Cardiovascular Assessment

Introduction
A focused cardiovascular assessment begins with taking a health history. While doing so, observe carefully for signs of inadequate perfusion or circulation, such as cyanosis, skin changes, dyspnea, or edema. Order of examination is performed as inspection, auscultation, and palpation. It is important to auscultate the carotids prior to any palpation. Assess blood pressure and heart rate as part of your cardiac assessment or review the findings if recorded at the start of the visit.

Optimal Patient Positioning

- Initially, examine the patient in the supine position with the head of the bed elevated approximately 30^{o}, then during chest auscultation, position both in left lateral decubitus and sitting upright, leaning forward to optimize appreciation of murmurs and abnormal heart sounds.
- Use appropriate draping while exposing the chest, to maintain patient comfort.

Exam Methods
Group your cardiac assessment by body region to minimize position changes and keep yourself organized.

Neck

- Inspection
    - Observe pulsations of the jugular veins and carotid arteries, often visible just medial to the sternocleidomastoid (SCM) muscles.
        - To distinguish between carotid artery and jugular vein pulsations recognize that carotid pulsations are easily palpable, are not eliminated by pressure/palpation, and do not vary with position changes or respirations.
    - Assess the jugular veins for distention.
    - Estimate the jugular venous pressure (JVP); the JVP gives an estimation of central venous pressure, or right atrial pressure, and gives valuable information about a patient's volume status.
        - Inspect both sides of the neck, using tangential lighting. Turn the patient's head slightly away from the side you are inspecting.
        - Identify the external jugular veins and find the internal jugular vein pulsations.
        - The right internal jugular vein pulse is preferred for assessing right heart hemodynamics since it is in direct line with the superior vena cava (Meyer, 2024).
        - While standing on the right side of the patient, visualize the right internal jugular vein, look for pulsations in the suprasternal notch, between the attachment of the SCM on the sternum and clavicle, or just posterior to the SCM.
        - Find the highest point of pulsation in the right jugular vein; use a card horizontally from this point and a centimeter ruler vertically from the sternal angle, to make an exact right angle.

        - Measure the vertical distance in centimeters above the sternal angle where the horizontal object crosses the ruler and add to this distance 5 cm (the distance from the sternal angle to the center of the right atrium).
        - Add the numbers together to get an estimated JVP.
        - Estimated right atrial pressure (in cm of water) = JVP in height + 5 cm.
        - Normal JVP is 1 to 11 cm of water (Meyer, 2024).
- Auscultation
    - Auscultate the carotid arteries (Lucerna, A. and Espinosa, J, 2023).
        - With the patient in a sitting position, approach the patient from behind.
        - Instruct the patient to inhale deeply without bearing down for 15-30 seconds to eliminate adventitious sounds and enhance the sound of the bruit, if present.
        - Listen for carotid bruits bilaterally during and shortly after the breath-holding.
        - Listen for referred murmurs in the left neck.
- Palpation
    - Use your index and middle fingers to palpate the carotid arteries *one at a time;* note the character of pulsation, including the amplitude of the pulse and the contour of the pulse wave.
    - Note the presence of vibrations, or thrills.

Chest

- Inspection
    - Examine the chest for a visible point of maximum impulse (PMI) and the presence or absence of heaves.
        - The *point of maximum impulse* is usually located at the fifth intercostal space near the left midclavicular line and locates the left border of the heart.
        - A *heave* is a sustained impulse that visibly lifts the soft tissue or can be felt through the pads of the examiner's fingers.
- Auscultation
    - Listen to the anterior chest from base to apex, at the six points for cardiac auscultation:
        1. Second intercostal space (ICS), near the right sternal border (aortic area)
        2. Second ICS, along the left sternal border (pulmonic area)
        3. Third ICS, along the left sternal border
        4. Fourth ICS, along the left sternal border (tricuspid area)
        5. Fifth ICS, along the left sternal border (tricuspid area)
        6. Near the midclavicular line at the fifth ICS (mitral area)
    - Identify the S1 and S2 heart sounds
        - The diaphragm of the stethoscope is best for hearing S1 and S2.
        - S1 and S2 can be identified by palpating the right carotid artery while listening to the heart tones; S1 will be noted just before the carotid upstroke, with S2 following.
        - Note any splitting of S1 or S2 and the location where this is noted.
    - Note the clarity of heart tones (muffling) and listen for extra heart sounds including opening snaps, systolic clicks, rubs, S3 or S4 gallops, or splitting of S1 or S2.
    - Auscultate for murmurs, noting timing, shape, location of maximum intensity, radiation or transmission from PMI, grade (intensity), and character (pitch-high, medium, low, and quality- blowing, harsh, rumbling, musical).

        - Position patient in left lateral decubitus to assist in auscultating for S3, S4, or murmur of mitral stenosis.
        - Position patient in sitting, forward-leaning position after full exhalation with breath held to assist in auscultating murmur of aortic insufficiency/regurgitation
        - Murmur Grading
            - Grade 1: Very faint, may not be heard in all positions
            - Grade 2: Quiet, but easily heard with stethoscope on chest
            - Grade 3: Moderately loud
            - Grade 4: Loud
            - Grade 5: Very loud, may be heard with stethoscope partly off chest
            - Grade 6: Loudest, and heard with stethoscope entirely off chest
- Palpation
    - Palpate precordium for PMI, heaves, or thrills.
        - Use your palm or finger pads to palpate for heaves.
        - Press the ball of your hand firmly on the chest to assess for thrills.
        - You can also feel for a palpable S1 and S2, S3 or S4, and murmurs.
        - Left ventricular apical impulse or apex beat is normally localized in the fourth to fifth left intercostal space medial to the left midclavicular line and is 2 to 3 cm in diameter. This is best palpated when the patient lays in the left lateral decubitus position.

Extremities

- Inspect for cyanosis, pallor, coolness of extremities, or edema.
- Palpate peripheral pulses for quality and presence of pulsus paradoxus or pulsus alternans.

PEARLS

- Use both the bell and the diaphragm of the stethoscope when auscultating the heart.
    - The bell is best to identify lower pitched sounds such as S3 and S4, and murmurs associated with mitral stenosis.
    - The diaphragm is more sensitive to pick up higher pitched sounds, such as S1 and S2, friction rubs, and murmurs associated with aortic and mitral regurgitation.
- Pulsus paradoxus is defined as an abnormally large decrease in systolic blood pressure (greater than 10 mm Hg) on inspiration. This is a common finding in moderate to severe cardiac tamponade and is often associated with muffled heart tones, tachycardia, and hypotension. A pericardial rub may also be present (Hoit, 2024).
- Carotid stenosis or atherosclerosis may present with a bruit. Use caution if palpating the carotids in the presence of a bruit, as there is danger of plaques breaking off and causing a stroke.
- Never palpate both carotid arteries simultaneously, as this could seriously impede blood flow to the brain.
- Palpation of the carotid arteries may cause a vagal response.
- Pulsus alternans (when a strong or normal pulse alternates with a weak pulse during normal sinus rhythm) may indicate severe left ventricular dysfunction.

Reference

Bickley, L. S., Szilagyi, P. G., Hoffman, R. M., & Soriano, R. P. (2021). Bate's Guide to Physical Examination and History Taking (13th ed.). Wolters Kluwer Health: Philadelphia.

Gersh, B. (2023, November 20). Examination of precordial pulsation. *UpToDate*. https://www.uptodate.com/contents/examination-of-the-precordial-pulsation

Hoit, B. (2024, Match 19). Cardiac tamponade. *UpToDate*. https://uptodate.com/contents/cardiac-tamponade

Lucerna, A. and Espinosa, J. (13, February 2023). *StatPearls.* https://www.ncbi.nlm.nih.gov/books/NBK536913/

Meyer, T.E. (2024, June 27). Assessment of the jugular venous pressure. *UpToDate.* https://www.uptodate.com/contents/assessment-of-the-jugular-venous-pressure