Percutaneous Intervention for Peripheral Vascular Disease

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Disclosure

- No speaker panel relationship to disclose
- No financial relationships with device manufacturers
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Question 1

- The risk of amputation in a diabetic vs. nondiabetic with peripheral arterial disease is estimated to be:
  - A. the same.
  - B. five times higher.
  - C. two times higher.
  - D. ten times higher.
Risk factors for PAD are similar to those for CAD. PAD is attributed to each but some more than others. Risk factors most which most strongly attribute to PAD are:

- A. family history and HTN.
- B. elevated C-reactive protein and homocysteine.
- C. hyperlipidemia and obesity.
- D. diabetes and tobacco use.
Question 3
- Risk of development of critical limb ischemia (CLI) is similar for patients presenting with symptomatic (claudicants) vs. asymptomatic PAD.
  - True
  - False

Answer 3
- True

Question 4
- The risk of amputation is the same for patients with PAD presenting as claudicants and with critical limb ischemia.
  - True / False
Upon completion of this lecture, the participant will be able to:

- Understand the evolution of percutaneous techniques
- Be clinically versed in peripheral arterial disease
- Recognize variations in patient presentation
- Understand indications for peripheral intervention
- Describe the mechanism of various interventional devices
Werner Forssmann (1904-1979)

- Hypothesis - the heart could be accessed by catheter from a peripheral access site
- Self catheterized – chained head nurse to OR table to force to assist
- Was dismissed from his post for self experimentation
- Quit cardiology and entered urologic training
- Joined Nazi party medical corps and rose to rank of Major
- POW until 1945 then became a lumberjack then country doctor (urologist)
- Won Nobel Prize in 1954


First cardiac cath
Angiography
- 1958 Charles Dotter performed sequential images of coronary vessels in animals after filling aorta with contrast.
- Applied technique to peripheral vessels in humans and later developed technique for dilating (Dottering) vessels with successively larger intra-arterial trochars
- Sones technique replaced by Seldinger technique then ‘single wall’ technique
- Melvin Judkins develops shaped coronary catheters in 1964

F Mason Sones, M.D.(1918-1985)
- Trained at Henry Ford Hospital in Detroit, MI
- Established at Cleveland Clinic in 1950 and later became head of pediatric cardiology
- While performing an aortic contrast injection on a 26 year old patient with rheumatic heart disease the first right coronary injection was performed

Intervention

- Charles Dotter
  - Dotter technique
  - Balloon angioplasty

- Andreas Gruentzig
  - First coronary angioplasty

- Palmaz-Schatz balloon expandable stent

Andreas Gruentzig (1939-1985)

N583AM

- Crashed in Forsyth, GA with wife in rain storm killing both on 27Oct1985

Peripheral Arterial Disease

- About 8 – 12 million Americans currently affected
- 7+ million in the over 65 age group
- Worse outcomes in diabetics and women
- Same risk factors as CAD
  - Tobacco
  - Diabetes
  - HTN
  - Hyperlipidemia
  - Family history of vascular disease
  - Obesity / dysmetabolic syndrome

Prevalence

Presentation of PAD
- Most asymptomatic
- 90% will be missed if clinician looks for classic claudication (10-30%) rather than abnormal ABI
- ABI less than 0.90 has 95% sensitivity and 100% specificity for detecting obstructive PAD
- Discovery of PAD significant since 70% will have coronary / cardiac / neurovascular event

Presentation of PAD
- Normal ABI = 1.1
- Claudication in most less than 0.80
- Resting leg pain in most less than 0.4 – 0.5
- If vessels noncompressible (ABI > 1.3) use TBI of 0.60

Indications for Revascularization
- Surgical and percutaneous indications are identical
- Critical limb ischemia
  - Ulceration
  - Resting leg pain
  - Gangrene with potential for limb salvage
  - To establish flow to promote healing at surgical amputation level
- Lifestyle limiting claudication
Critical Limb Ischemia

- Typically described as Rutherford IV-VI and Fontaine class III and IV
- Limb loss more common than in claudicants.
- Estimated 10-40% ultimately undergo amputation.
- Rate of amputation ranges from 7-12% per year.

- Patients have 3 fold higher risk of myocardial infarction than patients with claudication.
- High mortality rate as well. 20-30% annual mortality and 40-70% five year mortality.
- Mortality more so due to vascular events (34.5%) vs. nonvascular events (8.5%).


- Strongly associated with Tobacco use
- Diabetes
- Chronic renal insufficiency
- Can be multilevel but usually involves tibioperoneal vessels.
Factors Associated with Increased Risk of Limb Loss in CLI

- Diabetes
- Chronic renal failure
- Tobacco use
- Infection
- Trauma
- Vasospastic conditions
- Decreased cardiac output

Anatomic Considerations

- Single level vs. multilevel disease
- Inflow (iliofemoropopliteal) vs. outflow (tibioperoneal)
- State of profunda femoris
- Calcified vs. soft plaque
- Long vs. short / focal lesion

Anatomic Considerations

- Occlusive vs. stenotic disease
- Atherosclerotic vs. fibromuscular vs. vasculitic
- Stenotic vs. aneurysmal
- Antegrade vs. retrograde approach to lesion
Tools of the Trade

- POBA = “plain old balloon angioplasty”

- Stents
  - Balloon expandable
  - Self-expanding

- Atherectomy
  - Directional atherectomy
  - Rotational atherectomy
  - Laser atherectomy
  - “Crosser” device

Tools of the Trade

- Crossing devices

- Re-entry devices

- Distal protection devices
Most versatile when it comes to size
Can be used to predilate lesion to promote crossing with bulkier devices
Prone to lesion recoil
May cause dissection (most not "flow limiting")
Most inexpensive PVI device on the shelf
Preferred lesion type = noncalcified, focal, stenotic lesion
Balloon Angioplasty

Stents
- Scaffolds vessel to counteract recoil
- “Tacks up” dissections
- Covered variants can exclude perforations
  - Most PVI perforations are non-events except iliac perforation = disaster if not recognized
- Ideal lesion = common iliac (balloon expandable) / external iliac (self expanding), long, previously occlusive, flow-limiting dissection

Balloon Angioplasty / Stent of a Graft
Stents

- Unlike the coronary tree, the peripheral system has not been as accepting
  - Femoral (common and SFA) / popliteal
  - Tibioperoneal
- Fracture
- Restenosis / thrombosis

Crossing / Stenting Chronic External Iliac Occlusion

Stent at Distal SFA/ Popliteal
Despite general classification of device all have VERY different mechanisms

- Covidien Silverhawk – Directional. Good for soft plaque. Turbohawk variant good for Ca plaque
- CSI Diamondback – Rotational. Good for Ca plaque. Good for addressing long or short tibial lesions.
- Spectranetics Turbo Elite – Laser. Good for soft plaque. Low crossing profile can be used in very small, distal vessels. ISR
Diamondback

Laser Atherectomy

• PATent ISR
• EXCITE ISR
Reconnecting Occluded Tibials

Angiosome Concept

Angiosome Concept
Nonhealing Med Ankle Wound (ESRD)
Nonhealing Great Toe Wound
The fate of most patients with PAD (symptomatic and asymptomatic) is:

- A. a greater than 50% risk of critical limb ischemia leading to amputation.
- B. a 50-80% risk of nonfatal/fatal myocardial infarction or stroke.
- C. similar to age matched patients without PAD.
- D. higher than age matched patients without PAD but worse in symptomatic PAD patients.

What should be considered when evaluating a patient with critical limb ischemia (CLI)?

- A. The patient’s risk factors (modifiable and non-modifiable).
- B. The presence or absence of an adequate social support network.
- C. The general medical condition and expected survivability of the patient.
- D. The lesion-specific anatomic features of the individual’s disease.
- E. All of the above.
Answer 6
- E.

Question 7
- Regarding the angiosome concept;
  - A. if you can not open the artery directly accountable to a vascular territory, you should not pursue intervention.
  - B. direct surgical grafting of an angiosomic distribution is superior to percutaneous revascularization.
  - C. Probably best described by A.T. Still as “The role of the artery reigns supreme.”

Answer 7
- C.
Summary

- PVI has evolved into a state of the art process over the past 50+ years
- Despite homogeneous (90%) disease, presentation quite variable
- Device selection is based on several angiographic (anatomic) factors
- More work to be done in achieving better and better clinical endpoints