Lower Extremity Vascular Disease

Lower Extremity Vascular Disease

- Popliteal artery entrapment
- Mucinous cystic degeneration
- Buerger's disease
- Abdominal aortic coarctation
- Emboli
- Fibrodysplasia
- Pseudoxanthoma elasticum
- Persistent sciatic artery
- Iliac artery syndrome of cyclist
- Primary arterial tumors

Atherosclerosis

Lower Extremity Vascular Disease

- Claudication
- Critical Limb Ischemia

Claudication

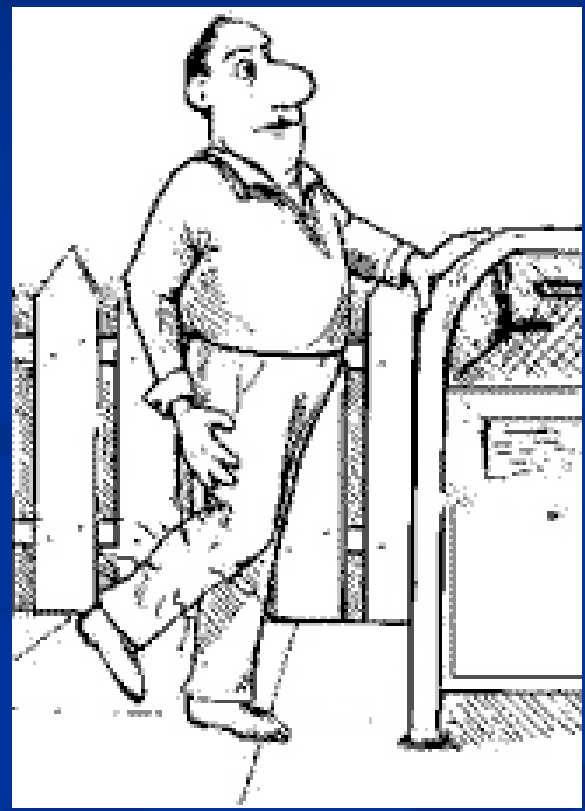
- "Doc, my legs hurt."
- *Claudere* - "to limp."
- Transient, exercise induced ischemic myalgia
- The locality of pain usually correlates with the location of the occlusion.

Intermittent Claudication

- 13% of patients over 50 have abnormal ABI
  - Partner's Program. *Vasc Med 2001*
- ABI ranging from 0.5 to 0.95
- Relatively few patients who present with claudication ever require revascularization to prevent limb loss.
- Amputation rate of 1% to 7% at 5 to 10 years
- Revascularizations totaled less than 20% at 10 years.

Intermittent Claudication

- Intervention controversial
- 233 consecutive patients (90% endovascular)
- Mean follow-up of almost 7 years
- Primary patency at 5 years was 27%
- 50% secondary interventions
- 12% of limbs ultimately developed CLI



Jamsen et al. J Vasc Surg 2003

Pros and Cons

- Benign natural history
- Graft failure and potential limb threat
- M&M of revascularization
- Diminished quality of life
- Inability to rehab

Smoking

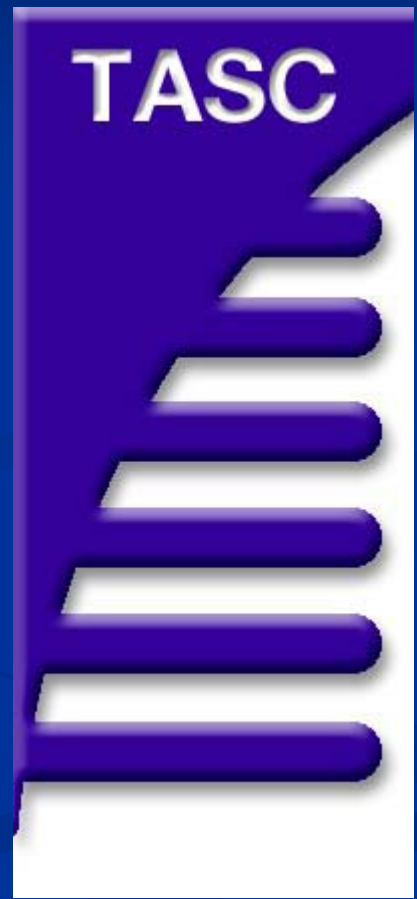
- 8% of patients who did not smoke or quit smoking within 1 year of diagnosis of PAD developed rest pain
- 21% who smoked or quit more than 1 year after diagnosis
- Diabetes also has been associated with increased development of CLI

Critical Limb Ischemia

- Inadequate arterial blood flow to accommodate the metabolic needs of resting tissue.
- Rest pain or pedal necrosis
- Risk factors include age, smoking, and diabetes

Critical Limb Ischemia

- Ankle pressure less than 50 to 70 mm Hg
- Toe pressure less than 30 to 50 mm Hg
- Transcutaneous partial pressure of oxygen at the foot less than 30 to 50 mm Hg



Rest pain

- Burning dysesthesia of the foot.
- Aggravated by elevation and relieved with dependency
- Increase in arterial pressure from gravity
- Nonfunctioning venoarteriolar reflex

Tissue Loss

- Ischemic ulcerations or gangrene
- Spontaneous
- After minor trauma or surgical incisions

Critical Limb Ischemia

- Estimated 500,000 to 1 million new cases per year
- CLI progresses directly from Fontaine I to stage III or IV
- 50% of patients were asymptomatic 6 months before major amputation for CLI

  - Dormandy. Br J Surg 1994

- Co-morbidities mask symptoms of claudication.

Critical Limb Ischemia

- Major risk factors - age, smoking, and diabetes.
- The incidence of major amputation increases with age.
- Smoking:PAD > Smoking: CAD
- Major amputation is 10 times more frequent in diabetic patients
- Diabetic smokers need amputation earlier in life than nondiabetic smokers

Evaluation

Relevant History

- Elapsed time after exercise is stopped before the pain is relieved
- Type of rest or position of patient (standing at rest, sitting, lying) necessary to relieve the pain
- Whether the pain returns after the same time and distance if exercise is then resumed

TASC Working Group: Management of peripheral arterial disease. J Vasc Surg 31(Pt 2):S56, 2000

Relevant History

- Location of the pain or discomfort
- Duration of the symptom
- Whether it worsens or improves with time and whether conservative therapy has had an effect
- Distance the patient can now walk before (1) experiencing the discomfort and (2) being forced to stop

TASC Working Group: Management of peripheral arterial disease. J Vasc Surg 31(Pt 2):S56, 2000

Symptom Pattern

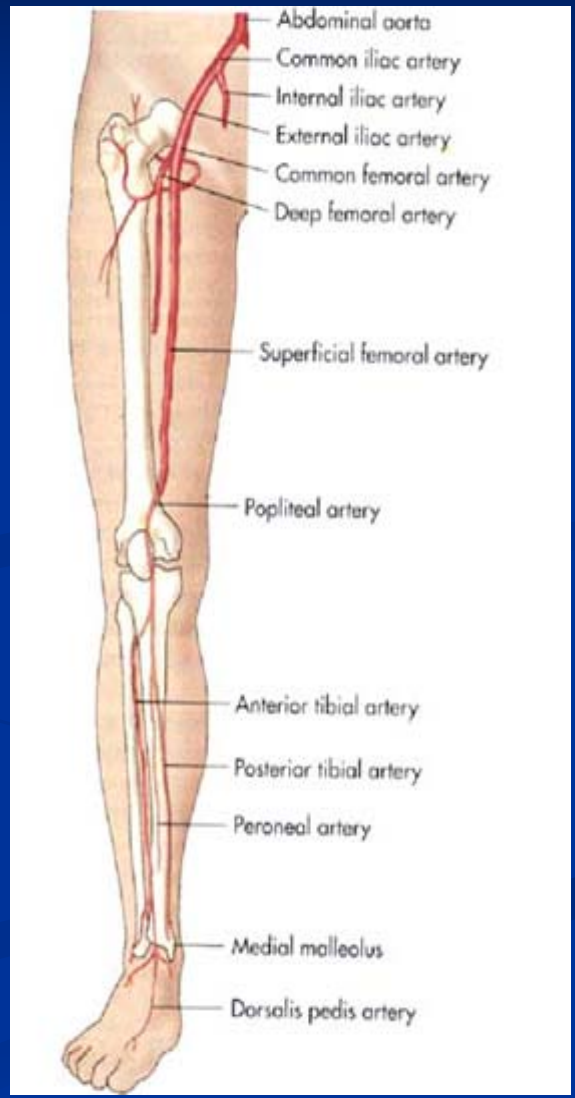
- Claudication generally results from a single level of arterial occlusion
- Three major patterns of arterial obstruction
    1) Inflow obstruction
    2) Outflow obstruction
    3) Combination
- Location of symptoms correlates with level of obstruction.

Inflow Obstruction

- Aortic and Iliac stenosis or occlusion.
- Buttock and thigh claudication
- Vasculogenic erectile dysfunction
- May exhibit classic symptoms of intermittent calf claudication resulting from inadequate perfusion of the entire leg

Outflow Obstruction

- Superficial femoral artery stenosis or occlusion is the most common lesion associated with intermittent claudication
- No specific thigh or foot symptoms.
- Popliteal and tibial arterial occlusions are associated more commonly with limb-threatening ischemia owing to the paucity of collateral vascular pathways beyond these lesions.



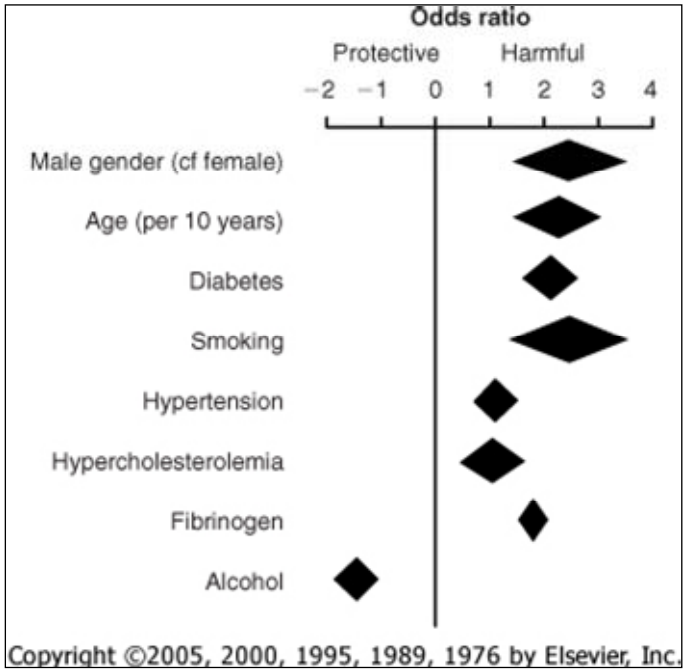
Multilevel Obstruction

- Broad symptoms of intermittent claudication affecting the buttock, hip, thigh, and calf.
- CLI requires at least two or more levels
- Pattern of occlusion is usually in adjacent vascular beds, but may be in parallel beds
- Limit flow through the collateral beds

Risk Factor Assesment

- HTN – risk of IC 2.5x in men, 3.9x in women
- Diabetes
- Smoking - severity of arterial occlusive disease proportional to the number of cigarettes smoked
- Each additional risk factor independently increases the risk of developing symptomatic PAD

Risk Factors

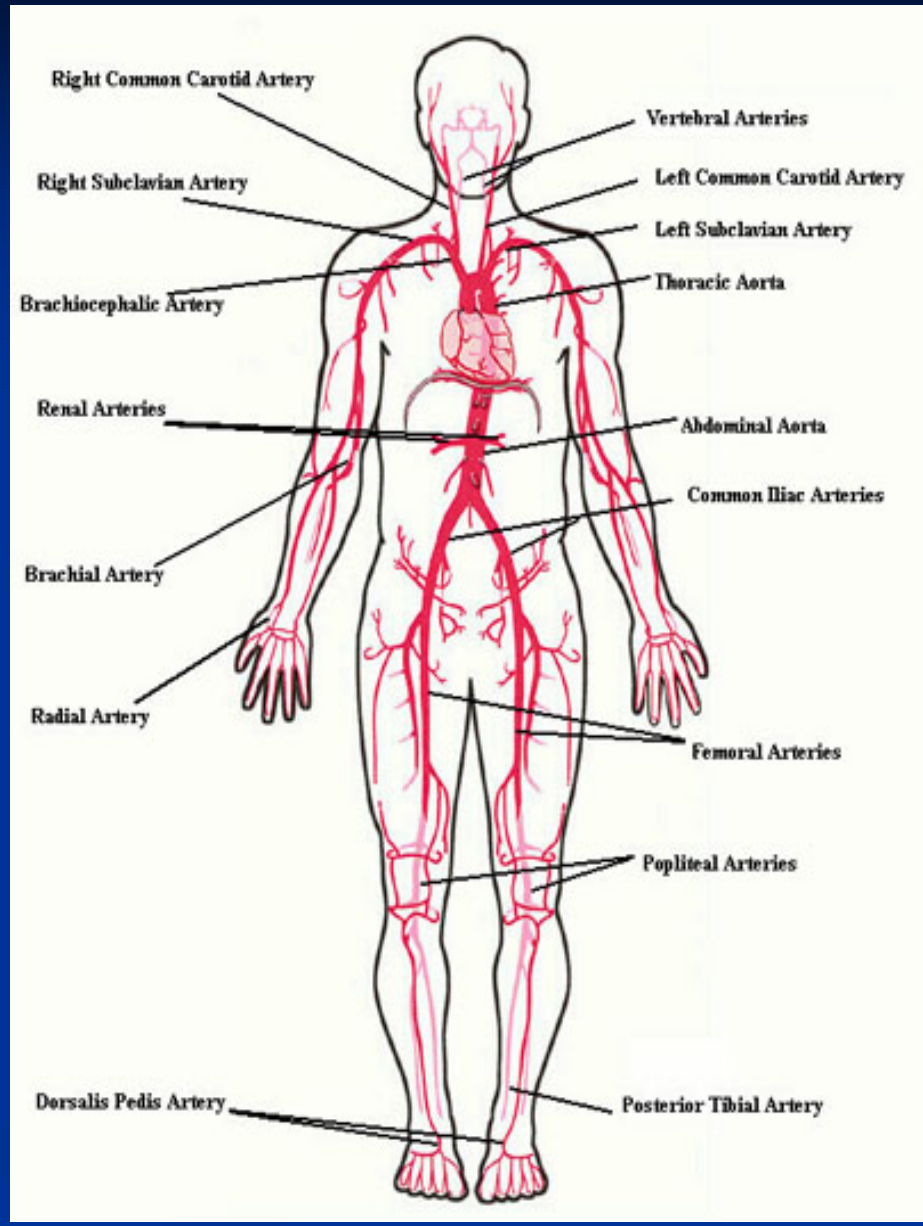


Physical Exam

- Loss of hair
- Thin, dry skin
- Thickened nails
- Ulcers
- Edema
- Gangrene

Physical Exam

- Pulses
- Bruits
- Pulsatile masses



Hematologic Evaluation

- Complete blood count, including white blood cells and platelets
- Fasting blood glucose
- Serum creatinine
- Fasting lipid profile
- Fibrinogen level
- Urinalysis

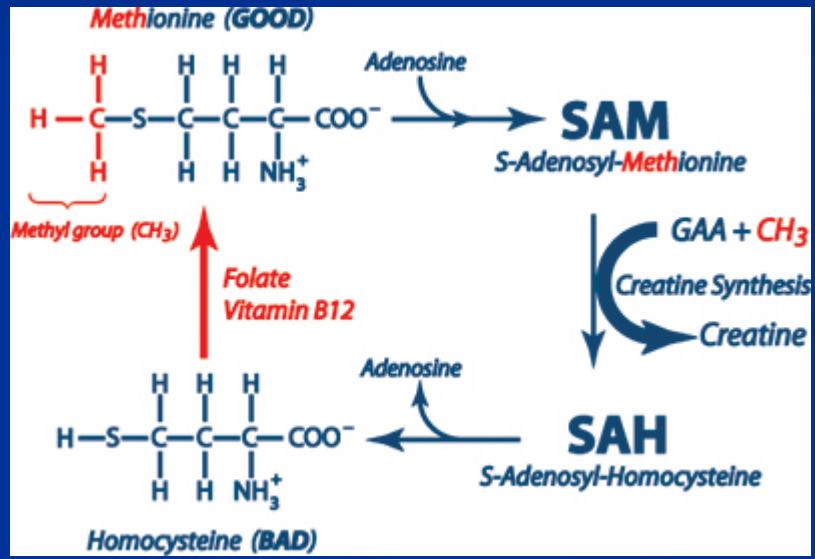
TASC Working Group: Management of peripheral arterial disease. J Vasc Surg 31(Pt 2):S59, 2000.

Hypercoaguable State

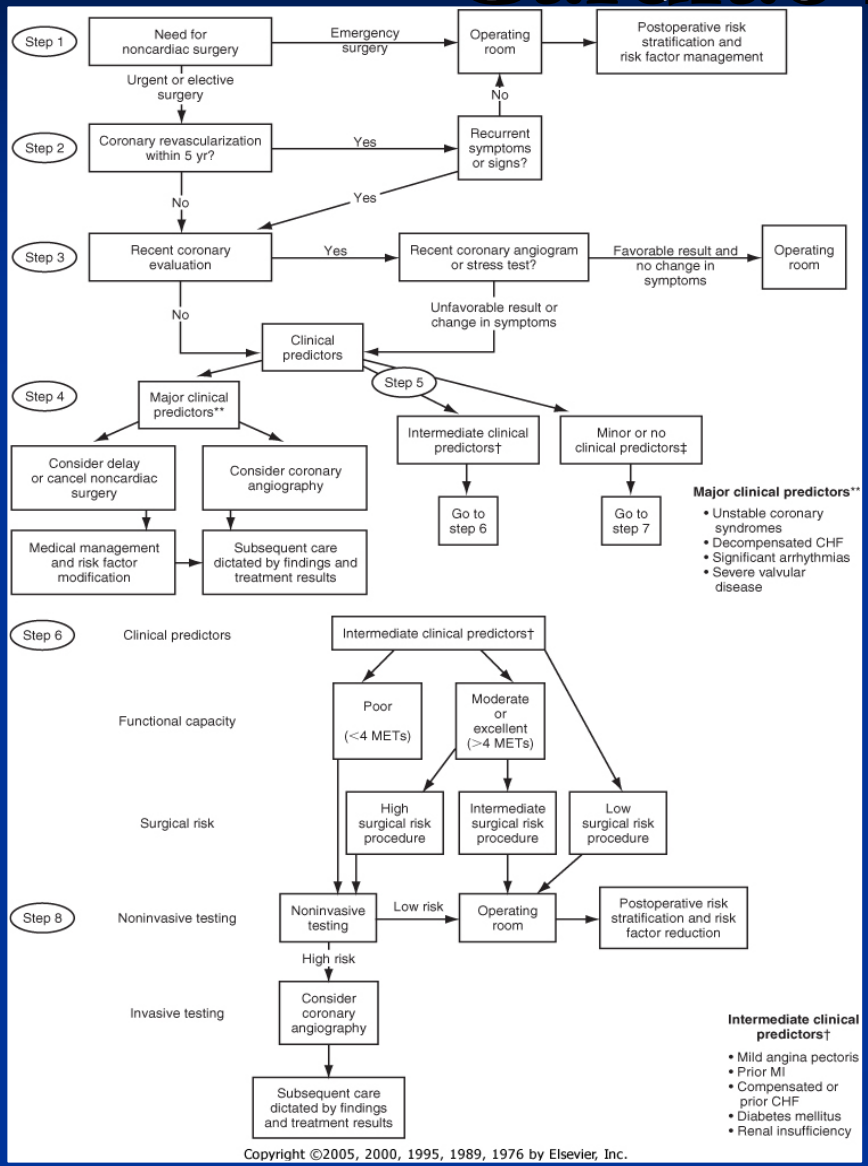
- Thrombin/prothrombin time
- Activated partial thromboplastin time
- Protein S/protein C assays
- Factor V Leiden assay
- Lupus anticoagulant assay
- Heparin-induced platelet antibodies
- Platelet adhesiveness/aggregability
- Fibrinogen/plasminogen levels
- Antithrombin activity
- Anticardiolipin antibody assay

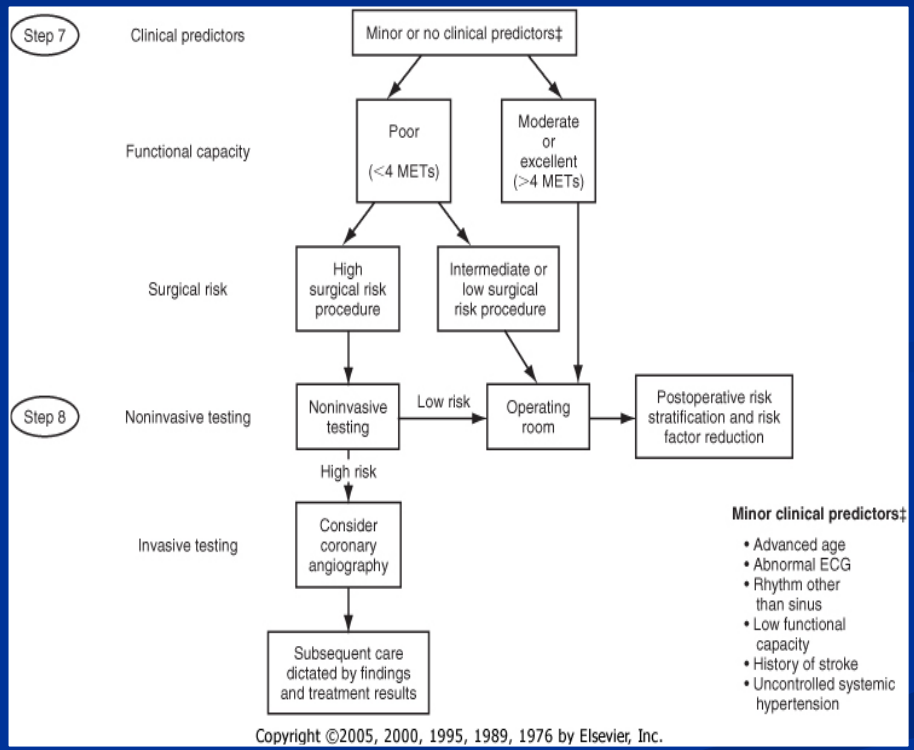
Homocysteine

- Young patients with PAD, no other risk factors
- Toxic to endothelial cells
- Reduced ability to generate and release nitric oxide .
- Smooth muscle cell proliferation
- Arterial wall inflammation
- Increased levels of plasminogen activator inhibitor



Cardiac Evaluation





Cardiac Evaluation in CLI

- Assume that they all have significant CAD
- Perioperative blood pressure control, antianginal regimens, and treatment for CHF are optimized
- Delay intervention only for the presence of frequent or unstable angina, recent myocardial infarction, poorly controlled CHF, or symptomatic or untreated arrhythmia.
- Even in these instances, cardiac evaluation should be focused and expeditious

Carotid Disease

- 225 patients, screened for carotid artery disease with duplex imaging
- Hemodynamically significant stenoses in 28.4%
- 4% had a greater than 80% stenosis requiring surgery
- 12% with symptomatic lower extremity had greater than 75% diameter reduction

-Gentile et al. Arch Surg;1995

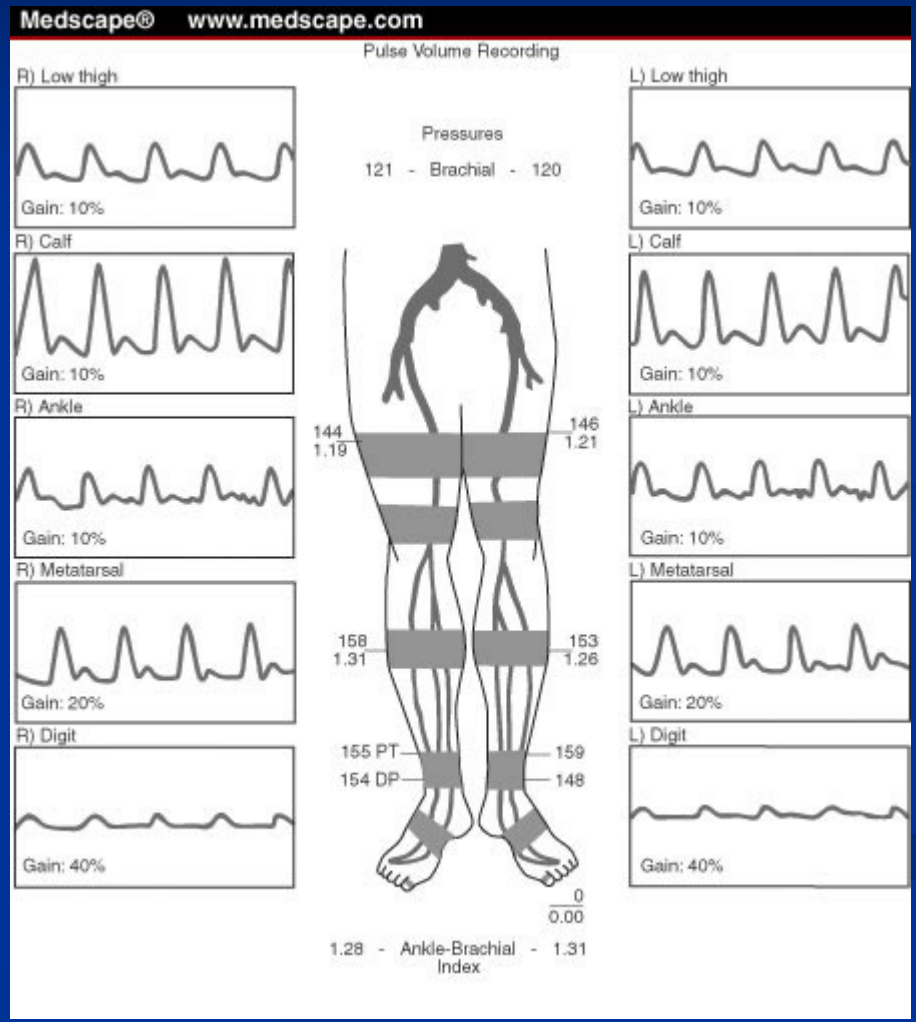
- De Virgilio et al. AnnVasc Surg;1997

Assesment

- Is significant arterial occlusive disease present?
- If so, how severe is the physiologic impairment?
- Where are the responsible lesions located?
- In multilevel disease, which arterial segments are most severely involved?

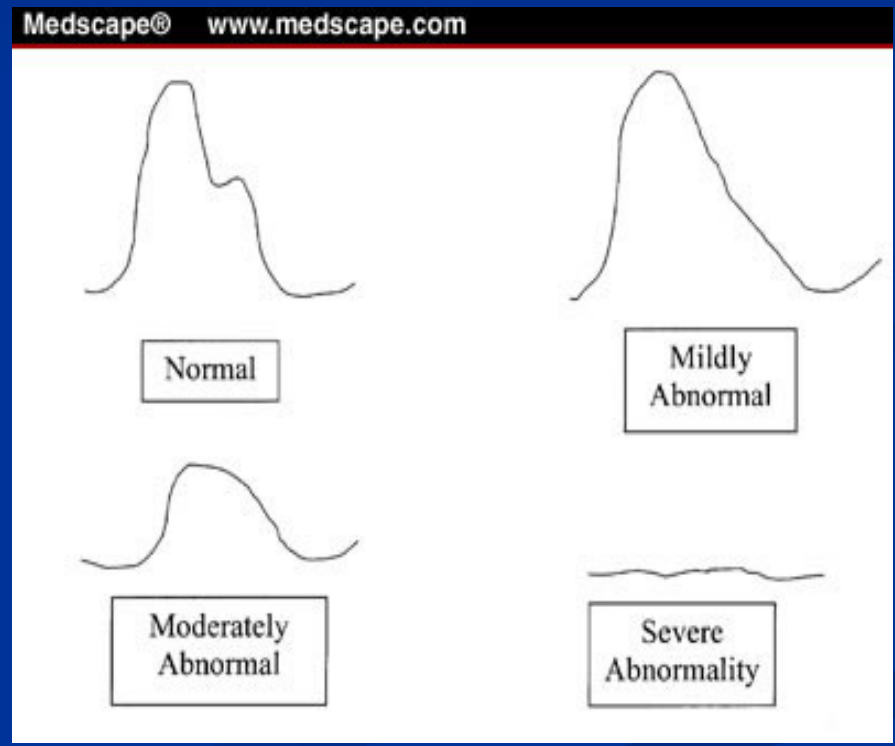
ABI's and Segmental Pressures

- Segmental arterial pressure measurement, with the calculation of the ABI
- Identifying the presence of arterial occlusive disease and locating the segment involved
- Toe pressures useful in diabetics
- Should include excercise



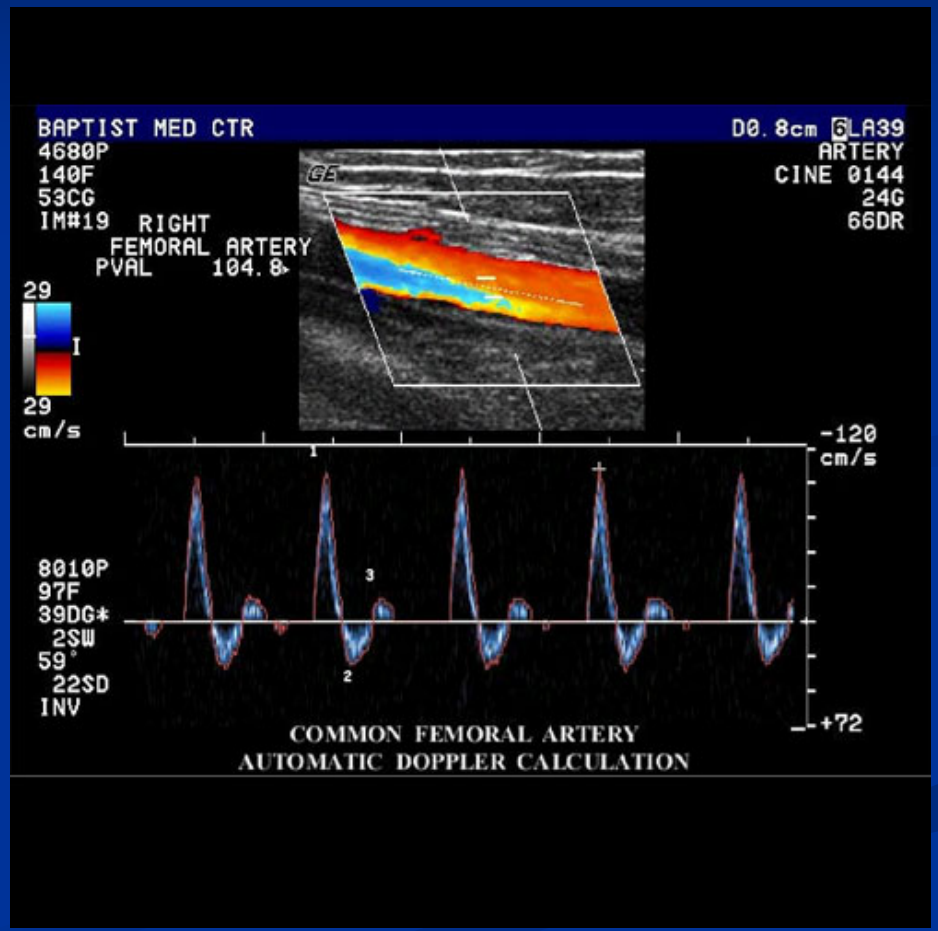
Pulse Volume Recordings

- Detect changes in the volume of blood flow
- Rapid systolic upstroke and a rapid downstroke with a prominent dicrotic notch
- With increasing severity of PAD, the waveforms become more attenuated with a wide downslope



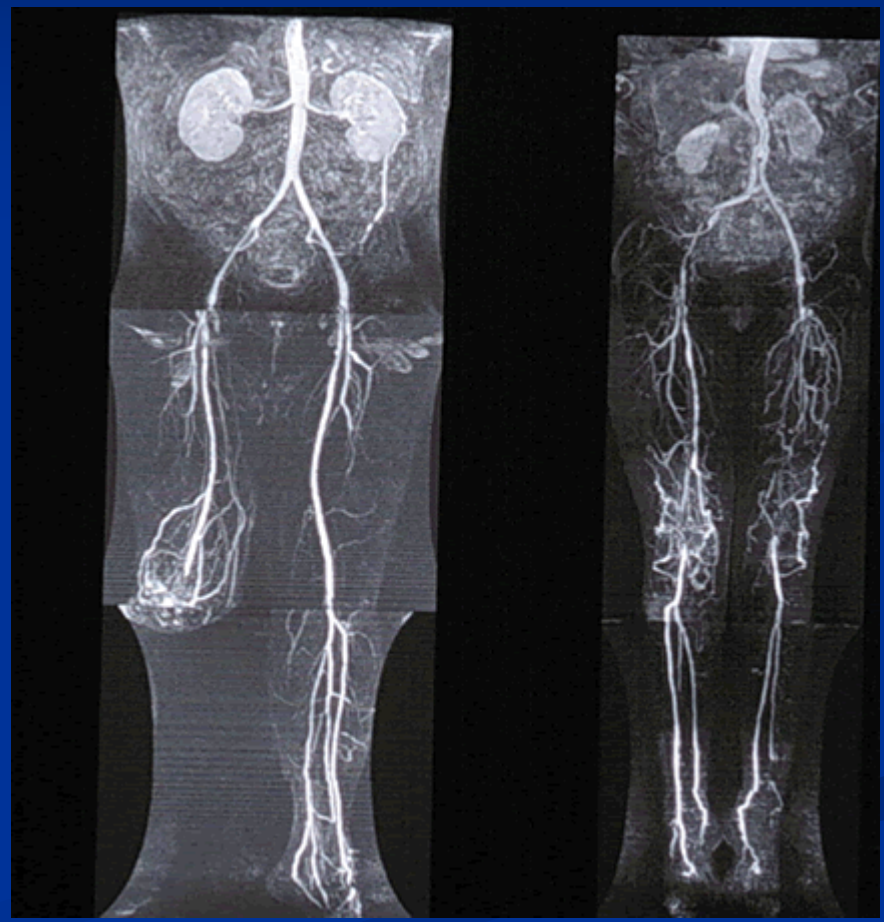
Screening

- B-mode ultrasound and pulsed wave doppler
- Non-invasive
- No contrast
- High sensitivity and specific for stenosis >50%
- Highly tech dependant



Evaluation

- Gadolinium-enhanced MRI
- No arterial puncture or standard ionic contrast
- Can identify patent pedal vessels
- Claustrophobia
- Artifact



Evaluation

- CT angiography
- Easily tolerated
- Non-invasive
- Great visualization
- Still requires ionic contrast
- Underestimates stenosis

Treatment

Non-operative Treatment

- Risk-factor modification
- Walking on treadmill of 60 minutes or more, at least three times a week.
  - mean improvement in absolute claudication distance of almost 200 m
  - improves quality of life
  - improves oxygen extraction in the lower extremities

Non-operative Treatment

- **Pentoxifylline - no sustained improvements in walking distance**
- Cilostazol - improve overall walking distance and quality of life.
- Naftidrofuryl, **Blufomedil, Carnitine, Prostaglandins, Vascular Endothelial Growth Factor, l-Arginine**

Operative Treatment

- Critical Limb Ischemia
- A predicted or observed lack of adequate response to exercise therapy and risk factor modification
- The patient must have a severe disability, either being unable to perform normal work or having very serious impairment of other activities important to the patient

TASC Work Group. J Vasc Surg; Jan 2001

Operative Treatment

- Absence of other disease that would limit exercise even if the claudication was improved (eg, angina or chronic respiratory disease)
- The individual's anticipated natural history and prognosis
- The morphology of the lesion must be such that the appropriate intervention would have low risk and high probability of initial and long-term success

TASC Work Group. J Vasc Surg; Jan 2001

Aortoiliac Occlusive Disease

- Buttock and Thigh claudication
- Erectile dysfunction
- Progresses to calf claudication
- Chronic, rarely cause of limb-threatening ischemia.

Morphology

- Type A - Single stenosis <3 cm of the CIA or EIA (unilateral/bilateral)
- Type B

  - Single stenosis 3–10 cm in length, not extending into the common femoral artery (CFA)

  - Total of two stenosis <5 cm long in the CIA and/or EIA and not extending into the CFA

  - Unilateral CIA occlusion

Morphology

- Type C
  - Bilateral 5–10-cm-long stenosis of the CIA and/or EIA, not extending into the CFA
  - Unilateral EIA occlusion not extending into the CFA
  - Unilateral EIA stenosis extending into the CFA
  - Bilateral CIA occlusion

Morphology

- Type D

  - Diffuse, multiple unilateral stenoses involving the CIA, EIA, and CFA (usually >10 cm)

  - Unilateral occlusion involving both the CIA and EIA

  - Bilateral EIA occlusions

  - Diffuse disease involving the aorta and both iliac arteries

  - Iliac stenoses in a patient with an abdominal aortic aneurysm or other lesion requiring aortic or iliac surgery

TASC Recommendations

- Type A

  "Endovascular procedures are treatment of choice"

- Type D

  "Surgery is the procedure of choice"

- Type B and C

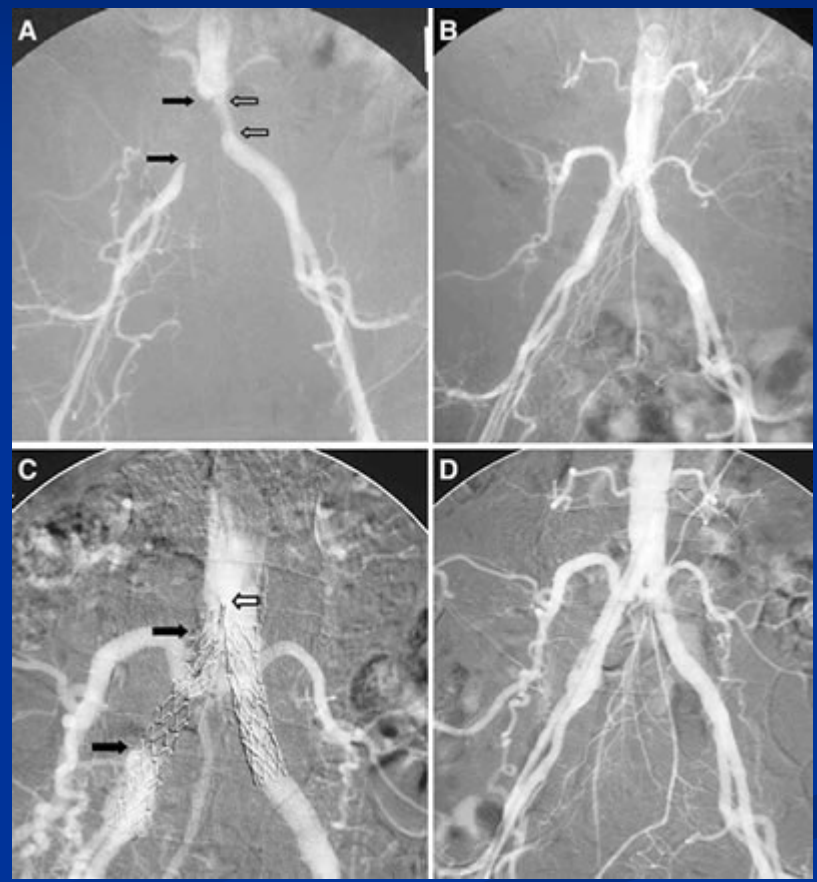
  - Insufficient data to make recommendations

Timaran C, Prault TL et al. Iliac artery stenting versus surgical reconstruction for TASC type B & C lesions. J Vasc Surg 2003;38:272-8

- Primary patency rates at 1, 3, and 5 years were 85%, 72%, and 64% after iliac stenting, and 89%, 86%, and 86% after surgical reconstruction
- Poor infrainguinal runoff is the main risk factor for decreased primary patency, however less so for those undergoing surgery.

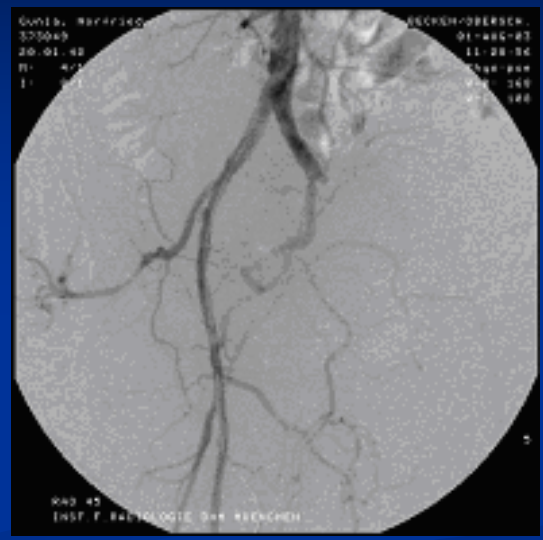
Endovascular Therapy

- "Kissing Stents"
- Technical success - 95%
- Primary patency at 3 years was 79%
- 5 yr patency 85-45%
  - location
  - discreteness
  - runoff
  - Clinical stage



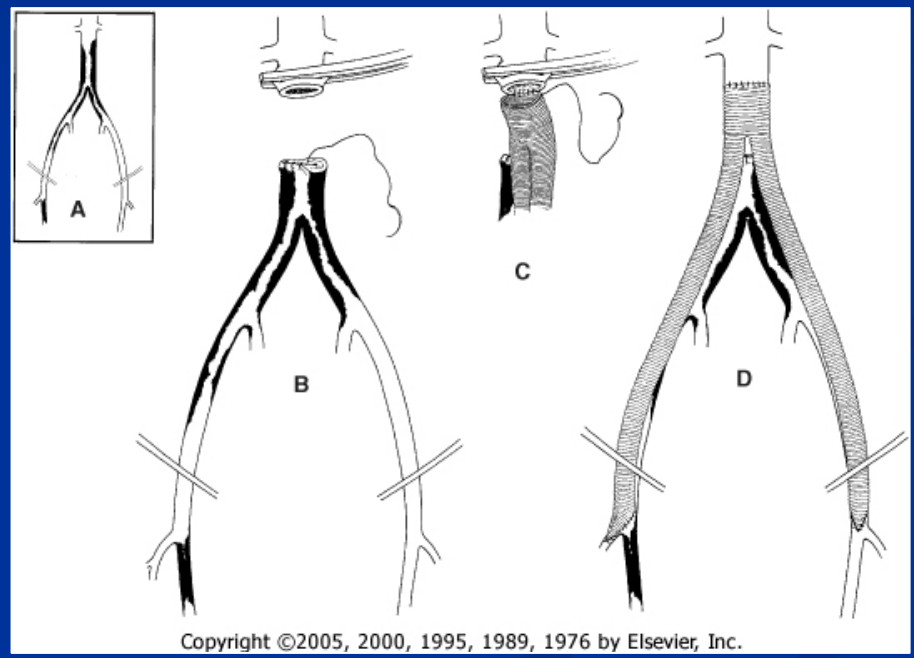
Endovascular Therapy

- Patency of endovascular therapy in the EIA is likely as good as that in the CIA
- Similar factors that affect patency



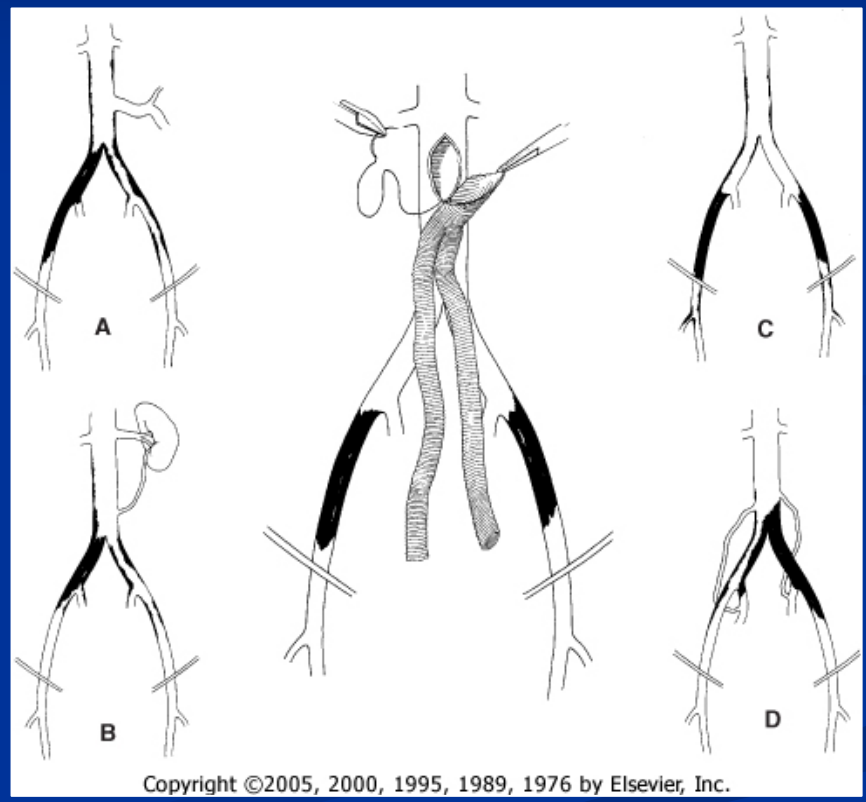
Surgical Reconstruction

- End – to – end
- Hemodynamically more sound
- Better flow characteristics
- Less chance of competitive flow
- Better long-term patency
- Lower incidence of aortic anastomotic aneurysms



Surgical Reconstruction

- End-to-side
- Certain anatomic patterns of disease
- Higher risk of dislodgment of intra-aortic thrombus or debris
- Difficult to cover



Results

- 85% to 90% graft patency rate at 5 years and 70% to 75% at 10 years.
- Perioperative mortality rates well below 3%
- Morbidity 20-30%
- 25% to 30% of patients are dead at 5 years, and 50% to 60% will have died at 10 years

Extra-anatomic bypass

- Axillofemoral or axillobifemoral bypass
- Femoral-Femoral bypass
- Obturator bypass

Infrainguinal Disease

- SFA occlusion or stenosis
- No thigh or foot symptoms
- Deep femoral artery
- Tibial disease most commonly associated with limb-threatening ischemia

Morphology

- Type A
  - Single stenosis up to 3 cm long, not at origin of superficial femoral artery or distal popliteal artery
- Type B
  - Single stenosis or occlusion 3-5 cm long, not involving distal popliteal artery
  - Multiple stenoses or occlusions, each less than 3 cm long

Morphology

- Type C
  - Single stenosis or occlusion longer than 5 cm
  - Multiple stenoses or occlusions, each 3-5 cm long
- Type D
  - Complete common femoral artery or superficial artery occlusions or complete popliteal and proximal trifurcation occlusions

TASC Recommendations

- Type A

  "Endovascular procedures are treatment of choice"

- Type D

  "Surgery is the procedure of choice"

- Type B and C

  - Insufficient data to make recommendations

Endovascular Therapy – femoral popliteal segment

- 4 Randomized Trials – 3 PTA vs. routine stent
  1 routine vs. selective stent
- Improved technical success with stenting
- Improved primary patency with stenting at 1 year – 85% vs. 74%
- Patency equalized after ~ 2 yrs
- All used balloon expandable stents

Endovascular Therapy – femoral popliteal segment

- Dynamic anatomic position
- Self-expanding stents used most often
- Have better performance in the flexible femoropopliteal segment
- 3-year patency ranging from 70% to 76%

Endovascular Therapy –tibial segments

- early clinical success ranges from 71% to 93%
- 1-year limb salvage rates ranging from 60% to 88%
- 2-year limb salvage rates ranging from 50% to 83%
- Hardware in the infrageniculate arteries is bad

Other Endovascular Options

- Peripheral atherectomy
- Laser Atherectomy
- Cryoplasty
- Subintimal Angioplasty

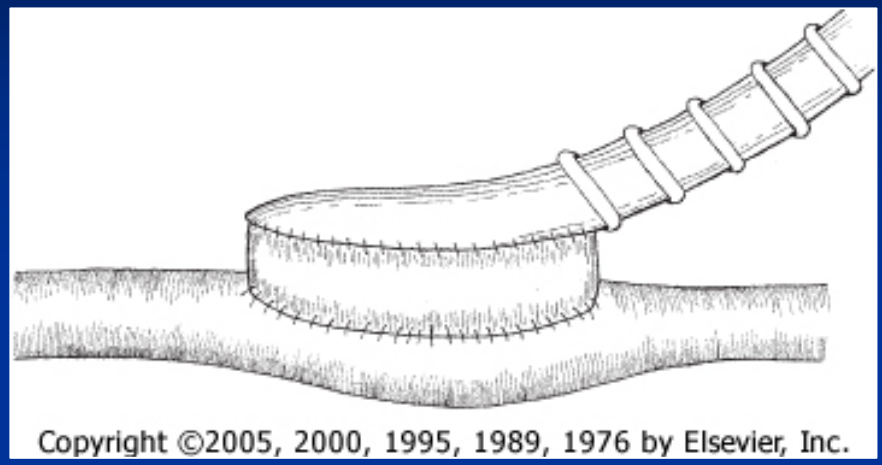
Infrainguinal bypass

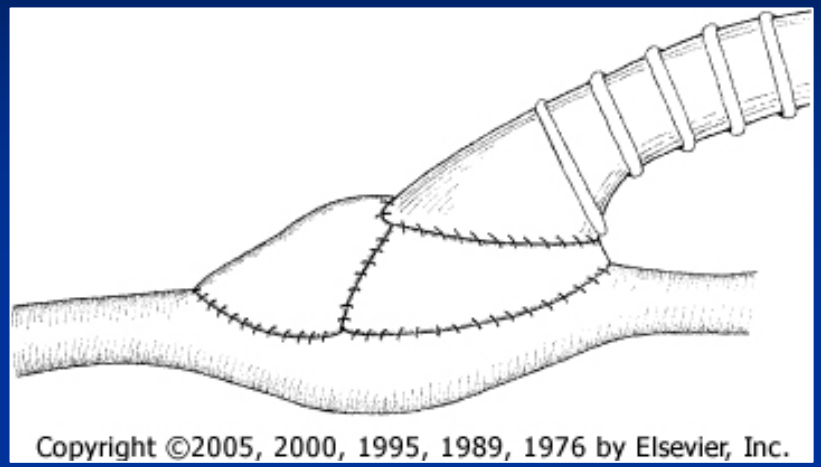
- Define the inflow source with selected alternative origins
- Correction of significant deep femoral disease at the time of bypass is clinically important; should the bypass ever fail
- Bypass all hemodynamically significant disease and to insert the bypass to the most proximal limb artery that has at least one continuous runoff artery to the foot.
- Pedal artery over peroneal.

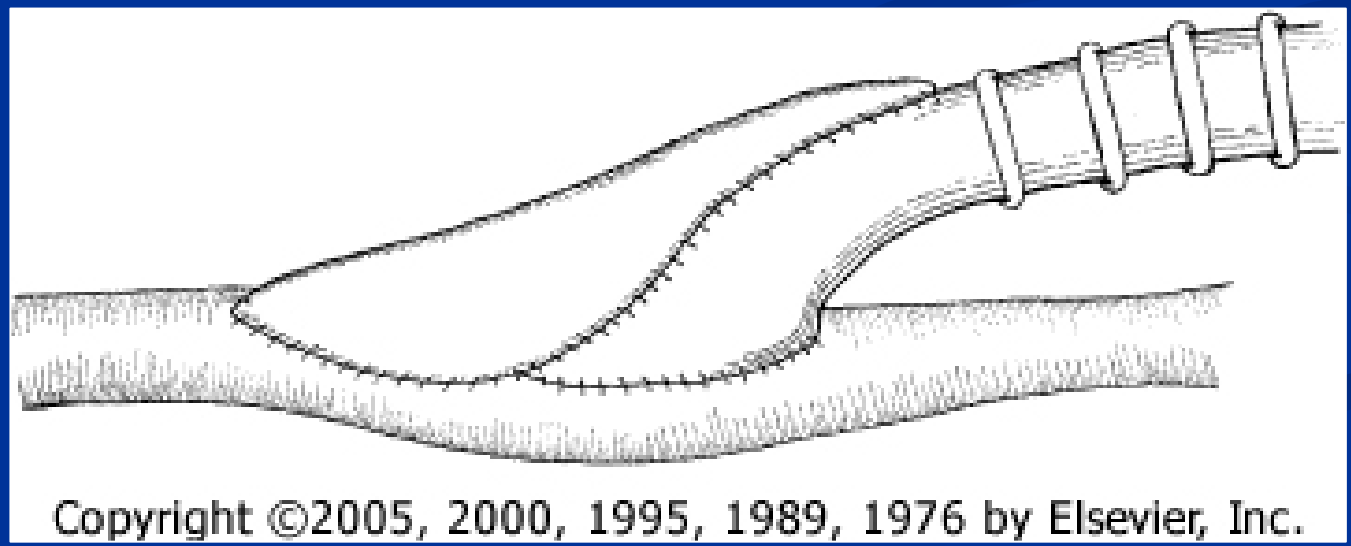
Choice of Conduit

- Ipsi-, contralateral GSV
- Lesser Saphenous
- Superficial femoral vein
- Arm vein (basillic and cephalic)
- Endarterectomized SFA
- Radial artery
- Dacron
- Heparin bonded Dacron
- PTFE
- PTFE with vein cuff
- Cryopreserved vein
- Human umbilical vein

Vein Cuffs







Patency

- 4 year patency AK pop vein – 75-85%
  PTFE – 40-50%
  HUV – 50-55%
- 4 year patency BK-pop vein – 75-80%
  PTFE – 35-45%
- 4 year patency infrageniculate vein – 50-60%
  PTFE – 12-15%

Goshima KR, Mills JL, Hughes JD: A new look at outcomes following infrainguinal bypass surgery: Traditional reporting standards systematically underestimate the expenditure of effort required to attain limb salvage. J Vasc Surg 39:330-335, 2004.

- University of Arizona - 318 patients undergoing infrainguinal bypass, 72% for CLI
- mortality < 1%, mean LOS - 9 days, 30-day graft patency - 96.9%, and 3-month limb salvage was 96.5%.
- 49% - at least one reoperation within 3 months, 50% required readmission within 6 months. The cumulative LOS was 11 days.
- > 50% CLI patients required more than 3 months of postoperative care to achieve wound healing.

Post-operative care

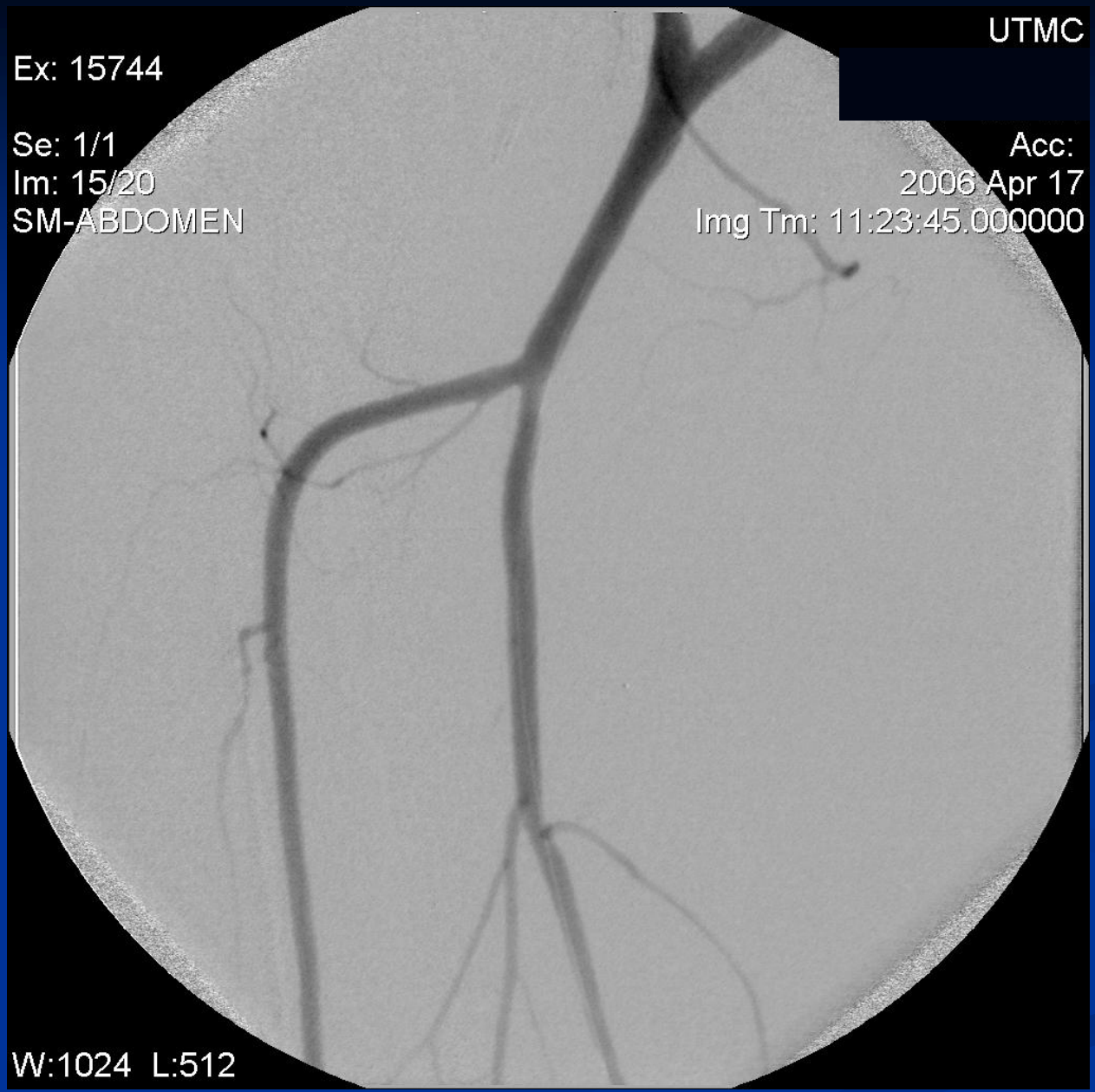
- To anticoagulate or not to anticoagulate.
- Meticulous wound care
- Pressure release
- Delay amputation/debridement for 4-10 days
- Graft surveillence with in 1 month, then every 3 months x 1 year, then biannually for 2 years, then annually thereafter.

Take Home Points

- Atherosclerosis is a systemic disease.
- Control of risk factors is most important determinant of success
- Endovascular option is generally the best first option in aortoiliac disease
- Endovascular therapy is probably as good as prosthetic bypass in femoral popliteal segment
- Hardware is bad.
- Vein better than prosthetic

Differential Diagnosis

- Chronic compartment syndrome
- Venous claudication
- Nerve root compression
- Symptomatic Baker's cyst
- Spinal cord compression
- Hip arthritis
- Inflammatory arthritis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Treatment

- Referral to vascular surgeon.
- Modification of risk factors
- Exercise rehabilitation
- Antiplatelet therapy
- Pentoxifylline
- Cilostazol
- Naftidrofuryl, Blufomedil, Carnitine, prostaglandins, VEGF, L-arginine

Survival

- The severity of systemic atherosclerosis is accurately reflected by the severity of the lower extremity disease.
- 5 and 10 year mortality for IC – 30% and 50%
- 5 and 10 year mortality for CLI – 70% and 85%
- 80% from vascular event – 60% CAD, 10%CVA, 10% other

-Muluk et al. JVasc Surg 33:2001

- Walker et al. Eur J Vasc Endovasc Surg 15:1998

Take Home Points

- Early referral
- Screening for other manifestations of atherosclerosis.
- Risk factor modification.