42nd ANNUAL SCIENTIFIC MEETING

DELAWARE VALLEY VASCULAR SOCIETY

THE UNION LEAGUE OF PHILADELPHIA
PHILADELPHIA, PENNSYLVANIA

Thursday, April 30, 2020

ADMINISTRATIVE OFFICE
Delaware Valley Vascular Society
9400 W. Higgins Rd., Suite 315, Rosemont, IL 60018
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The purpose of this meeting is to present state-of-the art clinical research and vascular biology relating to surgical aspects of vascular disease. The program will include presentations of original research by investigators in the field of Vascular Surgery and other areas of practice building. A significant portion of the program has been reserved for question and answer interaction between the presenters and the audience.

PROGRAM OBJECTIVES

At the end of this activity, participants will be able to:

1. Discuss strategies in management and use of outpatient vascular lab, wound care center, outpatient angiography suite;
2. Recognize importance of radiation safety and implement changes to minimize radiation exposure;
3. Evaluate and discuss advanced open and endovascular surgical treatment options for rare arterial and venous aneurysms;
4 Review novel endovascular techniques for treatment of peripheral artery disease and bypass grafts;
5. Describe thoracic outlet syndrome (venous, neurogenic) anatomic variations and management;
6. Manage complex aortic pathology with unique open and endovascular surgical approaches.

CONTINUING MEDICAL EDUCATION CREDIT INFORMATION

Accreditation

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American College of Surgeons and the Delaware Vascular Society. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

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The American College of Surgeons designates this live activity for a maximum of 6.00 *AMA PRA Category 1 Credits™.* Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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In compliance with the ACCME Accreditation Criteria, the American College of Surgeons must ensure that anyone in a position to control the content of the educational activity has disclosed all relevant financial relationships with any commercial interest. All reported conflicts are managed by a designated official to ensure a bias-free presentation. Please see the insert to this program for the complete disclosure list.

Commercial Support Acknowledgement

The Delaware Valley Vascular Society wishes to recognize and thank the following companies for their commercial support of this educational activity:

- Silk Road Medical
- W. L. Gore & Associates, Inc.

BEST TRAINEE AWARD

Abstracts presented by our trainees will be eligible for the Clinical Research Award and Basic Science/Case Report Award.

DVVS members will conduct the review and scoring of these presentations. Please complete the score sheet and return them to the registration counter by 5:00 pm. There will be monetary awards and certificates presented to each winner at the evening's dinner.

Delaware Valley Vascular Society
42nd Annual Meeting
Thursday, April 30th
The Union League of Philadelphia

SCIENTIFIC PROGRAM

11:00 a.m. - 11:05 a.m.	**Welcome** Eric T. Choi, MD, DVVS President
11:05 a.m. – 12:30 p.m.	**Case Reports**
11:05 a.m. – 11:11 a.m.	**Mesenteric Ischemia Secondary to an Embolus in Patient with a Newly Discovered Patent Foramen Ovale** Michael Qaqish, MD, Alexander Uribe, MD, Robert Meisner, MD
11:11 a.m. – 11:17 a.m.	**Traumatic Non-Anastomotic PSA Rupture of a Polytetrafluorethylene Femorofemoral Bypass** Marvin Chau, BS, Sandra Toth, MD, Faisal Aziz, MD, Almaz Kurbanov, MD, Tanya Flohr, MD
11:17 a.m. – 11:23 a.m.	**One Surgical Approach to a Mycotic Aortic Aneurysm** Joseph Hlopak, DO, JohnPaul Chizea, MD, Sunny Fink, MD, Nosayaba Enofe, MD, Sai Saaja, MD, Mark B. Kahn, MD
11:23 a.m. – 11:29 a.m.	**Evolving Management of Pancreaticoduodenal Aneurysms: A Case Series** Kunal Vani, DO, Keith Calligaro, MD, Krystal Maloni, MD, Nicholas Madden, DO, Douglas Troutman, DO, Matthew Dogherty, MD
11:29 a.m. – 11:35 a.m.	**Percutaneous Endovascular Management of Type B Dissection in the Setting of Malperfusion: Case Report** Lindsay J Lynch, MD, Kevin Nguyen, MD, Anand Tarpara, MD, Dawn Salvatore MD, Paul DiMuzio, MD, Babak Abai, MD
11:35 a.m. – 11:41 a.m.	**Case Report: Arterial Thoracic Outlet Syndrome** George Titomihelakis, MS, Kevin Nguyen, MD, Anand Tapara, MD, Babak Abai, MD, Dawn Salvatore, MD, Paul Dimuzio, MD
11:41 a.m. – 11:47 a.m.	**Innominate Artery Pseudoaneursym in the Setting of Marfan Syndrome** Tarik Ali, MD, Faisal Aziz, MD
11:47 a.m. – 11:53 a.m.	**Multidisciplinary Hybrid Management of Recurrent Tracheo-Innominate Artery Fistula After Open Ligation of the Innominate Artery** Manda Maley, MD, Nadia Awad, MD, Evan Deutsch, MD, Raymond Singer MD, Rashad Choudry, MD
11:53 a.m. – 11:59 a.m.	**Staged Left Vertebral Artery Transposition with Thoracic Endovascular Aortic Stent Graft in the Setting of Aberrant Vertebral Artery** Jaclyn Milici, DO, Lili Sadri, MD, Davek Sharma, MD, Danielle M. Pineda, MD

11:59 a.m. – 12:05 p.m.	**Surgical Treatment of a Thoracic Aortic Aneurysm in a Patient with Loeys-Dietz Syndrome** Amrina Cheema, MD, Nadia Awad, MD, Alexandra Tuluca, MD, Evan Deutsch, MD, Rashad Choudry, MD
12:05 p.m. – 12:11 p.m.	**Upper Extremity Thrombosis Secondary to Retained Axillary PTFE Cuff after Explant of Axillary-Femoral Bypass** Mikael Fadoul, MD, Lauren Jonas, BS, Katherine McMackin, MD, Karol Meyermann MD, Jose Trani, MD
12:11 p.m. – 12:17 p.m.	**Progressive Aneurysmal Disease in MAGIC Syndrome** Lauren Jonas BS, Jose Trani, MD, Katherine McMackin, MD, Devon Corrigan MD, Karol Meyermann MD, Joseph V Lombardi, MD
12:17 p.m. – 12:23 p.m.	**Retrograde Stenting of Symptomatic Innominate Artery Stenosis utilizing Extracorporeal Flow Reversal** Anand Tarpara, MD, Kevin Nguyen, MD, Babak Abai, MD, Dawn Salvatore, MD, Paul DiMuzio, MD
12:23 p.m. – 12:30 p.m.	**Q&A**
12:30 p.m. – 1:30 p.m.	**Lunch and Exhibits**
1:30 p.m. – 3:00 p.m.	**Carotid Panel Discussion** Jeffrey Jim, MD: TCAR Mike Mullen, MD: Management of Carotid Stenosis Joseph Lombardi, MD: Carotid Technique, mini endarterectomy Eric Choi, MD: Trans-femoral Carotid Stenting
3:00 p.m. – 3:30 p.m.	**Coffee Break/Exhibits**
3:30 p.m. – 5:00 p.m.	**Clinical Research**
3:30 p.m. – 3:38 p.m.	**Thoracoabdominal Aortic Aneurysm Repair in Patients with Chronic Type B Aortic Dissection versus Atherosclerotic Aneurysm** Vishal N. Shah, DO, Alexander Uribe, MD, Konstadinos A. Plestis, MD
3:38 p.m. – 3:46 p.m.	**Gastroduodenal Artery Aneurysm: A Rare Complication of Blunt Trauma** Joel B. Durinka, MD, Jeffrey Silpe, MD, Brandon Kuehlewind, MD, Jeffrey Brewer, MD, Raphael Blochle, MD, James K Lukan, MD
3:46 p.m. – 3:52 p.m.	**Pulsatile Abdominal Mass with Normal Aorta** Robert Weiss, MD, Henry Hirsch, MD, Paul Van Bemmelen, MD, Olubunmi Esan, MD
3:52 p.m. – 3:58 p.m.	**Wins, Losses and Long-Term Trends in Amputations in the Delaware Valley Abington Hospital** Ronald Renzi, DPM, Marvin Marcelin, DPM
3:58 p.m. – 4:04 p.m.	**A 6cm Internal Carotid Artery Aneursym Necessitating Carotid Ligation: A Case Report** Taelor Weaver, BS, Faisal Aziz MD, DFSVS, FACS

4:04 p.m. – 4:12 p.m.	**Effects of Continued Dual Antiplatelet Therapy on Major Adverse Cardiovascular Events after Carotid Artery Stenting** Nathan Belkin, MD, Benjamin M. Jackson, MD, Paul J. Foley, MD, Scott M. Damrauer, MD, Venkat Kalapatapu, MD, Julia D. Glaser, MD, Michael A. Golden, MD, Grace J. Wang MD
4:12 p.m. – 4:20 p.m.	**Patient Frailty as a Predictor of Mortality in Ruptured Abdominal Aortic Aneurysm** Devon E. Corrigan, MD, Joseph V. Lombardi, MD, Katherine K. McMackin, MD, Philip M. Batista, MD, Jeffrey P. Carpenter, MD, Jose L. Trani, MD
4:20 p.m. – 4:28 p.m.	**Techniques and Outcomes of Concomitant Aortic and Caval Resection and Reconstruction for Cancer** Samuel L. Chen, MD, Daniel H. Newton, MD, Douglas Fraker, MD, Thomas J. Guzzo, MD, Robert E. Roses, MD, Paul J. Foley, III, MD, Ronald M. Fairman, MD, Benjamin M. Jackson, MD
4:28 p.m. – 4:36 p.m.	**Defining and Validating Superior Mesenteric Artery Duplex Ultrasound Criteria for In-Stent Restenosis** Jessica Green, MD, PhD, Evan Ryer, MD, Nicholas Borden, BS, Bilal Ali, BS, James Elmore, MD
4:36 p.m. – 4:44 p.m.	**Lessons Learned in Maximizing Open Surgical Experience for Vascular Integrated Residents During the Non-Vascular Months of Training** Katherine K McMackin, MD, Jose Trani, MD, Devon E Corrigan, MD, Lauren Jonas MS, Philip M Batista, MD, Jeffrey P Carpenter, MD and Joseph V Lombardi, MD
4:44 p.m. – 4:52 p.m.	**Intraoperative Mean Arterial Pressure Variation Carries a Higher Risk of Headache after Carotid Endarterectomy** Daniel C. Lee, MD, Jose Trani, MD, Katherine K. McMackin, MD, Albert Ha, BA, Philip M Batista, MD, Jeffery P. Carpenter, MD, Joseph V. Lombardi, MD
4:52 p.m. – 5:00 p.m.	**Q&A**
5:00 p.m. – 6:00 p.m.	**Reception and Exhibits**
6:15 p.m. – 8:30 p.m.	**Keynote Lecture, TCAR** Jeffrey Jim, MD

11:05 a.m. – 11:11 a.m.

Mesenteric Ischemia Secondary to an Embolus in Patient with a Newly Discovered Patent Foramen Ovale

Michael Qaqish, MD, Alexander Uribe, MD, Robert Meisner, MD

This is a 33 yo F with history of Down Syndrome with hx of a broken foot 4 months prior to admission which has caused her to be more sedentary, pyloric stenosis s/p myotomy as an infant but no other significant medical history who had presented to our sister hospital with abdominal pain and vomiting for 2 days. She had worsened pain the morning of presentation. Denied fevers, chills, change in bowel habits, blood per rectum, or melena. Her lab work showed a mildly elevated lactate of 2.9 and repeat showed it remained elevated at 2.8 despite fluids and a mild troponin leak of 0.15. Here CBC and BMP were otherwise unremarkable. On exam she had generalized tenderness, no rebound, mild distension, and voluntary guarding. A CT chest, abdomen and pelvis was done with IV contrast which revealed bilateral submassive pulmonary embolus, a thrombus with partial occlusion of the celiac axis with no flow in the common hepatic artery or through the splenic artery with splenic infarcts. There was a secondary thrombus in the superior mesenteric artery with some flow seen in the distal artery.

Given the findings of the CTA, patient was started on heparin gtt and was transferred to Lankenau under the vascular service with plan for operative intervention. Upon her arrival she was stable, kept NPO and taken to the OR. She had a laparotomy, SMA embolectomy, and an IVC filter placed. Bowel was viable and she was closed. Post-operatively she had a Transthoracic echocardiogram with a bubble test done which showed bubbles in the left heart confirming our suspicions of a patent foramen ovale.

Cardiology was consulted and planned for closure of the PFO, however, family did not want another procedure despite the risk of embolic events. She was placed on Rivaroxiban indefinitely until PFO can be closed. Family wanted to wait until their follow up appointment before discussing closure again. She unfortunately has not followed up for further care at our facility regarding closure of the PFO

11:11 a.m. – 11:17 a.m.

Traumatic Non-Anastomotic PSA Rupture of a Polytetrafluorethylene Femorofemoral Bypass

Marvin Chau, BS, Sandra Toth, MD, Faisal Aziz, MD, Almaz Kurbanov, MD, Tanya Flohr, MD

Femorofemoral bypass (FFBP) is frequently utilized for lower extremity revascularization in patients with unilateral iliac artery occlusive disease, preserved contralateral inflow and comorbidities rendering them intolerant of aortic cross-clamping. Rarely do polytetrafluorethylene (PTFE) grafts form pseduoaneurysms (PSA) within the body of the graft. A few reports describe such events in patients with axillofemoral bypasses (AFBP). We describe a novel case of a non-anastomotic PSA in a PTFE FFBP after a traumatic event.

11:17 a.m. – 11:23 a.m.

One Surgical Approach to a Mycotic Aortic Aneurysm

Joseph Hlopak, DO; JohnPaul Chizea, MD, Sunny Fink, MD, Nosayaba Enofe, MD, Sai Saaja, MD, Mark B. Kahn, MD

Mycotic aortic aneurysms are rare entities that present challenges not only in initial surgical management, but in postoperative management. The objective of this clinical case report is to demonstrate one of the available viable options for patients presenting with a mycotic aortic aneurysm.

A 55-year-old black male presented with several week history of low back, left flank, and left leg pain. He denied claudication and muscle weakness but reported a 20-pound weight loss since the pain started. The patient has a history of mild intellectual impairment, schizophrenia controlled on medication, and a 30-pack year smoking history. Two days prior to admission he developed acute worsening of pain

and limited ability to walk. Vascular surgery was consulted for abnormal ABI's at 0.35 bilaterally. On physical exam, the right femoral pulse was absent, bilateral DP and PT arteries had monophasic signals, but no neuromuscular deficits were found. CTA demonstrated an occluded infrarenal abdominal aorta with a saccular aneurysm measuring 3.9 x 4.8 cm, occluded IMA, right common iliac, and left common iliac arteries with three-vessel reconstitution bilaterally. A mycotic aneurysm was suspected pre-operatively and confirmed at laparotomy when gross purulence was encountered upon opening the aneurysmal sac. The aorta was debrided and an aorto-bifemoral bypass was performed using a rifampin-soaked Dacron graft with omental wrap. The postoperative course was complicated by a prolonged ileus, NGT decompression, and short-term TPN administration. Intraoperative cultures grew salmonella enteriditis, which was sensitive to ceftriaxone. The patient was discharged home to complete an eight-week course of IV ceftriaxone followed by lifelong prophylaxis with Augmentin.

11:23 a.m. – 11:29 a.m. **Evolving Management of Pancreaticoduodenal Aneurysms: A Case Series**

Kunal Vani DO, Keith Calligaro MD, Krystal Maloni MD, Nicholas Madden DO, Douglas Troutman DO, Matthew Dogherty MD

Objectives: Pancreaticoduodenal aneurysms (PDAs) are rare with a high propensity for rupture. Only 131 cases have been previously reported. Historically, management of PDAs included surgical reconstruction but has evolved with advances in endovascular therapy. We report our experience with management of PDAs.

Methods: We reviewed our prospectively maintained registry between 1992-2020.

Results: We identified seven patients with PDAs: two with associated celiac artery occlusive disease but none with pancreatitis or other identifiable etiologies. Four patients were treated with surgical resection of the PDAs: two patients (both with intact aneurysms) underwent concomitant revascularization (superior mesenteric artery-to-hepatic artery Dacron graft; supraceliac aorta-to-hepatic artery Dacron graft) and two patients (1 intact, 1 rupture) did not undergo revascularization. Three patients were treated with coil embolization of the PDA: with concomitant exclusion of the aneurysm using a viabahn stent graft in two cases (1 non-rupture, 1 rupture) and as the sole intervention in one case (non-ruptured). There were no deaths or procedure-related significant morbidity .

Conclusion: We believe this series represents the largest single-center experience of PDAs reported in the literature. Both elective and emergent treatment of PDAs can successfully be performed using open or endovascular intervention. Selective revascularization may be necessary.

11:29 a.m. – 11:35 a.m. **Percutaneous Endovascular Management of Type B Dissection in the Setting of Malperfusion: Case Report**

Lindsay J Lynch MD, Kevin Nguyen MD, Anand Tarpara MD, Dawn Salvatore MD, Paul DiMuzio MD, Babak Abai MD

Introduction:

Type B aortic dissection with malperfusion can pose significant challenges in management and treatment to vascular surgeons. We present a case of type B dissection of the thoracoabdominal aorta with resulting malperfusion successfully treated with percutaneous endovascular repair.

Case Report:

The patient is a 35 year-old male who presented to his local ED with acute onset back pain. The patient was tachycardic and hypertensive to the 230/120. He had a cold right foot with only a doppler signal of the right femoral artery and palpable pulse on the left foot. He underwent a work up of his back and leg pain which was limited due to his history of renal insufficiency. Non-contrast imaging and symptomatology were concerning for a possible dissection prompting transfer to Thomas Jefferson University. On arrival, the patient was maintained on Esmolol and Nicardipine to control blood pressure. A CT Angiogram of chest, abdomen, pelvis and bilateral lower extremity was obtained which demonstrated type B dissection extending into the right and left common and internal iliac arteries. Of note, the true lumen was occluded below the SMA takeoff. The blood supply to the bowel was from the true lumen, the left kidney and renal artery did not opacify with contrast, the right kidney was supplied by 3 arteries, and the R common and external iliac arteries were occluded with distal reconstitution but no tibial or peroneal runoff. The patient was emergently taken to the OR for endovascular repair with Cook dissection grafts (Bloomingdale, Indiana). Two endografts (32 x102mm, 34x161mm), and two bare metal aortic stents (36x180mmx2) were deployed. Completion angiogram demonstrated continued malperfusion to the right iliac and the right renal artery; right renal artery iCAST stent (6x38mm) (Hudson, New Hampshire), and three right common and external iliac Cook Zilver bare metal stents (10mmx8cm, 9mmx6cm, 8mmx4cm) were deployed. Right lower extremity four compartment fasciotomy was also performed. Post-operatively, the patient had return of palpable femoral and distal pulses on the right foot. While he briefly required dialysis post-operatively, he had return of renal function to baseline. The patient's hospital course was complicated with ileus and need for skin grafting to close fasciotomy sites. Ultimately, the patient was discharged to inpatient rehab on post-operative day 31.

Conclusion:

This case highlights the complexity of identifying type B dissection, particularly in individuals with compromised renal function. It is feasible and safe to treat a patient using a total percutaneous approach by placing an aortic dissection graft and stenting of other vessels if malperfusion persists.

11:35 a.m. – 11:41 a.m. **Case Report: Arterial Thoracic Outlet Syndrome**

George Titomihelakis, Kevin Nguyen, MD, Anand Tapara, MD, Babak Abai MD, Dawn Salvatore MD, Paul Dimuzio MD

Introduction:

Thoracic outlet syndrome (TOS) is a rare disorder secondary to compression of the neurovascular bundle at the thoracic outlet. There are 3 types of TOS, depending on which structure is compressed: neurogenic TOS (nTOS) from brachial plexus compression, venous TOS (vTOS) from subclavian vein compression, and arterial TOS (aTOS) from subclavian artery compression. The most common form is nTOS which makes up over 95% of the cases, followed by vTOS comprising 4-5 % of the cases, and aTOS making up only 1% of the cases[1]. Herein we present a case report of arterial thoracic outlet syndrome with reconstruction of subclavian artery aneurysm.

Case Report:
A 60-year-old male presented to an outside hospital with three to four weeks of left upper extremity paresthesia and pain. A CT angiogram showed presence of a left cervical rib with stenosis of the subclavian artery consistent with aTOS. The patient also had a post-stenotic aneurysm of the subclavian artery. Catheter directed thrombolysis was performed at an outside institution resulting in incomplete revascularization of the upper extremity and was then transferred to Thomas Jefferson University Hospital for definitive care.
Decompression of the scalene triangle was performed with a supraclavicular approach, with anterior and middle scalenectomy and resection of both the first and cervical ribs. An infraclavicular incision was also created to obtain adequate exposure of the subclavian artery for reconstruction. A 3cm segment of the aneurysmal artery was resected and an interposition bypass graft was done with 7mm PTFE. The forearm was revascularized with thrombectomy of the radial and ulnar artery. Residual thrombus was treated with intra-operative catheter directed tPA and had significant improvement. Post-operative course was complicated by left hemothorax that was treated with a chest tube and video-assisted thoracoscopic surgery (VATS) to evacuate retained hematoma. Currently our patient is doing well without sequelae.
Conclusion:
Arterial TOS is a rare condition that requires a thorough understanding of the thoracic outlet anatomy as surgery is the only option for management. Open revascularization has been considered the gold standard for management of aTOS, however, currently and in the last decade minimally invasive endovascular therapies have created new ways to manage arterial thoracic outlet syndrome. Though rare, further research in the area of aTOS would provide significant benefit being that there are gaps in diagnosis, post-operative imaging, and comparative patency rates and need for reoperation.

11:41 a.m. – 11:47 a.m. **Innominate artery pseudoaneursym in the setting of Marfan Syndrome**
Tarik Ali, MD, Faisal Aziz, MD

Background: The incidence of an Innominate Artery Pseudoaneursym is rare including its incidence as it relates to iatrogenic injury. The majority of cases reported are related to trauma, most commonly penetrating trauma and is commonly fatal in the field.
Case presentation: 72-year-old female with class II congestive heart failure due to aortic insufficiency and a diagnosis of Marfan syndrome. The patient had a known ascending aortic aneurysm with the aortic root measuring 5 cm. The patient presented with an NSTMI and underwent PCI of her LAD at OSH. Following that the patient was found to have an innominate artery pseudoaneurysm likely secondary to iatrogenic injury at the time of her PCI. This initially followed conservatively but had been expanding in size and is now 3 cm in diameter. The patient underwent a complete resection of the innominate artery pseudoaneurysm. Innominate artery reconstruction with 10 mm Dacron graft from ascending aorta to right subclavian artery with 10 mm graft. Jump graft from the subclavian bypass to right common carotid artery bypass with 8-mm Dacron graft.
Discussion: More and more cardiac catheterizations and endovascular interventions are carried out through a right radial artery. This opens the door to not only access complications but injury to the great arch vessels including the innominate artery. In the setting of connective tissue disorder this risk is amplified. Repair of the innominate artery pseudoaneurysm is necessary as the pseudoaneurysm is at a risk of rupture which could be deadly. A combination of open and endovascular methods are available. In the setting of Marfan syndrome an open repair is believed to be more durable.
Figure:

11:47 a.m. – 11:53 a.m.

Multidisciplinary Hybrid Management of Recurrent Tracheo-Innominate Artery Fistula After Open Ligation of the Innominate Artery

Manda Maley MD, Nadia Awad MD, Evan Deutsch MD, Raymond Singer MD, Rashad Choudry MD

Objective

Tracheoinnominate artery fistula (TIF) is rare, yet life-threatening complication of tracheostomy. Even with expedient surgical repair, morbidity and mortality related to TIF remains high.

Methods

We present a case report of recurrent TIF after emergency open ligation of the innominate artery, salvaged with extra-anatomic left subclavian artery (LSCA) to left common carotid artery (LCCA) bypass and endovascular exclusion of the pseudoaneurysm with an aortic stent graft.

Results

A 29-year old female struck by an automobile suffered multiple organ system trauma requiring tracheostomy placement after prolonged intubation. On post-operative day 5 after tracheostomy, the patient had massive hemorrhage from the site that was controlled with over-inflation of the tracheal cuff. CT angiography demonstrated TIF without active hemorrhage. The patient underwent median sternotomy with ligation of the innominate artery and tissue coverage of the tracheal defect. Given hemodynamic instability at the time of the procedure, definitive repair with vascular reconstruction was deferred. The patient ultimately suffered a significant right hemispheric stroke with hemorrhagic conversion requiring neurosurgical intervention. However, she recovered well and was following commands with her unaffected side. She underwent open tracheostomy placement several weeks later.

Ten days later, the patient again began to hemorrhage from her tracheostomy site. Aortography demonstrated a pseudoaneurysm at the innominate artery stump without active extravasation. Given the patient's hostile thoracic anatomy, multidisciplinary discussion determined a hybrid procedure would minimize morbidity. A LSCA to LCCA artery bypass was performed with an 8mm Propaten graft (W.L. Gore; Flagstaff, AZ) and the aortic defect was excluded with a Medtronic Valiant Navion 34mm x 52mm aortic endograft (Medtronic; Santa Rosa, CA). The proximal LCCA was ligated due to backfilling of the pseudoaneurysm. Post-operative imaging confirmed successful exclusion of the pseudoaneurysm with good flow into the LCCA. The patient was subsequently discharged to a long-term care ventilator rehabilitation facility.

Discussion

TIF is a complex and highly moribund complication rarely seen after tracheostomy placement. In controlled situations, excision of the innominate artery with patch repair may be indicated to prevent pseudoaneurysm. Endovascular and hybrid approaches due to hostile anatomy may offer less morbidity and do not preclude definitive arch reconstruction in the future.

11:53 a.m. – 11:59 a.m. **Staged Left Vertebral Artery Transposition with Thoracic Endovascular Aortic Stent Graft in the Setting of Aberrant Vertebral Artery**

Jaclyn Milici, DO Lili Sadri, MD, Davek Sharma, MD, Danielle M. Pineda, MD

We present the case of a 75-year old man with a 7.7 cm descending thoracic artery aneurysm with an aberrant origin of the left vertebral artery who underwent a hybrid repair.

A 75-year old man presented to our office with a chief complaint of a history of unknown chest aneurysm**.** The patient was new to the system and there was no imaging of the aneurysm in our system. A CT angiogram was performed demonstrating a 7.7 cm x 7.1 cm descending thoracic artery aneurysm, with a notable anomaly of an aberrant left vertebral artery arising from the aortic arch. He had a history of a known occluded left internal carotid artery after an attempt at endarterectomy remotely. The patient also had a past surgical history of a repair of an ascending aortic aneurysm via median sternotomy.

The patient was taken for a left common carotid artery to left subclavian artery bypass in conjunction with a left vertebral artery transposition. Exposure was achieved via a supraclavicular approach with a transverse incision. The vertebral artery was anastomosed in an end to side fashion to the mid-CCA. Next, a CCA-SCL bypass was performed using a PTFE bypass graft. A jp drain was left behind. Overnight a lumbar drain was placed. The following day, the patient was taken for a TEVAR via percutaneous access to the bilateral femoral arteries and left brachial artery. A Cook thoracic alpha graft was used to seal his thoracic artery aneurysm from the origin of the L CCA to the origin of the celiac artery in conjunction with coil embolization of the proximal left SCL artery. Completion angiogram did not show any evidence of endoleak with excellent filling of transposed vertebral artery and distal left subclavian artery (Figure 2). The patient did well post-operatively, remained neuro-intact and was discharged home on postoperative day 5 without complication.

Figure 2: Completion Angiogram

Left vertebral artery transposition as an adjunct to TEVAR repair of thoracic aortic aneurysms is a rare procedure with only one other case reported in the literature. A 2014 study by Patterson et al. showed the only modifiable risk factor to reduce the incidence of posterior circulation stroke was to maintain perfusion to the vertebral artery via a carotid-subclavian bypass. In our patient's case the replaced vertebral artery in conjunction with an occluded left internal carotid artery necessitated direct revascularization of the vertebral artery. We report this case to show a hybrid approach to treat complex aortic and vertebrobasilar pathology.

11:59 a.m. – 12:05 p.m. **Surgical Treatment of a Thoracic Aortic Aneurysm in a Patient with Loeys-Dietz Syndrome**

Amrina Cheema, MD, Nadia Awad, MD, Alexandra Tuluca, MD, Evan Deutsch, MD, Rashad Choudry, MD

Introduction:

Loeys–Dietz syndrome (LDS) is an aggressive connective tissue disorder that predisposes affected individuals to aortic dissection and aneurysm rupture at an early age and smaller aortic diameters. Patients often present early in life with dissection and rapid progression of aneurysmal dilatation if untreated. It can present as a wide spectrum of multisystem involvement, and surgical management can be complex. In cases of aortic pathology where LDS is confirmed by genetic testing, timely prophylactic surgery has been shown to prevent catastrophic complications. As is the case with most other connective tissue disorders, open surgery is the preferred modality for definitive repair. In reoperative cases however, endovascular techniques may be required to complement open surgery to achieve the best patient outcomes.

Methods:

We describe a case of LDS-associated aortic pathology requiring both endovascular and open surgical methods and a multidisciplinary effort for successful aortic reconstruction.

Results:

A 59-year old male with LDS confirmed by genetic testing, status-post aortic root replacement and placement of mechanical aortic valve at an outside hospital in 2007 was referred to our institution in 2017 for management of a type B aortic dissection extending to the distal abdominal aorta. After a period of CT surveillance, he was noted to have enlargement of the false lumen with encroachment into the true lumen and became symptomatic, necessitating surgical intervention. At that time, he underwent left carotid to subclavian artery bypass with thoracic endovascular aortic repair to just above the celiac takeoff and coiling of the proximal subclavian artery.

Though surveillance CT initially demonstrated improvement in the size of the true lumen and false lumen thrombosis, he eventually had further aortic degeneration. The patient then underwent right external iliac artery to right renal artery bypass, followed by proximal ligation of the right renal artery, endograft placement in the abdominal aorta, and coil embolization of the false lumen, maintaining perfusion to all

visceral vessels. Short-interval follow up CT angiography demonstrated aneurysm sac expansion measuring 6.5 cm in maximal diameter.

Formal angiography demonstrated a type 1a endoleak, likely from aortic aneurysmal enlargement. In multidisciplinary review with cardiothoracic (CT) surgery, a total thoracoabdominal reconstruction with debranching was discussed with the patient as the most definitive surgical treatment for his condition. He was agreeable to undergoing a redo sternotomy to address the disease in the arch, but did not want to pursue more extensive repair at that time.

In conjunction with CT surgery, the patient underwent ascending aorta and total arch replacement (32mm GelWeave) and aorto-innominate and aorto-LCCA bypass with a bifurcated graft. TEVAR was then performed with the proximal landing site in Zone 0 (Medtronic Navion 40x170, 40x90), with complete eradication of the type 1a endoleak. Since discharge, he has followed up in the office and is having an uneventful recovery. Repeat CT is pending at this time.

Conclusion:

Patients with LDS can require multiple surgical interventions for successful and complete treatment of their aortic disease. According to one series that examined early and late outcomes of surgery in LDS patients, 82% of the patients who underwent multiple aortic interventions had a history of acute aortic dissection. Another study has reported a significantly higher prevalence of total aortic replacement (40%) in patients with LDS after aortic dissection. These data support the notion that surgical care of aortic pathology is complex in patients with connective tissue disorders.

In general, endovascular approaches are relatively contraindicated in aortic dissection and aneurysm syndromes related to connective tissue disorders. This owes to the high risk of progressive aortic dilatation and/or dissection at the landing zones. The best approach is most likely chosen on a patient-by-patient basis. Our patient had a prior history of sternotomy which complicates pursuing open repair. Additionally, although the definitive treatment in his case would be a total aortic reconstruction with debranching, our patient's preferences did not align with this operative plan. The use of endovascular techniques has been described in small series as a complement to open repair for patients with connective tissue disorders and specific indications for surgery. Some studies have reported performing an endovascular repair of a localized segment of aorta when both the proximal and distal landings zones lie within a surgical graft.

12:05 p.m. – 12:11 p.m.

Upper Extremity Thrombosis Secondary to Retained Axillary PTFE Cuff after Explant of Axillary-Femoral Bypass

Mikael Fadoul MD, Lauren Jonas, BS, Katherine McMackin MD, Karol Meyermann MD, Jose Trani, MD

Introduction:

Acute limb ischemia (ALI) is a well-documented vascular phenomenon. ALI in the upper extremity is less frequently encountered than in the lower extremity and is typically cardio-embolic. We present the case of recurrent acute upper limb ischemia following explant of an axillary-femoral bypass with retained axillary cuff.

Case Report:

A 63 year-old male with a history of diabetes, coronary artery disease, COPD, and hypertension presented with right lower extremity tissue loss. He underwent a fem-fem bypass that became infected requiring explant and placement of a right axillary-profunda bypass and a subsequent right femoral to above knee popliteal artery bypass. Four years later, he underwent a right above knee amputation. Two months following his amputation he presented to the hospital following a herald bleed with exposed prosthetic and purulent femoral drainage positive for Klebsiella and Proteus. The bypass grafts were explanted with a cuff of well incorporated PTFE oversewn at the axillary anastomosis. The patient represented one month later with significant pain, numbness and cyanosis in his right hand. CTA demonstrated occlusion of the distal brachial artery. A thrombectomy restored flow to the right arm. He was discharged on Xarelto. He represented a month later with recurrent thrombosis of the right upper extremity. A thrombectomy was again performed and a Viabahn stent was placed across the axillary anastomosis to exclude the PTFE cuff. He is continuing on his anticoagulation and has not had any further thromboembolic events.

Discussion:

Leaving a cuff of PTFE during explant of an axillary-femoral bypass is a common practice. Herein we present a case of recurrent upper extremity thromboembolic ischemia caused by emboli off of a retained cuff of PTFE treated initially with open surgical thrombectomy, but recurring and ultimately being treated with a covered stent.

12:11 p.m. – 12:17 p.m. **Progressive Aneurysmal Disease in MAGIC Syndrome**

Lauren Jonas BS, Jose Trani, Katherine McMackin, MD, Devon Corrigan MD, Karol Meyermann MD, Joseph V Lombardi MD

Introduction

Aneurysmal degeneration is a known rare complication of mouth and genital ulcers with inflamed cartilage (MAGIC) syndrome with high morbidity and mortality. We present a patient with MAGIC syndrome and extensive aneurysmal disease extending the thoracic aorta to the femoral arteries.

Case Report

A 57-year-old male former smoker with a history of known MAGIC syndrome managed with chronic steroids, DM, bladder cancer, and avascular necrosis of his right hip secondary to his steroid use had previously had multiple aneurysms requiring several stent-graft placements (EVAR and fEVAR with celiac and SMA stents and bilateral renal stents, bilateral iliac), presented with symptomatic bilateral common femoral artery aneurysms. A left lower extremity angiogram with stent placement and open plication of the left CFA was performed. Ten days later, an open repair of the right femoral artery aneurysm was performed with a bovine carotid bypass from the CFA to the SFA with reimplantation of the right profunda onto the side of the bypass. Eleven months later, the patient represented to the ED with worsening right groin pain. A CTA showed recurrence and growth of the right femoral aneurysm requiring stent placements traversing the previous open repair with coil embolization of the right profunda femoris artery to prevent back bleeding.

Discussion

MAGIC syndrome is an extremely rare autoimmune condition where patients possess some features of both Behçet disease (BD) and relapsing polychondritis (RP) such as systemic vasculitis and aneurysm of large arteries. To date there are less than 25 cases reported. In patients with BD, aneurysms occur in 10-15% of cases, mostly in the abdominal aorta. In patients with RP, aneurysms occur in 5-7% of cases, mostly in the ascending aorta. Herein we present our management of a patient with MAGIC syndrome with recurrent femoral aneurysms requiring a endovascular salvage following failed open repair.

12:17 p.m. – 12:23 p.m. **Retrograde Stenting of Symptomatic Innominate Artery Stenosis utilizing Extracorporeal Flow Reversal**

Anand Tarpara MD, Kevin Nguyen, MD, Babak Abai, MD, Dawn Salvatore, MD, Paul DiMuzio, MD

Introduction

Endovascular therapy for treating supra-aortic vessels, specifically, the innominate artery has evolved over the last 20 years. Isolated innominate artery stenosis treated with angioplasty and stenting has a reported overall stroke rate of 4% with various methods of cerebral protection. We present a case of innominate artery stenting utilizing extracorporeal flow reversal for cerebral protection.

Case Report

A 79-year-old male presented with uncontrolled hypertension, recent amaurosis fugax, and left-hand weakness. He has a history of right carotid endarterectomy 10 years ago without restenosis and a high grade stenosis in the proximal innominate artery. He was taken to the OR for retrograde placement of a covered stent in the innominate artery via right common carotid artery exposure with extracorporeal cerebral protection using the ENROUTE® (Silk Road Medical) system. A 6mm x 40mm iCAST (Atrium) balloon expandable covered stent was deployed across the innominate artery lesion followed by post stent dilation. He was discharged with an uneventful post-operative course.

Conclusion
Retrograde innominate artery stenting with cerebral protection is a minimally invasive and preferred approach for addressing innominate artery stenosis. Off label use of the ENROUTE flow reversal device (Silk Road Medical) is a safe and effective alternative cerebral protection strategy. The patient we presented was successfully managed utilizing extracorporeal flow reversal for cerebral protection prior to retrograde stenting of innominate artery stenosis.

3:30 p.m. – 3:38 p.m. **Thoracoabdominal Aortic Aneurysm Repair in Patients with Chronic Type B Aortic Dissection versus Atherosclerotic Aneurysm**
Vishal N. Shah, Alexander Uribe, Konstadinos A. Plestis, MD

OBJECTIVES:

Open surgical repair for descending and thoracoabdominal aortic aneurysm (TAAA) may result in different rates of morbidity and mortality, depending on patient characteristics associated with specific diagnostic subgroups. Here we determined whether patient-level variables and surgical outcomes are similar in the following two TAAA diagnostic subgroups: the chronic type B aortic dissection (CTABD) and the atherosclerotic aneurysm (AA) groups.

METHODS:

From 1999 to 2017, a total of 221 patients had repair of the descending and thoracoabdominal aortic aneurysms. There were 107 (18.6% descending and 81.4% TAA aneurysms) in the CTBAD Group and 113 (38.3% descending and 61.7% TAA aneurysms) patients in the AA Group ($p < 0.001$).

RESULTS:

There were more male CTBAD patients who were younger, had a history of dialysis, a diagnosis of Marfan syndrome and previous ascending and stage 1 elephant trunk procedures ($p<0.05$) (Table 1). AA patients tended to be older (12 years on average), smokers with a history of diabetes, chronic pulmonary obstructive disease, coronary artery bypass grafting and abdominal aortic aneurysm ($p<0.05$). Postoperative outcomes were similar in both groups, except for vocal cord paralysis which occurred more frequently in CTBAD patients ($p=0.04$). A significantly smaller percentage of AA than CTBAD patients were alive at long-term follow-up (48% vs 65%, respectively, $p=0.02$) (Figure 1 shown in next page).

CONCLUSIONS:

Although our results show that CTBAD patients differ from AA patients on a number of demographic and clinical characteristics, both groups seem to follow a similar postoperative course. Nevertheless, long-term follow-up suggests that CTBAD patients fare better with OSR than AA patients.

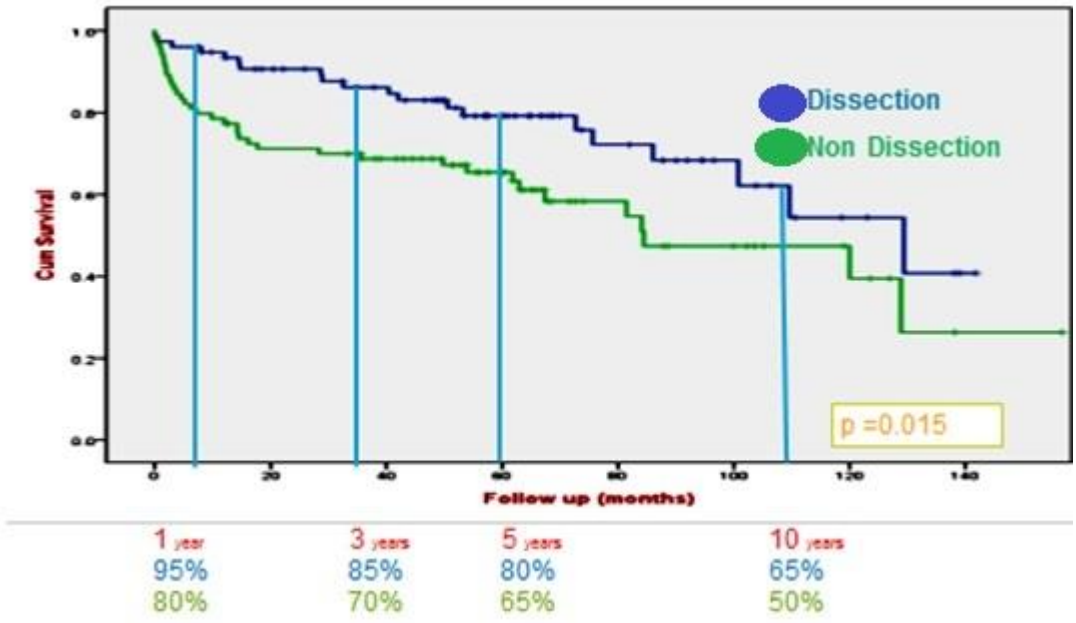


Figure 1: Long-term survival

3:38 p.m. – 3:46 p.m.

Gastroduodenal Artery Aneurysm: A Rare Complication of Blunt Trauma

Joel B. Durinka, MD, Jeffrey Silpe, MD, Brandon Kuehlewind, MD, Jeffrey Brewer, MD, Raphael Blochle, MD, James K Lukan, MD

Abstract:

Gastroduodenal artery aneurysms (GDA) are rare visceral aneurysms. Blunt trauma represents a common attributable etiology for these aneurysms. Therefore, an alternative treatment approach, which differs from those isolated aneurysms, is recommended. We hereby present a 62-year-old male patient who was admitted with sudden onset of severe abdominal pain and significant drop in hemoglobin, occurring within a 8-hour interval. After sustaining a fall from standing. Contrast-enhanced computed tomography revealed a ruptured visceral aneurysm arising from the Pancreaticoduodenal arcade. Selective catheterization of the supplying branch of the superior mesenteric artery, followed by coil embolization of the aneurysm, was performed, resulting in cessation of flow within the aneurysm. Gastroduodenal aneurysms are usually asymptomatic and discovered incidentally at rupture. The risk of rupture is independent of the aneurysmal size and is associated with a 50% mortality rate. The consensus on coping with aneurysms is to treat them whenever they are discovered. Selective angiography followed by coil embolization represents a less invasive, and frequently definitive, approach than surgery. The risk for ischemia mandates that the celiac territory must not be compromised after embolization

3:46 p.m. – 3:52 p.m.

Pulsatile Abdominal Mass with Normal Aorta

Robert Weiss, MD, Henry Hirsch, MD, Paul Van Bemmelen, MD, Olubunmi Esan, MD

Introduction: We are presenting a case of a 40 year old female who presented to the emergency department with a complaint of abdominal pain associated with pulsatile abdominal mass and the finding

of a 6.5cm common hepatic artery aneurysm abutting the pancreas. Operative repair of the aneurysm was performed using reversed saphenous vein graft.

Methods: A 40-year-old female with history of hypertension and smoking presented with three days of abdominal pain associated with a pulsatile mass. CT scan revealed a normal aorta and a 6.5cm common hepatic artery aneurysm **Figure 1**.

Figure 1

CHA – Common Hepatic Artery, PHA – Proper Hepatic Artery,
GDA – Gastroduodenal Artery, SMA – Superior Mesentaric Artery

Decision was made to take the patient to the operating room for open repair. Hepatobiliary service was present during the case due to involvement of hepatic artery and proximity of aneurysm to the pancreas. Case was started with left proximal saphenous vein harvest. Adequate venous conduit was identified and harvested. Midline laparotomy was performed. Lesser sac was entered and the aneurysm was exposed. Proximal control was obtained on the celiac trunk with ligation of the splenic artery. We then turned our attention to distal control. The distal aneurysm approached the bifurcation of the common hepatic artery into the gastroduodenal artery and proper hepatic. The aneurysm was mobilized from the superior aspect of the pancreas without penetration into the pancreatic parenchyma. Effort was made to preserve both of these arteries and clamps were placed on the GDA and the proper hepatic artery with adequate control. The aneurysm sac was then opened and mural thrombus was evacuated. Reversed saphenous vein was used as conduit and sewn using 5-0 prolene for successful celiac-hepatic artery bypass. Clamps were released with adequate flow in the vein graft, GDA and proper hepatic artery. Distal perfusion was confirmed via Doppler. Aneurysm sac was closed over the repair. Cholecystectomy was then performed. Jackson Pratt drain was left in place to bulb suction. Abdomen was closed and the patient was taken to the ICU. Postoperatively patient had mild elevations in LFTs which soon normalized. No signs of pancreatitis or pancreatic leak developed. Abdominal drain was removed. Aspirin was initiated. Patient was started on regular house diet and discharged home on Post Op day 6.

Discussion: Visceral artery aneurysm is estimated to occur in 0.1-2% of the general population. The splenic artery is most commonly affected (60%), followed by the hepatic artery (20%). While rare, large visceral aneurysm are often repaired due to risk of mortality associated with rupture. Repair is typically recommended for visceral aneurysms larger than 2cm, rapid expansion, symptomatic, and ruptured aneurysms. This may be performed endovascular or open. Our patient met criteria for repair based on size, and was with symptoms of abdominal pain. Due to anatomic restrictions, her repair was not amenable to endovascular intervention, and underwent successful open repair with reversed autologous saphenous vein graft.

Conclusions: Reversed saphenous vein is a safe and acceptable conduit for arterial bypass in the setting of giant hepatic artery aneurysm.

3:52 p.m. – 3:58 p.m. **Wins, Losses and Long-Term Trends in Amputations in the Delaware Valley Abington Hospital**

Ronald Renzi, DPM, Marvin Marcelin, DPM

Objective: Preventing the morbidity and suffering associated with lower extremity amputations (LEA) is a mainstay of both vascular surgeons and podiatrists. This analysis of LEA incidence and demographics in the Delaware Valley hopes to provide a measurement of amputation prevention strategy and efforts in southeastern PA.

Method: The state inpatient hospital database was accessed to capture the number of major and minor amputations suffered by residents of the Delaware Valley over the last 30 years. The rate of LEA was calculated for each county and zip code within this geographic area. Census data was used for population figures. Diabetic foot infections requiring hospitalization was also studied.

Results: Over the last 30 years changes in the rate of major and minor LEAs in the Delaware Valley are similar to national trends in amputation rates. Nationally there are dramatic geographical, racial, and gender disparity in amputation rates with similar trends in the Delaware Valley. Patients with critical limb ischemia (CLI) in the Delaware Valley are less likely to suffer a major amputation than patients with CLI nationally. (White patients 10 % in Delaware Valley compared to 34% nationally; black patients 22.8% in Delaware Valley compared to 56.4% nationally). Patients presenting with gangrene was higher nationally than in the Delaware Valley. (White patients 20.9% in Delaware Valley vs 41.1% nationally; black patients 40.1% in Delaware Valley compared to 50.2% nationally). Diabetic foot infections requiring hospitalization is increasing rapidly in the Delaware Valley.

Conclusion: Suburban areas surrounding the city of Philadelphia have a relatively low rate of LEA. Males and minorities are at the highest risk of limb loss. Further amputation effort is necessary in specific areas and populations to achieve an even lower overall amputation rate in the Delaware Valley.

3:58 p.m. – 4:04 p.m. **A 6cm Internal Carotid Artery Aneursym Necessitating Carotid Ligation: A Case Report**

Taelor Weaver, BS, Faisal Aziz MD, DFSVS, FACS

A healthy, 44-year old female presented with a 3-week history of sinus congestion, sore throat, and post-nasal drainage that progressed to right throat fullness and earache. Initial management included antibiotics and steroids for presumed pharyngitis. Persistent symptoms prompted evaluation by multiple providers, one of which noted right tonsillar enlargement with tonsillar pillar erythema and ordered a CT neck which showed a 3.0 x 2.8 x 6.1 cm aneurysm of the right cervical internal carotid artery (ICA) approximately 15 mm from its origin, extending into the skull base. Tortuosity of the artery and length of the lesion precluded any covered stent option. Extension of the aneurysm beyond the skull base precluded a revascularization procedure, due to inability to provide adequate distal control. The patient tolerated cerebral angiogram with thirty-minute balloon occlusion without neurologic changes and she was therefore offered ligation of the internal carotid artery.

A carotid ligation procedure with continuous neuromonitoring was performed under general anesthesia. Postoperatively, she was anticoagulated with intravenous heparin for 24 hours to prevent propagation of thrombus cephalad. The patient was discharged on postoperative day 2 without neurologic changes or complications. Carotid artery aneurysms have been well-described in the literature [1-4]. McCann et al [3] describe three management strategies for such aneursyms: Conservative Management (18% risk of

stroke and 5% risk of mortality), Carotid Reconstruction (8% risk of stroke and 2% risk of mortality) and Carotid Ligation (25% risk of stroke and 20% risk of mortality). Unfortunately, in the presented case, patient was symptomatic due to this large ICA aneurysm, and the anatomy was such that carotid reconstruction with an interposition bypass graft was not a possibility, leaving carotid ligation as the only surgical option.

4:04 p.m. – 4:12 p.m.

Effects of Continued Dual Antiplatelet Therapy on Major Adverse Cardiovascular Events after Carotid Artery Stenting

Nathan Belkin, MD, Benjamin M. Jackson, MD, Paul J. Foley, MD, Scott M. Damrauer, MD, Venkat Kalapatapu, MD, Julia D. Glaser, Michael A. Golden, MD, Grace J. Wang MD

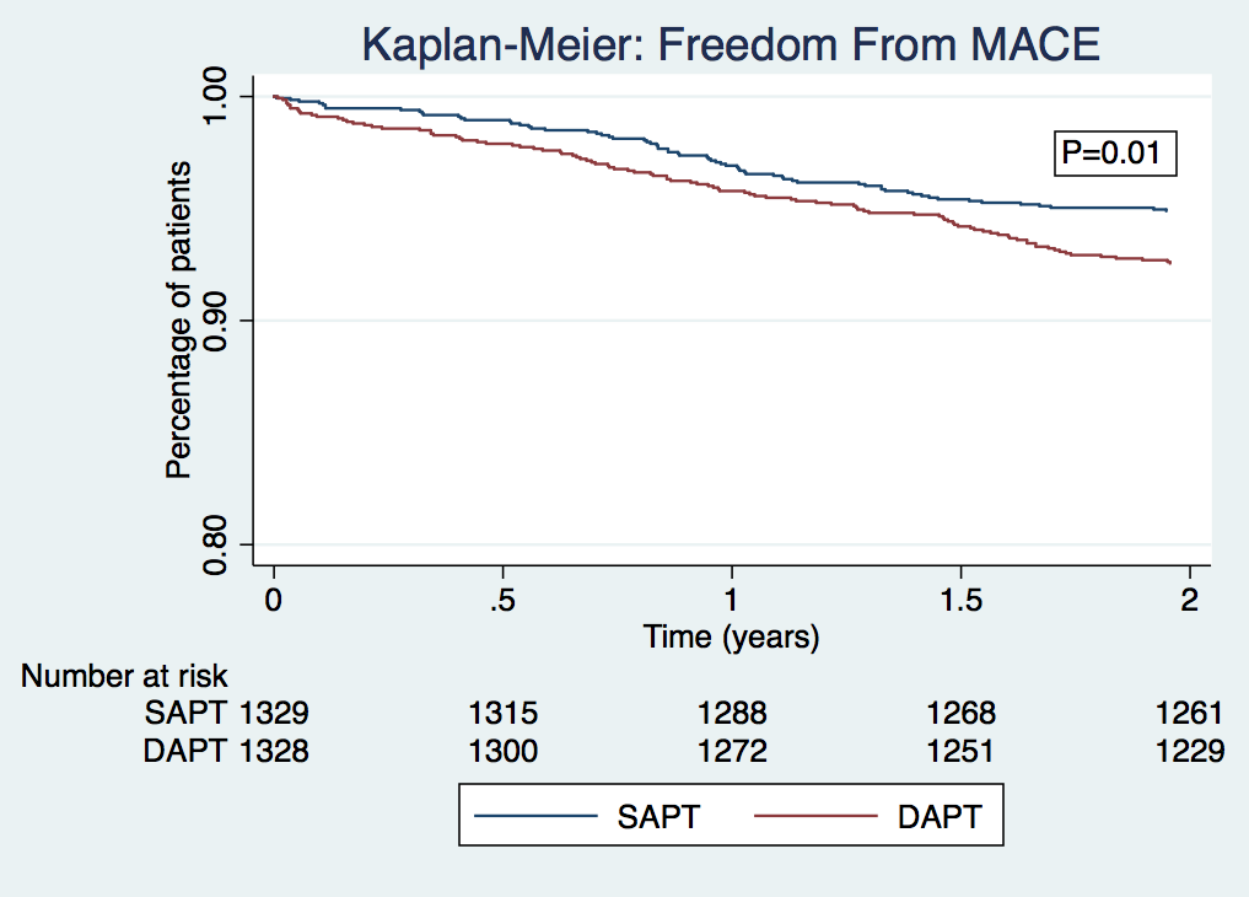
Introduction: Current guidelines recommend dual antiplatelet therapy (DAPT) for at least one month after Carotid Artery Stenting (CAS). The effects of maintained dual antiplatelet therapy after CAS have yet to be examined.

Methods: A retrospective review of CAS procedures entered in the national Vascular Quality Initiative (2005-2018) was performed. Patients discharged on DAPT were identified. Based on one year follow up antiplatelet regimens, two groups were propensity score matched: single antiplatelet therapy (SAPT) vs. maintained on DAPT. Kaplan Meier (KM) analysis investigated the impact of continued DAPT on two-year major adverse cardiovascular events (MACE), a composite outcome of stroke/TIA, MI, and mortality.

Results: Of the 18,326 CAS procedures, 88.2% were discharged on DAPT. At follow up, 68.0% of patients were maintained on DAPT, and 32.0% on SAPT. The DAPT cohort had higher frequencies of atherosclerotic comorbidities (PAD, CAD, prior PCI, prior CABG). After propensity score matching, two groups of 1,330 patients with similar demographics, comorbidities, and immediate post-operative outcomes were identified. KM analysis on the matched cohorts out to 2 years showed the DAPT cohort to have higher MACE (7.4% vs. 5.1%, p=0.01). The difference in MACE was driven by an increase in two-year mortality in the DAPT cohort (2.7% vs 1.5%, p=0.03). There was no difference in MI (0.8% vs 0.2%, p=0.06) or TIA/stroke (4.2% vs. 3.5%, p=0.35).

Conclusion: Continued dual antiplatelet therapy after carotid artery stenting does not improve long term cardiovascular outcomes over single antiplatelet therapy, and appears to be associated with increased combined major adverse cardiovascular events. In patients who do not otherwise have an indication for dual antiplatelet treatment, there is no additive benefit for DAPT beyond the postoperative 30-day period.

Figure 1: Kaplan-Meier analysis of freedom from major adverse cardiovascular events (MACE) based on continued antiplatelet regimen after carotid artery stenting.



4:12 p.m. – 4:20 p.m.

Patient Frailty as a Predictor of Mortality in Ruptured Abdominal Aortic Aneurysm

Devon E. Corrigan, MD, Joseph V. Lombardi, MD, Katherine K. McMackin, MD, Philip M. Batista, MD, Jeffrey P. Carpenter, MD, Jose L. Trani, MD

BACKGROUND: Despite advances in endovascular technology, mortality rates after surgical repair of ruptured abdominal aortic aneurysm (rAAA) remain considerably high. The preoperative assessment of rAAA patients must often be expedited given the acutely life-threatening nature of the condition. The Modified Frailty Index (mFI) represents a rapid objective measure of a patient's preoperative clinical status. This study aims to quantify the effect of patient frailty on mortality following endovascular (rEVAR) and open (rOPEN) repair of rAAA.

METHODS: The American College of Surgeons National Surgical Quality Improvement Program database was queried to identify patients undergoing rAAA repair between 2011 and 2018. Variables extracted included demographic information, type of surgical repair, presence of hypotension on arrival, and the component variables of the 11-factor mFI. Variables, including individual mFI criteria, were examined by univariate analysis to identify predictors of 30-day mortality. Chi-square, Student's T tests and Mann-Whitney U tests were used as appropriate. Significant ($p<0.05$) variables were included in a subsequent multivariable regression model.

RESULTS: A total of 4,892 rAAA patients were identified from the dataset; 2,524 rEVAR and 2,368 rOPEN. The mean age was 73.3 years (STD=9.81), and 77.9% of patients were male. The mean number of positive mFI criteria was 1.25 (STD=1.06); 1.2 in rEVAR and 1.31 in rOPEN ($p<0.0001$). Univariate analysis identified open technique, female sex, non-African American ethnicity, hypotension on admission, renal failure, blood transfusion, ASA status, and mFI ≥3 as predictors of 30-day mortality. After multivariable regression analysis, mFI ≥3 and rOPEN increased mortality at 30 days by 80% (OR=1.80; CI 1.42-2.27; $p<0.001$) and 90% (OR=1.90; CI 1.62-2.24; $p<0.001$), respectively. Mortality risk increased by 5.5% and 5.6% per unit increase in mFI in rEVAR and rOPEN groups, respectively. For the same degree of frailty, rOPEN increased mortality nearly twofold when compared to rEVAR (OR=1.92; CI 1.65-2.22; $p<0.0001$) (Fig. 1).

CONCLUSION: mFI strongly correlates with mortality in patients undergoing repair of rAAA regardless of repair technique. rEVAR demonstrated a survival benefit over rOPEN, even in patients with the lowest frailty

scores. The relative increase in mortality risk imparted by frailty is similar for rEVAR and rOPEN, increasing in a linear fashion for both groups. This data helps to stratify operative candidacy and assist in setting expectations for patients and families.

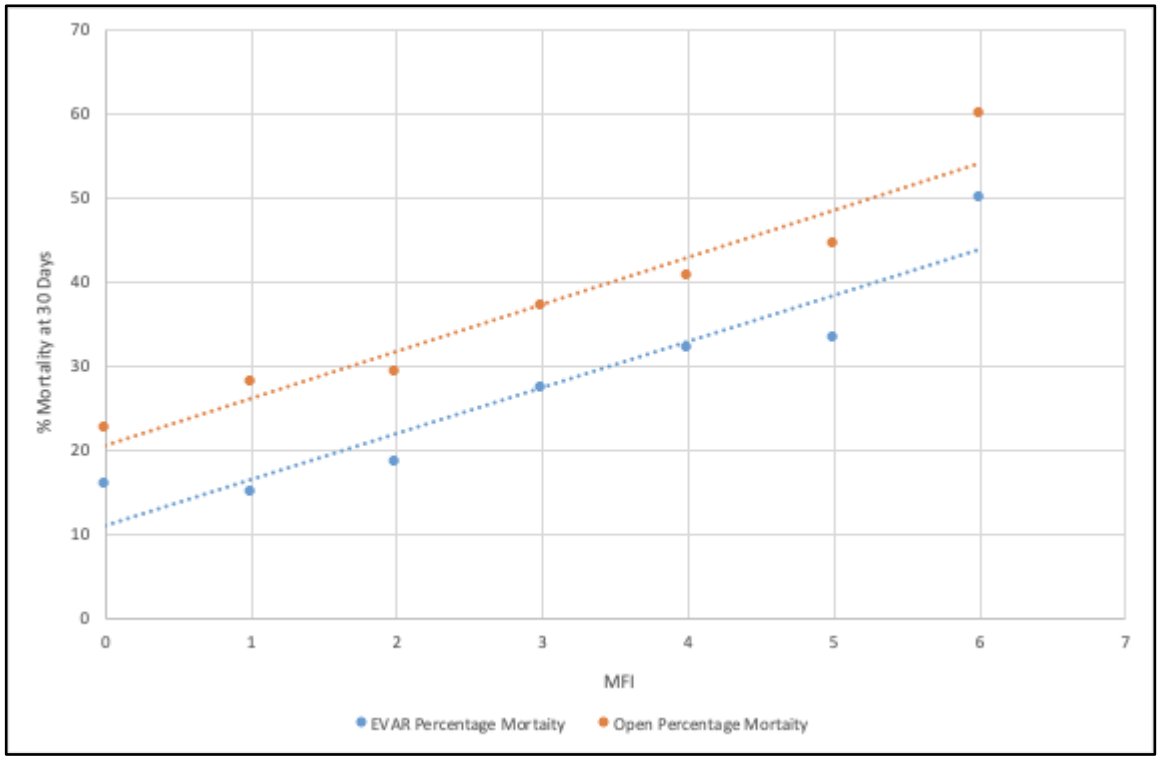


Figure 1. 30-Day Mortality after rAAA repaired by EVAR or Open Surgery per Unit Increase in mFI. mFI = Modified Frailty Index

4:20 p.m. – 4:28 p.m.

Techniques and Outcomes of Concomitant Aortic and Caval Resection and Reconstruction for Cancer

Samuel L. Chen, MD, Daniel H. Newton, MD, Douglas Fraker, MD, Thomas J. Guzzo, MD, Robert E. Roses, MD, Paul J. Foley, III, MD, Ronald M. Fairman, MD, Benjamin M. Jackson, MD

Objectives: Major vascular involvement is often considered a contraindication to resection of malignant tumors, but in highly selected patients it can be performed with mixed oncologic results that are highly dependent upon the tumor biology. Resection of both the aorta and inferior vena cava (IVC) is a rare undertaking, requiring both favorable tumor biology and a patient fit for a substantial surgical insult; nevertheless, it provides the possibility of a cure.
Methods: Patients requiring resection and reconstruction of both the aorta and IVC from 2009 through 2018 at a single university medical center were included. Patient characteristics, operative technique, and outcomes were retrospectively collected.
Results: We identified seven patients, all with infrarenal reconstruction or repair of the aorta and IVC. Patient characteristics are detailed in Table 1. All cases were performed with systemic heparinization and required simultaneous aortic and caval cross-clamping for tumor resection. No temporary venous or arterial bypass was used. Since arterial reperfusion with the IVC clamped was poorly tolerated in one patient, venous reconstruction was typically completed first. Primary repair was performed in one patient, while six required replacement. In two patients, aortic homograft was used for replacement of both the aortoiliac and iliocaval segments in contaminated surgical fields. In the remaining four, Dacron was used for arterial replacement; either Dacron (n=2) or PTFE (n=2) were used for venous replacement. Patients were discharged after a median stay of 8 days (range: 6-16). At median follow up of 16 months (range 1-79 months), there were no deaths. Two patients with paraganglioma had cancer recurrences. Venous

reconstructions occluded in three patients (50%), though symptoms were minimal. One patient presented acutely with a thrombosed iliac artery limb and bilateral common iliac artery anastomotic stenoses, treated successfully with thrombolysis and stenting.

Conclusions: Patients with tumor involving both the aorta and IVC can be successfully treated with resection and reconstruction. En-bloc tumor resection, restoration of venous return before arterial reconstruction, and most importantly, careful patient selection, all contribute to positive outcomes in this otherwise incurable population.

Table 1. Patient Characteristics and Oncologic Outcome

Patient Age/Sex	Diagnosis	Venous involvement	Venous reconstruction	Arterial involvement	Arterial reconstruction	EBL (L)	Antithrombotic therapy	Recurrence
1. 28 F	Paraganglioma	IVC, obliterated Left CIV	IVC only (Dacron)	Aortic bifurcation	Aortoiliac (Dacron)	2.5	Warfarin	None
2. 51 F	Paraganglioma	IVC	IVC only (ringed PTFE)	Aorta	Aortic tube graft (Dacron)	3	None	None
3. 50 M	Paraganglioma	IVC	Primary repair	Aorta	Primary repair	1.8	Aspirin 325mg	Spine
4. 71 F	Paraganglioma	IVC, bilateral CIVs	Iliocaval (ringed PTFE)	Aorta, bilateral CIAs	Aortoiliac (Dacron)	6	Aspirin 81mg	Spine, LN
5. 26 M	Mixed germ cell tumor	Thrombosed IVC	IVC only (thoracic aorta homograft)	Aortic bifurcation	Aortoiliac (aortoiliac homograft)	3.5	Aspirin 81mg	None
6. 36 M	Mixed germ cell tumor	IVC, bilateral CIVs	Iliocaval (aortoiliac homograft)	Aorta, bilateral CIAs	Aortoiliac (aortoiliac homograft)	3	Aspirin 81mg	None
7. 21 M	Mixed germ cell tumor	IVC, thrombosed bilateral CIVs	Iliocaval (Dacron)	Aortic bifurcation	Aortoiliac (Dacron)	5	Rivaroxiban	None

Abbreviations: inferior vena cava (IVC), common iliac vein (CIV), common iliac artery (CIA), estimated blood loss (EBL), lymph nodes (LN)

4:28 p.m. – 4:36 p.m.

Defining and Validating Superior Mesenteric Artery Duplex Ultrasound Criteria for In-Stent Restenosis

Jessica Green, MD, PhD, Evan Ryer, MD, Nicholas Borden, BS, Bilal Ali, BS, James Elmore, MD

Objective: This study sought to define and validate mesenteric duplex ultrasound (DUS) criteria for a >70% in-stent restenosis (ISR) of superior mesenteric artery (SMA) stents.

Methods: Five-hundred and three mesenteric DUS between 2004 and 2018 were reviewed from a single institution database. Thirty-seven scans had CTA performed within 30 days of mesenteric duplex ultrasound. Centerline reconstructions were generated using TeraRecon Aquarius iNtuition software and three independent observers measured percent stenosis. Stenotic areas were matched with peak systolic velocity (PSV) obtained with DUS. Logistic regression models were used calculate probabilities of a >70% in-stent restenosis based on pre-operative mesenteric DUS PSV. Patient outcomes were then reviewed; PSV from 28 samples that underwent re-intervention with angioplasty or stent were compared to 463 samples that did not undergo re-intervention. 12 scans did not report PSV values of the SMA.

Results: A PSV of 300 cm/sec had a 10% probability of a > 70% ISR (sensitivity (SN): 100%, specificity (SP): 79.3%, positive predictive value (PPV): 57.1, negative predictive value (NPV): 100%). A PSV of 450 cm/sec had a 70% probability of a > 70% ISR (SN: 50%, SP:100%, PPV: 100%; NPV: 87.9%). The PSV associated with a 50% probability of a >70% ISR was 411.2 cm/sec (Figure 1). Patients undergoing repeat intervention for ISR had a PSV of 554.9 $\pm$ 191.4 cm/sec compared to those that did not undergo repeat intervention (354.8 $\pm$ 157.9 cm/sec, $p<0.001$).

Conclusions: A PSV greater than 400 cm/sec in the stented SMA may signify severe ISR and further work-up with angiography should be considered. At a PSV between 300 cm/sec and 400 cm/sec, close interval follow-up with non-invasive imaging may be prudent.

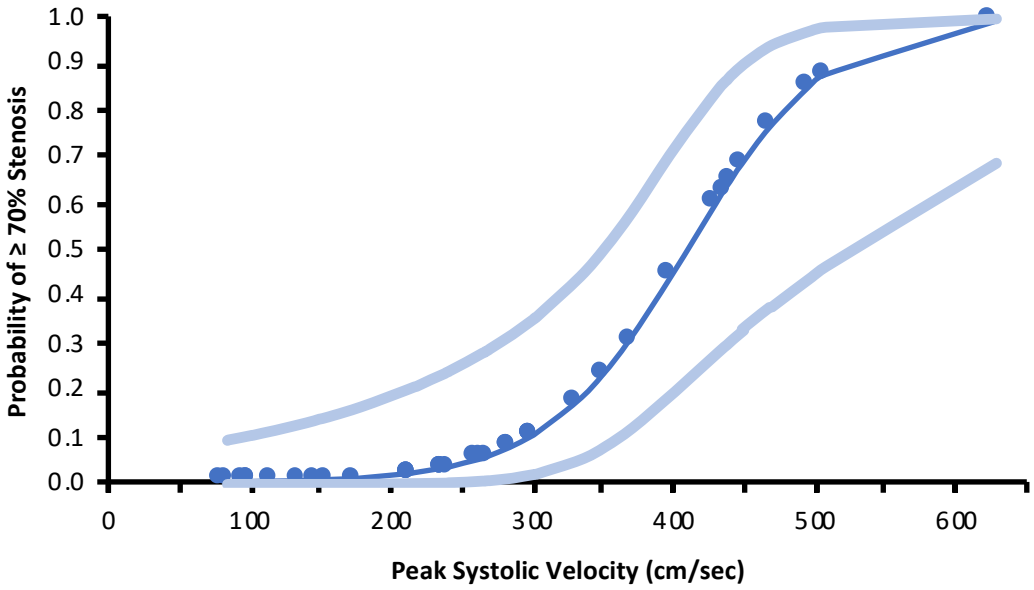


Figure 1. The probability of a >70% SMA in-stent stenosis with 95% confidence intervals (solid light blue lines) is shown based on the peak systolic velocity obtained from mesenteric duplex ultrasound. Probability is calculated from logistic regression models of mesenteric duplex ultrasound velocities matched to stenotic areas identified from concurrent (within 30 days) CTA centerline reconstructions.

4:36 p.m. – 4:44 p.m.

Lessons Learned in Maximizing Open Surgical Experience for Vascular Integrated Residents During the Non-Vascular Months of Training

Katherine K McMackin MD, Jose Trani MD, Devon E Corrigan MD, Lauren Jonas MS, Philip M Batista MD, Jeffrey P Carpenter MD and Joseph V Lombardi MD

Objective: Open surgical experience remains a highly coveted area of vascular integrated surgery (VIS) training. VIS training recently decreased the number of required non-vascular rotations (NVR) from 24 to 18 months. Our institution has developed a curriculum that maximizes open surgical exposure NVRs. The purpose of this study is to compare our experience with national trends, identifying site specific and national high yield open experience NVRs.

Methods: The Accreditation Council for Graduate Medical Education (ACGME) case log graduation statistics from 2012-2018 were compiled. Our institution's ACGME case logs from 2015-2019 were likewise compiled. Primary outcome was the average number of non-vascular cases performed as first assist, surgeon junior, surgeon chief and teach assist. Secondary outcomes were the number of open and minimally invasive cases (laparoscopic, thoracoscopic, etc) by VIS residents in ACGME defined categories. The VIS rotation schedules from the ACGME accredited programs was compiled. Number and type of NVR rotations were calculated by PGY year.

Results: A total of 185 VIS residents completed training during the study period. The abdominal category averaged the greatest number of cases during NVRs overall, however also had the greatest percentage of minimally invasive cases. Transplant surgery had the highest percentage of open cases (100%). Our institution's residents had comparable open and laparoscopic experience except in the cardiothoracic category, where the number of cases performed far exceeded the national average (Figure 1). When

evaluating rotation schedules, twenty-eight VIS programs' schedules were available for review (46.7%). The top three PGY 1 rotations were general surgery followed by trauma and plastic surgery. The top three PGY 2 rotations were general surgery followed critical care and transplant.

Conclusion: Much of today's general surgery experience for VIS residents on NVRs are minimally invasive surgeries. Both nationally and at our institution, transplant and trauma provide the highest percentage of open surgical experience. Cardiothoracic cases provide the highest number of open cases both at our institution and nationally. General surgery is the most common NVR among VIS programs even though it provides a lower yield of open surgery experience for VIS residents. Increasing the number of cardiac surgery months in place of low-yield rotations may increase open surgical training for VIS residents.

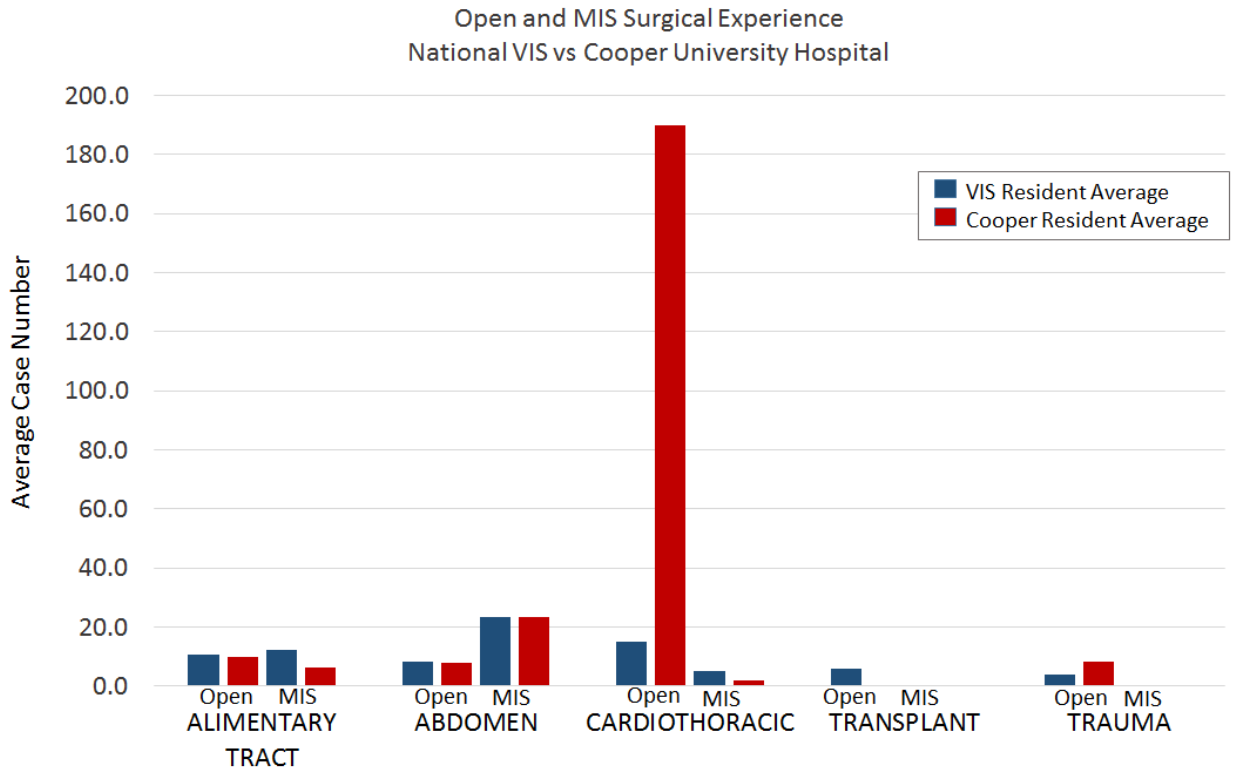


Figure 1: Surgical experience nationally and at our institution on non-vascular rotations stratified by open vs minimally invasive

4:44 p.m. – 4:52 p.m.

Intraoperative Mean Arterial Pressure Variation Carries a Higher Risk of Headache after Carotid Endarterectomy

Daniel C. Lee, MD, Jose Trani, MD, Katherine K. McMackin, MD, Albert Ha, BA, Philip M Batista, MD, Jeffery P. Carpenter, MD, Joseph V. Lombardi, MD

Objectives: Cerebral hyper-perfusion (CH) is a rare but potentially devastating complication following carotid endarterectomies (CEA). Its symptoms range from new-onset unilateral headache (HA) to intracranial hemorrhage (ICH). Patient length of stay is usually impacted significantly while waiting for symptoms to resolve on antihypertensive therapy. Risk factors of CH in the literature to date have not yet yielded a consensus. This study examined peri-operative blood pressure variation, mode of CEA, clamp times and other potential risk factors for CH.

Methods: A single center retrospective review at a tertiary care center from January 2010 to November 2019 was performed. Inclusion criteria were all patients undergoing carotid endarterectomy for symptomatic or asymptomatic carotid disease. Patients with incomplete charts were excluded. Primary endpoints were new-onset severe unilateral HA or post-operative ICH. Data on intraoperative and post-operative mean arterial blood pressure (MAP), systolic blood pressure (SBP), the mode of endarterectomy, shunt placement, carotid artery clamp times and contralateral carotid status were collected.

Results: Seven hundred and thirty five patients met inclusion criteria where 430 patients underwent modified eversion CEA (59%) and 305 patients had conventional patch angioplasty (42%). The incidence of sustained ipsilateral HA was 19% (N= 142) in our total cohort. Those patients with HA who demonstrated no relief with analgesics and strict blood pressure control, 1.5% (N=11), a non-contrast head computed tomography scan was performed. One patient (0.1%) had an ipsilateral ICH. Univariate analysis demonstrated that greater intra-operative MAP variability had the highest risk for HA (OR 1.02, 95% CI:1.013,1.027 p<0.0001) followed by intra-operative SBP variability (OR 1.011, 95% CI:1.007,1.015 p<0.0001) and lastly peak intra-operative SBP (OR 1.007, 95% CI:1.004, 1.010 p<0.0001) (Fig 1). Interestingly, there was no significant difference between post-operative MAP variability and HA (p=0.1) (Fig 2). Mode of endarterectomy showed no statistically significant difference in risk for developing HA (OR 1.165, 95% CI 0.801, 1.694; p=0.42). Carotid artery clamp times also showed no statistically significant difference in risk for HA (p=0.36).
Conclusions: Greater intra-operative variability in blood pressures is significantly associated with higher risk of postoperative HA. Adhering to strict blood pressure parameters and limiting blood pressure variability may be beneficial at reducing the incidence of HA and potentially CH and its complications.

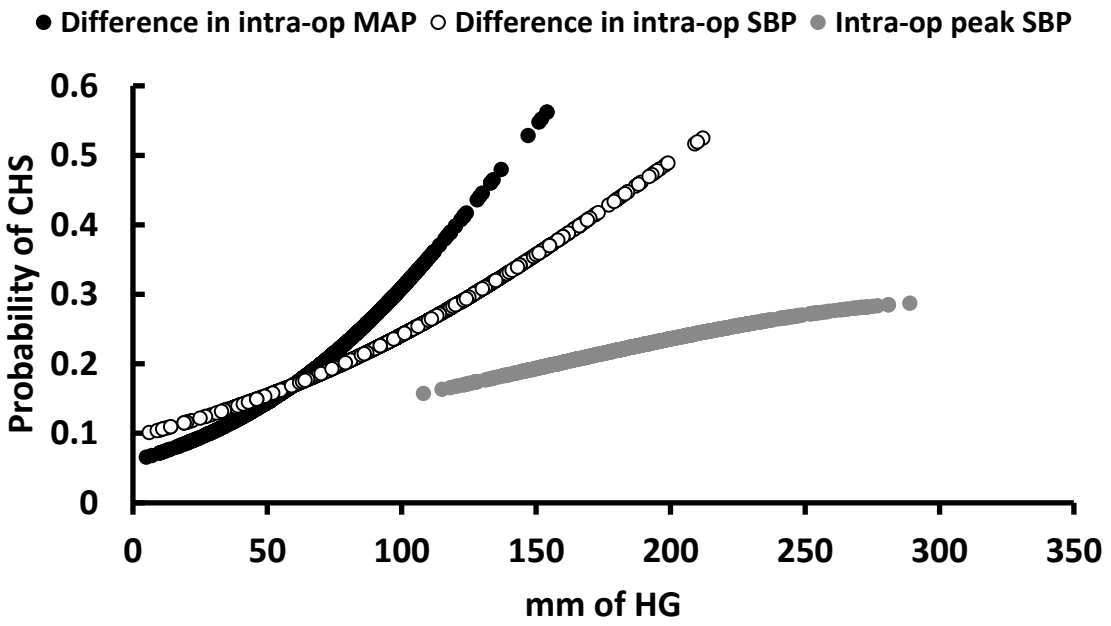


Figure 1: Probability of CH following carotid endarterectomy correlates with increase in the variability of intraoperative MAP, variability of intraoperative SBP as well as maximum SBP.