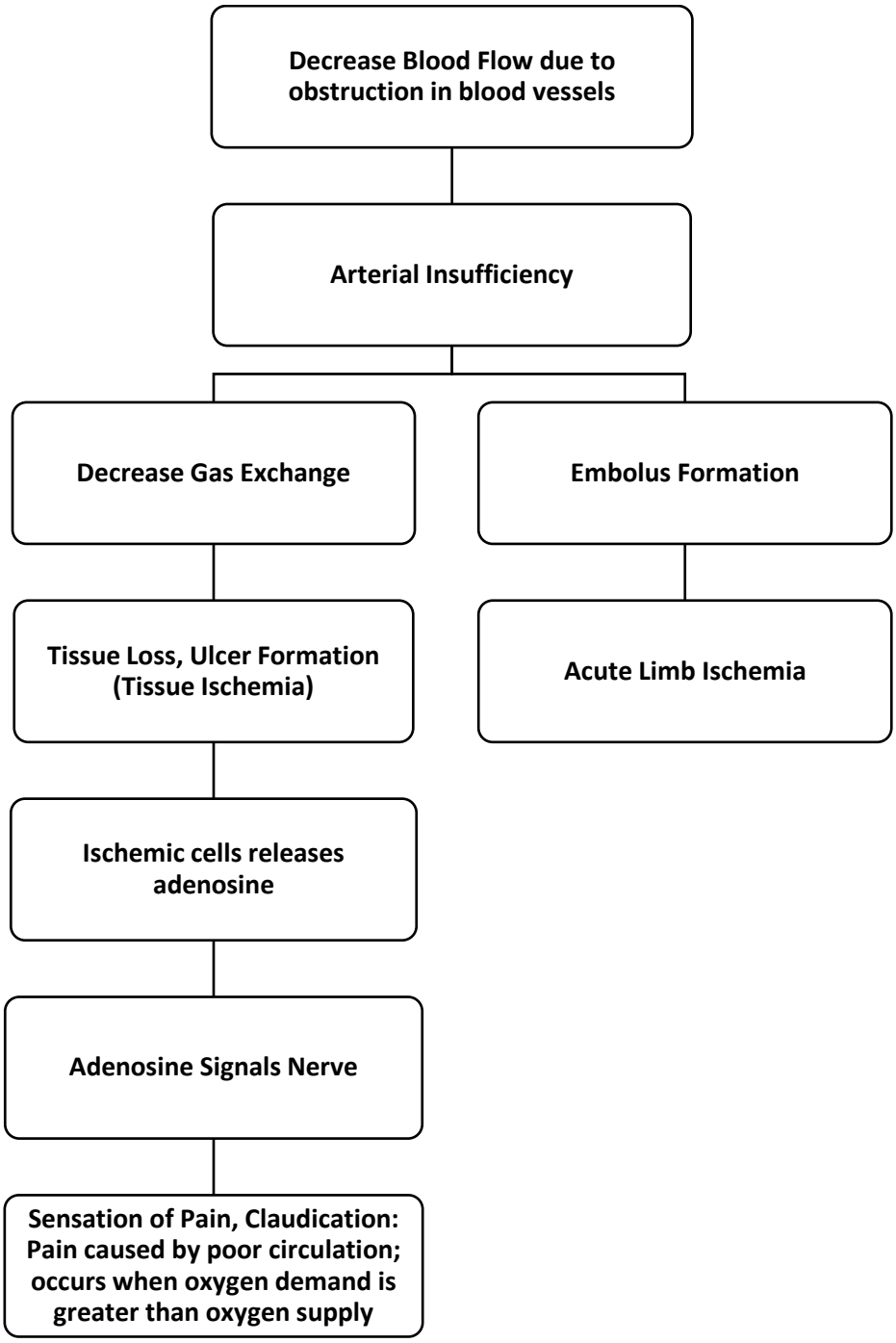
Peripheral Vascular Disease

Peripheral Vascular Disease (PVD) is a circulation disorder that causes narrowing of blood vessels to parts of the body other than the brain & heart.

Vessels of the lower extremities are most commonly affected

Pathophysiology



Types of Peripheral Vascular Disease

Peripheral Artery Disease

- Peripheral Artery Disease
- Carotid Artery Disease
- Pheripheral Renal Disease
- Abdominal Aortic Aneurysm
- Raynaud Syndrome
- Buerger Disease (Thromboangiitis Obliterans)
- Polyarteritis Nordosa

Peripheral Vascular Disease

- Thrombophlebitis
- Vericos Veins
- Chronic Venous Insufficiency
- Deep Vein Thrombosis

Comparison of Characteristics of Arterial & Venous Disorder		
	Arterial Disease	**Venous Disease**
Skin	Cool or cold, hairless, dry, shinny, pallor on elevation, rubor on dangling	Warm, though, thickened, mottled, pigmented area
Pain	Sharp, stabbing, worsens with activity & walking, lowering feet may relive pain	Aching, cramping, activity & walking sometimes help, elevating the feet relieves pain
Ulcers	Gray base found on heel, toes, dorsum of foot	Pink base, found on medial aspects of the ankle
Pulse	Often absent or diminished	Usually, present
Edema	infrequent	Frequent, especially at the end of the day & in area of ulceration

Arteriosclerosis Obliterans

- It is a disorder in which there is an arteriosclerotic narrowing or obstruction of the inner & middle layer of the artery

- Most common cause of arterial obstructive disease in the extremities
- The lower extremities are involved more than upper extremities
- Common sites of disease – femoral artery, iliac arteries, popliteal arteries
- In a diabetic, the disease become more progressive, affects the smaller arteries & often involves vessels below the knee

Thromboangiitis Obliterans (Buerger Disease)

- Characterized by acute inflammatory lesions & occlusive thrombosis of the arteries & veins
- Has a very strong association with cigarette smoking
- Commonly occurs in male between 20-40 years
- May involve the arteries of the upper extremities (wrists)
- Usually affect the lower leg, toes, feet

Raynaud's Phenomenon

- Refers to intermittent episodes during which small arteries or arterioles of left or right arm constrict (spasm) causing changes in skin color & temperature
- Generally unilateral & may affects only 1 or 2 fingers
- May occur after trauma, neurogenic lesions, occlusive arterial disease, connective tissue disease
- Characterized by reduction of blood flow to the fingers manifested by cutaneous vessel constriction & resulting in blanching (pallor)

  Raynaud's Disease
  - Unknown etiology, may be due to immunologic abnormalities
  - Common in women 20-40 years
  - May be stimulated by emotional stress, hypersensitivity to cold, alteration in sympathetic innervation

Aneurysm

- It is a localized or diffuse enlargement of an artery at some point along its course
- Can occur when the vessel becomes weakened from trauma, congenital vascular disease, infection or atherosclerosis
- May occur in any blood vessel, most common site is the aorta

  Types of aneurysm
  - **Saccular aneurysm**: involves only part of the circumference of the artery, it takes the form of a sac or pouch-like dilation attached to the side of the artery

- **Fusiform aneurysm**: spindle shaped, involves the entire circumference of the arterial wall
- **Dissecting aneurysm**: involves hemorrhage into a vessel wall, which splits & dissects the wall causing a widening of the vessel. Can caused by degenerative defect in the tunica media & tunica intima

Thoracic Aortic Aneurysm

- Occurs most frequently in hypertensive men between 40-70 years
- Can develop in the ascending, transverse or descending aorta

Abdominal Aortic Aneurysm

- Most common site for the formation of an aortic aneurysm (Abdominal aorta below the renal arteries)

  S/Sx:
  - Presence of pulsatile abdominal mass on palpitation
  - Pain or tenderness in the mid or upper abdomen
  - The aneurysm may extend to impinge on the renal, iliac or mesenteric arteries
  - Stasis of blood favors thrombus formation along the wall of the vessel
  - Rupture of the aneurysm: most feared complication can occur if the aneurysm is large. Can lead to death

Arterial Embolism

- Blood clots floating in the circulating arterial blood
- The embolus is frequently a fragment of atherosclerotic plaque loosened from the aorta
- Emboli will tend to lodge in femoral or popliteal arteries, blood flow is impaired & ischemia develops

Thrombophlebitis

- Inflammation of the veins caused by thrombus or blood clot
- Develops in both the deep & superficial veins of the lower extremities
  Deep veins: femoral, popliteal, small calf veins
  Superficial Veins: Saphenous vein

Deep Vein Thrombosis (DVT)

- Tends to occur at bifurcations of the deep veins, which are sites of turbulent blood flow

- A major risk during the acute phase of thrombophlebitis is dislodgement of the thrombus → embolism
- Pulmonary embolism is a serious complication arising from DVT of the lower extremities

  Clinical Manifestations:
  - Pain & edema of extremities – obstruction of venous flow
  - Increase circumference of the thigh or calf
  - (+) Homan's sign – dorsiflexion of the foot produces calf pain. Do not check for the Homan's sign if DVT is already known to be present → increase risk of embolus formation

Chronic Venous Insufficiency

- Results from obstruction of venous valves in legs or reflux of blood back though valves
- Venous ulceration is serous complication
- Pharmacological therapy is antibiotics for infections
- Debridement to promote healing
- Topical therapy may be used with cleansing & debridement

Varicose Veins

- It is an abnormally dilated veins with incompetent valve, occurring most often in the lower extremities
- Usually affected are women 30-50 years old

  Causes:
  - Congenital absence of a valve
  - Incompetent valves due to external pressure on the veins from pregnancy, ascites or abdominal tumors
  - Sustained increase in venous pressure due to CHF, cirrhosis

Risk Factors that can contribute to development of PVD:

- Family history of heart disease
- Smoking
- High blood pressure
- Diabetes
- Hyperlipidemia (high cholesterol, LDL, triglycerides and/or low HDL)
- Metabolic syndrome
- Age >60
- Overweight or Obesity
- Inflammatory process/infection

- Inc. risk in black people of African descent

Causes

- Atherosclerosis
- Blood clots
- Diabetes
- Inflammation of the arteries or arteritis
- Infection (salmonella & syphilis)
- Structural defects
- Injury

Signs & Symptoms

- Often asymptomatic until significant occlusion develops
- **Intermittent claudication**: muscle pain due to inc. oxygen demand & dec. supply
- **Rest Pain or burning sensation** in forefoot & toes **when legs elevated**, pain relieved when legs are lowered (gravity assisting flow)
  Location of pain is dependent upon artery implicated
  - Lower aorta or iliac artery = pain in hips & buttocks
  - Iliac or common femoral artery = pain in thigh
  - Superficial femoral artery = pain in upper $^{2}/_{3}$ of calf
  - Popliteal artery = pain in lower $^{1}/_{3}$ of calf
  - Tibial or peroneal artery = pain in foot
- **Dec. lower peripheral pulses** (e.g., pedal, tibial)
- **Leg/foot ulcers** that do not heal normally
  - Have **classic punched out apperance**
  - Often form on toes joints, malleoli, shin, base of heal, pressure points
  - **Painful**
  - **Slow healing** leads to inc. **risk of infection**
- **Impotence**
- **Cutaneous color changes**
  - **Elevation pallor**: foot turns pale when raised due to circulation having to work against gravity as well as narrowed
  - **Dependent rubor**: foot turns red when lowered as gravity works increases perfusion
- **Skin**: cool, dry, shiny, hairless
- **Nails**: brittle, hypertrophic, ridged

Signs of acute limb ischemia

Pain

Pallor

Pulselessness

Paresthesia

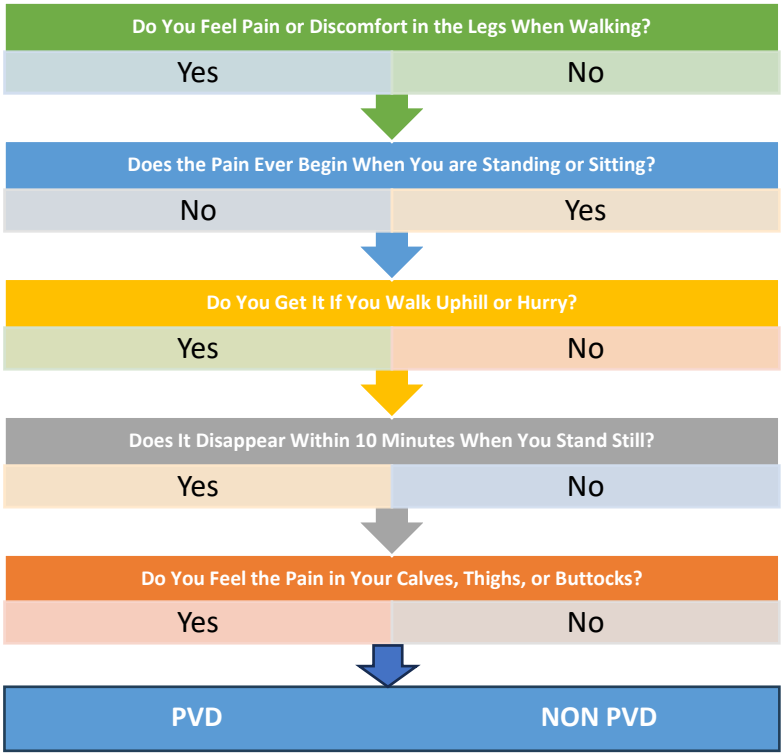
Paralysis (a surgical emergency)

Complications

- Increase risk of developing coronary artery & cerebrovascular disease (stroke 3 times more likely in people with PVD)
- Poor wound healing
- Restricted mobility due to severe pain or discomfort with exertion in affected extremity
- Tissue necrosis
- Amputation (loss of limb)

Diagnosis

- **Edinburgh Claudication Questionnaire**



- **Assessment**

- Condition of the skin: shinny, taut, absence of hair growth (indicates poor circulation)
- Ulcerations/necrotic tissue
- Extremely cold to touch
- Prolonged (>3 sec.) or absent capillary refill of nailbeds
- Peripheral pulses: diminished, weak, absent, bilateral inequality

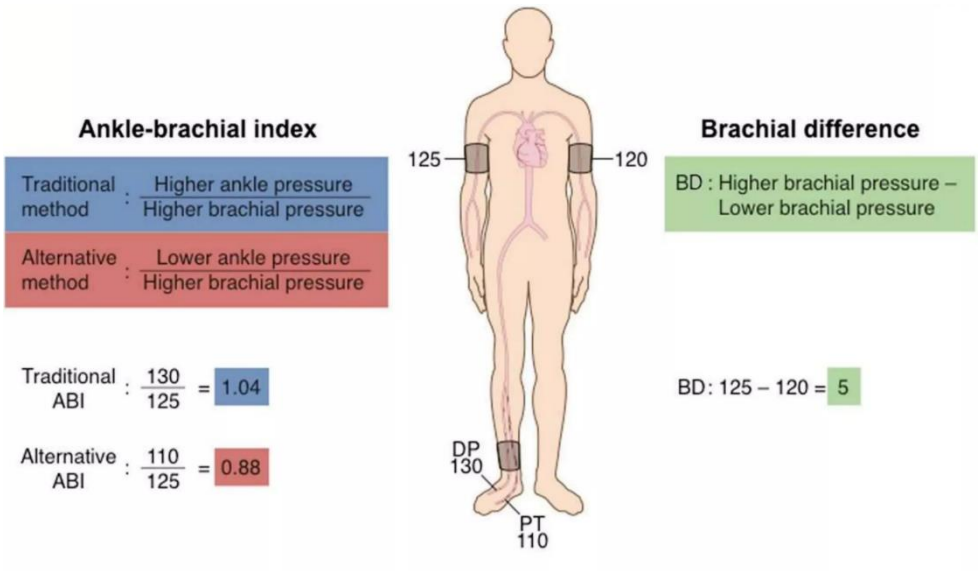
  Grading 0 – Absent

  1+ - Weak & Thready

  2+ - Normal

  3+ - Full & Bounding

- **Diagnostic Imaging**
  - **Peripheral Doppler Ultrasound & Duplex Ultrasonography**
    - High frequency sound waves directed to artery or veins through a hand-held transducer moved evenly across skin surface which shows → Dec. blood flow through vessel
  - **Peripheral Angiography or arteriography**
  - **Computed Tomography Angiography**
  - **Magnetic Resonance Angiography**
- **Other Diagnostics**
  - **Auscultation**
    - **Bruit (Whooshing sound)**, due to arterial narrowing, heard on auscultation of suspected artery. Usually pulse of leg's iliac artery
  - **Ankle-brachial index (ABI)**



This test compares the blood pressure in the arm (brachial) with the blood pressure in the legs. In a person with healthy blood vessels, the pressure should be higher in the legs than in the arms.

- ABI ≥0.9: Generally Normal
- ABI <0.9: Peripheral Artery Disease
  - ABI 0.8-0.9: Mild Disease
  - ABI 0.5-0.8: Moderate Disease
  - ABI <0.4-0.9: Severe
  - ABI of 0-0.4: tissue loss, ulcers, gangrene

- **Treadmill Exercise Test**
  - If necessary, the ABI will be followed by a treadmill exercise test.
  - Blood pressure in arms & legs will be taken before & after exercise (walking on a treadmill, usually until symptoms arrives)
  - A significant drop in leg blood pressures & ABIs after exercise suggests PVD

Treatment

- **Medication**
  - Antiplatelet Therapy: to prevent clot formation
  - Thrombolytics: streptokinase, urokinase
  - Statins
  - Vasodilators
  - Antihypertensive
- **Surgery**
  - Angioplasty (stent insertion)
    - **Balloon Angioplasty**: a small balloon is inflated inside the blocked artery to open the blocked area
    - **Stent:** a tiny coil is expanded inside the blocked artery to open the blocked area & is left in the place to keep the artery open
    - **Laser Angioplasty**: a laser is used to “vaporize” the blockage in the artery
    - **Atherectomy**: the blocked area inside the artery is “shaved” away by a tiny device on the end of a catheter
  - **Endarterectomy**: is removal of a blood clot & stripping of atherosclerotic plaque along with the inner arterial wall.
  - **Bypass graft** surgery to restore blood flow by diverting it around blockage

- **Amputation** with advanced atherosclerosis & gangrene of extremities. Toes are the most often amputated part of the body

- **Other Intervention**
  - **Lifestyle Changes**
    - Modify risk factors; e.g.,
    - Smoking cessation (smokes are 4 times more likely to get PAD & have symptoms of PAD than nonsmokers)
    - Controlling diabetes
    - Controlling Blood Pressure
    - Eating a diet low in saturated fats
    - Exercise regularly
      - ✓ *Reduce risk factors*
      - ✓ *Increase collateral circulation*
      - ✓ *Decrease claudication threshold*
      - ✓ *Increase oxygen capacity of muscle*