PAD vs Venous Disease: Discrepancies & Similarities

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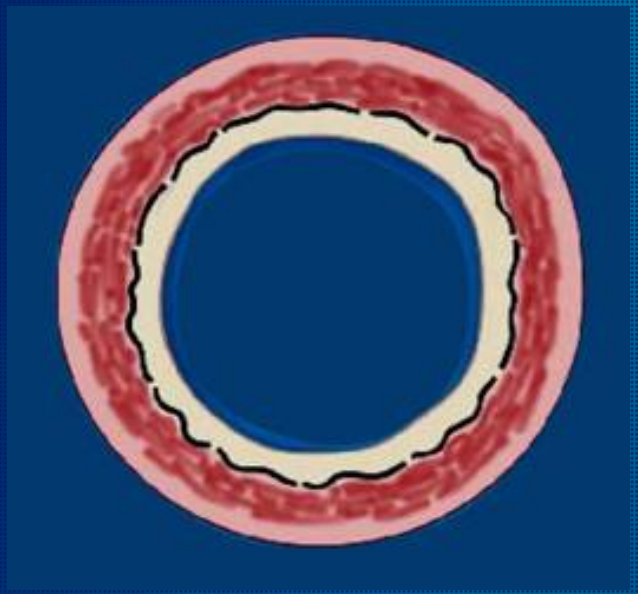
Peripheral Arterial Disease (PAD)

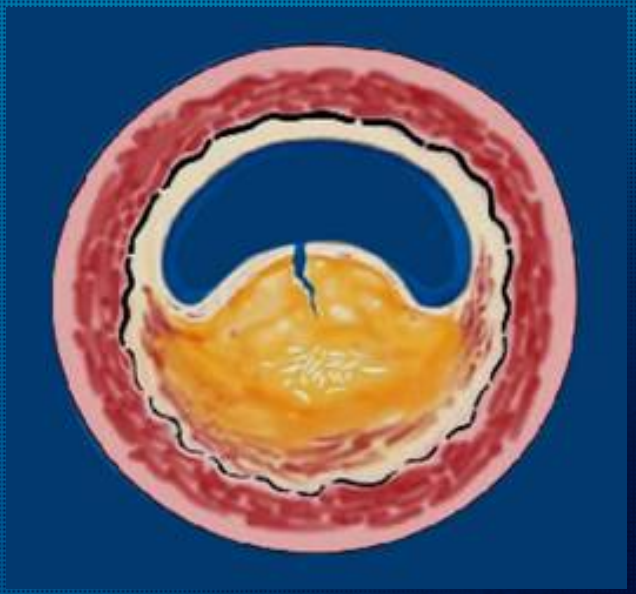
- Disorders of the circulatory system to the extremities, viscera and head

Introduction

Atherosclerotic changes



Normal Artery



Diseased Artery

Introduction

Disease evolution

- Claudication
- Rest pain
- Ulceration
- Gangrene
- Limb loss

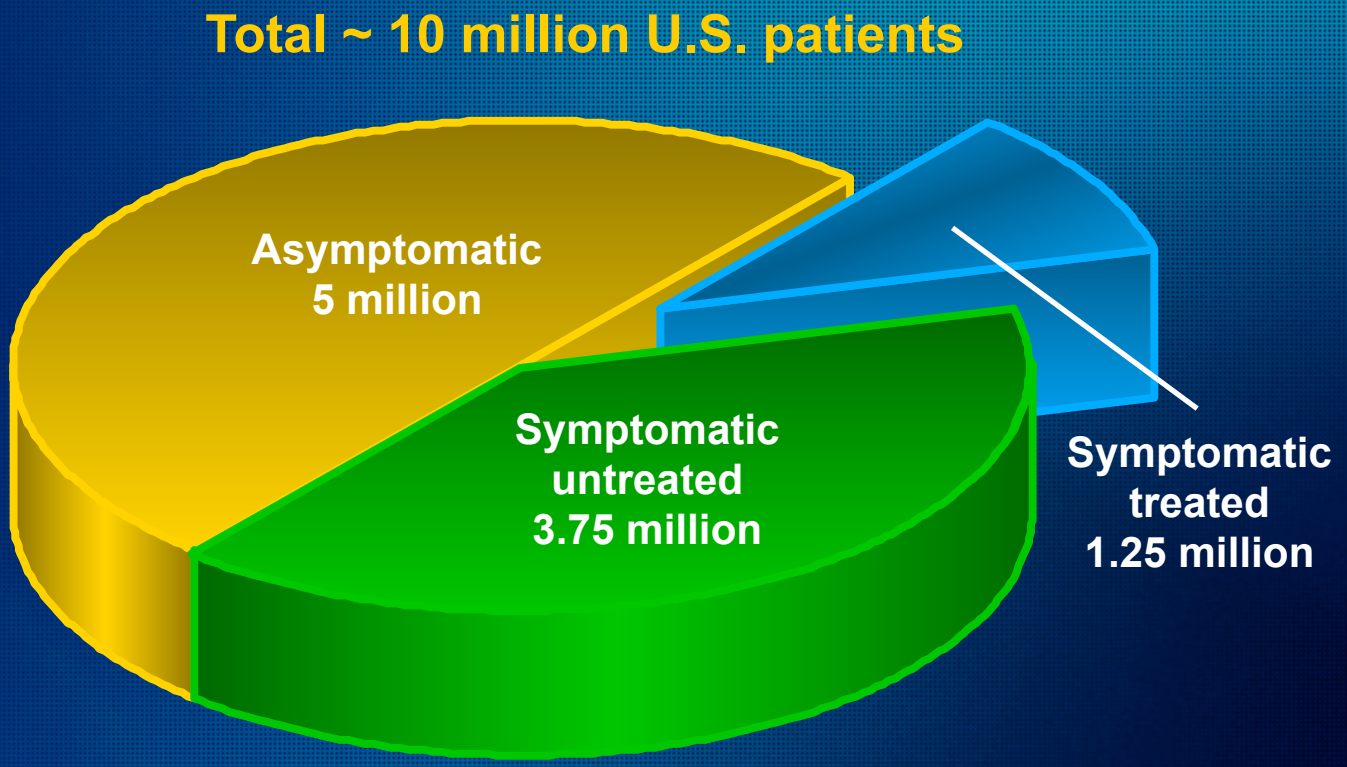
Introduction

Mortality

- **Life expectancy reduced 10 years in patients with PVD**
- **Mortality rate**
  - **~ 25% at 5 years**
  - **~ 50% at 10 years**
  - **~ 75% at 15 years**
- **75% of deaths caused by cardiovascular events**

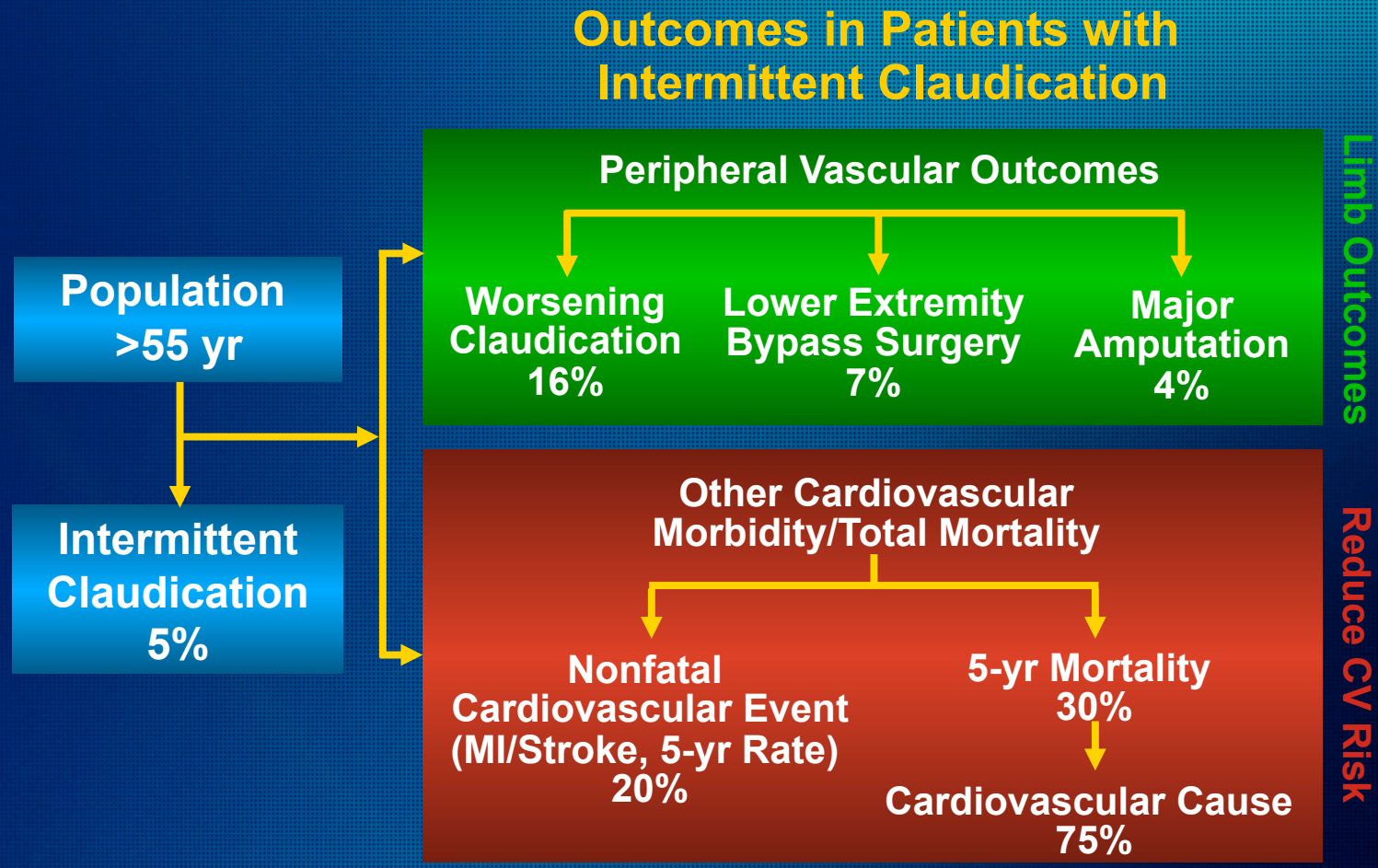
NEJM, 1991; 325:577-8

Prevalence



Pentecost, et al. "Guidelines for Peripheral Percutaneous Transluminal Angioplasty of the Abdominal Aorta and Lower Extremity Vessels"; 1993

Prevalence

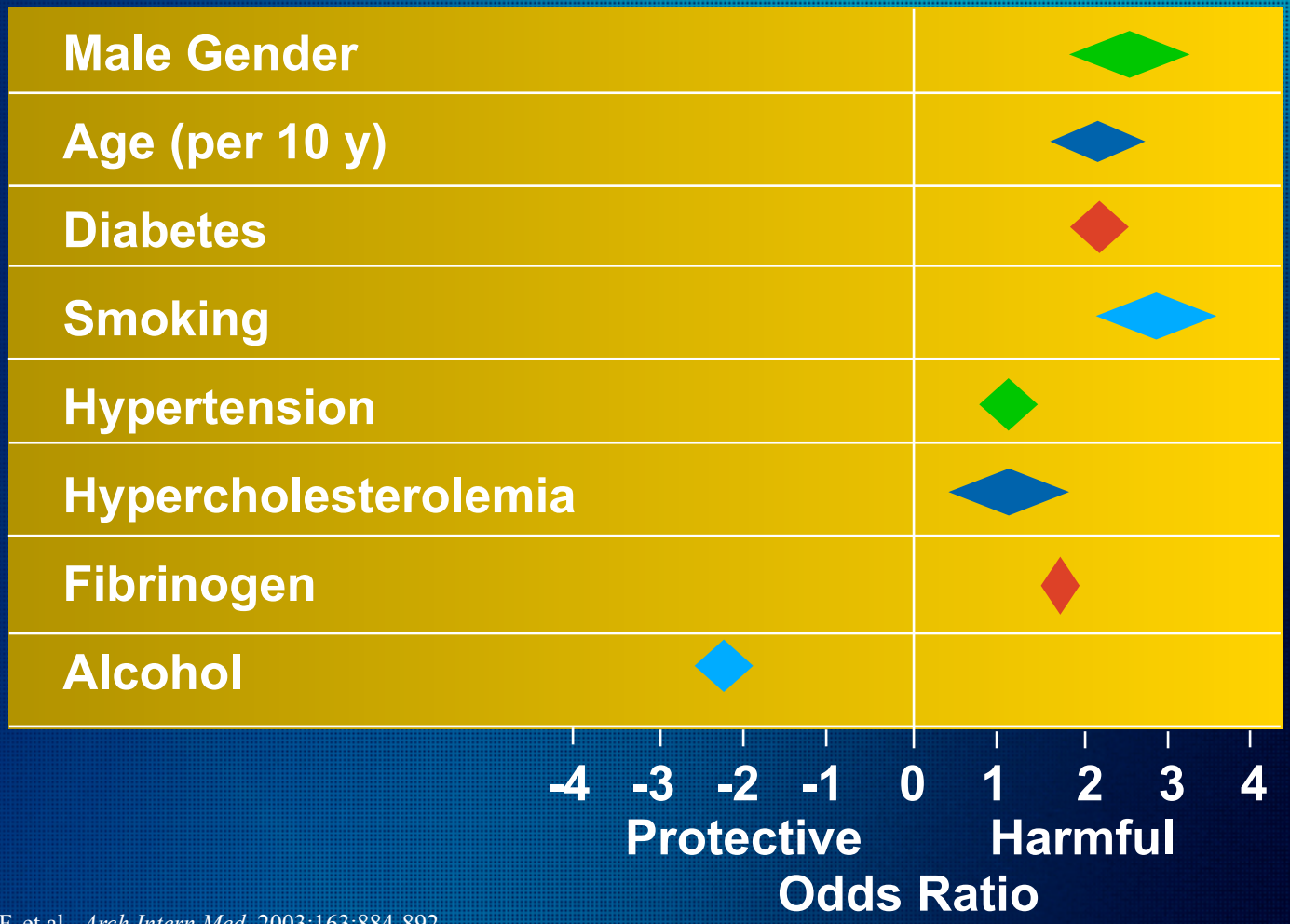


Adapted from Weitz JI, et al. *Circulation*. 1996;94:3026-3049.

Risk Factors

- Tobacco abuse
- Hypercholesterolemia
- Hypertension
- Diabetes
- Obesity
- Sedentary lifestyle

Risk Factors



Belch JJF, et al. *Arch Intern Med.* 2003;163:884-892.

Diagnosis

- Patient history
- Physical examination
- Laboratory values
- Noninvasive vascular studies
- Angiography

Patient History

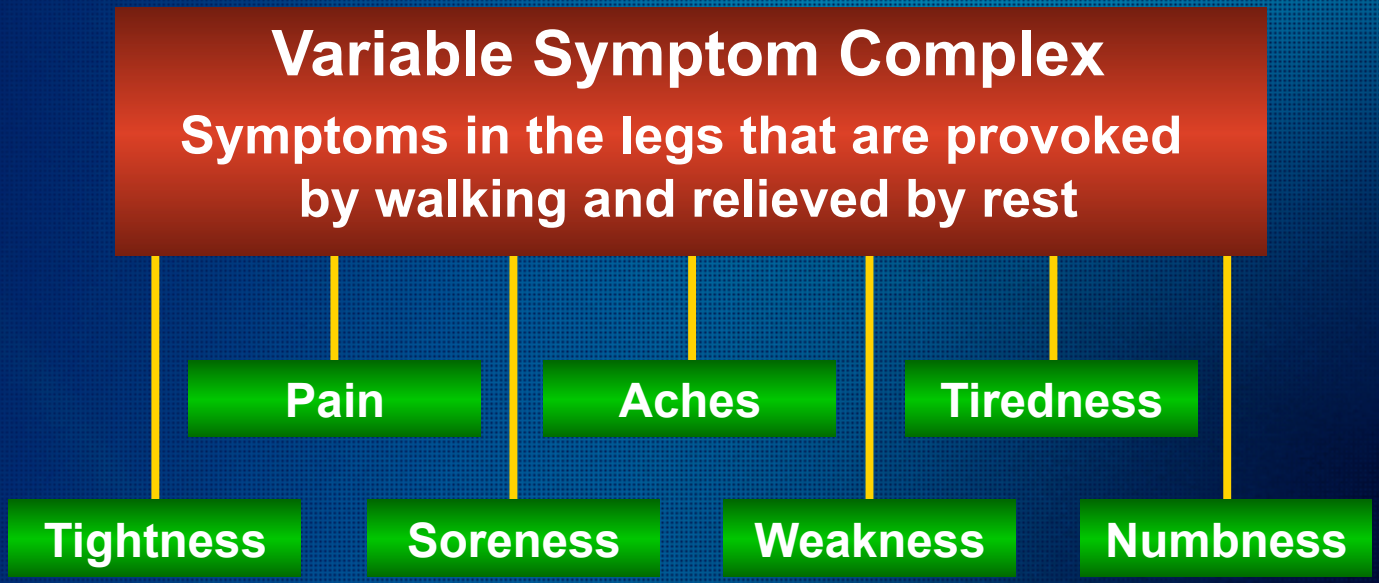
- Risk factors
- Exercise-induced symptoms
- Rest pain
- Ulceration

Patient History

- History—the most important aspect of the diagnostic evaluation of PAD
  - Location of symptoms
  - Description of discomfort
  - Exacerbating/ameliorating characteristics
  - Reproducible symptoms

Patient History

Historical clues to the diagnosis of intermittent claudication



Patient History

Is it vascular limb pain?

Historical Clue	Vascular Etiology	Neurogenic Etiology
Onset	Predictable	Variable
Only with walking?	Yes	No
Relief with stopping or standing?	Yes	Variable
Absent pedal pulses at rest	Variable	Variable

Patient History

Differential diagnosis of PAD

- Intermittent claudication
  - Atherosclerosis
  - Non-atherosclerotic
    - TAO/Buerger's
    - PAES
    - CAD of the popliteal artery
    - FMD
    - Vasculitis
- Neurogenic causes
  - Lumbar canal stenosis
  - Peripheral neuropathy
- Venous claudication
- Musculoskeletal causes
  - Arthritis
  - Bursitis
  - Tendonitis
  - Tight hamstring /quadriceps musculature
- Podiatric causes
  - Plantar fasciitis

Physical Examination

- Pulses
- Bruits
- Ankle-Brachial Index (ABI)

Physical Examination

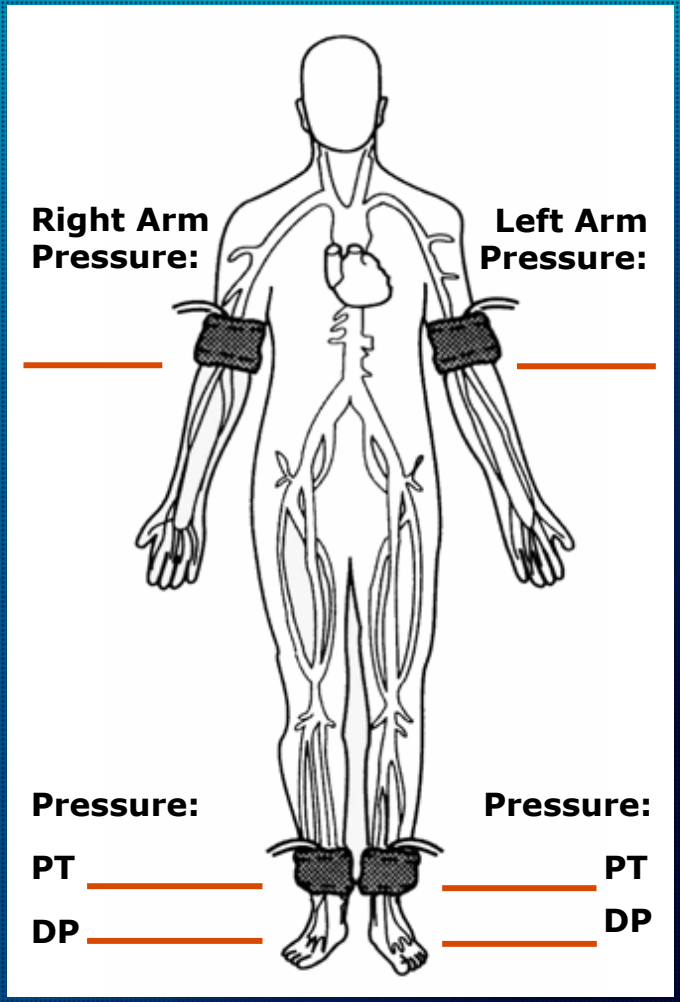
Ankle-Brachial Index

- **Simple, painless, accurate, highly reproducible examination**
- **Clinically useful**
  - **Identifies patients with PAD**
  - **Major indicator of premature MI, CVA, mortality**
- **Indications**
  - **Any patient with suspicion for PAD**
  - **Any patient at risk of PAD**
    - **Age 50 or greater with history of DM or tobacco use**
    - **Age 70 or greater regardless of risk factors**

Physical Examination

Ankle-Brachial Index

- How to perform
  - Patient resting supine for 5-10 minutes
  - Continuous wave, hand-held Doppler
  - Measure systolic BP in both arms
    - Higher value is DENOMINATOR of ABI
  - Measure systolic BP in DP and PT
    - Higher value is NUMERATOR of ABI



Physical Examination

$$\text{ABI} = \frac{\text{Ankle Systolic Pressure}}{\text{Brachial Systolic Pressure}}$$

>0.9 = Normal

≥0.4-0.9 = Moderate disease

<0.4 = Severe disease

Physical Examination

Interpretation and limitations of ABI

ABI Interpretation

Above 0.90	—	Normal
0.71-0.90	—	Mild Obstruction
0.41-0.70	—	Moderate Obstruction
0.00-0.40	—	Severe Obstruction

Two Main Limitations

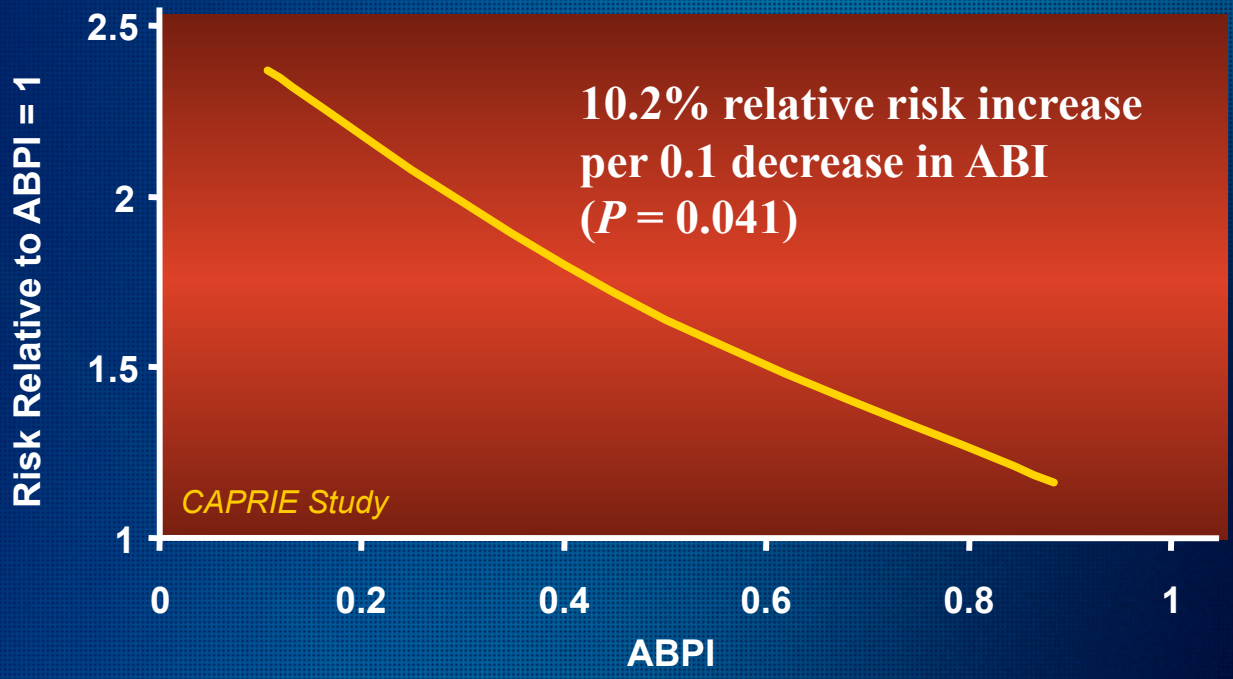
Calcified ankle vessels result in artificially "normal" ABI (DM, RF)

Normal ABI in patient with Aortoiliac Disease—only becomes abnormal with exercise testing

Physical Examination

ABI—Predictor of ischemic events

ABI – inverse relationship with three-year risk of cardiovascular events and deaths



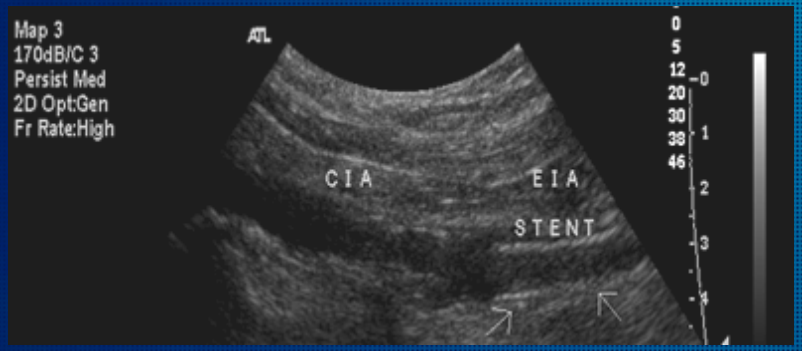
Dormandy JA. Cerebrovasc Dis. 1999;9 (Suppl 1):1–128.

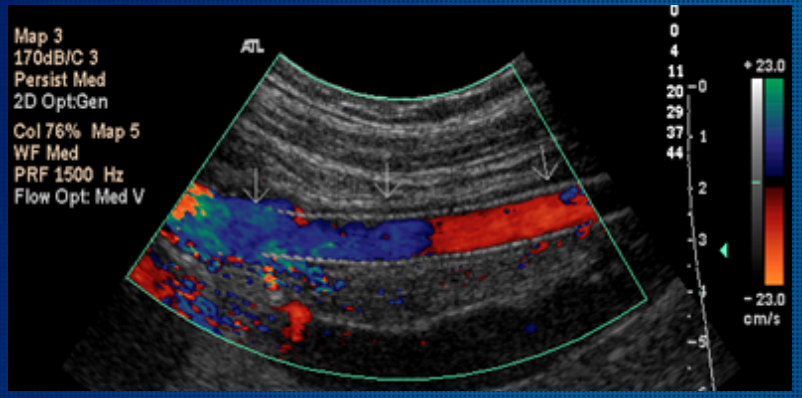
Noninvasive Vascular Studies

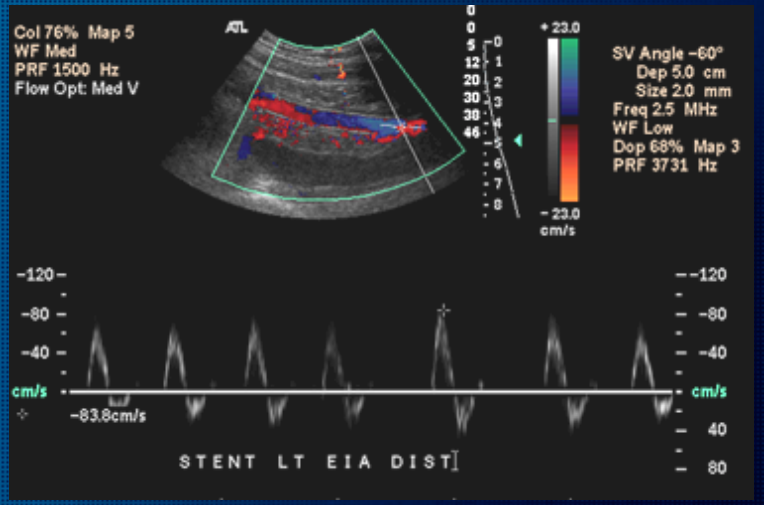
- Vascular ultrasound
- CT angiography
- Magnetic resonance angiography

Noninvasive Vascular Studies

Post-intervention iliac imaging

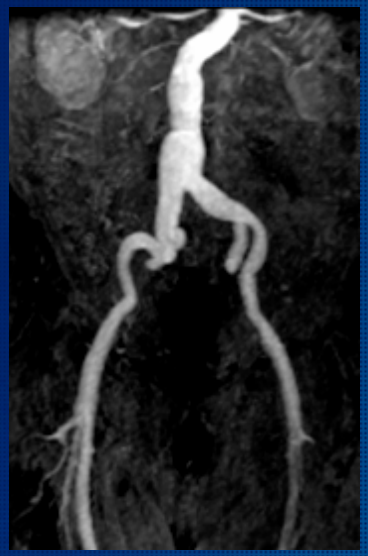


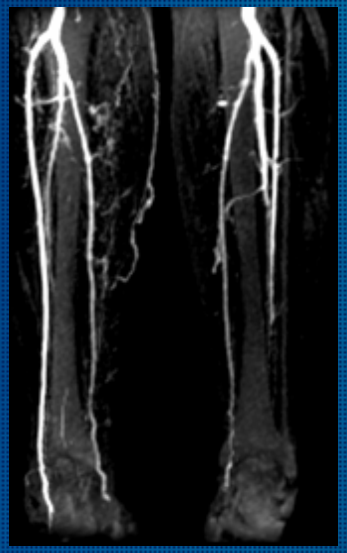


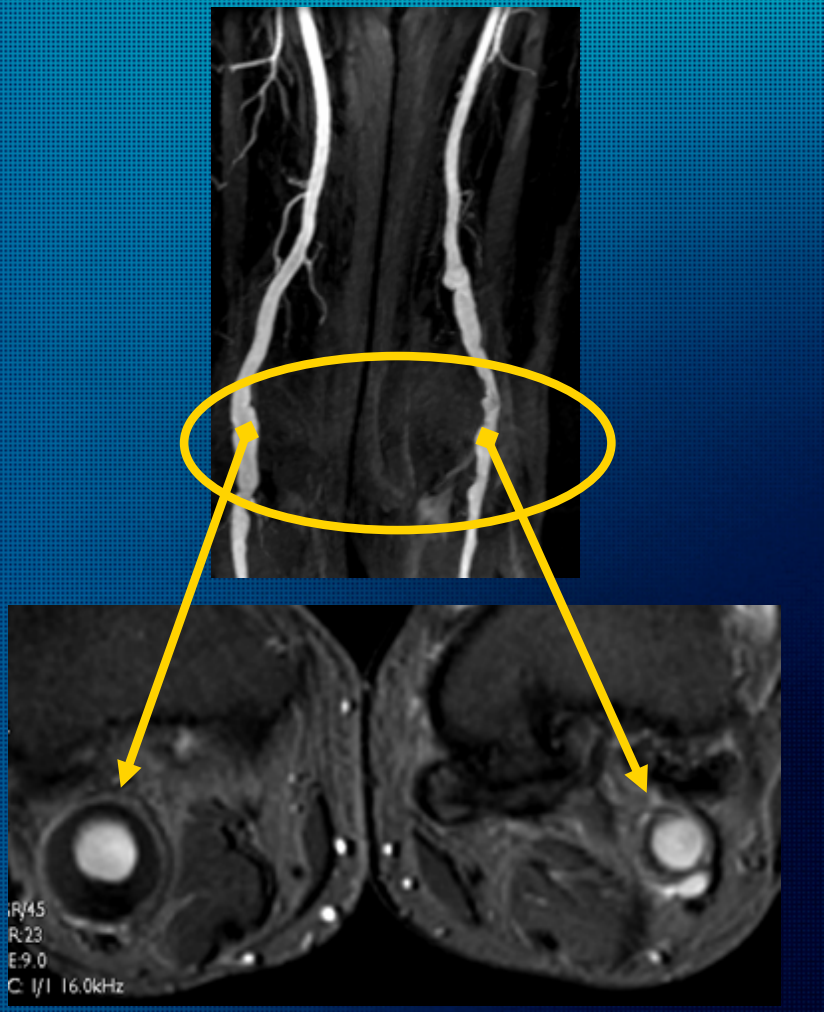


Noninvasive Vascular Studies

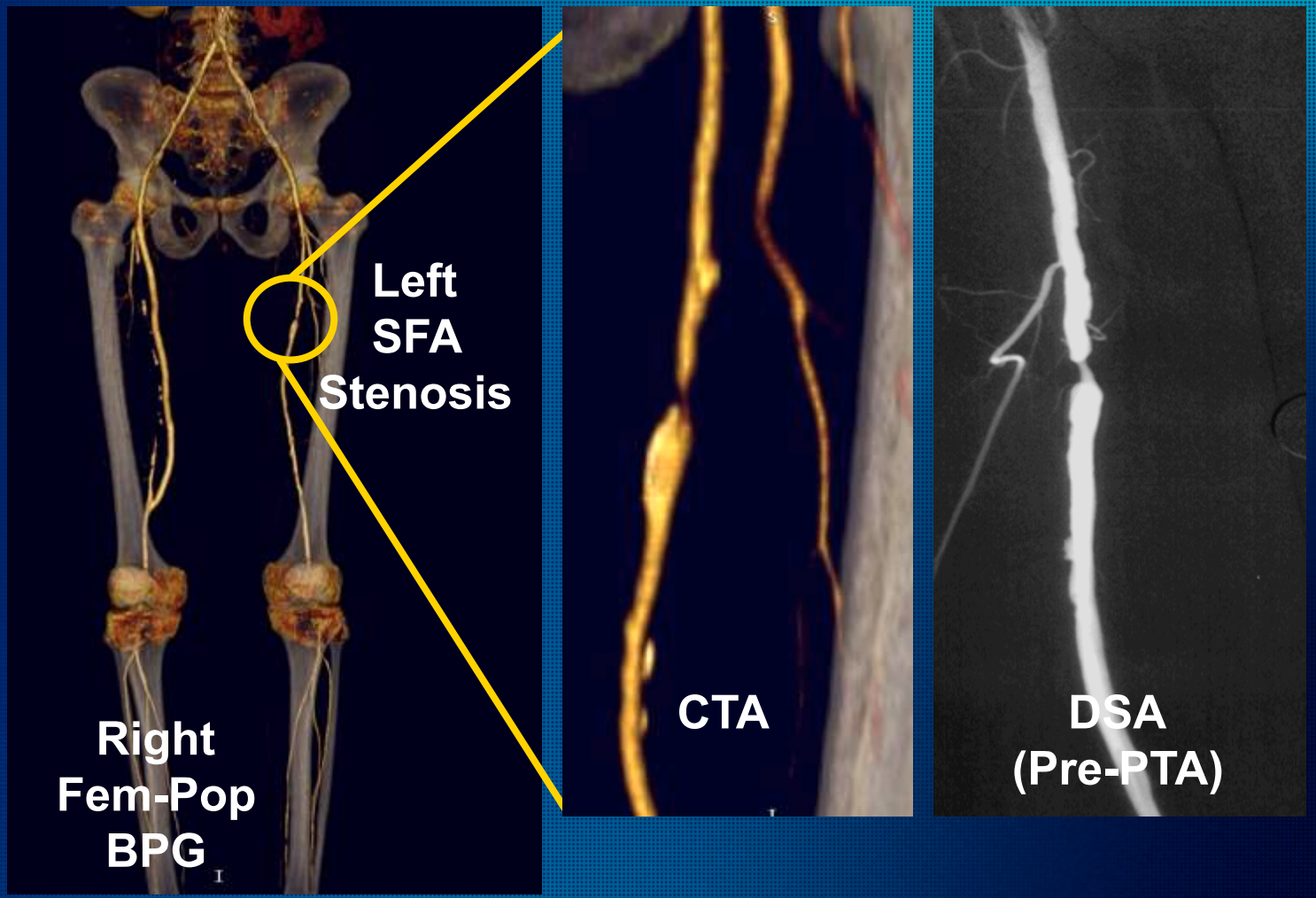
MRA in PAD







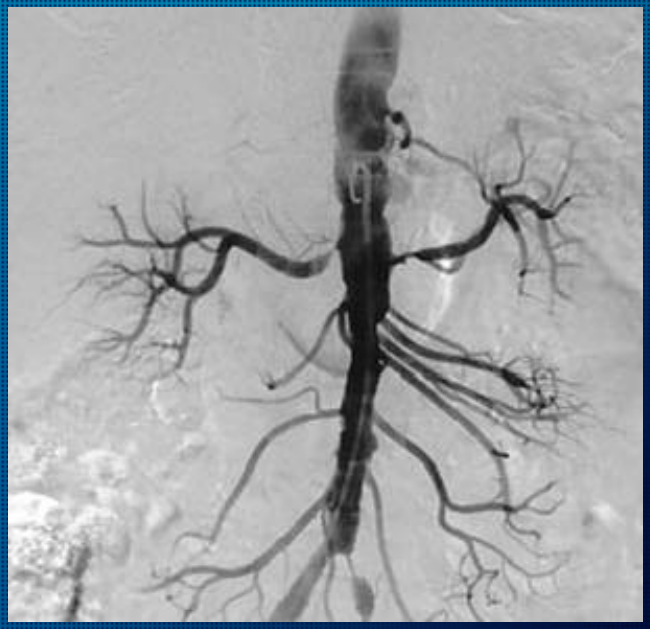
Noninvasive Vascular Studies



Noninvasive Vascular Studies

Diagnosis—angiography

Normal



Abnormal

Treatment

- Goals
- Risk factor modification
- Medical management
- Minimally invasive techniques
- Case studies
- Surgical intervention
- Follow-up care

Goals

PAD Therapeutic Goals

- **Improve functional status and quality of life**
- **Identify and treat systemic atherosclerosis**
- **Preserve the limb**
- **Prevent progression of atherosclerosis**

Risk Factor Modification

- Tobacco cessation
- Exercise
- Weight reduction
- Pharmacologic intervention
  - Hypercholesterolemia
  - Hypertension
  - Diabetes

Medical Management

Medical therapy for intermittent claudication

- **Symptom/Limb**
  - Tobacco cessation
  - Foot care
  - Control of DM
  - Reduction in cholesterol
  - Antiplatelet agents
  - Exercise
  - Cilostazol
  - Angiogenesis
  - Gingko biloba
- **Life**
  - Tobacco cessation
  - Control of DM
  - Reduction in cholesterol
  - Reduction in BP
  - Antiplatelet agents
  - Exercise

Medical Management

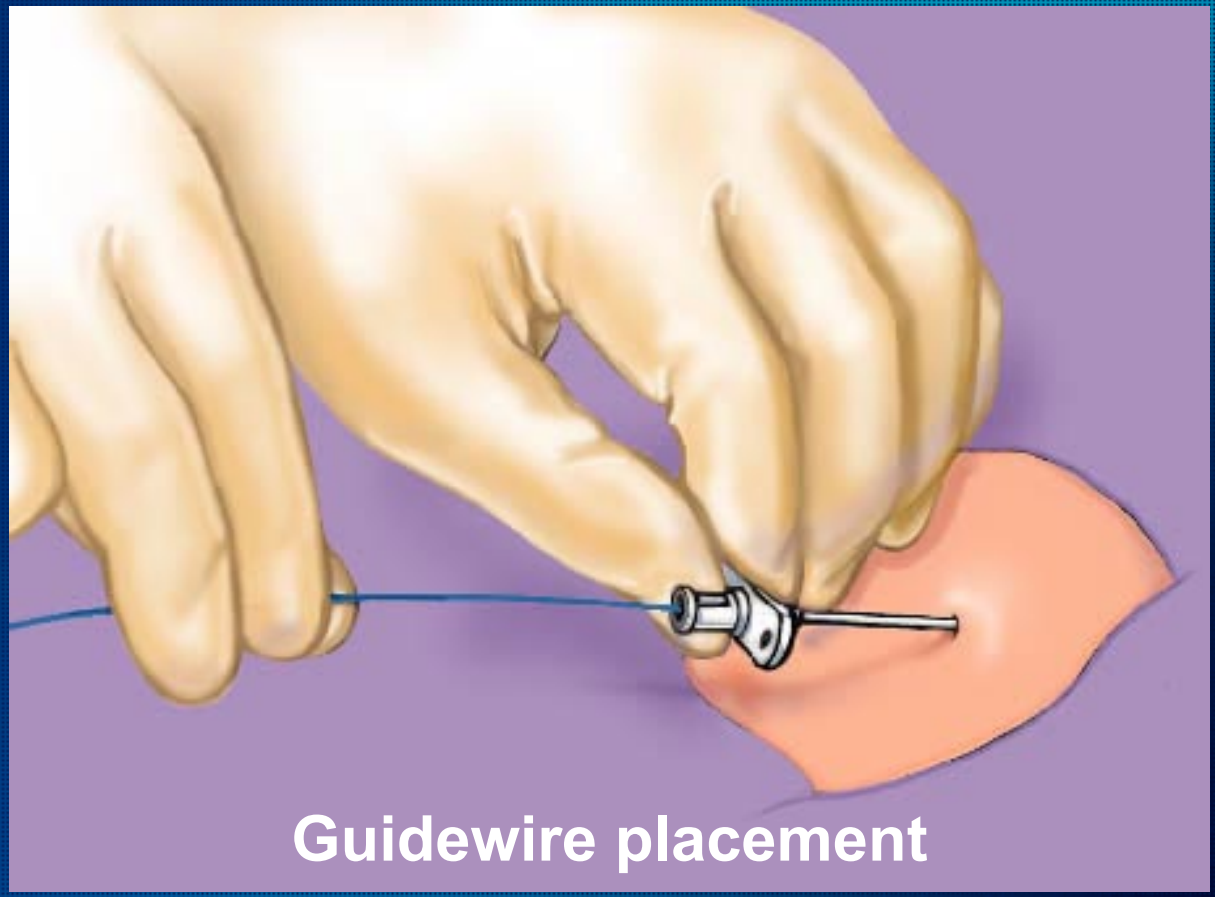
PAD risk reduction therapies

- **Smoking**
  - **Complete cessation**
- **Diabetes mellitus**
  - **HbA1c <7.0%, treat other risk factors**
- **Dyslipidemia**
  - **LDL <100 mg/dL, modify HDL and TG**
- **Hypertension**
  - **BP <140/90 or <130/80 in diabetes**
- **ACE inhibitors**
- **Antiplatelet therapy**
  - **Aspirin or clopidogrel**

Minimally Invasive Techniques

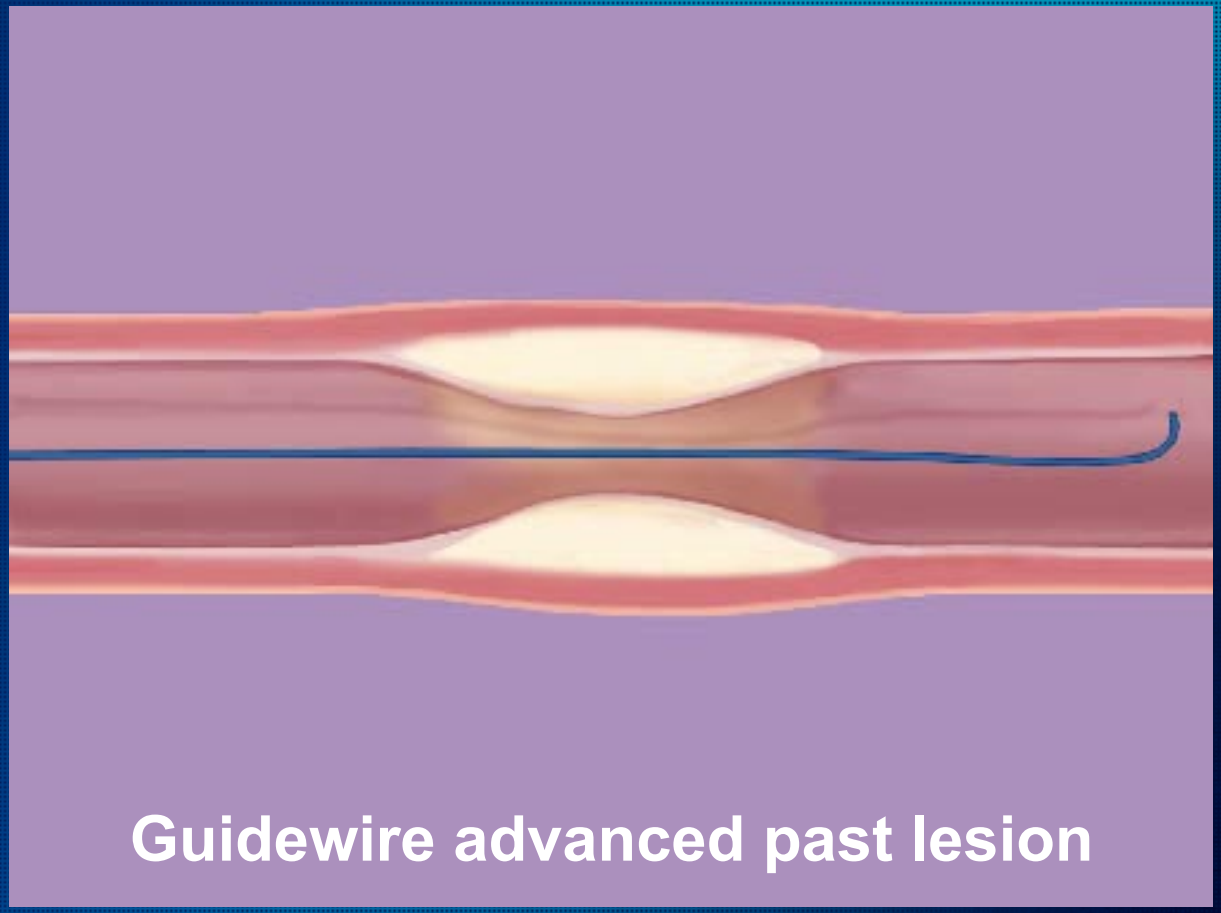
- Percutaneous transluminal angioplasty (PTA)
- Stenting
- Thrombolysis

Minimally Invasive Techniques



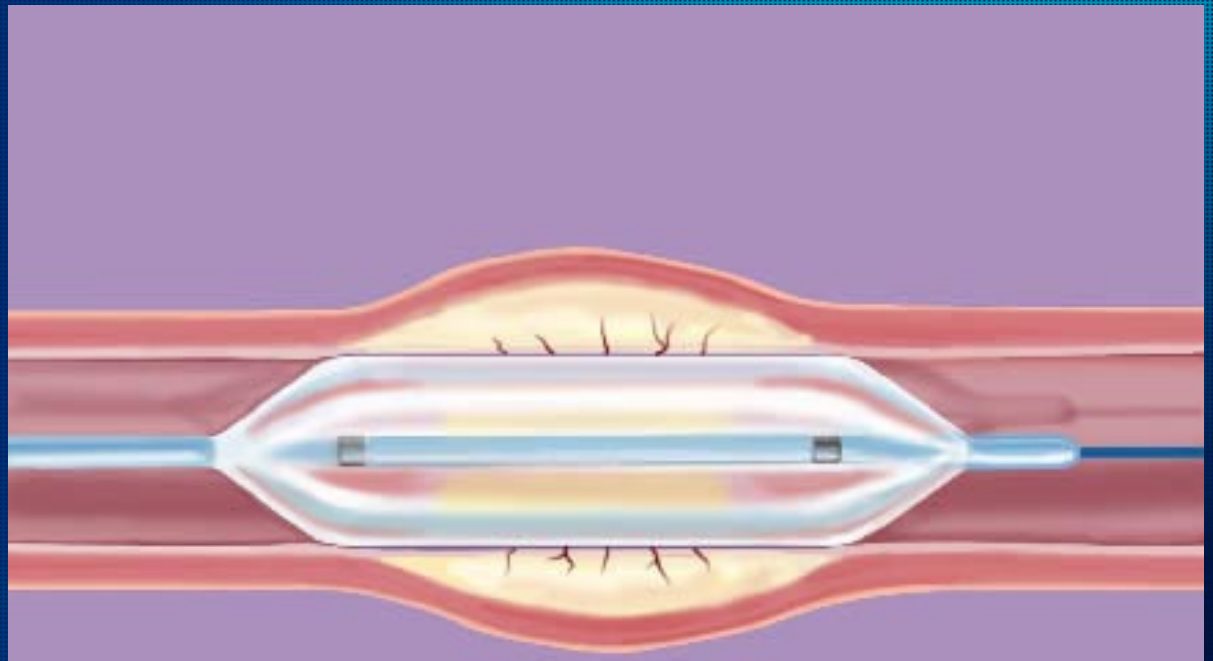
Guidewire placement

Minimally Invasive Techniques



Guidewire advanced past lesion

Minimally Invasive Techniques



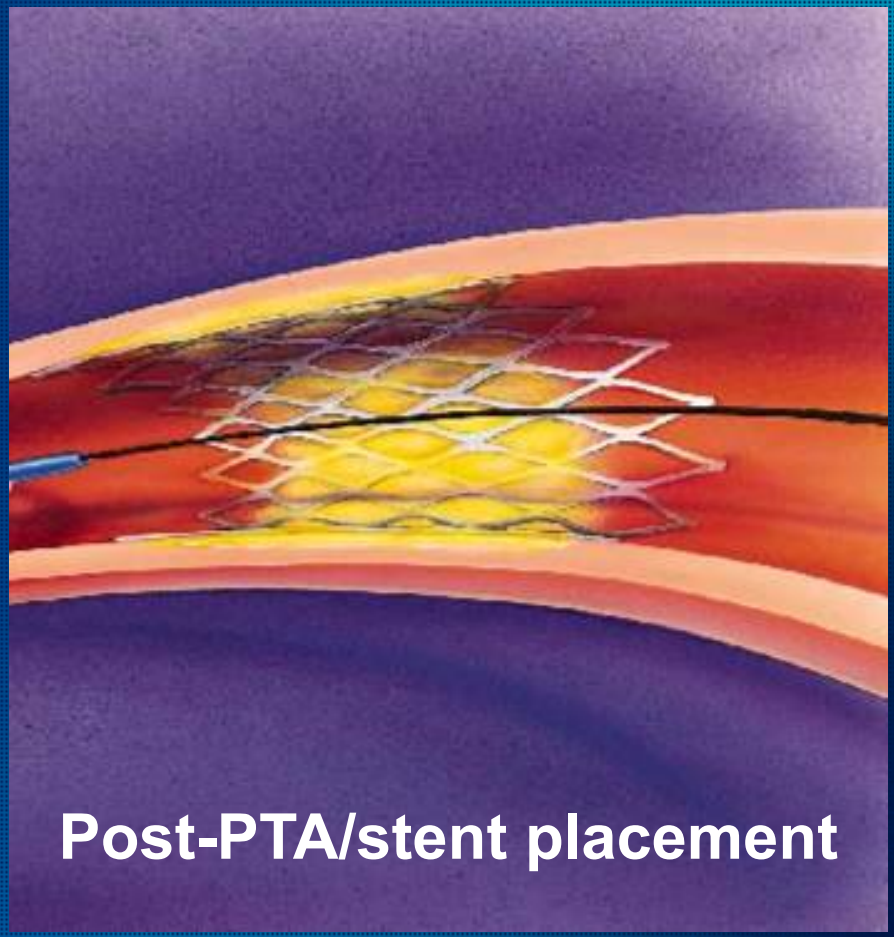
Balloon dilatation

Percutaneous Transluminal Angioplasty

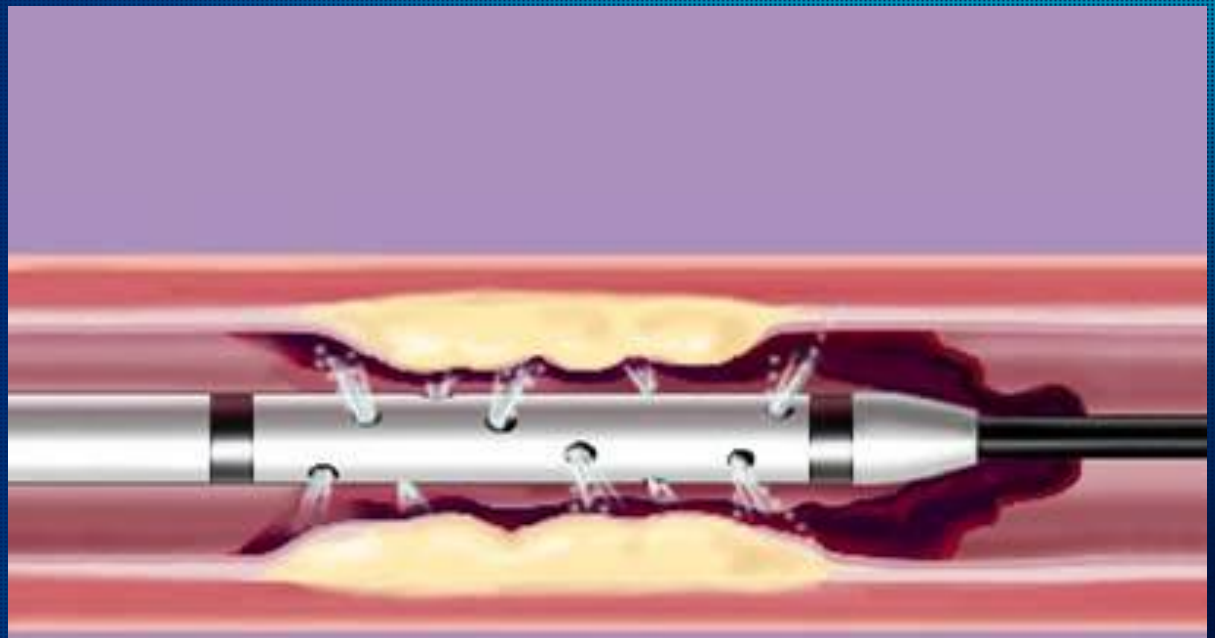
Minimally Invasive Techniques

Stent expansion by a balloon catheter over a guidewire

Minimally Invasive Techniques



Minimally Invasive Techniques

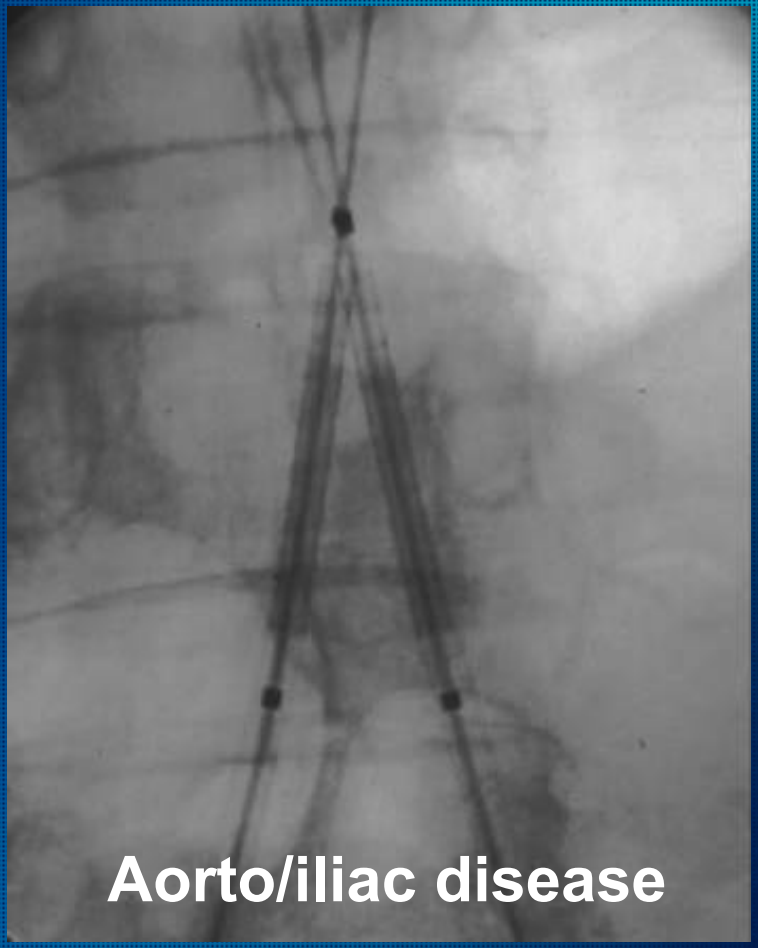


Thrombolysis

Post-thrombolytic infusion revealing stenosis

Case Study #1

Case Study #1



Case Study #1

Case Study #1

Case Study #1

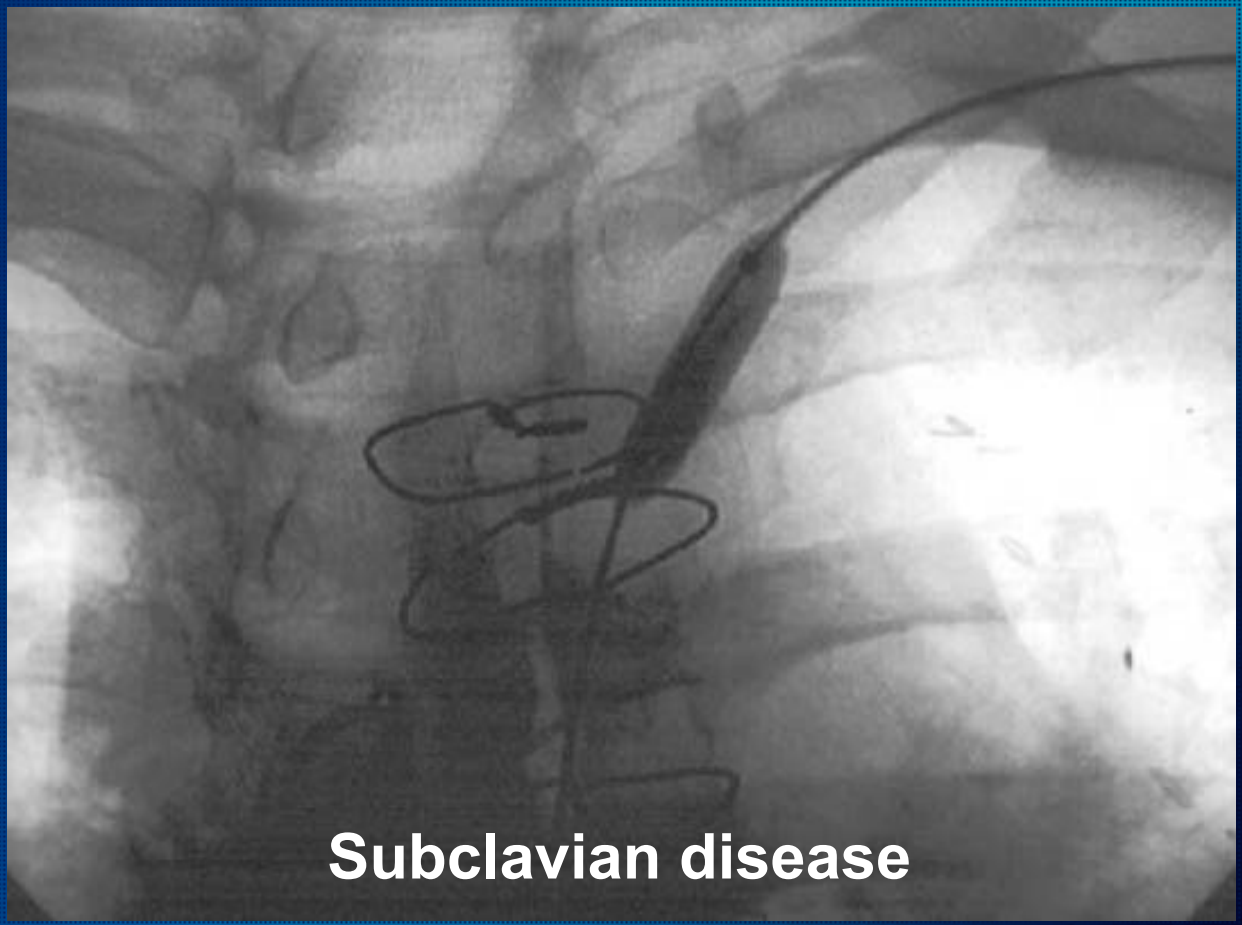
Case Study #1

Aorto/iliac disease
pre-PTA stenting

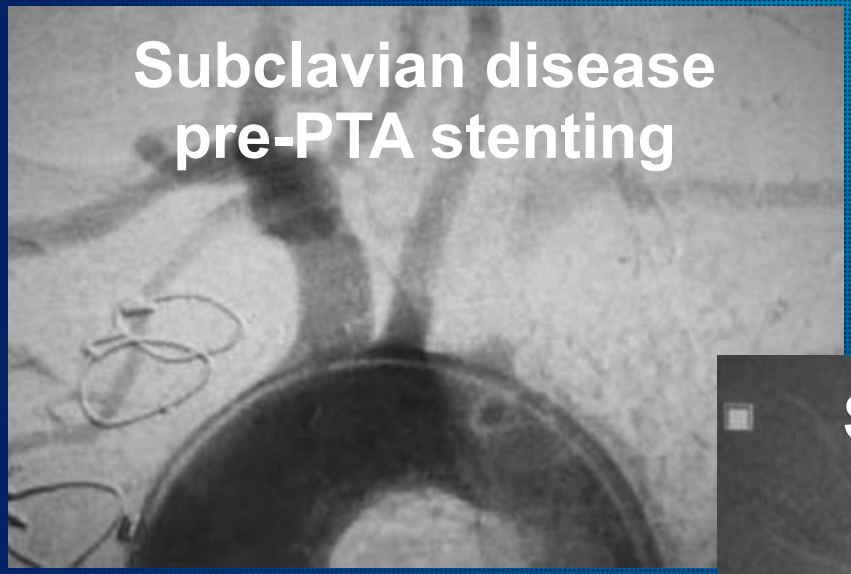
Aorto/iliac disease
post-PTA stenting

Case Study #2

Case Study #2

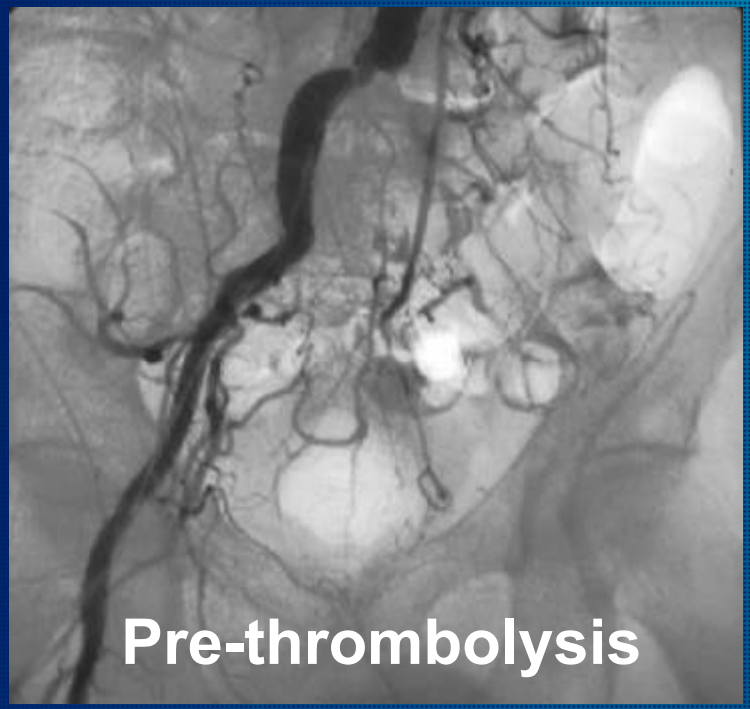


Case Study #2

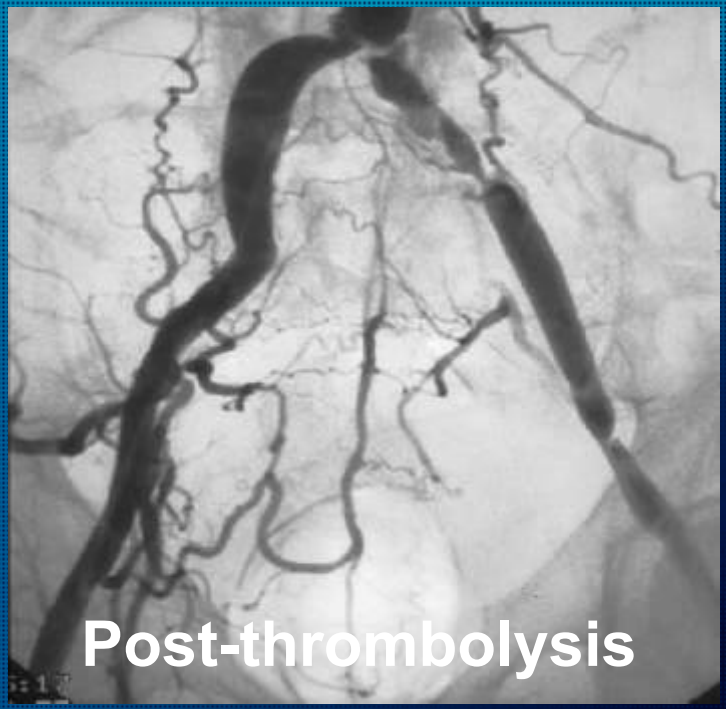

Subclavian disease
pre-PTA stenting


Subclavian disease
post-PTA stenting

Case Study #3

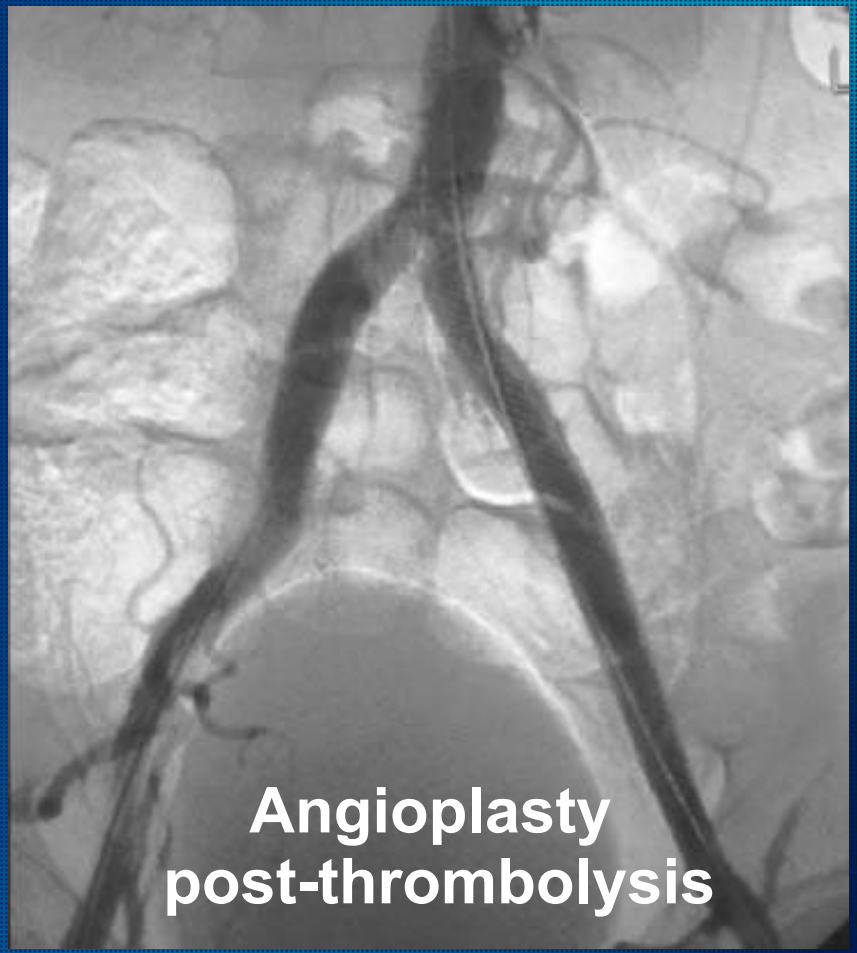


Pre-thrombolysis



Post-thrombolysis

Case Study #3

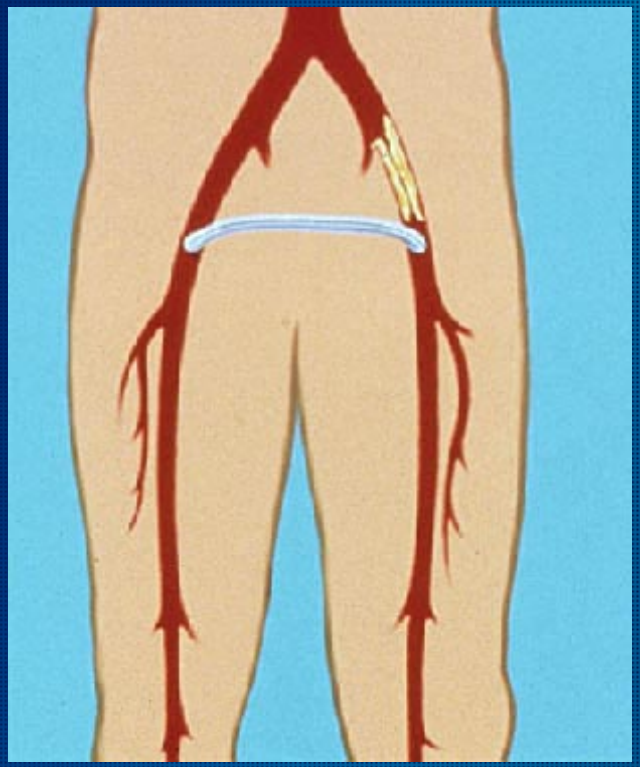


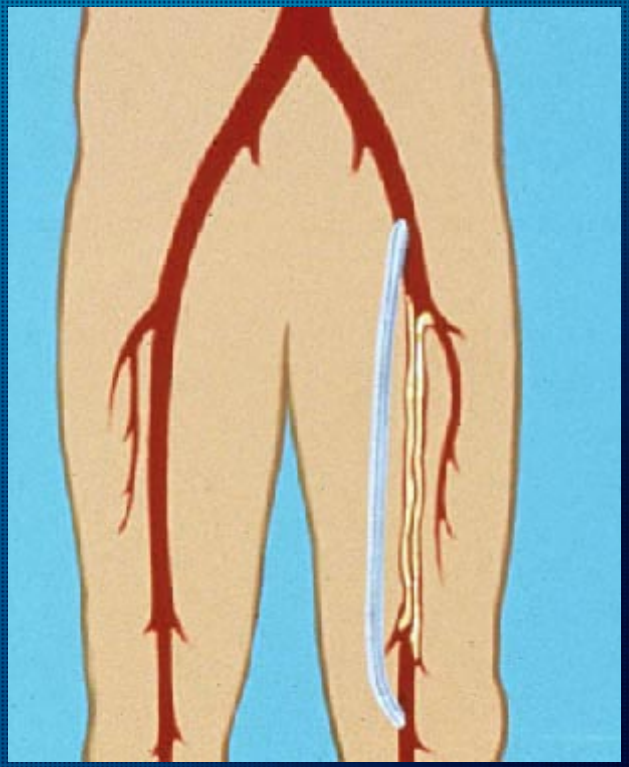
Surgical Intervention

- Bypass grafts
- Amputation

Surgical Intervention

- Bypass grafts

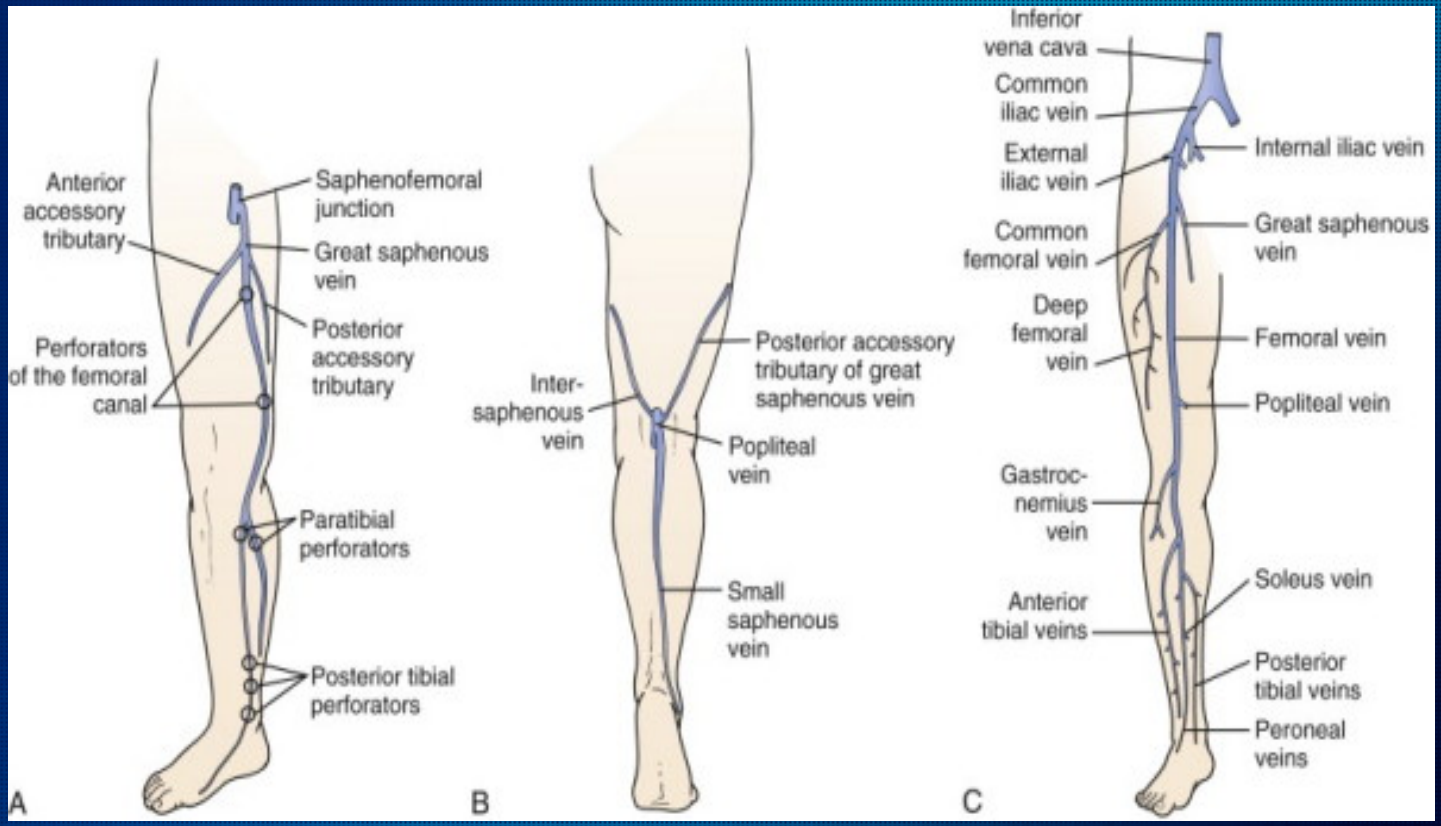




Venous Disease (CVI)

Simple spider veins to complex dermal sclerosis and ulcer formations.

Venous Anatomy



Hemodynamics

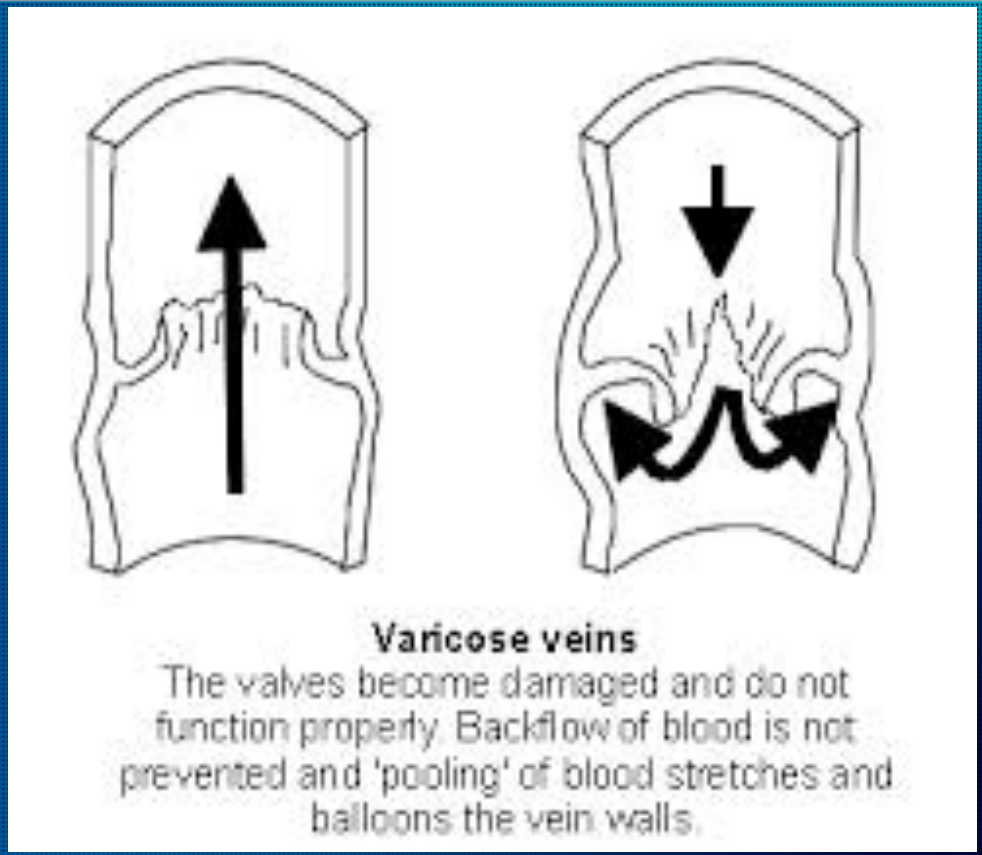
The leg muscle pumps, of which the calf pump is the most important, generate high pressure during muscle contraction, which propels venous blood toward the heart. During relaxation, valves close and blood is prevented from refluxing down the leg and breaking up the hydrostatic pressure column

Calf Pump

The calf muscle pump includes the soleal and gastrocnemius muscles, their intramuscular venous sinusoids, and the superficial and deep veins. The soleal and gastrocnemius muscle sinusoids constitute the major “bellows” of the calf pump. Even in the standing position, contraction of the calf muscles produces enough pressure to eject blood and propel it toward the heart. Intramuscular veins are also affected because of the strong fascia investing the muscles.

Venous Valves

- Presence of valves prevent reflux
- Pressure generated in deep veins by the calf muscles are prevented from transmission to superficial veins by the valves



Varicose veins
The valves become damaged and do not function properly. Backflow of blood is not prevented and 'pooling' of blood stretches and balloons the vein walls.

Venous Pathology

- Obstruction
- Reflux and/or incompetence

Venous Obstruction

- As a result of DVT or superficial phlebitis
- As a result of extrinsic compression
  1. Tumors
  2. Vascular compression (May-Thurner syndrome)

Venous Reflux

Spider Veins

Varicose Veins

Venous Reflux

Edema

Venous Statis w/wo Ulcer

Venous History of Patient

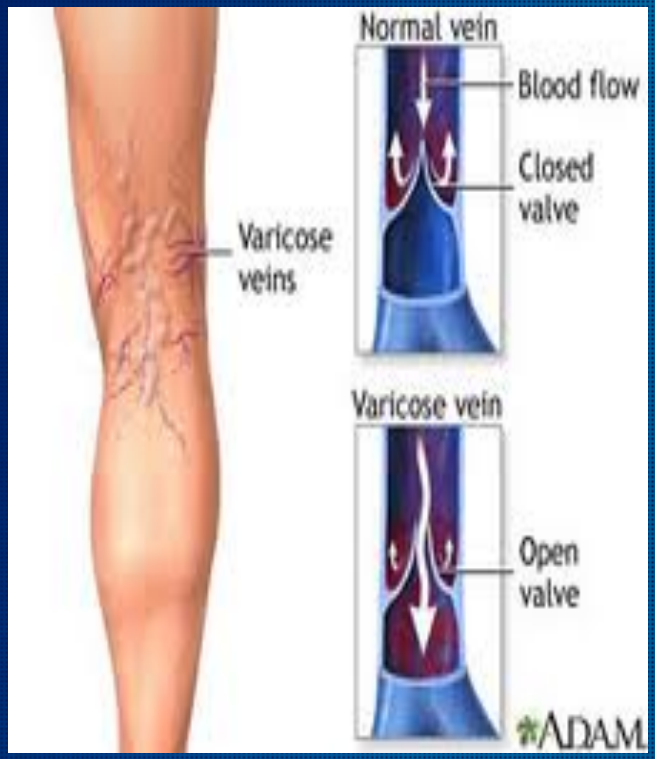
- Pain
- Edema
- Ulcers

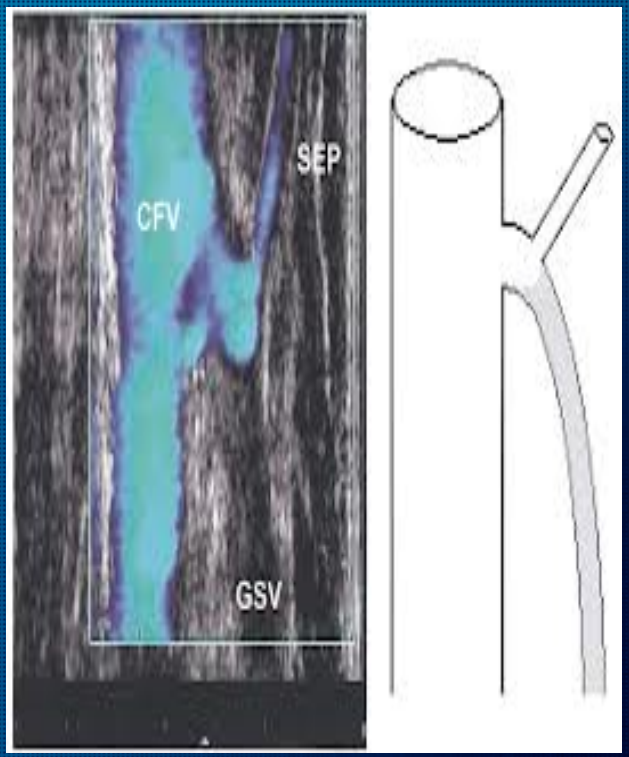
Physical Exam of Patient

- Supine and Standing
- Objective findings of spider or varicose veins
- Skin changes (hypopigmentation to atrophic blanch and atherosclerosis)
- Edema (typically pitting)
- Ulcer formation
- Pulses

Diagnostic Testing

Duplex Scan





Treatment

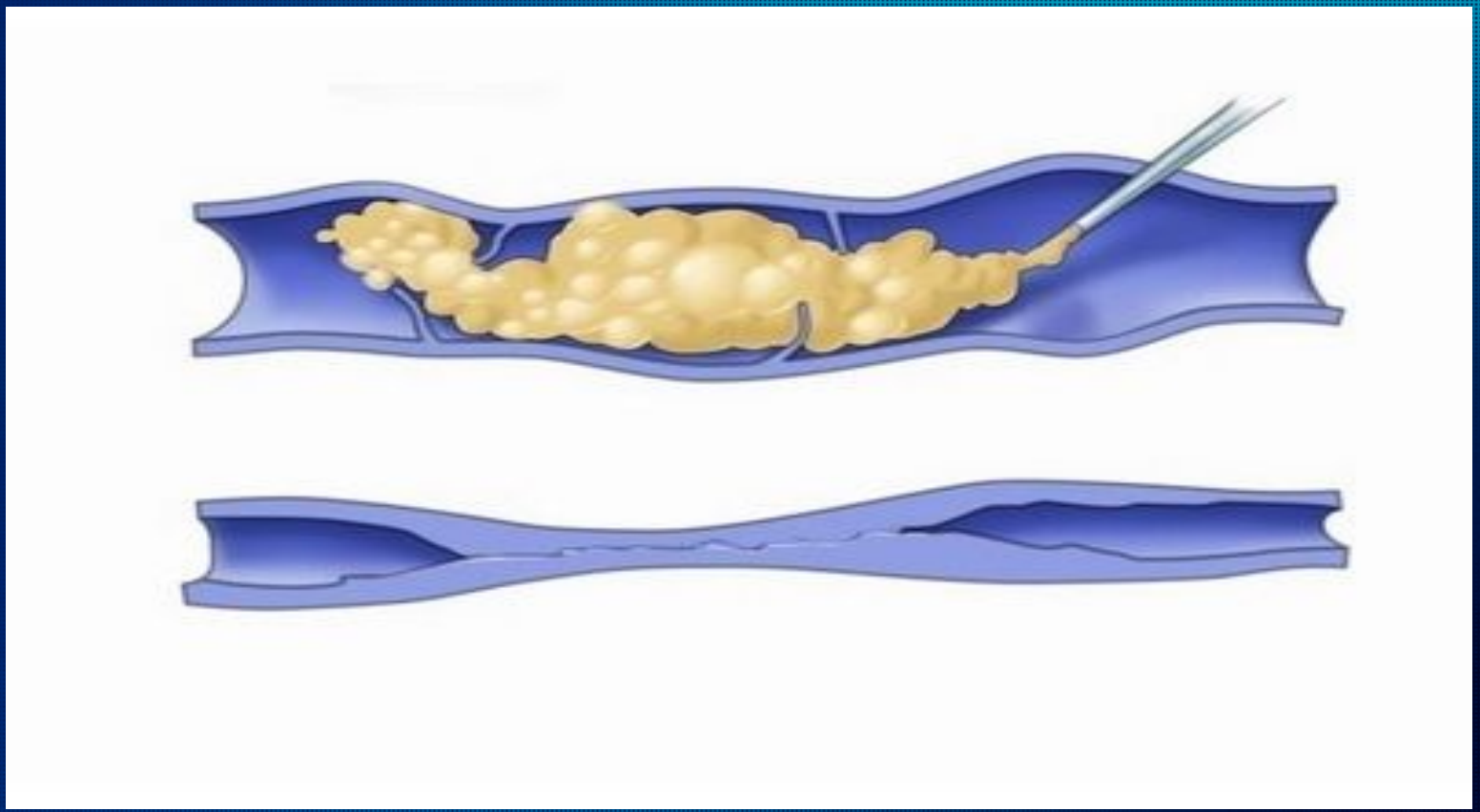
Medical Management

1. Leg elevation
2. Compression therapy
3. Exercise

Interventional Therapy

- Sclerotherapy
- Endovenous Ablation
- Surgical

Sclerotherapy

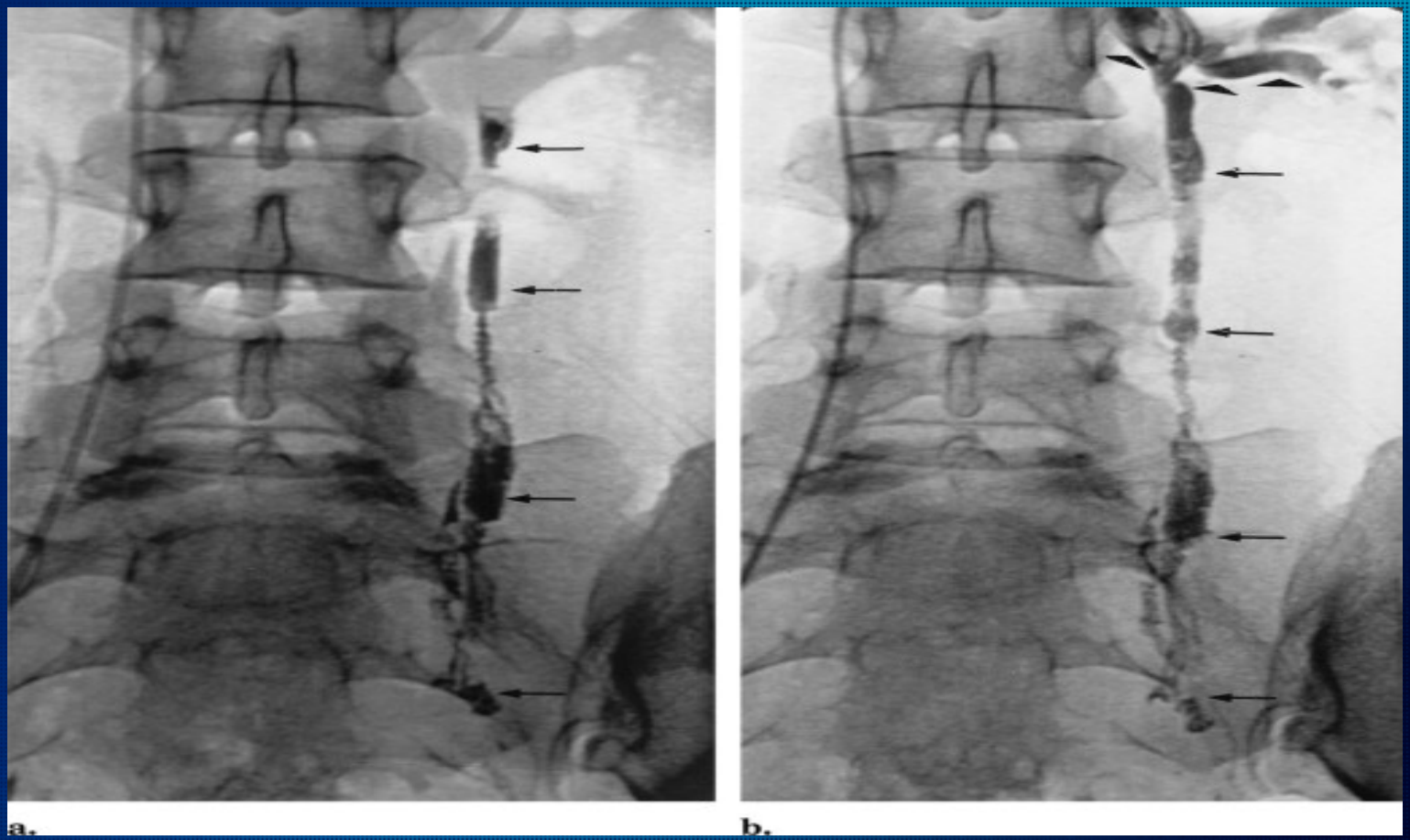


Endovenous Ablation

Surgical

Pelvic Congestion Syndrome

Treatment



Similarities and Differences

- Arterial symptoms produced by exercise and relieved by resting even standing
- Venous symptoms worsened by standing and improved by exercise and leg elevation

Venous Claudication

- Pain produced by prolonged exercise in the legs secondary to iliac vein obstruction and relieved by rest
- Symptoms present with normal arterial findings
- Exception:::: to venous symptoms

Treatment Differences

- In the arterial system, treatment is aimed at opening and restoring blood flow
- In the venous system, treatment is aimed at obstructing and eliminating dysfunctional blood vessels