

Critical Limb Ischemia



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And

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Disclosures

- Abdullah, Abdullah M.: I have no relevant relationships with commercial interests to disclose.
- Shishehbor, Mehdi H.: I have no relevant relationships with commercial interests to disclose.



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Patient History

- 58-year-old AAM with PMH of IDDM, HTN, DLP, Glucoma, BPH, GERD, ESRD s/p kidney tx (2008), bilateral PAD/CLI L >R
- On the right side, he underwent successful endovascular revascularization with subsequent open TMA and VAC dressing.
- On the left side, he underwent angioplasty of the left PT, AT, and peroneal arteries on 1/16/2020, but his hallux gangrene progressed to forefoot gangrene with worsening rest pain.
- He was offered a left BKA but he refused for which he was referred to Dr. Shishehbor



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Foot Pictures



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Evaluation

- Non-invasive diagnostic Testing
- Angiograms



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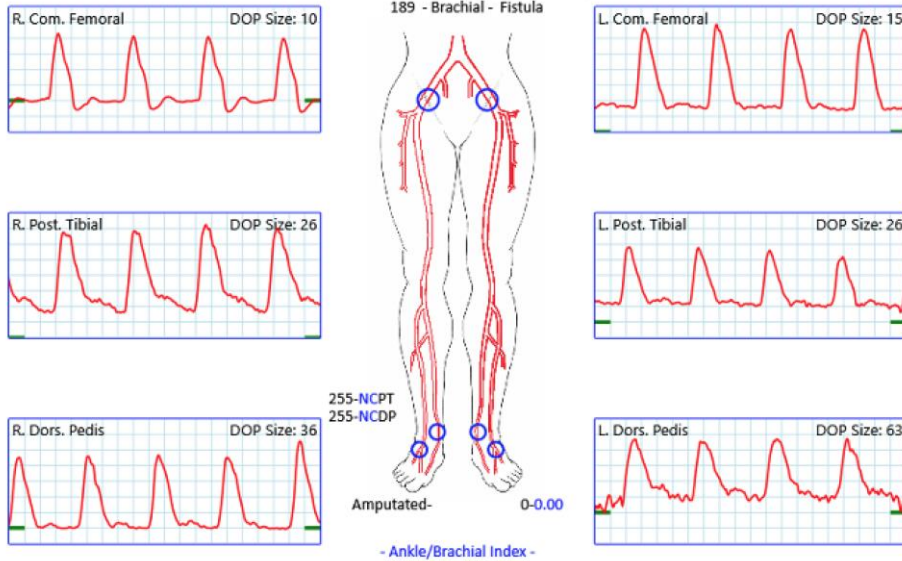
Non-invasive diagnostic Testing

Lower Arterial Segmental Pressures

Right		Left
189	Brachial	Fistula
255 - NC	Ankle (PT)	
255 - NC	Ankle (DP)	
Amputated	1st Toe	0 - 0.00

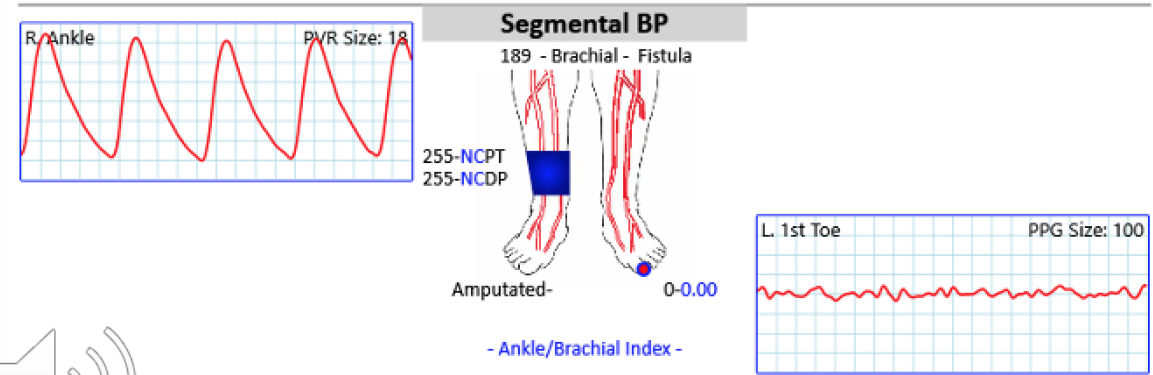
Doppler Waveforms

Segmental BP



PVR Waveforms

Segmental BP



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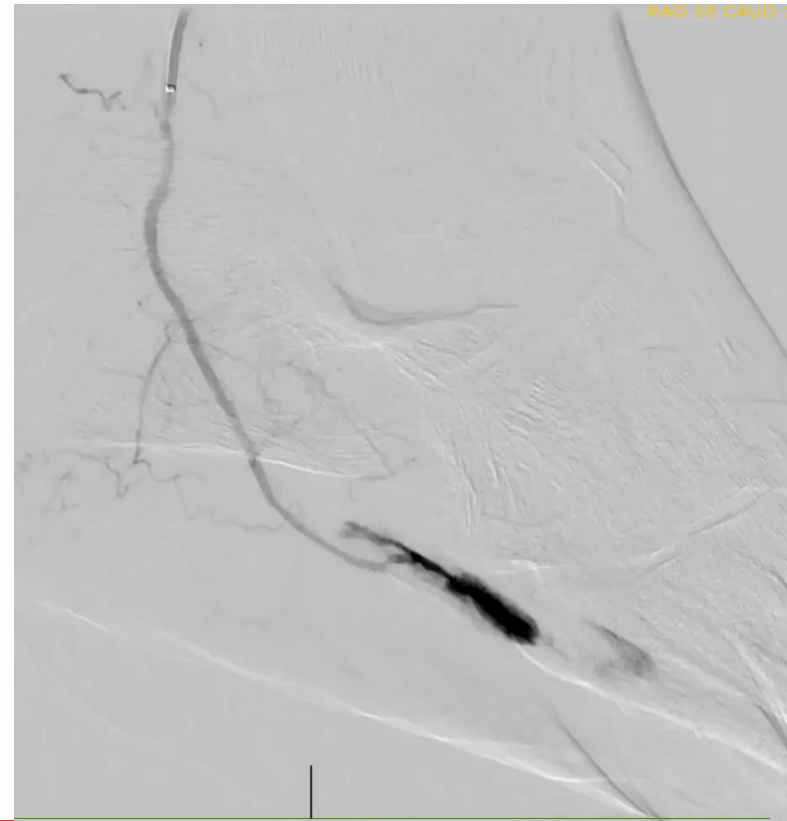
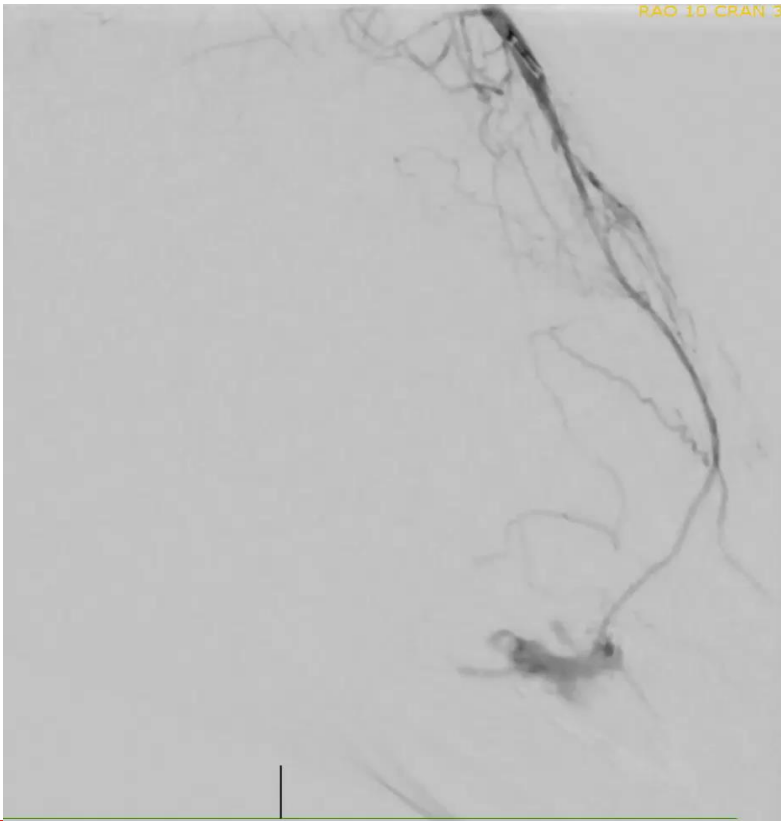
Angiograms



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Treatment 1: Attempted pedal loop recanalization on 02/04/2020



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Question

- What would you do next?
 - a. Trans metatarsal amputation
 - b. Below the knee amputation
 - c. Deep venous arterialization
 - d. Stem cell therapy



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Deep venous arterialization (DVA)

- DVA is an option in patients with Rutherford class 5 or 6 CLI who have no traditional open or endovascular revascularization options because of lack of a distal target and a desert foot. *
- The concept of using the disease-free venous bed as an alternative conduit for perfusion of the peripheral tissues with arterial blood was first published by Halstead and Vaughan in 1912 (Halstead & Vaughan, 1912). Flow in existing collateral vessels will increase, reversal of flow all the way through the capillaries improves tissue nutrition (Ozek et al., 1997) and possibly stimulates angiogenesis. (Baffour et al., 1988). *

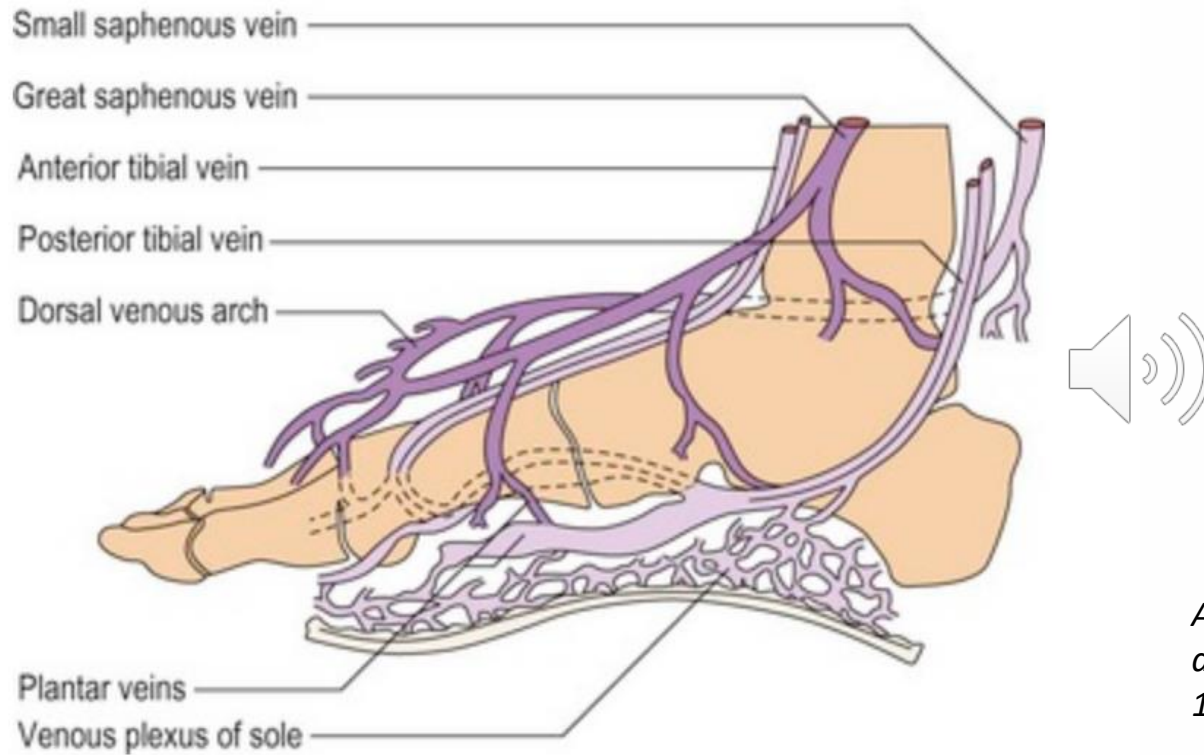
* Schreve, M. A., et al. "Promise International; a Clinical Post Marketing Trial Investigating the Percutaneous Deep Vein Arterialization (Limflow) in the Treatment of No-Option Chronic Limb Ischemia Patient." *CVIR Endovasc* 2.1 (2019): 26



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Plantar and dorsal venous arches



Adapted from: Tibbs DJ, Sabiston DC, Davies MG et al: Varicose veins, venous disorders, and lymphatic problems in the lower limbs, Oxford University Press, 1997



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Deep venous arterialization (DVA)

- A meta-analysis of the venous arterialization in patients with no-option CLI, showed a pooled limb salvage rate at 12 months of 75%.*
- In the limited amount of published experience, percutaneous DVA demonstrates <50% primary patency rate at 6 months across cohorts but 60% or higher rates of limb salvage in patients who present with critical limb ischemia without options for traditional arterial revascularization. **

* Schreve, M. A., et al. "Venous Arterialisation for Salvage of Critically Ischaemic Limbs: A Systematic Review and Meta-Analysis." *Eur J Vasc Endovasc Surg* 53.3 (2017): 387-402.

** Schreve, M. A., et al. "Promise International; a Clinical Post Marketing Trial Investigating the Percutaneous Deep Vein Arterialization (Limflow) in the Treatment of No-Option Chronic Limb Ischemia Patient." *CVIR Endovasc* 2.1 (2019): 26



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Treatment 2: percutaneous DVA on 02/21/2020

- Patient didn't qualify for the LimFlo trial as he is on immune suppressive therapy for kidney transplant.
- So, we proceeded with off the shelf percutaneous DVA



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Venous duplex

CONCLUSIONS:

Left Lower Vein Mapping: Left lower extremity vein: Medial marginal vein is visible for 17.7 mm from the medial malleolus. Diameters are as follows:
Proximal- AP-2.3 mm, T 2.2 mm
Mid- AP-2.3 mm, T 2.2 mm
Distal- 2.4 mm, T 2.3 mm

PTV diameter:

Anterior vein- AP-2.6 mm, T 2.4 mm
Posterior vein- AP- 2.6mm, T 2.4 mm

The distal anterior tibial artery is patent, antegrade, and monophasic with velocities of 69/7 cm/sec.

The distal posterior tibial artery is patent, antegrade, and monophasic with velocities of 47/8 cm/sec.



The distal peroneal artery was not patent.
The lateral plantar vein was not visualized.

Additional Findings:

Imaging & Doppler Findings:

<u>Left</u>	<u>Compress</u>	<u>Thrombus</u>	<u>Diam</u>
Dist Calf GSV	Yes	None	2.3 mm



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US guided LPV access on the plantar aspect of the foot



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Antegrade CFA access with selective BK angiogram



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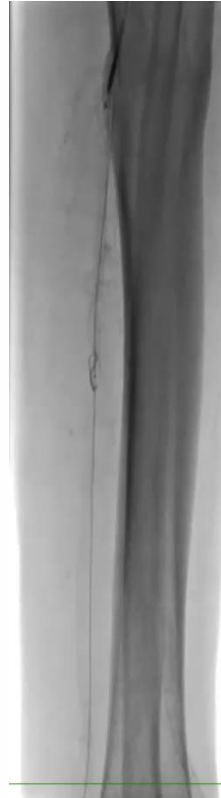
Angioplasty of the dpop, TPT and pPT



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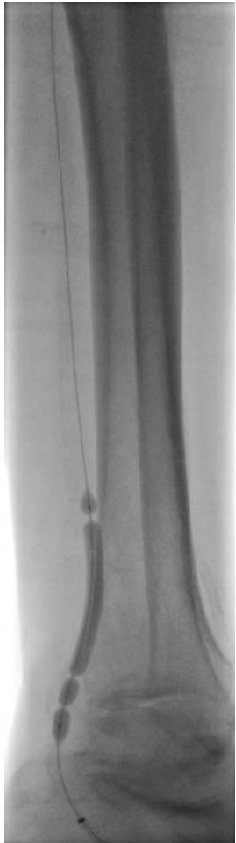
AV fistula creation between the pPTA and PTV via Outback + wire externalization



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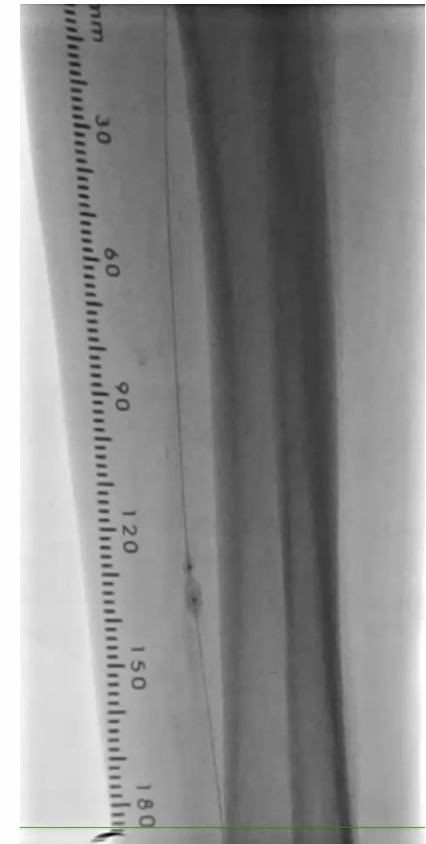
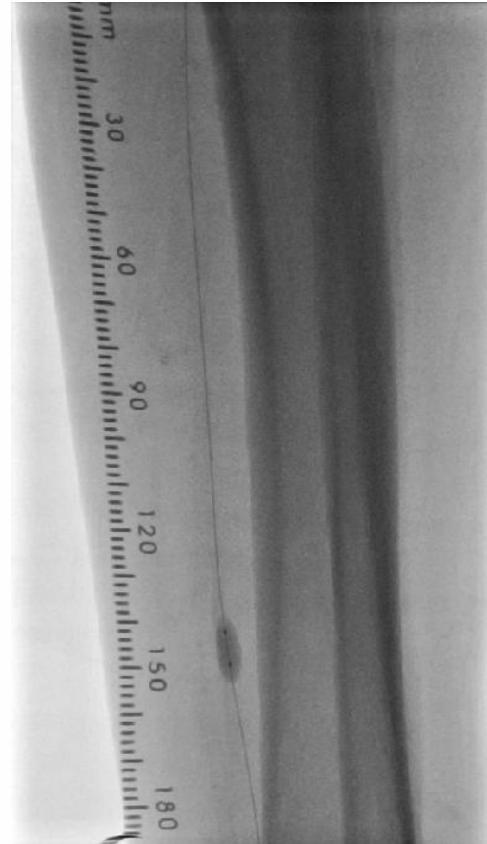
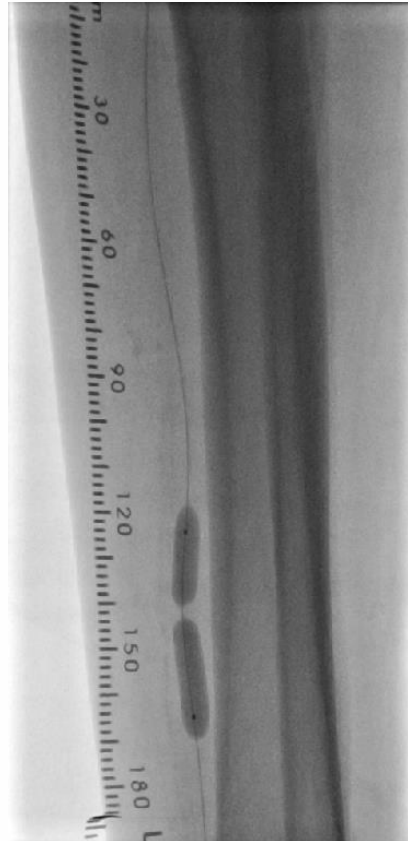
Lysis of PTV valves via angioplasty



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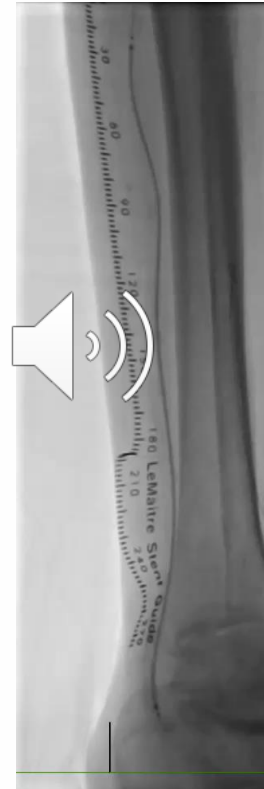
Lysis of PTV valves via angioplasty



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Venogram + Viabahn stent graft (5x250 mm + 5x150 mm)



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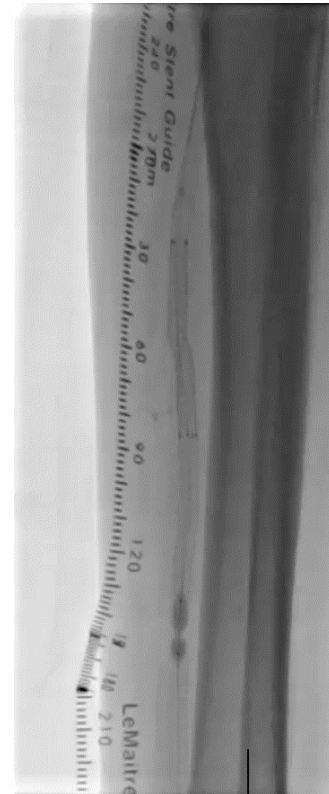
Angioplasty of the LPV and plantar venous arch



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Post stent angioplasty + angioplasty of a residual PTV valve



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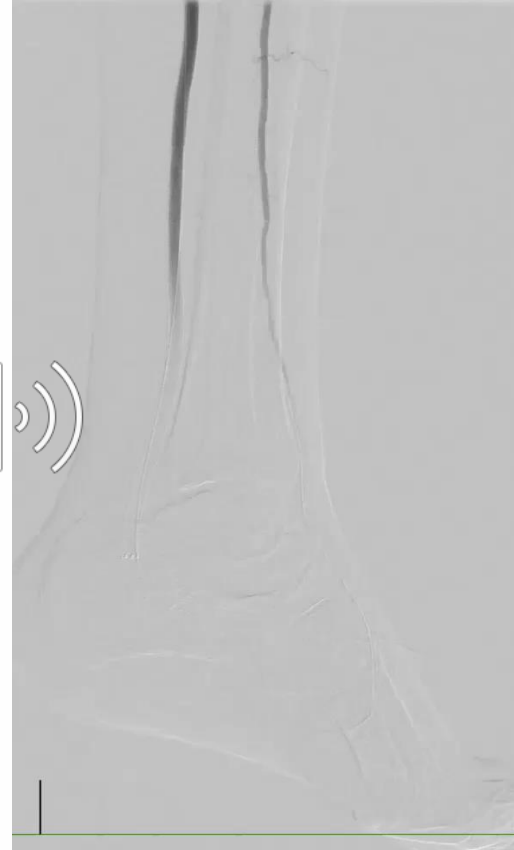
Stent of the pPT and TPT with DES (3.5x38 mm) in overlap with the Viabahn stent graft



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Completion angiogram

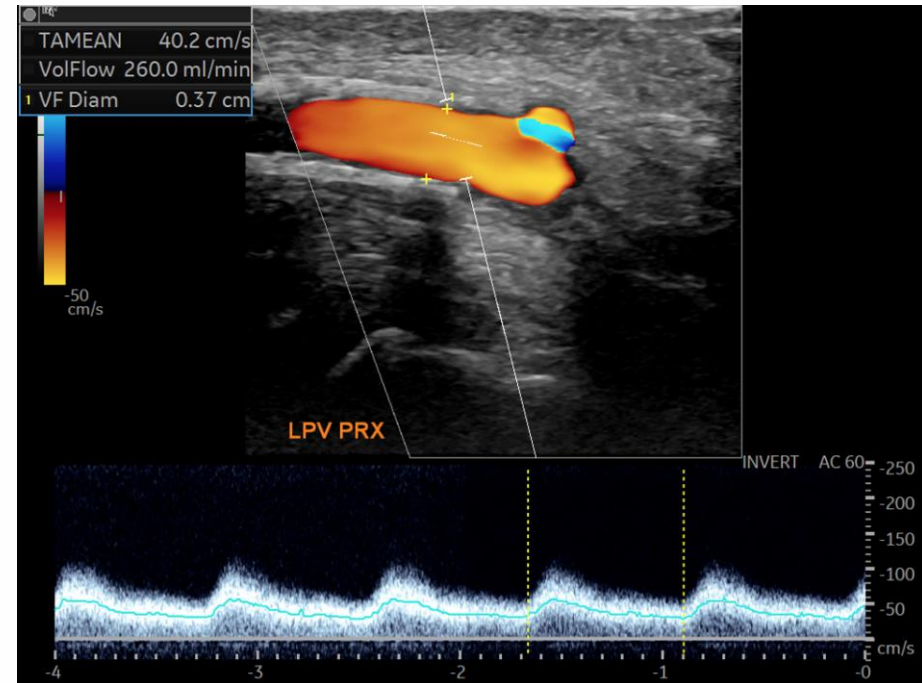


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Hospital Course and Follow-Up

- Patient left the hospital on the 4th day post procedure on Rivaroxaban, ASA and Clopidogrel to a long-term acute care facility.
- Follow up on 03/12/2020: No rest pain with well demarcated gangrene and patent stent grafts. Volume flow in the LPV at 260 ml/min
- Plan: To wait for 3 months post procedure prior to TMA



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Conclusions and Learning Points

- CLI patients are very sick patients with multiple comorbidities and at high mortality risk.
- Major amputations increase their morbidities and mortality.
- Early recognition and referral to advocated limb salvage centers with multidisciplinary team result in amputation prevention and reduction in morbidity and mortality
- Percutaneous DVA is a great option for no-option CLI patients with acceptable limb salvage rate.



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