Respiratory system examination

Preparation for Examination: client and environment

Adequate respiratory examination requires a warm, well-lighted, quiet room. In addition to adequate room lighting, a mechanism for supplementary lighting is essential to aid in close inspection of specific areas.

Privacy is important because of the need to examine the entire chest area. Female clients may wish to have a gown or towel to cover their breasts while the posterior thorax is being examined. Tell them that you will be asking them to move their breasts to the side so that you will be better able to palpate, percuss, and auscultate the anterior thorax.

Before starting the examination, teach the patient how to sit and how to breathe during the auscultation of the posterior thorax. For examination of the posterior thorax, instruct the client to hunch forward slightly and cross the arms over the chest so that the greatest amount of lung surface is available for examination. Also, instruct the patient to breathe deeply and quietly, slowly inhaling and exhaling through the open mouth.

The client can be seated throughout the examination and stripped to the waist. Female clients can use a towel or grown to cover their breasts when the posterior and lateral portions of the chest are being examined.

The examination of the respiratory system generally is done in the traditional sequence-inspection, palpation, percussion, and auscultation.

Examination technique and normal findings

Inspection. Inspection is performed to (1) measure and assess the pattern of respirations and (2) assess the skin and the overall configuration, symmetry, and integrity of the thorax.

The approach to the physical examination is regional and integrated. The examination of systems is combined in body regions when appropriate. Because the client is uncovered to the waist during the examination, a large portion of skin and tissue is accessible to inspection. The observation of skin and underlying tissue provides information about the client's general nutritional state. Common thoracic skin findings are the spider nevi associated with cirrhosis.

Thoracic configuration. The first point of observation is the general shape of the

thorax and its symmetry. Although no individual is absolutely symmetrical in both body hemispheres, most individuals are reasonably similar from side to side. Using the client as his or her own control whenever paired parts are examined is an excellent habit and often yields important findings. The anteroposterior diameter of the thorax in the normal adult is less than the transverse diameter at an approximate ratio of 1:2 to 5:7. In the normal infant, in some adults with pulmonary disease, and in elderly adults, the thorax is generally round. This condition is called **barrel chest**. The barrel chest is characterized by horizontal ribs, slight kyphosis of the thoracic spline, and prominent sternal angle. The chest appears as though it is in continuous inspiratory position.

Other observed abnormalities of thoracic shape include the following:

1. ***Retraction of thorax***. The retraction is unilateral, involving only one side.

2. ***Pigeon or chicken chest***. Sternal protrusion anteriorly. The anteroposterior diameter of the chest is increased, and the resultant configuration resembles the thorax of a fowl.

4. ***Spinal deformities*** (scoliosis, kyphosis. lordosis). The respiratory examination offers an excellent opportunity to initiate inspection of the spine.

Pattern of respiration. Normally, men and children breathe diaphragmatically, and women breathe thoracically or costally. A change in this pattern might be significant. If the client appears to have labored respiration, it is important to observe for the use of the accessory muscles of respiration in the neck (sternocleidomastoid, scalenus, and trapezius muscles) and for supraclavicular retraction. Impedance to air inflow is often accompanied by retraction of the intercostals spaces during inspiration. An excessively long expiratory phase of respiration is characteristic of outflow impedance and may be accompanied by the use of abdominal muscles to aid in expiration.

In the normal adult, the resting respiratory rate is 12 to 20 breaths/min and is regular and unlabored. The ratio of respiratory rate to pulse rate normally is 1:4. ***Tachypnea*** is an adult respiratory rate of more than 24 breaths/min. ***Bradypnea*** is an adult respiratory rate of less than 10 breaths/min. ***Dyspnea*** is a subjective phenomenon of inadequate or distressful respiration. Many more abnormal patterns of respiration exist, such as ***Cheyne-Stokes respiration***, ***Biot's breathing*** and ***sighing respirstion***.

Palpation. Palpation is performed to (1) further assess abnormalities suggested by the health history or by observation, such as tenderness, pulsations, masses, or skin lesions; (2) assess the skin and subcutaneous structures; (3) assess thoracic expansion; (4) assess ***tactile fremitus***; and (5) assess tracheal position.

In examination of the thorax, three parts of the thorax need consideration: posterior chest, anterior chest, right and left lateral chest. During the examination, move from the area of one hemisphere to the corresponding area on the other side (right to left, left to right) until all four major parts have been surveyed. During palpation for assessment of fremitus and all subsequent procedures for examination of the respiratory system, examine all areas meticulous ly and systematically.

A very helpful landmark for location of points on the thorax, especially the counting of ribs and interspaces, is ***the angle of Louis***, the junction of the manubrium and the body of the sternum. It is also important to remember that the second rib connects with this palpable bony prominence and that the second interspace lies immediately below it.

Assessment of thoracic expansion. The degree of thoracic expansion can be assessed from the anterior or the posterior chest. Anteriorly, place your hands over the client's anterolateral chest with the thumbs extended along the costal margin, pointing to the xiphoid process. Posteriorly, place the thumbs at the level of the tenth rib and place the palms on the posterolateral chest. In either position, the thumbs will be approximately 3 to 5 cm apart before inspiration, depending on the client's size. The amount and symmetry of the thoracic expansion can be felt during quiet and deep respiration. First, feel thoracic expansion during normal, quiet respiration. Next, ask the client to take a deep breath in slowly and then exhale. The symmetry of respiration should be felt between the left and the right hemi thoraces as the thumbs are separated an additional 3 to 5 cm during the deep inspiration.

***Assessment of tactile fremitus*.** Fremitus is vibration that is perceptible on palpation. Tactile (sometimes also called "vocal") fremitus is palpable vibration of the thoracic wall produced by phonation.

Ask the client to repeat "one, two, three" or "ninetynine" while you systematically palpate the thorax. Use the palmar bases of the fingers, the ulnar aspect of the hand, or the ulnar aspect of the closed fist. You can use two hands to assess both sides of the chest simultaneously or one hand moving alternately to compare one side of the chest to the other. If one hand is used, move it from one side of the chest to the corresponding area on the other side. If two hands are used, place them simultaneously on the corresponding areas of each thoracic side.

Fremitus is decreased or absent when the distance between the palpating hand is increased or when there is interference with sound transmission. Distance is increased and sound transmission is decreased in the following conditions: pneumothorax with lung collapse, fluid in the pleural space (pleural effusion), pleural thickening, tumors or masses in the pleural space, emphysema, bronchial

obstruction, and a thick, muscular chest wall. Fremitus is increased in conditions that decrease the distance between the lungs and the palpating fingers and that favor the sound transmission in the chest, for example, in pneumonia with **consolidation, atelectasis** (with open bronchus), lung tumors, pulmonary infarction, and pulmonary fibrosis.

***Assessment of tracheal deviation*.** The trachea is assessed by palpation for lateral deviation. Place the index finger of your dominant hand on the trachea in the suprasternal notch, then move the finger laterally left and right in the spaces bordered by the upper edge of the clavicle, the inner aspect of the sternocleidomastoid muscle, and the trachea. These spaces should be equal on both sides. In diseases such as atelectasis and pulmonary fibrosis, the trachea may be deviated toward the abnormal side. The trachea may be deviated toward the normal side in conditions such as neck tumors, thyroid enlargement, enlarged lymph nodes, pleural effusion, unilateral emphysema, and tension pneumothorax.

Percussion. Percussion is the tapping of an object to set underlying structures in motion and thus produce a sound called a percussion note and a palpable vibration. Percussion penetrates to a depth of approximately 5 to 7 cm into the chest. This technique is used in the thoracic examination to determine the relative amounts of air, liquid, or solid material in the underlying lung and to determine the positions and boundaries of organs.

With experience and study, one learns to differentiate among the five percussion tones commonly elicited from the human body. The procedure for thoracic percussion is as follows:

1. Position the client with the head bent and the arms folded over the chest. With this maneuver, the scapulae move laterally and more lung area is accessible to examination. On the posterior chest, percuss systematically at about 5 cm intervals from the upper to lower chest, moving left to right, right to left, and avoiding scapular and other bony areas.

2. Percuss the lateral chest with the client's arm positioned over the head.

3. On the anterior chest, percuss systematically, as done for the posterior chest.

If the client's breathing is shallow or painful, the measurement of diaphragmatic excursion is indicated. Various pulmonary and abdominal lesions, ascites, or trauma may limit the movement of the diaphragm. The following is the procedure for assessing diaphragmatic excursion:

1. Instruct the client to inhale deeply and hold the breath in.

2. Percuss down the scapular line on one side, starting at T7 or at the end of the scapula, until the lower edge of the lung is identified. Sound will change from resonance to dullness.

3. Mark the point of change at the scapular line. This point is the edge of the diaphragm at full inhalation.

4. Instruct the client to take a few normal respirations.

5. Instruct the client to take a deep breath, exhale completely, and hold the breath at the end of the expiration.

6. Proceed to percuss upward from the marked point at the scapular line. Mark the point where dullness of the diaphragm changes to the resonance of the lung. This point is the level of the diaphragm at full expiration. An alternate method of determining the level of the diaphragm at full exhalation is to percuss down along the scapular line and note where the resonance of the lung changes to the dullness of the diaphragm.

7. Repeat the procedure on the opposite side.

8. Measure and record the diaphragmatic excursion, the distance between the upper and lower marks in centimeters for each side of the thorax.

The diaphragm is usually slightly higher on the right side because of the location of the liver on that side. Diaphragmatic excursion which is normally 3 to 5 cm bilaterally, is usually measured only on the posterior chest

Auscultation. Through auscultation, information can be obtained about the functioning of the respiratory system and about the presence of any obstruction in the passages. For auscultation of the lungs, a stethoscope is used. The diaphragm of the stethoscope is commonly used for the thoracic examination because it covers a larger surface than does the bell. Also, the diaphragm is designed to transmit the usually higher pitch of abnormal breath sounds.

Place the stethoscope firmly, but not tightly, on the skin. Avoid client or stethoscope movement because movements of muscle under the skin or movements of the stethoscope over hair produce confusing extrinsic sounds.

The auscultatory assessment includes (1) analysis of breath sounds, (2) detection of

any abnormal sounds, and (3) examination of the sounds produced by the spoken voice. As with percussion, use a zigzag approach, comparing the finding at each point with the corresponding point on the opposite hemithorax.

Before beginning auscultation, instruct the client to breathe through the mouth and more deeply and more slowly than in usual respiration. Then, systematically auscultate the posterior, lateral, and anterior chest. At each application of the stethoscope, listen to at least one complete respiration. Observe the client for signs of hyperventilation and alter the procedure if the client becomes lightheaded or faint.

Breath sounds. Breath sounds are produced by the movement of air through the tracheobronchoalveolar system. These sounds are analyzed according to pitch, intensity, quality, and relative duration of inspiratory and expiratory phases.

The sounds heard over normal lung parenchyma are called *vesicular breath sounds*. The inspiratory phase of the vesicular breath sounds is heard better than the expiratory phase and is about 2.5 times longer. These sounds have a low pitch and soft intensity.

Bronchovesicular breath sounds are normally heard in the areas of the major bronchi, especially in the apex of the right lung and at the sternal borders anteriorly and posteriorly between the scapula. Bronchovesicular breath sounds are characterized by inspiratory and expiratory phases of equal duration, moderate pitch, and moderate intensity. When bronchovesicular breath sounds are heard over the peripheral lung of an adult, an underlying pathological condition is likely to be present.

Bronchial breath sounds are normally heard over the trachea and indicate a pathological condition if heard over lung tissue. They are high-pitched, loud sounds associated with shortened inspiratory and lengthened expiratory phases. A gap of silence audibly separates the inspiratory and expiratory phases.

Absent or decreased breath sounds can occur in (1) any condition that causes the deposition of foreign matter in the pleural space, (2) bronchial obstruction, (3) emphysema, or (4) shallow breathing.

Increased breath sounds, as from vesicular to bronchovesicular or bronchial, can occur in any condition that causes a consolidation of lung tissue.

Abnormal or adventitious sounds. Adventitious sounds are not alterations in breath sounds but abnormal sounds superimposed on breath sounds.

A crackle (or rale, a term used in older texts) is a short, discrete, interrupted, crackling or bubbling sound that is most commonly heard during inspiration. The sound of crackles is similar to that produced by hairs being rolled between the fingers while close to die ear. The exact mechanism by which crackles are produced is not fully understood. Crackles are thought to be produced by air passing through moisture in the bronchi, bronchioles, and alveoli or by air rushing through passages and alveoli that were closed during expiration and abruptly opened during inspiration. The pitch and location in the inspiratory phase of the crackles are thought to indicate their site of production. Low-pitched, coarse crackles occurring early in inspiration are thought to originate in the bronchi, as in bronchitis. Medium-pitched crackles in midinspiration occur in diseases of the small bronchi, as in bronchiectasis. High-pitched, fine crackles are found in diseases affecting the bronchioles and alveoli and occur late in inspiration.

Wheezes (rhonchi) are continuous sounds produced by the movement of air through narrowed passages in the trachcobronchial tree. Sonorous wheezes predominate in expiration because bronchi are shortened and narrowed during this respiratory phase. However, they can occur in both the inspiratory and the expiratory phase of respiration, suggesting that lumina have been narrowed during both respiratory phases. As with crackles, the pitch and location of sonorous wheezes in the expiratory phase are thought to indicate their origins. Low-pitched sonorous wheezes are usually heard in early expiration and probably originate in the larger bronchi. High-pitched, sibilant wheezes originate in small bronchioles and often occur in late expiration.

A ***pleural friction rub*** is a loud, dry, creaking or grating sound indicative of pleural irritation. It is produced by the rubbing together of inflamed and roughened pleural surfaces during respiration (e.g., in pleurisy). Therefore it is heard best during the latter part of inspiration and the beginning of expiration. Because thoracic expansion is greatest in the lower anterolateral thorax, pleural friction rubs are most often heard there.

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