

## Panvascular Disease Vascular Issues

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**CMC**  
**Cardiac Patient Care Problems (47%)**

- A. Acute Coronary Syndrome
- B. Dysrhythmias
- C. Heart Failure
- D. Other Cardiac Issues
- E. Vascular Issues**
  - o **Acute Peripheral Vascular Insufficiency**
    - a. Acute Arterial Occlusion
    - b. Carotid Artery Stenosis
    - c. Venous Thrombosis

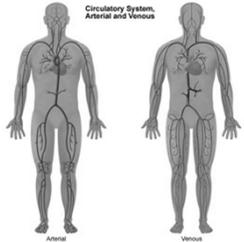
CSC  
DVT Prophylaxis

**CMC**  
**Other Patient Problems (21%)**

- A. Acute Pulmonary Embolus**
- B. Acute Respiratory Failure
- C. Acute Lung Injury (ALI/ARDS)
- D. Cor Pulmonale
- E. Pneumothorax
- F. Hemothorax

### Peripheral Vascular Disease

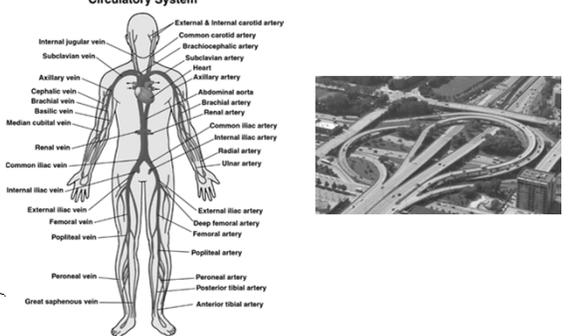
- ▶ Disease of the arteries and veins of the legs or arms that disturb the blood flow;
- ▶ Can result from atherosclerosis or "hardening of the arteries" leading to stenosis (blockage), and blood clots.
- ▶ It causes either acute or chronic ischemia with initial symptoms of pain and later damage to structures (such as nerves).



Circulatory System, Arterial and Venous

[www.theregeninc.com/glossary.html](http://www.theregeninc.com/glossary.html)

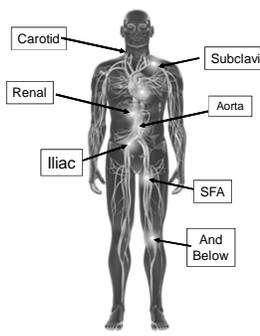
#### Circulatory System



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### Practical Estimates

- ▶ Population is aging
- ▶ Each cardiovascular patient has:
  - o 2 carotids
  - o 2 arms
  - o 2 renal arteries
  - o 2 legs
  - o 6+ sites to develop aneurysmal or occlusive disease



**YOU DO THE MATH!**

### Why are we missing PAD?

- ▶ Most do not ask enough questions
  - Dull cramping or pain during exercise or rest?
  - Changes in skin temperature and color?
  - Hair loss on feet and legs?
  - Numbness or tingling in legs, feet or toes?
  - Has there been an ABI?
- ▶ Most wait until there are ulcers and/or pain -- **No *good* treatment options at this point**

### Peripheral Vascular Insufficiency

#### Definition

- ▶ Inadequate peripheral blood flow

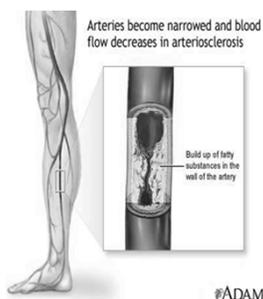


#### Diagnosis

- ▶ Diagnosis may be made by comparing peripheral pulses in contralateral extremities or by angiography, ultrasonography, and skin temperature tests

### Peripheral Arterial Disease (PAD)

- ▶ A condition in which the arteries that carry blood to the arms or legs become narrowed or clogged. This interferes with the normal flow of blood



### PAD- Narrowed Artery



### PAD Facts

- ▶ Affects about 8 - 12 million people in the USA
- ▶ About 1 in every 20 Americans over the age of 50 has PAD
- ▶ The risk increase with age
- ▶ 1 in 3 people affected
  - If over 70 y/o
  - Diabetic or smoker over 50 y/o



Retrieved March 27, 2013 from <http://www.nhlbi.nih.gov/health/health-topics/topics/pad/atrisk.html>



### Why are we missing PAD?

- ▶ Symptoms not reported (pain or cramping in the legs) believing they are a natural part of aging.
- ▶ Providers do not ask enough questions
  - Dull cramping or pain during exercise or rest?
  - Changes in skin temperature and color?
  - Hair loss on feet and legs?
  - Numbness or tingling in legs, feet or toes?
  - Has there been an ABI?
- ▶ Most wait until there are ulcers and/or pain -- **No *good* treatment options at this point**

## PAD Risk Factors

- ▶ **Age over 50**
- ▶ **Smoker or history of smoking**
  - Up to four times greater risk of PAD
  - Develop PAD symptoms 10 years earlier than nonsmokers
- ▶ **Diabetes**
- ▶ **Hypertension**
- ▶ **Hyperlipidemia**
- ▶ **History of vascular disease, MI, or stroke.**
  - One in three chance of also having PAD
- ▶ **African American**
  - More than twice as likely to have PAD as their white counterparts.

## PAD Symptoms

20% of patients with PAD are asymptomatic



- ▶ **Intermittent claudication**
  - ▶ Fatigue, heaviness, tiredness, cramping in the leg muscles (buttocks, thigh, or calf) that occurs during activity such as walking or climbing stairs.
  - ▶ This pain or discomfort goes away once the activity is stopped and during rest.
- ▶ **Rest pain**
  - ▶ Pain in the legs and/or feet that disturbs sleep
  - ▶ BP ↓ 10 - 20 mmHg at night
  - ▶ ↓ blood flow to an extremity that already has ↓ flow
  - ▶ Tissues become ischemic
  - ▶ Causes pain
  - ▶ Burning pain
  - ▶ Atypical symptoms (nonspecific exercise intolerance, hip or other joint pain)

- ▶ Two very characteristic types of pain:
  - ▶ intermittent claudication and ischemic rest pain

## PAD More Symptoms



- ▶ Weak or absent pulses in the legs or feet
- ▶ Sores or wounds on the toes, feet, or legs that heal slowly, poorly, or not at all
- ▶ Color changes in the skin of the feet, including paleness or blueness.
- ▶ Dependent rubor
- ▶ Elevating the foot causes loss of color and worsens ischemic pain
- ▶ A lower temperature in one leg compared to the other leg
- ▶ Poor nail growth on the toes and decreased hair growth on the legs
- ▶ Affected leg may sweat excessively and become cyanotic
- ▶ Erectile dysfunction, especially among men who have diabetes

However, most people with PAD do not experience symptoms

## Case Study

- ▶ Ms. A.K. Leggs is a 66-year-old female that presents to your office with complaints of left lower extremity pain. She states that while walking on the golf course she gets pain in her lower calf, primarily on her left side. She states that when she stops and rests on a bench at the next tee, the pain slowly resolves. She does not have the pain when she uses a golf cart.
- ▶ Her past history is significant for HTN, hyperlipidemia (Recent: LDL 160, Triglycerides of 210). She takes HCTZ, and was recently started on atorvastatin 10mg after her recent lab work.
- ▶ Examination of her legs shows that her left leg is slightly cooler to the touch than her right. There is paucity of hair on her lower leg and on exam you note a diminished posterior tibial pulsation.

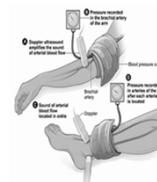
## PAD Diagnosis

Confirmed by noninvasive testing

- ▶ Ankle Brachial Index (ABI)
- ▶ Magnetic resonance angiography
  - Noninvasive
  - Minimal damage to kidneys
- ▶ Ultrasonography and Doppler color flow imaging
  - Noninvasive
  - Indicated before revascularization or surveillance of grafts
- ▶ Angiography
  - Used for patients being considered for revascularization
  - Not preferred due to risk of contrast induced nephrotoxicity
- ▶ CT angiography

## Ankle Brachial Index (ABI)

- ▶ Most effective, accurate, practical way to assess for PA
- ▶ ADA recommends diabetic patients over 50 y/o be assessed with ABI



**ABI WORKSHEET**

**Right Arm:**  
Systolic Pressure:  mmHg  
Diastolic Pressure:  mmHg

**Right Ankle:**  
Systolic Pressure:  mmHg  
Diastolic Pressure:  mmHg

**Left Arm:**  
Systolic Pressure:  mmHg  
Diastolic Pressure:  mmHg

**Left Ankle:**  
Systolic Pressure:  mmHg  
Diastolic Pressure:  mmHg

**Right ABI equals Ratio of:**  
Highest of the Right Ankle Pressures (S/D) or BP2  
Highest Arm Pressure (right or left arm) =  /  =

**Left ABI equals Ratio of:**  
Highest of the Left Ankle Pressures (S/D) or BP2  
Highest Arm Pressure (right or left arm) =  /  =

\* The lower of these numbers is the patient's overall ABI.  
Overall ABI (lower ABI) =

**Ankle Brachial Index Interpretation**

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

### Interpretation of ABI

- ▶ A resting ankle-brachial index of less than 1 is abnormal. If the ABI is:
  - Less than 0.95, significant narrowing of one or more blood vessels in the legs is indicated.
  - Less than 0.8, pain in the foot, leg, or buttock may occur during exercise (**intermittent claudication**).
  - Less than 0.4, symptoms may occur when at rest.
  - 0.25 or below, severe limb-threatening PAD is probably present

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

### Active Pedal Plantar Flexion

Heel raises 

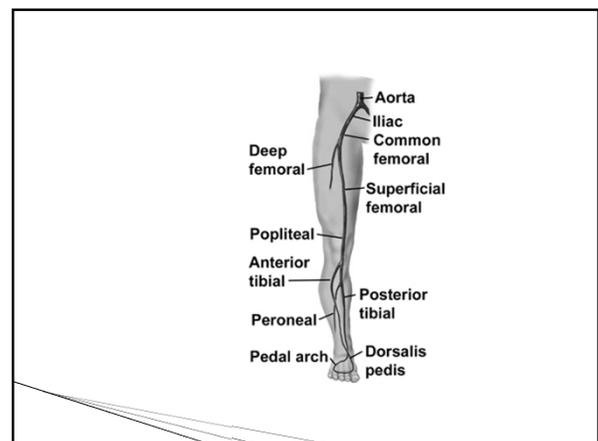
- ▶ Face wall - place fingertips against the wall for balance
- ▶ Keep legs straight, raise heels as high as possible
- ▶ Lower heels back to floor
- ▶ Repeat 30 - 50 times or until patient uncomfortable
- ▶ Lie supine take ankle pressure
- ▶ With normal circulation, ABI should be the same with moderate exercise as with rest
- ▶ With PAD, ankle pressure will drop to a low or indeterminate level with exercise and back to baseline with rest

### Mr O Clusion 65 y/o male

- Severe disabling claudication of the right lower extremity - only able to walk three blocks
- No resting ischemia
- PMH
  - Diabetes. HgA1c 6.5 with metformin
  - Hypertension controlled < 130/80 on several meds
  - Hyperlipidemia treated with statin. LDL controlled < 100
  - A Fib
  - Quit smoking 14 years ago
  - EF 60%, mild AS, mild AR
  - Bilateral carotid stenosis < 60% (no benefit for surgery if asymptomatic)

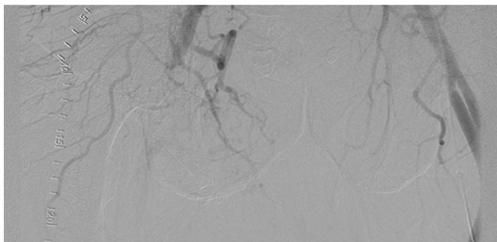
### Ankle Brachial Index (ABI)

- ▶ Right ABI = 0.62
  - Drops to 0.25 post exercise
- ▶ Left ABI = 1.12
  - Drops to 0.76 post exercise



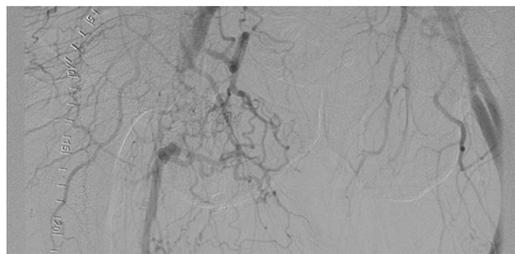
## Peripheral Angiogram

Mr O Clusion



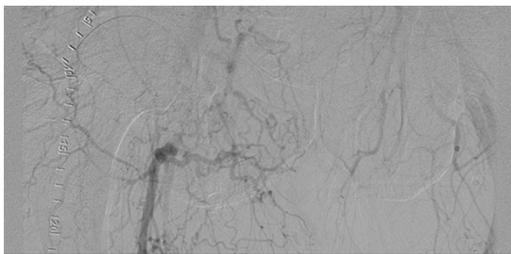
- ▶ Right lower extremity extremely calcified
- ▶ Moderately long occlusion involving the right common femoral artery
- ▶ Left femoral artery patent

## Mr O Clusion

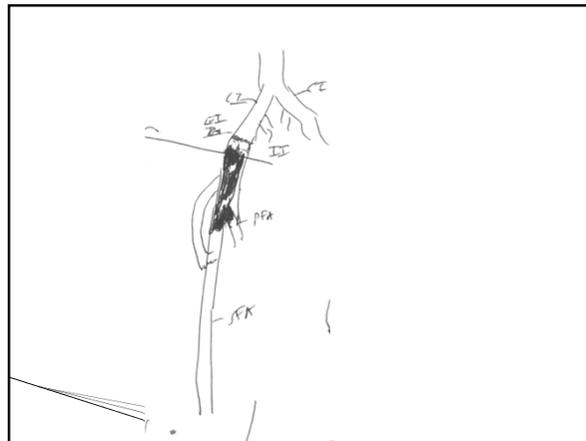


- ▶ This occlusion involves the origin of both the profunda and the superficial femoral artery (SFA).
- ▶ The SFA reconstitutes proximally and patent all the way down to the proximal popliteal where there are two 70 - 80% narrowing

## Mr O Clusion



- ▶ Popliteal artery is patent



## PAD Medical Management

### ▶ Three Treatment modalities

#### 1. Risk factor modification

- Smoking cessation and control of diabetes, dyslipidemia, hypertension

#### 2. Exercise training or rehabilitation

- 35 to 50 min of treadmill or track walking in an exercise-rest-exercise pattern 3 to 4 times/week
- The greatest improvements in walking ability occurred when each exercise session lasted more than 30 minutes with at least three exercise sessions per week, when the patient walked until near maximal pain was reached at each session, and when the program continued for at least six months.
- By exercising PAD patients have been able to increase the distance they can walk painfree, increase their total walking distance, and improve functional ability

#### 3. Pharmacologic therapy

## PAD Pharmacological Treatment

### ▶ Antiplatelet drugs to reduce risk of MI, stroke or vascular death

- Aspirin 75 - 325 mg daily (LOE = A)
- Clopidogrel (Plavix) 75 mg po daily - alternate to ASA (LOE = B)

### ▶ Meds to reduce symptoms of intermittent claudication

- Pentoxifylline (Trental) 400 mg
  - Improves blood flow by reducing blood viscosity
  - Take with meals
- Cilostazol (PLETAL) 100 mg po bid (contraindicated in HF)
  - Take on an empty stomach
  - May take up to 3 months to show benefits
  - Avoid grapefruit juice

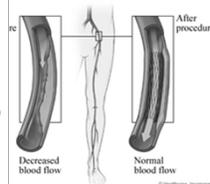
### PAD Other Medical Management

- ▶ **Keep the legs below heart level**
- ▶  $\beta$ -Blockers are safe unless PAD is very severe
- ▶ Elevate HOB
- ▶ Avoid cold and drugs that cause vasoconstriction
- ▶ Preventive foot care

▶ Early treatment of PAD can restore mobility, decrease the risk for MI and stroke, and possibly save your life/leg.

### PAD Interventions

- ▶ Peripheral angioplasty with or without stenting
- ▶ Thromboendarterectomy (surgical removal of an occlusive lesion)
- ▶ Revascularization (femoropopliteal bypass grafting) helps prevent limb amputation and relieve claudication
- ▶ Amputation (last resort) indicated for uncontrolled infection, unrelenting rest pain, and progressive gangrene.

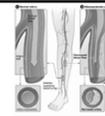


### Subclavian Artery Stenosis



### PAD Revascularization

- ▶ In patients with critical limb ischemia revascularization is recommended for limb salvage
  - Endovascular
  - Open surgical treatment
- ▶ Two year follow-up: no significant difference in amputation free survival and overall survival in both treatment options
- ▶ However bypass first approach was associated with a significant increase in overall survival of 7.3 months and trend towards improved amputation-free survival of 5.9 months for those who survived 2 years



### Post Peripheral Vascular Treatment Care

- ▶ Routine post-procedure checks plus frequent assessment to ensure graft patency
- ▶ Vascular Checks
  - q 15 min x 4, q 30 min x 4, q 1 hour x 4
  - Pulses: distal to treatment area: popliteal, dorsalis pedis, posterior tibial
  - Capillary refill, skin color
  - Sensation, motor function
  - Compare to baseline, if available
- ▶ Good feet/skin care
  - Sheep skin
  - Warm blankets to feet
  - Foot cradle
- ▶ Re-vascularization pain

### Critical Limb Ischemia (CLI)

Definition	Signs & Symptoms
<ul style="list-style-type: none"> <li>▶ Occurs when distal arteriole pressure is so low there is not adequate pressure to provide tissue perfusion</li> <li>▶ Prognosis is very poor the limb once for CLI develops unless blood flow restores</li> </ul>	<ul style="list-style-type: none"> <li>▶ Ischemic rest pain</li> <li>▶ Pain requiring narcotics</li> <li>▶ Ulcers/gangrene</li> <li>▶ Impending limb loss</li> <li>▶ Dependent redness</li> <li>▶ Pallor on elevation of extremities</li> <li>▶ Shiny, scaly skin</li> <li>▶ Loss of hair on feet</li> <li>▶ Reduced capillary fill</li> </ul>

## Critical Limb Ischemia



## Popliteal Case Study

### Clinical History and Background

- **Age:** 82, female
- **Hx:** Rest pain in the left foot; foot is discolored
- **Left ABI = 0.30; Rutherford Category IV**
- **Occlusion of left popliteal artery distal to SFA stents**



Pre-Stent

## Results Post-Stent

Rest pain resolved, and patient is ambulating without difficulty upon follow-up



## Acute Limb Ischemia

### Definition

- Sudden decrease in limb perfusion
- Threatens limb viability

### Causes

- Thrombosis associated with plaque rupture
- Thrombosis of lower extremity bypass graft
- Thromboembolization from an aneurysm
- Arterial embolization is suspected when onset is sudden and there is a suspected embolic source

## Acute Limb Ischemia



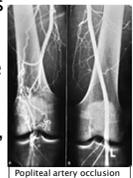
## Acute Limb Ischemia Acute Arterial Occlusion

### Signs - 6 Ps

- Severe Pain
- Polar (cold) unilateral
- Pallor unilateral - followed by cyanosis if left unattended
- Pulselessness
- Parathesias
- Paralysis

### Diagnosis

- Immediate angiography is required to confirm location of the occlusion, identify collateral flow, and guide therapy



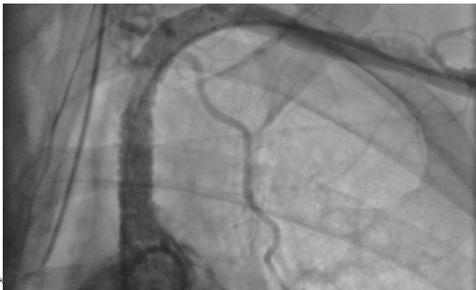
### Acute Limb Ischemia It's an emergency!



Case Study: Cold left arm-- No pulses  
Angiogram: Totally occluded Left Subclavian artery



Left subclavian open post stent  
Palpable left arm pulses



### Acute Arterial Occlusion Treatment

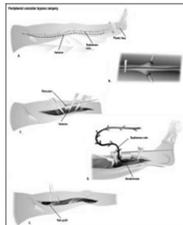
- ▶ Embolectomy (catheter or surgical)
- ▶ Thrombolysis (tPA)
- ▶ Bypass surgery



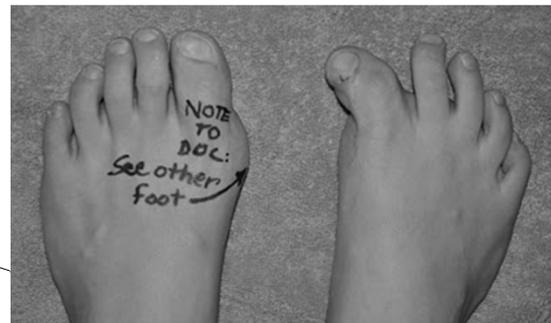
Embolectomy

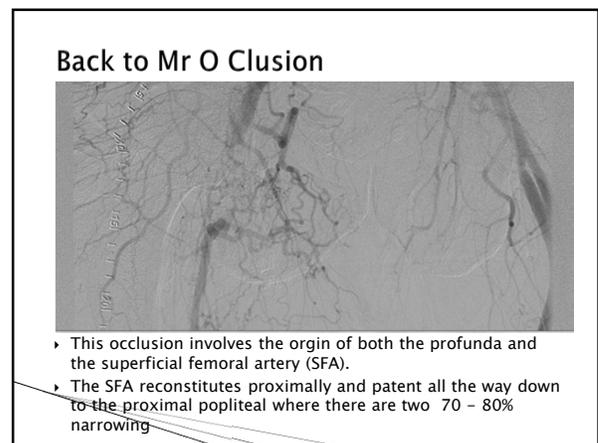
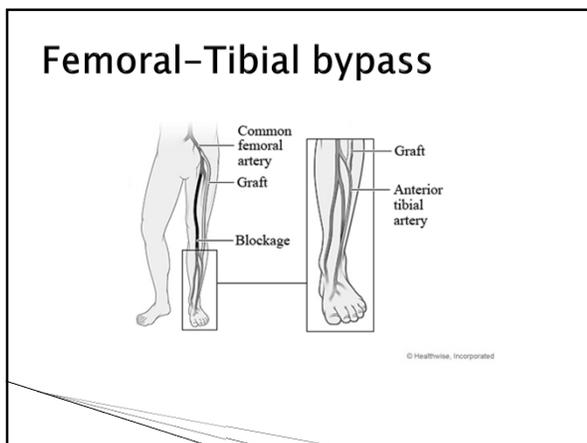
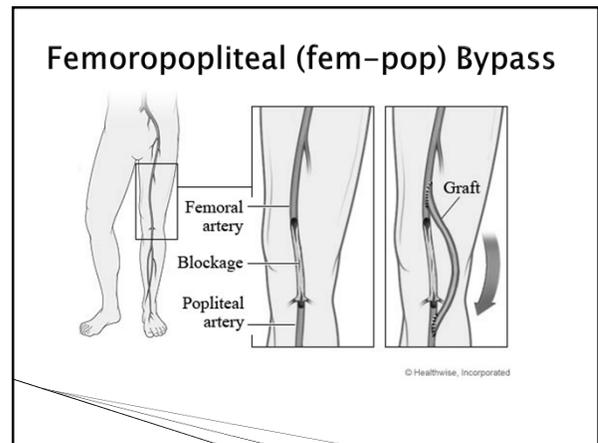
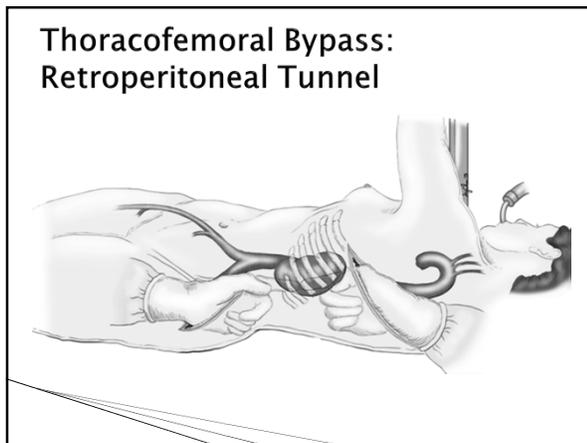
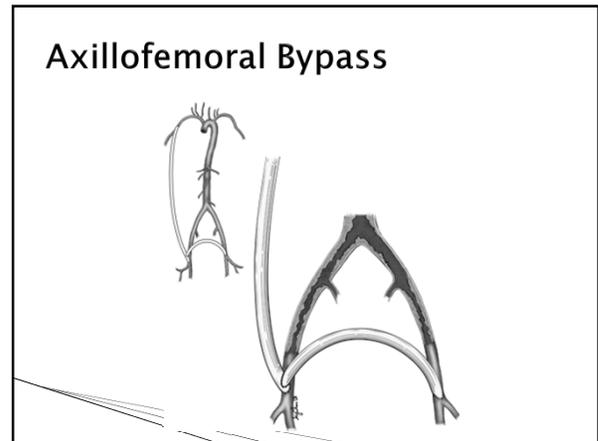
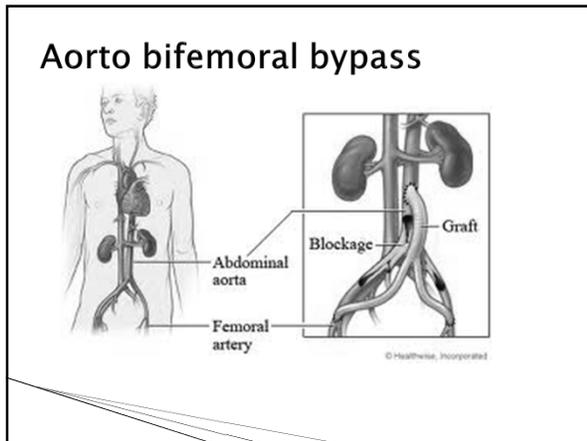
### Surgical Revascularization

- ▶ Surgery to bypass blocked arteries and restore blood flow to the leg.
- ▶ Blood is redirected through a graft



### Surgical Safety

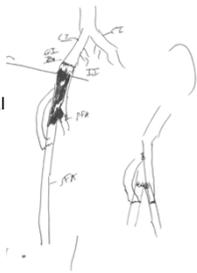




## Surgery

### Mr O Clusion

- ▶ Complete reconstruction of the right common femoral, profunda femoral, and suprafacial femoral artery
- ▶ Interposition graft was done with and end to end anastomosis to the proximal common femoral artery proximally
- ▶ Another anastomosis was done distally in end to end fashion to the profunda femoral artery
- ▶ Another graft was placed in and end to side fashion to the mid graft
- ▶ End to end anastomosis distally to the superficial femoral artery



Discharged POD #2

## Surgical Revascularization Complications

- ▶ Bleeding
- ▶ Limb Ischemia
- ▶ Distal embolization
- ▶ Graft thrombosis
- ▶ Respiratory failure
  - Results from effusion or hemothorax after a left thoracotomy or from inadvertent pneumothorax during exposure of the axillary artery
  - Thoracofemoral bypass, axillofemoral bypass
  - Also from atelectasis due to general anesthesia
  - All bypass surgeries

## Case Study

87 y/o female calls clinic regarding left leg pain

- ▶ Woke up in early morning hours with left leg pain
- ▶ The pain is from the hip down
- ▶ It worsens with activity and improves with rest
- ▶ She waited a day to call the office
- ▶ She notes her left toes have been cold

## PMH

- ▶ Left femoropopiteal bypass several years ago and multiple left leg interventions since then.
- ▶ COPD
- ▶ Carotid stenosis
- ▶ Heart Failure

## Assessment

- ▶ Right leg: warm and dry, 2+DP pulses
- ▶ Left leg: from mid shin down is pale, discolored and cold. No DP pulses
- ▶ No palpable left femoral pulse. Right femoral pulse is 2+

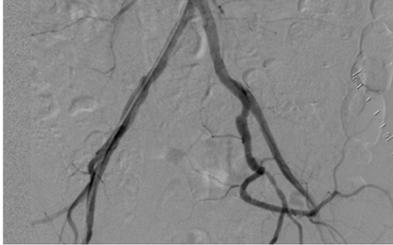
## Angiogram

- ▶ Mild disease right common femoral artery
- ▶ Left common femoral artery completely occluded
- ▶ Total occlusion or thrombotic occlusion of left graft with a thrombus at the distal anastomosis site.



## Post tPA

- ▶ tPA given in cath lab and then infusion a 0.3 mg/hr x 24 hours



## Surgical Revascularization Complications

- ▶ Paraplegia
  - Results from the sacrifice of intercostal vessels supplying the anterior spinal artery
  - Thoracofemoral bypass
- ▶ Arm paralysis
  - Results from injury to the deep and superiorly oriented brachial plexus
  - Axillofemoral bypass

## Surgical Revascularization Complications

- ▶ Ureteral injury
  - Results from ureters overlying the iliac vessels
  - Aortoiliac endarterectomy, iliofemoral bypass, axillofemoral bypass
- ▶ Impotence
  - Results from damage to the autonomic nerve fibers around the origin of the left common iliac artery
  - Aortoiliac endarterectomy, iliofemoral bypass, axillofemoral bypass
- ▶ Renal failure
  - Results from acute tubular necrosis or embolization when a suprarenal aortic clamp is used
  - Thoracofemoral bypass and aortobifemoral bypass

## Surgical Revascularization Complications

- ▶ Colonic ischemia or infarction,
  - Results from hindered primary flow via the inferior mesenteric artery or collateral vessels from the hypogastric arteries
  - All bypass surgeries
- ▶ Buttock claudication
  - Results from disruption of inline flow to the pelvic circulation
  - all bypass surgeries
- ▶ Aortoduodenal fistula
  - Resulting from incomplete coverage of an aortic graft
  - Aortofemoral and iliofemoral bypass

## Surgical Revascularization Late Complications

- ▶ Graft infection
- ▶ Recurrent disease
- ▶ Pseudoaneurysm formation

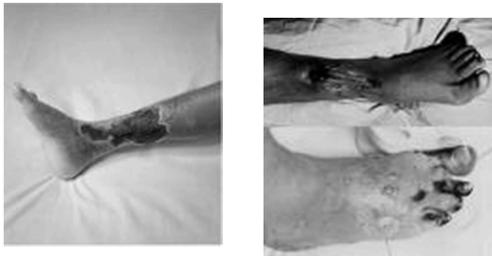
## Prognosis



- ▶ Best treatment is management of risk factors and exercise



## Gangrene



## Hyperbaric Therapy for Problem Wounds

- ▶ Wounds may fail to respond to standard care because of low oxygen levels and impaired circulation
- ▶ Foot ulcers in diabetics are one such problem
- ▶ By increasing oxygen levels within the wound tissues, hyperbaric therapy promotes healing.

## More hyperbaric uses

- ▶ **Soft Tissue Infections:** These are serious infections -- in which tissue is dying -- that may be complicated by conditions such as diabetes or vascular disease.
- ▶ While primary treatments are removing the infected tissue and administering antibiotics, hyperbaric oxygen may inhibit bacteria from growing and enhance the ability of white blood cells to kill bacteria.

## Procedure

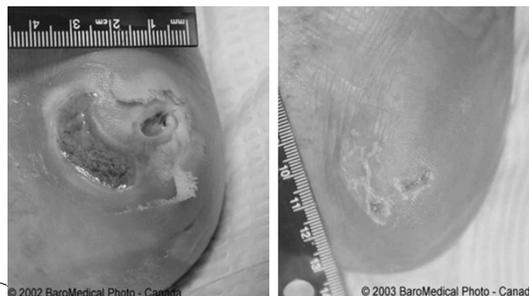
- ▶ Patients undergoing hyperbaric treatment are placed in a chamber where 100% oxygen is circulated
- ▶ The oxygen is pressurized so that air pressure may be 2-3 times greater than normal.
- ▶ This allows the lungs and skin to absorb more concentrated oxygen in a shorter period of time.



## Goal of Hyperbaric Treatment

- ▶ Main effect of hyperbaric oxygen therapy in arterial ulcers is in providing adequate oxygen for stopping further damage and salvage of viable tissue.
- ▶ New capillary growth induced by HBO can counteract the reduced blood supply due to arterial disease.

## Before.....After



## VTE Symptoms

### DVT

- ▶ Classical sign: Unilateral swelling with possible tenderness with palpitation
- ▶ Pedal pulses may be diminished if arterial flow is compromised
- ▶ Positive Homan's sign (pain with forced dorsiflexion of the foot when the leg is raised) - has many false positives so not considered a good test

### PE - sudden onset

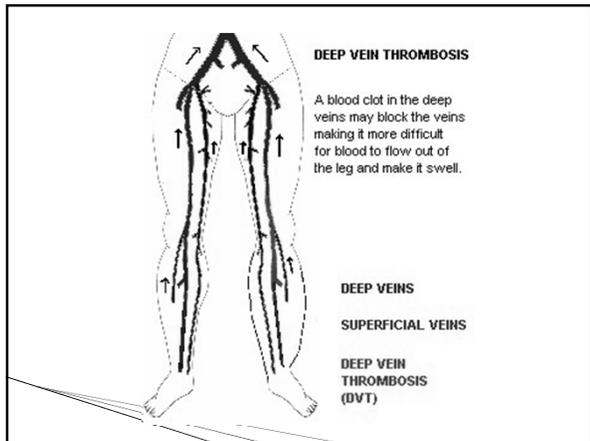
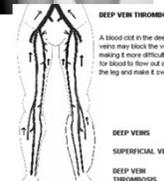
- ▶ Symptoms depend on severity
- ▶ Dyspnea/Tachypnea- use of accessory muscles
- ▶ Tachycardia
- ▶ Pallor or cyanosis
- ▶ Sharp, pleuritic chest pain .. worse with deep inspiration
- ▶ Anxiety - feeling of impending doom

Major PE - one causing hemodynamic instability is an ominous emergency!

## DVT Symptoms

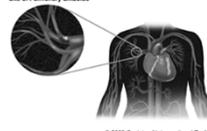
### DVT

- ▶ Classical sign: Unilateral swelling with possible tenderness with palpitation
- ▶ Pedal pulses may be diminished if arterial flow is compromised
- ▶ Positive Homan's sign (pain with forced dorsiflexion of the foot when the leg is raised) - has many false positives so not considered a good test

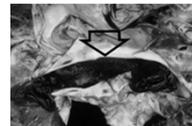


## PE Symptoms

Site of Pulmonary Embolus



© 2003 Society of Interventional Radiology



### PE - sudden onset

- ▶ Symptoms depend on severity
- ▶ Dyspnea/Tachypnea- use of accessory muscles
- ▶ Tachycardia
- ▶ Pallor or cyanosis
- ▶ Sharp, pleuritic chest pain .. worse with deep inspiration
- ▶ Anxiety - feeling of impending doom

Major PE - one causing hemodynamic instability is an ominous emergency!

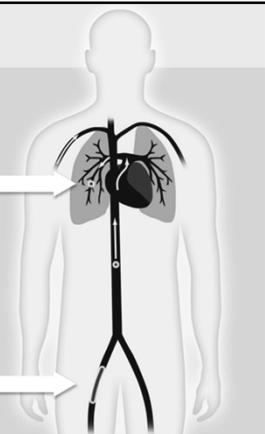
## Venous Clots

### Pulmonary embolism (=PE)

- shortness of breath
- chest pain
- cough
- bloody sputum

### Deep vein thrombosis (=DVT)

- swelling
- pain
- warmth
- blue-purple discoloration



## VTE Diagnostic Tests

### DVT

- ▶ Venous Duplex
- ▶ Can differentiate between chronic venous obstruction and acute venous thrombosis

### DVT and PE

- ▶ D-dimer
  - Positive indicates abnormally high levels of fibrin degradation products → significant thrombus formation and breakdown in the body
  - Doesn't give the location of the fibrin degradation
  - Can be elevated with surgery, trauma, infection, heart disease, pregnancy

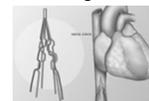
## VTE Diagnostic Tests

### PE

- ▶ Ventilation/perfusion (V/Q) lung scan
  - Assesses airflow patterns and circulation of lungs
  - With PE, shows obstructed pulmonary artery blood flow and any under perfused areas of the lungs
  - Has high false positive rate
- ▶ Computed Tomography Venography (CTV)
  - Highly sensitive and specific
  - Expensive so not first line test
- ▶ Pulmonary Angiogram
  - Gold standard for establishing diagnosis PE
  - May or may not be available and expensive so other tests used first.
- ▶ Spiral computed tomography

## VTE Treatments

- ▶ Reduce risk
  - Intersperse activity during periods of inactivity
  - Stop smoking
- ▶ Anticoagulation
  - Do not break up clot
  - Inhibit clot formation
  - Heparin
  - Low-molecular weight heparin
  - Warfarin
- ▶ Thrombolytic therapy for PE
  - NOT recommended unless patient hemodynamically unstable and low risk to bleed
- ▶ Vena Caval Interruption
  - Only recommended for patients unable to take anticoagulation or those with recurrent VTE despite adequate anticoagulation



Reduce risk... Anticoagulation

## Arterial versus Venous Occlusion

### Arterial

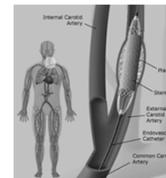
- ▶ Excruciating pain
- ▶ Pallor
- ▶ Cool/cold extremities
- ▶ No edema
- ▶ Diminished or absent pulses

### Venous

- ▶ Crampy pain
- ▶ Normal or ruddy color
- ▶ Warm color
- ▶ Edema – may be severe
- ▶ Normal pulses

## Carotid Artery Stenosis

- ▶ Majority of patients are asymptomatic
- ▶ Goal is to prevent stroke
- ▶ Treatment is carotid endarterectomy or carotid stent
  - Both carry the primary risk of stroke
  - Risk and benefit must be weighed



## Carotid Artery Stenosis

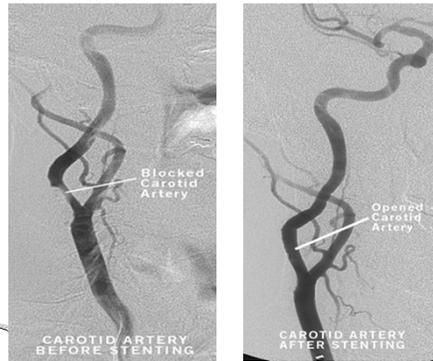
### Diagnosis

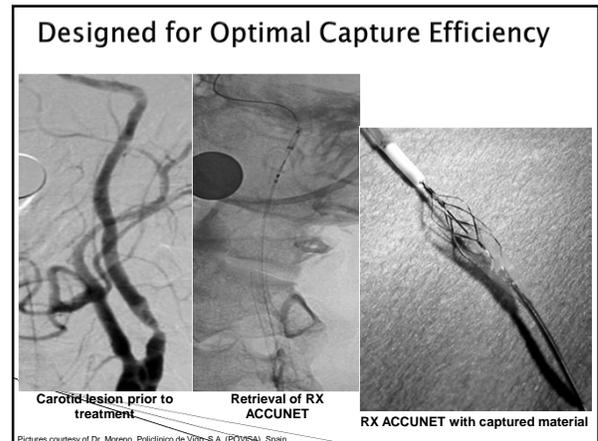
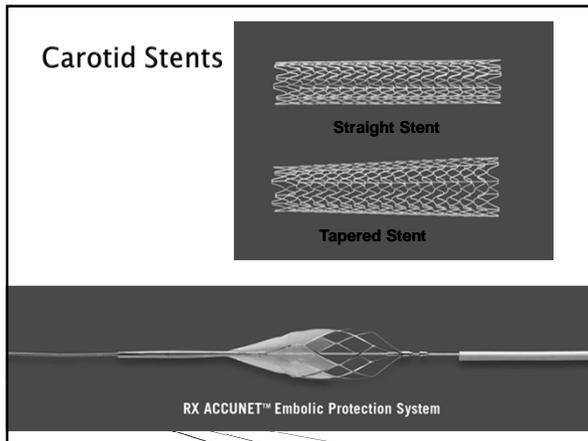
- ▶ Most patients asymptomatic
- ▶ May present with ischemic stroke symptoms
- ▶ Carotid artery bruit – may or may not be present
- ▶ Duplex ultrasound
- ▶ CT
- ▶ MRI
- ▶ Angiogram – not used as much with the improvement of noninvasive tests

### Treatment

- ▶ Medical
  - Aspirin
  - Ticlopidin (Ticlid) or Clopidogrel (Plavix)
- ▶ Surgical/Endovascular
  - Carotid Endarterectomy
  - Carotid angioplasty and stent
    - Needs Clopidogrel (Plavix) preprocedure
    - Risk of distal embolization during procedure

## Before and After





### Post Procedure Care – CEA or Stent

Assessments	Neurological exam for nerve injury
<ul style="list-style-type: none"> <li>▶ Routine post procedure care plus</li> <li>▶ Peripheral Circulation                             <ul style="list-style-type: none"> <li>◦ Facial pulses</li> </ul> </li> <li>▶ Incision assessment                             <ul style="list-style-type: none"> <li>◦ Bleeding</li> <li>◦ Hematoma                                     <ul style="list-style-type: none"> <li>▪ Maintain adequate airway if hematoma present</li> </ul> </li> <li>◦ Increased neck size</li> </ul> </li> <li>▶ BP: May be labile – hypertensive/hypotensive due to manipulation of carotid bodies</li> <li>▶ Carotid stents – "yawning" indication of lack of blood flow to brain</li> </ul>	<ul style="list-style-type: none"> <li>▶ Ask patient to talk                             <ul style="list-style-type: none"> <li>◦ Assesses cranial nerve (CN) XII and X</li> </ul> </li> <li>▶ Stick out their tongue                             <ul style="list-style-type: none"> <li>◦ Assesses CN XII</li> </ul> </li> <li>▶ Swallow                             <ul style="list-style-type: none"> <li>◦ Assesses CN X and IX</li> </ul> </li> <li>▶ Smile                             <ul style="list-style-type: none"> <li>◦ Assesses CN VII</li> </ul> </li> <li>▶ Shrug shoulders                             <ul style="list-style-type: none"> <li>◦ Assesses XI</li> </ul> </li> <li>▶ Deficits are result of traction during surgery</li> </ul>

### 12 CRANIAL NERVES:

VII, IX, X, XI, XII MAY BE AFFECTED WITH CEA OR STENTS

On Old Olympus Tearing Tops A Finn And German Viewed Some Hops

The diagram shows the 12 cranial nerves originating from the brain and exiting the skull. The nerves are labeled as follows: Olfactory, Optic, Oculomotor, Trochlear, Trigeminal, Abducens, Facial, Acoustic, Glossopharyngeal, Vagus, Spinal Accessory, and Hypoglossal. The mnemonic 'On Old Olympus Tearing Tops A Finn And German Viewed Some Hops' is used to remember the first 12 nerves.

### OLFACTORY CRANIAL NERVE I

▶ Controls sense of smell

The diagram shows a stylized face with numbers indicating the sense of smell. The numbers are: 2 (eyes), 1 (nose), 6 (ears), 4 (cheeks), 9 (mouth), 10 (throat), and 12 (neck).

Source: American Nurse Today November 2006

### OPTIC CRANIAL NERVE II

▶ Controls central and peripheral vision

▶ Count how many fingers holding up

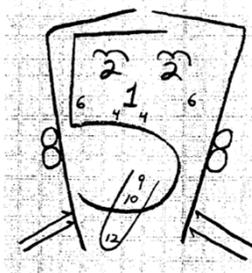
▶ Use index finger to test superior and inferior fields

The diagram shows a stylized face with numbers indicating vision. The numbers are: 2 (eyes), 1 (nose), 6 (ears), 4 (cheeks), 9 (mouth), 10 (throat), and 12 (neck).

Source: American Nurse Today November 2006

### OCCULOMOTOR CRANIAL NERVE III

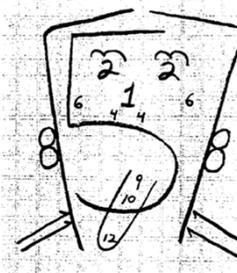
- ▶ Controls pupillary constriction



Source: American Nurse Today November 2006

### TROCHLEAR CRANIAL NERVE IV

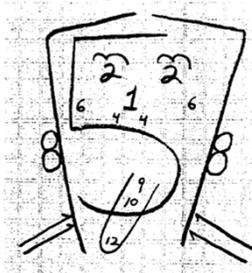
- ▶ Moves eyes downward towards nose



Source: American Nurse Today November 2006

### TRIGEMINAL CRANIAL NERVE V

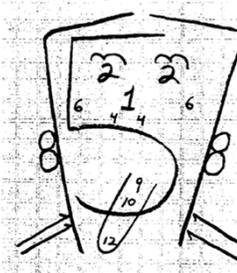
- ▶ Covers most of the face
- ▶ Check sensation of forehead, cheek, and jaw



Source: American Nurse Today November 2006

### ABDUCENS CRANIAL NERVE VI

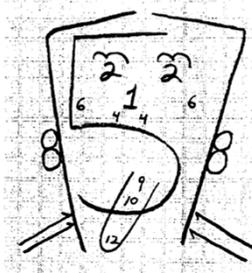
- ▶ Controls movements to the sides
- ▶ Follow examiners fingers through the 6 cardinal fields of gaze



Source: American Nurse Today November 2006

### \* FACIAL CRANIAL NERVE VII

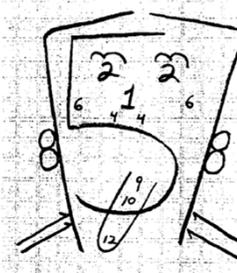
- ▶ Facial movements and expressions



Source: American Nurse Today November 2006

### ACOUSTIC CRANIAL NERVE VIII

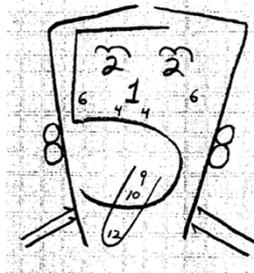
- ▶ Controls hearing



Source: American Nurse Today November 2006

**\* GLOSSOPHARYNGEAL CRANIAL NERVE IX AND VAGUS NERVE X**

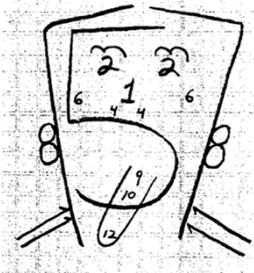
- ▶ Innervate the tongue and throat



Source: American Nurse Today November 2006

**\* SPINAL ACCESSORY CRANIAL NERVE XI**

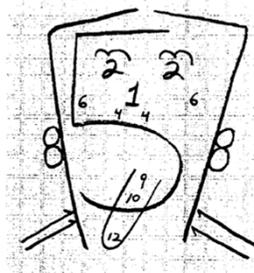
- ▶ Controls shoulder and neck movements



Source: American Nurse Today November 2006

**\* HYPOGLOSSAL CRANIAL NERVE XII**

- ▶ Innervates the tongue



Source: American Nurse Today November 2006

**In Summary**

- ▶ Prevention – Risk factor Reduction!



"I'll have an ounce of prevention."