How Can Ultrasound help me
Lets talk beyond the access?

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Will Not discuss US Benefit in Traditional Access
Cook Tibio-Pedal Registry

Planned Enrollment
- 200 patients at up to 12 US and European sites

Patient population
- Patient has an infrainguinal artery occlusion
- Previous attempts to cross the occlusion from an antegrade approach have been unsuccessful (unless institutional standard of care permits primary retrograde access)
- All techniques to be used for access, lesion crossing, lesion treatment, and vessel closure are at the investigator’s discretion according to institutional standard of care

Data collected include:
- Procedural information, access site and lesion characteristics, procedural times, treatments used, and closure methods
- Procedural complications and complications occurring within 30 days following the procedure
Outline

• We are discussing Extravascular US imaging
• US Landmarks
• US therapy guidance
• US crossing of CTO
US Features of Arteries

Healthy Intima with no significant thickening
US Features of Tibial Vessels

1. Echogenic Intima
2. Echo lucent Media
3. Echogenic Adventitia
Limitations of US

• Plaque echogenicity depends on calcium content
• Acoustic shadowing is a sign of severe calcification
• It will prohibit real time visualization.
- PW Doppler can not penetrate severe calcification
- Color wave Doppler can not penetrate severe calcification
The Challenge of Antegrade Access

Angle of Entrance

SFA

Profunda

Angle of 30-60 degrees
US allows control over the depth, needle exit hub

Note the angle between Profunda and SFA
Management of Tibial Access
Ultrasound Landmarks

Inferior Epigastric Artery
Inferior Epigastric is usually the cutoff point between the CFA and the iliac artery.
“NOT” good for antegrade and retrograde access

“Ok” for antegrade and retrograde access
US landmarks

Distal Femoral Head

Severe Calcification within The posterior wall
Collaterals
Ultrasonic features of Endovascular devices

- Needles
- Wires
- Catheters
- Sheaths
- Balloons
- Stents
- CTO crossing devices
- Atherectomy devices
Needles

- Needles are reflective of US waves
- It is essential to visualize the needle during puncture of the artery
Wires

Reverberation artifacts appear as multiple equally spaced lines.
Guidance and immediate feedback
No Radiation-No Contrast
Catheters

Double braided catheter allows for excellent visualization
Catheters
Pedal Sheath
Balloon inflations
Stents

- Most self expanding stents are made of Nitinol structures.
- The metal is reflective and refractive. This will allow the operator to observe the cells within the stent.
- Covered stents may not allow US waves to penetrate and can create a blind spot within the stent.
- Real time US imaging allows better visualization than still images.
- Most stents will appear as a cress-cross pattern with proximal and distal edges very clear.
- An additional advantage is sizing of the vessel during balloon angioplasty in most patients with adequate US windows.
Atherectomy Devices
Laser Atherectomy

JetStream
CTO Crossing Devices

Crosser Device
Antegrade Crossing Attempt

Viance
CTO US characteristics

- Evaluate proximal and distal CTO cap morphology
- Length of the CTO
- Assess any evidence of hibernating lumen
- Calcium content, soft vs. calcified
CTO Cap Morphology

• Concave
• Convex
• Acoustic Shadowing
• Branching and collaterals
Chronic Total Occlusion Crossing Approach based on the Plaque Cap Appearance. The C-TOP Trial

- Retrospective analysis evaluating CTO CAP morphology.
- Prevalence of different CTO caps
- Access selection, technique and success rate of crossing
C-TOP classification
1. Detailed prior angiographic map
2. Adequate visualization of vessels with US
3. Calcium burden
4. Characteristics of endovascular devices under US (Sheath, Catheter, CTO device, atherectomy device, Balloons, Stents)
5. Chronic total occlusion mapping:
   - The proximal CTO cap morphology, architecture, shape
   - The distal CTO cap morphology, shape
   - Collaterals at the proximal CTO cap
Catheter will be directed into the sub-intimal olane
Controlled entry site to the true lumen
Wire from subintimal space to true lumen
CTO Cap Morphology

1. Concave CTO Cap will direct into the true lumen
2. Convex CTO Cap will direct into the subintimal or extravascular space
CTO CAP Morphology

- Convex proximal CTO CAP directing you to subintimal space
- Side branches at the CAP are a clear sign of the complexity of the cap (Convex)
Color Doppler
Define the Proximal Cap

Note the Pulsating Proximal Vessel
Distal CTO Cap

Choose Retrograde Access

Proximal CTO Cap
Directing the wire through the proximal CTO Cap
Predict Device Behavior
The Challenge

Wire in Hibernating Lumen

Saab et al
US guided CTO crossing

Define CTO caps

CTO Crossing Device if CTO Cap is favorable

CTO crossing device for antegrade access, low profile

Wire and catheter technique if CTO device fails

Saab et al
Flouro Time with TAMI and EVUS

Time in minutes

Year | PV | TAMI
--- | --- | ---
2012 | 33.09 | 22.3
2013 | 27.4 | 15.43
Conclusion

• The use of US is essential in obtaining access
• Adapting US in guiding therapy is a rapidly evolving field
• Identifying US landmarks limits the use of fluoroscopy and contrast
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