



ARTERIAL
Symposium

July 15-17, 2021

Clinical Case

Paradoxical embolization

Dr. Nicos Labropoulos

Professor of Surgery and Radiology

Director, Vascular Laboratory

Stony Brook University Medical Center

nlabrop@yahoo.com

History of presentation

- ❖ A 67-year-old male who developed acute onset of **left lower quadrant abdominal pain accompanied by nausea and vomiting** on **10/2014**.
- ❖ The patient had a laminectomy on **October 8** and discharged on **October 12**.
- ❖ He denied fever, chills, diarrhea, dysuria, chest pain or shortness of breath.

Past Medical History

- Hypertension, hyperlipidemia, prostate cancer, severe degenerative joint disease, disc herniation
- Former smoker 40 pack years

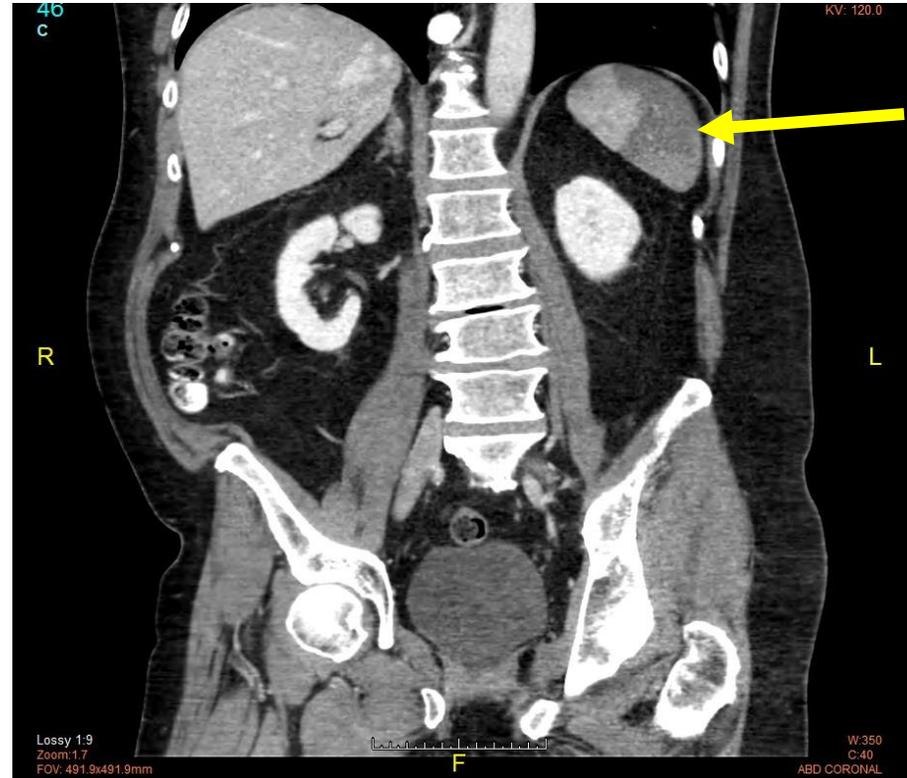
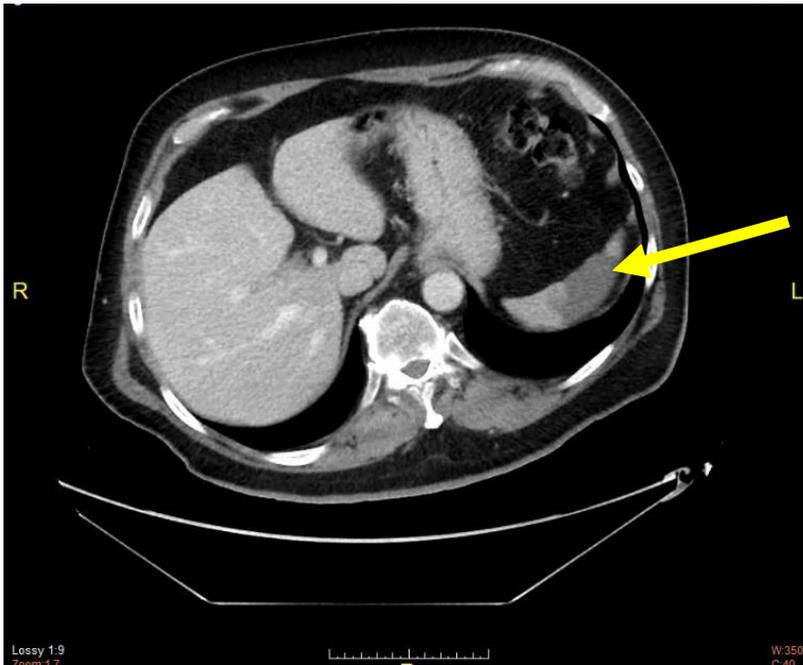
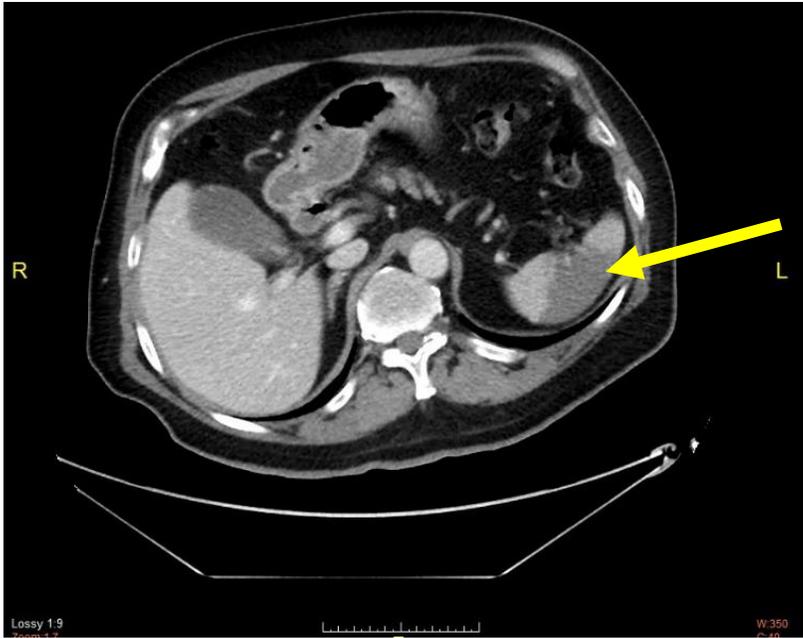
Past Surgical History

- TURP, laminectomy

Physical exam

- VS: T 37.5 HR 60 BP 138/76 R15 95% RA
- Abdomen: Soft, non-distended, diffuse mild tenderness, no rebound

CT Abdomen and pelvis on admission 10/14/2014



Acute uncomplicated diverticulitis of the sigmoid colon was diagnosed. There was no evidence of perforation or abscess formation. There were **multiple infarcts** involving most of the spleen.

- ❖ The patient was admitted and placed on antibiotics for diverticulitis.
- ❖ There was **concern for shower emboli** and EKG, echocardiogram, lower extremity venous duplex was obtained.
- ❖ **Anticoagulation was deferred** due to risk for epidural hematoma.

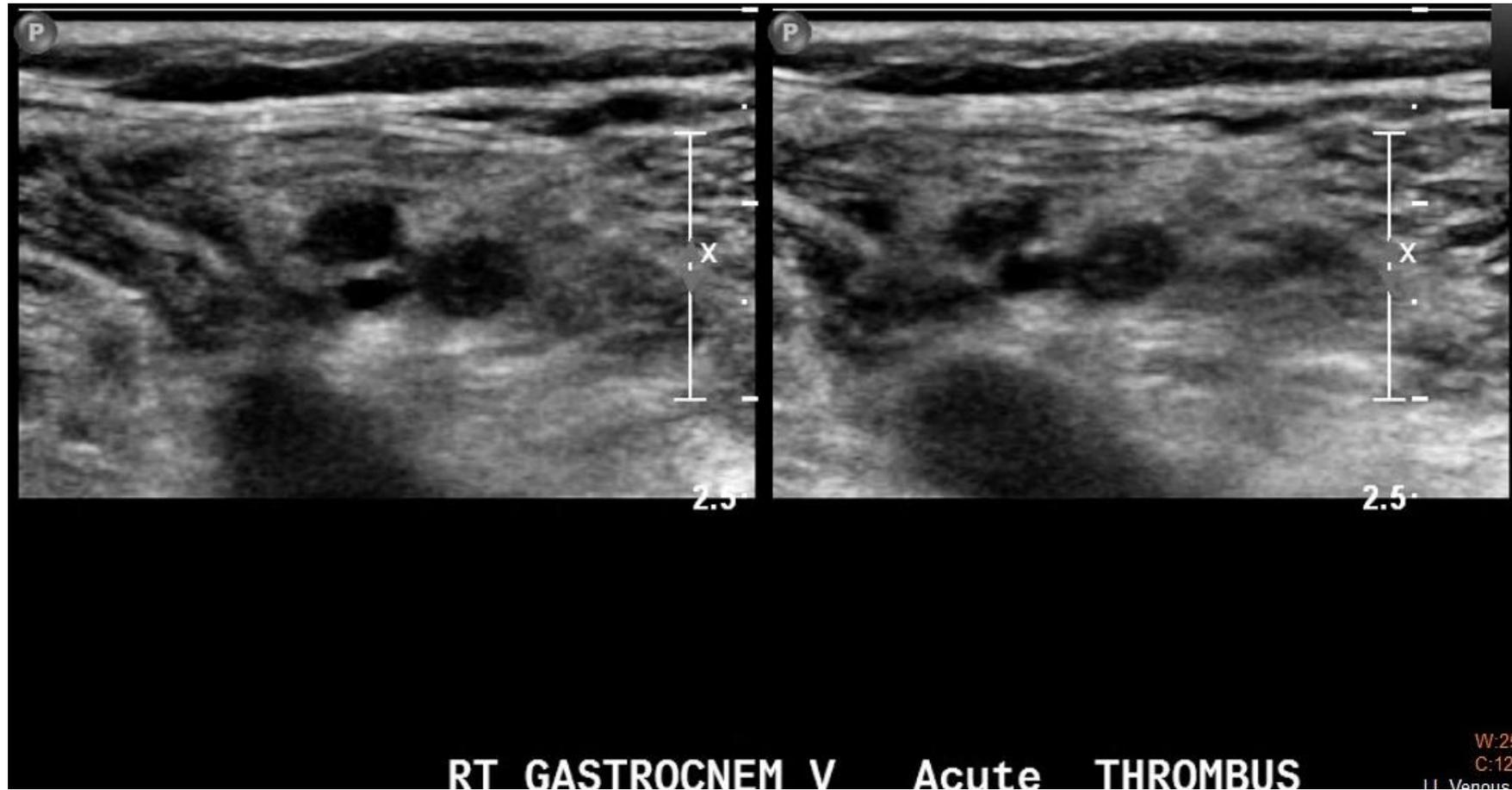
Transthoracic Echo 10/16/2014

Patent foramen ovale with atrial septal aneurysm

LE Venous Duplex 10/17/2014

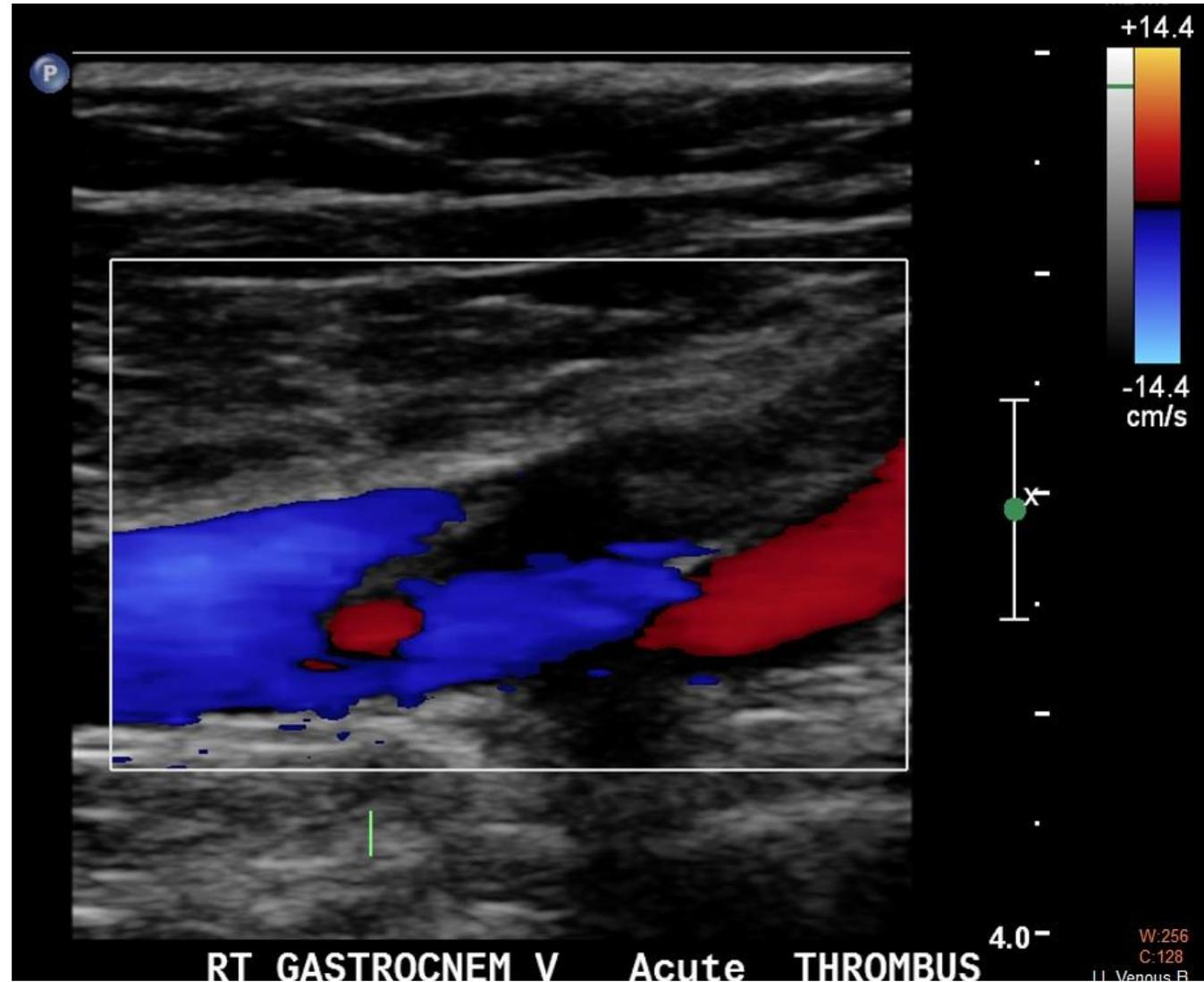
Acute thrombosis in the right popliteal and gastrocnemius veins

LE Venous Duplex 10/17/2014



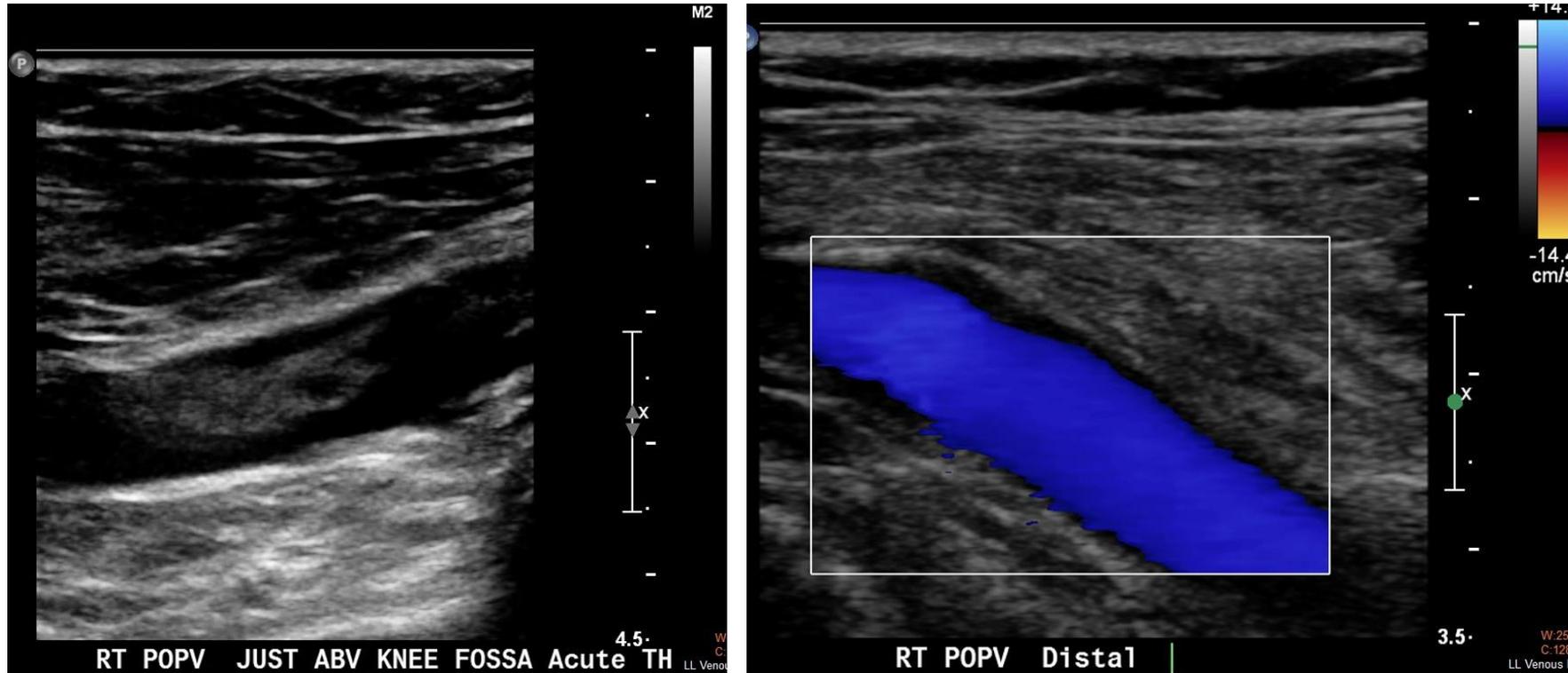
Acute thrombosis of the medial gastrocnemius veins.
The veins are dilated with homogenous, echolucent material
and are non-compressible.

LE Venous Duplex 10/17/2014



The thrombus extended in the popliteal vein.

LE Venous Duplex 10/17/2014



The **thrombus in the popliteal was free-floating** while the distal vein segment was normal indicating that the **thrombus started in the medial gastrocnemius veins** and extended into the POPV. Calf DVT may propagate to the popliteal vein or higher in **10-20%** of patients. In patients with isolated calf DVT, PE rate is around **2%**.

[Garry J, Duke A, Labropoulos N. Systematic review of the complications following isolated calf deep vein thrombosis. Br J Surg. 2016 Jun;103\(7\):789-96.](#)

[Wu AR, Garry J, Labropoulos N. Incidence of pulmonary embolism in patients with isolated calf deep vein thrombosis. J Vasc Surg Venous Lymphat Disord. 2017 Mar;5\(2\):274-279.](#)

During the venous duplex examination, it was found that **the popliteal artery was thrombosed**. Then a complete bilateral arterial duplex examination was performed.

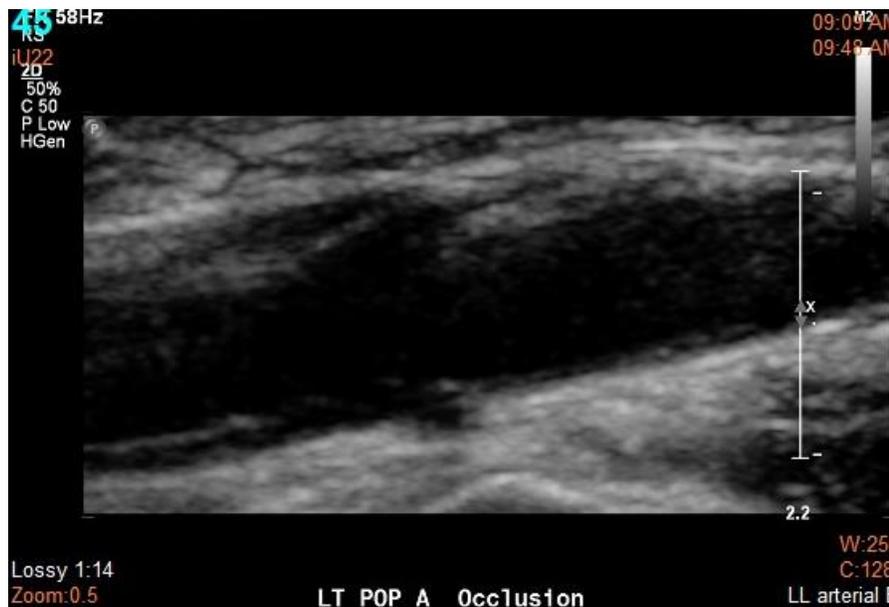
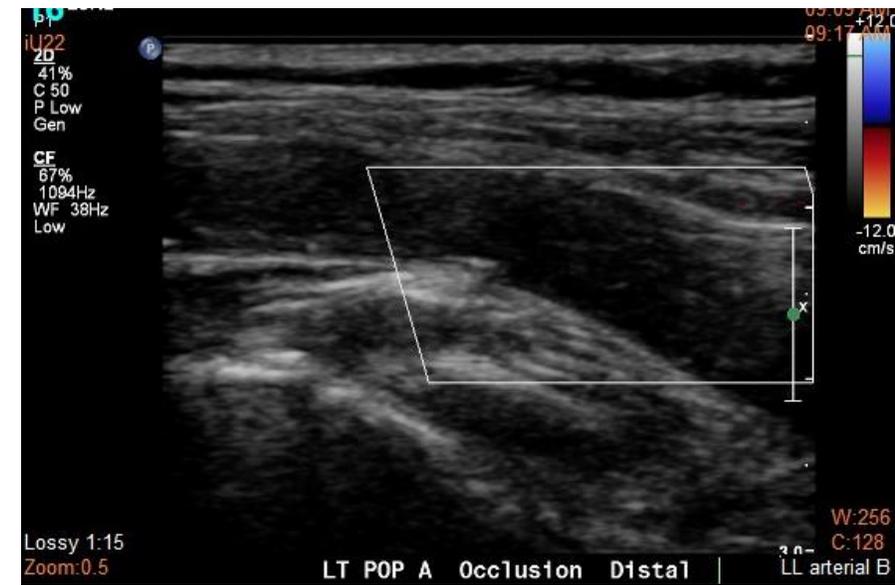
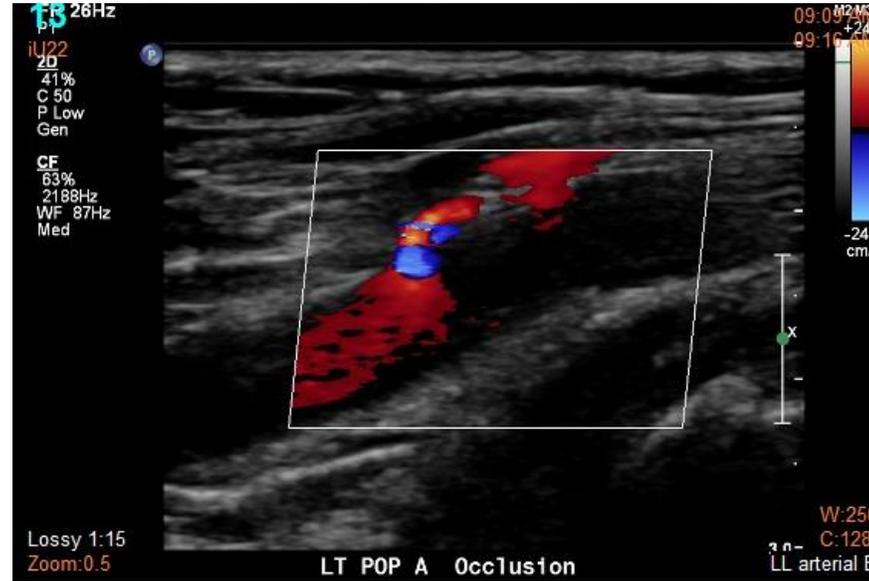
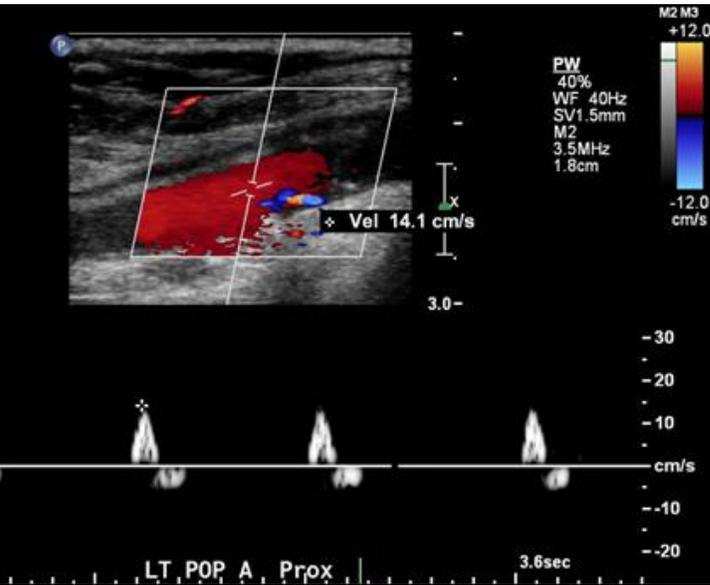
On examination the left lower extremity was cooler but not with threatening limb ischemia.

Arterial Duplex 10/17/2014

- ❖ Acute occlusion of the left popliteal artery and tibioperoneal trunk.
- ❖ The proximal posterior tibial, anterior tibial and peroneal artery were occluded.
- ❖ Low flow was detected in the mid peroneal and anterior tibial.

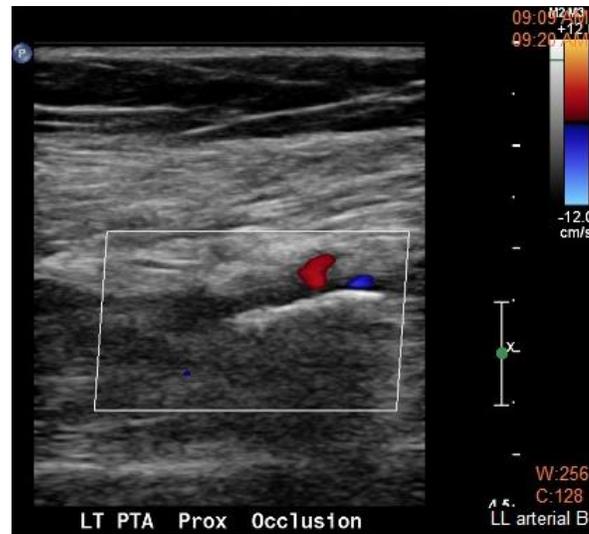
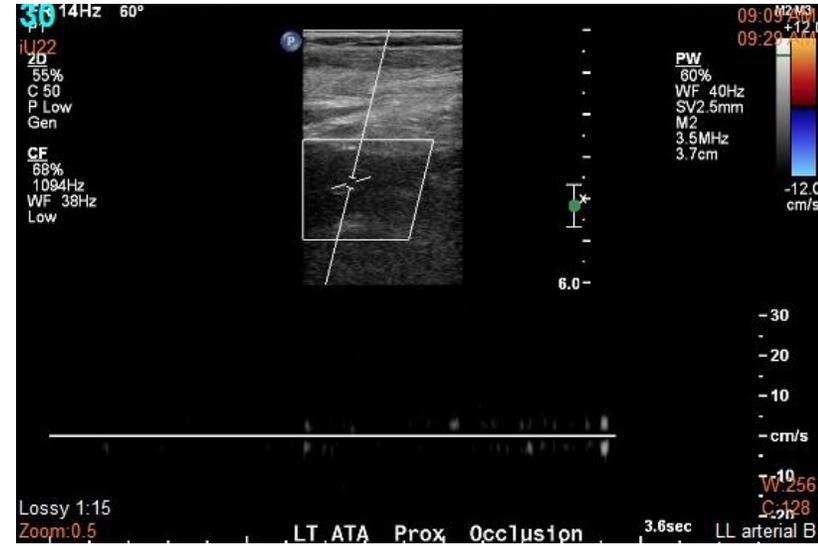
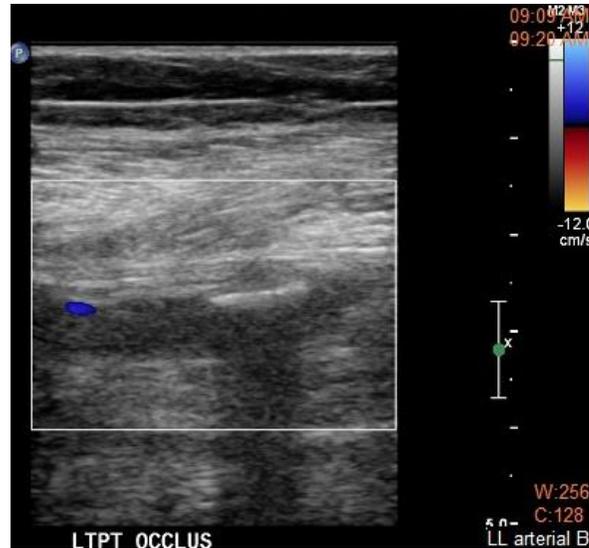
Arterial Duplex 10/17/2014

Low flow just before the occlusion



Acute occlusion of the left popliteal artery.
There is absence of color and no plaque is seen.
According to the findings this is an **embolic occlusion**.

Arterial Duplex 10/17/2014



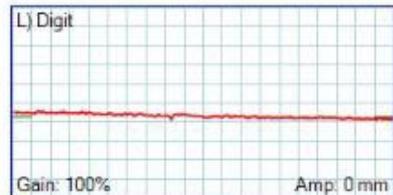
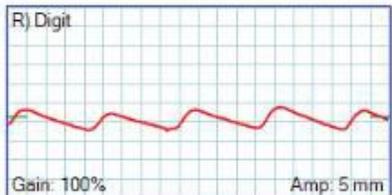
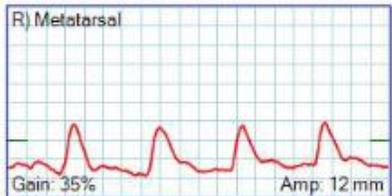
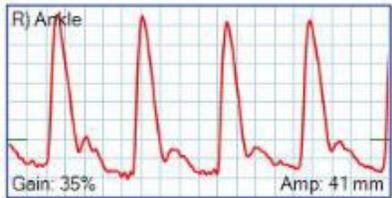
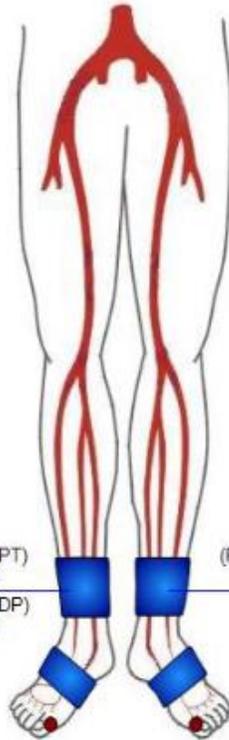
Acute occlusion of the tibioperoneal trunk and the proximal PTA, ATA and peroneal arteries. There is absence of color flow and Doppler signal.

Arterial Duplex 10/17/2014



Low flow in the distal ATA. There is a delay in the rise to PSV, low PSV, lack of flow reversal and prolonged EDV. This is due to the acute occlusion of the POPA, TPT, and proximal PTA, ATA and peroneal arteries.

ABI 10/18/2014

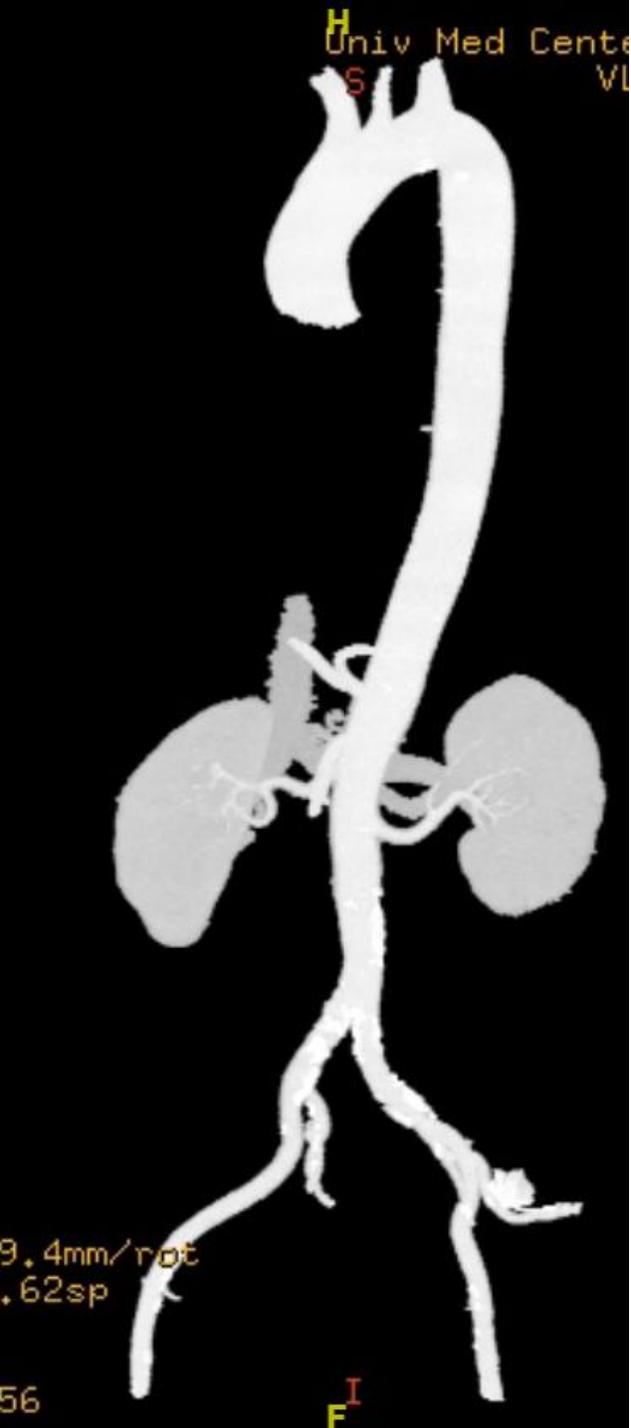


189 (PT) 1.44
169 (DP) 1.29

(PT) 43 0.33

1.44 **Ankle/Brachial Index** 0.33

Reduced pressure in the left lower limb with an ABI of 0.33



CTA 10/19/2014

No thrombus, significant stenosis, or aneurysm were found in the aorta and iliac arteries.

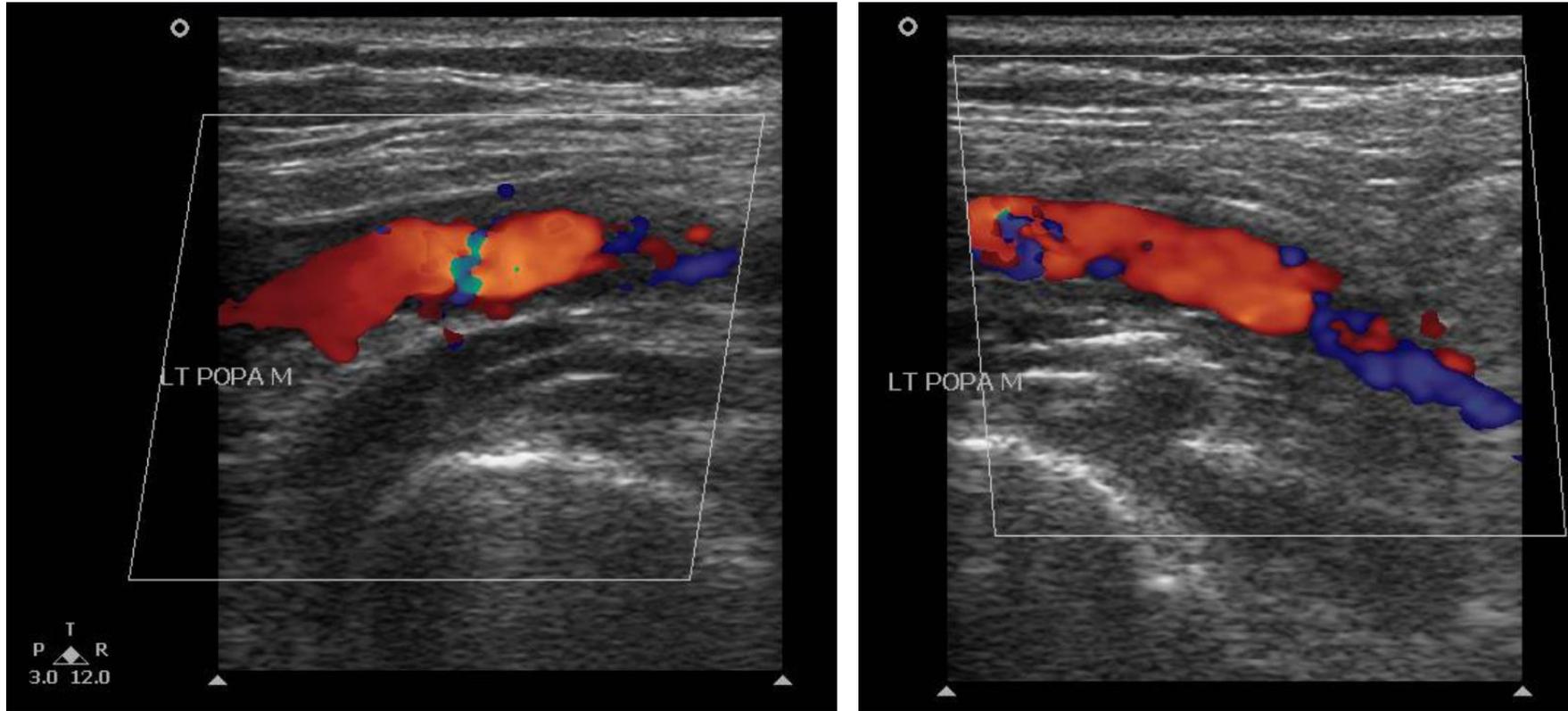
Anticoagulation since 10/17/2014

DVT

Arterial thrombosis

Symptoms improved within a week

Arterial Duplex 1/20/2015



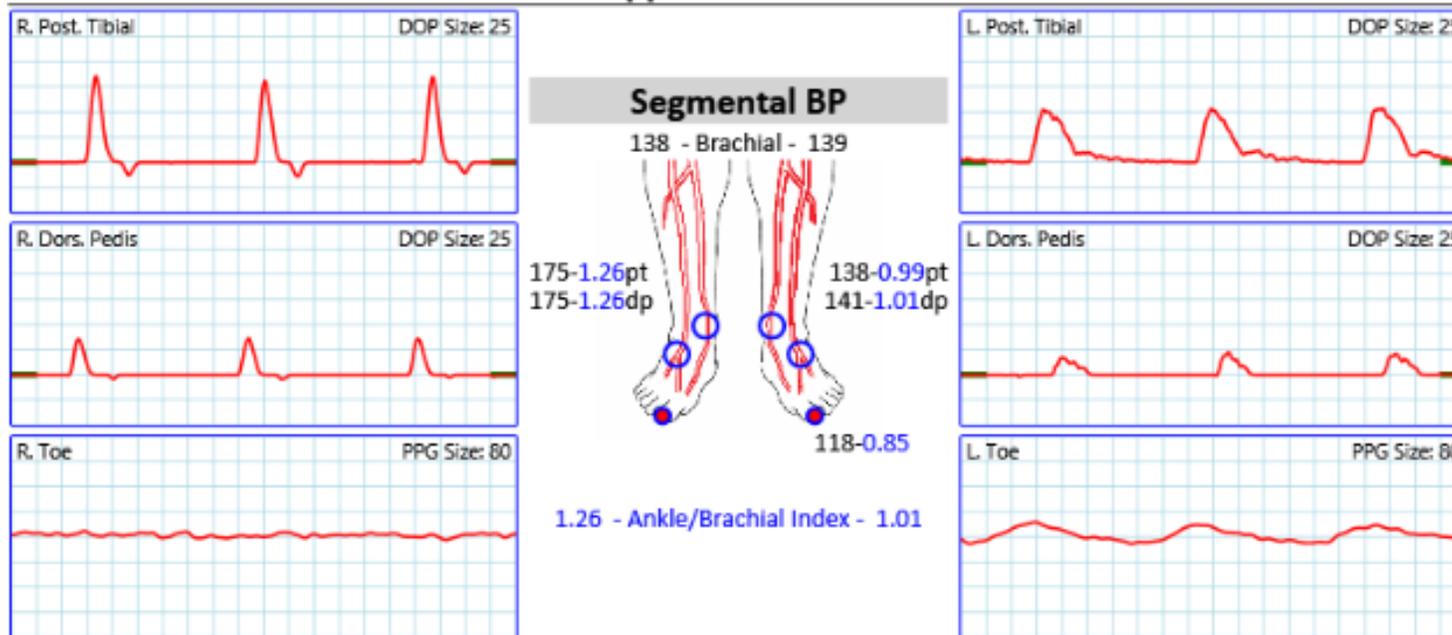
Popliteal and all other artery almost fully recanalized and an ABI of 0.9.

ABI 4/12/2016

Lower Arterial Segmental Pressures

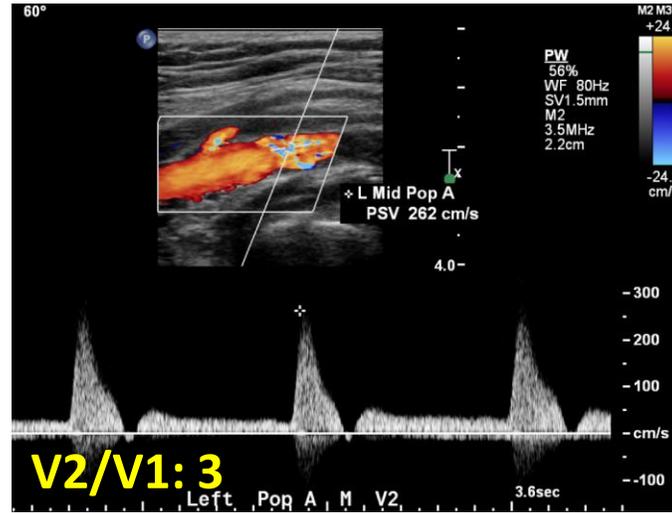
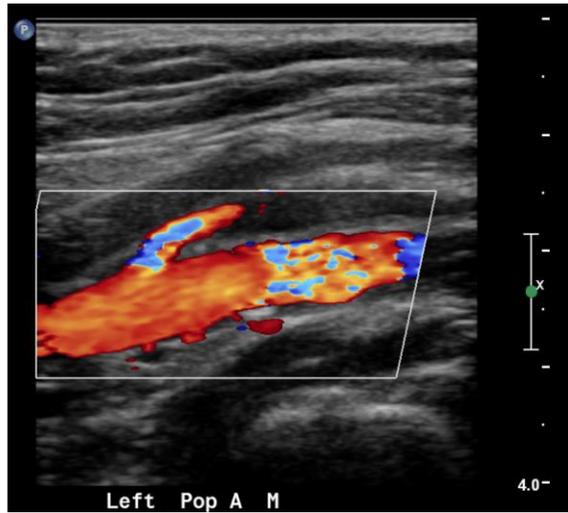
Right		Left
138	Brachial	139
175 - 1.26	Ankle (PT)	138 - 0.99
175 - 1.26	Ankle (DP)	141 - 1.01
	Toe	118 - 0.85

Doppler Waveforms

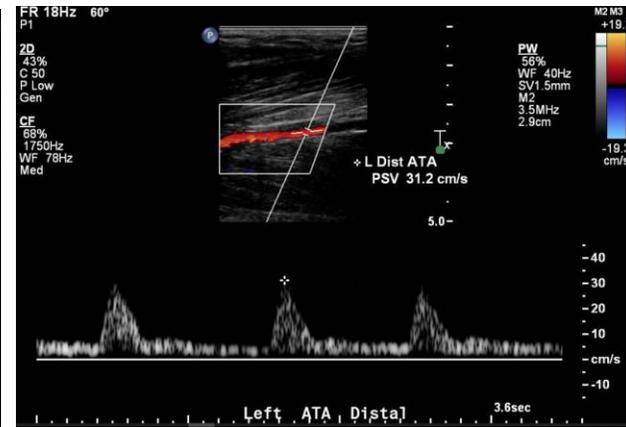
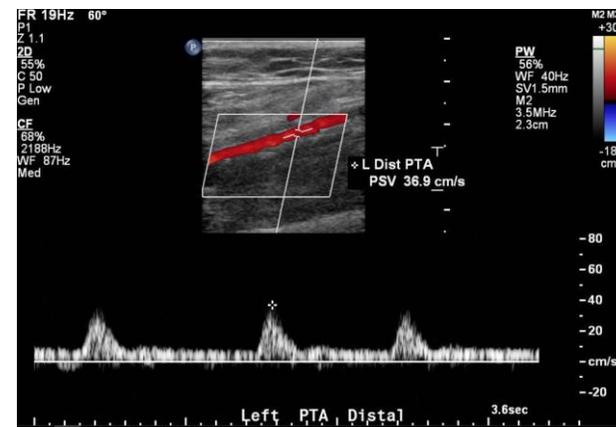


ABI remained normal 18 months after the event.

Arterial Duplex 5/22/2018



Focal stenosis



Stenosis in the left popliteal artery but not compromised flow distally. No intervention was planned. Conservative treatment until now and the patient 7 years after the event remains stable.

Elements for paradoxical embolism

Systemic embolism confirmed by clinical, angiographic, or pathologic findings without an apparent source on the left side of the heart or in the ascending aorta.

Embolic source is within the venous system.

Abnormal intracardiac or intrapulmonary communication between the right and left circulations – **most common cause is PFO found in about a third of people**
Other causes include: Atrial and ventral septal defects, pulmonary arteriovenous malformation, systemic to pulmonary venous communication, arterio-arterial communication or veno-venous communication.

Pressure gradient that promotes a right-to-left shunt at some point during the cardiac cycle.

Best diagnostic method for cardiac causes is **TEE** other methods include: TTE, TCD, CT, MRI and ear oximetry.

[Windecker S, et al. Paradoxical embolism. J Am Coll Cardiol. 2014;64:403-15.](#)

[Saremi F, et al. Paradoxical embolism: role of imaging in diagnosis and treatment planning. Radiographics. 2014 Oct;34\(6\):1571-92.](#)