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Cardiovascular Assessment

Cardiovascular (CV) disease affects 6.2 million people in the United States, placing many of these individuals at risk for heart failure. The number of patients with heart failure who utilize home healthcare services after hospital discharge is high. There is also a high rate of readmission following hospitalization for heart failure, contributing to morbidity and mortality, as well as creating a financial burden for healthcare systems. Home care clinicians can make a significant contribution to reducing CV morbidity and readmissions by becoming proficient at CV assessment and using this information to develop an action plan to prevent exacerbations and rehospitalizations. This article reviews the anatomy and physiology of the CV system and describes subjective and objective CV assessment.

Cardiovascular (CV) disease remains the number one cause of death in the United States (Centers for Disease Control and Prevention (CDC, 2021) and affects nearly 6.2 million American adults each year (CDC, 2020). People with CV disease are at risk of heart failure (HF) that occurs when the heart is unable to pump effectively to provide sufficient blood and oxygen to meet the body's requirements. *Healthy People 2030* identified heart disease and stroke as targeted health conditions, with a goal of increasing overall CV health in adults by 10% from the 2020 baseline (United States Department of Health and Human Services, n.d.). The most recent data suggest there has been no improvement on this index, with only a slight decrease in the rate of CV deaths since the 2020 baseline data report. The number of HF admissions who utilize home healthcare services after discharge is remarkably high (Arundel et al., 2018). There is also a high rate of readmission following hospitalization for HF (Blecker et al., 2019), contributing to increased morbidity and mortality, and placing a financial burden on healthcare systems (CDC, 2020). Home care clinicians can make a significant contribution to reducing CV morbidity and readmissions by becoming proficient at CV assessment and using this information to develop an action plan to prevent exacerbations and rehospitalizations. This article describes cardiac assessment of the adult patient. Pediatric considerations can be found in the Sidebar.

Anatomy and Physiology of the Heart

Cardiac function is governed by cardiac anatomy, physiology, and electrical impulses that control the pumping action of the heart. The heart itself is a muscular organ consisting of atria, ventricles, and heart valves. Deoxygenated blood flows from the inferior and superior vena cava into the right atrium and right ventricle during diastole. The right ventricle then pumps deoxygenated blood to the lungs via the pulmonary artery during systole. Simultaneously, oxygenated blood from the lungs returns to the left atrium and ventricle via the pulmonary veins during diastole and is then pumped to the body via the aorta during systole (Figure 1). The pumping of the heart is synchronized by an automatic electrical structure that enables the heart's contraction. The conduction impulse is induced by specialized tissue of the sinoatrial (SA) node situated in the right atrium. The SA node produces a regular electrical impulse, causing the atria to normally contract between 60 and 100 times per minute. This electrical impulse travels through the heart, causing the ventricles to contract, pumping blood out of the lower chambers into the aorta and pulmonary artery.

Subjective Data

Gather information regarding family history, prior tests, hospitalizations, surgeries, dietary intake (including fat and salt intake), and alcohol/tobacco/illicit drug use. Ask the patient to gather all medications including over-the-counter products and perform medication reconciliation. Ask about possible comorbidities such as diabetes and other chronic health conditions that may be

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associated with heart disease. For women, CV disease is also affected by gender-specific risk factors, including polycystic ovary syndrome, primary ovarian insufficiency, pregnancy-induced hypertension, preeclampsia, and gestational diabetes (Appelman et al., 2015).

Ask the patient if they experience shortness of breath (SOB) and whether it occurs with lying down (orthopnea), or if it comes on suddenly after falling asleep (paroxysmal nocturnal dyspnea). Both types of SOB are associated with HF. Pain in the calves or thighs that occurs with walking and decreases with rest is known as intermittent claudication and can suggest insufficient arterial blood flow. Ask the patient if they have heart palpitations, a sensation of skipping, racing, fluttering, or pounding of the heart. Ask if they are experiencing chest pain, but keep in mind that about 50% of older patients do not experience typical chest pain (Engberding & Wenger, 2017). It is not unusual for older adults and especially female patients to experience dyspnea, fatigue, nausea, or syncope rather than chest pain (Shao et al., 2020). The PQRST mnemonic is a good tool to assess chest pain.

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- **Provocative/Palliative (P):** Ask what is happening when the pain starts, what causes it, aggravates, or alleviates it.
- **Quality/Quantity (Q):** Ask what the pain feels like. Suggest words such as dull, stabbing, crushing, burning, squeezing, tightness, pressure.
- **Region/Radiation (R):** Ask the patient to point to where the pain is and whether it radiates elsewhere on the body such as the jaw, arm, or back.
- **Severity (S):** Using a pain scale of 0–10, ask the patient to rate the severity of pain. Inquire if it interferes with activities and whether it is associated with other symptoms.
- **Timing (T):** Ask when the pain started, how long it lasted, and how often it occurs.

Objective Data

Begin with a general survey. Assess physical appearance and note level of consciousness and whether the patient is oriented to person, place, time, and situation. Does the patient respond appropriately to questions or are they confused, drowsy, or lethargic? Are they cooperative and interacting appropriately, or do they appear hostile, distrustful, or distressed? Facial features and extremities should be symmetrical.

Gather objective data including vital signs and weight. Assess the rate, rhythm, and strength of the radial pulse. If the pulse is regular, count for 30 seconds and multiply by two. If irregular, count for 1 full minute. A 60 to 100 beats/minute pulse rate is considered normal range. Tachycardia is a pulse rate above 100 beats/minute, and bradycardia is a pulse rate below 60 beats/minute (Jarvis, 2020). Next, evaluate the strength of the pulse that reflects stroke volume. This is documented on a scale of 0 to 4; zero equals a nonpalpable pulse, +1 is weak, and thready; +2 is slightly diminished but greater than +1, +3 is normal and easily palpable, and +4 is full and bounding. Anxiety, exercise, and some abnormal conditions can cause a bounding pulse (Zimmerman & Williams, 2021).

Next assess respiratory rate. Generally, patients are not conscious of their breathing, so it is advisable to count respirations immediately after evaluating the radial pulse without mentioning it to the patient. Observe respirations for 1 full minute to evaluate rate and pattern deviations. The normal respiratory rate for adults is 12 to 20. Rapid respirations (tachypnea) can be caused by anxiety, emotional distress, pain, fever, HF, and respiratory disease. Document the rate and rhythm and whether breathing is labored, shallow, or deep. Pulse oximetry provides valuable data about arterial oxygen saturation (SpO_2) and is typically assessed along with vital signs. A healthy person with no cardiac or lung disease normally has an SpO_2 of 97% to 99% on room air (Jarvis, 2020).

Next take the patient's blood pressure (BP). Systolic BP occurs with ventricular contraction (systole) and pushes blood into the aorta via high pressure. Diastolic pressure reflects the pressure when the ventricles relax during diastole. Patients should be seated with feet on the floor, legs uncrossed, with the upper arm exposed, and supported at heart level. If the patient's arm is not at heart level, the BP reading may be artificially low (Bickley et al., 2021), and leg crossing can cause a false high BP (Jarvis, 2020). A BP cuff that is too

Sidebar: Pediatric Considerations

- Cardiac disease in children is generally a result of a congenital cardiac defect rather than an acquired condition. There are familial conditions associated with cardiac dysfunction in children, therefore, assessment of family history is essential.
- Familial history should include inquiry regarding congenital heart disease (CHD), sudden infant death syndrome, maternal illness during pregnancy, and genetic disorders. In addition, history of the child should include inquiry about rheumatic fever & Kawasaki disease because both these diseases can damage cardiac structure and function (Frank & Jacobe, 2011).
- The infant's heart rate averages 110–160 bpm and decreases throughout childhood, reaching the adult rate in adolescence. Auscultate the apical pulse for a full minute to determine heart rate and rhythm (Hughes & Kahl, 2018).
- Auscultate the heart for murmurs which are common in infants and children; most are considered innocent and are the results of normal blood flow through the heart, especially if a child is febrile. Red flags for possible pathologic murmurs include diastolic murmurs and a murmur that is a grade 3/6 or higher (Frank & Jacobe, 2011).
- Infants and children with cardiac disease often display the primary symptom of activity intolerance which will manifest differently depending on the age of the individual.
- Feeding difficulties in the infant may be the first sign of congestive heart failure. This can result in inadequate oral intake and the infant may present as "failure to thrive" evidenced by poor weight gain. Infants may also display signs of dyspnea, circumoral cyanosis, or diaphoresis during feedings (Hueckel, 2019).
- To prevent fatigue in infants which can occur in severe cardiac conditions, make attempts to sooth the infant to avoid prolonged periods of crying. Caregivers should provide small frequent feeds, with the infant held in an upright position. O_2 by nasal cannula may be used to support the infant during the feeding (Ricci et al., 2021).
- Children who have activity intolerance may demonstrate developmental delay due to inability to participate in age-appropriate physical activities. Therefore, developmental assessment in children with CHD, combined with early referral is imperative (Mussatto et al., 2014).
- General cyanosis can be present if the infant or child has a cyanotic heart condition such as Tetralogy of Fallot (Jone et al., 2019).
- In some forms of CHD, the degree of cyanosis can be profound, often precipitated by the infant's crying or with increased activity in an older child. This may cause hypercyanotic spells (often called Tet Spells), which can be relieved by squatting, or by holding the infant in the "knee-chest" position. Recurrent, and/or unrelieved hypercyanotic spells are considered a medical emergency and specific treatment plans should be discussed with the cardiac specialist (Jone et al., 2019; Schneider, 2019).

small for the patient's arm can cause the BP reading to be artificially high, whereas one that is too large can cause an artificially low result. According to the American Heart Association (AHA, 2022), normal BP is 120/80 mmHg. Hypertension is a systolic pressure greater than 140 or a diastolic pressure greater than 90 (AHA, 2022). Note the arm used when documenting the BP.

Obtain a body weight. Have the patient remove shoes and heavy clothing and instruct them to weigh daily every morning after urinating but before eating breakfast. A sudden weight gain suggests fluid retention indicative of HF deterioration, whereas a sudden weight loss may be an indication of extreme diuresis (Jaarsma et al., 2021).

Inspection

Inspect the face, lips, and fingertips for cyanosis or pallor. Pallor can suggest reduced perfusion, low oxygenation, or anemia. Feel the skin for temperature, moisture, texture, and turgor. Apply pressure on the nailbeds to assess capillary refill. The nailbed color should return to pink in less than 2 seconds. A finding of greater than 2 seconds suggests poor perfusion. Examine the nailbeds for clubbing which is an indication of chronic hypoxemia (Jarvis, 2020). Inspect the neck for jugular vein distention which can indicate fluid overload.

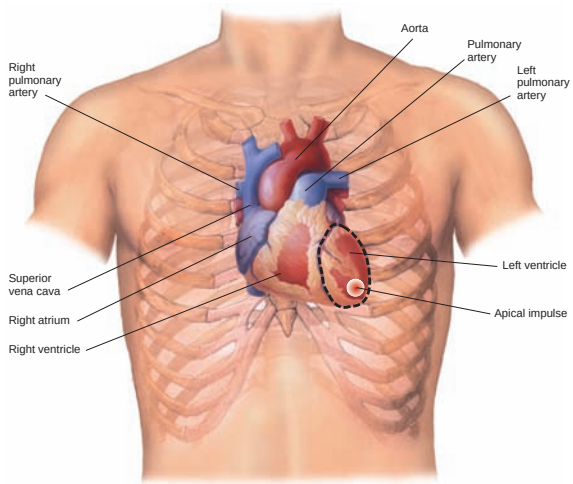
Examine the toes, feet, and legs bilaterally for color and the presence of peripheral edema; they should be symmetrical. Accumulation of fluid in the tissues can suggest infection or thrombosis, but with a diagnosis of HF, it is most likely fluid retention from reduced pumping action of the heart. Grade edema on a four-point scale from zero (no edema) to 4+ (severe edema).

As home care patients are often confined to bed in the hospital, assess for signs of deep vein thrombosis (DVT): unilateral warmth, redness, tenderness, swelling in the calf, or sudden onset of intense muscle pain (Potter et al., 2021). If findings suggest a possible DVT, notify the healthcare provider at once because this is a life-threatening condition.

Palpation

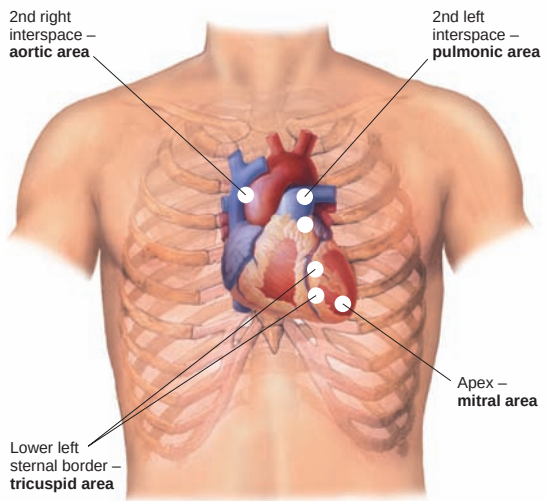
Palpate peripheral pulses, including radial, brachial, posterior tibialis, and dorsalis pedis pulses, assessing quality and whether they are equal bilaterally. Grade peripheral pulses on a scale of zero to three as you did with the radial pulse. The carotid arteries are medial to the sternomastoid muscles in the neck and should be palpated gently one at a time to avoid occlusion. If a patient has a history of CV disease, assess the carotid artery for a bruit—a blowing, swishing sound indicating blood flow turbulence due to restricted blood flow (Bickley et al., 2021). Keep the patient's neck positioned neutrally, apply the bell of the stethoscope lightly over the carotid artery at three levels: (1) the angle of the jaw, (2) the midcervical area, and (3) the base of the neck. Avoid constricting the carotid artery with pressure from the stethoscope bell which can produce an artificial bruit or jeopardize carotid artery circulation. As you listen, ask the patient to hold their breath to reduce tracheal breath sounds which can sound like a bruit (Bickley et al., 2021).

Figure 1:



The apical impulse is normally localized in the patient's fourth or fifth intercostal space, midclavicular line (Potter et al., 2021). Palpate the impulse using one finger pad with the patient in an upright position, noting the location, intensity, and amplitude. With left ventricular dilation, the apical impulse moves laterally and downward due to volume overload and increased ventricular size. This condition develops in patients with HF or cardiomyopathy. Use the palmar aspects of your first four digits to palpate the precordium from side to side, gently examining for atypical pulsations. A palpable vibration is called a thrill and feels like a purring cat, signifying turbulent blood flow. This may suggest the presence of a murmur. The lack of a thrill, however, does not preclude a murmur (Jarvis, 2020).

Figure 2:



Percussion

Percussion is used to locate the cardiac borders, although it is not often done in the home care setting. Typically, the sounds noted during cardiac percussion should alter from resonance to dullness over the left border of the heart at the midclavicular line. The heart's right border cannot be percussed because it is parallel with the sternum. It may be challenging to percuss obese patients or patients with large breasts due to the overlay of adipose tissue on the chest (Jarvis, 2020).

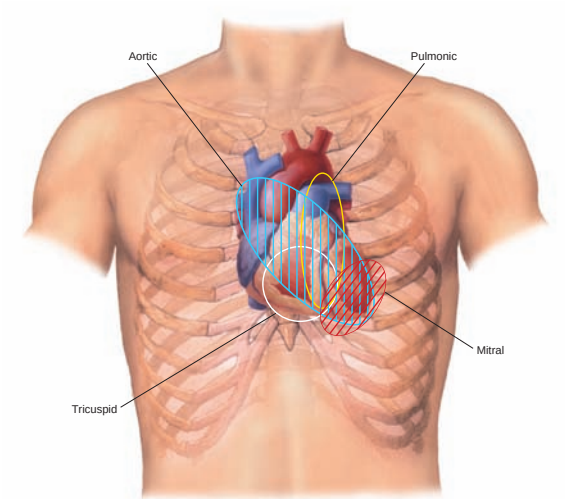
Auscultation

A quiet environment is essential for cardiac auscultation. Remove clothing and expose only the area needed for the examination to maintain privacy. Chest hair can produce friction under the stethoscope, imitating abnormal sounds similar to friction rubs. To prevent this, dampen the chest hair prior to auscultation. Count the apical pulse for 60 seconds. If the heart rate is irregular, assess for a pulse deficit by auscultating the apical pulse and simultaneously palpating the radial pulse. Every heartbeat auscultated over the apex should perfuse to the radial pulse and create a palpable pulse. If there is a difference between the apical and radial pulse rates, subtract the radial rate from the apical rate to identify the pulse deficit (Jarvis, 2020). Pulse deficits indicate weak ventricular contractions, usually due to HF, atrial fibrillation, or premature ventricular beats. Listen with eyes closed and focus on the sounds heard, identifying S1, S2, and potentially S3 and S4 separately (Jarvis, 2020).

Auscultate the heart with the patient in three positions; sitting up, lying on their left side, and lying on their back with head raised 30 to 45 degrees (Bickley et al., 2021). When auscultating, locate the four main heart valves (Figure 2). Auscultation of the valves does not occur over their anatomic locations, but at specific chest wall sites. This is because valve sounds are best heard when a sound is emitted with the direction of blood flow (Wilson & Giddens, 2022). Heart sounds are expressed as "lub-dub," where the mitral and tricuspid valves close (S1) during systole, accompanied by the aortic and pulmonary heart valves (S2) closing during diastole. S1 is best heard in the mitral area. Ask female patients to gently displace the breast tissue while you place the stethoscope directly on the chest wall. S2 is best identified at the left upper sternal border. Auscultation begins at the aortic valve located in the second intercostal space to the right of the sternum, where the aortic valve is heard best during S2. Move the stethoscope to the pulmonic area (upper left sternal edge) where the pulmonic valve is heard best during S2. Erb's point is located left of the third intercostal space at the sternal border where S1 and S2 can be heard equally. The tricuspid area (fifth intercostal space left of the sternal border) is where the tricuspid valve is heard during S1. The mitral valve is located at the fifth intercostal space midclavicular line and is where S1 is best heard (Wilson & Giddens, 2022).

Additional heart sounds are S3 and S4. S3 is a cardinal sign of HF and indicates mitral valve regurgitation and dilated ventricles; it is heard during rapid ventricular filling in the diastolic phase (Potter et al., 2021). Assess for S3 at the apex of the heart with the patient lying on their left side. S3 sounds like the "y" in "Ken-tuck-y" and is low-pitched. In early ventricular diastole, S3 follows S2 and occurs from the pulsations associated with abrupt ventricular distention and opposition to filling (Jarvis, 2020). S4 is an atrial gallop heard when the patient is lying on their left side at the location of the tricuspid or mitral areas during late diastole (Jarvis, 2020). S4 is sometimes called an "atrial kick" caused by strong atrial ejection into stiff ventricles (Mansen & Gabiola, 2015). It is associated with ventricular hypertrophy and is heard in elderly, hypertensive patients or in patients with a history of aortic stenosis or myocardial infarction.

Figure 3:



Murmurs are abnormal extra heart sounds described as a blowing, swooshing sound occurring with turbulent blood flow. Murmurs occurring between S1 and S2 are systolic heart murmurs, whereas diastolic murmurs occur during diastole between S2 and the next S1 (Bickley et al., 2021). At each auscultation point (Figure 3), listen for murmurs. If detected, describe the murmur by the segment of systole or diastole. It can be classified as either midsystolic, holosystolic, or late systolic. Midsystolic is seen with mitral stenosis and is described as low-pitched and rumbling. Holosystolic murmurs are associated with mitral regurgitation and are high-pitch blowing sounds. Late systolic is detected with mitral valve prolapse and described as a high-pitch click (Bickley et al., 2021). Pitch describes the frequency of the sounds and is classified as high, medium, or low. The stethoscope's diaphragm is utilized for medium- to high-pitched sounds, whereas the bell assists with low-pitched sounds. Intensity describes the shape of the sound; increased intensity is termed crescendo, decreasing intensity is labeled decrescendo, and if the sound increases followed immediately by decreasing intensity, it is referred to as crescendo-decrescendo (Wilson & Giddens, 2022). Ascertain the location where the murmur is detected clearly and identify the noise of the murmur such as whooshing, musical rumbling, scratchy, blowing, or clicking. Becoming proficient at identifying heart sounds takes time and practice. Audios of abnormal heart sounds are available on the internet (e.g., https://www.youtube.com/watch?v=6StYVx6BVLo).

Conclusion

Heart disease is the number one cause of death among adults in the United States, and a significant number of patients receiving home healthcare have HF. Patients with HF are known to have frequent readmissions to the hospital, creating burden for patients and placing health systems at financial risk. Home care clinicians can reduce CV morbidity, emergency department visits, and hospital readmissions by becoming proficient at CV assessment and using this information to intervene in a timely manner to prevent disease exacerbations. Diligence and practice are necessary to become adept at cardiac assessment. ⌂

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