Assessment of the Peripheral Vascular System

History:

I. Chief Complaint

II. Patient profile
   Employment
   Home life
   Recreation and exercise

III. History of present illness

IV. Past medical history

V. Family history

VI. System review

Examination of the Peripheral Vascular System:

I. Arterial pressures and pulses
   a. Arterial pulses
      1. Radial
      2. Carotid
         a. Technique - hook index and middle fingers around sternomastoid in lower half of neck. Turn patient's head slightly toward the side being examined.
   b. Note:
      1. Rate and rhythm
      2. Amplitude
      3. Contour - speed of upstroke, duration of peak, and speed of collapse
      4. Variation of amplitude - from beat-to-beat; with respiration.
Standard Procedure for Blood Pressure Measurement:

A. Select a cuff of proper size - width of the bladder 20% wider than diameter of the limb; too small cuffs give false high reading; too large cuff give false low reading.

B. Technique

1. Patient comfortable with arm flexed at elbow and brachial artery at level of the heart.

2. Center cuff over artery with lower border 2.5 cm above antecubital crease.

3. Inflate cuff 30 mm Hg above level at which radial pulse disappears.

4. Lower the cuff pressure slowly until the radial pulse is detectable (this prevents being misled by the auscultatory gap).

5. Deflate cuff completely.

6. Place stethoscope firmly over brachial artery in antecubital space - usually just medially to the biceps tendon. The stethoscope should touch neither the cuff nor clothing.

7. Inflate cuff again to about 30 mm HG above the palpatory systolic pressure. Then deflate cuff slowly at a rate of 3 mm Hg per second.

8. Note the level at which you hear at least two consecutive beats. This is the systolic pressure.

9. Continue to lower the pressure slowly until the sounds become suddenly muffled. This point is the most reliable measure of diastolic pressure, although usually somewhat above that found by intra-arterial measurement.

10. Continue decreasing the pressure and note the point at which all sounds disappear. Record all three points; e.g., 120/80/70.

11. When using a mercury sphygmomanometer, make all readings at eye level with the meniscus.

12. Blood pressure should be taken in both arms, when evaluating the patient initially. Normally, there may be a difference in pressure of 5 mm Hg, sometimes up to 10 mm Hg. Subsequent readings should be made on the arm with the high pressure. (Pressure difference of over 10 mm Hg suggest arterial compression or obstruction.)
Special Problems:

1. *The Apprehensive Patient:* Anxiety is a frequent cause of high blood pressure, especially on a first visit. Make repeated measurements before concluding that the patient has persistent hypertension.

2. *The Obese Arm:* Use a wider cuff that completely encircles the arm. Be sure that the bag does not balloon out from under the cuff.

3. *Leg Pulses and Pressures:* In order to rule out coarctation of the aorta, two observations should be made at least once on every hypertensive patient: (1) compare the volume and timing of the radial and femoral pulses; (2) compare blood pressures in the arm and leg.

   To determine blood pressure in the leg, use a wide cuff on the lower third of the thigh. Center the bag over the posterior surface, wrap it securely and listen over the popliteal artery. If possible, the patient should be prone. If he cannot lie on his abdomen, flex his leg slightly. By sphygmomanometry, systolic pressure in the legs is usually found to be significantly higher than in the brachial artery. This does not reflect true inter-arterial pressure differences. A systolic pressure lower in the legs than the arms is significant.

4. *Inaudible Blood Pressure:* Consider the possibilities - act accordingly. (a) Erroneous placement of your stethoscope. Search again for the brachial artery. (b) Venous engorgement of the arm from repeated inflation of the cuff. Remove the cuff. Elevate the patient’s arm over his head for one or two minutes than reapply the cuff and try again. (c) Shock. It may be impossible to measure the blood pressure of a patient in shock without direct arterial puncture.

5. *Arrhythmias:* Irregular rhythms produce variations in systolic pressure and, therefore, unreliable measurements. Ignore the effects of an occasional premature contraction. With frequent premature contractions and in atrial fibrillation, take an average of several observations and note that your measurements are approximate.

6. *Auscultatory Gap:* In some patients, usually those who are hypertensive, there is a silent interval part way between systolic and diastolic pressures. If this is not recognized, it may lead to serious underestimation of systolic pressure or overestimation of diastolic pressure. Recording your findings completely; e.g., “Blood pressure is 200/110/100 with an auscultatory gap from 170-150.”


C. Blood pressure.
Both arms
Record all three readings.

II. Jugular venous pressures and pulse accurate measurement of CVP

A. Position: Patient in supine position with head slightly elevated on pillow (normal) 30-45° or higher with CHF patient.

B. Light: Tangential (oblique) to examine both sides of neck.

C. Identity:

1. External jugular vein on each side;
2. Find pulsations of internal jugular;
3. Distinguish from carotid by the following:

<table>
<thead>
<tr>
<th>Internal Jugular Pulsations:</th>
<th>Carotid Pulsations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rarely palpable.</td>
<td>Palpable.</td>
</tr>
<tr>
<td>Three components.</td>
<td>One component.</td>
</tr>
<tr>
<td>Soft undulating.</td>
<td>Swift localized.</td>
</tr>
<tr>
<td>Obliterated with light pressure.</td>
<td>Not obliterated with light pressure.</td>
</tr>
<tr>
<td>Level of pulsations ↓ with inspiration.</td>
<td>Not affected by inspiration.</td>
</tr>
<tr>
<td>Pulsations ↓ in recumbent position.</td>
<td>Unchanged from position.</td>
</tr>
</tbody>
</table>

4. Normal jugular pulsations (venous)

\[
\begin{align*}
\text{a} & = \text{atrial contraction} \\
\text{c} & = \text{bulging of tricuspid at beginning of ventricular contraction} \\
\text{x} & = \text{atrium relaxes} \\
\text{v} & = \text{atrial filling} \\
\text{y} & = \text{atrial emptying}
\end{align*}
\]

atrial pressure curve

systole (ventricular) diastole

heart sounds
5. Note the highest point at which pulsations of jugular can be seen.

D. Measure = 1. The distance between this point and sternal angle (see attached).
           2. Point where the external jugular vein appears to collapse can also be used.

E. Record = 1. The distance in cm above the sternal angle.
           2. The angle of the bed.

F. Hepatojugular reflex. Check in patients with CHF.

   1. Adjust bed so that highest level of pulsation is in middle of neck.
   2. Exert firm pressure over patients RUQ for 30-60 seconds.
   3. Watch for an increase in JVP. A rise of more than 1 cm is abnormal.

III. Arteries.

A. Arms
   Brachial
   Radial
   Ulnar

   1. Inspect: Both arms, fingers to shoulder. Size, symmetry, color - texture of skin and nail beds, hair distribution (compare extremities), temperature, venous pattern, edema.

   2. Palpate

      a. Radial arteries

         1. Describe pulse:

            0-4 scale-- 0  -  completely absent
                        1  -  markedly impaired
                        2  -  moderately impaired
                        3  -  slightly impaired
                        4  -  normal

         2. Allen test. For patency of ulnar and radial arteries - while patient clenches fists - examiner occludes radial or ulnar arteries. (N) palm turns pink when released.

b. Legs (drape patient).

1. Inspect from groin to feet. Size and symmetry, color and texture of skin and nails, hair distribution, pigmentation, rashes, scars, ulcers, venous pattern and evidence of venous enlargement, and edema.

2. Palpate

   a. Inguinal noises (NOTE: Size, consistency, tenderness).

3. Pulses


   b. Popliteal. Use two hands.

   c. Dorsal pedis → may be congenitally absent. Use three fingers.

   d. Posterior tibial.

3. Test for arterial insufficiency

   a. Elevate both legs 12" and move feet up and down at ankles. Inspect for pallor.

   b. Have patient sit up with legs dangling. Note time required for:

      1. Return of color.
      2. Filling of veins. (NOTE: unusual rubor.)

4. Palpate for edema.

   Behind medial malleolus → Note pitting edema
   Over dorsum.
   Over skin.

5. Palpate calf for phlebitis

   Note tenderness.
   Note firmness.
   Muscle tension.
   Dorsiflex foot and note pain.
6. Inspect saphenous for varicosities.

With patient standing check for: redness, discoloration, palpate for tenderness and cords.

7. Evaluate varicose veins.

a. **Trendelenburg test.** Elevate legs 90° then place tourniquet around thigh and ask patient to stand. Normal - Saphenous tills from below in 35 seconds. No filling when tourniquet released at 60 seconds.

b. **Perthe’s test.** With patient standing place tourniquet on mid thigh and walk five minutes. Normal - Superficial veins drain.
Techniques of Examination — Examples of Abnormalities

Identify the highest point at which pulsations of the internal jugular vein can be seen. Measure the vertical distance between this point and the sternal angle. If you are unable to visualize the internal jugular pulsations, identify the point above which the external jugular veins appear to be collapsed. Make this observation on both sides of the neck. Measure the vertical distance as visualized in the figure below.

By either technique record the distance in centimeters above the sternal angle together with the angle at which the patient is lying, e.g., "the internal jugular venous pulse is 2 cm above the sternal angle with the head of the bed elevated to 45 degrees." Venous pressure greater than 3 cm above the sternal angle is abnormal.
Chronic Arterial Insufficiency
ADVANCED

No edema
Skin-Shiny Atrophic
Nails-Thick Rridged

1. Skin condition
   Thin, shiny, atrophic skin; loss of hair over foot and toes; nails thickened and ridged.

2. Pulses
   Decreased or absent.

3. Color
   Pale, especially on elevation; dusky red on dependency (rubor).

4. Temperature
   Cool.

5. Ulceration
   If present, involves toes or points of trauma on feet.
   Gangrene
   May develop.

6. Edema
   Absent or mild.

Chronic Venous Insufficiency
ADVANCED

Edema
Brown Pigment
Ulcer of Ankle

1. Skin condition
   May show brown pigmentation around ankles, stasis dermatitis.

2. Pulses
   Normal, though may be difficult to feel through edema.

3. Color
   Normal, or cyanotic on dependency.

4. Temperature
   Normal.

5. Ulceration
   If present, develops at sides of ankles.
   Gangrene
   Does not develop.

6. Edema
   Present, often marked.