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Peripheral Arterial Occlusive Disease

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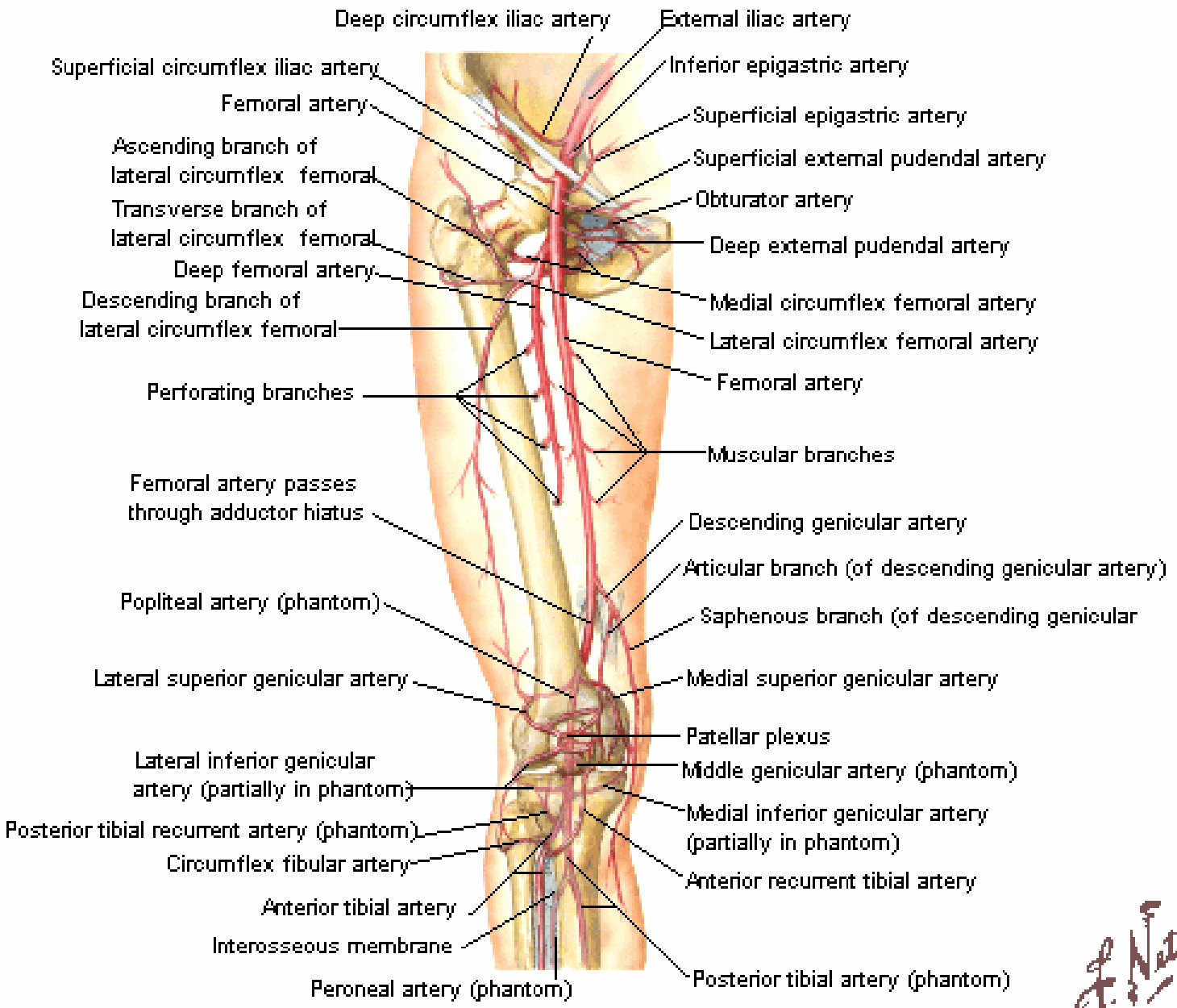
Arteries of Thigh and Knee

Schema



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Epidemiology

- Intermittant claudication
  - 2-3% of men over age 60
  - 1-2% of women over age 60
- PAD (ABI <0.9) over age 55
  - 17% of Men
  - 21% of Women

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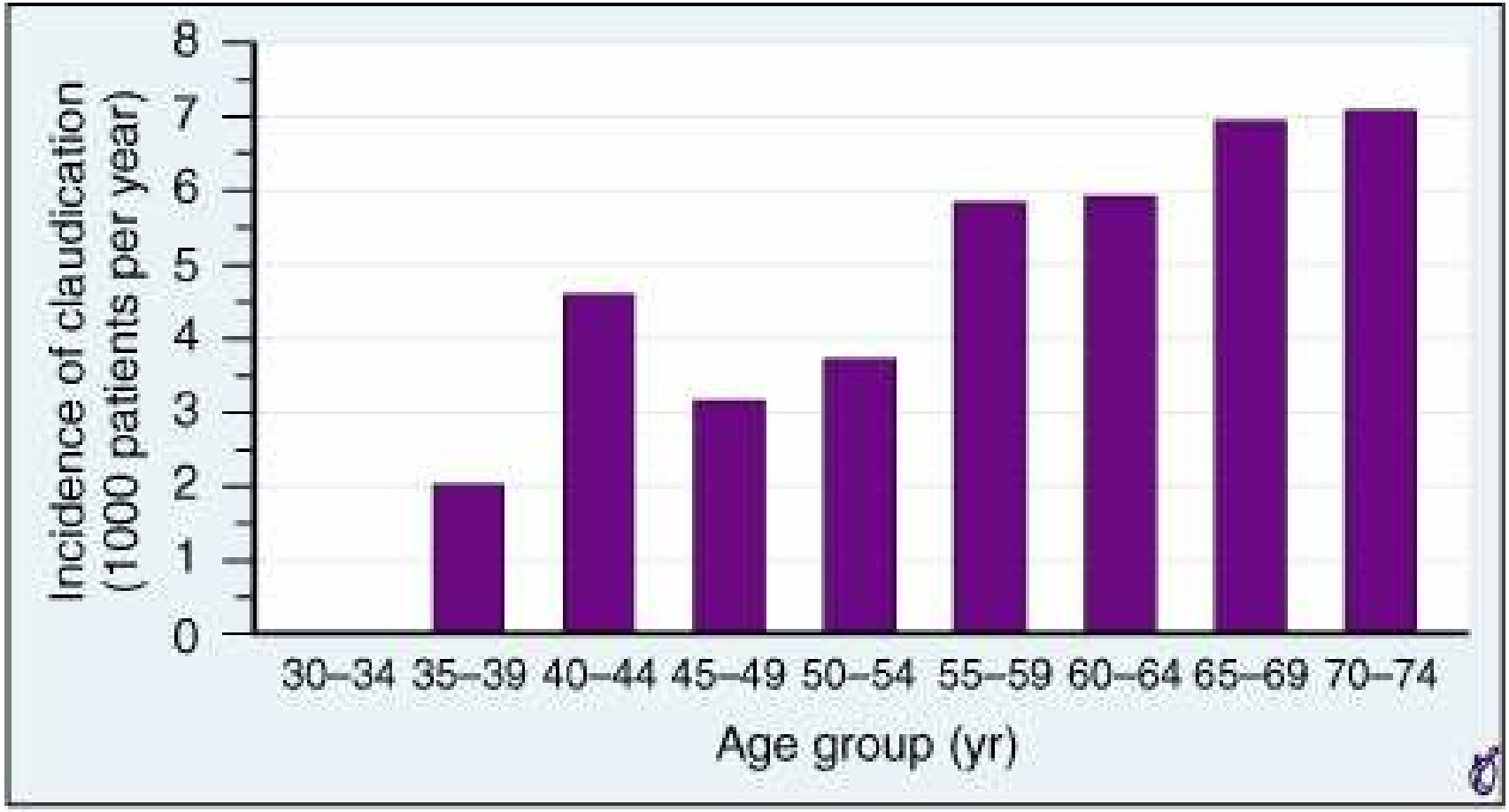
IC increases with age



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Disease Progression in Claudicants

- 25% of Claudicants will ultimately require revascularization
  - Overall deterioration fastest in 1st year (6-9%) then 2-3% annually therafter
- 5% will develop critical limb ischemia
- Overall major amputation rate 1-3% at 5 years

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PAD is a marker of systemic atherosclerosis

- Cleveland Clinic study of routine heart catheterization prior to peripheral vascular surgery
  - 90% had CAD
  - 28% had severe, 3 vessel CAD
- Carotid ultrasound shows atherosclerosis in 25-50% of patients with PVD
- Over 10 years, overall 4.5x mortality risk for patients with PAD

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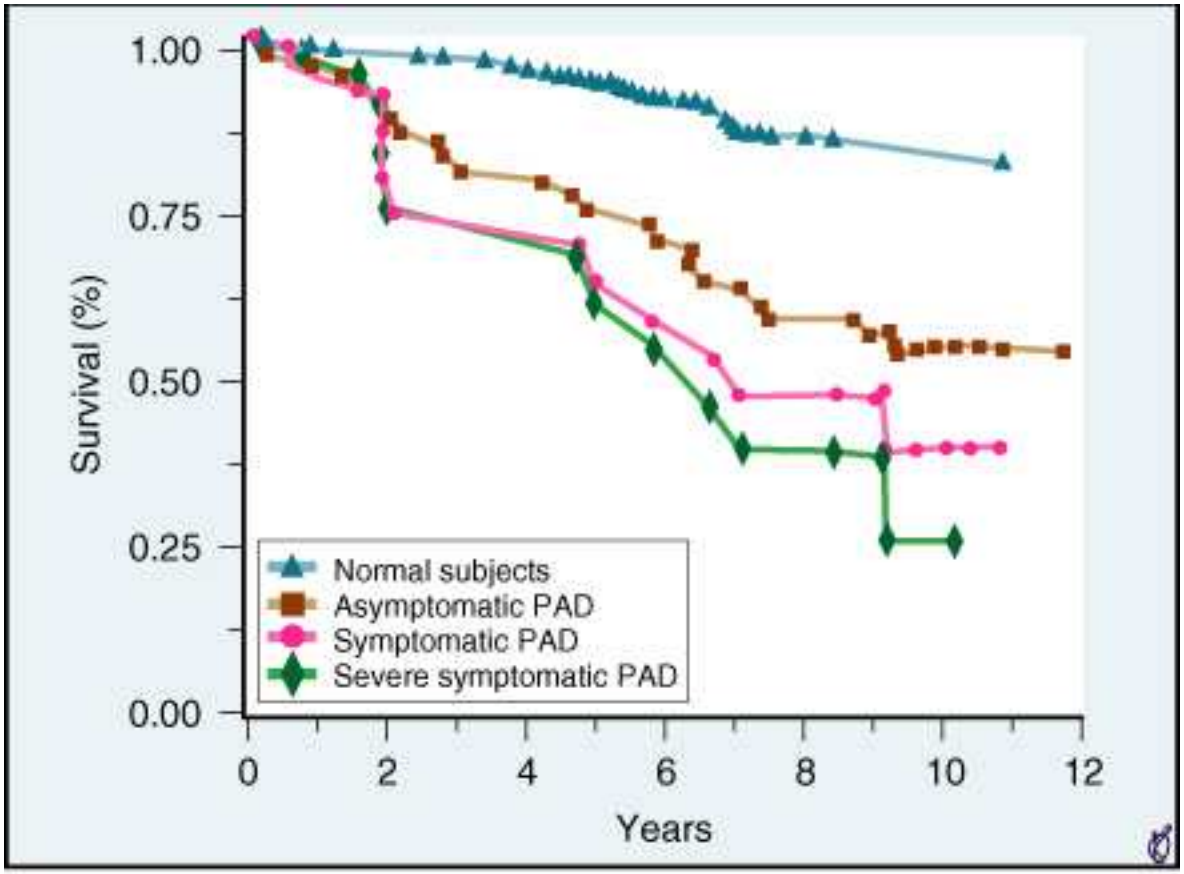

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Risk factors for PAD

- More common in elderly, men
- Smoking is most important modifiable risk factor
  - Smokers have 1.7-5.6x risk of PAD than nonsmokers
  - Smokers have 3x risk of intermittent claudication
  - Amputation more common in smokers (up to 11%)
- Diabetes
  - DM have 1.5-6x prevalence of PAD
  - DM have 2-4x more intermittent claudication
  - DM have 10x risk of amputation
  - However – there is some uncertainty that DM is a causative agent in PAD

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Risk factors for PAD

- Hypertension
  - Men with HTN have 2.5x risk of PAD
  - Women with HTN have 4x risk of PAD
- Lipids
  - Total cholesterol/HDL ratio predictive
  - Hs-CRP predicitve

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TABLE 54–2 Risk of Peripheral Arterial Disease in Persons with Modifiable Risk Factors

Risk Factor	Estimated Relative Risk
Cigarette smoking	2.0-5.0
Diabetes mellitus	3.0-4.0
Hypertension	1.1-2.2
Hypercholesterolemia (per 40-50 mg/dl increase in total cholesterol)	1.2-1.4
Fibrinogen (per 0.7 g/liter increase in fibrinogen)	1.35
C-reactive protein	2.1
Hyperhomocysteinemia	2.0-3.2

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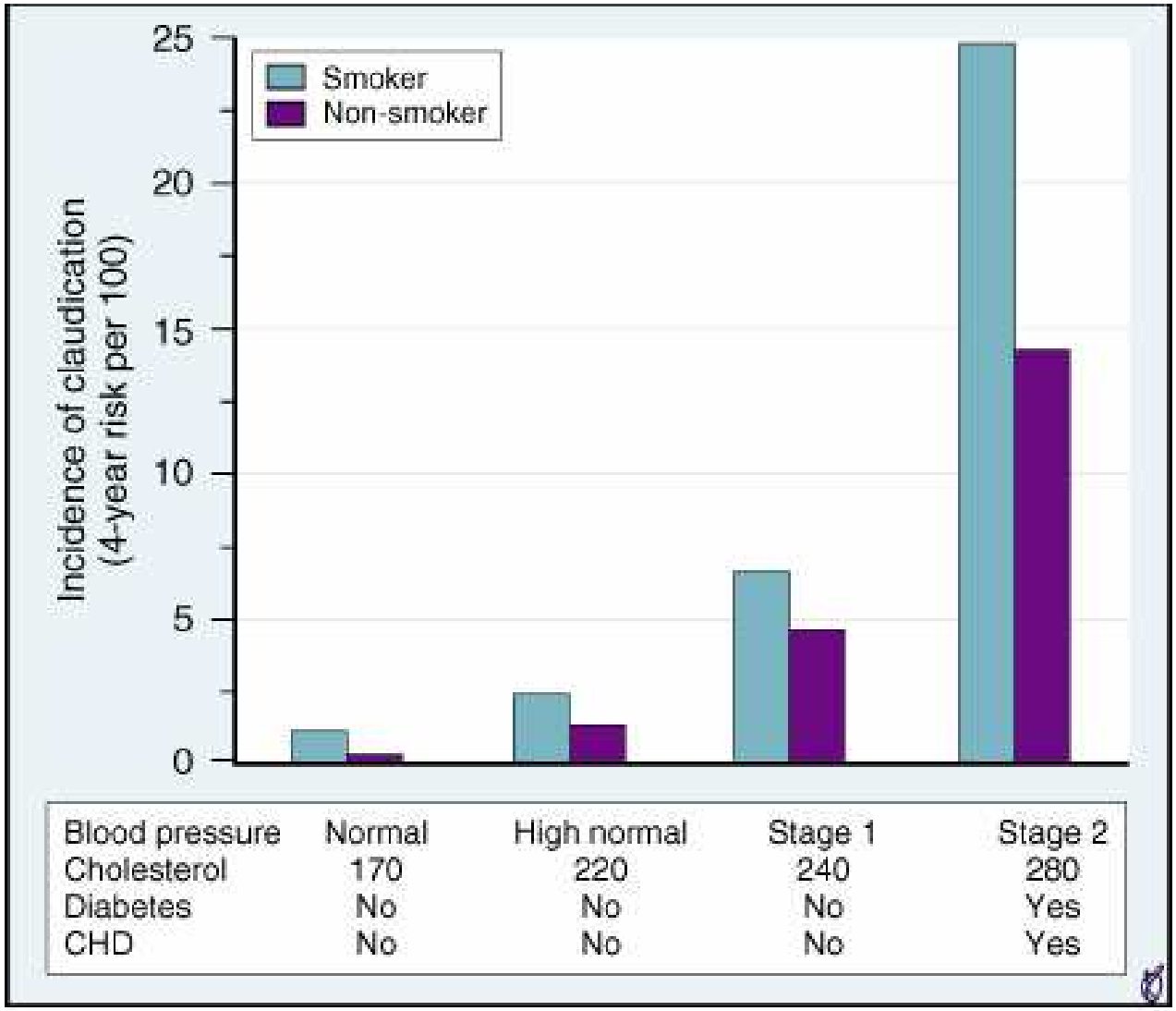
Framingham data



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Diagnosis – H+P

- History of claudication
  - Pain in muscle groups with exertion
  - Relieved with rest (usually 5-10 minutes) but not positional
  - Claudication variants
    - Pseudoclaudication – neurogenic or muscular, requires positional change for relief
    - *Vasospastic – normal pulses at rest, LE ischemia at exercise with absent pulses; usually there is proximal subcritical disease
    - Venous – congestion with standing or walking, relief with leg elevation
    - Muscular distress – common with myopathies, muscular dystrophy, amyotrophic lateral sclerosis; associated muscular deficits
- Physical exam for pulses and bruits

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TABLE 54–4 Differential Diagnosis of Exertional Leg Pain

- Vascular causes
  - Atherosclerosis
  - Thrombosis
  - Embolism
  - Vasculitis
    - Thromboangiitis obliterans
    - Takayasu arteritis
    - Giant cell arteritis
  - Aortic coarctation
  - Fibromuscular dysplasia
  - Irradiation
  - Extravascular compression
    - Arterial entrapment (e.g., popliteal artery entrapment, thoracic outlet syndrome)
    - Adventitial cysts
- Nonvascular causes
  - Lumbosacral radiculopathy
    - Degenerative arthritis
    - Spinal stenosis
    - Herniated disc
  - Arthritis
    - Hips, knees
  - Venous insufficiency
  - Myositis
  - McArdle syndrome

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Diagnosis - ABI

- Ankle-Brachial index
  - Most effective non-invasive test for detection of PAD
  - Resting ABI <90%; 95% sensitive, 99% specificity for >=mild PAD
  - Exercise – may bring out >20mm Hg ankle pressure drop if PAD present
  - When ABI >130%, consider vessel incompressibility, toe pressures should be examined

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Interpretation of ABI

- In peripheral arteries, significant symptoms arise from 70-90% decrease in cross sectional area
- >20 mm Hg drop between segments is considered significant for lower extremity
  - (>10 mm Hg drop for upper extremity)
- Toe pressures should be >60% of brachial pressure
- Normal ABI – 0.9-1.0
- Claudication – 0.5-0.8
- Critical limb ischemia - <0.5
  - With ABI <0.4, <40% of patients can walk 6 minutes
- Ankle pressure <55 mm Hg predicts poor wound healing

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Right ABI = Higher right-ankle pressure / Higher arm pressure

Left ABI = Higher left-ankle pressure / Higher arm pressure

Interpretation of ABI

> 1.30	Noncompressible
0.91–1.30	Normal
0.41–0.90	Mild-to-moderate peripheral arterial disease
0.00–0.40	Severe peripheral arterial disease

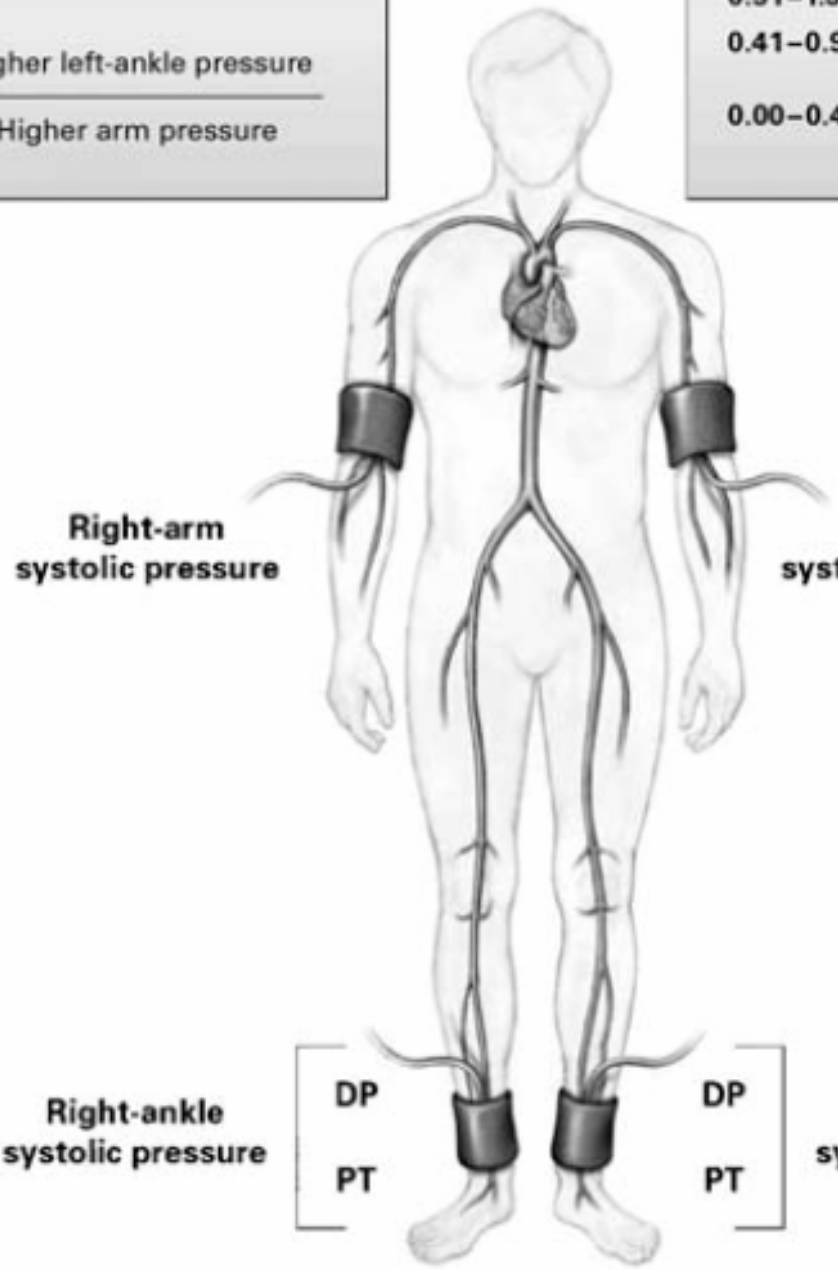

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TABLE 54–7 Leg Segmental Pressure Measurements in a Patient with Bilateral Calf Claudication

	152/84	
Brachial Artery	***Right leg***	***Left leg***
Upper thigh	160	162
Lower thigh	110	140
Calf	108	100
Ankle	64	78
Ankle/brachial index	0.42	0.51

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Exercise ABI

- Used to enhance detection of PAD
  - When rest ABI is normal with claudication symptoms
- Treadmill – 12% grade, 1.5-2.0 mph
- Dorsiflexion

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Pulse Volume Recording

- Records blood volume changes in each segment of limb
  - Resembles arterial pulse
- Typically sharp systolic upstroke, shart peak, dicrotic notch, concave down to baseline
- Distal to stenosis – blunted rise, rounded peak, loss of dicrotic notch, slow descent
- Compare segments upstream and contralateral

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Diagnosis – Ultrasound and MRA

- US
  - May be useful to screen patients for PAD, or assess vasculature for revascularization
  - B-mode ultrasound + doppler
    - Look for rise in velocities to find stenosis
      - 2x increase in velocitiy = 50% stenosis
      - 3x rise in velocity = 75% stenosis
      - 4x rise in velocity = 90% stenosis
- MRA
  - 97% sensitive and 99% specific compared to angiography for detection of PAD

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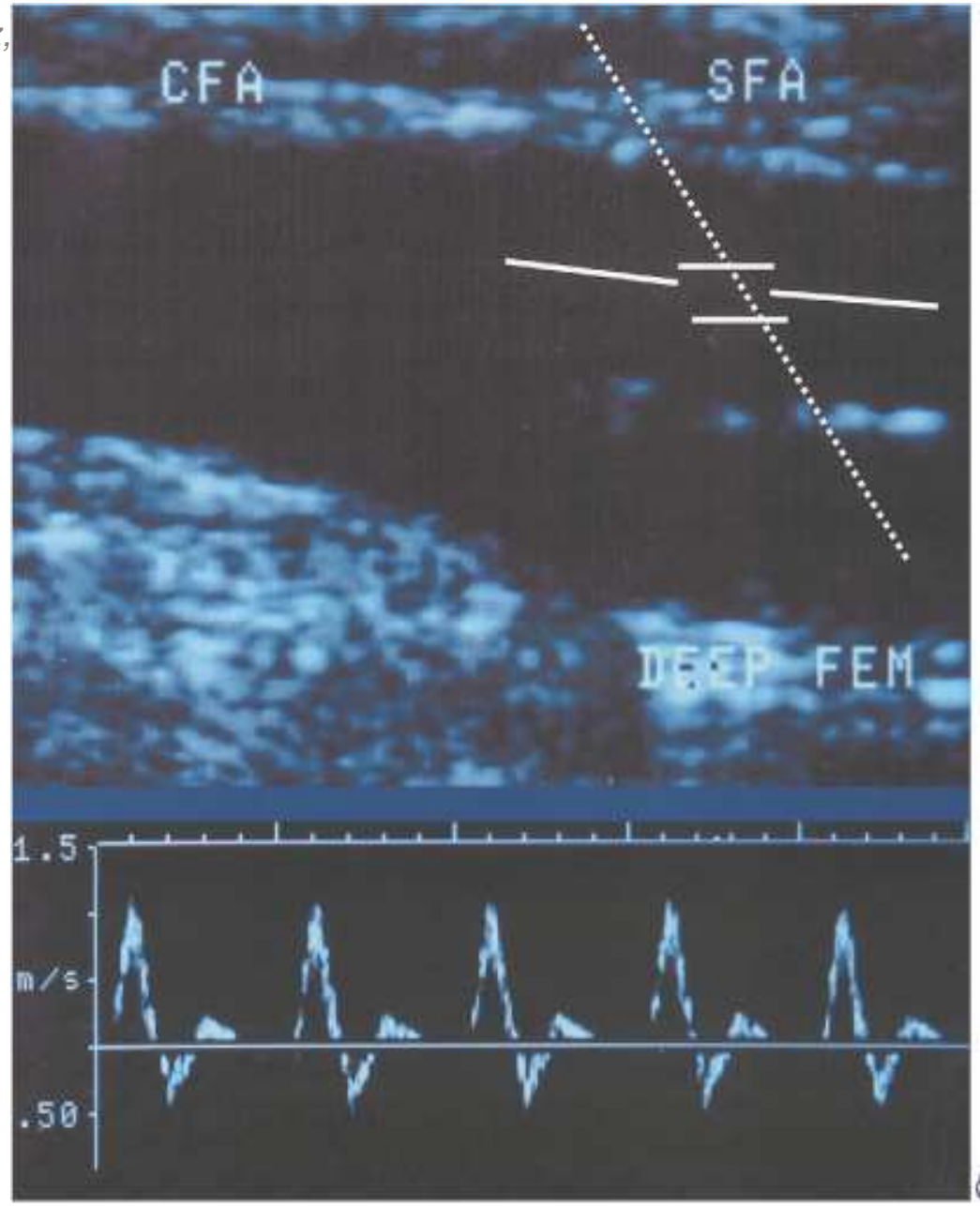

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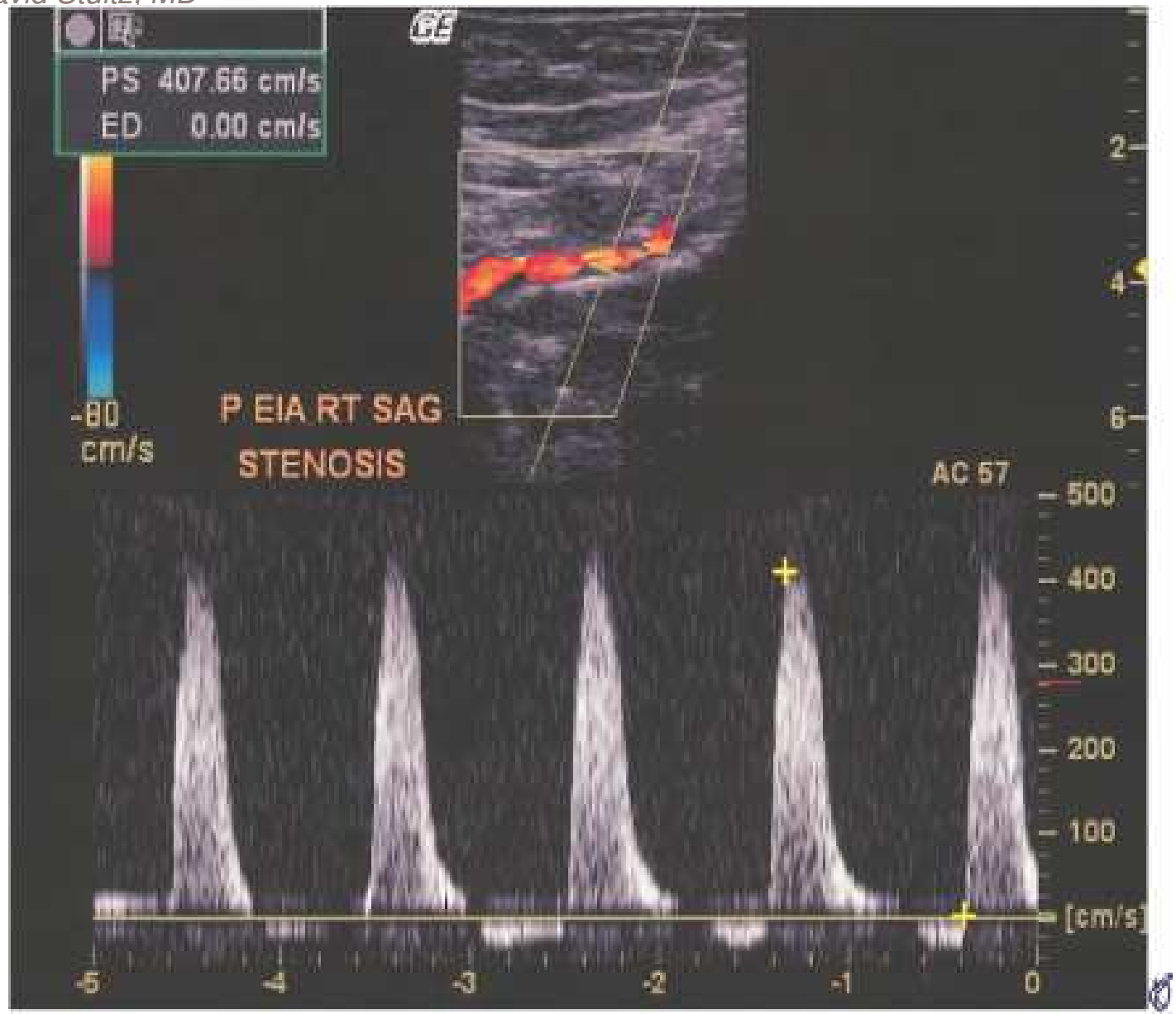

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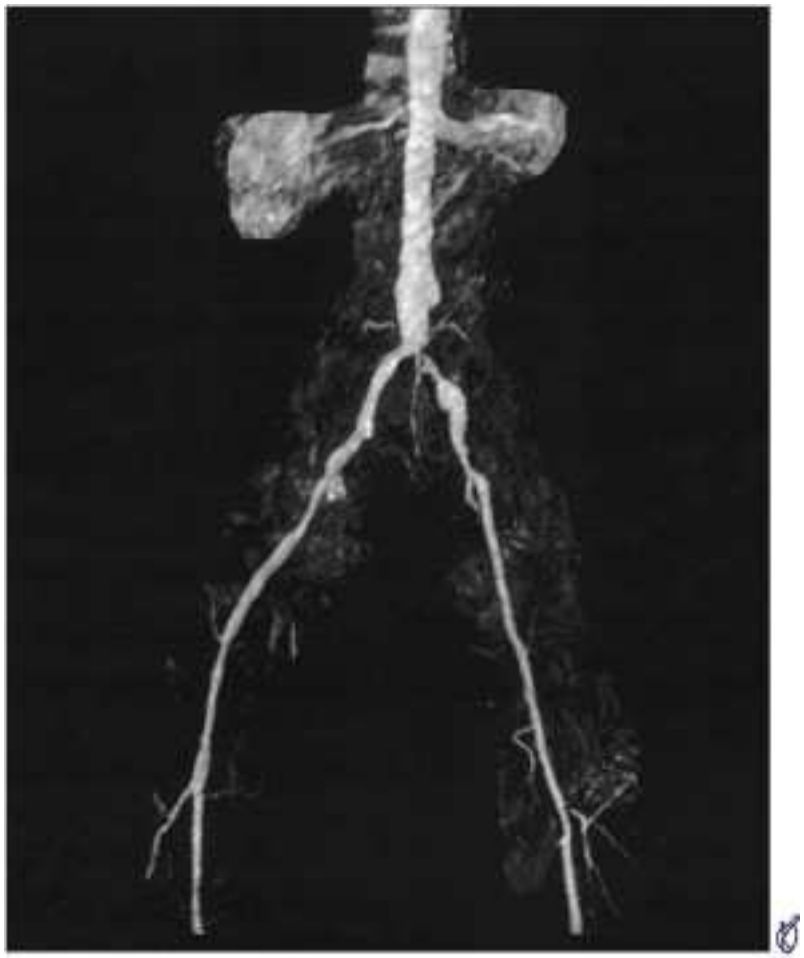

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Diagnosis - Screening

- Broad based screening not cost effective
- Target screening to patients
  - With exertional leg pain
  - >50 years old with risk factors (smoking, DM)
  - With DM >20 years
  - >70 years old

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Noninvasive testing - followup

- For patients with stable intermittant claudication who have a deterioration in status, consider angiography
- Noninvasive studies can be used for periodic followup of grafts or previously intervened segments

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Acute Limb Ischemia

- Worsening limb perfusion, causing a threat to limb viability
- Due to embolization or thrombosis
- Pain, Pulselessness, Pallor, Parasthesia, Paralysis
- 15% 30-day mortality rate
- 10-30% 30-day amputation rate

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TABLE 54–8 Clinical Categories of Acute Limb Ischemia (Modified from the SVS/ISCVS Classification)

Category	Description/Prognosis	Findings		Doppler Signals	
		Sensory loss	*Muscle weakness*	*Arterial*	*Venous*
I. Viable	Not immediately threatened	None	None	audible	Audible
II. Threatened					
a. Marginally	Salvageable if promptly treated	Minimal (toes) or none	None	(Often) inaudible	Audible
b. Immediately	Salvageable with immediate revascularization	More than toes, rest pain	Mild, moderate	(Usually) inaudible	Audible
III. Irreversible	Major tissue loss or permanent nerve damage inevitable	Profound, anesthetic	Profound, paralysis (rigor)	Inaudible	Inaudible

Adapted from Rutherford RB, Baker JD, Ernst C, et al. Recommended standards for reports dealing with lower extremity ischemia: revised version. J Vasc Surg 26:517, 1997.

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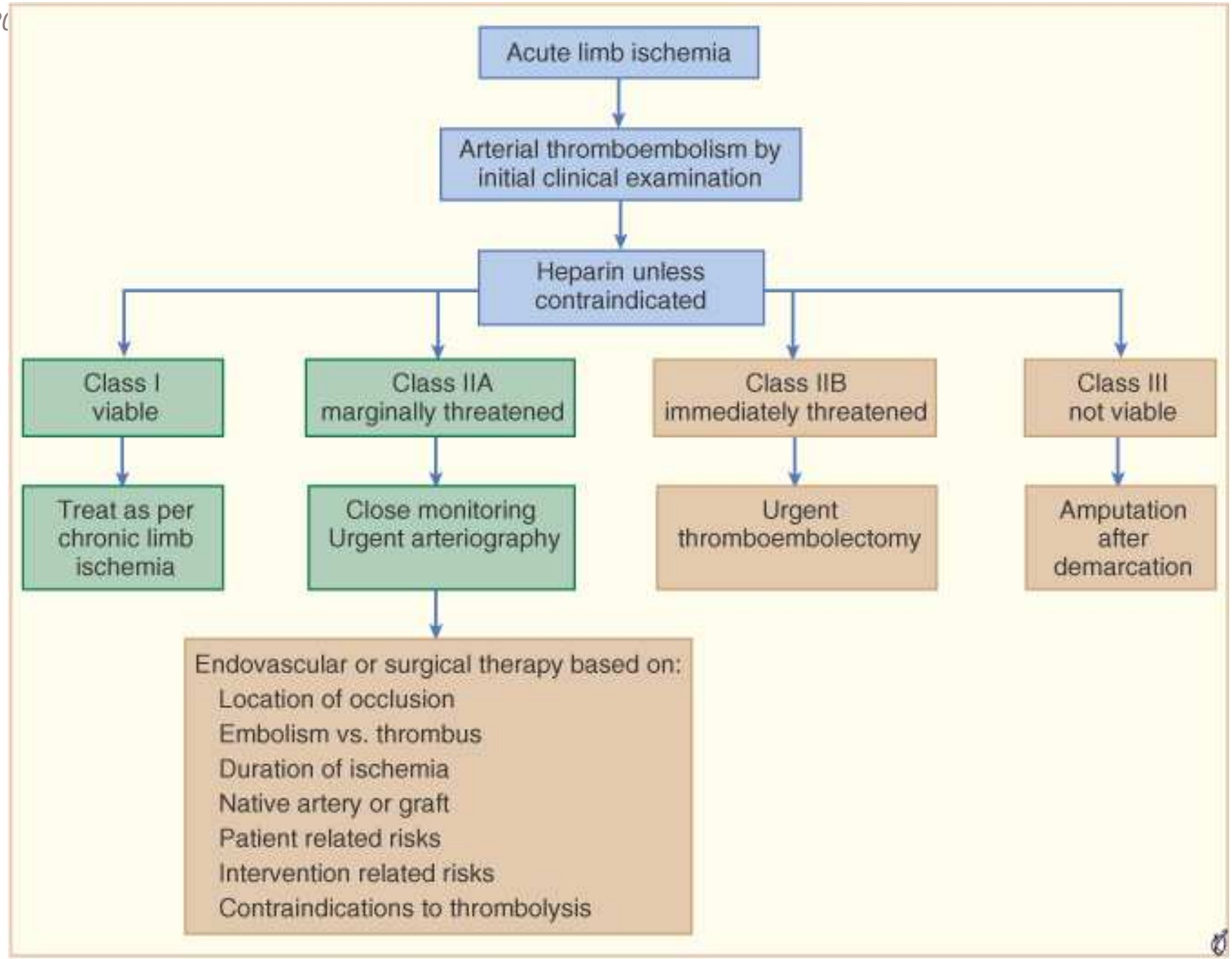

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Chronic Critical Limb Ischemia

- Includes ischemic rest pain, ulcers, gangrene, or at risk for major amputation
- Absolute ankle pressure <=50 mm Hg
- Toe pressure <=30 mm Hg

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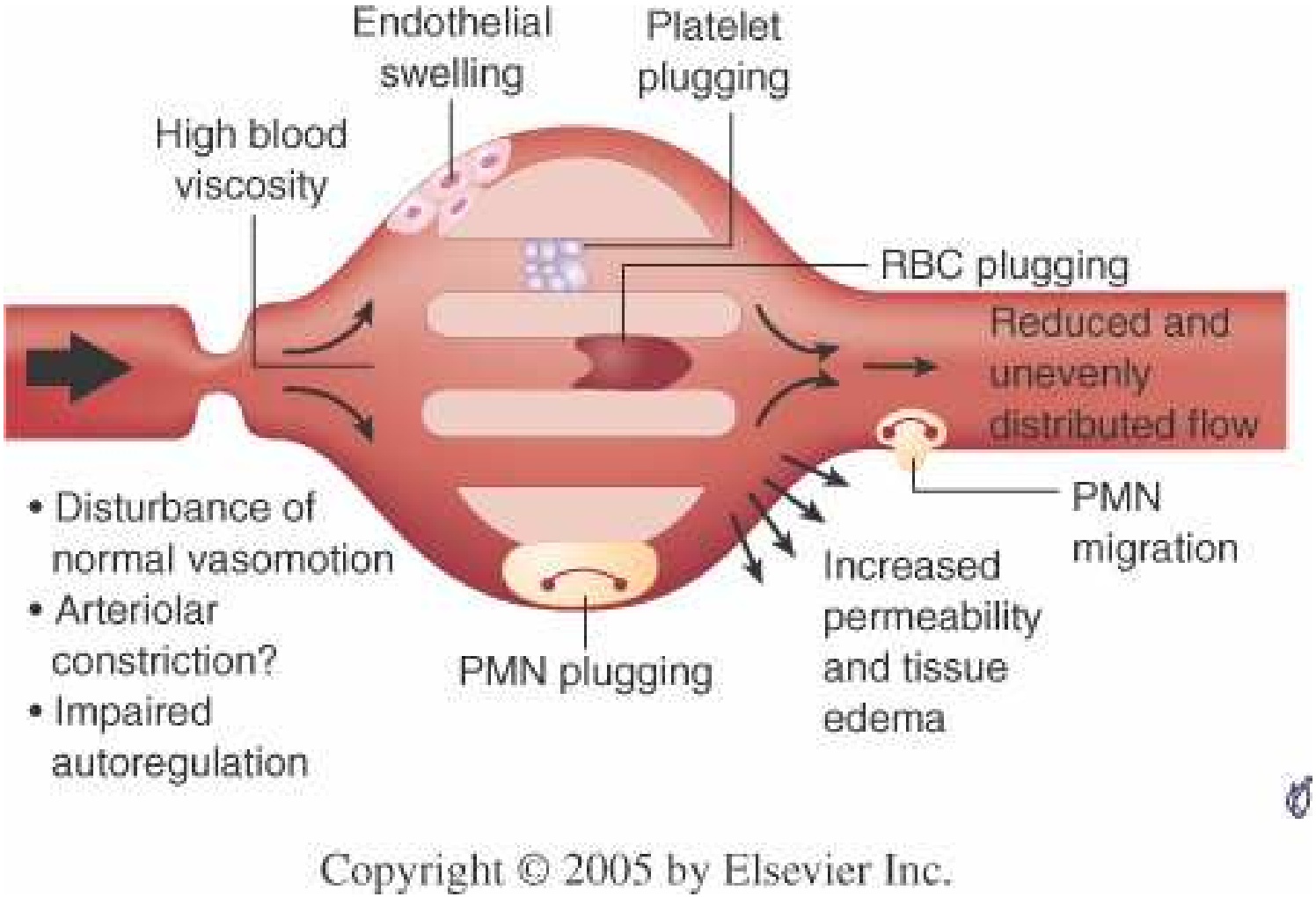
Pathophysiology of Microvascular circulation in Critical Ischemia



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	Fontaine			Rutherford	
Stage	Clinical description	Grade	Category	Clinical description	Objective description
I	Asymptomatic		0	Asymptomatic	Normal treadmill test
IIa	IC,* painfree walking distance >200 m	I	1	Mild IC	Treadmill exercise limited to 5 min; ankle pressure after exercise >50 mm Hg, but at least 20 mm Hg lower than at rest
			2	Moderate IC	Between Rutherford 2 and 3 disease
IIb	IC, painfree walking distance <200 m		3	Severe IC	Treadmill exercise limited to <5 min; ankle pressure after exercise <50 mm Hg
II (compli-cated)	Lesions without CLI* (ankle pressure >50 mm Hg and/or great toe pressure >30 mm Hg)				
III	Rest pain	II	4	Rest pain	Ankle pressure <40 mm Hg and/or great toe pressure <30 mm Hg; pulse volume recording barely pulsatile or flat
IV	Ischemic lesion (ulcer, gangrene, necrosis)	III	5	Limited ischemic lesion	Ankle pressure <60 mm Hg and/or great toe pressure <30 mm Hg; pulse volume recording barely pulsatile or flat
			6	Extended ischemic lesion (above metatarsal level)	

*IC, intermittent claudication; CLI, critical leg ischemia.

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TABLE 54–5 Fontaine Classification of Peripheral Arterial Disease

Stage	Symptoms
I	Asymptomatic
II	Intermittent claudication
IIa	Pain-free, claudication walking >200 m
IIb	Pain-free, claudication walking <200 m
III	Rest and nocturnal pain
IV	Necrosis, gangrene

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TABLE 54–6 Clinical Categories of Chronic Limb Ischemia

Grade	Category	Clinical Description
	0	Asymptomatic, not hemodynamically correct
I	1	Mild claudication
	2	Moderate claudication
	3	Severe claudication
II	4	Ischemic rest pain
	5	Minor tissue loss: nonhealing ulcer, focal gangrene with diffuse pedal ulcer
III	6	Major tissue loss extending above transmetatarsal level, functional foot no longer salvageable

Adapted from Rutherford RB, Baker JD, Ernst C, et al. Recommended standards for reports dealing with lower extremity ischemia: Revised version. J Vasc Surg 26:517, 1997.

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Treatment

- Address and treat risk factors
- PAD is a CAD equivalent
- Medical management prior to revascularization for claudication
- Revascularization for chronic limb ischemia
- Limb salvage preferable to amputation

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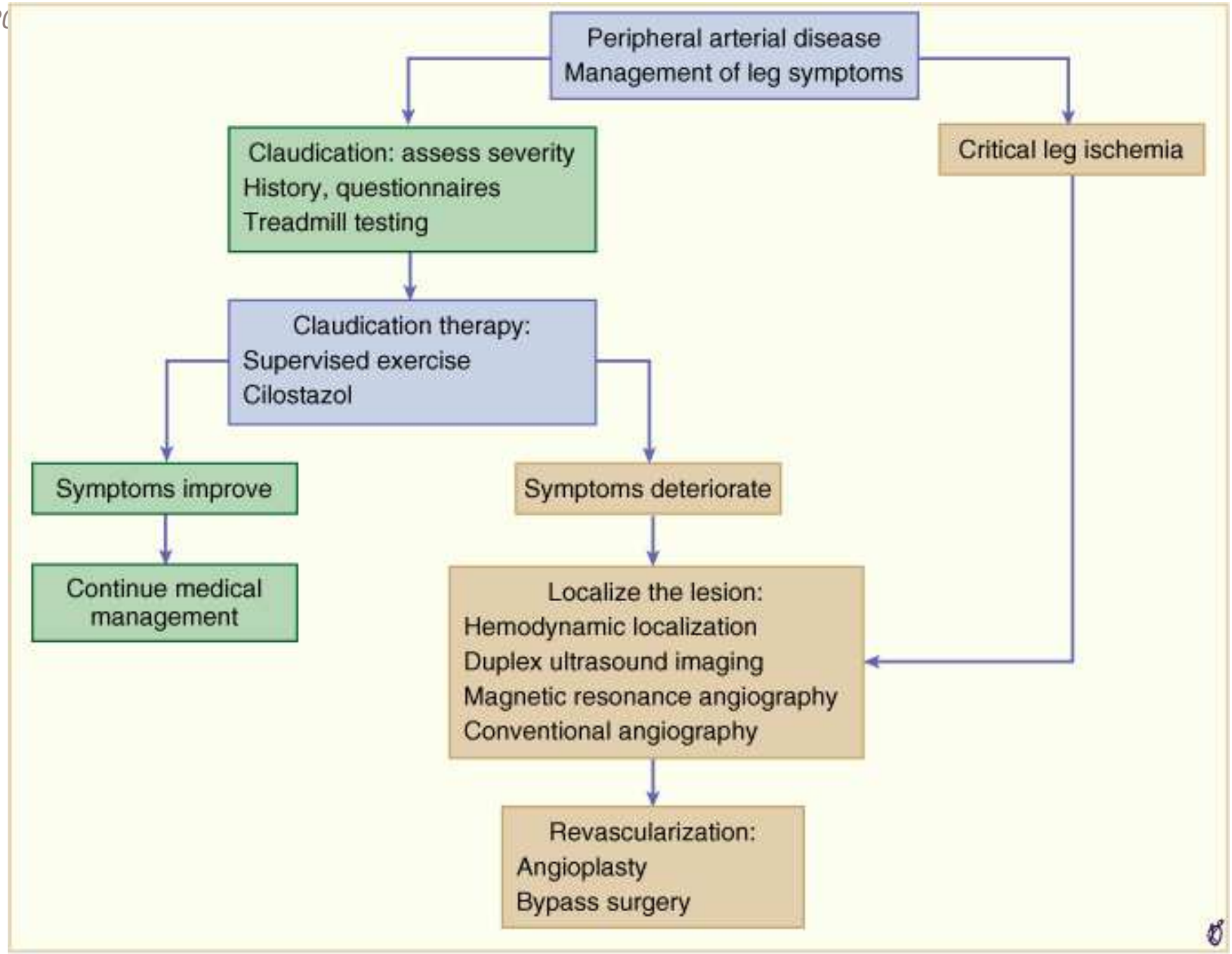

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Lifestyle Modification

- Low fat diet
- DM, HTN, HLP control
- Regular exercise (30-40 min/day, 4-5 times/week)
- Smoking cessation

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Antiplatelet Therapy

- ASA 75-150mg/d results in 23% relative risk reduction in MI, stroke, CV death
- CAPRIE trial supports use of Plavix over Aspirin for PAD (3.7% vs 4.9% annual risk of major vascular event)
- No data yet to support combination of ASA + Plavix

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Adjunctive Agents

- Pentoxifylline not useful, average benefit of 44m of maximal walk distance
- Cilostazol (Pletal) approved for symptom relief, improves walk distance more than ASA or Pentoxifylline
- Prostaglandin I_2, E_1, and iloprost have shown improvement for severe PAD
  - Not commonly used as no oral form available

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Catheter-based revascularization

- Reserved for lifestyle disabling claudication, wounds without adequate arterial supply, or chronic limb ischemia
- Contraindications include abnormal hemostasis, CHF class 4, occlusion of abdominal aorta or calcified occlusions of iliac or femoral arteries (occlusions >10 cm have less favorable outcomes)

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Percutaneous treatment

- Acute or Subacute occlusion below inguinal ligament
  - Thrombus aspiration, thrombolytic infusion
  - Angioplasty
- Small trials support use of 2b-3a

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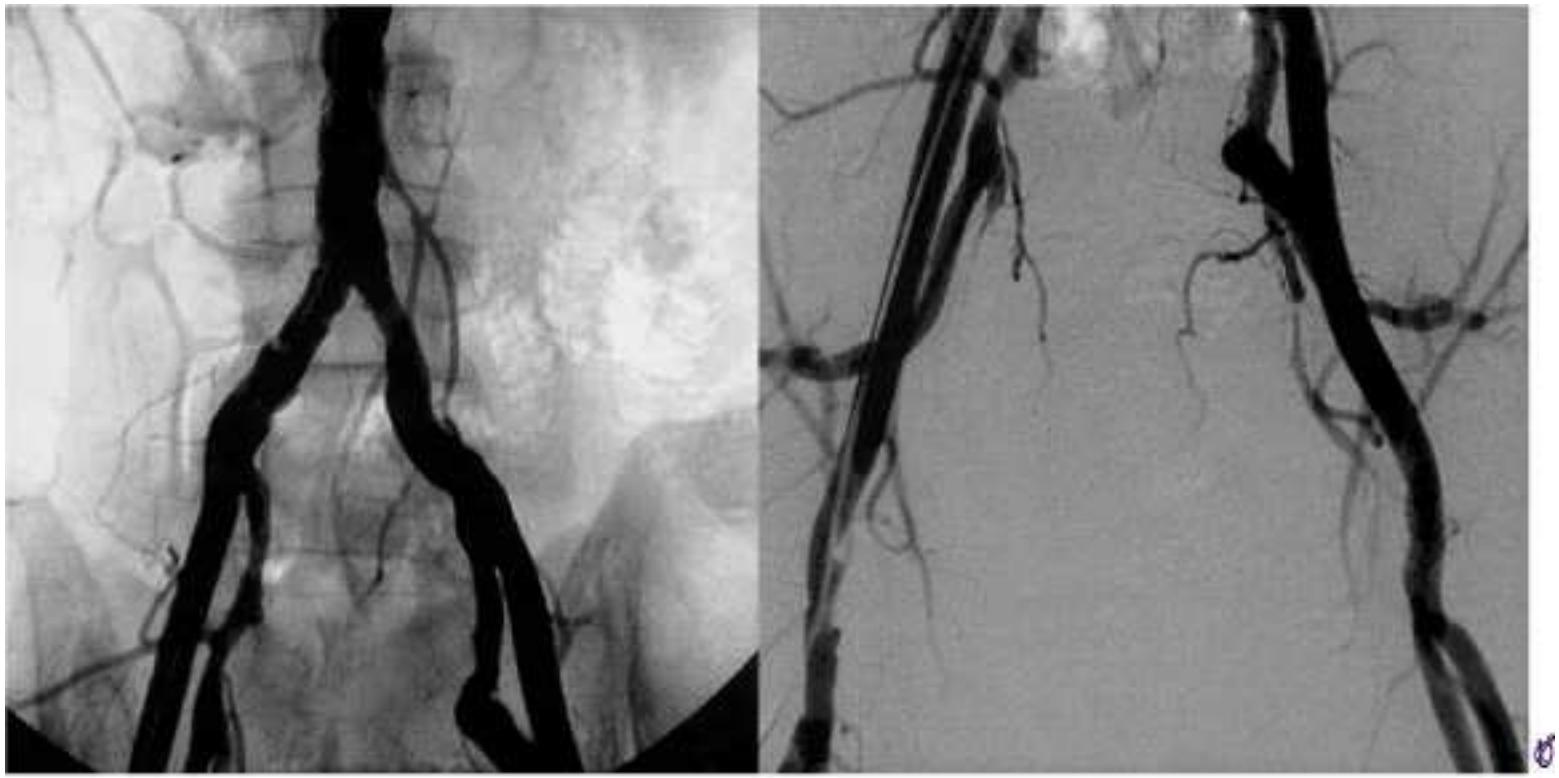

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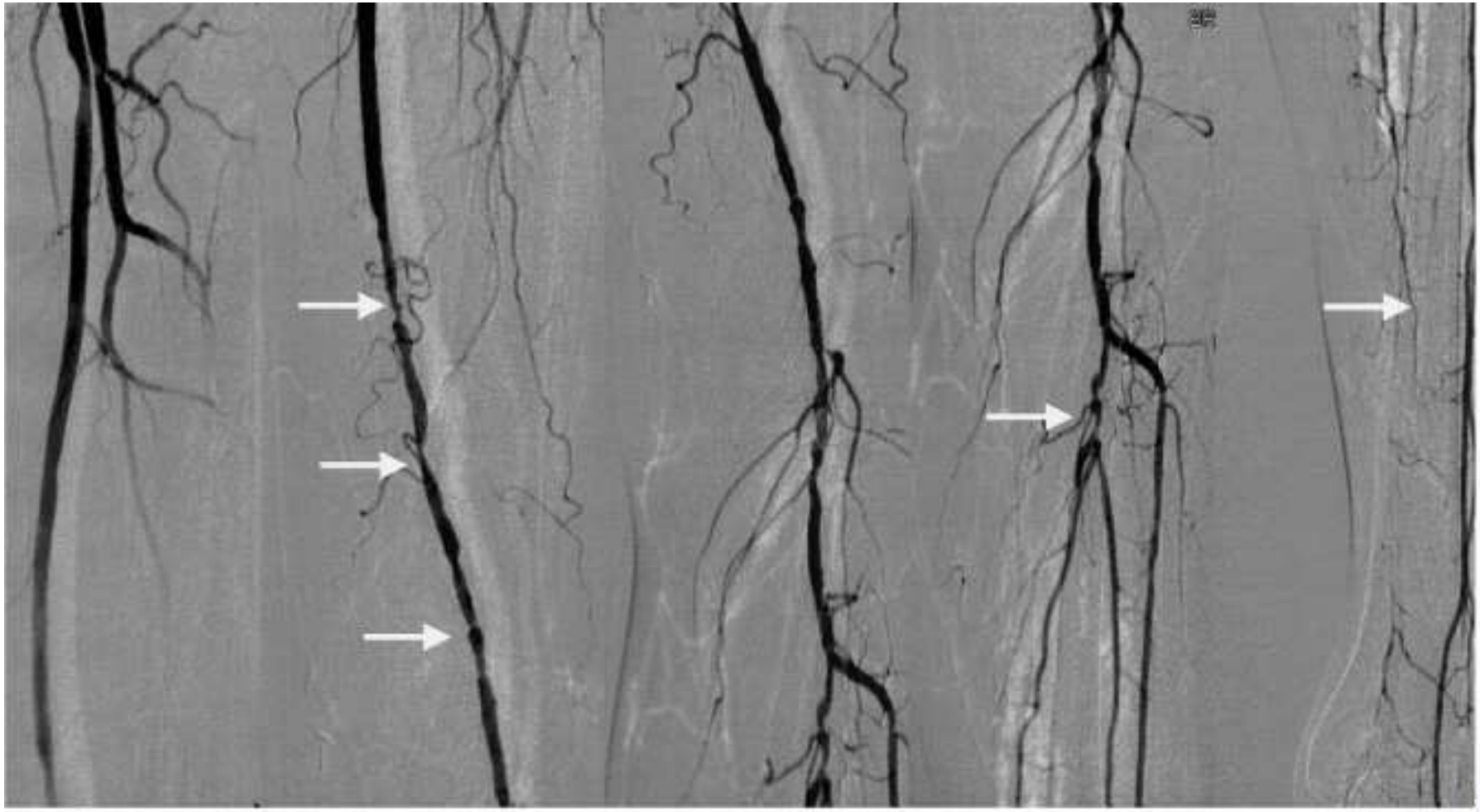

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Restenosis following catheter intervention

- Iliac arteries – 10-20% over 5 years
- Tibial vessels – 50% over 5 years

- Depends on length of interevened segment
- Most restenosis can be re-interevened

- Radiation therapy delays intimal hyperplasia
- Drug eluting stents being evaluated

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Surgical Revascularization

- Rarely indicated for intermittant claudication
- Aortobifemoral bypass uses prosthetic graft
- Venous graft preferred for infrainguinal bypass
- Higher success with more proximal disease
- 25-75% failure rate of femoral-distal grafts

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Antithrombotic Therapy

- Data supports use of antiplatelet therapy (ASA) following vein or prosthetic graft
- ASA should be started preoperatively
- Coumadin better at preserving patency of vein grafts; ASA better for prosthetic grafts
- However, coumadin reserved for patients at risk for graft failure
  - Femoral-distal bypass graft
  - Marginal quality vein
  - Poor arterial runoff
  - Previously failed bypass graft