

## **Advanced Assessment in Clinical Practice: Cardiopulmonary Assessment**

- I. The cardiopulmonary system
  - A. Location and structure of the heart
    1. Mediastinum
    2. Pericardium
    3. Epicardium
    4. Myocardium
    5. Endocardium
    6. Four chambers separated by valves
    7. Coronary perfusion
    8. Collateral circulation
  - B. Muscles of respiration
    1. Diaphragm
    2. Intercostals
    3. Sternocleidomastoid
    4. Trapezius

C. Lung structure

1. Lobes and the pleural cavity

- 3 lobes on the right, 2 on the left.
- Surrounded by the parietal and visceral pleura.
  - Parietal pleura lines the chest cavity.
  - Visceral pleura is directly on top of the lungs.
  - Pleural space is filled with pleural fluid.

2. Trachea and the bronchiole tree

- Trachea
- Divides into the right and left bronchi.

D. Assessment and cardiopulmonary disorders

1. Assessment of pulses

- Carotid
- Brachial
- Radial
- Femoral
- Dorsalis pedis
- Posterior tibial

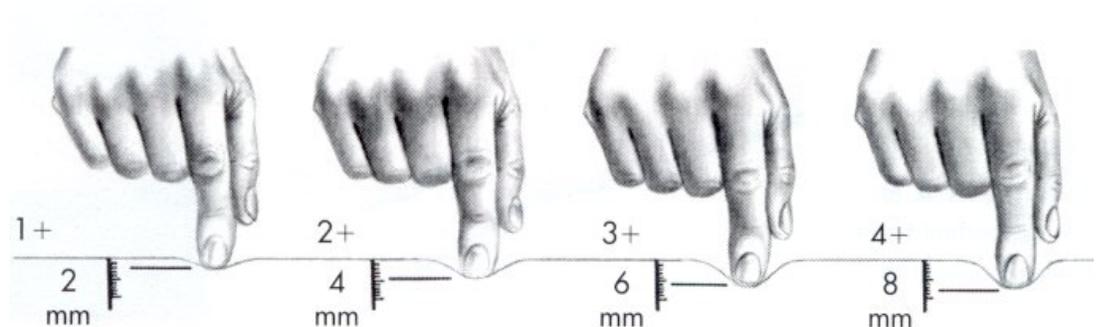
2. Jugular vein distention

- External jugular vein
- “Quick and dirty” for fluid volume status.

3. Hepatojugular reflex

- Firm and sustained hand pressure to the mid-epigastric area.
- Observe for neck vein distention with pressure.
- Collapse of the veins when pressure is removed.
- Exaggerated in right-sided heart failure.

4. Pulsus alternans
  - Amplitude varies from beat to beat with weak and strong beats.
  - Hallmark sign of heart failure. Also seen in pulmonary disorders.
5. Pulsus paradoxus
  - Apply the BP cuff and inflate it until no sounds are heard.
  - Deflate the cuff gradually until sounds are audible only during expiration. Note the pressure.
  - Deflate the cuff further until sounds are also audible on inspiration. Note the pressure. If greater than 10 then positive pulsus paradoxus.
  - Positive reading in pericardial effusion or tamponade.
6. Paroxysmal nocturnal dyspnea
  - Sudden shortness of breath after a period of being supine.
  - Sitting upright relieves the symptoms.
  - Hallmark sign of heart failure.
7. Edema



8. Other assessment parameters

- Cough
- Cyanosis
- Dyspnea
- Capillary refill
- Orthopnea
- Clubbing
- Xanthelasma

9. Transient syncope

Non-cardiac	<ul style="list-style-type: none"> <li>• Due to dominant parasympathetic activity.</li> <li>• Pressure on the carotids or sudden rising.</li> </ul>
Situational	<ul style="list-style-type: none"> <li>• Due to numerous causes.</li> <li>• Extreme exhaustion, hunger, exposure to heat, pain, emotional events, coughing, swallowing, micturition or defecation.</li> </ul>
Cardiac	<ul style="list-style-type: none"> <li>• Most common and the most dangerous.</li> <li>• Dysrhythmias, valvular heart disease, cardiomyopathy, cardiac tamponade or pulmonary embolism.</li> </ul>
Neurological	<ul style="list-style-type: none"> <li>• Dangerous due to cerebral impairment.</li> <li>• Decreased blood flow, vasovagal or seizures.</li> <li>• Vertebral artery occlusion can occur looking upward or putting pressure on the back of the neck.</li> </ul>

E. Respiratory patterns

1. Normal: RR 12-20.

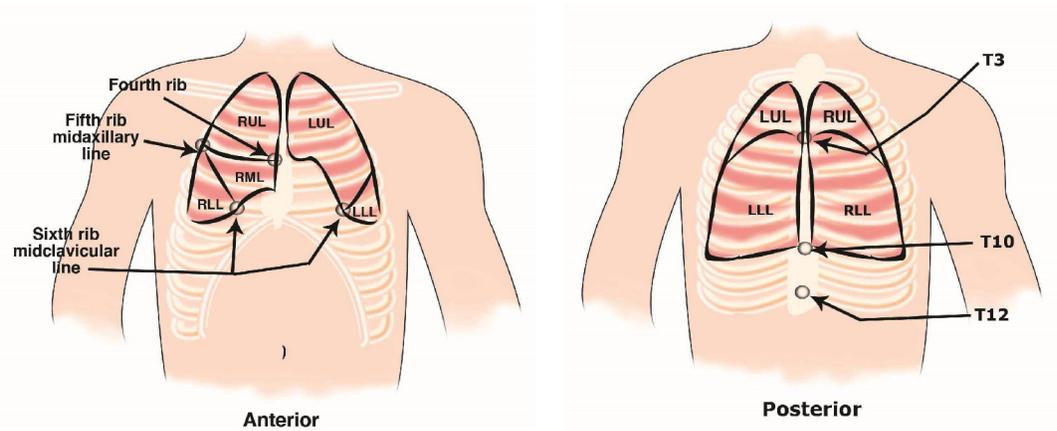
- Respiration to heart rate should be 1:4.
- Look for symmetrical chest expansion, even breathing, and variations in the rate of respirations.

2. Dyspnea: When it is of an acute onset, dyspnea always has a cause.
  - Pneumonia
  - Pneumothorax
  - Pulmonary asthma
  - Peanut or foreign object
  - Pulmonary embolus
  - Pericardial tamponade
  - Pump failure
  - Peak seekers
  - Psychogenic
  - Poisons
  - Paroxysmal nocturnal dyspnea
  
3. Irregular breathing patterns

Cheyne-Stokes	Varying periods of increasing depth interspersed with apnea.
Kussmaul's	Deep, rapid, and labored breathing.
Apneustic	Slow, deep and held for 30-90 seconds. Pause after inspiration.
Biot's	Irregular pattern of breathing with periods of apnea in a disorganized sequence of breaths.
Ataxic	Very irregular respiratory pattern with varying depths and length of apneic periods.

F. Lung auscultation

1. Sequence and examination considerations.
2. Location and lobes.



3. Breath sounds

Vesicular	Heard over most of the lung fields.
Bronchovesicular	Medium pitch and heard over the main bronchus.
Bronchial	Louder and heard over the trachea. When heard over the periphery, can indicate consolidation.
Decreased or absent	Can indicate pleural effusion, obstruction, hyperinflated lungs, or hypoventilation.
Crackles	Heard on inspiration and indicate fluid or atelectasis.
Rhonchi	Primarily heard on expiration and indicates movement of air through mucus.
Wheezing	Indicates air movement through narrowed airways.
Friction rubs	Dry, cracking and grating sound which is heard on both inspiration and expiration. Usually caused by inflamed, roughened surfaces rubbing together.
Vocal resonance	The ability to hear the spoken word clearly when listening to the chest through the stethoscope. Indicates consolidation.

G. Heart tone assessment

1. Heart sounds

S1: Lubb	Closure of the tricuspid and mitral valves.
S2: Dubb	Closure of the pulmonic and aortic valves.
S3: Ken-tuck-y	Produced by turbulence on ventricular filling.
S4: Ten-ness-ee	Produced when the atria contract. More pronounced and able to be heard when they contract against resistance in the ventricles.
Split S1: la-lub-dub Split S2: lub-da-dub	Occurs when the right side events occur before the left side events. Most often splits are heard with S2, but can split both heart sounds. Splitting heard only on inspiration is a normal finding.
Friction rubs	Rubbing sound which occurs with S1 and S2.
Prosthetic valves	May or may not hear a click. Intensity depends on the type of valve.

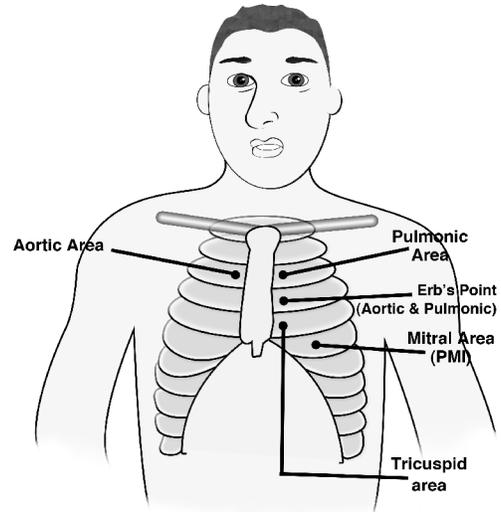
2. Classifications of heart murmurs

Innocent murmurs	<ul style="list-style-type: none"> <li>• Occur in children, adolescents, and young adults with no apparent cause.</li> <li>• They are most frequently heard when lying flat but disappear when sitting up.</li> </ul>
Benign murmurs	<ul style="list-style-type: none"> <li>• Murmurs which are heard due to a structural problem but the conditions is not severe enough to cause a problem.</li> <li>• Heard in high output states such as fever, exercise, pregnancy, anemia, and thyrotoxicosis.</li> </ul>
Valvular dysfunction	<ul style="list-style-type: none"> <li>• Caused by disruption of blood flow, usually due to diseased valves.</li> <li>• Murmurs may also be caused by a hole in the ventricular or atrial septum.</li> </ul>

3. Terms associated with murmurs

Timing and duration	Systole or diastole. Early, late, mid, or throughout.
Pitch	High, medium, or low
Intensity	Grade I: Barely audible in a quiet room Grade II: Quiet but clearly audible Grade III: Moderately loud Grade IV: Loud, associated with a thrill Grade V: Very loud, thrill easily palpable Grade VI: Very loud, audible without a stethoscope not on the chest. Thrill palpable and visible.
Pattern	Crescendo, decrescendo
Quality	Harsh, raspy, vibratory, musical, blowing
Location	Anatomical landmarks where the murmur is heard
Radiation	To various structures such as the axilla, neck, etc.
Thrill	Feels like a cat burring on the skin surface. May be visible in Grade VI murmurs.

4. Systolic murmurs: Swish-dub
5. Diastolic murmurs: Lub-swish-dub
6. Mitral valve prolapse: Lub-click-dub
7. Aortic area: 2<sup>nd</sup> ICS, RSB
8. Pulmonic area: 2<sup>nd</sup> ICS, LSB
9. Tricuspid area: 4<sup>th</sup> ICS, LSB
10. Mitral area: 5<sup>th</sup> ICS, MCL



<b><u>Aortic Area</u></b>	<b><u>Pulmonic Area</u></b>
S2 Systolic murmur: Stenosis Diastolic murmur: Regurgitation	S2 Systolic murmur: Stenosis Diastolic murmur: Regurgitation
<b><u>Tricuspid Area</u></b>	<b><u>Mitral Area</u></b>
S1 Systolic murmur: Regurgitation Diastolic murmur: Stenosis	S1 Systolic murmur: Regurgitation Diastolic murmur: Stenosis

11. Other physical findings associated with murmurs

<b><u>Aortic stenosis</u></b>	<b><u>Pulmonic stenosis</u></b>
Systolic murmur Crescendo-decrescendo Radiates down the LSB to the apex May radiate to the carotid with a thrill Often have LVH with it May be cause of sudden death in children and adolescents. See in atherosclerosis and rheumatic HD Bounding pulse usually seen	Systolic murmur Usually a congenital murmur Radiates into the left neck Thrill at the 2 <sup>nd</sup> and 3 <sup>rd</sup> LICS
<b><u>Aortic regurgitation</u></b>	<b><u>Pulmonic regurgitation</u></b>
Diastolic murmur Hear best with the diaphragm of stethoscope Sitting forward May hear a click Early diastole, high pitch, blowing Wide pulse pressures Water hammer pulse common in the carotid, brachial and femoral areas.	Hard to distinguish from aortic regurgitation

<p style="text-align: center;"><b><u>Tricuspid regurgitation</u></b></p> <p>Systolic murmur                  Left lower sternal border                  Holosystolic, blowing murmur                  Thrill in the tricuspid area                  May have pulsatile liver                  Peripheral edema often seen</p>	<p style="text-align: center;"><b><u>Mitral regurgitation</u></b></p> <p>Systolic murmur                  Best at apex radiating into left axillae                  Holosystolic. Harsh, blowing                  Thrill at apex                  S3 and S4 common                  Hand grip will increase intensity of the murmur</p>
<p style="text-align: center;"><b><u>Tricuspid stenosis</u></b></p> <p>Diastolic murmur                  Hear best with bell of stethoscope                  Loud rumble on inspiration                  Thrill over right ventricle                  JVD common                  Usually seen with mitral stenosis. Rare alone.</p>	<p style="text-align: center;"><b><u>Mitral stenosis</u></b></p> <p>Diastolic murmur                  Hear with bell at the apex in the left lateral position                  May have a thrill at the apex                  May occur with regurgitation                  Caused by rheumatic fever or cardiac infection</p>

H. Palpation of the chest

<u>Abnormality</u>	<u>Potential causes or associated findings</u>
Crepitus	<ul style="list-style-type: none"> <li>• Rupture or gas producing organisms.</li> </ul>
Coarse vibration	<ul style="list-style-type: none"> <li>• Pleural friction rub and pleurisy.</li> </ul>
Fremitus	<ul style="list-style-type: none"> <li>• Fremitus decreases with effusions.</li> <li>• Fremitus increases with lobar pneumonia.</li> </ul>
Tracheal shift	<ul style="list-style-type: none"> <li>• Should be midline. May seem to pulsate.</li> <li>• May have a tracheal tug which is seen with aortic aneurysm.</li> <li>• Atelectasis</li> <li>• Thyroid enlargement</li> <li>• Pulmonary fibrosis</li> <li>• Pulmonary effusions</li> <li>• Tension pneumothorax</li> </ul>
Heaves	<ul style="list-style-type: none"> <li>• Right ventricular hypertrophy</li> <li>• Pulmonary abnormality</li> </ul>
Thrills	<ul style="list-style-type: none"> <li>• Most often associated with a valve defect.</li> <li>• Murmurs with a grade IV or more, often have a thrill.</li> </ul>

- I. Physiologic changes in the geriatric population
  1. Size decreases with age unless hypertrophy present.
  2. Left ventricular wall thicker.
  3. Valves calcify.
  4. Heart can't handle stress as well. Heart rate and stroke volume decrease. Less cardiac output with exercise.
  5. Endocardium and myocardium more rigid.
  6. Decreased arterial lumen and decreased blood flow to organs.
  7. Arteries less elastic and lose vasomotor tone.
  8. Stretching of veins and diminished effectiveness of valves leading to pooling of blood.
  9. Fibrosis in the conduction system. Conduction defects result.
  10. Barrel chest.
  11. Loss of muscle strength.
  12. Increased AP diameter.
  13. Alveoli less elastic.
  14. Decreased ventilation in lower lobes.
  15. Decreased PaO<sub>2</sub> leading to impaired cellular oxygenation.
  16. Mucous membranes drier and ineffective cough response.
  17. Macrophages decrease.