

Abstracts From the Amputation Prevention Symposium (AMP)

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AMP 2021-1

An Endovascular Approach as a Backup for Open Surgery After *Corynebacterium striatum* Vascular Graft Infection

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PURPOSE. The infection of an extra-anatomical graft limits the options of open revascularization. We describe a successful endovascular approach as a backup for open surgery in a patient with a vascular graft infection.

MATERIALS AND METHODS. We present the case of a 74-year-old male who was operated on in 2009 because of severe claudication in his left leg. A femoro-femoral crossover bypass (he had a prior cystectomy) was done, but there was a dehiscence of the left wound that required prolonged wound care. Nine years later in our outpatient facility, fluid was seen on ultrasound surrounding the graft and the labeled leukocyte imaging showed an active infection. The culture of the fluid was positive for *Corynebacterium striatum* and the patient was prescribed minocycline, but he stopped taking it because of adverse events. The graft had been patent, but after 11 years the patient was admitted because of left limb ischemia and general syndrome due to the infection. The bypass was explanted and the patient was kept on antibiotics.

RESULTS. The patient was admitted 3 months later due to severe claudication in his left limb. To avoid putting on a new graft, an endovascular approach was planned. Through a left radial access, the 15 cm chronic total obstruction was crossed, and 1 covered stent and 1 bare metal stent were implanted. He is being followed in our outpatient facility and is doing well, without claudication and without signs of infection. The origin of the bacteria is probably the urinary tract due to multiple infections of the neobladder.

CONCLUSIONS. An endovascular approach can be done after a failed open surgery and is especially helpful in cases of infection.

AMP 2021-2

A Hybrid Approach to ALI Utilizing Penumbra Aspiration Thrombectomy in Conjunction With Catheter-directed Thrombolysis

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PURPOSE. Acute limb ischemia (ALI) due to thromboembolism is a vascular emergency. Its etiology is commonly cardioembolism with other causes, including iatrogenic and atheromatous plaques. Complications from vessel occlusion in peripheral vessels contribute to a yearly economic burden of \$7-10 billion in the United States, and the 5-year survival rate after ALI secondary to acute thrombosis is only 44%. The Penumbra System has been utilized for mechanical thrombectomy associated with ALI since 2007. Additions to the Penumbra System include catheter-directed thrombolytic therapy in the treatment of acute vascular occlusion, which aims to improve the success rate and patency of interventional revascularization attempts.

MATERIALS AND METHODS. An initiative to improve limb salvage outcomes beginning in 2019 introduced hybrid therapy, with adjunct Penumbra thrombectomy included in patients for which catheter-directed thrombolytic therapy alone would have been standard practice.

RESULTS. Early recanalization following vessel occlusion has been associated with improved clinical outcomes in acute ischemia. Introducing hybrid therapy with Penumbra thrombectomy in addition to catheter-directed thrombolytic therapy was intended to improve patient outcomes in a community hospital with a preponderance of high-risk vasculopathies. Following the start of this initiative, catheter-directed thrombolytic therapy alone was associated with a longer, more tumultuous recovery. Early return of signals within the first hour post therapy was also noted in patients who received a hybrid treatment.

CONCLUSIONS. Patient outcomes were improved following hybrid therapy compared with those of catheter-directed thrombolytic therapy alone.

AMP 2021-3

Cost-Effectiveness of Office-Based Labs for Treating Peripheral Arterial Disease*Morish Shah; Ashish Chaturvedi, BS; Paramjit S. Chopra, MD; Manasvi Paudel, BS; Kashish Shah**MIMIT Health, Vernon Hills, Illinois*

PURPOSE. Minimally invasive endovascular procedures provide a low-risk substitute for open surgery in patients with peripheral arterial disease (PAD). These procedures rely on state-of-the-art imaging and technology to properly diagnose and intervene. Endovascular procedures for PAD increased by 20% from 2011 to 2018. There is limited research available regarding the impact of location of service on cost and quality of care in PAD. The purpose of this study was to understand the necessity of educating patients and primary care providers of the advantages that office-based labs (OBL) provide patients in terms of outcomes and cost compared with outpatient and inpatient facilities.

MATERIALS AND METHODS. A retrospective review of available national Medicare data from 2011 to 2018 was conducted on lower extremity PAD endovascular procedures. A cost-benefit analysis of care and cost onsite was performed for inpatient (IP), outpatient (OPH), and OBL. Quality of care and outcomes of procedures that prevent amputation will be analyzed through internal MIMIT Health data. Procedures related to percutaneous transluminal angioplasty (PTA), atherectomy, and stent placement within iliac, femoropopliteal, and infrapopliteal vessels were analyzed with proper CPT codes.

RESULTS. OBL procedures are on average 50% more cost-effective than OPH site procedures. Iliac PTA and stent (CPT 37221) has a 100% higher median and 106% higher average cost in OPH vs. OBL. Femoro-popliteal PTA with stent and atherectomy (CPT 37227) median cost at OPH is 90% higher than OBL. Femoro-popliteal PTA and atherectomy (CPT 37225) has a 60% higher median and 76% higher average cost in OPH vs. OBL. Femoro-popliteal PTA and stent (CPT 37226) has a 90% higher median and 66% higher average cost in OPH vs. OBL. Infrapopliteal PTA and atherectomy (CPT 37229) has a 52% higher median and average cost in OPH vs. OBL.

CONCLUSIONS. Endovascular procedures in OBL are consistently increasing and are on average >50% more cost-effective than OPH and IP procedures. While there remains a high volume of hospital OPH procedures, they remain expensive. In addition, IP procedure rates have stayed consistent. OBL have been shown to be more cost-effective and provide optimal health outcomes for patients. Necessary education and awareness must be established across providers and patients about the benefits of OBL to treat PAD and avoid amputations.

AMP 2021-4

Hybrid Approach for Chronic Limb-Threatening Ischemia: A Case Report*Vincent Demesmaker, MD; Arnaud Kerzmann, MD; Evelyne Boesmans, MD; Vlad Alexandrescu; Jean-Olivier Defraigne**University Hospital of Liège, Raeren, Liège, Belgium*

PURPOSE. Chronic limb-threatening ischemia is a major public health concern, given its association with increased mortality, risk of amputation, and impaired quality of life. The arterial lesions are often extensive, reaching several levels and making revascularization complex. Hybrid treatment, combining the advantages of open surgery and endovascular therapy, may be helpful.

MATERIALS AND METHODS. We present the case of a 74-year-old man with a history of myocardial infarction, stage 3 chronic kidney disease, arterial hypertension, dyslipidemia, and diabetes. He had a femoro-popliteal bypass 9 years earlier, a femoro-tibial bypass and transmetatarsal amputation 7 years earlier, and a new femoro-tibial bypass with ligation of the superficial femoral artery ostium 2 years earlier. He developed a gangrenous foot stump (Rutherford classification stage 5) following subacute thrombosis of his last femoro-tibial bypass.

RESULTS. We performed retrograde transluminal femoro-popliteal recanalization and short prosthetic bypass between the common femoral artery and the proximal part of the superficial femoral artery. Six months later, the foot stump was healed.

CONCLUSIONS. Hybrid treatment may be helpful to revascularize limbs with multilevel complex occlusive arterial disease. When open surgery is realized, it is mandatory to avoid any arterial ligation to keep potential future percutaneous treatment possible.

AMP 2021-5

Observations Regarding the Effect of COVID-19 on Amputations Performed in a Tertiary Referral Health System*Dayle K. Colpitts, DO; Richard F. Neville, MD, FACS, DFSVS; Arkadii Sipok, PhD; Anthony Comerota, MD, FACS**Inova Heart and Vascular Institute, Inova Fairfax Medical Campus, Fairfax, Virginia*

PURPOSE. Vascular practices across the country engaged in care prioritization during the COVID-19 pandemic. Our tertiary referral center implemented guidelines to tier procedures by type and urgency with a shift toward telehealth encounters. The aim of this analysis is to reveal the impact of this alteration in practice pattern on the amputation experience for a similar time interval before and during the initial pandemic.

MATERIALS AND METHODS. Our institutional Vascular Quality Initiative (VQI) database was used to evaluate and compare amputations and contemporaneous vascular procedures performed in the 6 months following the pandemic-related healthcare changes (April–September 2020) to a 6-month period immediately prior to this interval (July–December 2019). All lower extremity amputations, bypass procedures, and peripheral vascular interventions performed by a single vascular surgery practice across 5 hospitals of a major healthcare system were included.

RESULTS. There was an increase in total amputations performed during the initial pandemic interval ($n = 64$) compared with the pre-COVID interval ($n = 42$), with an increase in both major (32 vs. 25) and minor (32 vs. 17) amputations. There was a statistically significant increase in mean amputations per month during the pandemic interval for total amputations (mean 7.0 vs. 10.7, $P = .028$) and minor amputations (2.8 vs. 5.3, $P = .016$). The total number of revascularization procedures performed during the initial pandemic ($n = 169$) decreased compared with pre-COVID levels ($n = 208$). Decreases in the performance of bypass (mean per month: 14 vs. 11.2, $P = .24$) and endovascular procedures (mean per month: 20.7 vs. 17.0, $P = .37$) were noted but did not reach mean statistical significance. However, the ratio of amputation to bypass increased from 0.5 to 1.0 ($P = .01$) as did amputation to endovascular procedures from 0.3 to 0.6 ($P = .01$).

CONCLUSIONS. A rise in the total number of amputations, predominantly minor, and a corresponding decrease in revascularization procedures was observed during the initial COVID-19 pandemic. Further investigation is warranted to identify the underlying etiology of this impact: decreased revascularization performed, delayed care, infection, or the result of case prioritization. Future emphasis on the delivery of care to prevent amputation and optimize outcomes during a pandemic is indicated.

AMP 2021-6

Salvage of Popliteal-Dorsalis Pedis Bypass: A Case Series*Crystal James, MD; Denise Alabi, BA; Mabel Chan, MD; So Park, MD; John C. Lantis, II, MD**Mount Sinai Morningside/West Hospitals, New York, New York*

PURPOSE. It has been well established that distal bypass is an effective treatment option in patients with critical limb ischemia (CLI), especially in achieving limb salvage. In fact, it has been reported that there is an amputation-free survival rate approaching 80% at 1 year at experienced centers. Unfortunately, a significant number of patients (about 30%–50%) must also have secondary interventions performed to maintain and/or improve graft patency.

MATERIALS AND METHODS. A retrospective chart review was performed on patients treated at a single center for CLI requiring distal bypass. Primary outcomes were salvage procedure performed and need for amputation. Secondary outcomes were time to reintervention and time to amputation.

RESULTS. Three patients with CLI and prior distal bypass underwent additional interventions to achieve limb salvage after their bypass grafts were threatened. Two out of 3 patients had eventual ipsilateral major amputation due to failure of salvage techniques to restore adequate perfusion. Of the 2 patients who ultimately required amputation, 1 had a femoral to peroneal bypass graft with PTFE graft and subsequent embolectomy to restore graft patency performed < 60 days following bypass. This patient later had an above-knee amputation performed < 1 week following the salvage procedure. The other patient had 2 reinterventions following below-knee popliteal to dorsalis pedis (DP) bypass. The first reintervention procedure was balloon angioplasty 6 months after bypass, which was followed by reoperative dissection of right popliteal fossa with femoral to below-knee popliteal bypass using a Distaflo graft performed 1 month later. Amputation was performed 6 months following the second reintervention. The remaining patient had success after reintervention procedures performed after popliteal to DP bypass, avoiding amputation. Graft patency was restored in this patient in 3 separate procedures including angiography with stent placement, angioplasty, and embolectomy.

CONCLUSIONS. Secondary interventions following popliteal to DP bypass are often necessary and can be of profound benefit in preventing limb loss in patients with CLI. While some patients may eventually require amputation, utilizing salvage procedures can delay or prevent limb loss.

AMP 2021-7

PRELUDE BTK vs. POBA Analysis: Serration Angioplasty and POBA

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PURPOSE. Comparative analysis of standard balloon angioplasty vs. serration angioplasty (Serranator®) for infrapopliteal arterial interventions.

MATERIALS AND METHODS. The PRELUDE BTK Study was a single-arm, prospective, multicenter feasibility study designed to assess the Serranator in subjects with atherosclerotic lesions in below-the-knee (BTK) arteries. The Serranator is a semi-compliant balloon with 3 embedded external metal strips or scoring elements. The unique scoring elements are serrated, designed to modify the plaque by creating linear, interrupted scoring along the endoluminal surface. This occurs during balloon inflation and is designed to aid arterial expansion. We performed a subset analysis of our acute angiographic results after serration angioplasty (PRELUDE BTK data) to a prospective percutaneous old balloon angioplasty (POBA) treatment group using any percutaneous transluminal angioplasty balloon. Previous Core Lab adjudicated data from serration angioplasty treated lesions (n = 17) was compared with data from POBA-treated lesions (n = 25) from our center using the same operators. The acute angiographic results were analyzed by the SynvaCor Core Lab.

RESULTS. Lesion data was broken down into a comparable subset analysis with serration angioplasty lesions (n = 17) vs. POBA lesions (n = 13) to compare similar lesion lengths and diameters. Results were favorable for lesions treated with serration angioplasty compared with POBA cases despite higher rates of chronic total occlusion (CTO) with 41.2% in serration angioplasty vs. 7.7% in POBA (comparable subsample) groups. The average atmosphere (ATM) of pressure was 5 in serration angioplasty vs. 9 in POBA (comparable subsample). Lesion size was longer, with 52.8 ± 39.1 mm in serration angioplasty vs. 35.7 ± 29.7 mm in POBA (comparable subsample). There was a reduction in dissection in the serration angioplasty group, with 82.4% (n = 14/17) with no dissection vs. 69.2% (n = 9/13) in the POBA group. The final residual stenosis was $17.2 \pm 8.2\%$ in the serration angioplasty group vs. $28.2 \pm 16.9\%$ in the POBA group. No bailout stents were used in either group.

CONCLUSIONS. These data showed that serration angioplasty treatment of infrapopliteal arteries appears to provide improvement in acute angiographic results compared with standard balloon angioplasty showing less final residual stenosis and lower ATM of pressure. More studies are needed to confirm these initial results. ■