Advances in Limb Salvage

David Vogel MD

Vascular and Interventional Specialists

Disclosures

- None related to this topic

Peripheral vascular disease Overview

- Late identification + inconsistency of care lead to high cost and highly variable outcomes

200+ MILLION

12+ MILLION

74% OF AT-RISK PATIENTS ARE UNAWARE OF PAD AS A DISEASE

95% HAVE AT LEAST 1 OTHER CHRONIC DISEASE

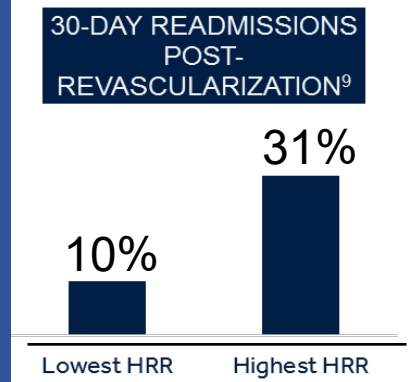
50% HAVE UNRECOGNIZED SYMPTOMS AND MAY PROGRESS DIRECTLY TO CLI

140,000 AMPUTATIONS OCCUR EACH YEAR DUE TO PAD IN US ALONE

55% OF CLI PATIENTS RECEIVE NO INTERVENTION WITHIN 3-YRS POST-DIAGNOSIS

3% OR FEWER PAD PATIENTS RECEIVE ANY ENDOVASCULAR THERAPY/YR

30-DAY READMISSIONS POST-REVASCULARIZATION[9]



HHR= Hospital Readmission Rate

47% 90-DAY READMISSION RATE FOR CLI[7^]

*Patients who readmit have an average of 1.57 readmissions

$100K ANNUAL MEDICARE SPEND PER CLI PATIENT[7**]

**12 month episode of care for endovascular procedure

PAD DIAGNOSIS MAY BE OVERLOOKID UNTIL WOUNDS ARE PRESENT

~300,000
PAD PATIENTS NEWLY DEVELOP **REST PAIN, WOUNDS OR GANGRENE** EACH YEAR

89%
OF CLI PATIENTS REPORT AN **ULCER AS THEIR FIRST RECOGNIZED SYMPTOM**

3-6
MONTHS
AVERAGE TIME PATIENTS WAIT **BEFORE STARTING WOUND CARE**

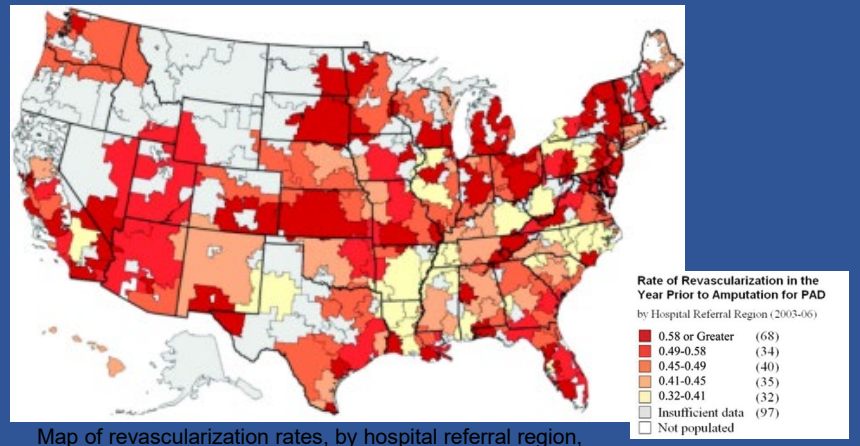
2-10
YEARS
TIME FRAME FROM 1ST PATIENT REPORTED **SYMPTOMS TO PAD DIAGNOSIS**

1 IN 5

PAD PROCEDURES
EACH YEAR
INVOLVES AN AMPUTATION

~54%

OF PAD PATIENTS WHO UNDERWENT
MAJOR LEG AMPUTATION
WERE NOT REVASCULARIZED
IN THE YEAR
PRIOR TO AMPUTATION



Map of revascularization rates, by hospital referral region, from 2003 to 2006.

Smokers + diabetics over age 50 at greatest risk of PAD

1. SCREEN FOR PAD RISK FACTORS[5]

50+

- ☑ ADVANCED AGE
- ☑ SMOKING
- ☑ DIABETES
- ☑ HISTORY OF HEART ATTACK OR STROKE
- ☑ HIGH CHOLESTEROL
- ☑ HIGH BLOOD PRESSURE

Leg pain, sleep disruption + skin changes are warning signs of pad

2. INQUIRE ABOUT PRESENCE OF PAD SYMPTOMS

SYMPTOMS MAY INCLUDE:

FATIGUE

- Fatigue in legs when active
- Limiting activity due to fatigue

PAIN OR CRAMPING

- That disrupts sleep and is alleviated by lowering feet

SKIN CHANGES

- In texture or pale/blue in color

LOWER TEMP

- Cooler temperature or less sensation in leg or foot

POOR GROWTH

- Poor growth of nails or hair on legs and feet

SUSPICIOUS SORES

- Presence of calluses, blisters, or non-healing wounds

Prompt diagnosis and treatment of foot infection are recommended to avoid amputation

3. CHECK LEGS + FEET FOR SIGNS OF PAD

PHYSICAL EXAM
OF THE LEGS, FEET AND TOES

- Weak or absent peripheral pulses
- Skin integrity or presence of wounds
- Signs of limb ischemia

Cost of a Below knee amputation or Above knee amputation

- First year cost of AKA or BKA $89,808 (2000-2014 data)

- BMJ Open. 2019; 9(1): e024963.

Mortality rates of amputations

1 yr mortality

- 25.5 % bka
- 49.4% aka

- Rutherford 7th ed ch 115

5 yr Mortality rate

- BKA- 62.2%
- AKA- 78.5%

- Rutherford 7th ed ch 115

Ambulation Rate

- 80% in BKA
- 38-50% AKA

BKA and AKA are not definitive therapy

- 9.4-19.6% require revision

Benefits of Revascularization

- Mayo Clinic reported 50% drop in major amputation rate after revascularization open and endovascular

- Rutherford section 15 ch 114 7th ed

Preop imaging

Non-invasive vascular studies

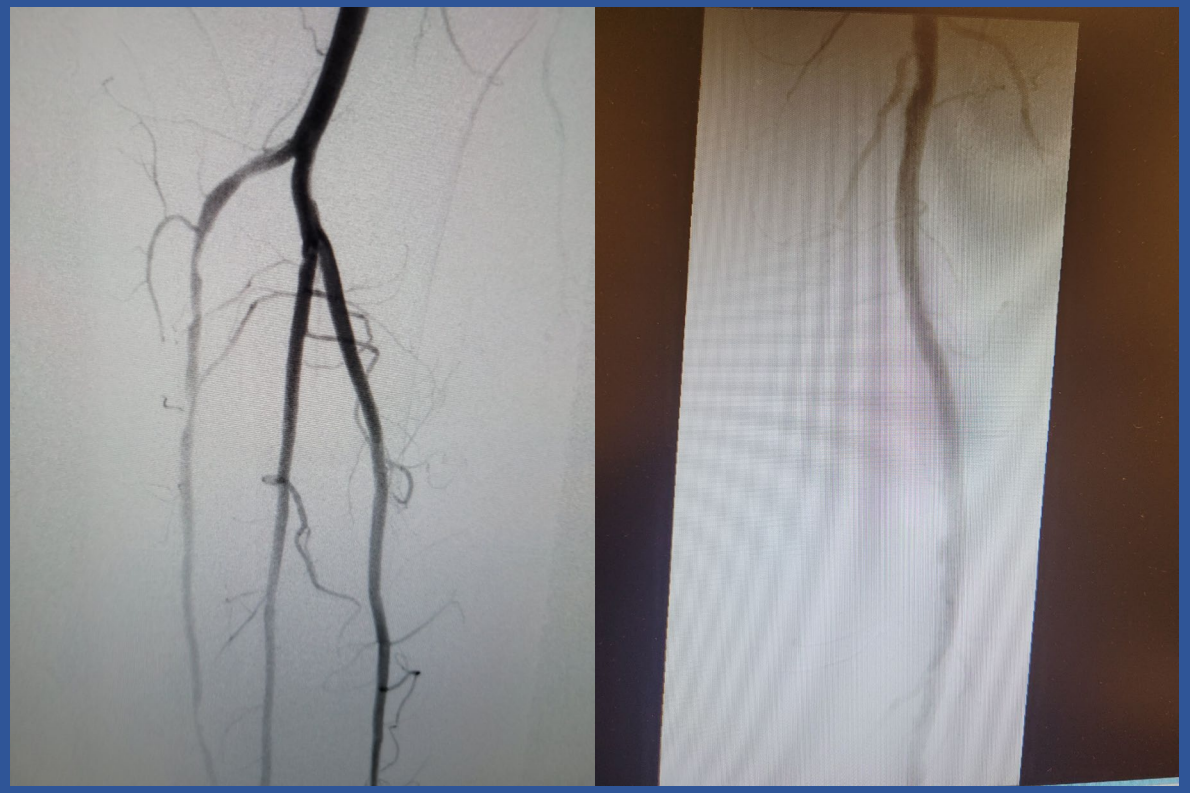
- Arterial physiological studies
  - Arterial doppler waveforms
  - Arterial segmental pressures
  - Pulse volume recordings
- Arterial duplex
  - Actual ultrasound imaging
  - Doppler waveforms
  - Color doppler
- ABIs not reliable in diabetic population

CT angiography

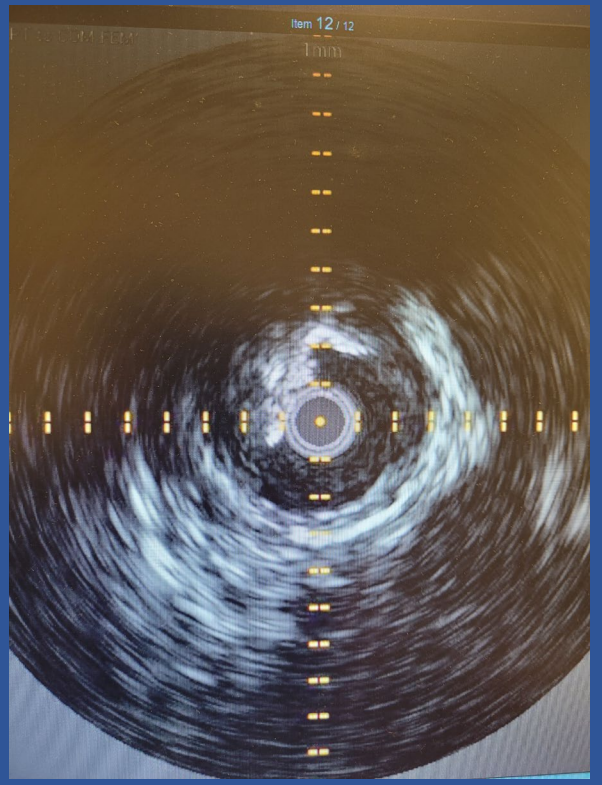
- CT with 1-2 mm slice thickness in an arterial phase of contrast
- Good for imaging aorta, iliac arteries and femoral/popliteal segments
- Limiting in imaging tibial vessels secondary to small size and calcium in diabetics

Intraop Multimodality imaging

Angiography/CO2 Angiography



Intra Vascular Ultrasound



Treatment

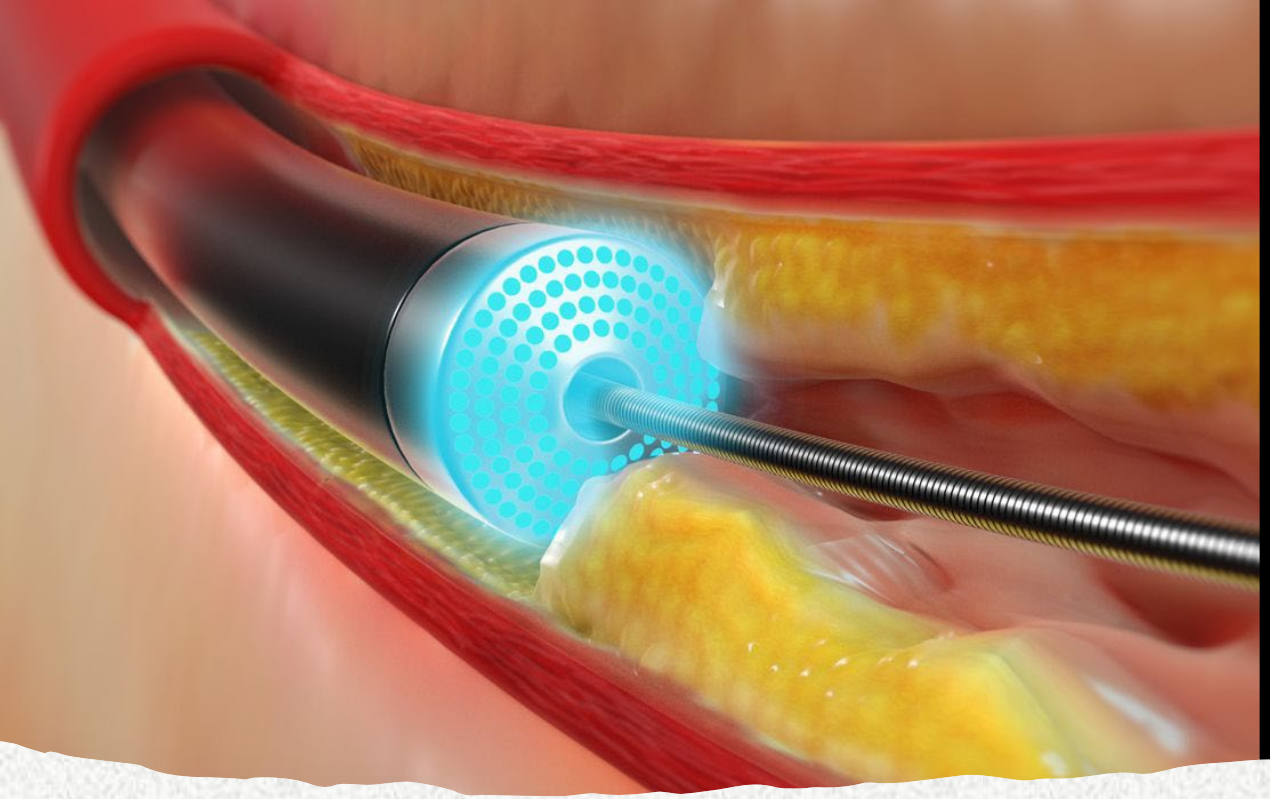
Stenting

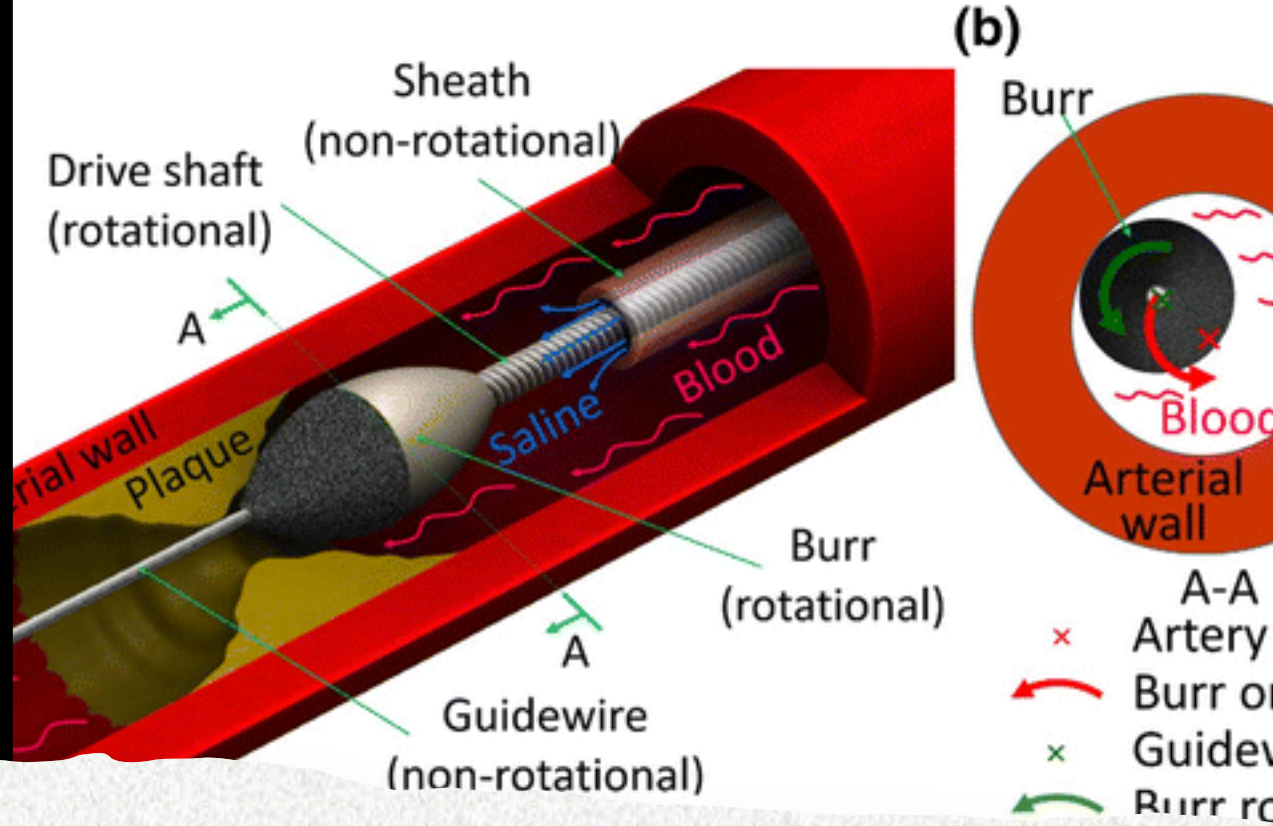
- Drug eluting stents
- Regular stents
- Covered Stents

Treatment

Atherectomy

- Laser
- Orbital
- Rotational
- Directional





LASER ATHERECTOMY

ORBITAL ATHERECTOMY

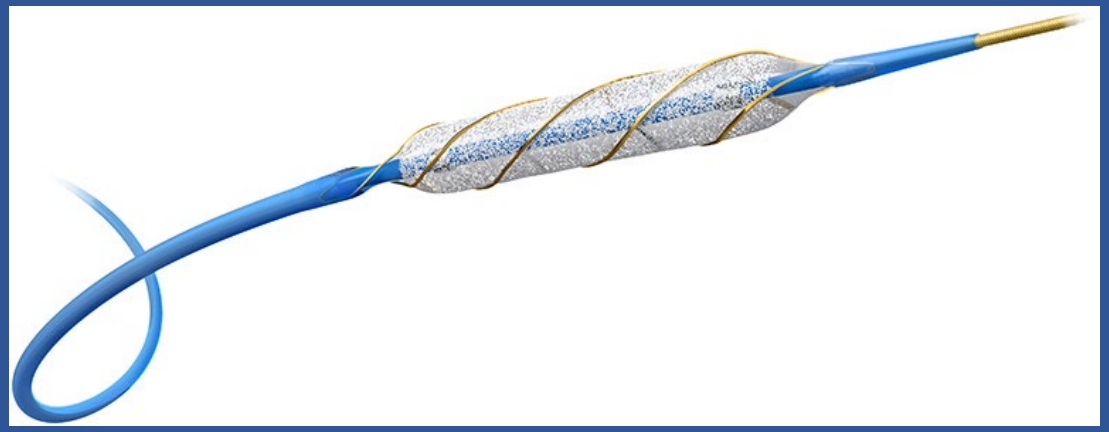
ROTATIONAL ATHERECTOMY

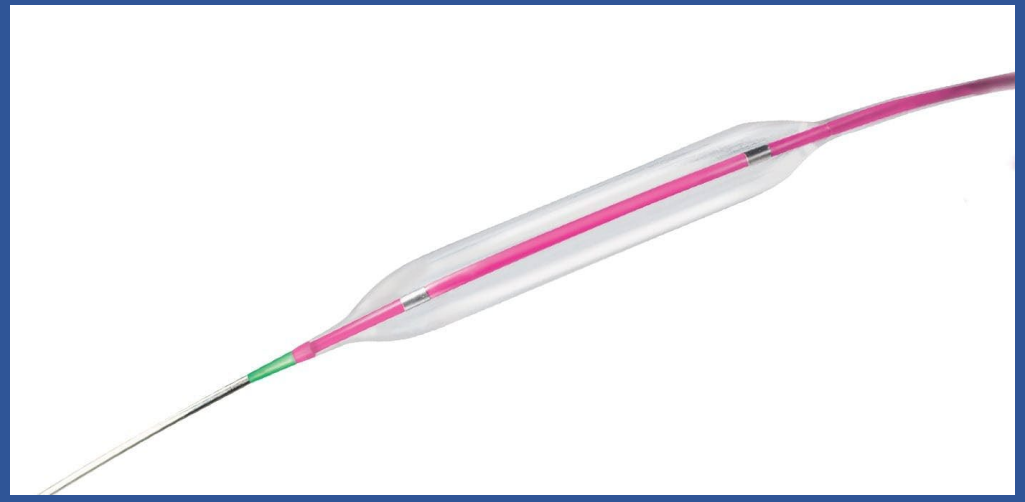
DIRECTIONAL ATHERECTOMY

Treatment

Balloons

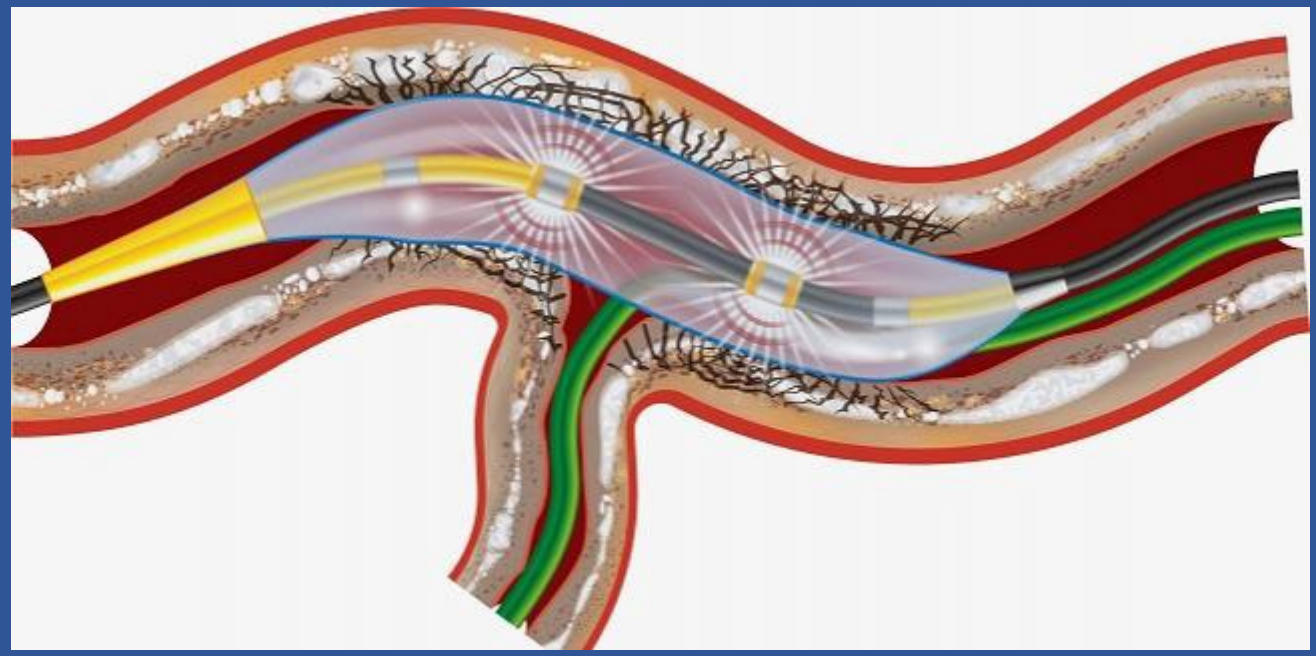
- Scoring balloons
- Drug coated balloon
- Non-compliant balloons





Treatment

Intravascular lithotripsy



84 y/o male, DM2, no tobacco use

PRE

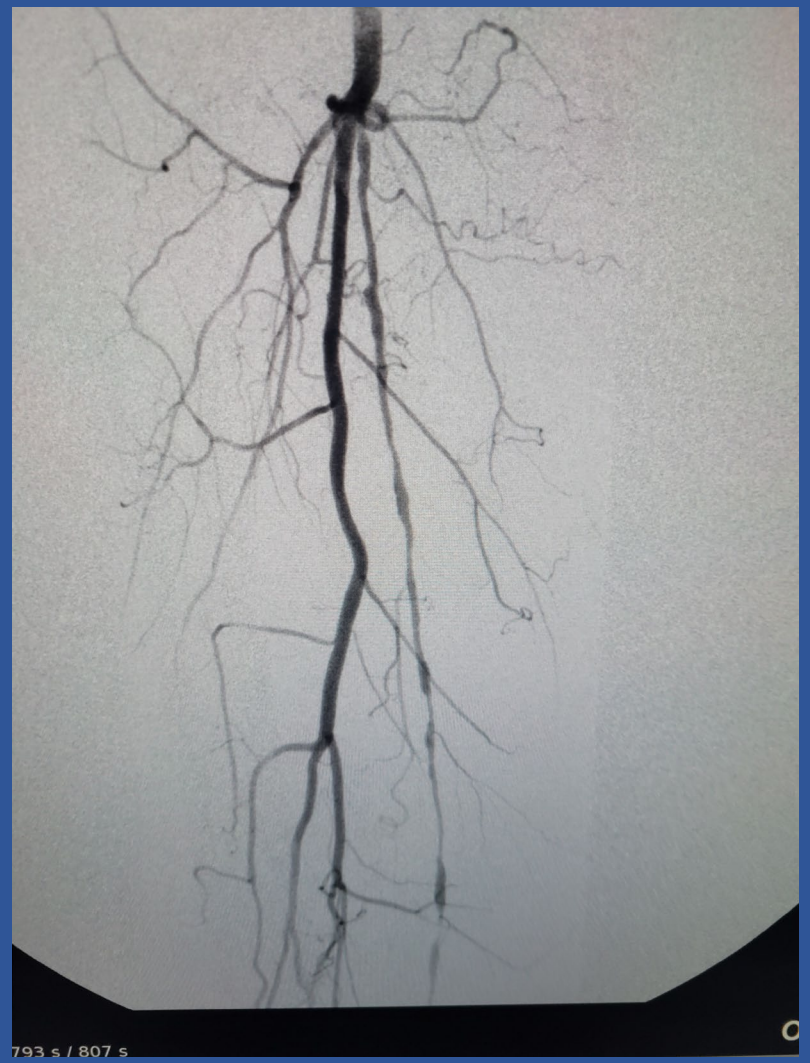
POST

PRE

POST

56 y/o female DM2, h/o tobacco use, recurrent great toe ulcers

PRE



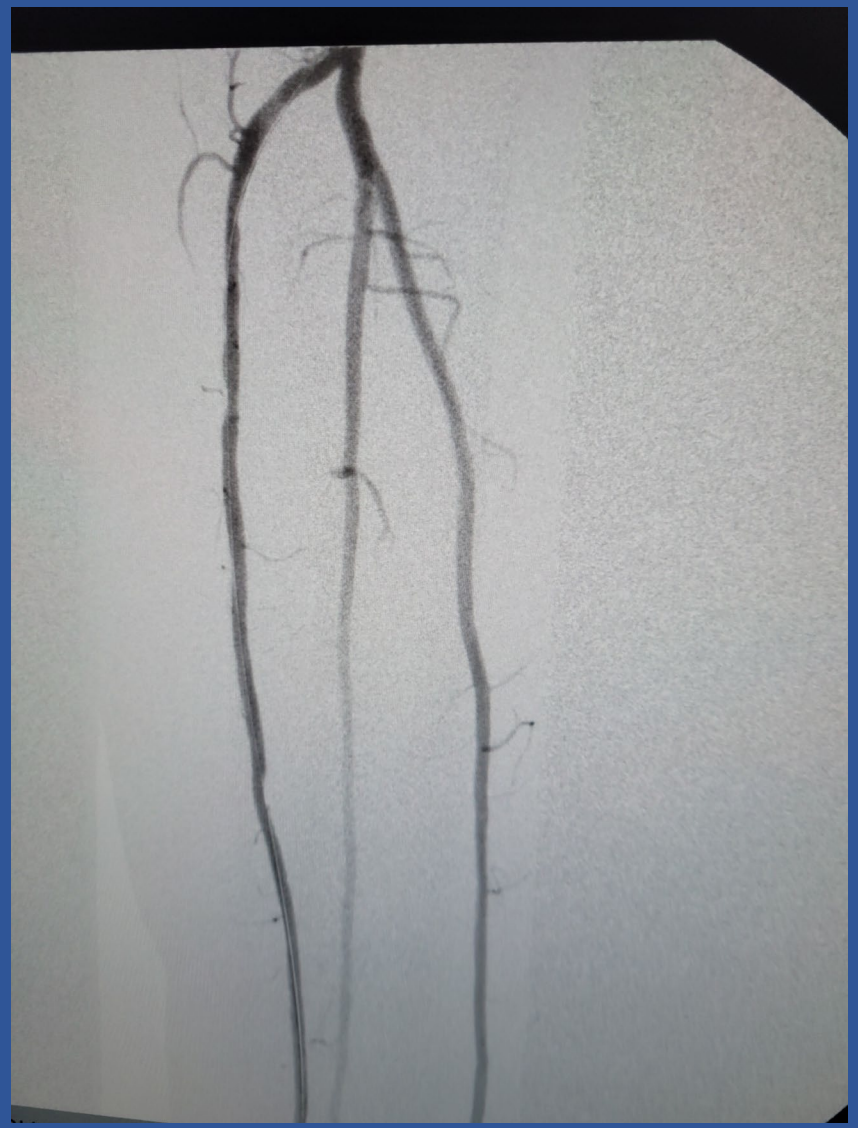
POST

PRE

40 y/o male DM1, ESRD bilateral foot ulcers

RIGHT LEG

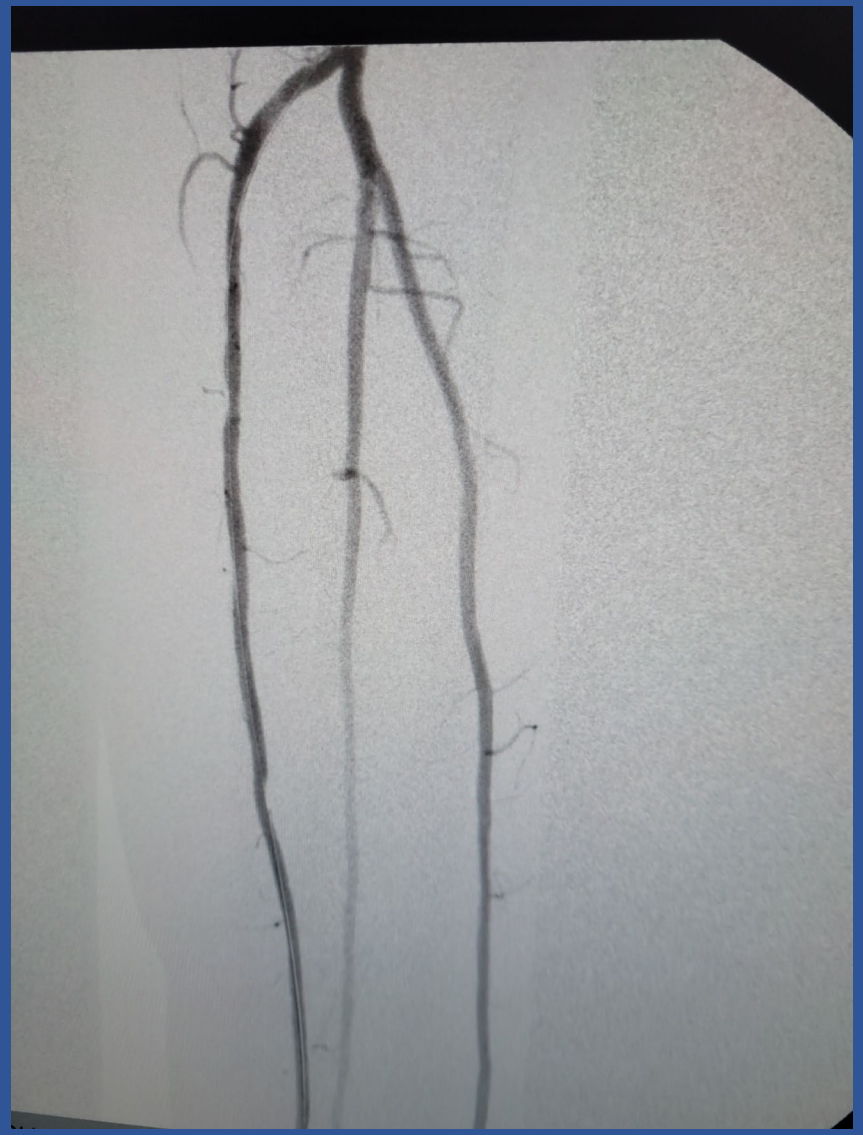
PRE



POST

RIGHT LEG

PRE



POST

RIGHT LEG

PRE

POST

LEFT LEG

Pre

Post

65 y/o male DM1, kidney transplant non-healing wound 3 months

RIGHT FOOT

Pre

Post

Pre

Post

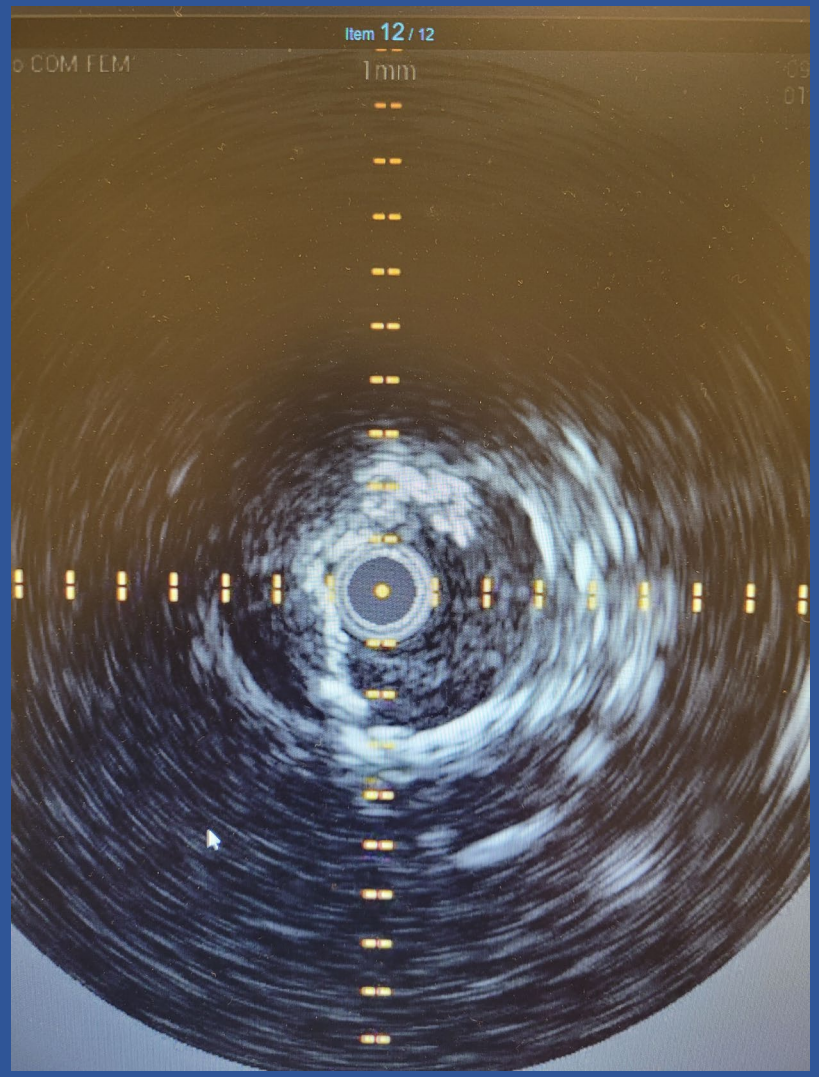
87 y/o male DM, stage 3 CKD

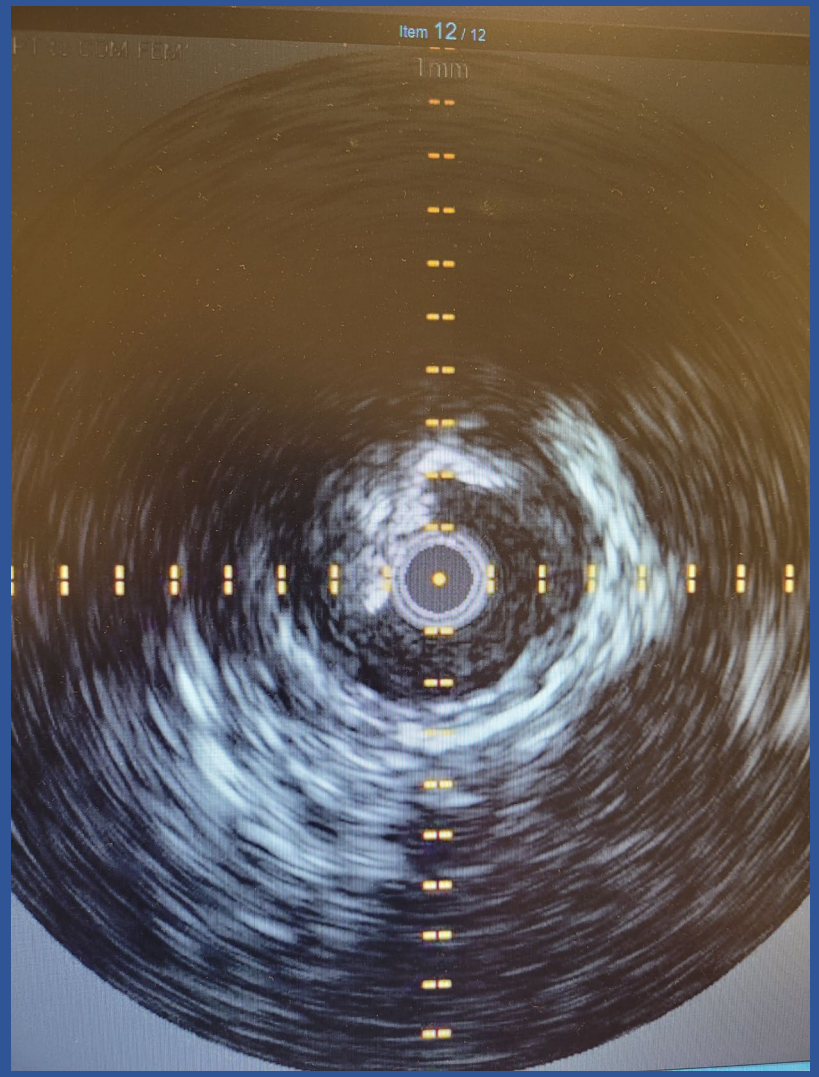
Angiograms pre treatment

Traditional Contrast

CO2 angiography

IVUS



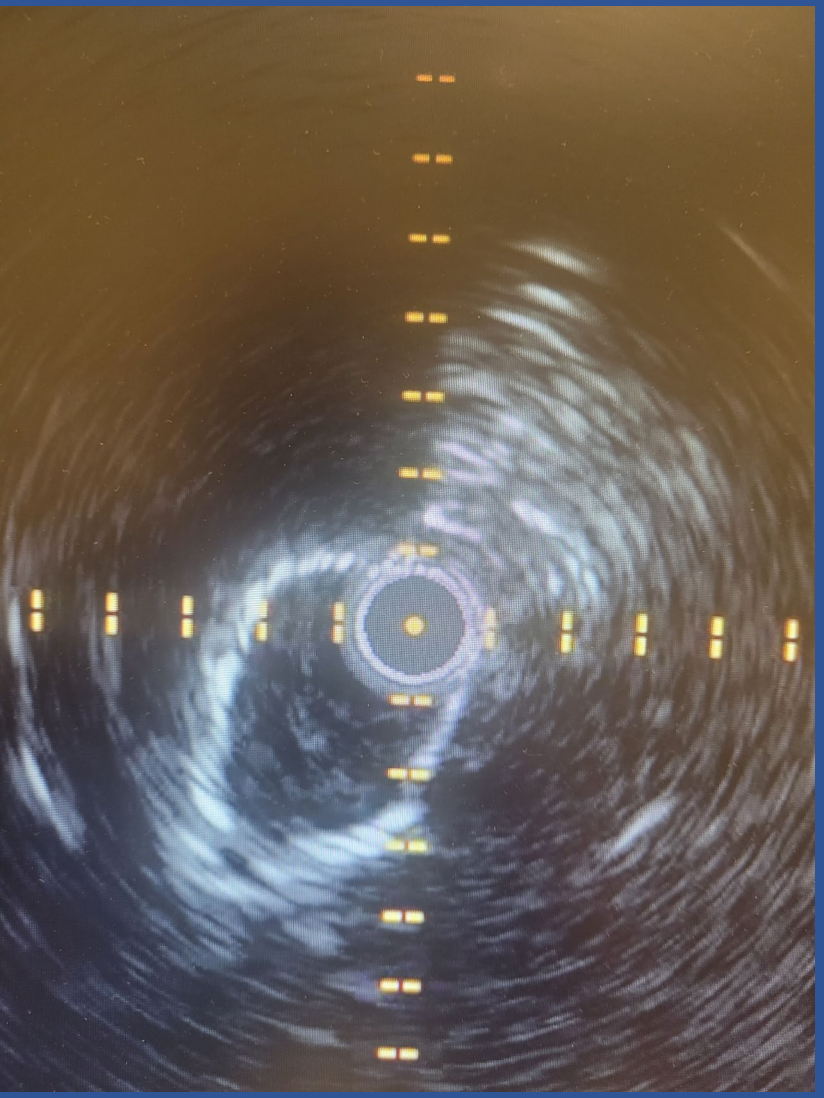


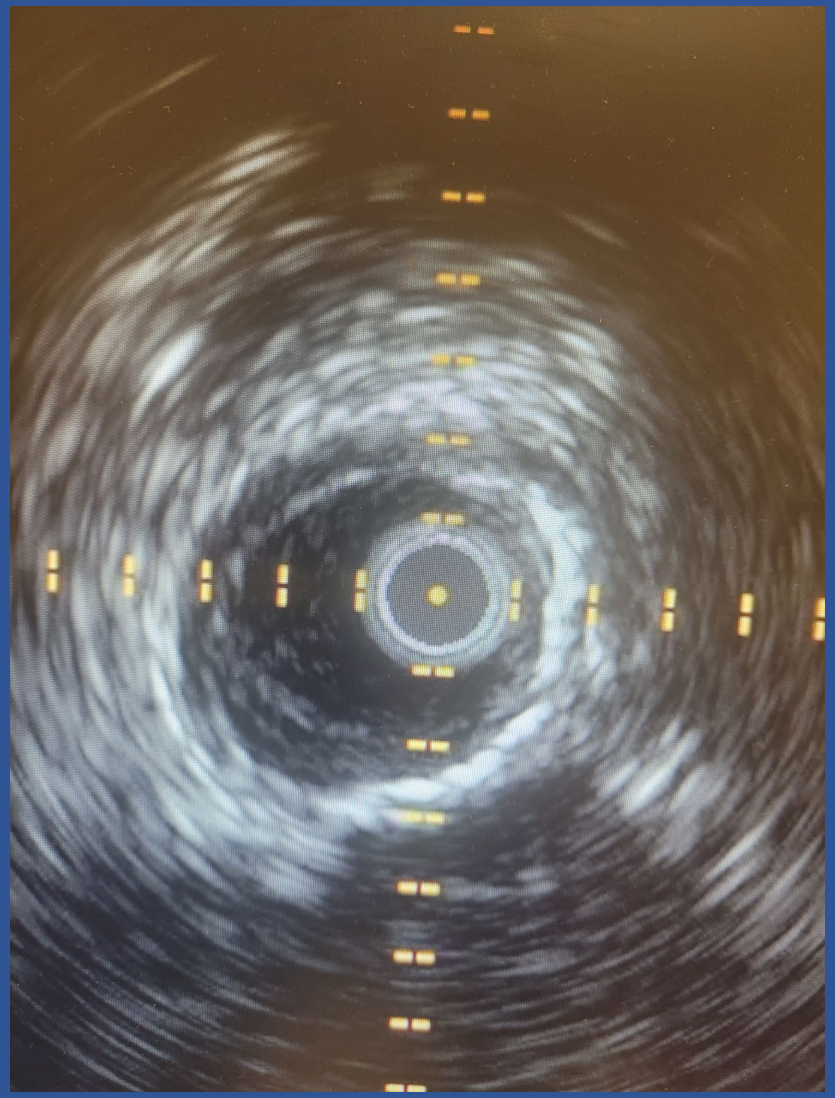
POST

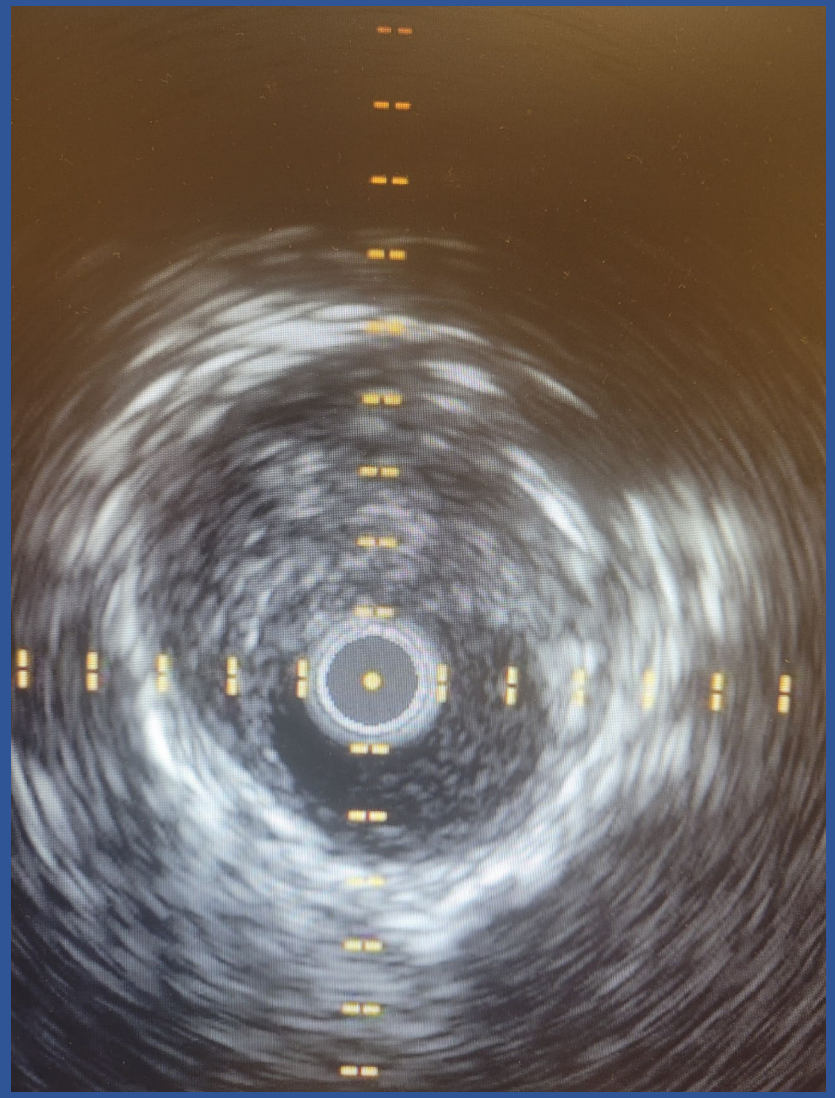
83 y/o DM2, h/o tobacco use

Angiograms pre treatment

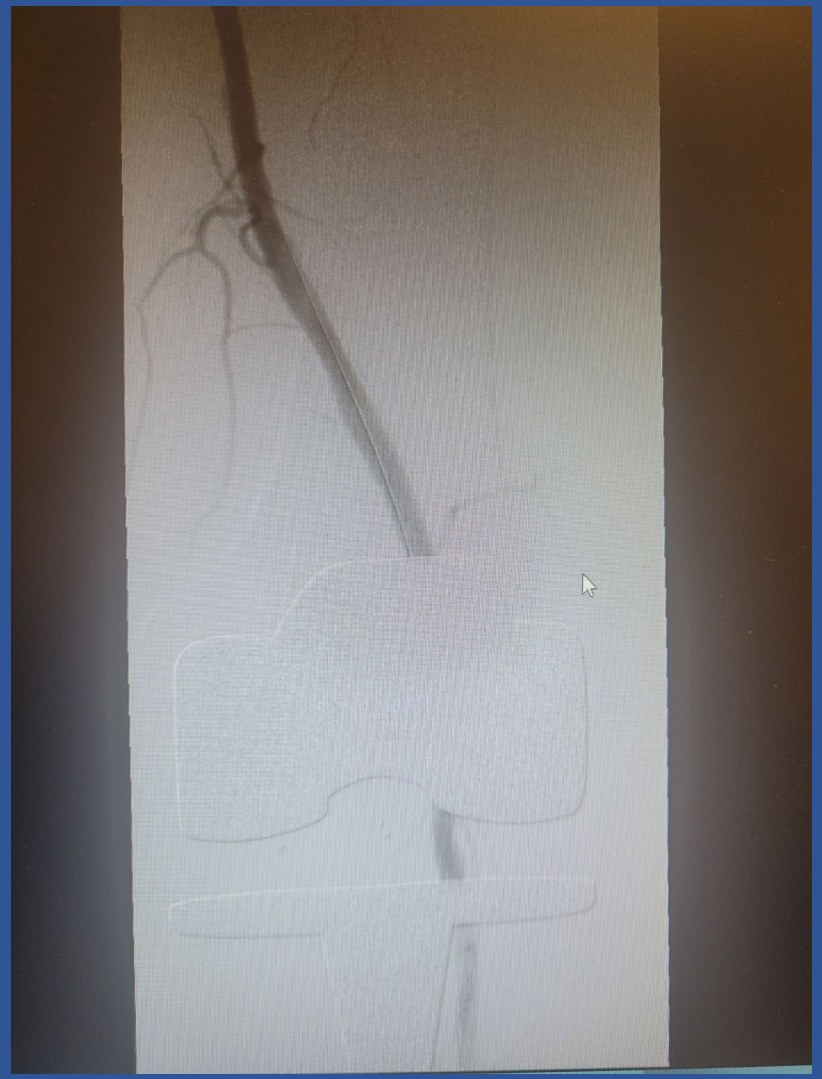
IVUS







Angiograms post treatment



Conclusion

- 54% of patients who have undergone major amputation never were revascularized
- Biggest risk factors for Critical limb ischemia (CLI) diabetes and tobacco use.
- Wound and gangrene may be first presenting symptom of PAD
- 50% reduction in major amputation with revascularization. (older data likely better now)
- Multiple modalities for imaging and treatment many didn’t exist in current forms even 5 yrs ago
- Limb salvage is obtainable