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#### PERIPHERAL VASCULAR DISEASE: CONCEPTS IN EVALUATION AND TREATMENT

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#### Disclosures

#### No disclosures relevant to this presentation



#### Q1.

- 79 yo M, R calf cramping at 100 feet, relieved with rest and palpable R pedal pulse. The patient
- 1. does not have vasculogenic claudication
- 2. may have vasculogenic claudication
- 3. definitely has vasculogenic claudication



#### Q2.

- 79 yo M, h/o CAD, HTN with 6m h/o constant calf pain and numbress relieved with walking. ABI 0.6/0.7. Next step should be
- 1. immediate referral to vascular surgeon
- 2. immediate angiogram and intervention
- 3. initiate w/u for non-vasculogenic etiologies of leg pain



#### Q3.

- 79 yo M, with 1 block thigh/calf claudication. The NEXT diagnostic test should be
- 1. ABI w/ exercise
- 2. arterial duplex ultrasound only
- 3. angiogram

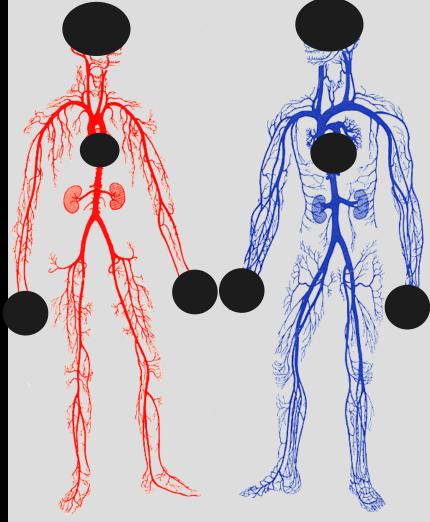


#### Q4.

- 79 yo M, severe COPD/DOE, home O2/steroids, ambulates 5 steps w walker, c/o calf-ankle swelling/redness/pain. Arterial/venous leg dopplers show no DVT, SFA occlusion and ABI 0.6/0.7. Treatment options may include all of the following EXCEPT:
- 1. compression stockings for lymphedema and/or venous insufficiency
- 2. antibiotics for cellulitis
- 3. angioplasty and/or stent for SFA occlusion



#### Scope of Peripheral Vascular Disease



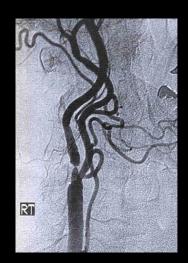


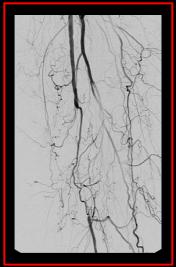
#### Peripheral Vascular Disease

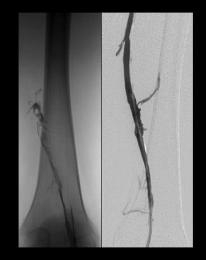
- Aortic Aneurysms
- Carotid Stenosis
- Lower Extremity Occlusive Disease
- Venous Thrombosis



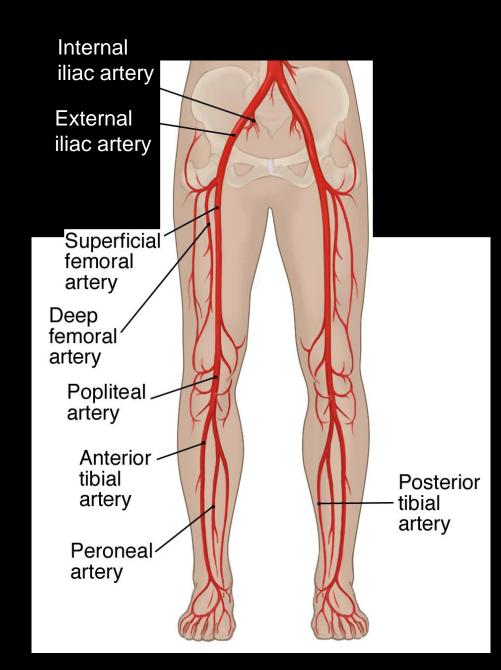








#### Brief Anatomic Review





#### Peripheral Vascular Disease

 Progressive process of stenosis and acute-onchronic occlusion (typically from atherosclerosis) in the major and mediumsized arteries

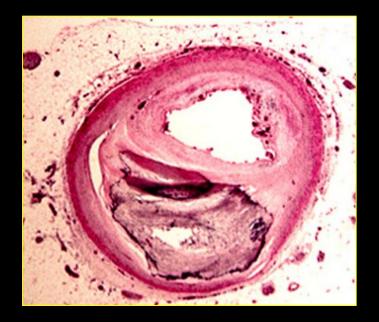


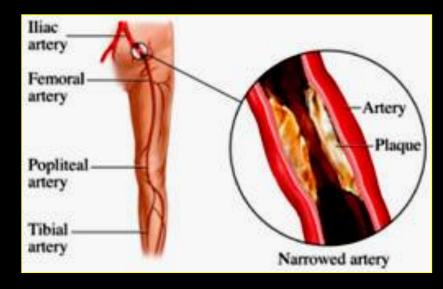


#### Lesion Types

- Focal vs. diffuse
- Stenosis
- Output Chronic total occlusion (CTO)
- Soft plaque
- Calcific disease
- Intimal hyperplasia
- Acute thrombosis
- Embolic

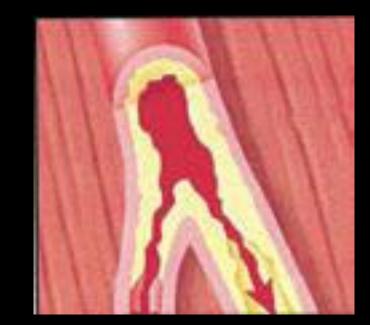






#### Demographics

- Prevalence
  - 8-10 million people in US
  - 12 20% of adults over the age of 65
  - 75% (50% asymptomatic + 25% atypical leg pain) require NO treatment
    - Don't look for it!!!

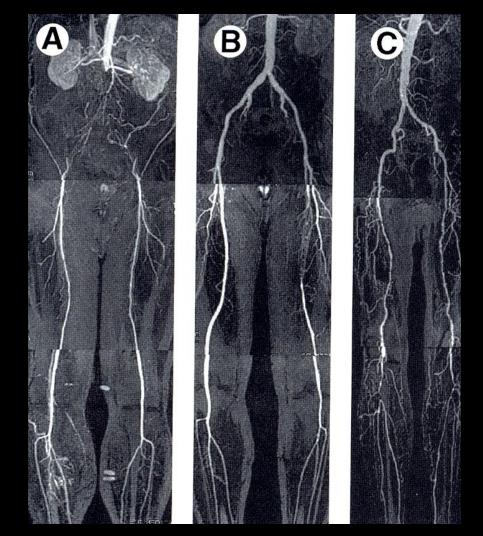






#### Spectrum of Clinical PVD

- Claudication: ~20-25%
- Critical limb ischemia: ~1-2%
  - Untreated CLI: ~25% amputation, ~25% CVrelated death @ 6months





#### **Risk Factors**

- Age >70 years
- CAD/Stroke
- Smoking
- Diabetes
- Hyperlipidemia
- Hypertension
- Antiplatelet tx
- Sedentary lifestyle



# MODIFIABLE





#### **Classifications for LE Ischemia**

Table 1 Fontaine Classification System for Peripheral Artery Disease				
Stage	History			
1	Asymptomatic			
lla	Mild claudication			
llb	Moderate-severe claudication			
III	Ischemic rest pain			
IV	Tissue loss or ulceration			

\*Source: Management of peripheral arterial disease (PAD). TASC Working Group. TransAtlantic Inter-Society Consensus (TASC). J Vasc Surg 2000;31(1 pt 2):S39.

Table 2				
Rutherford's Classification of Peripheral Arterial Disease*				

Grade	Category	History
0	0	Asymptomatic
1	1	Mild claudication
1	2	Moderate claudication
1	3	Severe claudication
	4	Ischemic rest pain
=	5	Tissue ulceration (minor)
=	6	Tissue loss/gangrene

\*Source: Management of peripheral arterial disease (PAD). TASC Working Group. TransAtlantic Inter-Society Consensus (TASC). J Vasc Surg 2000;31(1 pt 2):S39.



#### Critical Limb Ischemia (CLI)

- Rest pain (Fontaine III, Rutherford Grade II-Category 4)
- Tissue loss (Fontaine IV, Rutherford Grade III-Categories 5, 6)





## **Trans-Atlantic Inter-Societal Consensus** cati assi

# ENDOVASCULAR

### SURGERY

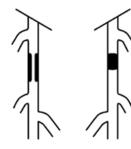


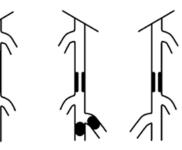
Single stenosis ≤10 cm in length
Single occlusion ≤5 cm in length

#### Type B lesions:

- Multiple lesions (stenoses or occlusions), each ≤5 cm
- Single stenosis or occlusion ≤15 cm not involving the
- infrageniculate popliteal artery

  Single or multiple lesions in the absence of continuous
- tibial vessels to improve inflow for a distal bypass • Heavily calcified occlusion ≤5 cm in length
- Single popliteal stenosis



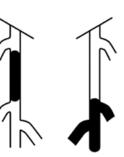




- Multiple stenoses or occlusions totaling >15 cm with or without heavy calcification
- Recurrent stenoses or occlusions that need treatment after two endovascular interventions

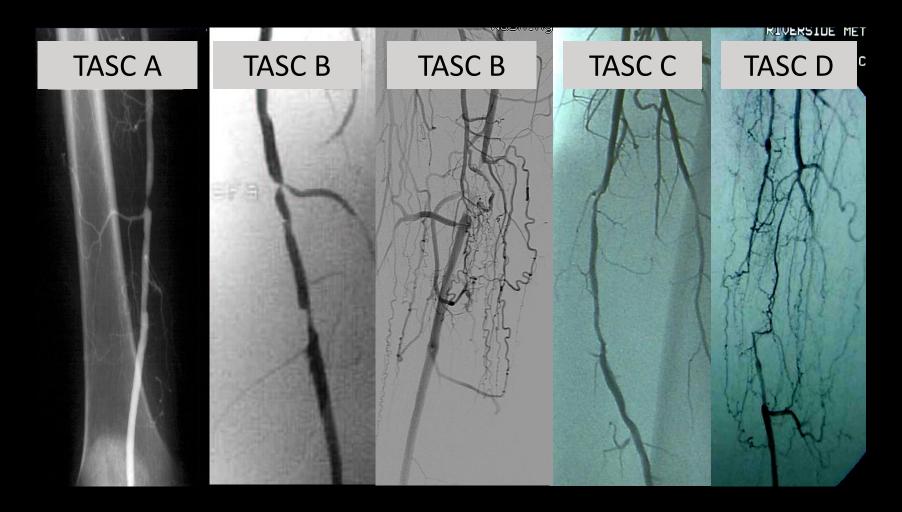
#### Type D lesions

- Chronic total occlusions of CFA or SFA (>20 cm, involving the popliteal artery)
- Chronic total occlusion of popliteal artery and proximal trifurcation vessels





#### Examples





#### Infrainguinal PAD

	Normal	Claudication	Rest Pain	Tissue Loss
Rutherford	0	1-3	4	5-6
Fontaine	I.	Ш	111	IV
ABI	1.1-0.9	0.8-0.5	0.4-0.0	
TASC	N/A	A-B	C-D	









#### Diagnosis: Symptoms

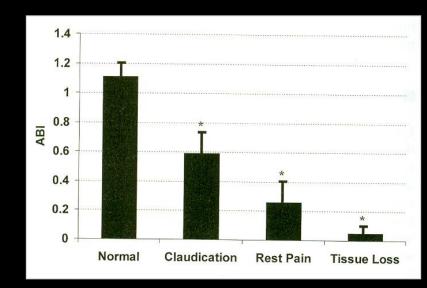
- Reproducible pain ("crampy") and/or fatigue with walking, relieved with rest (intermittent claudication)
- Numbness, pain, paresthesia localized to the toes (esp. 1<sup>st</sup> toe) and/or the instep at night, relieved with dependent positioning (metatarsalgia/rest pain)



#### Diagnosis: Signs

- None
- Mild muscle wasting
- Hair loss
- Shiny skin
- Dependent rubor

- Coolness
- Pallor
- Tissue loss
- Sensory change
- Motor change

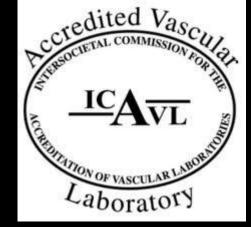




#### Diagnostic Studies: Physiologic

#### Vascular Lab

- ICAVL accreditation ("Good Housekeeping" seal)—ACCEPT NO SUBSTITUTES
- Validation
- "garbage in, garbage out"



- The most important diagnostic tool (2<sup>nd</sup> to a careful H&P)
- May be the ONLY preoperative diagnostic study required



#### Diagnostic Studies: Physiologic

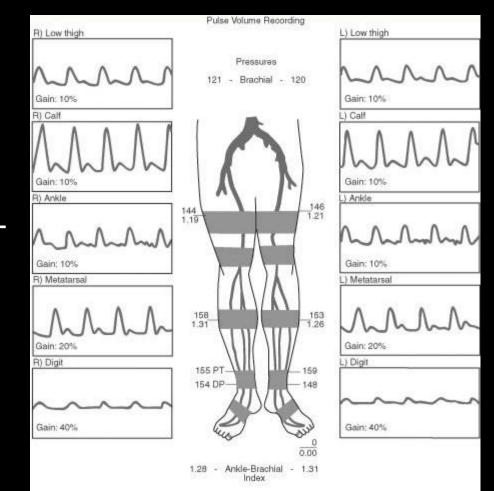
- Single most important study
  - ABI (resting)—ankle-brachial index
  - Segmental pressures
- False negative (decreased arterial compressibility)
  - Diabetes
  - CKD/HD
  - Calcinosis





#### ABI

 The higher of the 2 ratios obtained by dividing the calf pressure required to occlude either DP or PT doppler signal by the higher of 2 brachial pressures

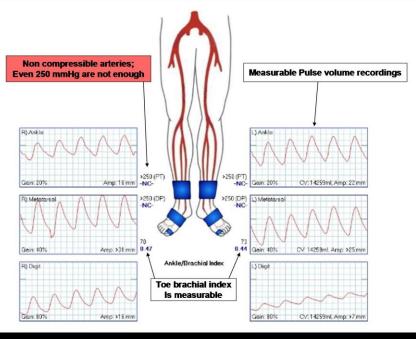


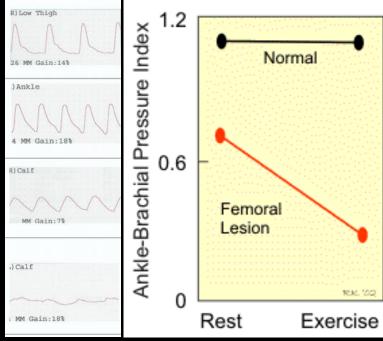


#### When ABI's Fail

- PVR (pulse volume recording)—waveform analysis
- TBI (toe brachial indices)
- Exercise ABI
  - Increased sensitivity for hemodynamically significant lesion







#### **Diagnostic Studies: Anatomic**

- Do NOT order if you are going consult vascular surgery
- Optimal study dependent on clinical presentation
- Non-Invasive
  - Arterial duplex ultrasound
  - CT angiography (CTA)
  - MR angiography (MRA)
- Angiography





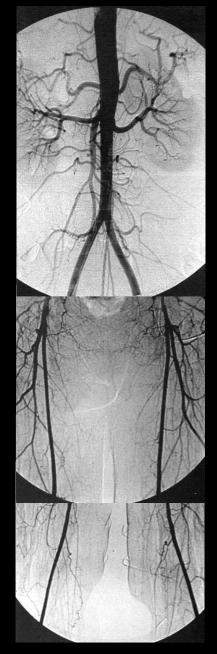
#### Non-Invasive Imaging

- Optimal approach to lesion (L vs. R, brachial vs. femoral, etc.)
- Technical risk assessment (single vs. multi-vessel runoff)
- Endovascular vs. surgical candidacy
- Limitations
  - Complex/multisegmental lesions→low flow
  - Duplex: Quality dependent on flow characteristics (eg. proximal lesions underestimate severity of distal lesions)
  - CT & MR: Quality dependent on contrast delivery and bolus timing
  - Pseudo-stenosis/occlusion



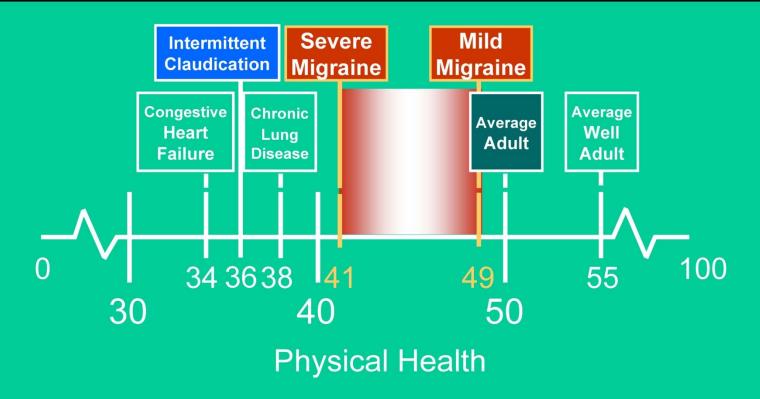
#### **Contrast Angiography**

- The "Gold Standard"
- Allows simultaneous diagnosis and catheter-based intervention
- Limitations
  - Contrast nephropathy (1-8%)
  - Anaphylaxis (0.1-0.2%)
  - Puncture site related complications (4-7%)





#### **Comparing Severity Levels** Example of Migraine Headache



Adapted from Understanding Health Outcomes Educational Series (1998).



#### Treatment

- Medical
- Surgery
- Endovascular (angioplasty/stenting)
- Goals
  - Improve quality of life
  - Relieve pain
  - Heal ischemic ulcers/wounds
  - Prevent limb loss



#### **Medical Management**

- Risk factor modification
- Orug
  - ASA
  - Statin
  - Pletal (cilostazol)
- Exercise
  - Min: 30 min x 5x/week
- Weight loss



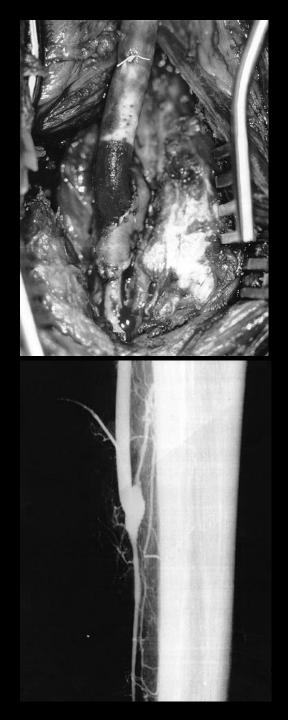




#### Surgery

- Sypass/Endarterectomy
- Salvage" therapy for
  - Failed endovascular treatment
  - Unfavorable lesion types
  - Unfavorable lesion locations
- Pros: Durable, Low-Cost
- Cons
  - Maximally-invasive
  - Conduit-limited





#### Endovascular

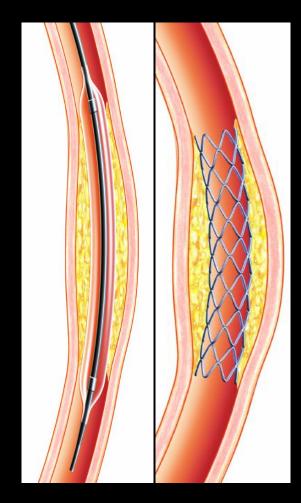
- Evidence-based/ "textbook" vs.
   "real-world"
- First line (invasive) treatment
- Pros: Minimally-invasive
  - Outpatient, low morbidity, rapid recovery
- Cons: Durability, Cost

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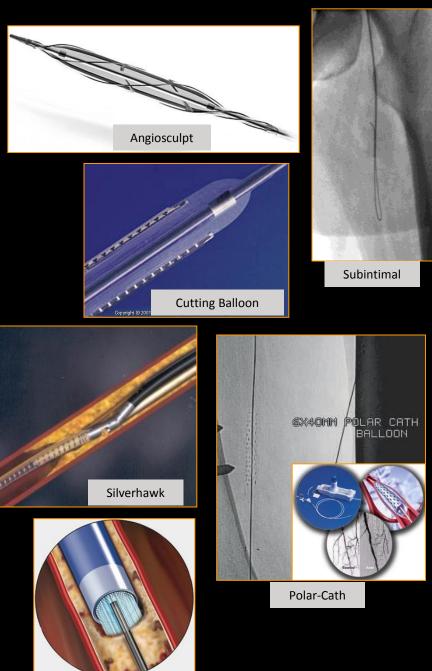
 Favorable lesions: short, stenotic, non-calcified, large vessel, good outflow, non-diabetic, non-CKD



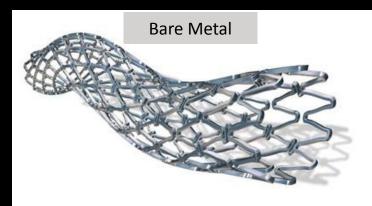
#### Tools & Techniques

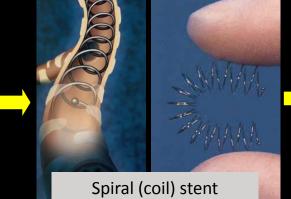
- Intraluminal PTA +/- stent
- Subintimal PTA
- Cutting balloon PTA
- Cryoplasty
- Laser
- Oirectional atherectomy
- DES (drug-eluting stent)
- Absorbable stent

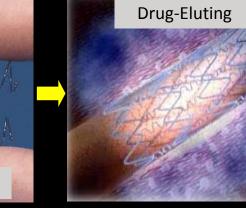


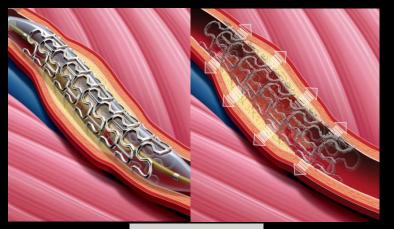


#### Stents

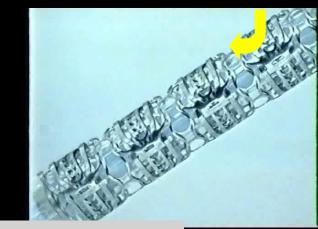








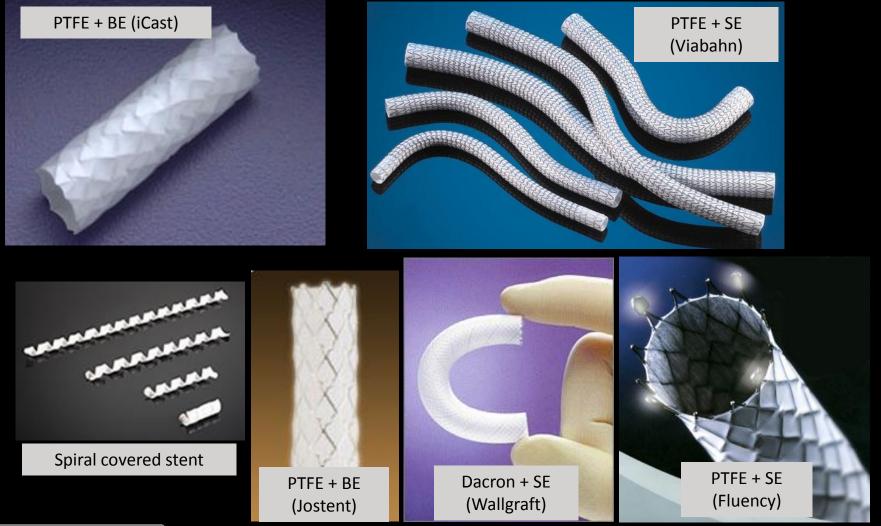
Absorbable



Balloon-expandable NiTi stent



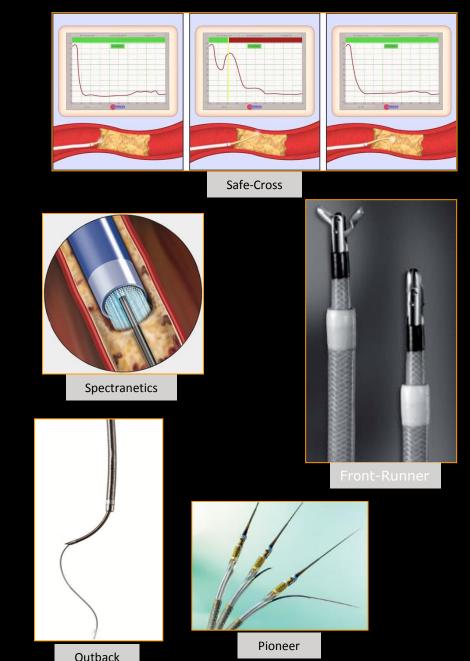
#### **Covered Stents**





### Chronic Total Occlusions (CTO)

- 70-80% overall success
- Recanalization tools and techniques
  - Intraluminal
  - Subintimal
- Re-entry



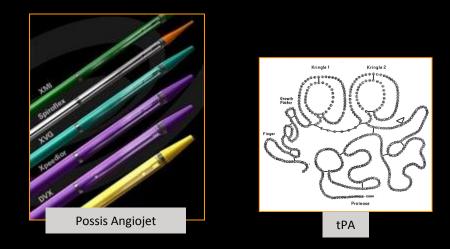
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#### Aspiration/Thrombus Management

- Thrombo- vs. atheroemboli
- Recognized complication in all interventional procedures
- Mechanical
  - Aspiration
  - Fragmentation
- Pharmaco-lysis









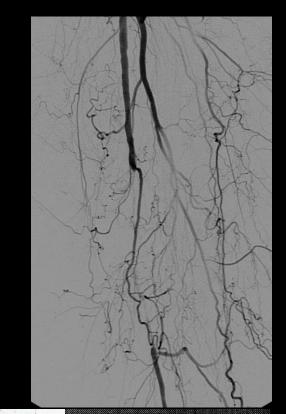
Medtronic Export

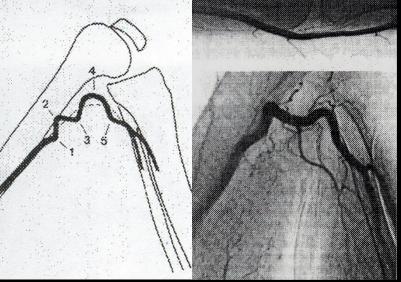
#### Challenges to SFA Intervention

- Diffuse disease more common (vs. focal)
- Occlusions more common (vs. stenoses)
- Adductor canal (repetitive flexion motion)
- Small diameter, low flow, high resistance
- Frequent outflow disease

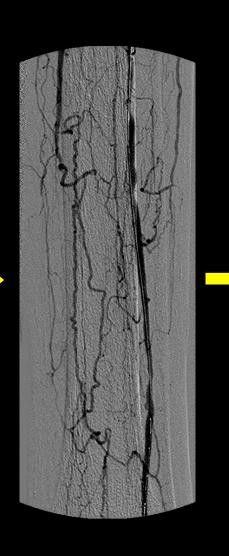
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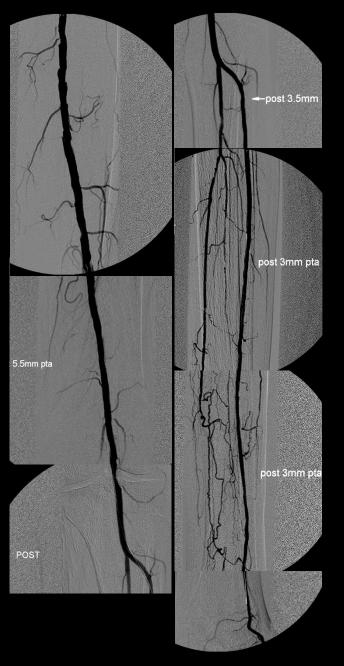
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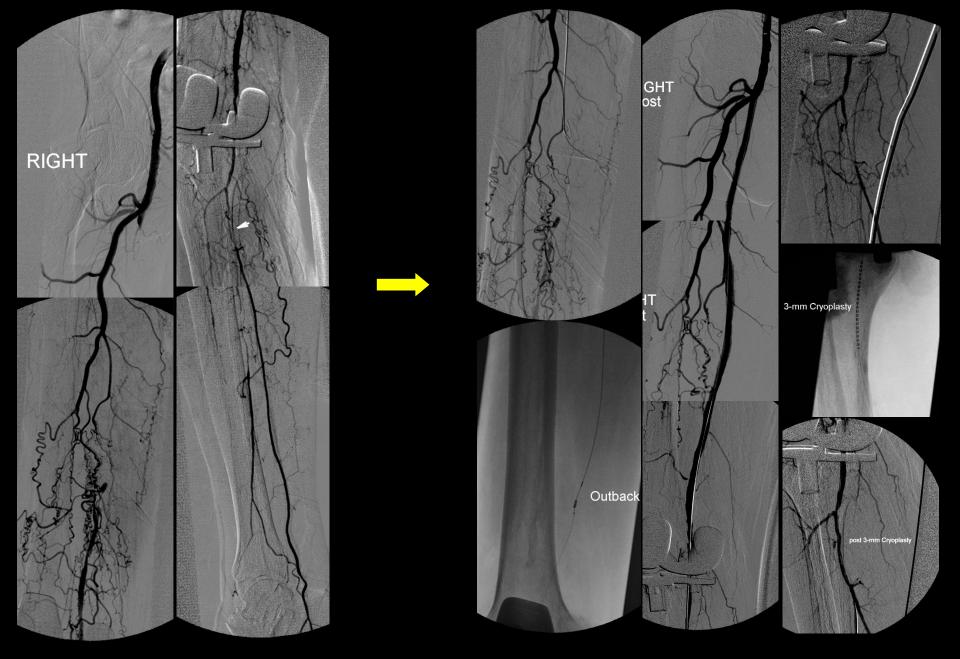








66F, DM, ESRF, HTN, L great toe ulcer and rest pain





82 yo M w/ HTN, R LE short distance claudication

