46th ANNUAL SCIENTIFIC MEETING

DELAWARE VALLEY VASCULAR SOCIETY

THE UNION LEAGUE OF PHILADELPHIA
PHILADELPHIA, PENNSYLVANIA

Thursday, May 9, 2024

ADMINISTRATIVE OFFICE
Delaware Valley Vascular Society
9400 W. Higgins Rd., Suite 315, Rosemont, IL 60018
Telephone: 312-334-2321 · Fax: 312-334-2320
Email: DVVS@vascularsociety.org · www.vascular.org/dvvs

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2015-2016.....Benjamin M. Jackson, MD
2016-2017.....Theodore Sullivan, MD
2017-2018.....Grace J. Wang, MD
2018-2019..... Rashad Choudry, MD
2019-2020.....Eric Choi, MD
2020-2021..... Jose Trani, MD
2021-2022..... Evan Ryer, MD
2022-2023..... Dawn Salvatore, MD

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 current management strategy of complex aortic aneurysm disease
2. Discuss current endovascular techniques of complex aneurysmal disease
3. Discuss current surgical techniques of complex aortic aneurysm disease
4. Discuss complications and treatment strategies after aneurysm repair
5. Discuss pathophysiology of aortic aneurysm disease

BEST TRAINEE AWARD

Abstracts presented by our trainees will be eligible for the Clinical Research Award, Basic Science/Case Report Award, Medical Student Award and Poster 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
46th Annual Meeting
Thursday, May 9, 2024
The Union League of Philadelphia

SCIENTIFIC PROGRAM

11:00 am	**Welcome** Douglas Troutman, DO, President, Delaware Valley Vascular Society
11:05 am - 12:40 pm	***Rapid Fire Case Presentations***
11:05 - 11:12 am	**Gastrocnemius Flap and Serial Washouts to Salvage Synthetic Redo Femoropopliteal Redo Bypass: A Multidisciplinary Approach to Limb Salvage** **Christopher DeHaven BS,** Kristen Kent, MD, Faisal Aziz, MD, Maria Camila Castello Ramirez, MD *Penn State Health Milton S. Hershey Medical Center*
11:12 - 11:19 am	**Inflammatory Celiac Artery Aneurysm Accompanied by Insidious Onset Abdominal Pain** **Kristen Kent, MD,** M. Phil, MD, Faisal Aziz, MD, FACS, Christopher Noty, DO, Maria Camila Castello Ramirez, MD *Penn State Health Milton S. Hershey Medical Center*
11:19 - 11:26 am	**Case Report: Rupture Abdominal Aortic Aneurysm treated with PMEG – Technical Considerations** **Mohammed Irfan Ali, MD PhD,** Gaurang Joshi, MD, S. Vincent, MD, Michael Nooromid, MD, Babak Abai, MD, Dawn M. Salvatore, MD, Paul J. Dimuzio, MD *Thomas Jefferson University Hospital*
11:26 - 11:33 am	**Endovascular Repair of Abdominal Aortic Aneurysm Complicated by Type IB Endoleak and Aortocaval Fistula: A Case Report** **Joel B Durinka MD,** Gaurang Joshi, MD; M. Irfan Ali, MD; Michael Nooromid, MD Dawn Salvatore, MD Paul DiMuzio, MD, Babak Abai, MD *Thomas Jefferson University Hospital*
11:33 - 11:40 am	**Open Repair of an Incidental Internal Carotid Artery Pseudoaneurysm Discovered after Cardiac Arrest** **Sean DuBois, MD,** Jacob Wilson, MD, Michael Qaqish, MD *St. Luke's University Health Network*

11:40 - 11:47 am	**Carotid Axillary Bypass with Partial Clavicular Resection for Arterial Thoracic Outlet Syndrome Secondary to Congenital Clavicular Pseudoarthrosis** **Rajbir Singh, DO,** Alvaro, Mendez, MD Michael Qaqish, MD *St. Luke's University Health Network*
11:47 -11:54 am	**Abdominal Aorta Injury Secondary to Blunt Trauma Requiring Endovascular Intervention: A Rare and Interesting Case** **Ioannis Tsouknidas, MD,** Alvaro Mendez, MD, Lia Michos, MD, Alexander Uribe, MD, Henry Hirsch, MD *Lankenau Medical Center*
11:54 am-12:01 pm	**Rescue of ECMO-related Access Complications in an 18-year-old with a Massive Pulmonary Embolism using the Arterial ECMO Cannula as an External Conduit** **Abby Clark, MD,** Mikael Fadoul, MD, Mitchell McDaniels, BA, Laurel Hastings, MD, Christopher Noel, MD, Nitin Puri, MD, Joseph Lombardi, MD, MBA, Katherine McMackin, MD *Cooper University Hospital*
12:01 pm-12:08 pm	**Persistent sciatic artery aneurysm: a case report** **Brian N. Lifschutz, DO,** Danielle M. Pineda, MD *Jefferson Abington Hospital*
12:08 pm-12:15 pm	**Endovascular Intervention in Penetrating Trauma** **T Bhamidipati, MD,** Joseph Yoo, MD, Afshin Parsikia, MD, Nadia Awad, MD, Evan Deutsch, MD *Einstein Medical Center*
12:15 pm-12:22 pm	**Case Series of Left Ovarian Vein Transposition for Nutcracker Syndrome** **Perry Kerner, MD,** Kathleen Marulanda, MD, Ciaran O'Brien, MD, Christopher Cappellini, DO, Keith Calligaro, MD, Matthew Dougherty, MD, Douglas Troutman, DO *Pennsylvania Hospital (UPHS)*
12:22 pm-12:29 pm	**Persistent Sciatic Artery: A Real Pain in the Buttock** **Lynde K. Lutzow MD, MPH,** Alison Messina, MD, Mohammed Eslami, MD, MPH, Frank Schmieer, MD PVT, Amanda Phillips, MD *Temple University*
12:29 pm-12:38 pm	**Aorto-BiFemoral Bypass with Inferior Mesenteric Artery Re-Implantation for Chronic Mesenteric Ischemia** **Ciaran O'Brien, MD,** Julia Drake Glaser, MD *University of Pennsylvania*
12:40 - 1:40 pm	**Lunch & Exhibits**

1:40 - 2:40 pm **Complex Aortic Aneurysm Disease Panel**

- Darren Schneider, MD: "Comercially Available Fenestrated/Branch Endografts in the Abdominal Aortic Aneurysms"
- Joseph Lombardi, MD: Physician-Modified Endografts (PMEGs) in Abdominal Aortic Aneurysms
- Shang Loh, MD: In Situ Laser Fenestrating EVAR Grafts for Difficult Proximal Necks
- Faisal Aziz, MD: Open Conversion for EVAR Failure
- Keith Calligaro, MD: Parallel Grafts are an Excellent Option for Difficult Aortic Necks

2:40 - 3:00 pm **Coffee Break & Exhibits**

3:00 - 4:40 pm ***CLINICAL RESEARCH PRESENTATIONS***

3:00 - 3:09 pm **African American Women are more likely to Undergo Carotid Endarterectomy for a Higher Degree of Stenosis and Have Increased Risk of Return to the Operating Room as compared to White Women**
Leana Dogbe BS, Ahsan Zil-E-Ali MBBS MPH, Alpha Tall BS, Abdul Wasay Paracha BS, Maria Camila Castello Ramirez MD, Faisal Aziz MD FACS DFSVS
Penn State Health Milton S. Hershey Medical Center

3:09 – 3:18 pm **African American Race and Medicaid Insurance are Associated with Increased Frequency of Unplanned Return to Operating Room after Lower Extremity Bypass for Chronic Limb Threatening Ischemia**
Abdul Wasay Paracha BS, Ahsan Zil-E-Ali, MBBS, MPH, Alpha Tall, MD, Jacob Soucy, MD, Leana Dogbe, MD, Billal Alamarie, MD, Faisal Aziz, MD
Penn State Health Milton S. Hershey Medical Center

3:18 - 3:27 pm **Access to Access: Investigating Racial Disparities in the Arteriovenous Access Continuity-of-Care.**
Paarth Jain, BS, Michael Nooromid, MD, Dawn Salvatore, MD, Paul DiMuzio, MD, Babak Abai, MD
Thomas Jefferson University Hospital

3:27 - 3:36 pm **Clinical Outcomes of Endovascular and Open Repair of Arterial Injury during Total Knee Arthroplasty (TKA)**
Jeremy Zack, BS, Paarth Jain, BS, Lauren Posego BA, Brandon A. Creisher BS, Dawn Salvatore, MD, Paul DiMuzio, MD, MBA, Michael Nooromid, MD, Babak Abai, MD
Thomas Jefferson University Hospital

3:36 - 3:45 pm	**Trends in Lower Extremity Major Amputation during the COVID-19 Pandemic** **Arjun Kumar, BS;** Katherine McMackin, MD, Besher Tolaymat, MD, Bruce L. Tjaden, MD, Philip M. Batista, MD, Laurel Hastings, MD, Joseph V. Lombardi, MD, MBA *Cooper University Hospital*
3:45 - 3:54 pm	**Length of Coverage Does Not Impact Aortic Remodeling after TEVAR for Type B Aortic Dissection** **Katherine K McMackin MD,** Alec J Schubert, MD, Marta Majewski, BS, Philip M Batista MD, Bruce Tjaden MD, Laurel Hastings MD, Joseph V Lombardi, MD *Cooper University Hospital*
3:54 – 4:03 pm	**Development and Validation of a Machine Learning Prediction Model to Improve Abdominal Aortic Aneurysm Screening** **Alexandra Maningat, DO,** Gregory G. Salzler MD**,** Evan Ryer, MD, Robert Abdu, DO, Alon Lanyado, Bsc, Tal Sagiv, Bsc, Eran Choman, Msc, Abdul Tariq, PhD, Jim Urick, MS, Elliot Mitchell, PhD, Rebecca Maff, BS, Grant DeLong, BA, Stacey Shriner, BS, James Elmore, MD *Geisinger Medical Center*
4:03 – 4:12 pm	**Transversus Abdominis Plane Block Provides Early Opioid-Sparing Pain Control in Open Aortic Surgery** **Emily Unrue, DO,** Amber S. Hussain, DO**,** Gayatri S. Pillai, BS, Sahaj S. Shah, BA, Heather S. Hussain, ScD, Robert W. Abdu, DO, Evan J. Ryer, MD, Gregory G. Salzler, MD, James R. Elmore, MD *Geisinger Medical Center*
4:12 – 4:21 pm	**Outcomes of Combined Open Femoral Endarterectomy and Endovascular Femoral-Popliteal Stenting for Treatment of Flush Superficial Femoral Artery Occlusions** **Christopher Cappellini DO,** Keith Calligaro MD, Matthew Dougherty MD, Douglas Troutman DO *Pennsylvania Hospital (UPHS)*
4:21 – 4:30 pm	**Open Juxta-renal Abdominal Aortic Aneurysm Repair Still Confers Post-Operative Rupture Risk** **Lena Chatterjee MD,** Afshin Parsikia MD, Evan Deutsch MD, Nadia Awad MD *Einstein Medical Center*
4:30 – 4:39 pm	**Surge in Volume of Injection Drug Use Associated Pseudoaneurysms in North Philadelphia** **Amanda R Phillips, MD MSc,** Shina Patel, MD, Kenny Oh, MD JD, Frank Schmieder, MD *Temple University*
4:40 – 4:50 pm	**DVVS Member Business Meeting**

4:50 - 5:00 pm	**Past President Recognition & Toast**
5:00 - 5:30 pm	**Reception & Exhibits**
5:30 - 7:00 pm	**Dinner and Keynote Lecture** Complex Endovascular Aortic Interventions Manish Mehta, MD, MPH Community Care Physicians President & Chairman, Center for Vascular Awareness

ABSTRACTS

11:05 - 11:12 am

Gastrocnemius Flap and Serial Washouts to Salvage Synthetic Redo Femoropopliteal Redo Bypass: A Multidisciplinary Approach to Limb Salvage

Christopher DeHaven BS, Kristen Kent, MD, Faisal Aziz, MD, Maria Camila Castello Ramirez, MD
Penn State Health Milton S. Hershey Medical Center

Introduction: Graft Infection is a feared complication of vascular prostheses. Although its incidence is reported to be as low as 0.9-4.6% in the femoral, popliteal segment, infection is more likely to involve prosthetic grafts implanted during an emergency procedure or with inflow from the femoral artery. This case describes a multidisciplinary approach to treating refractory methicillin-sensitive staph aureus (MSSA) graft infection of a redo femoral, popliteal bypass with PTFE.

Case Description: A 64-year-old male with past medical history of CAD, COPD, CVA, and PAD status post multiple revascularizations of bilateral lower extremities. Most recently, he presented to the emergency department with acute limb ischemia and was found to have a downed bypass. Thrombectomy was unsuccessful, and the prior bypass required explant and redo with a common femoral artery to below knee popliteal bypass with PTFE. 2.5 weeks postoperatively, he presented acutely with calf wound dehiscence and infected bypass graft. He subsequently underwent seven irrigation and debridements with wound vac changes in a 14-day span, and ultimately a right medial gastrocnemius flap and split-thickness skin graft with plastic surgery. He was discharged home the next day with wound care follow-up, six weeks of IV antibiotics, and the intention of continuing lifelong suppression antibiotics. One year post operatively, his bypass remains patent, and his wound has healed entirely.

Discussion: Graft preservation in the setting of infection is often overlooked in favor of the gold standard therapy of explant. In this patient with a patent bypass, PTFE conduit, infection with a low

virulence organism, and no signs of systematic infection, preservation was a reasonable treatment. Local tissue flap coverage is an accepted treatment adjunct in graft infection and can alleviate the complications associated with extensive soft tissue loss.

Conclusion: A multidisciplinary approach utilizing medical therapy and surgical coverage of infected grafts can prevent the need for explant, ultimately maintaining flow to the foot and preventing further urgent extra-anatomic bypasses.

Figure 1: Gastrocnemius Flap of RLE

Figure 2: Left: POD 8, Prior to Gastroc Flap and Skin Graft;

Right: 5 Months Post Discharge

11:12 - 11:19 am

Inflammatory Celiac Artery Aneurysm Accompanied by Insidious Onset Abdominal Pain

Kristen Kent, MD, M. Phil, MD, Faisal Aziz, MD, FACS, Christopher Noty, DO, Maria Camila Castello Ramirez, MD
Penn State Health Milton S. Hershey Medical Center

Introduction: Visceral artery aneurysms (VAAs) are rare but potentially devastating given the high mortality associated with rupture. They are typically asymptomatic. Celiac artery aneurysms (CAAs) make up only 5% of VAAs. Up to 87% of the patients with CAA presented ruptured and the diagnosis was made postmortem. Therefore, current Society of Vascular Surgery guidelines recommend repair of these at 2.5cm, as they are associated with up to 40% mortality when ruptured. Surgical intervention includes endovascular embolization and/or stenting; versus open revascularization. This case presents a large CAA with very particular features concerning for mycotic aneurysm who underwent open ligation of the celiac artery at the origin. Splenectomy was performed given the need for ligation of the splenic artery. He had a replaced right hepatic artery from the SMA; thus no revascularization was needed.

Case Description: A 43 year old male with history of seizure disorder, smoking, and newly diagnosed hypertension presented with constipation and five days of abdominal pain. He did not report any fevers or chills. His lab work was significant for a leukocytosis of 17.7, mildly elevated CRP at 1.63, and ESR that was within normal limits at 15. A CT angiogram of the abdomen and pelvis revealed a 5.2cm celiac artery aneurysm with stranding. Given its appearance and the concern for infection, he underwent emergent laparotomy and ligation. He was on broad spectrum antibiotics. Blood cultures and intraoperative tissue cultures revealed no microorganism growth. Pathology was remarkable only for periarterial abscess with acute and chronic inflammation and focal tissue necrosis compatible with aneurysm.

Discussion: This case report presents a rare CAA and its management with open intervention. In this case, his vessel anatomy was favorable for open repair with ligation of the celiac axis due to the presence of a replaced right hepatic artery. This also highlights the importance of anatomic vessel variants when making surgical decisions.

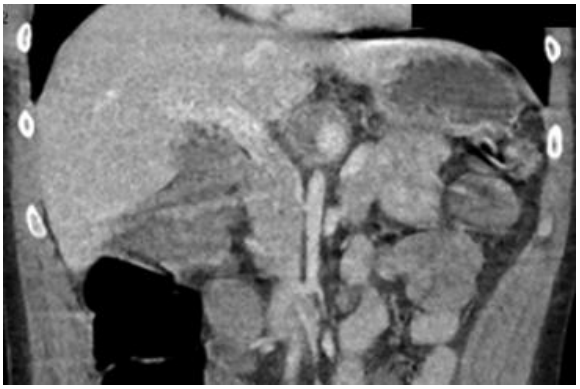


Figure 1: CT angiogram of 5.2 x 4.2 inflammatory celiac artery aneurysm.

11:19 - 11:26 am

Case Report: Rupture Abdominal Aortic Aneurysm treated with PMEG – Technical Considerations

Mohammed Irfan Ali, MD PhD, Gaurang Joshi, MD, S. Vincent, MD, Michael Nooromid, MD, Babak Abai, MD, Dawn M. Salvatore, MD, Paul J. Dimuzio, MD
Thomas Jefferson University Hospital

Introduction:
This is a 77-year-old male presenting with a 2 week history of abdominal from an outside hospital. The patient has a significant history AFib, lymphoma in remission and a recent hospitalization for Gram-positive sepsis. On further radiographic evaluation, the patient was found to have a contained rupture of the pararenal abdominal aorta. The clinical course highlights technical challenges with endovascular interventions on this patient that ultimately underwent successful technical and clincial outcome after physician modified endograft repair.

Clinical Presentation:
The patient presented with significant history of abdominal pain of unknown origin. As part of his workup, patient was found to have Gram-positive sepsis for which he was treated with IV antibiotics and further imaging workup revealed a contained rupture of the posterior aorta at the pararenal segment (Figure 1).
Further imaging studies and clinical management of the patient revealed a stable clinical course and multiple operative approaches were discussed and ultimately the most tenable approach with a physician modified endograft for this difficult anatomic presentation of a life-threatening condition. Multiple planning sessions and discussions were had that ultimately led to a successful graft modification plan and operative approach. Intraoperative resuscitation and management yielded a successful technical result with three-vessel stent placement and one-vessel fenestration (Figure 2). Subsequent imaging demonstrated excellent coverage of the rupture with no endoleak (Figure 3). The patient was discharged with excellent clinical outcome.
Results:
Technical challenges with endovascular techniques are highlighted within the overall approach with discussion of open technique versus endovascular technique prior to surgical intervention. Careful consideration preoperative and intraoperative care highlights the clinical relevance of contemporary physician modified endograft techniques to address life-threatening aortic pathology.

Figure 1.

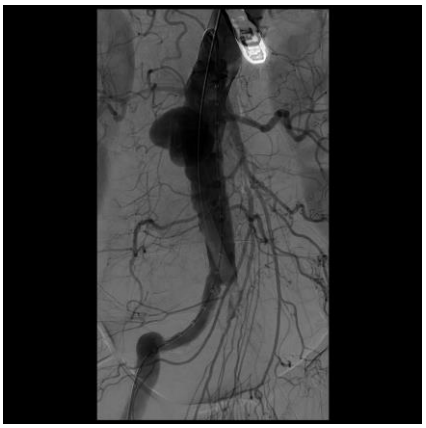


Figure 2.

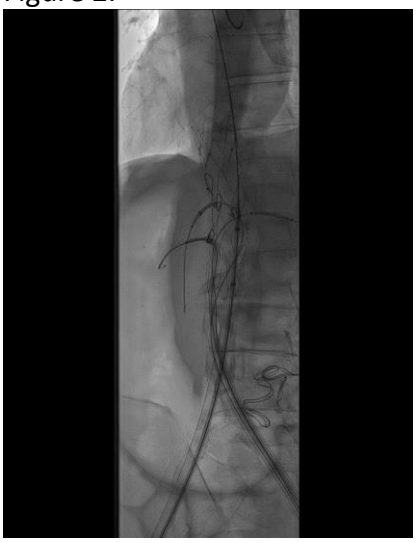


Figure 3.

11:26 - 11:33 am

Endovascular Repair of Abdominal Aortic Aneurysm Complicated by Type IB Endoleak and Aortocaval Fistula: A Case Report

Joel B Durinka MD, Gaurang Joshi, MD; M. Irfan Ali, MD; Michael Nooromid, MD Dawn Salvatore, MD Paul DiMuzio, MD, Babak Abai, MD
Thomas Jefferson University Hospital

Introduction:
A 42 year old male with a history of cocaine abuse and hypertension presented with a type A aortic dissection. He underwent a successful ascending aorta repair with two dacron grafts without

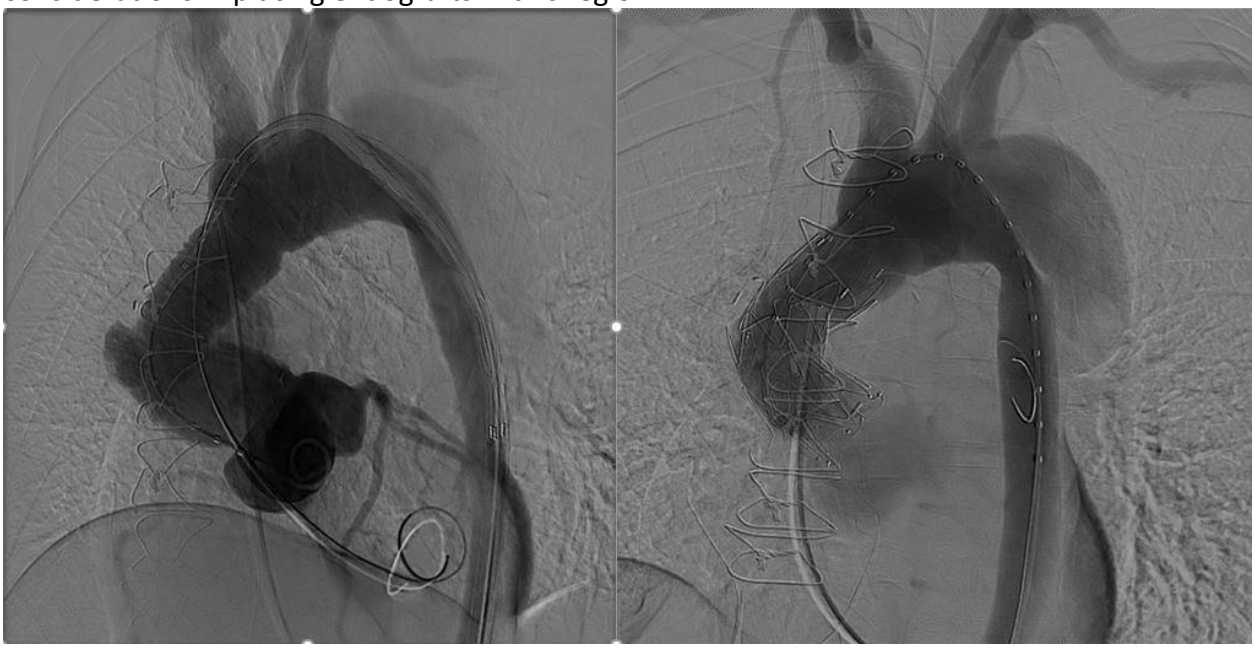
replacement of the aortic valve or debranching, with the assistance of cardiopulmonary bypass and systemic hypothermia. 6 months after this operation he returns with similar chest after reportedly using cocaine. A CT scan shows a pseudoaneurysm at the junction of the graft to graft anastomosis. As operative planning was being discussed patient left against medical advice and returned a few hours later after using cocaine. Given his high-risk behavior, the location of the pseudoaneurysm and history of a sternotomy, an endovascular intervention was preferred.

Surgical Management:

The morning of the operation the patient was sent to the electrophysiology lab and a transvenous pacer was placed through the right IJ. In the OR, bilateral ultrasound guided femoral artery access was obtained. A pigtail catheter was placed at the aortic root and an aortogram was performed that demonstrated a pseudoaneurysm on the outer curve of the previous dacron to dacron graft anastomosis. There was an 11 cm distance from the ST junction to the brachiocephalic trunk. The tip of the TEVAR was 5 cm in length. It was anticipated to cross the aortic valve for deployment. A curled lunderquist was placed into the left ventricle with the assistance of a glide wire and glide catheter. A Terumo relay pro 32x104 mm thoracic endograft was loaded on a stiff wire. Rapid ventricular pacing was induced the thoracic endograft was deployed. The coronary arteries, and brachiocephalic trunk were not covered. The pacing was used for less than 10 seconds. After a compliant balloon was used to assist in complete expansion of the graft again with pacing and a completion angiogram was performed which yielded complete exclusion of the pseudoaneurysm without endoleak. Patient recovered well, and a CT scan on post operative day 2 showed complete exclusion of the PSA. The patient left against medical advice on post-operative day 3 with no chest pain.

Conclusion:

Redo repair of the ascending aorta in a non-compliant patient can carry a significant morbidity and mortality. Endovascular repair is a safe option for these patients, however there are some technical considerations in placing endografts in this region.



11:33 - 11:40 am

Open Repair of an Incidental Internal Carotid Artery Pseudoaneurysm Discovered after Cardiac Arrest

Sean DuBois, MD, Jacob Wilson, MD, Michael Qaqish, MD
St. Luke's University Health Network

Extracranial carotid artery aneurysms (ECCAs), which include pseudoaneurysms and true aneurysms, are scarcely reported in the literature. They have a low incidence of less than 1% in the largest series available, and account for less than 2% of carotid procedures performed yearly. Recommendations for management can be difficult as there are no single agreed upon guidelines for diagnosis and treatment, however the clinical implications are significant with untreated aneurysms posing a risk of stroke or rupture. Etiologies include prior trauma or carotid surgery, atherosclerotic disease, and connective tissue disorders. The most common presenting symptoms are neurologic manifestations or neck pain, otherwise, these are often asymptomatic when they are discovered. Repair can be approached with an open, endovascular, or hybrid technique. The choice of how to approach each individual lesion depends on patient anatomy, comorbidities, surgeon preference, and other clinical factors. Here we present the case of a 56-year-old man with transient facial drooping and slurred speech approximately one week after a cardiac arrest with cardiopulmonary resuscitation (CPR). Computed tomography (CT) imaging was negative for any intracranial abnormality but did show a 1cm right sided pseudoaneurysm (PSA) arising from the tortuous proximal internal carotid artery (ICA). The patient was taken for open resection of the PSA with primary repair by end-to-end anastomosis. He recovered well post-operatively and was discharged on dual-antiplatelet therapy and a statin. He is doing well without any persistent neurological deficits. Post-operative carotid artery duplex showed normal velocities.

11:40 - 11:47 am

Carotid Axillary Bypass with Partial Clavicular Resection for Arterial Thoracic Outlet Syndrome Secondary to Congenital Clavicular Pseudoarthrosis

Rajbir Singh, DO, Alvaro, Mendez, MD Michael Qaqish, MD
St. Luke's University Health Network

Arterial thoracic outlet syndrome is a rare subset of thoracic outlet syndrome (TOS) accounting for only 1% of all cases of TOS. Arterial compression via a cervical first rib has the highest incidence regarding etiology with reported rates of upwards of 60% as primary etiology for arterial thoracic outlet syndrome with anomalous first rib and trauma being the other most common causes.

Congenital clavicular pseudoarthrosis is an even more uncommon pathologic process with only a few case studies documenting its correlation to thoracic outlet with a scarcity of literature on the subject. We present an extremely rare case of congenital clavicular pseudoarthrosis causing arterial thoracic outlet syndrome with concomitant subclavian artery thrombosis and upper extremity acute limb ischemia.

This is a case report of a 51-year-old female with no significant past medical history who presented with right upper extremity pain and paresthesias over 2 months with acute exacerbation over 2 days with progressive weakness of her right hand. Physical exam was pertinent for a cool right upper extremity with no palpable or dopplerable radial or ulnar pulses, decreased sensation but intact motor function. CTA imaging was performed of the right upper extremity which showed right subclavian artery occlusion in addition to congenital clavicular pseudoarthrosis with nonunion of her mid clavicle. Right upper extremity provocation maneuvers indicated evidence of clavicular motion to the lateral aspect of the nonunion clavicle with a fixed medial component indicating subclavian arterial compression causing arterial thoracic outlet syndrome.

In setting of Rutherford's 2A acute limb ischemia patient underwent urgent surgical intervention with right brachial artery embolectomy, partial resection of the medial and lateral clavicular ends, and carotid-to-axillary bypass with ringed 6 mm PTFE tunneled non-anatomically. Patient had palpable radial and ulnar pulses at conclusion of procedure. In setting of arterial thoracic outlet syndrome secondary to congenital clavicular pseudoarthrosis with acute on chronic thrombosis of subclavian artery, carotid axillary bypass along with partial clavicular resection is a therapeutic treatment option to restore distal perfusion and treat the rare underlying etiology of the arterial compression.

11:47 -11:54 am

Abdominal Aorta Injury Secondary to Blunt Trauma Requiring Endovascular Intervention: A Rare and Interesting Case

Ioannis Tsouknidas, MD, Alvaro Mendez, MD, Lia Michos, MD, Alexander Uribe, MD, Henry Hirsch, MD
Lankenau Medical Center

Introduction: Blunt abdominal aortic injury (BAAI) is very uncommon, with an annual incidence of 0.02%-0.1% of blunt trauma. The majority of BAAI occur from motor vehicle collisions, as a result of forceful aortic compression between mobile abdominal contents and the fixed spinal column. Given the rarity of this condition, no standard guidelines are available for the treatment of BAAI.

Methods: We describe the case of a young female patient that presented in our Institution as Trauma. She was found to have a symptomatic blunt abdominal aorta injury, requiring surgical intervention. Patient provided consent for surgery and presentation of the case.

Case Presentation: A 23 year-old female with medical history of anxiety was brought by EMS, after being involved in a high-speed motor vehicle collision as a front seat restrained passenger. Patient was complaining of abdominal and back pain, as well as bilateral lower extremity pain. On physical exam she had a seatbelt sign at the level of her umbilicus and non palpable pedal pulses.

CT imaging showed a grade 3 hepatic laceration, a high-grade stenosis with near occlusion of an approximately 2.2 cm longitudinal segment of the distal abdominal aorta just proximal to the aortic bifurcation, right pulmonary contusions and unstable L1-L2 lumbar spine flexion distraction injury (Figure). Patient was started on heparin gtt, after she had neurosurgical evaluation. Due to her unstable spine and concomitant liver injury, it was elected to attempt an endovascular approach. Risks and benefits of the procedure were discussed with her, and she provided consent. She was brought to the OR, where a 22 x 60 Endologix AFX 2 main body EVAR was successfully deployed covering the area of disease. Pedal pulses were palpable post-operatively, and asa 81mg was initiated. On POD 3 she underwent lumbar spine ORIF with neurosurgery. Her course was uncomplicated and she was discharged home with outpatient follow-up on POD 7. At two months follow-up visit, patient was recovering well from her injuries. She denied any symptoms of claudication and her abdominal stent was patent on imaging.

Conclusions: In BAAI with concomitant abdominal and spinal injuries, endovascular approach is a safe option with good results.

Figure. CT demonstrated a high-grade stenosis with focal near occlusion of the distal abdominal aorta just proximal to the aortic bifurcation.

11:54 am-12:01 pm

Rescue of ECMO-related Access Complications in an 18-year-old with a Massive Pulmonary Embolism using the Arterial ECMO Cannula as an External Conduit

Abby Clark, MD, Mikael Fadoul, MD, Mitchell McDaniels, BA, Laurel Hastings, MD, Christopher Noel, MD, Nitin Puri, MD, Joseph Lombardi, MD, MBA, Katherine McMackin, MD
Cooper University Hospital

Introduction

An 18-year-old male presented with a massive pulmonary embolism (PE) and obstructive shock requiring veno-arterial (VA) extracorporeal membrane oxygenation (ECMO). Vascular surgery was consulted for hemorrhagic shock from attempted ECMO cannulation sites. We describe the use of the arterial ECMO cannula as an external conduit in order to maintain access for our therapeutic intervention.

Case Description

A 18-year-old male with a history of acute leukemia presented with a saddle PE. Patient was hemodynamically stable on room air with elevated D-dimer and troponins. Echocardiogram demonstrated moderate right heart strain and therapeutic anticoagulation was initiated.

Shortly thereafter, patient suffered cardiac arrest and successful cardiopulmonary resuscitation. Peripheral intravenous thrombolytic therapy was administered. VA ECMO was initiated via right common femoral artery, left common femoral vein, with an antegrade distal reperfusion cannula in the right superficial femoral artery. The patient subsequently developed hemorrhagic shock with an expanding right groin hematoma and a tense abdomen, for which vascular surgery was consulted.

The patient was brought emergently to the operating room. Percutaneous left axillary artery access was obtained for a new arterial ECMO cannula. We then clamped the arterial cannula in the right groin and disconnected it from the ECMO circuit. Before removal, we utilized the right femoral cannula as an external conduit to facilitate sheath exchange via direct stick of the cannula with an 18 gauge needle followed by a wire. The canula was then removed and replaced with a sheath. Through

this an aortogram demonstrated active extravasation from a previously-attempted left common femoral artery access, which was successfully excluded with a covered self-expanding stent.

The right femoral arterial canula site was closed with a biomechanical vascular closure device, MANTA, (Teleflex, Morrisville, NC). A right lower extremity angiogram was performed using right axillary artery access, which demonstrated additional active extravasation from around the antegrade distal reperfusion cannula site. This was successfully excluded with a covered self-expanding stent.

Once we had achieved control of hemorrhage, a percutaneous pulmonary thrombectomy was performed via the right common femoral vein. A decompressive laparotomy was performed for abdominal compartment syndrome. Post-operatively, the patient was decannulated from ECMO, extubated, and his abdomen was subsequently closed.

Conclusion
The use of an existing arterial ECMO cannula as an external conduit allows for preservation of access to treat ongoing hemorrhage. This case also highlights the importance of a multidisciplinary approach for a patient in extremis.

12:01 pm-12:08 pm

Persistent Sciatic Artery Aneurysm: A Case Report
Brian N. Lifschutz, DO, Danielle M. Pineda, MD
Jefferson Abington Hospital

Persistent sciatic artery (PSA) is a rare congenital variant, characterized by the sciatic artery's failure to regress normally. This artery is an extension of the internal iliac artery that perfuses the lower extremity in early fetal development, prior to maturation of the iliofemoral system. In normal development, involution of the sciatic artery forms the gluteal arteries proximally and contributes to the popliteal and peroneal arteries distally, though failure of normal regression has been described, leading to various anatomic subtypes that delineate the PSA's extent and the presence or absence of a normal superficial femoral artery as the main lower limb blood supply. The PSA's location in the superficial buttocks makes it susceptible to trauma from daily activities and aneurysmal degeneration, seen in up to 48% of patients with this anatomic variant. We present a case of a 29-year-old male who presented with a peri-rectal abscess, incidentally found to have a 5 cm aneurysm arising from a distal branch of the internal iliac artery concerning for an incomplete regression of his sciatic artery. This PSA aneurysm was treated with coil embolization using Boston Scientific Interlock coils, with follow-up imaging showing successful exclusion of the aneurysm. This case demonstrates that persistent sciatic artery can present with incomplete regression in the setting of normal femoral anatomy and can be a cause of aneurysm in young patients.

12:08 pm-12:15 pm

Endovascular Intervention in Penetrating Trauma

T Bhamidipati, MD, Joseph Yoo, MD, Afshin Parsikia, MD, Nadia Awad, MD, Evan Deutsch, MD
Einstein Medical Center

Abstract

Currently, there are no codified guidelines for open versus endovascular treatment of patients suffering penetrating trauma. Decisions are made on a case-by-case basis and heavily swayed by surgeon preference as well as availability of resources. Previous literature shows feasibility of endovascular techniques in the treatment of vascular trauma however there are limitations to selection criteria. This study aims to add to the growing body of literature surrounding the use of endovascular techniques in vascular trauma to guide selection criteria and protocol. In particular, this study will highlight two cases that showcase the use of endovascular feasibility.

Methods

Five years of data (2018-2023) were reviewed from a Level I trauma center. The data was stratified to include all vascular interventions. Over 1700 penetrating trauma patients were identified and over 200 vascular interventions were reviewed which revealed 10 cases where endovascular intervention was performed. Patients who underwent operative intervention >12 hours after arrival were excluded. Two patients in particular were selected to highlight the role of endovascular intervention

Results

10 patients were identified as suffering penetrating trauma and undergoing endovascular intervention with indication for intervention including loss of pulses or pulse mismatch. All patients survived their injuries. Four patients were part of hybrid procedures where angiograms and angioplasties were performed in conjunction with conventional surgical bypass. This report will highlight two patients in particular.

Case #1

A 60s M presented as a level 1 trauma alert after suffering a GSW to the right anterior chest. Upon arrival the patient was stabilized with no vital sign abnormality. There was no extravasation noted on secondary survey. He was found to have an asymmetric pulse exam with a non palpable right radial pulse when compared to his left. The patient underwent a CTA which showed a right axillary artery injury with complete occlusion and non enhancements of the radial and ulnar arteries.

The patient was taken emergently to the operating room and underwent a right upper extremity angiogram which demonstrated a right axillary artery occlusion which was able to be transversed with a glidewire. After systemic heparin was administered, there was new extravasation noted from the axillary artery. A covered 7mm x 5cm Viabahn (GORE, DE, USA) was deployed with subsequent percutaneous transluminal angioplasty. Completion angiogram showed brisk flow through the right subclavian, axillary and brachial artery. The right radial pulse was palpable upon completion of the case.

Post operatively, the patient was resuscitated and observed in the ICU. He was discharged home on aspirin and plavix with surveillance duplex follow up.

Case #2

A 29M presented as a level 1 trauma after suffering a GSW to his left hand and right lower extremity. Patient was stabilized and had normal vital signs. There was no active bleeding or extravasation on secondary survey. Patient was found to have non palpable pedal pulses on the right lower extremity. Patient underwent CTA which showed a mid superficial femoral artery

(SFA) narrowing with concern for intimal injury.
The patient was taken emergently to the operating room and underwent a right lower extremity angiogram which showed an approximately 8 cm narrowing at the mid SFA. Decision was made to heparinize the patient. The lesion was then crossed successfully and a 5mm x 100mm Viabahn (GORE, DE, USA) stent was deployed. Post deployment percutaneous transluminal angioplasty was performed. Completion angiogram demonstrated brisk flow through the superficial femoral and popliteal arteries. The patient had palpable pedal pulses upon completion of the case. Postoperatively, the patient was admitted to the ICU. He was discharged on DAPT and follow up duplex shows patent arterial system of the right lower extremity.

Discussion

Both open and endovascular techniques are utilized in the treatment of patients with traumatic vascular injury. Experience with endovascular approaches continues to grow and may help lessen morbidity and mortality of areas that are technically challenging to approach from an open approach. The two selected patients above highlight an evolving set of criteria to help clinicians guide choice of intervention. Both patients presented with hard signs of vascular injury (ie loss of pulses) however they both did not have gross signs of exsanguination nor hemodynamic instability. Thus we can preliminarily create guidelines to dictate endovascular intervention on those who suffer penetrating traumas to patients who present with hemodynamic stability and a mismatched pulse exam. Further data and patient review is needed to codify these guidelines. However, these guidelines can help dictate clinician care in settings without easy access to hybrid suites and other community centers.

12:15 pm-12:22 pm

Case Series of Left Ovarian Vein Transposition for Nutcracker Syndrome

Perry Kerner, MD, Kathleen Marulanda, MD, Ciaran O'Brien, MD, Christopher Cappellini, DO, Keith Calligaro, MD, Matthew Dougherty, MD, Douglas Troutman, DO
Pennsylvania Hospital (UPHS)

INTRODUCTION: Nutcracker syndrome (NCS) involves compression of the left renal vein (LRV) between the aorta and superior mesenteric artery (SMA) with associated symptoms including hematuria and left flank pain. In women, additional symptoms may include pelvic pain, left-sided labial swelling, pelvic varicosities, dyspareunia, and menometrorrhagia. Many surgical options for NCS have been described such as LRV transposition, LRV to inferior vena cava (IVC) interposition graft, LRV to IVC bypass, and left ovarian vein (LOV) transposition. Endovascular intervention to the LRV has also been described. We aim to present a small series of LOV transposition as treatment for NCS.

METHODS: This case series reports symptoms, diagnosis, and outcomes of four (4) patients who have undergone LOV transposition at our center.

RESULTS: Mean patient age was 43 +/- 7 years (range 32-50 years). All four patients had left flank pain, 3 had hematuria, 1 had dyspareunia, 1 had menometrorrhagia, 2 had postprandial pain, and none had lower extremity varicosities. Patients were referred to vascular surgery by gastroenterology (2) and gynecology (2). Computed tomography (CT) or magnetic resonance (MR) imaging or venography was performed in all four patients. All had findings of LRV compression by the SMA, LOV dilation (mean diameter 8 +/- 1 mm, normal range 3-4 mm), and pelvic venous dilation and collateralization. Two patients underwent duplex ultrasound revealing LOV dilation and reflux. Two patients underwent venography with intravascular ultrasound (IVUS) revealing mean LRV stenosis = 85% and mean LRV:IVC pressure gradient = 9. Via a midline incision, the LOV was dissected free from the LRV to the pelvis with division and ligation of side-branches. The LOV was divided caudally and coursed anterior to the aorta as it was anastomosed end-to-side to the IVC. There were no postoperative complications. Length of hospital stay was 3 or 4 days for all patients. After mean follow-up of 7 weeks (range 4-18 weeks), all patients reported significant symptom improvement (3 complete, 1 with persistent mild gastrointestinal symptoms). Surveillance duplex ultrasound showed patent LOV transposition in all cases.

CONCLUSION: In young, healthy women with NCS, LOV transposition is a safe, relatively straightforward surgical treatment without significant morbidity, is associated with significant symptom resolution, and is likely a better option than LRV stenting or other surgical options.

12:22 pm-12:29 pm

Persistent Sciatic Artery: A Real Pain in the Buttock

Lynde K. Lutzow MD, MPH, Alison Messina, MD, Mohammed Eslami, MD, MPH, Frank Schmieer, MD PVT, Amanda Phillips, MD
Temple University

Introduction: The Persistent Sciatic Artery (PSA) is a rare vascular congenital malformation. In the developing human embryo, the sciatic artery serves as the primary blood supply to the lower limb until the femoral artery further develops, after which it undergoes planned involution. Although rare, with an estimated incidence of less than 0.04%, the PSA remains surgically significant, as its location predisposes it to aneurysm formation and its predictable consequences including distal embolization, thrombosis, rupture, and compression of surrounding structures.[1,2] Given its rare nature, the range

of presenting symptoms is not well described. We present an unusual case of a PSA presenting as referred right lower quadrant abdominal pain and pelvic pain.

Case Description: Ms. VR, a 68-year-old female with hyperlipidemia and a strong family history of colon cancer, presented to her gynecologist with a one-year history of persistent right lower quadrant abdominal and pelvic pain. Her initial evaluation revealed a small uterine fibroid, and she was referred to gastroenterology for colonoscopy, which showed no cancerous lesions. An abdominal CT scan showed no acute intraabdominal pathology but incidentally noted a right-sided persistent sciatic artery (PSA). She was referred to vascular surgery for further evaluation where she reported right lower quadrant pain radiating to her right lower back and buttock. On physical exam she had intact motor and sensory function with palpable distal pulses though slightly diminished on the right side. Given her symptomatic PSA, she was offered surgical intervention and opted to proceed after undergoing informed consent. A preoperative angiogram showed a widely patent and tortuous PSA continuing from the anterior division of the internal iliac artery to the popliteal artery (**Figure 1a**). She subsequently underwent a right lower extremity femoral to below-knee popliteal bypass with ipsilateral reversed great saphenous vein and proximal PSA exclusion via right internal iliac coil embolization and external iliac stenting (**Figure 1b**). Her post-operative course was unremarkable with surveillance duplex showing d a widely patent femoral to below the knee popliteal artery bypass. Most importantly, her pain has improved, and she is completing a 3-month course of dual antiplatelet therapy with plans to continue aspirin monotherapy thereafter.

Discussion: Aside from compressive symptoms such as the pain syndrome experienced by our patient, PSA is also associated with several risks including aneurysm formation and subsequent limb ischemia related to aneurysmal thrombosis or emboli.[2] Diagnosis of symptomatic PSA may be difficult given patients can present with vague symptoms, have palpable distal pulses on physical exam and may masquerade as sciatica given extrinsic compression of the nerve. Additional consideration must be made to address whether the superficial femoral artery is hypoplastic in the setting of a PSA as this can impact the surgical plan and typically requires vascular reconstruction rather than simple ligation as was the case with our patient.

Conclusion: This case underscores the importance of critically assessing seemingly incidental findings, as these may be central to the underlying patient problem. Additionally, this case highlights the value of understanding the clinical manifestations of congenital vascular malformations including PSA. Despite their rarities, their potential for significant medical and surgical consequences necessitates a thorough understanding in order to ensure optimal patient outcomes and effective care.

References

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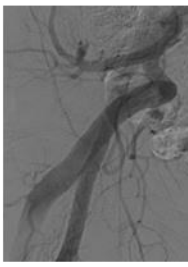
Figure 1. a. Preoperative angiogram of PSA showing its extent and tortuosity, traversing to the popliteal space where it returns to normal anatomic position. b. After exposing and clamping the below the knee popliteal artery to prevent coil embolization, detachable coils were buried within one of the large branches of the PSA and extended into the main PSA and IIA. The origin of the IIA was covered with a balloon mounted stent in the CIA

and extended with a self expanding stent in the EIA. Post stenting angiogram revealed absence of flow within the PSA. PSA persistent sciatic artery; IIA internal iliac artery; CIA common iliac artery; EIA external iliac artery.



12:29 pm-12:38 pm

Aorto-BiFemoral Bypass with Inferior Mesenteric Artery Re-Implantation for Chronic Mesenteric Ischemia

Ciaran O'Brien, MD, Julia Drake Glaser, MD
University of Pennsylvania

DEMOGRAPHICS

The patient is a 59 year old man with a history of prior tobacco use, peripheral arterial disease with claudication, and chronic mesenteric ischemia.

HISTORY

Previously the patient had presented to another vascular surgeon with post prandial pain and was treated with celiac artery stenting, which occluded a month later requiring re-intervention. The patient presented to our center with severe postprandial epigastric pain and 30lb weight loss. He also had significant longstanding lower extremity claudication, on cilostazol. CT angiogram showed occlusion of celiac artery stent as well as chronic flush occlusion of the SMA and occlusion of the infrarenal aorta, with patent IMA. Initially an attempt was made to reopen the celiac artery stent but the occlusion was not able to be crossed.

PLAN

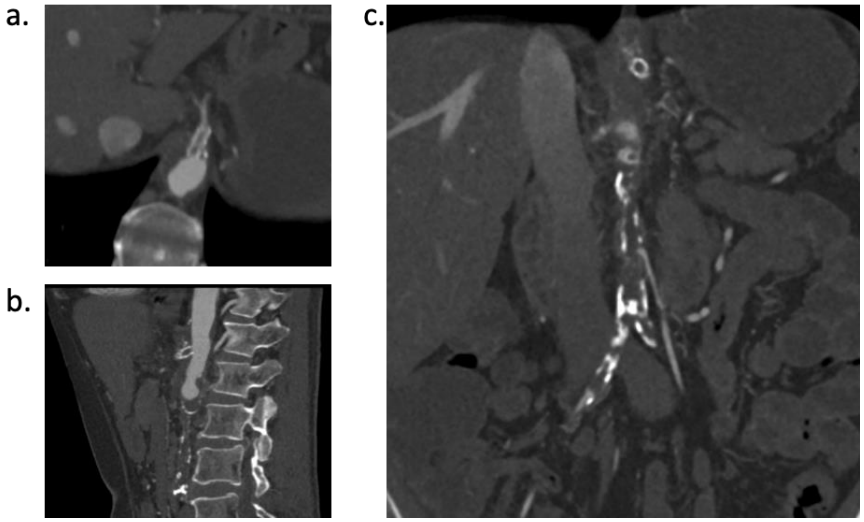
The patient had long segment occlusions of the previously stented celiac artery and SMA (Fig. 1a, b) with no reasonable landing zone for a mesenteric bypass. Additionally, he had a replaced right hepatic artery, which would complicate an attempt at retrograde stenting. He had not been able to be revascularized endovascularly and despite supportive care with a heparin infusion he was unable to maintain adequate caloric intake due to severe postprandial pain. He had a substantial patent IMA (Fig. 1c) which extended to the occluded aorta and measured 4mm. The patient was taken to the operating room and underwent an aorto-bifemoral bypass and re-implantation of the IMA. Post-operatively he recovered well and had marked improvement in his symptoms.

DISCUSSION

IMA reimplantation is an established technique to decrease the risk of colonic ischemia after abdominal aneurysm repair, but here we report a case of IMA reimplantation being used to treat chronic mesenteric ischemia. The mesenteric circulation has a rich collateral network and in instances where there are inadequate celiac or SMA targets for bypass, increasing mesenteric blood flow

through IMA reimplantation may be a viable strategy with the added benefit of avoiding supraceliac clamping.

Fig. 1



3:00 - 3:09 pm

African American Women are more likely to Undergo Carotid Endarterectomy for a Higher Degree of Stenosis and Have Increased Risk of Return to the Operating Room as compared to White Women

Leana Dogbe BS, Ahsan Zil-E-Ali MBBS MPH, Alpha Tall BS, Abdul Wasay Paracha BS, Maria Camila Castello Ramirez MD, Faisal Aziz MD FACS DFSVS
Penn State Health Milton S. Hershey Medical Center

Objective: Racial and gender disparities in healthcare outcomes including surgery is a well-known phenomenon. Some of these disparities have been attributed to social determinants of health which affect access to quality care and preventative medicine. In this study, we analyse differences in outcomes by race and gender following endarterectomy for carotid stenosis.

Methods:

All adult females undergoing carotid endarterectomy for an indication of carotid stenosis in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) between 2012 and 2021 were stratified between Black females (Group I) and White females (Group II). Primary outcomes include 30-day mortality, stroke and return to the operating room (OR). Secondary

outcomes included length of stay (LOS) and operative time. A p-value of <0.05 was considered statistically significant.

Results:

The study population included 10,564 patients, of which 764 (7.23%) are in Group I and 9,800 (92.7%) in Group II. Of these, 6,302(59.65%) were asymptomatic (6.42% Black females and 93.58% White females). Patients in Group I were more likely to present with ipsilateral stroke (27.09% vs 17.18%, p<0.001), severe ipsilateral stenosis (80-99% of stenosis) (67.80% vs 66.20%, p<0.001) or ipsilateral total occlusion (100% stenosis) (1.57% vs 0.69%, p<0.001) as compared to Group II. Group I was also observed to have severe contralateral stenosis (80-99%) (7.46% vs 6.39%, p=0.004), less likely to be on aspirin (16.49% vs 10.95%, p<0.001) and less likely to undergo an elective procedure (24.08% vs 15.90%, p<0.001). For post-operative outcomes, patients in Group I had higher risk of Return to the OR (3.66% vs 2.28%, p=0.015), longer operative time [Mean:126.15mins (SD- ± 44.08) vs 112.29mins (± 45.70), p<0.001] and longer LOS [3.9days (±6.38) vs 2.56 days (± 4.52), p<0.001]. There were no significant differences in mortality (p=0.290) and stroke (p=0.210).

Conclusion:

African American females tend to present as symptomatic with more severe forms of carotid disease, such as severe stenosis or total carotid occlusion. They are also at a higher risk for return to the operating room, longer operative time and longer length of stay. This study highlights the effect of inadequate care on clinical outcomes and the importance of early access to quality preventative care, education among minority groups and referral to vascular surgeons by primary care physicians.

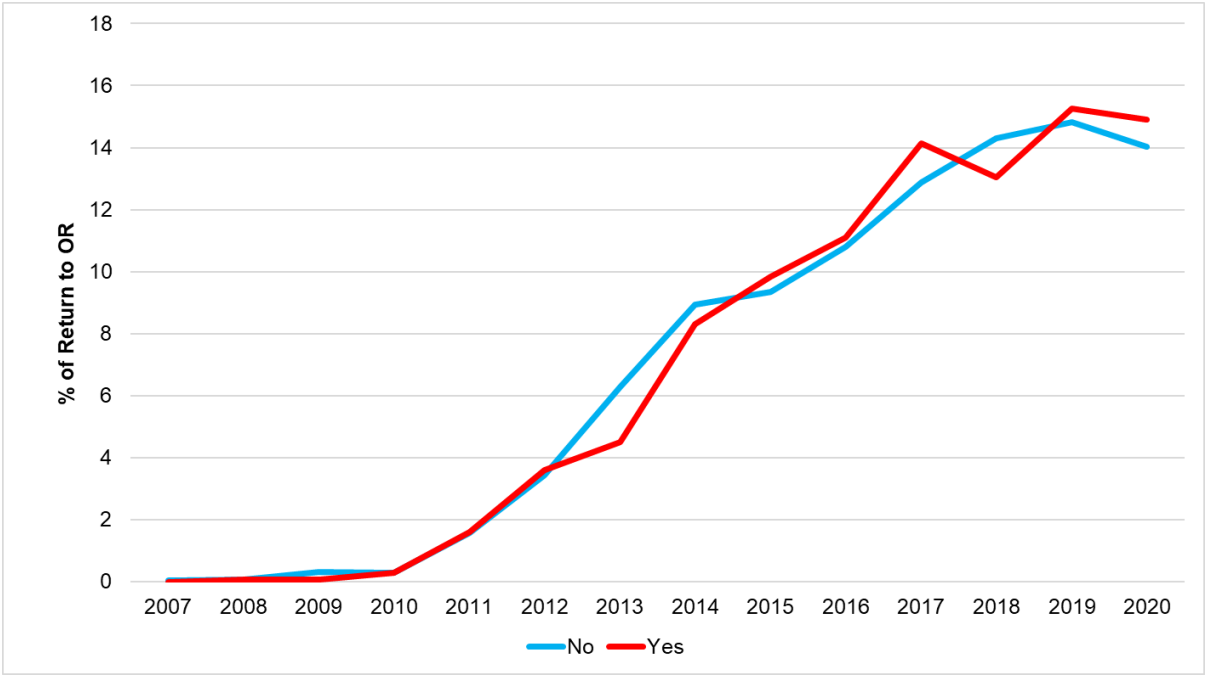
3:09 – 3:18 pm

African American Race and Medicaid Insurance are Associated with Increased Frequency of Unplanned Return to Operating Room after Lower Extremity Bypass for Chronic Limb Threatening Ischemia

Ahsan Zil-E-Ali, MBBS, MPH, Alpha Tall, MD, Jacob Soucy, MD, Leana Dogbe, MD, Billal Alamarie, MD, Faisal Aziz, MD
Penn State Health Milton S. Hershey Medical Center

Objective: Postoperative return to the operating room (ROR) can be a metric to assess quality of care and monitor the surgical outcomes. This study aims to identify the risk factors associated with ROR after Lower Extremity Bypass (LEB) for Chronic Limb Threatening Ischemia (CLTI).
Methods: A retrospective analysis was performed using the Society for Vascular Surgery Vascular Quality Initiative (SVS-VQI) database who had undergone LEB for CLTI between 2007 and 2020. The sample size was divided into two groups: Group I consisted of patients who did not ROR after LEB and Group II consisted of patients who did ROR after LEB for CLTI. Univariate and multivariate regression analysis was performed on the data collected to study patient outcomes and identify risk factors associated with patients ROR with significance set at $p<0.05$.
Results: A total of 10,800 patients were included in this study cohort and divided into two groups. Group I (No ROR) consisted of 9,357 (86%) patients, with 6,070 (64%) males, 3,287 (36%) females and a mean age of 68. Group II (ROR) comprised of 1,443 (14%) patients', with 968 (67%) males, 475 (33%) females and a mean age of 67. Group I had relatively more African Americans (18% vs. 7%) as compared to Group II. Regression analyses reveal multiple factors that were found to be associated with ROR: African American race (OR 1.39, CI [1.18-1.63]), patients with Medicaid insurance (OR 1.36, CI [1.06-1.75]), patients ambulatory with assistance (OR 1.21, CI [1.05-1.41]), patients discharged to rehabilitation (OR 2.98, CI [2.58-3.44]), and those transferred to other hospitals (OR 4.06, CI [2.38-6.93]). Additionally, risk factors included a concomitant bypass (OR 1.46, CI [1.05-2.03]), infrageniculate graft insertion (OR 1.39, CI [1.15-1.67]), non-autologous biologic prosthetic conduit (OR 1.71, CI [1.25-2.33]), and the use of general anesthesia (OR 2.58, CI [1.25-5.33]). Furthermore, two factors were found to significantly reduce the risks of patients ROR: Females (OR 0.82, CI [0.71-0.95]), and patients on aspirin (OR 0.85, CI [0.73-0.99]). Notably, the annual trend analysis showed that no significant improvement has been noticed in ROR over the study period (**Figure 1**).
Conclusion: Multiple factors increase the patient's risk of ROR after LEB for CLTI. These factors can lead to severe patient complications and increase healthcare costs. Risk stratification should be conducted in patients undergoing LEB for CLTI to mitigate the risks of severe complications and improve overall outcomes.

Figure 1. Trend of Return to OR (2007-2020) after lower extremity revascularization for Chronic Limb Threatening Ischemia (CLTI) recorded in Vascular Quality Initiative (VQI) (p=0.081)



3:18 - 3:27 pm

Access to Access: Investigating Racial Disparities in the Arteriovenous Access Continuity-of-Care.

Paarth Jain, BS, Michael Nooromid, MD, Dawn Salvatore, MD, Paul DiMuzio, MD, Babak Abai, MD
Thomas Jefferson University Hospital

Purpose: The purpose of this study is to investigate rates of arteriovenous fistula (AVF) and graft (AVG) creation in patients with ESRD, complications of those procedures, and subsequent rates of correction in White and Black patients. **Methods**: The TriNetX database was queried for subjects with ICD-10 diagnoses of ESRD and divided into White and Black cohorts using available demographic data. Cohorts were 1:1 propensity matched based on relative contraindications to arteriovenous access (AVA) creation, which was the primary endpoint (site specific AVF and autologous versus non-autologous AVG). This methodology was repeated with White and Black cohorts that received AVA surgery and had a final endpoint of surgical complication (thrombosis, stenosis, infection). Finally, rates of correction (revision, thrombectomy, new AVA) between White and Black patients with surgical complication were compared in the same manner. **Results**: 288,761 White patients had ESRD, of which 36,810 had AVA surgery and 17,852 had complication. 164,959 Black patients had ESRD, with 22,142 having AVA surgery and 10,688 having complication. Black patients were more likely than propensity matched White patients to receive ultrasound evaluation for AVA (18755 vs 16291, $p<0.001$), any AVA (18755 vs 16291, $p<0.001$) and AVGs (8341 vs 4277, $p<0.001$). Black patients received fewer AVFs (13366 vs 13889, $p<0.001$), especially via the forearm (456 vs 526, $p=0.025$), as well as fewer renal transplants (10916 vs 13222, $p<0.0001$). Among patients with the same type of AVA, Black patients had significantly more thromboses, stenoses and other complications, but not infection (Table II). Among those with access site complication, Black patients received more thrombectomies (1050 vs 680, $p<0.001$) and corrections overall (4858 vs 4525, $p<0.001$). Restricting analysis to patients diagnosed with ESRD in 2021 or later, patterns in AVA creation, complication, and correction are similar. **Discussion:** Black patients continue to receive disproportionately fewer kidney transplants but have access to AVA services that bridge the

difference. Nevertheless, outcomes are unequal at several stages of the care continuum. AVA is more proximal on the arm and more likely non-autologous graft. The same procedures still have more frequent complication even with greater antiplatelet use in Black patients. Despite the growing movement against race-based GFR, which may address underlying disparities in long-term ESRD treatment, such benefit has not yet been realized in the arteriovenous access continuity of care.

Table II: Rates of arteriovenous access (AVA) complication by AVA subtype between 1:1 propensity matched White and Black patients that have undergone an AVA procedure. Other complications include neuropathy, ischemia/steal, and other unspecified diagnoses.

	n	Complication Type	White	Black	p
Any Arterial Access	21397	Any	12847	13757	<0.0001
		Thrombosis	6330	7982	<0.0001
		Stenosis	8475	9598	<0.0001
		Infection	1895	2618	<0.0001
		Other complications	9161	9896	<0.0001
AVF	15882	Any	9443	10259	<0.0001
		Thrombosis	4385	5505	<0.0001
		Stenosis	6288	7298	<0.0001
		Infection	1256	1683	<0.0001
		Other complications	6756	7495	<0.0001
Any AVG	7434	Any	4757	4883	0.0305
		Thrombosis	3016	3405	<0.0001
		Stenosis	3086	3375	<0.0001
		Infection	1199	1203	0.929
		Other complications	3243	3372	0.033
Autologous AVG	1196	Any	732	782	0.0339
		Thrombosis	458	551	0.0001
		Stenosis	514	576	0.011
		Infection	130	195	0.0001
		Other complications	538	579	0.092
Non-Autologous AVG	6289	Any	4095	4132	0.488
		Thrombosis	2639	2909	<0.0001
		Stenosis	2620	2824	0.0002
		Infection	1097	1029	0.101
		Other complications	2741	2847	0.057

Diagnoses	Group	Progestin Status	n	DVT	DVT p	Stab Phlebectomy	Phlebectomy p	Endovenous Intervention	Endovenous p	Intervention	Intervention p	Pregnancy	Pregnancy p
All VV	**All**	No progestin	13440	805	0.54	545	<0.0001	880	<0.0001	1058	<0.0001	662	0.0003
		Progestin	13440	784		204		296		366		540	
	Female	No progestin	11597	565	0.0069	547	<0.0001	817	<0.0001	1015	<0.0001	625	0.0012
		Progestin	11597	657		200		287		357		518	
	Pre- Menopausal	No progestin	2788	73	0.099	129	<0.0001	197	<0.0001	233	<0.0001	418	0.0015
		Progestin	2788	94		60		77		98		337	
Complicated VV	**All pts**	No Progestin	5375	325	0.461	453	<0.0001	710	<0.0001	681	<0.0001	192	0.757
		Progestin	5375	307		149		214		262		198	
	Female Pts	No Progestin	4741	238	0.546	405	<0.0001	680	<0.0001	817	<0.0001	177	0.63
		Progestin	4741	251		144		207		255		186	
	Pre-Menopausal	No Progestin	1147	35	0.303	109	<0.0001	167	<0.0001	194	<0.0001	133	0.74
		Progestin	1147	27		44		59		47		128	
Asymptomatic VV	**All pts**	No progestin	7655	415	0.523	13	0.531	40	0.0001	46	<0.0001	406	<0.0001
		Progestin	7655	433		10		12		15		292	
	Female Pts	No progestin	6469	322	0.085	10	1	29	0.0023	30	0.0094	382	<0.0001
		Progestin	6469	366		10		10		13		297	
	Pre Menopausal	No progestin	1571	52	0.389	10	1	10	1	10	1	270	<0.0001
		Progestin	1571	61		10		10		10		185	

3:27 - 3:36 pm

Clinical Outcomes of Endovascular and Open Repair of Arterial Injury during Total Knee Arthroplasty (TKA)

Jeremy Zack, BS, Paarth Jain, BS, Lauren Posego BA, Brandon A. Creisher BS, Dawn Salvatore, MD, Paul DiMuzio, MD, MBA, Michael Nooromid, MD, Babak Abai, MD
Thomas Jefferson University Hospital

Objectives: Vascular injury during TKA is a rare cause of acute limb ischemia. Endovascular approach is becoming an increasingly common method for repair. In this series, we examined the type of injury, method of repair, and patency rate associated with both endovascular and open repair.

Methods: This study was a retrospective chart review at a single center tertiary care hospital. International Classification of Diseases (ICD) -9 and -10 codes were used to identify 15 patients with TKA with a vascular complication from 2015 to 2023. Demographics, injury characteristics, repair approach and outcomes were recorded.

Results: Among 15 patients with vascular injury after TKA, 53.3% were male and the mean age was 64.9 years. Overall, 10 patients (66.7%) had endovascular repair, while 5 patients (33.3%) had open repair with reversed great saphenous vein bypass. All vascular injuries were recognized and repaired within hours of TKA. The primary indication for TKA in this series was osteoarthritis, with 11 (73.3%) primary repairs and 4 (26.7%) revisions. The cause of injury was determined by angiography or intraoperative findings. All patients with thrombus formation (n=7, 46.7%), with or without dissection, had an endovascular repair. 4 patients had dissection without thrombus formation, of which 3 had an endovascular repair and one had an open repair. All patients with a laceration injury (n=3, 20%) had an open repair. 14 (93.3%) of the repairs remained patent at a mean follow up of 1.8 years. Length of stay was significantly longer in patients with open repair (17.6 days vs, 3.9 days, p=0.002). Only patients with open repair experienced post-operative complications, encompassing 4 of 15 (26.7%) total patients. Complications included sepsis (n=1, 6.7%), cellulitis (n=2, 13.3%), deep vein thrombosis (n=1, 6.7%), and abscess (n=1, 6.7%). Five patients had fasciotomies (33.3%), 4 of which had an open repair. Table I shows a summary of angiogram findings and method of vascular repair.

Conclusions: Both endovascular and open repair of arterial injury after TKA achieved excellent patency at a mean follow up of approximately two years. This analysis supports the use of endovascular repair when possible due to the lower risk of complications and shorter hospital stay.

Table 1: Surgical Approach based and Angiographic Findings

Angiogram finding	Count	Repair Approach	Repair Approach	Fasciotomy
		Endovascular 10 (66.7%)	**Open Bypass 5 (33.3%)**	**5 (33.3%)**
Thrombus alone (6.7%)	1	1	0	0
Dissection alone (26.7%)	4	3	1	1
Laceration alone (20%)	3	0	3	3
Dissection + thrombus (40%)	6	6	0	0
Other: iatrogenic occlusion likely due to ligation injury (6.7%)	1	0	1	1

3:36 - 3:45 pm

Trends in Lower Extremity Major Amputation during the COVID-19 Pandemic

Arjun Kumar, BS; Katherine McMackin, MD, Besher Tolaymat, MD, Bruce L. Tjaden, MD, Philip M. Batista, MD, Laurel Hastings, MD, Joseph V. Lombardi, MD, MBA
Cooper University Hospital

The COVID-19 pandemic temporarily halted elective and non-urgent surgical practice, including revascularization, in an effort to allocate resources to address those in critical condition. Simultaneously, the effects of COVID-19 on the vasculature and the increase of critical illness led to major amputation. We seek to evaluate whether there was an increase in major amputation, whether acutely during the height of the pandemic, or sub-acutely secondary to delays in revascularization.

Methods

The National Surgical Quality Improvement Program (NSQIP) database was queried for cases of major lower extremity amputations and lower extremity revascularization from 2017 to 2021. Rate

of amputation was calculated as a proportion of the sum of lower extremity revascularizations and amputations, which were then compared quarterly and yearly. Peri-operative and post-operative variables were compared for amputations before (2017-2019) and during the pandemic (2020 and 2021).

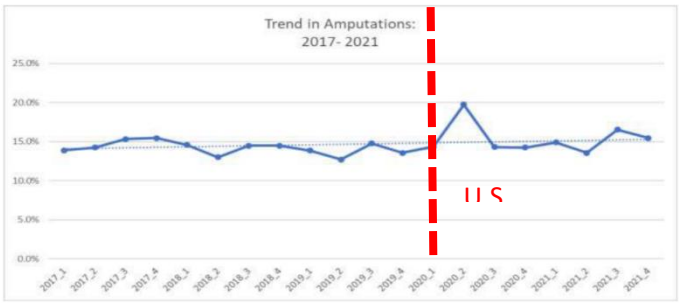
Results

A total of 14,800 amputations and 86,416 lower extremity revascularizations were included over the 5-year period. Although operative volume decreased in 2020, 2,777 amputations accounted for 18.6% of these cases, increased from 15.9% in 2019. The second quarter of 2020 had the highest rate of amputation (882 amputations, 24.6% of lower extremity cases), as opposed to 14.6-19.8% in any other 3-month period (Figure 1). Patients who underwent amputation in 2020-2021 had higher rates of emergency classification, mechanical ventilation, congestive heart failure, wound infection, pneumonia, unplanned reintubation, stroke, cardiac arrest, and septic shock (each $p<0.05$).

Conclusion

There was a sharp increase in major amputation during the height of the pandemic. Following this acute period, however, the rate of amputation was similar to the pre-pandemic era, suggesting no increase in limb loss despite delays in non-urgent revascularization, although post-operative outcomes were more morbid.

Figure 1. Quarterly trend of major amputation, before and after COVID-19 pandemic



3:45 - 3:54 pm

Length of Coverage Does Not Impact Aortic Remodeling after TEVAR for Type B Aortic Dissection

Mark Zemela, MD, Katherine K McMackin MD, Alec J Schubert, MD, Marta Majewski, BS, Philip M Batista MD, Bruce Tjaden MD, Laurel Hastings MD, Joseph V Lombardi, MD
Cooper University Hospital

Objectives
Prior literature describing the remodeling of type B aortic dissections (TBAD) after intervention with thoracic endovascular aortic repair (TEVAR) focuses on remodeling of the largest diameter of the thoracic and/or abdominal aorta. The literature does not stratify remodeling data by zones, as reported in the Society for Vascular Surgery (SVS) reporting standards for TBAD. We sought to study zone-specific remodeling after TEVAR for TBAD.
Methods
A single center retrospective review was performed on patients with TBAD who underwent TEVAR with or without adjuncts, such as dissection stents, concomitant bypass, or a staged repair, between 2014 and 2023. Inclusion criteria were patients with preoperative chest, abdomen, and pelvis computed tomographic angiography (CTA) who underwent endovascular repair with TEVAR and had significant long-term follow-up CTA imaging. Centerline processing in Tera Recon imaging software was used to measure the diameters of the true and false lumens, in addition to the total aortic diameter, at zones 1 through 11 of the aorta and used to determine the true and false lumen index at each zone. Two-tailed *t*-test and ANOVA statistical analyses were performed.
Results
Twenty patients met inclusion criteria and were included in this study, with 18 involving high risk features, and 4 demonstrating malperfusion or rupture. The average length of time from repair to most recent CTA imaging was 473.9 days (range 13-2174 days). Most repairs involved coverage of zones 3-5 (n=10). Most primary entry tears were in zone 3 (n=11). 7 patients (35%) had dissection stents placed concomitantly with TEVAR with most extending to zone 9 (n=5, 71%). Remodeling in zones 3-6 was found to be statistically significant **(Figure 1)** with increases in true lumen index (TLI). The length of TEVAR coverage did not seem to confer greater extent of aortic remodeling of any zone. Interestingly, compared to TEVAR of any length alone, patients with a petticoat repair had significant segmental remodeling in zone 4.
Conclusions
The greatest extent of remodeling occurred at zones of the aorta covered with a TEVAR graft, which supports previously established literature for endovascular TBAD repair of covering the dissection tear. However, when stratifying the data by length of coverage with TEVAR, no statistical significance was found in remodeling of discrete zones of the aorta. Overall, petticoat management rather than length of coverage with TEVAR, may have a larger impact on positive remodeling in TBAD.

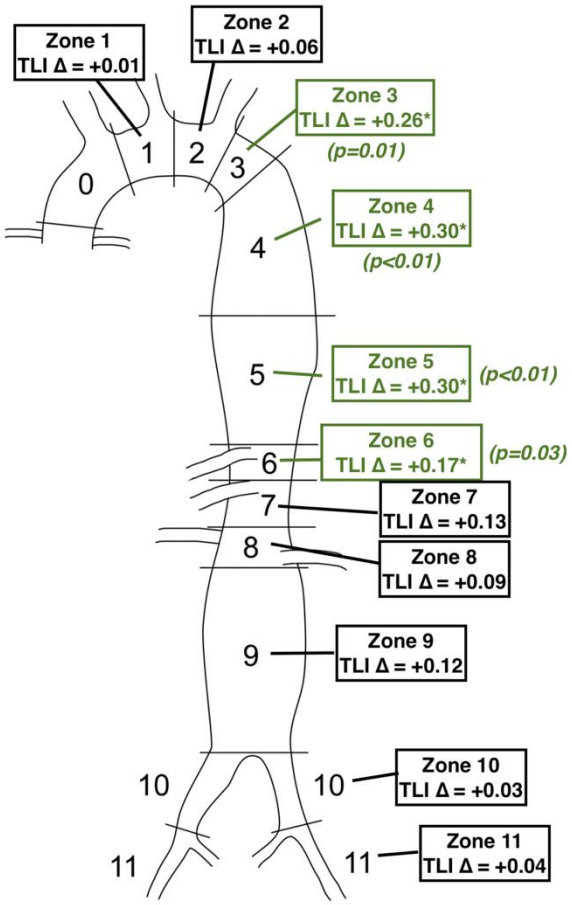


Figure 1. All zones demonstrated remodeling with an average increased true lumen index (TLI), with zones 3-6 demonstrating statistically significant remodeling amongst all patients. Figure adapted from SVS *Reporting standards for thoracic endovascular aortic repair.*

3:54 – 4:03 pm

Development and Validation of a Machine Learning Prediction Model to Improve Abdominal Aortic Aneurysm Screening

Gregory G. Salzler MD, Evan Ryer, MD, Robert Abdu, DO, Alon Lanyado, Bsc, Tal Sagiv, Bsc, Eran Choman, Msc, Abdul Tariq, PhD, Jim Urick, MS, Elliot Mitchell, PhD, Rebecca Maff, BS, Grant DeLong, BA, Stacey Shriner, BS, James Elmore, MD
Geisinger Medical Center

OBJECTIVES:

Despite recommendations by the U.S. Preventive Services Task Force and the Society for Vascular Surgery, adoption of screening for abdominal aortic aneurysms (AAA) remains low. One challenge is the low prevalence of AAA in the unscreened population, and therefore a low detection rate for AAA screenings. We sought to use machine learning to identify factors associated with the

presence of AAA and create a model to identify individuals at highest risk for AAA, with the aim of increasing the detection rate of AAA screenings.

METHODS:

A machine-learning model was trained using longitudinal medical records containing lab results, medications, and other data from our institutional database. A retrospective cohort study was performed identifying current or past smoking in patients aged 65 to 75 years and stratifying the patients by sex and smoking status as well as determining which patients had a confirmed diagnosis of AAA. The model was then adjusted to maximize fairness between sexes without significantly reducing precision and validated using 6-fold cross validation.

RESULTS:

Validation of the algorithm on the single-center institutional data utilized 18,660 selected patients over 2 years and identified 314 AAA. There were 41 factors identified in the medical record included in the machine learning algorithm with several factors never having been previously identified to be associated with AAA. With an estimated 100 screening ultrasounds completed monthly, detection of AAA is increased with a lift of 200% using the algorithm as compared to screening based on guidelines. The increased detection of AAA in the model-selected individuals is statistically significant across all cut-off points.

CONCLUSIONS:

By utilizing a machine-learning model, we created a novel algorithm to detect patients who are at high risk for AAA. By selecting individuals at greatest risk for targeted screening, this algorithm resulted in a 200% lift in the detection of AAA when compared with standard screening guidelines. Using Machine learning, we also identified several new factors associated with the presence of AAA. This automated process has been integrated into our current workflows to improve screening rates and yield of high-risk individuals for AAA.

4:03 – 4:12 pm **Transversus Abdominis Plane Block Provides Early Opioid-Sparing Pain Control in Open Aortic Surgery**

Amber S. Hussain, DO, Gayatri S. Pillai, BS, Sahaj S. Shah, BA, Heather S. Hussain, ScD, Robert W. Abdu, DO, Evan J. Ryer, MD, Gregory G. Salzler, MD, James R. Elmore, MD
Geisinger Medical Center

OBJECTIVE: Post operative pain control is a major factor in patients undergoing open aortic surgeries. Historically, epidurals have been utilized to aid pain management. More recently, transversus abdominis plane (TAP) blocks have been shown to be effective pain adjuncts in various abdominal surgeries. However, their utility in open aortic surgeries is largely unknown. We sought to determine the effectiveness of ultrasound-guided TAP blocks to achieve targeted analgesia of T6-L1 segmental nerves for long midline abdominal incisions in open aortic surgeries.

METHODS: A retrospective single-center chart review was conducted on all patients who underwent open aortic surgeries from January 2016 to December 2021. Patients were classified into three groups: general anesthesia (GA), general anesthesia with an epidural (EPI), or general anesthesia with a TAP block (TAP). Post operative outcomes were compared between groups including 48-, 72-, and 120-hour morphine milligram equivalence (MME), vasopressor requirements, time to extubation, intensive care unit (ICU) length of stay, and overall length of stay (LOS). The ultrasound guided TAP block was performed with a total of 266 mg/20 mL liposomal bupivacaine (EXPAREL®) diluted to 60 mL and injected in 10 mL aliquots into the transversus abdominis plane at three anterolateral abdominal wall points bilaterally.

RESULTS: A total of 89 open abdominal aortic surgeries were performed for aneurysmal disease and 63 of those cases met inclusion criteria. Cases that involved rupture, intraoperative death, and the need for additional procedures including thrombo-embolectomy, renal bypass, and other abdominal surgery, were excluded. Mean age was 69 years, 68% male and 99% white. There were no differences in group characteristics. The subgroups of TAP had 17 (27%) patients, EPI had 32 (50.8%) patients, and GA had 14 (22.2%) patients. Mean MME_{48} is 140.5±121.7 (95% CI 63.2-217.8) in the GA group, 51.1±71.9 (95% CI 14.1-88) in the TAP group, and 9.3±17.3 (95% CI 3.1-15.5) in the EPI group ($p<0.001$). Subgroup comparisons between TAP versus GA exhibit a difference in MME_{48} ($p=0.038$). The difference of MME from 48 to 72 hours is insignificant between subgroups of TAP and GA

(ΔMME_1 p=0.99). However, the total MME at 72 hours for the TAP group is still significantly less than GA (ΔMME_1 p= 0.034). Epidural anesthesia is effective compared to TAP and GA up to 72 hours (ΔMME_1 p=0.045, p=0.015). There is no difference in MME beyond 72 hours, vasopressor requirements, time to extubation, and ICU and hospital LOS across all groups.

CONCLUSIONS: TAP blocks performed led to significant opioid-sparing effects compared to general anesthesia alone in the first 48 and 72 hours postoperatively. TAP blocks provide patients with increased pain control and should be included as an effective pain adjunct in open aortic surgeries. Additional investigation into the efficacy of TAP blocks in open aortic cases across a multi-center review can provide more information on the impact of TAP blocks as an incorporation of standard clinical practice.

4:12 – 4:21 pm

Outcomes of Combined Open Femoral Endarterectomy and Endovascular Femoral-Popliteal Stenting for Treatment of Flush Superficial Femoral Artery Occlusions

Christopher Cappellini DO, Keith Calligaro MD, Matthew Dougherty MD, Douglas Troutman DO
Pennsylvania Hospital (UPHS)

Background: Our previous work suggested common femoral artery (CFA) endarterectomy for patients with extensive CFA disease combined with endovascular femoral-popliteal stent-grafting provided a viable option for revascularization of Trans-Atlantic Inter-Society Consensus (TASC) C and D femoral-popliteal lesions involving a flush occlusion of the SFA. We report updated results using this hybrid technique over an 18-year period.

Methods: A retrospective review of 31 patients who underwent this hybrid procedure between May 2005 and November 2023 were identified from our retrospectively reviewed, prospectively maintained registry.

Results: Of the 31 patients, twenty-one (68%) were treated for disabling claudication, five (16%) for rest pain, and five (16%) for tissue loss. Ten patients met TASC C criteria and twenty-one TASC D. Twenty patients had stent-grafts, 8 had bare-metal stents, and 3 had a combination of stent-graft and bare-metal stent placed. The mean ABI of the affected leg was 0.61 (range, 0.19-1.71) before surgery

and 0.95 (range, 0.55-1.39) after surgery (p = 0.001). There were groin wound issues in 7 patients, four (13%) of which required operative exploration. Average primary patency of stenting was 22.66 months (range, 25 days to 11.3 years). Primary patency for the stented segment at 1, 3, 6, and 12 months were 97%, 89%, 81%, and 60%, respectively. Endarterectomy primary patency was 97% at 1, 3, 6, and 12 months. One patient required endovascular intervention for in-stent stenosis at 3-month follow-up (primary-assisted patency at 4 months). Six stent-grafts and one bare-metal stent occluded during follow-up (range, 25 days to 14 months). Two of these patients required bypass surgery, one patient underwent endovascular salvage, three patients had unchanged claudication or rest pain, and one patient declined re-intervention. Limb salvage was 100% at median follow-up of 13.52 months (mean, 31.26 months).

Conclusions: Our data suggests revascularization of flush SFA occlusions can be achieved with combined femoral endarterectomy and endovascular femoral-popliteal stenting with acceptable outcomes, with only two of 31 patients ultimately requiring surgical bypass after mean follow-up of 11.48 months. All stent failures occurred within 14 months of intervention, highlighting the likely pathologic role of myointimal hyperplasia. Although this hybrid approach is reasonable for patients lacking autologous vein, and considering the primary patency of the hybrid approach was 60% at one year, autologous vein bypasses remain the optimal treatment for TASC C and D lesions.

4:21 – 4:30 pm

Open Juxta-renal Abdominal Aortic Aneurysm Repair Still Confers Post-Operative Rupture Risk

Lena Chatterjee MD, Afshin Parsikia MD, Evan Deutsch MD, Nadia Awad MD
Einstein Medical Center

Background: While endovascular approaches to repairing abdominal aortic aneurysm have expanded and both physician-modified and prefabricated devices can address juxta-renal anatomy, open aneurysm repair is still considered the gold-standard. However, these cases are technically more complex and carry higher risk of morbidity and mortality. We sought to evaluate the real-world outcomes of open juxta-renal abdominal aortic aneurysm repair.

Methods: We utilized the NSQIP vascular-targeted dataset for abdominal aortic aneurysm, merged with the regular NSQIP adult dataset from 2017 to 2020, selecting juxta-renal as the proximal aneurysm extent. Patients that expired peri-operatively were identified and relevant pre-, intra-, and post-operative features were considered. A bivariate analysis of patients was performed to assess characteristics of patients who did or did not survive the peri-operative period with a multivariate logistic regression performed for those variables with a p-value <0.2.

Results: 557 patients underwent open surgery for a juxta-renal abdominal aortic aneurysm, and there were 60 peri-operative deaths. Older age, longer operative time, and patients presenting with rupture were all predictors of death. Interestingly, 13 patients were noted to have post-operative aneurysm rupture, nine of which died, accounting for 15% of deaths (OR 11.038, $p < 0.001$). Additionally, post-operative ischemic colitis conferred significant mortality risk (OR 3.826, $p < 0.006$).

Conclusion: As expected, older patients, longer cases, and patients presenting with rupture have a higher risk of peri-operative mortality after open repair. However, while open aneurysm repair is still considered the gold-standard approach, review of the NSQIP data reveals that there is still a significant post-operative rupture risk in these patients, which is counter to standard teaching that open aneurysm repair is considered more durable. Further research but this may indicate that the durability of open repair is not as high as perceived.

Table 1: Prognostic Factors for Mortality (Multi-Variate)

Mortality	OR	SE	P-value	95% Lower CI	95% Higher CI
Age > 65 y. o	2.816	1.324	**0.028**	1.121	7.077
BMI>40 kg/m^2	0.330	0.394	0.354	0.032	3.439
Pre-operative blood transfusion	2.703	1.483	0.070	0.922	7.920
Pre-operative SIRS, sepsis, septic shock	0.764	0.381	0.590	0.287	2.032
Abdominal non-arterial repair or excision	0.423	0.392	0.354	0.069	2.604
ASA class					
3-Severe Disturb	Reference				
4-Life Threat	2.111	0.960	0.100	0.866	5.145
5-Moribund	1.310	0.884	0.689	0.349	4.920
Proximal clamp location					
Infrarenal	Reference				
Above one renal	0.622	0.309	0.339	0.235	1.647
Between SMA & renals	1.156	0.597	0.779	0.420	3.179

Supraceliac	1.310	0.667	0.596	0.483	3.554
Operation characteristics					
Non-elective	0.596	0.364	0.397	0.180	1.973
Total time of operation > 280 minutes	2.676	0.924	**0.004**	1.360	5.265
Indication for Surgery					
Diameter	Reference				
Non-ruptured symptomatic	0.707	0.636	0.700	0.121	4.119
Other indication for surgery	3.525	4.396	0.312	0.306	40.630
Prior endovascular intervention w/ unsatisfactory result	0.809	0.922	0.853	0.087	7.541
Rupture w/ hypotension or use of pressors	8.129	6.230	**0.006**	1.810	36.513
Rupture w/out hypotension	4.574	3.315	**0.036**	1.105	18.932
Concomitant Revascularization					
Lower extremity revascularization	1.782	0.960	0.283	0.620	5.123
Renal Revascularization	0.439	0.336	0.282	0.098	1.967
Post-op occurrence					
Ischemic colitis	3.826	1.868	**0.006**	1.469	9.964
Rupture of aneurysm	11.038	8.297	**0.001**	2.530	48.159
LE ischemia requiring intervention	1.188	0.999	0.837	0.229	6.177

4:30 – 4:39 pm

Surge in Volume of Injection Drug Use Associated Pseudoaneurysms in North Philadelphia

Amanda R Phillips, MD MSc, Shina Patel, MD, Kenny Oh, MD JD, Frank Schmieder, MD
Temple University

Introduction: Injection drug use is highly prevalent in the urban Philadelphia region. One of the many complications from IVDU is associated arterial pseudoaneurysm (PSA) formation from multiple punctures, injection of foreign substances, and seeding of bacteria. IVDU associated PSA has a risk of rupture and can be life threatening. We report our recent experience to highlight the surge in volume.

Methods: This is a single center review of patients undergoing surgical management for IVDU associated pseudoaneurysms since August 10, 2023. Patient information has been reviewed retrospectively from a prospectively maintained database. We compared the volume experienced in the 5 months of this study to the volume of patients in the largest series reported in the literature in the United States (1, 2).

Results: Nine patients underwent urgent or emergent pseudoaneurysm exploration and surgical management since August 10 (5 months; approximately 1.8 patients per month). The largest series to date in the US reports 58 patients over a 14-year period (168 months; 0.3 patients per month). Conclusions: While we do not think that a statistical comparison is appropriate from this extrapolated data, the volume we have experienced this quarter is undoubtably higher than any other time reported in the US. If this trend continues, over a time frame of 14 years we would expect this crisis to surge to over 300 patients. Whether the rise has been due to increased injection drug use or whether the introduction of newer drugs such as xylazine ("tranq") has a more deleterious effect on the blood vessels than previously available drugs is outside of the scope of this report but is of great interest to vascular surgeons.

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