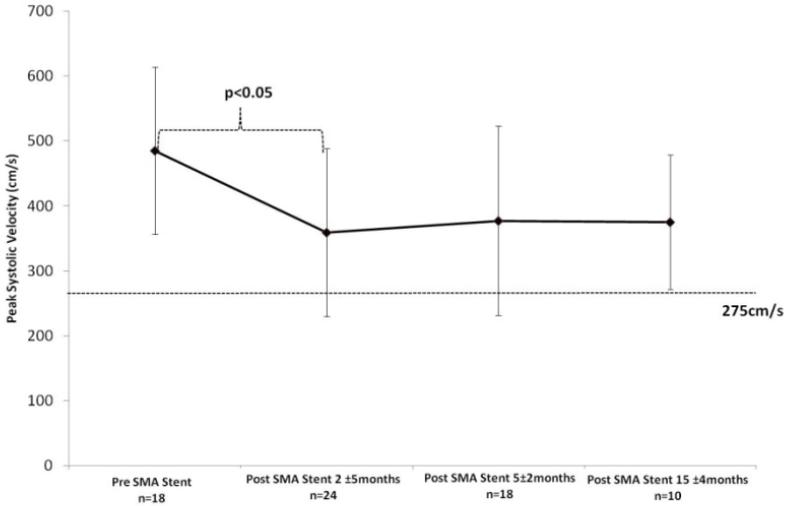
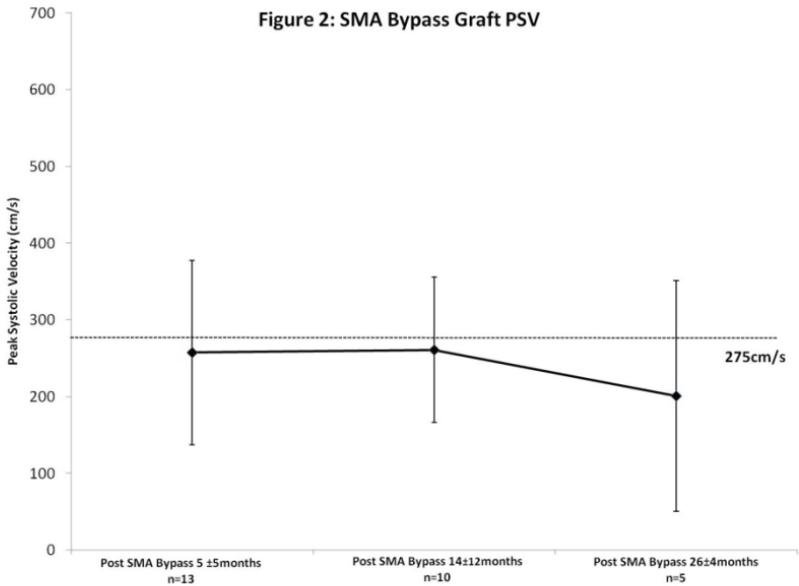


Figure 2: SMA Bypass Graft PSV



10:20 a.m. 23. **Durability and Stroke Free Survival After Carotid Stenting: Long-term Follow-Up in a Community Setting**

Peter A. Schneider, MD¹, Michael Peterson, MD², Michael T. Caps, MD²,
Nicolas Nelken, MD²

¹Vascular Therapy, Hawaii Permanente Medical Group, Honolulu, HI,

²Honolulu, HI

Discussant: Robert J. Hye, MD, San Diego, CA

OBJECTIVES: The aim of carotid angioplasty and stent (CAS) is stroke prevention. Large trials have been conducted or are underway to understand the results of CAS. However, two significant questions remain. 1) What are the long-term results, beyond the reports of 2 to 4 years? Do the results of major trials correlate with similar results in the community at large? The purpose of this study is twofold: to evaluate the long-term results of CAS with respect to stroke-free survival, re-stenosis, and re-intervention; and, assess the overall result of CAS in a community setting.

METHODS: Over a nine year period (2002-2010) we used CAS as a treatment for significant carotid stenosis in 162 procedures in 150 patients. In most of the patients, there was one or more anatomic or physiologic indication for CAS due to high risk status for carotid endarterectomy. After CAS, patients were followed with surveillance duplex in a certified vascular laboratory at 1 month, 6 months, 1 year and annually thereafter. Peak systolic velocity >200cm/sec was considered to be a re-stenosis of >50% and PSV >300cm/sec was considered to be >70% re-stenosis. Repeat interventions were performed at the discretion of the treating surgeon.

RESULTS: The risk of perioperative stroke was 3.1% and death was 0.6%. Mean follow-up was 2.6 years with a range of 0 to 8.9 years. 120 of the procedures (74%) had a follow-up of at least one year. Stroke-free survival at 1, 3 and 5 years was 91%, 70% and 53%, respectively. Freedom from all cause stroke was 96% at 1 year, 95% at 3 years, and 92% at 5 years. Re-stenosis of 50% or more occurred in 4% at 1 year, 8% at 3 years and 8% at 5 years. Re-stenosis of 70% or more occurred in 2% at 1 year, 6% at 3 years and 6% at 5 years. Only 3 (1.9%) of the index procedures required re-treatment. None of the patients with recurrent stenosis presented with neurologic symptoms. None of the patients died of stroke during long-term follow-up.

CONCLUSION: Long-term stroke free survival was diminished in this population at high risk for carotid surgery. The rates of re-stenosis, re-intervention, and stroke from any cause were acceptable after CAS. These data suggest that CAS can be performed in a community setting with acceptable long-term durability and stroke prevention.

10:40 a.m. 24. Perioperative Complications Associated with Femoral Vein Harvest

Ravi V. Dhanisetty¹, Timothy K. Liem, MD², Gregory L. Landry, MD², Erica L. Mitchell, MD², Gregory L. Moneta, MD²

¹Department of Surgery, Oregon Health & Science University, Portland, OR, ²Portland, OR

Discussant: E. John Harris, Jr., MD, Stanford, CA

OBJECTIVES: The femoral vein is increasingly utilized as a conduit in major arterial and venous reconstructions. However, the perioperative complications associated with femoral vein harvest (FVH) are not well described. The purpose of this study was to determine the incidence and risk factors for the development of deep venous thrombosis in patients who undergo FVH.

METHODS: All patients who underwent FVH over a 5-year period were reviewed. Patient clinical characteristics and indications for surgery were determined from an electronic medical record query. Postoperative venous duplex scans and computerized tomography scans of the chest were reviewed. Data were analyzed using t-test.

RESULTS: 57 patients (53% male, mean age 62 years) underwent 58 FVH procedures. 53% of procedures were performed for arterial reconstruction and 47% for major venous reconstruction after cancer resection (80% portomesenteric reconstruction). Perioperative ipsilateral DVTs were detected in 17 of 58 (29%) FVH procedures. 11 (19%) were isolated to the veins distal to the FVH site, and 6 (10%) occurred proximal to the FVH site. The incidence of DVT was significantly greater in patients with malignancy (56% vs 13%) (P-value = 0.003). All DVTs proximal to the vein harvest site occurred in patients with malignancy. Pulmonary embolism occurred in 2 patients, and none of the patients developed compartment syndrome or limb loss. 8 patients (14%) required bedside or operative FVH wound debridement.

CONCLUSIONS: FVH is frequently associated with ipsilateral DVT, and the incidence is significantly higher in patients with malignancy. Aggressive thromboprophylaxis may be warranted after femoral vein harvest, especially in patients with known malignancy. Longer-term studies are needed to determine the natural history of DVTs associated with femoral vein harvest.

11:10 a.m. 25. **Development of a Rapid, High Resolution Magnetic Resonance Imaging Protocol for the Assessment of Arteriovenous Fistula Remodeling**

Warren J. Gasper, MD¹, Monica Sigovan², Vitaliy Rayz², Joseph Rapp², David Saloner², Christopher D. Owens²

¹Vascular Surgery, UCSE, San Francisco, CA, ²San Francisco, CA

Proposed Discussant: TBD

OBJECTIVE: To investigate the relationship of hemodynamic forces to structural remodeling in the maturing arteriovenous fistula (AVF), we developed a rapid MRI-based AVF imaging protocol from a series of newly created and mature AVFs. In addition, we report, for the first time, use of a non-gadolinium-based contrast agent, ferumoxytol, for contrast-enhanced MRA (CE-MRA) of an AVF.

METHODS: This was a cross-sectional study of subjects with stage IV or V chronic kidney disease before and after AVF creation. The imaging protocol consisted of 2D and 3D time of flight (TOF) sequences performed at 1.5T (Siemens Avanto, Germany). Through-plane blood flow velocities in the artery and vein were measured 3cm above the anastomosis with a 2D phase contrast (PC) sequence. CE-MRA was done with superparamagnetic iron oxide particles (ferumoxytol, AMAG, Lexington MA). Computational fluid dynamics (CFD) simulations were performed using a finite volume solver to determine velocity field and wall shear stress distributions (Fluent, Lebanon NH).

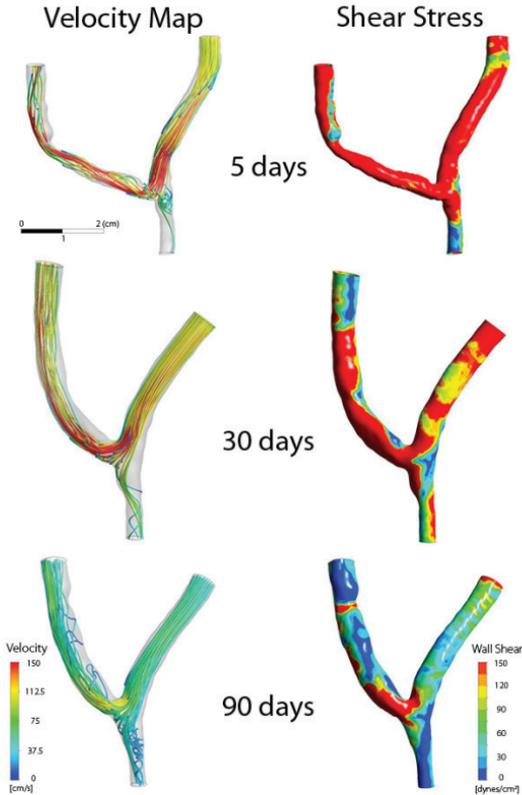
RESULTS: Twelve subjects (median age 67 years, IQR 59-76) had 22 scans. Among patients with a brachial artery AVF, the average arterial diameter increased while arterial velocity and volumetric flow both increased by 20 times, $P < 0.01$. Both vein diameter and volumetric flow increased after AVF surgery (table). CFD demonstrated decreasing blood velocities and asymmetric wall shear stress mappings along the AVF from 5 to 90 days postop. Importantly, areas of stagnation persisted during this critical time frame (figure). Compared to TOF, ferumoxytol-enhanced MRA significantly increased spatial resolution, increased fistula coverage (12.8cm vs 6cm) and decreased imaging time (20 sec vs 3 min).

CONCLUSIONS: Development of a rapid, high-resolution MRI protocol with CFD models, allowed for a comprehensive characterization of blood vessel structure and hemodynamic forces in newly created and mature AVFs. This MRI protocol is now being used prospectively to investigate the relationship between hemodynamic forces, blood vessel remodeling and AVF maturation. Additionally, ferumoxytol in CE-MRA shows promise as a safe, non-invasive method for evaluating AVFs, especially non-maturing AVFs and potentially other vascular structures in patients with end-stage renal disease.

26TH ANNUAL MEETING - KAUAI, HI

Blood vessel characteristics before and after AVF (*p<0.01, ANOVA)

	Preoperative (n=5)	Immediately postop (n=2)	1 month postop (n=2)	Mature (>1yr) (n=2)
Brachial artery				
Diameter, mm (SD)	4.5 (0.48)	5.4 (0.56)	5.1 (0.41)	4.9 (1.8)
Average velocity, cm/s (SD)	5.5 (3.2)*	62 (17)*	70 (7)*	112.5 (57)*
Volumetric flow, ml/min (SD)	56 (33)*	850 (58)*	878 (225)*	1120 (236)*
Cephalic or Basilic Vein				
Diameter, mm (SD)	3.7	4.8 (0.05)	4.7 (1.3)	13.2 (7.2)
Average velocity, cm/s (SD)	2.25	55 (17)	64 (14)	15.7 (9.7)
Volumetric flow, ml/min (SD)	14.8	596 (201)	733 (530)	1054 (492)
Percent of blood flow in the distal artery	N/A	30%	17%	6%
Percent of blood flow in the venous limb	N/A	70%	83%	94%



11:30 a.m.

ADJOURN

RESIDENT FORUM ABSTRACTS

12:30 p.m. – 2:00 p.m.

18th RESIDENT FORUM

Kauai Ballroom

12:30 p.m. Introduction and Welcome

David L. Dawson, MD

12:35 p.m.RF1 Important Predictors of DWI Lesions and Neurological Sequelae Following Carotid Intervention

Mohamed A. Zayed, MD, Jeffrey Stephens, Simin Gholibeikian, MD, Shahrzad Ossareh, MD, Allyson Rosen, PhD, Barton Lane, MD and Wei Zhou, MD

Surgery, Veterans Affairs Hospital Palo Alto, Palo Alto, CA

OBJECTIVES: Embolic detection on diffusion weighted MRI (DWI) is a promising outcome measure for carotid interventions. We previously reported that patients undergoing carotid artery stenting (CAS) have a 50% greater chance of developing new microemboli on DWI compared to CEA. We sought to re-evaluate these outcomes in a larger patient set after technical modifications to our CAS program. We also examined the risk factors for DWI lesions and correlated neurologic symptoms with DWI derived mean lesion volume (MLV).

METHODS: From 7/2004 to 12/2010, a total of 228 patients (143 CEA, 85 CAS) who underwent carotid interventions also received pre- and post-operative DWI evaluations at a single academic institution. A novel neuroimaging analysis technique was used to derive MLV on DWI. Hospital records for all patients were reviewed for comorbidities, lesion characteristics, post-operative outcomes, and incidence of peri-procedural microemboli.

RESULTS: Forty (47%) CAS patients compared to 15 (10%) CEA patients had postoperative DWI lesions ($P<0.01$), and a higher incidence of contralateral microembolization ($P=0.01$). Multivariate analysis demonstrated that the strongest predictors of DWI lesions after CAS or CEA were BMI >30 ($P<0.01$, CI 1.4-8), pre-operative stroke ($P<0.01$, CI 2.9-15.3), COPD ($P=0.03$, CI 1.1-6.2) and CAD ($P=0.05$, CI 1-6.2; Table). Subset analysis of MLV demonstrated a significant correlation with the incidence of post-operative neurological symptoms ($P=0.04$, R^2 0.248). MLV was not different between CAS and CEA ($P=0.13$).

CONCLUSION: The incidence of microembolic events following CAS is higher compared to CEA, but the MLV is similar for the two groups. DWI derived MLV highly correlates with post-procedural neurological sequelae. Further investigational use of peri-procedural DWI is needed to determine the utility and cost-effectiveness of identifying patients at risk of neurological sequelae following carotid intervention.

26TH ANNUAL MEETING - KAUAI, HI

Multivariate Analysis Of Peri-Operative Factors

Factor	P Value	CI
Age > 70	0.70	5.2-2.6
Gender	0.09	0.02-1.3
Smoking	0.68	0.4-1.9
Hypertension	0.53	0.1-3.4
Hyperlipidemia	0.89	0.2-5.3
Obesity (BMI > 30)	<0.01	1.4-8
CAD	0.05	1-6.2
COPD	0.03	1.1-6.2
PVD	0.16	0.2-1.3
Pre-Operative Stroke	<0.01	2.9-15.3
Carotid Lesion Calcification		

NOTES

12:43 p.m.RF2 **Upregulation of Mitochondrial Chaperone Proteins in Vein Grafts: A Potential Mechanism of Apoptosis-Resistance in the Arterialized Vein**

Khanh P. Nguyen, Christopher Owens, MD, Peng Yu, MD, Sara J. Runge, MD and Michael S. Conte, MD
Surgery, UCSF, San Francisco, CA and Boston, MA

OBJECTIVES: Resistance to apoptosis is a salient feature of neoplasia and neointimal hyperplasia. In cancer, a mitochondrial chaperone network consisting of heat shock proteins (Hsp) 75 and Hsp90 mediates apoptosis-resistance. We hypothesize that these mitochondrial proteins regulate survival in venous smooth muscle cells (VSMC) following arterialization, and may be critical in the hyperplastic response.

METHODS: Primary cultured VSMC from human saphenous veins were stimulated with PDGF-BB (100 ng/ml) or TNF α (10 ng/ml) for 24 hrs. Cells were fractionated for immunoblotting and cytosolic and mitochondrial fractions probed for Hsp75 and Hsp90. Excised segments of diseased human vein grafts (N=12) and control saphenous veins (N=10) were obtained from discarded specimens. Rabbits (N=9) underwent carotid interposition vein grafting and grafts were harvested on day 5 or 28. Specimens were stained for Hsp75, Hsp90, or the inducible isoform Hsp90 β .

RESULTS: Immunoblotting showed that Hsp90 and Hsp75 were expressed primarily in the cytosol and mitochondria of VSMC, respectively. Mitochondrial Hsp75 was significantly increased following either cytokine or growth factor stimulation in-vitro. Following arterialization, Hsp75 expression was notably increased in all vein grafts. In the rabbit, both early (5 days, N=2) and late (28 days, N=7) vein grafts had significantly greater Hsp75 staining throughout the intima and media as compared to absent or minimal expression in control jugular veins (N=9, ANOVA, $p < 0.05$). Human vein grafts (age 84 to 1330 days) showed significantly increased Hsp75 expression in the intima and media as compared to controls ($p < 0.05$). Early vein grafts (<365 days, N=3) may have greater relative Hsp75 expression than late vein grafts (>365 days, N=9) (ANOVA, $p < 0.05$). Both saphenous veins and human vein grafts had positive staining for Hsp90 and weaker staining for Hsp90 β in the intima and media.

CONCLUSIONS: Upregulation of the mitochondrial chaperone protein Hsp75 following venous arterialization may promote a state of relative apoptosis-resistance within VSMC in the healing graft wall. Further studies are underway to determine the specific role of these proteins in vein graft remodeling.

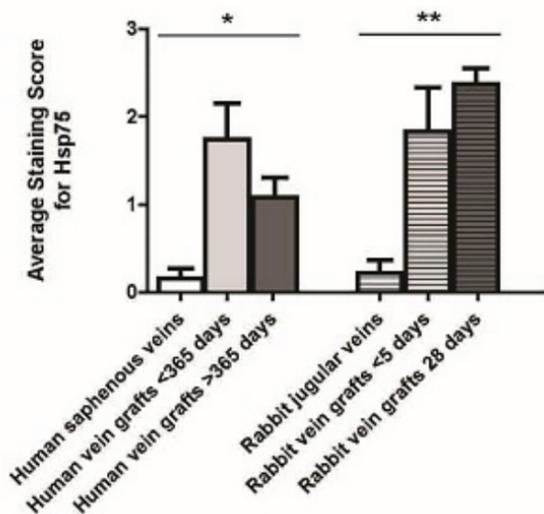


Figure 1. Quantification of Hsp75 expression in human vein grafts versus saphenous vein controls (N=10, 9,3; ANOVA * $p < 0.05$) and rabbit vein grafts versus jugular vein controls (N=9, 2, 7; ANOVA ** $p < 0.05$) showed significant upregulation of Hsp75 in all vein grafts as compared to control veins.

NOTES

12:51 p.m.RF3 **Increased Transfusion of Autologous Blood but not Plasma is Associated with Improved Survival in Ruptured Abdominal Aortic Aneurysm**

David S. Kauvar, MD, Mark R. Sarfati, MD and Larry W. Kraiss, MD
Vascular Surgery, University of Utah, Salt Lake City, UT and Uniformed Services University of the Health Sciences, Bethesda, MD

OBJECTIVES: The resuscitation of ruptured abdominal aortic aneurysm (RAAA) patients has not been well-studied and the potential benefit of autotransfusion (AT) is unknown. Increased use of plasma (FFP) is associated with decreased mortality in trauma patients and may improve RAAA mortality. We explored the influence of AT and FFP resuscitation on mortality in massively transfused (MT) RAAA patients.

METHODS: A single-center review of RAAA patient records from April 1989 to October 2009 was undertaken. Clinical data and outcomes were studied. Operative and anesthesia records were queried for intraoperative transfusion totals, MT was defined as ≥ 10 units of red blood cells inclusive of AT units (RBC).

RESULTS: 151 RAAA were identified, 89 (60%) received MT. In-hospital mortality was 44%. Univariates predictive of mortality included increased age, preoperative hypotension, operative blood loss, and crystalloid, RBC, and FFP volume. 85 patients received AT, with an increased ratio of AT:PRBC units associated with survival. Mortality was 34% with AT:PRBC ≥ 1 (HIGH AT) and 55% with AT:PRBC less than 1 (LOW AT, $P=.03$). On multivariate analysis, age >74 ($P=.03$), preoperative SBP less than 90mmHg ($P=.06$), blood loss $>6L$ ($P=.06$), and LOW AT ($P=.02$) independently predicted mortality. Mean RBC:FFP ratios were similar in those that died (2.7) and lived (2.9, $P=.66$). RBC:FFP ≤ 2 (HIGH FFP) was present in 38 (43%) patients, with mortality of 49%. RBC:FFP less than 2 (LOW FFP) had 40% mortality ($P=.39$). Over time, RBC:FFP ratios decreased from 3.6 (1989-1999) to 2.2 (2000-2009, $P<.001$), but the more liberal use of FFP was not associated with decreased mortality (47% vs 41%, $P=.56$). AT:PRBC ratios were stable over time (1.4 to 1.2, $P=.18$).

CONCLUSION: Greater use of AT but not of FFP was associated with survival in massively transfused RAAA patients. We did not see a mortality benefit with increased FFP, but few patients had high FFP transfusion ratios. Further study to identify RAAA patients at risk for massive transfusion should be undertaken and a potentially greater role for AT in RAAA resuscitation investigated.

1:00 p.m. RF4 **The Impact and Outcomes of Establishing an Integrated Interdisciplinary Team To Care for Patients with Diabetic Foot Ulcers**

Matthew L. White, MD, David G. Armstrong, DPM, , Manish Bharara, PhD, Brian Lepow, DPM, Kaoru R. Goshima, MD, Daniel M. Ilnat, MD, John D. Hughes, MD, Sugam Bhatnagar, MBBS, Timothy Fisher, DPM and Joseph L. Mills, Sr., MD

Vascular and Endovascular Surgery, University of Arizona, Tucson, AZ and Salt Lake City, UT

OBJECTIVE: To quantify the impact of an integrated diabetic foot surgical service on outcomes.

METHODS: We abstracted registry data from 48 consecutive months at a single institution, evaluating all patients with diabetic foot complications requiring foot surgery or vascular intervention. We compared outcomes in the 24 months before and after integrating podiatric surgery with a vascular surgical limb-salvage service.

RESULTS: The service performed 2923 operations; 790 (27.0%) operations were related to the treatment of diabetic foot complications in 374 patients. Of these, 502 operations were classified as non-vascular diabetic foot surgery and 288 were vascular interventions. Overall, one-third of patients required vascular intervention, initially endovascular in 86.5% of patients. Conversion to open bypass was required in 29.2% of these patients, more than double the revision rate of those receiving open bypass first (13.1%). After team integration, vascular reconstructions increased 44.2%. This increase held true for both endovascular (26.7% increase) and open interventions (88.2% increase), with a trend toward more infrageniculate vascular procedures (43.2% vs. 57.7%, $p = 0.02$, OR = 1.8). After team integration, the percentage of urgent operations was significantly reduced (74.4% vs. 51.8% $p < 0.0001$, OR = 2.7), and the high/low amputation ratio decreased from 0.34 to 0.26, ($p < 0.0001$) due to an increase in midfoot amputations (6.7% vs. 11.6%, $p < 0.08$, OR = 1.8). BKAs were reduced 45.7% with a relatively stable above knee/below knee amputation (AKA/BKA) ratio (0.73 to 0.81).

CONCLUSIONS: Creation of an interdisciplinary vascular and podiatric surgical team significantly impacts surgery type and volume. Significantly more non-urgent operations are performed, with a decrease in the high/low amputation ratio. Vascular surgery volume is significantly increased, especially with regard to open infrageniculate procedures. While endovascular procedures have become increasingly applicable, open bypass remains critical to success.

1:08 p.m. RF5 Operative Management of Neurogenic Thoracic Outlet Syndrome in the Adolescent

Wesley K. Lew, MD, Jessica O'Connell, MD and Hugh Gelabert
Vascular Surgery, UCLA, Los Angeles, CA

OBJECTIVES: Neurogenic Thoracic Outlet Syndrome (TOS) in adolescents is an uncommon condition where neuro-vascular compression may result in incapacitating symptoms. Teenage athletes may also have their academic and competitive careers placed in jeopardy. We have reviewed our experience with neurogenic TOS in adolescents to better define the presentation, diagnosis, and results of surgical intervention.

METHODS: A retrospective review of our database identified patients 19 years of age and younger, presenting with neurogenic TOS who underwent surgical decompression. Patient characteristics on presentation, preoperative testing, surgical course, and follow up data were all collected.

RESULTS: From 1996-2009 a total of 20 patients (19 female, 1 male) underwent surgery for neurogenic TOS. Twelve were student athletes. Presenting symptoms included upper extremity paresthesia (n=19), pain (n=18), weakness (n=9), and hand atrophy (n=2). Symptoms affected the dominant limb in 80% and were bilateral in 45%. Pre-operative evaluation included a combination of anterior scalene muscle block (n=11) and electromyography or nerve conduction studies (n=16). Non-operative therapy was attempted but failed in all. The surgical approach was a trans-axillary first rib resection (TAFRR) in 19 and total anterior scalene muscle resection (TASMR) in 1 patient. Intra-operative findings included the presence of 4 cervical ribs, 7 scalene minimus muscles, and 4 patients had both. There were no peri-operative or post-operative complications. The mean follow up was 372 days. Six patients required additional TASMR. Two patients underwent contralateral TAFRR for neurogenic TOS. Overall, 18 patients had either complete resolution or minimal residual symptoms. All patients were able to return to school and 92% (11/12) of athletes were able to return to competition.

CONCLUSIONS: Surgical treatment of neurogenic TOS in adolescents may be performed with low morbidity. The majority of patients are female and anatomical anomalies are commonly identified. Almost one third of patients may require additional TASMR. Significant improvement in symptoms, the ability to return to school, and resumption of athletic competition suggests that in carefully selected adolescent patients results may be superior to those reported in adults.

1:16 p.m. RF6 Hospital Volume of Thoracoabdominal Aneurysm Repair Does Not Affect Mortality in California

Anna C. Weiss, MD, Amanda Green, Katherine E. Brown, MD, David Chang, PhD and Nikhil Kansal, MD
General Surgery, UCSD, San Diego, CA

OBJECTIVE: Current literature has shown that high volume institutions have better outcomes following thoracoabdominal aneurysm repairs (TAARs). The objective of this study was to investigate the morbidity and mortality rates of TAAR in California. We hypothesized that the morbidity and mortality rates have improved over the last 15 years, and that higher volume institutions have significantly better outcomes.

METHODS: We queried the California 100% discharge database for patients who underwent TAAR between 1995-2008. We performed a retrospective review comparing morbidity and mortality rates each year. Morbidities included paraplegia, myocardial infarction, stroke, respiratory failure, and renal failure. Two methods of classifying hospitals into low and high volume cohorts were utilized: volume each year, or 3-year averages to account for fluctuations. High volume was defined as more than eight TAARs per year. An adjusted analysis was performed correcting for the patient demographics, Charlson index, aneurysm rupture, and elective repair.

RESULTS: There were a total of 1085 TAARs between 1995-2008. There were 117 low-volume and 4 high-volume institutions. The morbidity and mortality rates following TAAR did not significantly improve over time ($p=0.3$ and 0.25 respectively). On unadjusted analysis, the mortality rate at 1-year low volume institutions was 27%, compared to 20% at 1-year high-volume institutions ($p=0.02$). The mortality rate at 3-year averaged high-volume institutions was 23%, compared to 25% at low-volume ($p=0.353$). Adjusted analysis revealed an odds ratio of mortality of 0.385 at 1-year high-volume institutions ($p=0.053$, 95% confidence interval 0.35-1.01). Three-year averaged high-volume hospitals had an odds ratio of mortality of 0.59 ($p=0.396$, 95% CI 0.175-1.99).

CONCLUSIONS: The morbidity and mortality rates following TAAR have not significantly changed over the past 15 years in California. Although current literature reports significantly better outcomes following TAAR at high volume institutions, in the state of California, the mortality following TAAR is similar at both low and high volume institutions.

1:24 p.m. RF7 **Aortic Measurements in Endovascular Aneurysm Repair**
Marlin Causey and Niten Singh, MD
Surgery Residency, Madigan Army Medical Center, Ft. Lewis, WA

OBJECTIVE: Accurate preoperative planning and sizing for Endovascular Aneurysm Repair (EVAR) is essential for reduced procedural time, more efficient utilization of fluoroscopy and contrast, and prevention of latter adjunctive procedures. The current preoperative standard for EVAR is axial computed tomography (CT) but other imaging modalities such as intravascular ultrasound (IVUS), angiography, and CT reconstruction software packages have also been employed. Our objective was to determine which of the above-mentioned imaging modalities is the optimal method of preoperative planning for EVAR.

METHODS: Data was collected prospectively over a 10 month period of time on consecutive patients undergoing EVAR. Preoperatively, the surgeon of record obtained his measurements and calculations utilizing a CT-reconstruction software package (RS) with centerline measurements. Another surgeon blinded to the case obtained measurements and calculations utilizing standard axial CT. A standardized measurement protocol was employed. Both surgeons chose endografts based on their individual measurements. Intraoperatively, IVUS and angiographic measurements were obtained in a non-blinded fashion.

RESULTS: 20 EVARs were performed during the study period (3 females and 17 males) with a mean age of 72 +/-5.5 years utilizing an average of 94.5 mLs of contrast and 22 minutes of fluoroscopy. Aortic measurements are listed in Table 1 comparing the different modalities. There was no statistically significant difference in diameter measurement between different modalities. However, centerline measurements from the RS were significantly longer than either the CT or IVUS lengths and did correlate with the actual length and ultimately graft employed (Table 2). The ultimate endograft chosen correlated with the endograft in the RS software in 15/17 patients while only 1/3 was sized appropriately from axial CT.

CONCLUSIONS: The ideal method to measure the aorta prior to deployment of an abdominal aortic endograft is evolving as technology improves. We believe employing reconstructive software of axial CTs allows for more accurate preoperative planning particularly with the length of grafts chosen.

Table 1. EVAR diameters at different levels.

Level	CT (mm)	M2S (mm)	IVUS (mm)	p-value
Renal Arteries	23.7 +/- 0.9	23.8 +/- 0.8	22.8 +/- 0.7	.731
5mm	24.1 +/- 0.9	24.5 +/- 1.1		.986
10mm	24.2 +/- 0.9	25.8 +/- 1.2	24.9 +/- 1.2	.921
15mm	25.9 +/- 1.0	26.4 +/- 1.2		.811
20mm	26.9 +/- 0.8	27.2 +/- 1.2	26.3 +/- 1.2	.812
Bifurcation	23.0 +/- 1.1	24.9 +/- 1.7	22.8 +/- 1.5	.822
R CIA seal	12.8 +/- 0.7	13.7 +/- 0.6	12.0 +/- 0.6	.272
L CIA seal	13.0 +/- 0.8	12.3 +/- 0.4	11.7 +/- 0.6	.413

Table 2. Centerline measurements comparing different modalities.

Centerline Measurements	CT (mm)	RS (mm)	Angiography (mm)	p-value
Aorta to Bifurcation	104 +/- 3.3	103 +/- 9.5	102 +/- 7.5	.812
Aorta to Left Hypogastric	160 +/- 4.7	184 +/- 6.1	156 +/- 9.8	.019
Aorta to Right Hypogastric	161 +/- 4.0	183 +/- 7.0	160 +/- 9.3	.012

NOTES

1:32 p.m. RF8 **Significant Clinical Predictors of Post-Operative Mortality Following Endovascular Abdominal Aortic Aneurysm Repair**
Nhan-Vu Nguyen, MD, Linda Chun, MD, Jateen Prema, MD, Clarence W. Cole, MD and Kevin Patel, MD
Kaiser Permanente-LAMC, Los Angeles, CA

OBJECTIVES: To study the relationships between endovascular aneurysm repair and the causes for long-term post-operative death in order to identify significant predictors of mortality.

METHODS: A retrospective review of a multi-institution database of all patients that underwent EVAR between May 2003 and June 2010 was performed. Comparisons of patient demographics and clinical characteristics between deceased and alive patients were evaluated.

RESULTS: 588 patients (68 females and 520 males) underwent EVAR during the study period. There were a total of 82 (13.9%) deaths. The causes of death were distributed as follows: 12 (14.6%), 6 (7.3%), 25 (30.5%), 3 (3.7%), 7 (8.5%) and 29 (35.4%) in pulmonary, cardiac, cancer, post-operation, other, and unknown respectively. The average age of patients was 77.8 +7.8 years for those who died and 73.9+8.1 years for those who were alive. Adjusting for all the other variables in the models, for each year increase in age, there was an 8 percent increase risk of death. In addition, positive and significant relationships were found between age, ESRD, COPD, postoperative pulmonary event and risk of all cause mortality. Patients with ESRD or COPD had approximately 4 and 2 times higher risk of death compared to those without ESRD and COPD. There was a protective relationship between the patients on ASA or preoperative Statin and risk of all cause mortality. Those on an ASA or Statin before operation were 50 percent and 46 percent less likely to die than those patients who did not.

CONCLUSIONS: Patient age at time of EVAR and the presence of ESRD or COPD were significant risk factors for long-term post repair mortality. Peri-operative ASA and Statin use were protective.

1:40 p.m. RF9 Screening Carotid Artery Duplex in Patients Undergoing Cardiac Surgery

Linda J. Chun, MD, Michael Tam, MD, Jerry Tsai, MD, Clarence W. Cole, MD, Kevin Patel, MD
Vascular Surgery, Kaiser Permanente, Los Angeles, CA

OBJECTIVE: To determine the incidence of carotid artery stenosis in a large multi-institutional HMO found during screening duplex prior to cardiac surgery and to identify risk factors to increase the yield of a pre-operative screening program.

METHODS: This is a retrospective review of a multi-institutional database of all patients that had a screening carotid artery duplex prior to cardiac surgery between January 2006 and January 2011. The main outcome was carotid artery stenosis greater than 50% detected on screening duplex. Multivariate analysis was done to analyze for risk factors of carotid artery stenosis.

RESULTS: 406 patients (67% male, median age of 71) had screening carotid artery duplex before undergoing cardiac surgery. The main indications for cardiac surgery were coronary artery disease (38.9%) and valvular disease (42.4%). Sixty-nine patients (17.0%) had carotid artery stenosis detected during screening duplex. There were 20 patients (29.0%) that had bilateral carotid artery stenosis. Twenty-two patients (31.9%) had at least 70% unilateral carotid artery stenosis. The presence of peripheral vascular disease (OR 3.0 [1.7-5.2], $p < 0.0001$), coronary artery disease (OR 3.5 [1.6-7.7], $p = 0.001$), and left main disease (OR 6.5 [2.3-18.7], $p = 0.002$) were all risk factors associated with carotid artery stenosis. A history of smoking (OR 1.9 [1.1-3.3], $p = 0.002$), prior cerebrovascular accident or transient ischemic attack (OR 2.2 [1.2-3.9], $p = 0.01$), and prior myocardial infarction (OR 1.9 [1.1-3.2], $p = 0.02$) were also independent factors that were associated with the presence of carotid artery stenosis found during screening duplex.

CONCLUSIONS: Carotid artery stenosis is quite common for patients that are undergoing cardiac surgery. Independent risk factors that are predictive of the presence of carotid artery stenosis are peripheral vascular disease, coronary artery disease, left main disease, history of smoking, prior cerebrovascular accident or transient ischemic attack, and prior myocardial infarction.

1:48 p.m.RF10 **Vasospasm As A Novel Mechanism To Explain Claudication In Female Athletes With External Iliac Arterial Endofibrosis**
Sherene Shalhub, MD, R. Eugene Zierler, Watson Smith, Kari Olmsted and Alexander W. Clowes, MD
Surgery and Vascular Surgery, University of Washington, Seattle, WA

OBJECTIVE: External iliac arterial endofibrosis (EIAE) is rare and has been described primarily in endurance male cyclists. Clinically it presents as claudication during maximal exercise with quick resolution post-exercise. Most patients are found to have fibrotic changes within the external iliac artery (EIA). We describe our experience with EIAE and propose a hypothesis for the mechanism involved.

METHODS: This was a retrospective review of athletes who presented with symptomatic EIAE requiring an operative repair between 2001 and 2010. Data collected included demographic information, initial presentation, type of exercise, method of repair, and long term outcome. Diagnostic studies consisted of duplex evaluation, modified exercise treadmill test, and angiography.

RESULTS: Seven patients, all female, presented with symptomatic EIAE. All were endurance athletes (2 cyclists, 1 runner, 4 both cyclists and runners). Median age at presentation was 42.5 years (range 39-60). Median duration of symptoms was 5.5 years (range 2-15). Two patients had bilateral EIAE. Diagnosis was confirmed with an exercise treadmill test modified to accommodate the high level of conditioning these patients exhibited and unmask the claudication. In two cases, there was marked EIA vasospasm noted post-exercise by duplex scanning. All cases were treated by EIA vein patch angioplasty. Follow-up ranged from one to ten years. All had a normal modified exercise treadmill test and resumed their athletic activities post-operatively. In two cases, there was a recurrence of symptoms associated with vasospasm in the unpatched EIA segments. In one case, there was onset of claudication and documented post-exercise vasospasm of the EIA in the contralateral leg.

CONCLUSIONS: This is the largest reported series of female endurance athletes with EIAE and highlights a possible mechanism to explain this disease entity as a pathologic response to exercise-induced high blood flow leading to EIA vasospasm, not vasodilation. This suggests that repetitive injury leads to endothelial dysfunction of the regenerated EIA endothelium. We recommend vein patch angioplasty as a durable repair for this condition.