

physical functionality scores was 27.6 in the vertebroplasty group and 36.1 in the other group which was statistically significant ($P = 0.005$). The mean amount of cement injected was 4 ml in vertebroplasty group and 5.1 in the other group. The mean change in anterior vertebral height was 0.63 mm in the vertebroplasty group and 2.47 mm in the other group which was significantly higher ($P < 0.001$). There was cement leak seen in 20% patients in the vertebroplasty group which was minor and mainly involved the paravertebral and intradiscal regions. In the other group, no intradiscal leak was seen. **Conclusion:** Balloon vesselplasty is superior to vertebroplasty in terms of disability scores, increase in anterior vertebral body height, and volume of cement injected with low complication rate.

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Outback LTD Re-Entry Device for Endovascular Recanalization of Central Venous Occlusions Associated with Failing Hemodialysis Access

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Objectives: To report our experience with the Outback LTD re-entry device for endovascular recanalization of central venous occlusions associated with dysfunctional arteriovenous fistulas. **Methods:** Between January 2013 and January 2019, 11 patients (4 males and 7 females, mean age: 61.8 years) with dysfunctional fistulas secondary to central venous occlusion underwent endovascular treatment using the Outback LTD re-entry device. Reasons for referral were increased venous pressure during hemodialysis ($N = 5$), arm swelling ($N = 5$), and graft thrombosis ($N = 1$). The mean age of the fistulas was 58.1 months, during which time nine patients had prior history of at least one salvage endovascular procedure. In all patients, the Outback LTD re-entry device was used as a bail-out measure after failed attempts to cross the occluded central vein using conventional wiring techniques. A retrospective review was performed to assess the clinical outcome of these patients. **Results:** The site of occlusion was at the junction of the subclavian and innominate veins ($N = 9$), in the right innominate vein ($N = 1$), or in the subclavian vein ($N = 1$). The re-entry device was introduced via the outflow vein of the arm ($N = 6$), femoral vein ($N = 4$), or internal jugular vein ($N = 1$). Technical success was achieved in ten patients (90.9%), seven of whom required provisional placement of bare metallic stents. All ten patients underwent successful hemodialysis immediately after the procedure. Five patients with arm swelling were relieved of their symptoms. Excluding four patients who were lost for follow-up, the mean intervention-free period in the remaining six patients was 6.8 months, while the mean functional period of the fistula circuit after assisted procedures was 33.3 months. No complication related to the procedure was reported during this period. **Conclusion:** The Outback re-entry device can be safely and effectively used as a bail-out measure in patients who fail conventional wiring techniques during the endovascular treatment of central venous occlusions.

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Retrograde Access for Lower Limb Revascularization

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Objectives: To assess the efficacy and success of the retrograde approach as the first line for arterial revascularization or as an adjunct to the antegrade approach in patients with critical limb ischemia at a high-volume vascular institution. **Methods:** A prospective cohort study was performed to evaluate the success rate of using a retrograde approach to revascularize patients who had a failed previous attempt at antegrade angioplasty or as primary attempt if noninvasive imaging showing a patent pedal or popliteal artery. The approach was decided at the time by the interventionist who was doing the procedure. The access vessels used were the popliteal, posterior tibial and anterior tibial arteries. Under ultrasound guidance, access to the chosen artery was secured with 4–6 F sheath and distal access cocktail (heparin, verapamil, and nitroglycerin) used directly after gaining access. The method used to complete the intervention up to the external iliac artery. All patients have clinical and duplex scan follow according to the same pathway for antegrade angioplasty. **Results:** 32 patients with critical limb ischemia with multilevel stenoses and or occlusions had retrograde angioplasty performed. 75% patients had diabetes mellitus and 46% (15 of 32) patients had a failed previous attempt of antegrade angioplasty. 3 (9%) patients had both antegrade and retrograde access performed, with the retrograde wire snared. 7 (21%) had popliteal access, 17 (53%) had posterior tibial access, and 8 (25%) patients had the anterior tibial artery used as the primary access vessel. 21 of 23 (91%) patients were successfully revascularized with good results with two cases being abandoned, one no target vessel and one unable to re-enter proximal inflow. There were no periprocedure complications, but one patient developed pseudoaneurysm at the access site (injected with thrombin). **Conclusion:** This cohort showed that retrograde access in the right choice of patients can have an excellent success rate and should be considered as a primary access site or an adjunct to the antegrade approach.

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Anterior Tibial Artery-Anterior Tibial Vein Deep Vein Arterialization: A Potential Option for Limb Salvage: A Case Report

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Background: Critical limb ischemia (CLI) is considered the end-stage of peripheral arterial disease and is characterized by rest pain, ulceration, and gangrene. CLI has an annual incidence of 50–100 cases per 100,000 and has a poor prognosis with mortality rates exceeding 20% at 1 year after presentation and overall cumulative incidence of CLI patients with major amputation

reported to be greater than 20%. Endovascular revascularization strategies for limb salvage have advanced over the years and are often considered first line over surgical techniques. In spite of these advances, many CLI patients ultimately require amputation when conventional endovascular techniques fail creating the need for new techniques. Deep venous arterialization (DVA) is an emerging endovascular alternative to amputation in these patients with no option CLI, aka “desert foot.” The goal of DVA is to percutaneously create a bypass from high flow arterial veins to high capacitance plantar veins to facilitate wound healing. In a case series, Kum *et al.* described the outcomes of seven patients with no option CLI undergoing DVA and showed promising results with 100% with no deaths, above the ankle amputations, or major interventions at 30 days and five of seven patients with complete wound healing at 12 months. Most described cases involve deep vein arterialization between the posterior tibial artery (PTA) and posterior tibial vein (PTV) due to the direct drainage of the plantar venous arch into the PTV. We describe a case in which we attempted DVA of the anterior tibial artery (ATA) to the anterior tibial vein (ATV) due to occluded PTV, with successful limb preservation. **Methods:** Our patient, a 65-year-old male with diabetes, cadaveric renal transplant for end-stage renal disease status post renal transplant, coronary artery disease status post-CABG, and peripheral arterial disease who presented with a 7-month history of nonhealing ulcer of the left forefoot with associated rest pain. The patient’s ulcer was complicated by osteomyelitis requiring amputation of the left great toe and third toe. Multiple endovascular attempts at revascularization were performed including combined antegrade and retrograde subintimal recanalization of the PTA. Despite these interventions, the patient had persistent rest pain and recurrent nonhealing wounds and has undergone additional debridements. On examination, the patient had no palpable pulses at the ankle with Dopplerable biphasic dorsalis pedis and posterior tibial signals. Ankle-brachial indices could not be obtained due to noncompressibility, attributed to extensive calcifications of the lower extremity vessels. Informed consent was obtained for all procedures. Initial angiograms demonstrated extensive atherosclerotic calcifications of the lower extremity vessels. The infrainguinal and suprapatellar inflow arteries were patent. Below the knee, the peroneal artery was patent up to the distal third segment with complete occlusion distally. The ATA was occluded beyond its mid aspect. A short segment of the proximal PTA was patent with complete occlusion beyond its proximal portion. Overall, there was no in-line arterial flow into the left foot with limited perfusion to the foot provided by numerous small corkscrew collateralized vessels. DVA between the PTA and PTV was initially attempted however was unsuccessful as venogram demonstrated no patent PTV, rather paired peroneal veins which coursed toward the expected PTV near the medial malleolus, presumably collateralized. Therefore, we decided to attempt an ATA to ATV arterialization to provide increased vascularization to the foot. Antegrade access was obtained in the left common femoral artery. Due to extensive calcified disease, atherectomy of the proximal ATA was performed followed by aggressive scoring balloon angioplasty. After obtaining retrograde ATV access, a 5-mm balloon was placed in the vein adjacent to the proximal ATA. Using a Pioneer re-entry device in the ATA, the venous balloon was successfully punctured and 0.014 inch wire advanced into the balloon. The wire was externalized through the ATV access in the leg. Through the antegrade direction, a 0.014 inch guidewire was advanced into the pedal venous loop and angioplastied. After scoring balloon angioplasty of the arterio-

venous fistula site, a 5 mm × 25 cm covered self-expanding stent was advanced and deployed from the proximal ATA and distally above the ankle joint. Poststent angiogram showed delayed flow through the stents, suggesting persistent valve in the ATV beyond the stent. After failed attempts with scoring balloon angioplasty and valvulotomy passage, a short overlapping-covered stent was deployed to cover the distal valve. Completion angiogram demonstrated brisk antegrade flow through the ATA and venous stent, with rapid venous arch filling and small venous perfusers. The peroneal artery and small collateralized arterial vessels were still present. Overnight as expected patient had significant pedal edema, which resolved over the next 7 days. **Results:** Within 3 weeks, the patient had complete wound healing, resolution of rest pain, and ambulating without restrictions, which has been stable over 3 months. DVA between the ATA and ATV can be a viable option for providing inline flow to the foot for limb salvage when the PTV is not available. Further studies would be beneficial to better understand long-term effects and outcomes.

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The Treatment of Neck Lymphorrhea after Total Thyroidectomy: Direct Intranodal Embolization Using N-Butyl Cyanoacrylate: A Case Report

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Background: A 57-year-old female patient was referred for treatment of lymphatic leak after total thyroidectomy. The patient had undergone total thyroidectomy and left level IV lymph nodal dissection 1 week previously after which she developed swelling in the left neck. After failed surgical attempts, the patient was referred for lymphangiography. **Results:** A lymph node in the right groin was punctured using a fine needle under ultrasound guidance and lymphangiography was performed by injecting lipiodol into the lymph node under fluoroscopy. However, lymphangiography could not reveal the cisterna chyli and thoracic duct, which has the role of bridge to further procedure, such as thoracic duct embolization. On the decision to approach retrogradely, we tried to cannulate the thoracic duct via right common femoral vein but also failed. Hence, we decide to puncture the neck lymph node directly, and we could figure the leakage point out. We punctured using a 22-gauge needle and then flushed with dextrose-5-water, after which N-butyl cyanoacrylate diluted in lipiodol was injected. Two days later, a dry tap was confirmed from the surgical drain which was successfully removed. **Conclusion:** While thoracic duct embolization has been reported to be successful in treating lymphatic leaks occurring in the neck regions, reports on direct neck node embolization are scarce. With growing interest in embolization techniques for lymphatic leaks occurring after the surgery, this case demonstrates the application of embolization for the treatment of lymphatic leaks in the neck. **Take Home Points:** The technique of direct neck node puncture and embolization is useful to treat lymphatic leaks occurring in locations not only abdomen or thorax but also neck region.