

Respiratory System

Inspection

Ensure that this is always conducted on bare skin!

- General Assessment: When you walk into the room, **immediately determine whether or not your patient is in respiratory distress.**
 - Sign of Respiratory Distress
 - Tachypnea
 - Difficult or labored breathing
 - Diaphoresis
 - Accessory muscle usage/retractions
 - Cyanosis
 - Mental status
 - Grunting
 - Tripoding (patient is bent over or forward and leaning on their knees)
 - Nasal flaring
 - Lip pursing
 - Check for color, edema, symmetry, lesions, and deformities
- Integument
 - Skin, Nails, and Lips: Presence of any pallor (suggestive of anemia), cyanosis (suggestive of compromised oxygen distribution from the lungs and/or heart to the peripheral tissues), and/or clubbing of the fingernails.
 - Nipples: Note both number and position (there could be supernumerary nipples along the mammary line, which could suggest congenital abnormalities). The nipples usually sit around the level of T4, which is also where the division of the mainstem bronchi occurs.
 - Superficial Venous Pattern: Presence may suggest heart problems (i.e. heart failure) and/or vascular obstruction.
- Chest Configuration
 - Note the shape and symmetry from the **front, side, and back.**
 - Observe the bony skeleton
 - Clavicles
 - Sternum
 - Ribs
 - Thoracic Vertebrae
 - Compare the anterior/posterior diameter with the lateral diameter.
 - The anterior/posterior diameter should be less than the lateral diameter.
 - Thoracic ratio is expected to be 0.70, but becomes closer to 1.0 with chronic lung conditions such as COPD.
 - Congenital Variations
 - Pectus excavatum: Indentation of the lower sternum, “funnel chest” (think of *excavate* or when a person is digging into the ground)
 - Pectus carinatum: Sternal protrusion, “pigeon chest” (think of *canary*)
 - Barrel chest: Increased anterior/posterior diameter (seen in COPD and cystic fibrosis)
 - Flail chest: A portion of the lower chest moves paradoxically inward during inspiration (indicative of a rib at least being fractured in two places)
 - Scoliosis: Lateral deviation of the spine
 - Kyphosis: Increased thoracic anterior/posterior curvature
- Respiration Observation
 - Rate, Rhythm, and Depth
 - It is important that the patient is **unaware** that you are counting their respirations
 - Rate: 12-20 respirations per minute is expected for adults
 - Rhythm: The pattern that the chest expands
 - Depth: Equal respirations that are not too shallow or deep

- Abnormal Findings
 - Retractions: Chest wall caves in between the bony parts of the rib cage during inspiration due to upper airway obstruction.
 - Paradoxical breathing: On inspiration the lower thorax moves in, on expiration the lower thorax expands, and this is due to a poorly functioning diaphragm or obstruction.
- Smell (these are **not** always present)
 - Malodorous: Infection
 - Sweet/Fruity: DKA
 - Cinnamon: Pulmonary tuberculosis

Palpation

- General: Feel for pulsations, areas of tenderness, masses, unusual movements or position, bulges, and depressions.
Remember that many complaints of chest pain are of musculoskeletal origin and in fact are not a disease of the heart or lungs (a proper evaluation is still always critical and good clinical judgement should always be used).
- Bony Palpations
 - Clavicle
 - Sternum
 - Ribs
 - Spinous Processes
- Tracheal Position
 - How:
 - Place the right index finger in the suprasternal notch.
 - Move laterally to feel the location of the trachea.
 - Repeat to the opposite side.
 - Why:
 - The space between the trachea and the clavicle on each side should be equal.
 - Deviation indicates a problem with the chest (the *exceptions* are a tumor or thyroid enlargement).
 - Causes: Thyroid enlargement, fibrosis, tumor, atelectasis, and tension pneumothorax
 - Tension pneumothorax: Trachea is deviated *away* from the insult
 - Basic pneumothorax: Trachea *may* deviate towards insult
 - Tumors: Trachea is deviated *towards* the pathology
 - Video Links
 - <https://www.youtube.com/watch?v=YMufMulGnFE>
 - https://www.youtube.com/watch?v=LJI1OID_azA
- Chest Excursion
 - How:
 - Stand behind the patient.
 - Place your hands flat against the patient's back with the thumbs parallel to the midline at approximately the level of the 10th ribs.
 - Pull the underlying skin slightly toward the midline.
 - Ask the patient to inhale deeply.
 - Repeat facing the patient, but this time place your thumbs along the costal margin to the xiphoid process.
 - Why:
 - The movement of your hands should be symmetric.
 - Decreased symmetry can indicate a problem with one or both lungs.
 - Excursion is usually decreased in a barrel chest.
 - Video Link
 - <https://www.youtube.com/watch?v=8IjMjFSRmII>
- Crepitus
 - How:
 - Place your fingertips in the intercostal spaces during respiration.
 - Feel and listen for a crackly sensation/sound.

- Why:
 - A crackly sensation or sound indicates air in the subcutaneous tissue.
 - Subcutaneous emphysema causes include:
 - A rupture in the respiratory system
 - Improper intubation inflation
 - Infiltration with gas producing bacteria
- Pleural Friction Rub
 - How:
 - Place your fingertips in the intercostal spaces during respiration.
 - Feel for a grating vibration.
 - It may feel like leather rubbing on leather.
 - Why:
 - Suggestive of inflammation of the pleural surface.
- Tactile Fremitus
 - How:
 - Palpate the chest wall while an individual is talking.
 - Techniques:
 - “Karate Chop”
 - Place the ulnar side of the hand against the patient’s chest wall.
 - Ask the patient to repeat “99” and perform this in all lung fields.
 - “The Piano”
 - Place the palmar surface of fingertips against the patient’s chest wall.
 - Ask the patient to repeat “99” and perform this in all lung fields.
 - Palpate both sides simultaneously or with one hand at a time.
 - Alternate from side to side.
 - Test the anterior, posterior, and lateral chest wall (perform in all lung fields).
 - Why:
 - Increased fremitus is increased sound transmission from fluid or a solid mass and is caused by conditions that increase the density of the lungs (i.e. tumor).
 - Decreased fremitus is decreased sound transmission from excessive air (i.e. emphysema and bronchial obstruction).
- Video Link
 - <https://www.youtube.com/watch?v=NoJeTljJ-PQ>

Percussion

- How:
 - Tip of the digit or digits of one hand should strike the terminal portion of another digit or digits of the opposite hand on the chest wall.
 - *****Remember that the motion comes from the wrist and not the elbow!*****
 - Percuss on one side and then on the other side at the same level for bilateral comparison.
 - When percussing the back, ask your patient to bend their head forward and fold their arms in front.
 - This will move the scapulae laterally.
 - Percuss all lung fields (anterior, posterior, and lateral).
 - Perform the percussion within the intercostal spaces.
- Why:
 - Note the different characteristics of the sound that is produced (i.e. intensity, pitch, quality, and duration).
 - Dull: Low amplitude, short duration without resonance (heard over solid organs such as the liver and also over pneumonia and tumors)
 - Resonant: High amplitude, lower pitched note (heard where air is within tissue, such as a lung)
 - Tympanic: High pitched, loud (heard over a hollow and air-containing structure, such as the stomach)
 - Flat: High pitched, soft (heard over a solid mass, such as the thigh)
 - Hyper-resonant: Low pitched, hollow quality note (heard over pockets of air, such as a lung with emphysema)

- Diaphragmatic Excursion
 - How:
 - Stand behind your patient and ask them to inhale deeply and hold their breath.
 - Percuss downwards along the scapular line to the area where percussion turns from resonance to dullness.
 - This indicates the lowest level of the diaphragm.
 - Mark the lowest area with a pen or a piece of tape.
 - Next, ask your patient to exhale as much as possible and hold their breath.
 - Percuss up from the previous level until the sound becomes resonant.
 - Why:
 - The difference between inspiration and expiration levels represents the diaphragmatic movement/excursion.
 - This is normally 3-6 cm (between the T9 to T12 levels).
 - Decreased excursion indicates conditions such as COPD, ascites, tumor, and superficial pain (i.e. rib fracture). In a patient with phrenic nerve palsy, the diaphragmatic movement is absent.
 - Video Link
 - <https://www.youtube.com/watch?v=dbMO9dqVkJHA>

Auscultation

- How:
 - Have the patient upright if possible.
 - Communicate with the patient that you will need to listen on their **bare skin**.
 - Ensure to appropriately expose the area to be auscultated.
 - **Instruct them to take deep and slow breaths through their mouth.**
 - **Always listen systematically from side to side.**
 - When auscultating the posterior chest, ask your patient to bend their head forward and fold their arms in front, because this will move the scapulae laterally.
 - Auscultate in the axilla to best hear the middle lobe of the right lung and the lingula of the left lung, but remember that this is not the physical locations of these lobes and are instead just where they are heard the best.
- Why:
 - Normal Breath Sounds
 - Bronchial/Tracheal: Loud and high pitched; heard over the manubrium/trachea, and the expiratory component is longer and louder than the inspiratory.
 - Bronchovesicular: Intermediate intensity and pitch; found over the mainstem bronchi bifurcation, and the inspiratory and expiratory components are equal in length.
 - Vesicular: Soft, low pitched and heard over most of the lung fields; inspiratory is much longer than expiratory.
 - Adventitious Breath Sounds
 - These are *abnormal* sounds that are heard during auscultation.
 - Crackles/Rales: Discrete discontinuous brief sounds heard mostly during inspiration that can be fine or coarse. Commonly found in CHF, COPD, interstitial fibrosis, and pneumonia.
 - Rhonchi: Loud, low, coarse sounds that are more pronounced during expiration. They are caused by air moving through a narrowed airway due to thick mucus, external pressure, muscular spasm, or new growth. Tend to disappear after coughing and sounds similar to snoring.
 - Wheezes: High pitched musical sounds produced continuously and heard in expiration or inspiration. Cause by a narrowed or obstructed airway. Commonly heard in asthma, pulmonary edema, bronchitis, and CHF. Sounds similarly to whistling.
 - Pleural Friction Rub: Dry, rubbing, or grating sound heard during both inspiration and expiration due to impedance of the pleural motion by frictional resistance.
 - Audible Breath Sounds
 - Sigh: The patient lets out a long, deep, and audible breath.
 - Stridor: High pitched, piercing sounds heard most often on inspiration, but may occur in expiration as well. Inspiratory stridor is associated with obstruction higher in the respiratory tree. Might signal a **life threatening** situation. Can be due to epiglottitis, congenital defects, croup, edematous response to infection or allergen, or foreign body aspiration. Expiratory stridor is associated with obstruction lower in the respiratory tree.

- Cough: Sound of clearing the airway. A deep inspiration followed by spasmodic expiration. It might be voluntary or reflexive.
- Video Link
 - <https://www.youtube.com/user/WVSOMgglass/search?query=lung>

Special Tests

- Bronchophony
 - How:
 - Patient repeats a phrase (i.e. "99") while you auscultate the chest.
 - Why/Positive Sign:
 - Increased sound suggests consolidation.
 - Video Link
 - <https://www.youtube.com/watch?v=NlfUy3yyAEs>
- Whispered Pectoriloquy
 - How:
 - Ask the patient to whisper "1-2-3" while you auscultate the chest.
 - Why/Positive Sign:
 - Normally, whispering produces high pitched sounds that are filtered out by the lungs (i.e. muffling of the sound occurs). If consolidation is present, whispers will have a louder and clearer sound.
 - Video Link
 - <https://www.youtube.com/watch?v=V761MusII1I>
- Egophony
 - How: Patient says "E-E-E-E" while you auscultate the chest.
 - **It is critical that you have the patient state "E" individually and not as one continuous sound!**
 - Why/Positive Sign:
 - If egophony is present, the "E-E-E-E" will be heard as "A-A-A-A." This is positive for consolidation. Lastly, the area of a compressed lung above pleural effusion often produces egophony.
 - Video Link
 - <https://www.youtube.com/watch?v=VthSqLviduk>