Assessing peripheral vascular system

By

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Structure and Function

ARTERIES

- The arterial network is a high-pressure system.
- Because of this high pressure, arterial walls must be thick and strong; the arterial walls also contain elastic fibers so that they can stretch.

VEINS

- The veins contain nearly 70% of the body's blood volume.
- Because blood in the veins is carried under much lower pressure than in the arteries, the vein walls are much thinner

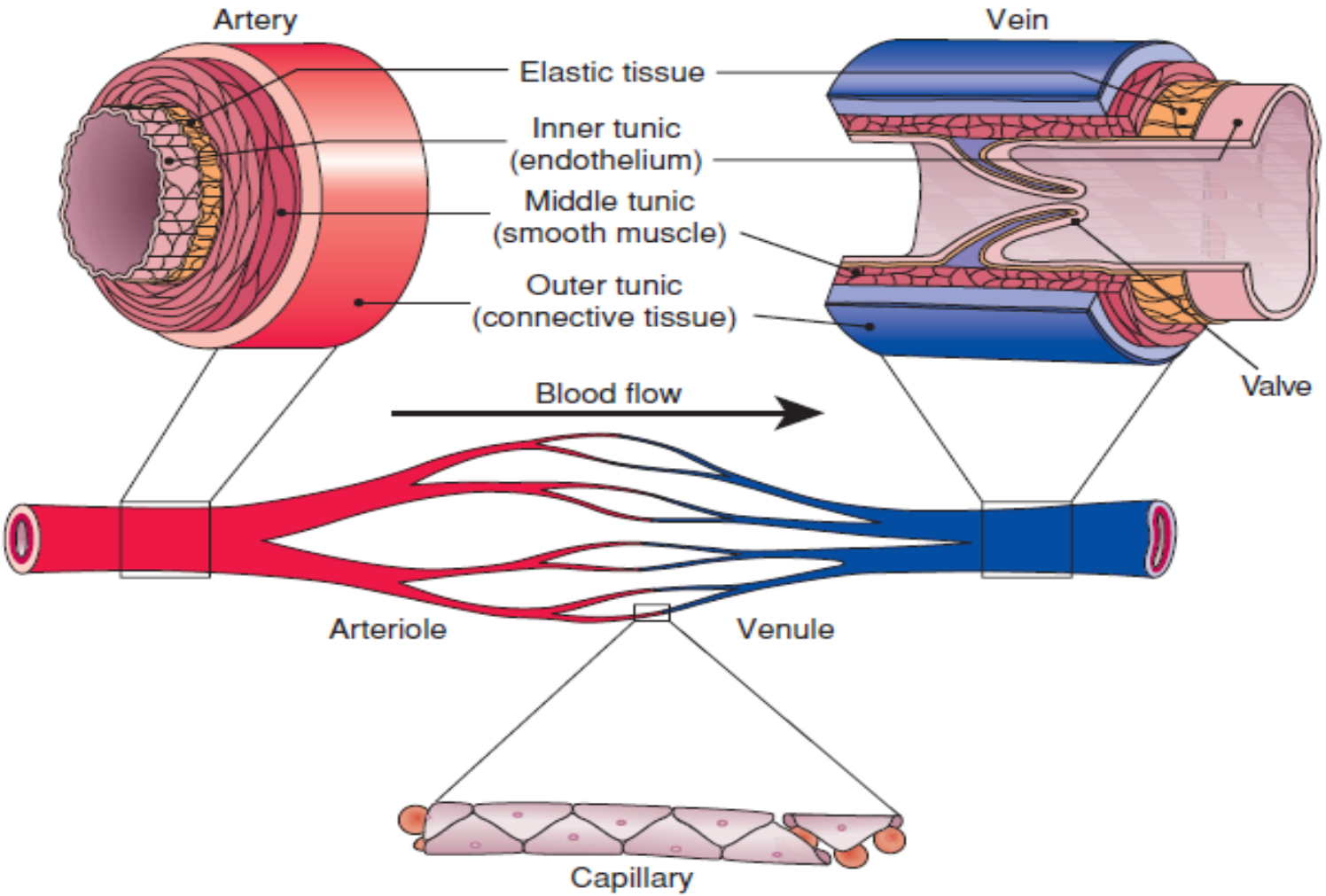

FIGURE 22-1 Blood vessel walls. Arterial walls are constructed to accommodate the high pulsing pressure of blood transported by the pumping heart, whereas venous walls are designed with valves that promote the return of blood and prevent backflow.

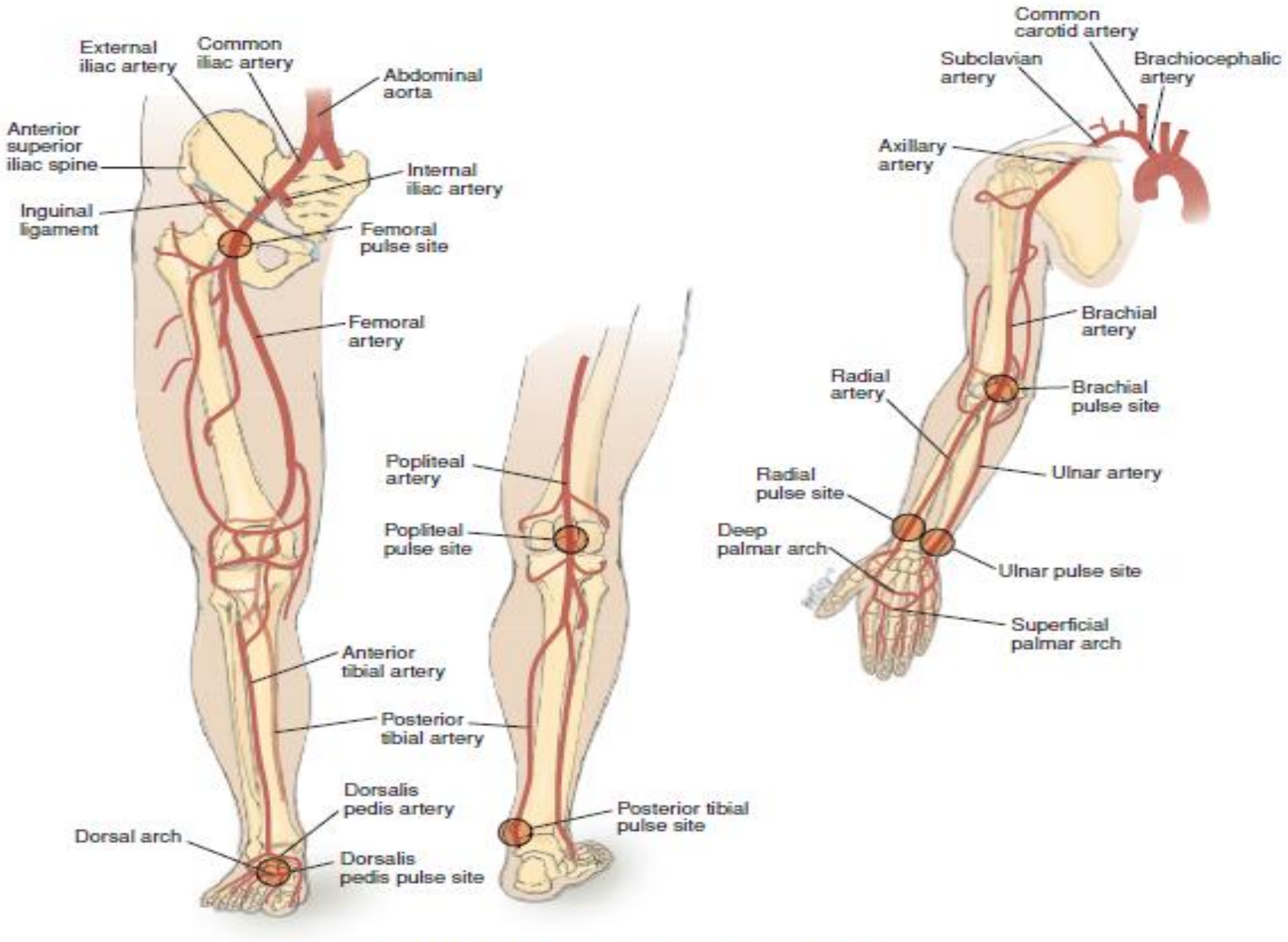

FIGURE 22-2 Major arteries of the arms and legs.

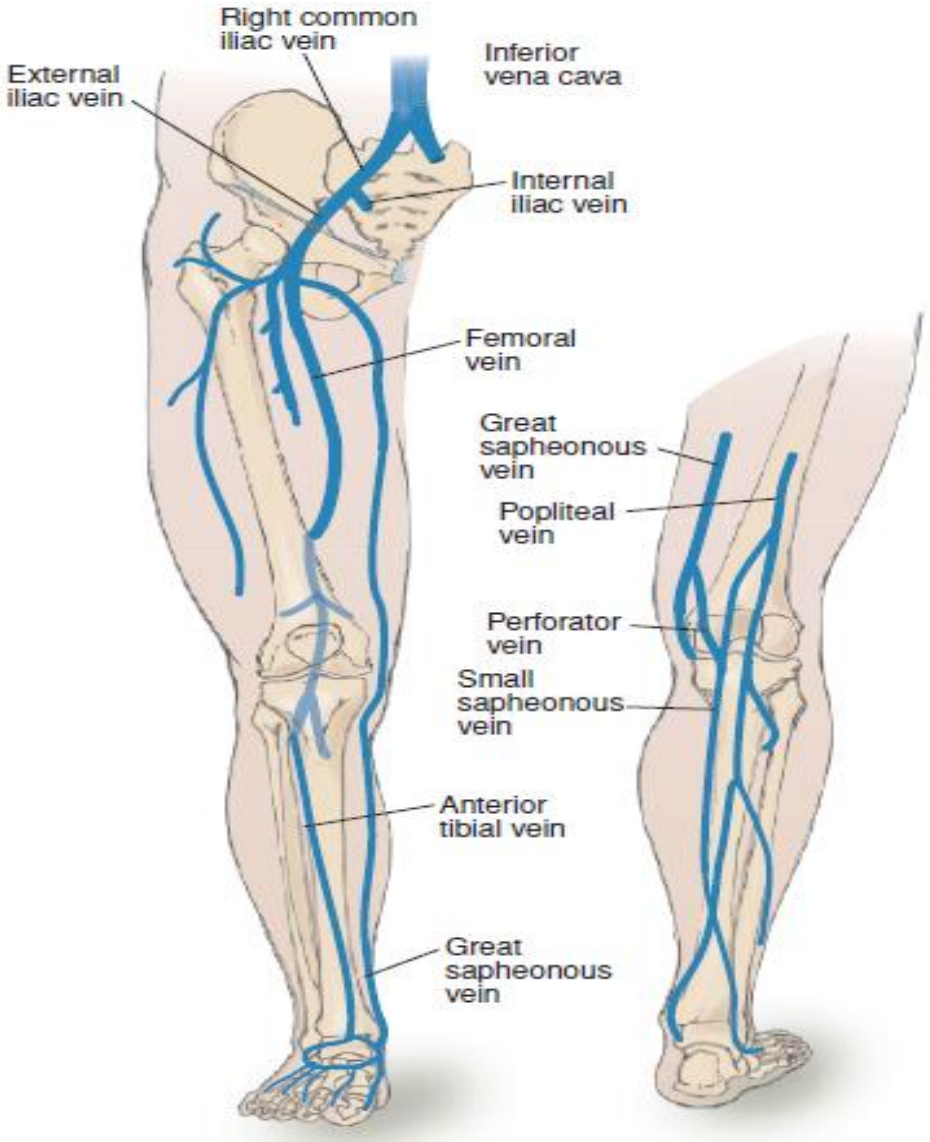

FIGURE 22-3 Major veins of the legs.

Three mechanisms of venous function help to propel blood back to the heart.

- The first mechanism has to do with the structure of the veins. Deep, superficial, and perforator veins all contain oneway valves. These valves permit blood to pass through them on the way to the heart and prevent blood from returning through them in the opposite direction.

- The second mechanism is muscular contraction. Skeletal muscles contract with movement and, in effect, squeeze blood toward the heart through the one-way valves.

- The third mechanism is the creation of a pressure gradient through the act of breathing. Inspiration decreases intrathoracic pressure while increasing abdominal pressure, thus producing a pressure gradient.

LYMPHATIC SYSTEM

- The *lymphatic system,* an integral and complementary component of the circulatory system, is a complex vascular system composed of lymphatic capillaries, lymphatic vessels, and lymph nodes.

- Its primary function is to drain excess fluid and plasma proteins from bodily tissues and return them to the venous system.

- Draining excess fluid action prevents edema, which is a buildup of fluid in the interstitial spaces.

Health Assessment

COLLECTING SUBJECTIVE DATA: THE NURSING HEALTH HISTORY

History of Present Health Concern

Questions to ask

- Have you noticed any color, temperature, or texture changes in your skin?

- Do you experience pain or cramping in your legs? If so, describe the pain (aching, cramping, stabbing). How often does it occur? Does it occur with activity? Is the pain reproducible with same amount of exercise?

- If you have pain with walking, how far and how fast do you walk prior to the pain starting? Is the pain relieved by rest? Are you able to climb stairs? If so, how many stairs can you climb before you experience pain? Does the pain wake you from sleep?
- Do you have any leg veins that are rope-like, bulging, or contorted?
- Do you have any sores or open wounds on your legs? Where are they located? Are they painful?
- Do you have any swelling (edema) in your legs or feet? At what time of day is swelling worst? Is there any pain with swelling?
- Do you have any swollen glands or lymph nodes? If so, do they feel tender, soft, or hard?

Personal Health History

Questions to ask

- Describe any problems you had in the past with the circulation in your arms and legs (e.g., blood clots, ulcers, coldness, hair loss, numbness, swelling, or poor healing).

- Have you had any heart or blood vessel surgeries or treatments such as coronary artery bypass grafting, repair of an aneurysm, or vein stripping?

Family History

Questions to ask

- Do you, or does your family, have a history of diabetes, hypertension, coronary heart disease, intermittent claudication, or elevated cholesterol or triglyceride levels?

Lifestyle and Health Practices

Questions to ask

- Do you (or did you in the past) smoke or use any other form of tobacco? How much and for how long?
- Do you exercise regularly?
- Are you experiencing any stress in your life at this time?
- Do leg ulcers or varicose veins affect how you feel about yourself?
- Do you regularly take medications prescribed by your physician to improve your circulation?
- Do you wear support hose to treat varicose veins?

COLDSPA mnemonic for pain assessment

- **C**haracter
- **O**nset
- **L**ocation
- **D**uration
- **S**everity
- **P**attern
- **A**ssociated factors/How it **A**ffects theclient

COLLECTING OBJECTIVE DATA: PHYSICAL EXAMINATION

Equipment

- Centimeter tape
- Stethoscope
- Doppler ultrasound device
- Conductivity gel
- Tourniquet
- Gauze or tissue
- Waterproof pen
- Blood pressure cuff

INSPECTION: Arm

- **Observe arm size and venous pattern; also look for edema.** If there is an observable difference, measure bilaterally the circumference of the arms at the same locations with each re-measurement and record findings in centimeters.

- Normal: Arms are bilaterally symmetric with minimal variation in size and shape. No edema or prominent venous patterning.

- Abnormal: Lymphedema results from blocked lymphatic circulation, which may be caused by breast surgery

Observe coloration of the hands and arms

- Normal: Color varies depending on the client's skin tone, although color should be the same bilaterally

- Abnormal: Raynaud's disorder It is a vascular disorder caused by vasoconstriction or vasospasm of the fingers or toes, characterized by rapid changes of color (pallor, cyanosis, and redness), swelling, pain, numbness, tingling, burning, throbbing, and coldness.

FIGURE 22-8 Hallmarks of Raynaud's disease are color changes.

PALPATION

Palpate the client's fingers, hands, and arms, and note the temperature.

- Normal: Skin is warm to the touch bilaterally from fingertips to upper arms.

- Abnormal: A cool extremity may be a sign of arterial insufficiency. Cold fingers and hands, for example, are common findings with Raynaud's.

Palpate to assess capillary refill time.

- Compress the nailbed until it blanches. Release the pressure and calculate the time it takes for color to return. This test indicates peripheral perfusion and reflects cardiac output.

- Normal: Capillary beds refill (and, therefore, color returns) in 2 seconds or less.

- Abnormal: Capillary refill time exceeding 2 seconds may indicate vasoconstriction, decreased cardiac output, shock, arterial occlusion, or hypothermia.

- **Note: Inaccurate findings may result if the room is cool, if the client has edema, has anemia, or if the client recently smoked a cigarette.**

Palpate the radial pulse/ulnar pulse/brachial pulses

Gently press the radial artery against the radius. Note elasticity and strength.

- Normal: Radial pulses are bilaterally strong (2+). Artery walls have a resilient quality (bounce).

- Abnormal: Increased radial pulse volume indicates a hyperkinetic state (3+ or bounding pulse). Diminished (1+) or absent (0) pulse suggests partial or complete arterial occlusion (which is more common in the legs than the arms).

FIGURE 22-9 Palpating the radial pulse.

FIGURE 22-10 Palpating the ulnar pulse.

FIGURE 22-11 Palpating the brachial pulse.

Perform the Allen test

- The Allen test evaluates patency of the radial or ulnar arteries. The test begins by assessing ulnar patency.
- Normal: Pink coloration returns to the palms within 3–5 seconds if the ulnar artery/radial artery is patent.
- Abnormal: With arterial insufficiency or occlusion of the ulnar artery/radial artery, pallor persists.

Legs: Inspection

- Ask the client to lie supine. Then drape the groin area and place a pillow under the client's head for comfort. Observe skin color while inspecting both legs from the toes to the groin.

- Normal: Pink color for lighter-skinned clients and pink or red tones visible under darker-pigmented skin. There should be no changes in pigmentation.

- Abnormal: Pallor, especially when elevated, and rubor, when dependent, suggests arterial insufficiency. Cyanosis when dependent suggests venous insufficiency.

Inspect distribution of hair.

- Normal: Hair covers the skin on the legs and appears on the dorsal surface of the toes.
- Abnormal: Loss of hair on the legs suggests arterial insufficiency. Often thin, shiny skin is noted as well.

Inspect for lesions or ulcers.

- Normal: Legs are free of lesions or ulcerations.
- Abnormal: Ulcers with smooth, even margins that occur at pressure areas, such as the toes and lateral ankle, result from arterial insufficiency. Ulcers with irregular edges, bleeding, and possible bacterial infection that occur on the medial ankle result from venous insufficiency

Inspect for edema

- Inspect the legs for unilateral or bilateral edema. If the legs appear asymmetric, use a centimeter tape to measure in four different areas:
- circumference at mid-thigh, largest circumference at the calf, smallest circumference above the ankle, and across the forefoot.

- Normal: Identical size and shape bilaterally; no swelling or atrophy.

- Abnormal: Bilateral edema usually indicates a systemic problem, such as congestive heart failure, or a local problem, such as lymphedema or prolonged standing or sitting (orthostatic edema).

- Unilateral edema is characterized by a 1-cm difference in measurement at the ankles or a 2-cm difference at the calf, and a swollen extremity.
- It is usually caused by venous stasis due to insufficiency or an obstruction.

Palpate edema

- Press the edematous area with the tips of your fingers, hold for a few seconds, then release. If the depression does not rapidly refill and the skin remains indented on release, pitting edema is present.

- Normal: No edema (pitting or nonpitting) present in the legs.

- Abnormal: Pitting edema is associated with systemic problems, such as congestive heart failure or hepatic cirrhosis, and local causes such as venous stasis due to insufficiency or obstruction or prolonged standing or sitting (orthostatic edema).

- A 1+ to 4+ scale is used to grade the severity of pitting edema, with 4+ being most severe

Pitting, documented as:

1+ = slight pitting

2+ = deeper than 1+

3+ = noticeably deep pit; extremity looks larger

4+ = very deep pit; gross edema in extremity

Pitting edema

Palpate bilaterally for temperature of the feet and legs

- Use the backs of your fingers. Compare your findings in the same areas bilaterally. Note location of any changes in temperature.
- Normal: Toes, feet, and legs are equally warm bilaterally.
- Abnormal: Generalized coolness in one leg or change in temperature from warm to cool as you move down the leg suggests arterial insufficiency.
- Increased warmth in the leg may be caused by superficial thrombophlebitis resulting from a secondary inflammation in the tissue around the vein.

Palpate the femoral pulses

- Ask the client to bend the knee and move it out to the side. Press deeply and slowly below and medial to the inguinal ligament. Use two hands if necessary. Release pressure until you feel the pulse. Repeat palpation on the opposite leg.

- Normal: Femoral pulses strong and equal bilaterally.

- Abnormal: Weak or absent femoral pulses indicate partial or complete arterial occlusion.

Auscultate the femoral pulses

- If arterial occlusion is suspected in the femoral pulse, position the stethoscope over the femoral artery and listen for bruits. Repeat for other artery.

- Normal: No sounds auscultated over the femoral arteries.

- Abnormal: Bruits over one or both femoral arteries suggest partial obstruction of the vessel and diminished blood flow to the lower extremities.

Palpate the popliteal pulses

- Ask the client to raise (flex) the knee partially. Place your thumbs on the knee while positioning your fingers deep in the bend of the knee. Apply pressure to locate the pulse (**If you cannot detect a pulse, try palpating with the client in a prone position)**. It is usually detected lateral to the medial tendon.
- Normal: It is not unusual for the popliteal pulse to be difficult or impossible to detect.
- Abnormal: Although normal popliteal arteries may be nonpalpable, an absent pulse may also be the result of an occluded artery.

Palpate the dorsalis pedis pulses

- Dorsiflex the client's foot and apply light pressure lateral to and along the side of the extensor tendon of the big toe (**if difficult or impossible to palpate a pulse in an edematous foot, a doppler ultrasound device may be useful).**

- Normal: Dorsalis pedis pulses are bilaterally strong. This pulse is congenitally absent in 5%–10% of the population.

- Abnormal: A weak or absent pulse may indicate impaired arterial circulation.

Palpate the posterior tibial pulses

- Palpate behind and just below the medial malleolus (in the groove between the ankle and the Achilles tendon)(**Doppler Ultrasound may be used in case of ankle edema).**

- Normal: The posterior tibial pulses should be strong bilaterally. However, in about 15% of healthy clients, the posterior tibial pulses are absent.

- Abnormal: A weak or absent pulse indicates partial or complete arterial occlusion.

Special Tests for Arterial or Venous Insufficiency

Perform position change test for arterial insufficiency.

- The client should be in a supine position. Place one forearm under both of the client's ankles and the other forearm underneath the knees. Raise the legs about 12 inches above the level of the heart. As you support the client's legs, ask the client to pump the feet up and down for about a minute to drain the legs of venous blood, leaving only arterial blood to color the legs.
- At this point, ask the client to sit up and dangle legs off the side of the examination table. Note the color of both feet and the time it takes for color to return.

- Normal: Feet pink to slightly pale in color in the light-skinned client with elevation.
- When the client sits up and dangles the legs, a pinkish color returns to the tips of the toes in 10 seconds or less.

- Abnormal: Marked pallor with legs elevated is an indication of arterial insufficiency.
- Return of pink color that takes longer than 10 seconds and superficial veins that take longer than 15 seconds to fill suggest arterial insufficiency.
- Persistent rubor (dusky redness) of toes and

Manual compression test.

- If the client has varicose veins, perform manual compression to assess the competence of the vein's valves.
- Ask the client to stand. Firmly compress the lower portion of the varicose vein with one hand. Place your other hand 6–8 inches above your first hand.
- Feel for a pulsation to your fingers in the upper hand.
- Repeat this test in the other leg if varicosities are present.

Trendelenburg test.

- If the client has varicose veins, perform the Trendelenburg test to determine the competence of the saphenous vein valves and the retrograde (backward) filling of the superficial veins.
- The client should lie supine. Elevate the client's leg 90 degrees for about 15 seconds or until the veins empty.
- With the leg elevated, apply a tourniquet to the upper thigh.

- Assist the client to a standing position and observe for venous filling. Remove the tourniquet after 30 seconds, and watch for sudden filling of the varicose veins from above.

- Normal: No pulsation is palpated if the client has competent valves.
- Saphenous vein fills from below in 30 seconds. If valves are competent, there will be no rapid filling of the varicose veins from above (retrograde filling) after removal of tourniquet.

- Abnormal: You will feel a pulsation with your upper fingers if the valves in the veins are incompetent.
- Filling from above with the tourniquet in place and the client standing suggests incompetent valves in the saphenous vein.

SELECTED NURSING DIAGNOSES

Risk Diagnoses

- Risk for Infection related to poor circulation to and impaired skin integrity of lower extremities.

- Risk for Injury related to altered sensation in lower extremities secondary to edema and/or neuropathy.

- Risk for Impaired Skin Integrity related to poor circulation to extremities secondary to arterial or venous insufficiency.

- Risk for Impaired Skin Integrity related to arterial or venous insufficiency.

- Risk for Activity Intolerance related to leg pain upon walking

Actual Diagnoses

- Ineffective Tissue Perfusion (peripheral) related to arterial insufficiency.
- Impaired Skin Integrity related to arterial or venous insufficiency.
- Pain (acute or chronic) related to arterial or venous insufficiency.
- Fear of loss of extremities related to arterial insufficiency.
- Disturbed Body Image related to edema, leg ulcerations, or varicosities

ARTERIAL INSUFFICIENCY

VENOUS INSUFFICIENCY

EDEMA ASSOCIATED WITH LYMPHEDEMA

EDEMA ASSOCIATED WITH CHRONIC VENOUS INSUFFICIENCY

THANK YOU