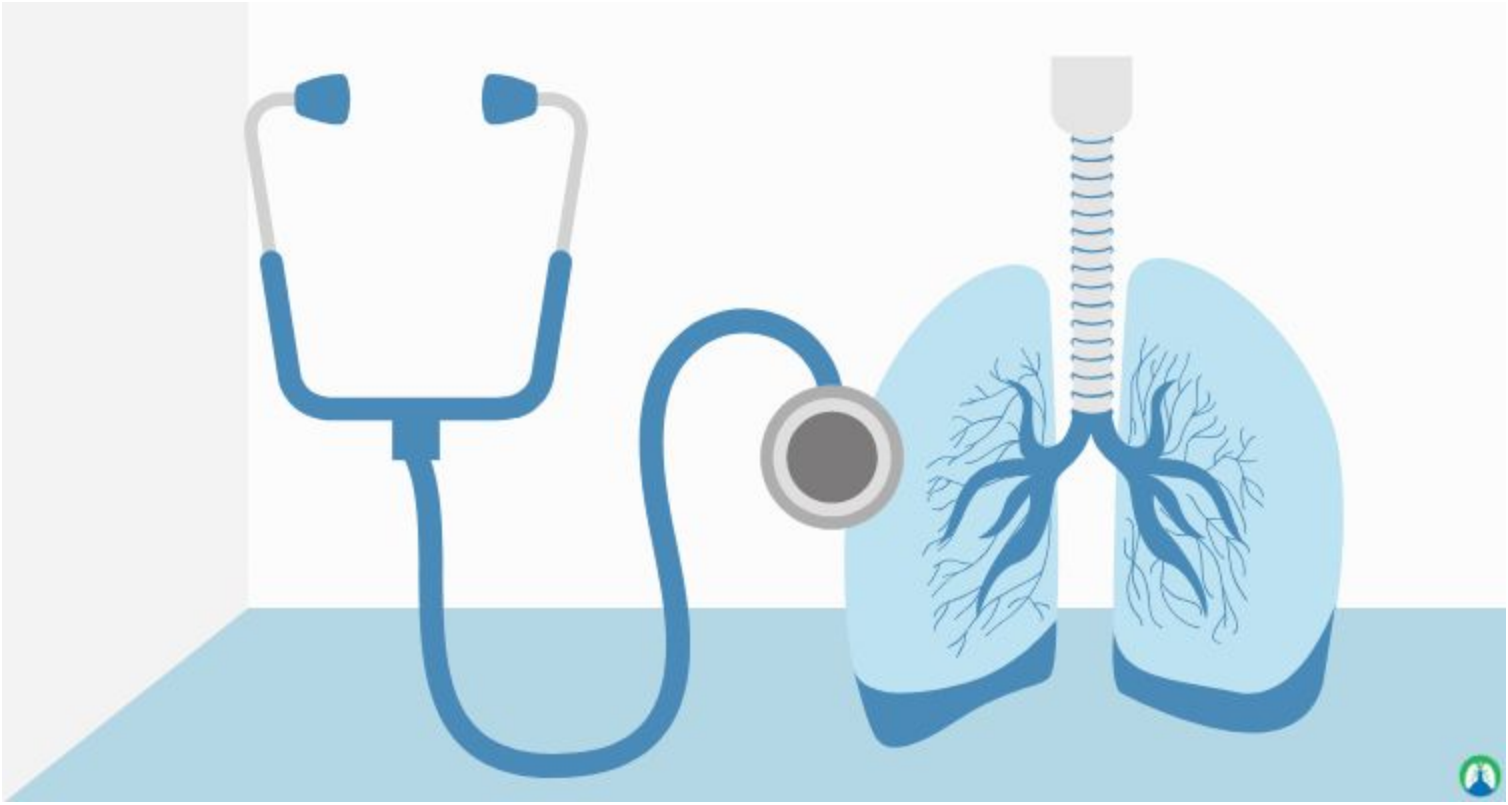


What are Breath Sounds?

Breath sounds are the noises that come from your lungs when you inhale and exhale. Any abnormality in breath sounds indicates a problem in the lungs such as:

- Accumulation of fluid
- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Foreign body in the lungs or airways
- Heart failure
- Infection
- Inflammation of the airways
- Obstruction
- Pneumonia

By listening to the quality, duration, and intensity of breath sounds, healthcare providers can come up with a proper diagnosis and medical management.

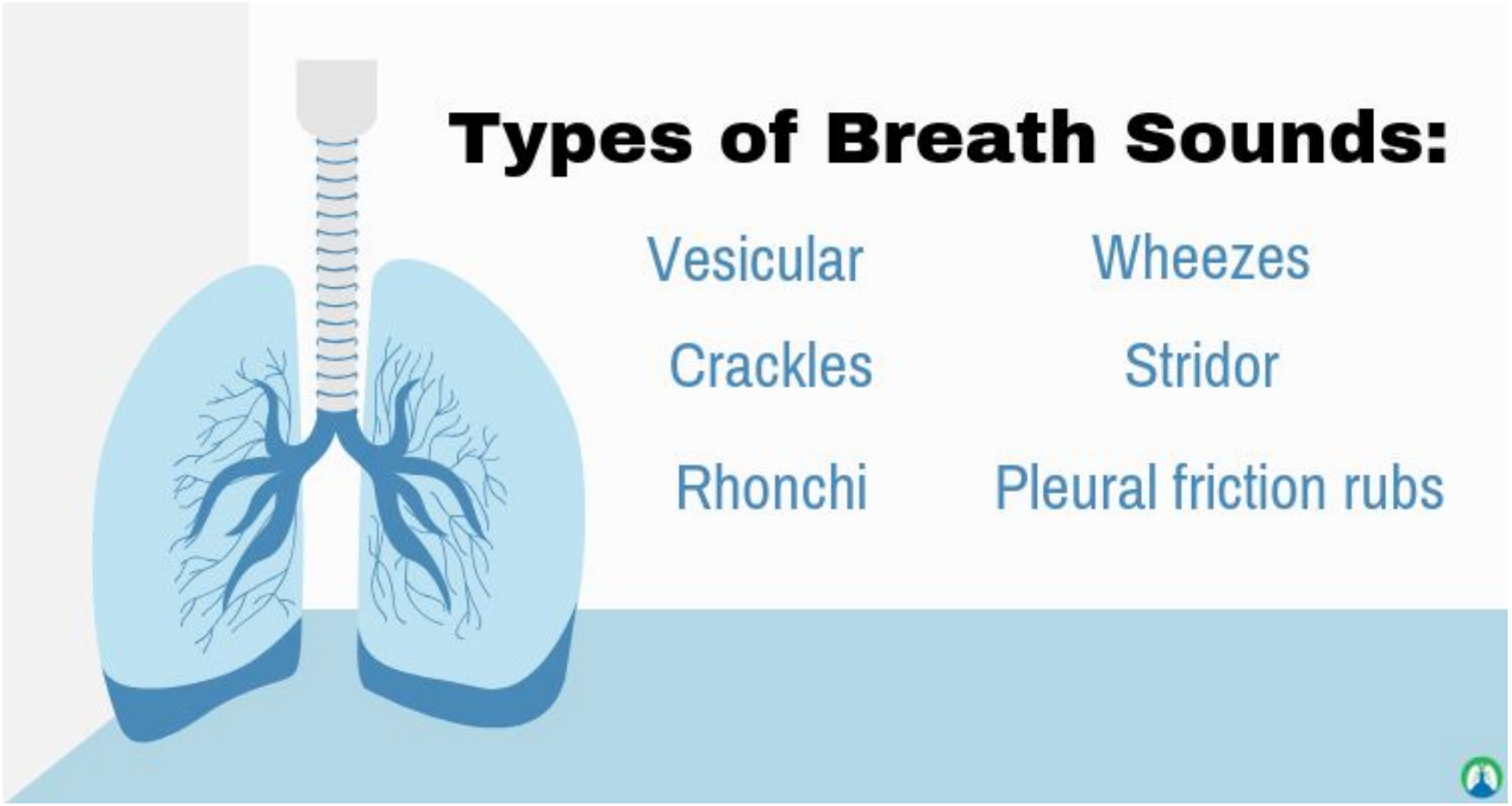
What is Auscultation?

Auscultation is a simple, non-invasive procedure that involves the use of a stethoscope to listen to the sounds produced by your body. This device can amplify the sounds within your body so that your healthcare provider can have an idea of what's going on inside.

When performing lung auscultation, your healthcare provider places the bell or diaphragm of the stethoscope on your back and compares one side with the other. Your healthcare provider also compares the sound on the front of your chest with your back.

Types of Breath Sounds:

If your healthcare provider thinks that you might have a lung problem or an issue in your airways, the type and location of breathing sounds can give him a cue. The following are the breath sounds which can be heard using a stethoscope:


Types of Breath Sounds:
Vesicular
Wheezes
Crackles
Stridor
Rhonchi
Pleural friction rubs

1. Vesicular (Normal)

Vesicular or normal breath sounds are usually soft and low-pitched and are heard during auscultation of the chest and lung surface of a healthy person. The sound has a rustling quality during inspiration. This is generated by turbulent airflow within the lobes of the lungs.

During expiration, the sound becomes softer as air flows within the larger airways. The inhalation process is normally 2-3 times the length of the exhalation process.

2. Crackles (Rales)

Crackles, also known as rales, are short, explosive, nonmusical sound and are audible in a lung field that has fluid in the small airways. Crackles can occur either when you inhale or exhale but are more common during the inspiratory phase. It can be classified as fine and coarse. The difference between the two is that fine crackles have a higher frequency and a shorter duration and are caused by sudden opening of a narrowed or closed airway. The sound of fine crackles can be compared to that of salt heated on a frying pan.

Coarse crackles, on the other hand, are louder, lower in pitch and last longer, and are caused by secretions. The sound of course crackles is like pouring water out of a bottle. Crackles are often associated with lung inflammation or infection. If they do not clear after a cough, this may indicate fluid in the alveoli, acute respiratory distress syndrome, or pulmonary fibrosis.

3. Wheezes

Wheezes are defined as continuous musical tones that commonly occur at the end of the inspiratory phase or early expiratory phase as a result of the gradual opening or closing of a collapsed airway. Wheezes are either high-pitched or low-pitched. They sound like a whistle when you breathe and are most audible during the expiratory phase.

Aside from narrowed airways, wheezes can also be caused by inflammation secondary to asthma and bronchitis.

4. Rhonchi

Rhonchi are now called a sonorous wheeze because their sound can be compared to snoring or gurgling. These lung sounds are often low-pitched and are audible during the expiratory phase. The main difference between rhonchi and wheezes is that rhonchi are low and dull while wheezes are high and squeaky. Rhonchi are mainly caused by airway obstruction including accumulation of mucus secretions, lesions, or foreign bodies.

Certain medical conditions such as pneumonia, chronic bronchitis, and cystic fibrosis can also cause rhonchi.

5. Stridor

Stridor, also known as “noisy breathing”, is a high-pitched sound caused by airway obstruction. This sound is commonly heard during the inspiratory phase but can also be present during the expiratory phase. If heard during inhalation, the airway obstruction is typically at the level of the vocal cords or just below the windpipe. If heard during exhalation, the airway obstruction might be in the lower trachea or the bronchi.

Several medical conditions can cause stridor including vocal cord abnormality, narrowing of the larynx (voice box), abnormal growth of blood vessels, lesions, infection, and foreign bodies.

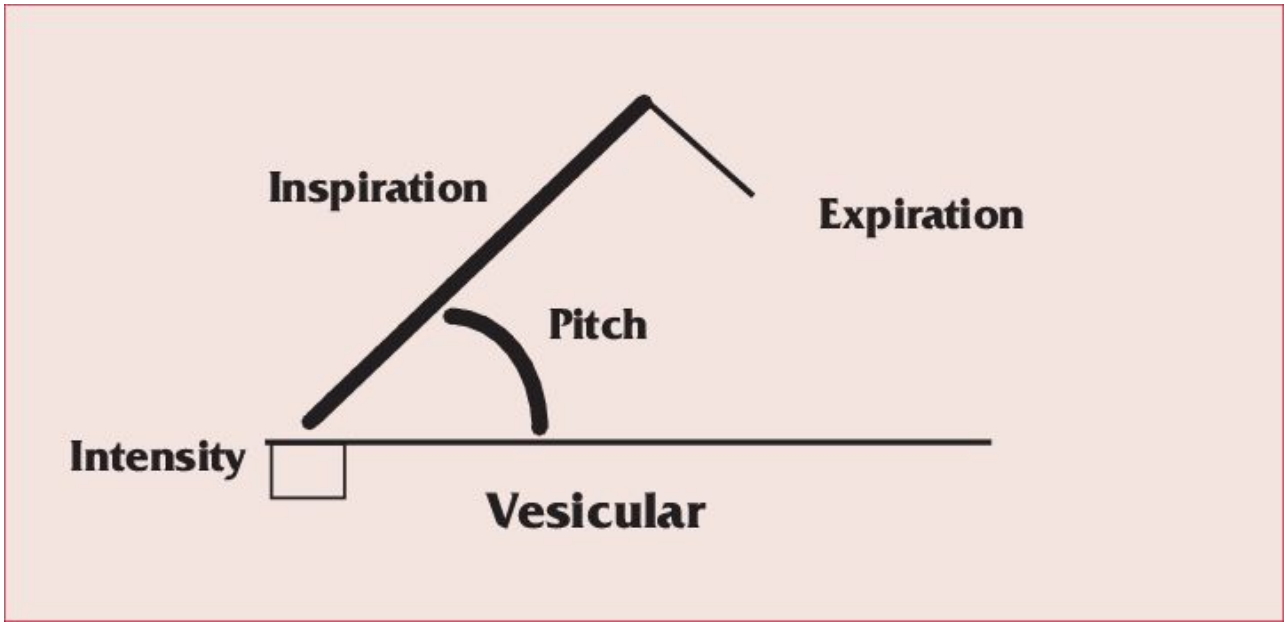
6. Pleural friction rubs

Pleural friction rubs are creaking or grating sounds. Because these sounds occur whenever the chest wall moves, they are generally heard throughout inhalation and exhalation. This lung sound is almost always associated with inflammation of serous membrane lining in the thorax known as pleurae.

As the name implies, pleural friction rubs sound like two objects rubbing against each other or walking on fresh snow. Other medical conditions such as pneumonia and pulmonary embolism can also cause pleural friction rubs.

What are Vesicular Breath Sounds?

Vesicular breath sounds are normal breath sounds that are low-pitched with a rustling quality. They can be heard as a soft noise during inhalation and slowly gets softer as you exhale. These sounds are normally audible throughout most of the lung fields. The inspiratory component predominates and is 2-3 times longer than the expiratory phase.



What are Adventitious Breath Sounds?

Adventitious breath sounds are abnormal sounds that occur over the lungs and airways. The term “adventitious” breath sounds describe the additional audible lung sounds during auscultation. These include abnormal lung sounds such as crackles (rales), wheezes, rhonchi, stridor, and pleural friction rubs.

Adventitious breath sounds are commonly associated with a wide array of heart and lung conditions. The type, duration, location, and intensity of each adventitious breath sounds can help the healthcare provider determine the root cause of the medical condition.

Causes of Abnormal Breath Sounds:

There are several causes of abnormal breath sounds. Each of which are specific to the type of breath sounds a patient is experiencing:

- Air moving through narrowed airways due to swelling or obstruction causes wheezes.
- Airway obstruction due to the accumulation of mucus secretions, lesions, or foreign bodies causes rhonchi.
- Fluid accumulation in the small airways or atelectasis (lung collapse) causes crackles.
- Obstruction of the upper airway causes stridor.
  Rubbing of inflamed pleural surfaces against each other during respiration causes pleural friction rub.

In addition to this, certain lung and heart problems can also cause abnormal breath sounds.

Treatment for Abnormal Breath Sounds

If you are experiencing continuous abnormal breathing sounds, you should consult with your doctor for proper diagnosis and medical management. Abnormal breath sounds are often associated with common and treatable medical conditions. However, these sounds can also indicate an underlying disease.

The following are the common therapeutic strategies for abnormal breath sounds:

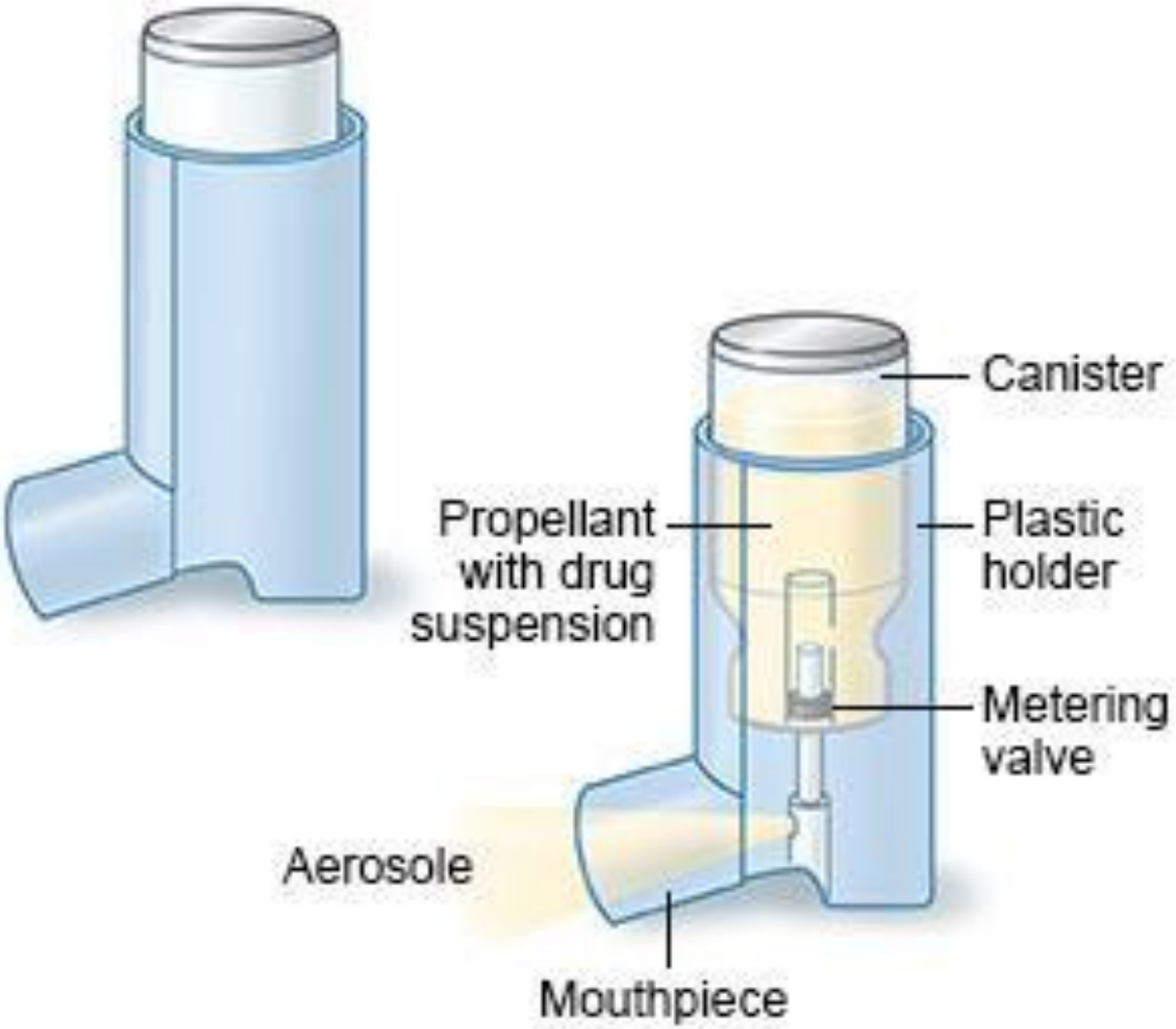
1. Metered-Dose Inhaler (MDI)

This is a pressurized inhaler that delivers a bronchodilator (dilates the airways), corticosteroid (suppresses inflammation) or a combination of both. By opening the airways and suppressing the inflammatory process, it can help restore breath sounds to normal.

2. Nebulizer

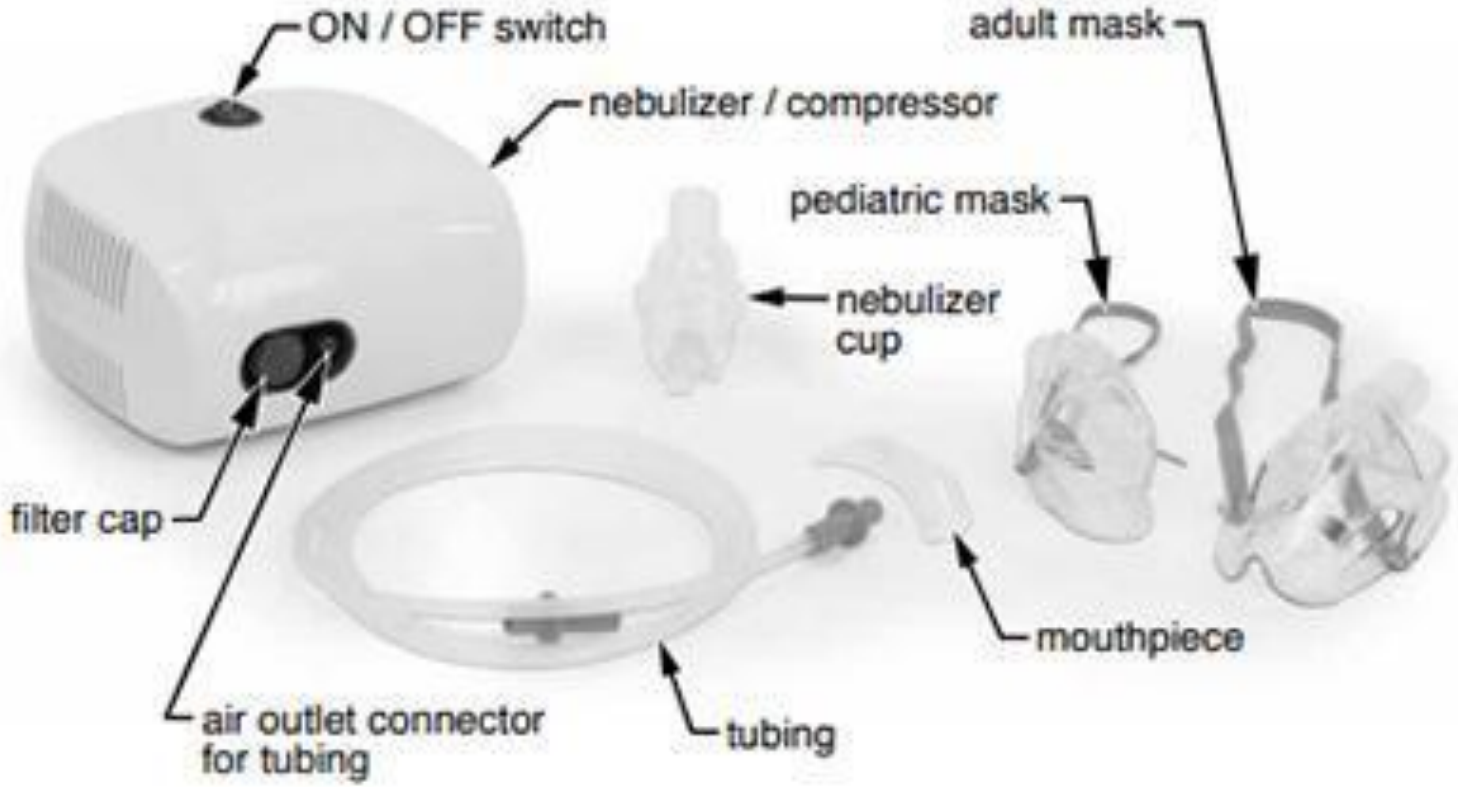
This delivers aerosolized form of medications into the alveoli via inhalation. This treatment adds moisture to the respiratory system, which in turn improves clearance of pulmonary secretions. Nebulizers also help improve breath sounds by dilating the airways.

Metered Dose Inhaler



Features and Components

Please note nebulizer features and components, labeled in the illustration below.



3. Incentive spirometry

This is a simple, inexpensive and effective tool for achieving a normal lung function. This device mimics natural sighing or yawning, which in turn improves lung expansion and gas exchange. To use the device, you need to place the mouthpiece spirometer in your mouth and do deep breathing exercises.

4. Chest physiotherapy (CPT)

This is also considered a simple and effective method of achieving normal breath sound. CPT includes various techniques in order to naturally clear lung secretions through the use of vibration or shaking, proper positioning, breathing exercises, and coughing techniques.

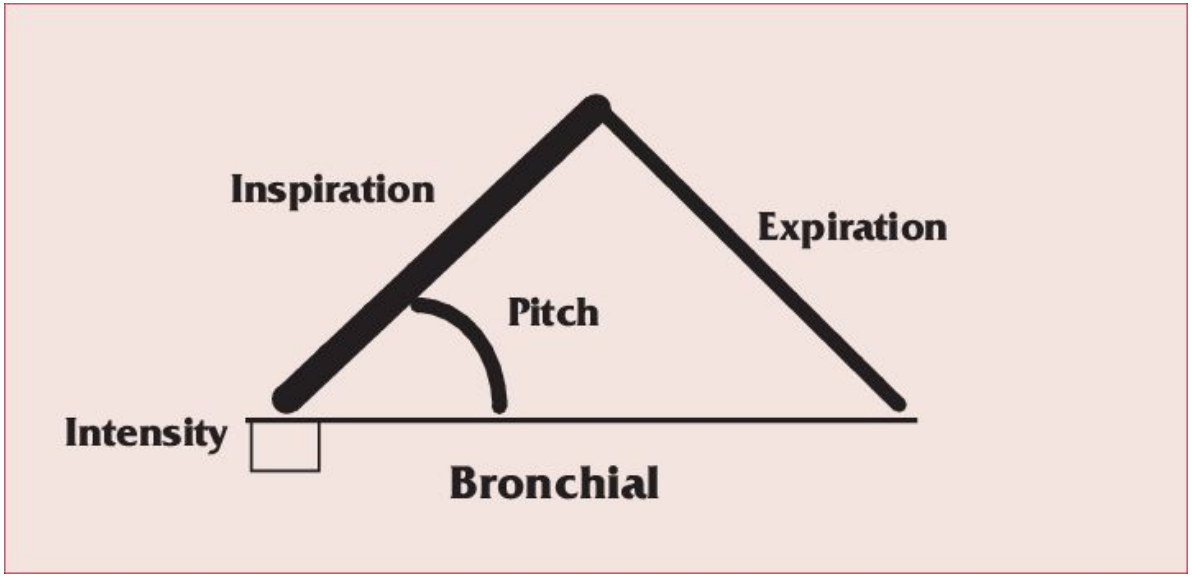
5. Antibiotics

Antibiotic therapy is designed to fight infection and destroy microorganisms that affect lung function. This treatment strategy can also help clear airway inflammation and mucus secretions.

What are Bronchial Breath Sounds?

Bronchial breath sounds are tubular, hollow sounds produced during the inspiratory and expiratory phase as a result of abnormal increase in the transmission of airway sounds to the chest surface. The sound is very similar to the sound produced by blowing to a hollow tube. They are audible upon auscultation of the large airways and have a higher pitch compared to vesicular breath sounds.

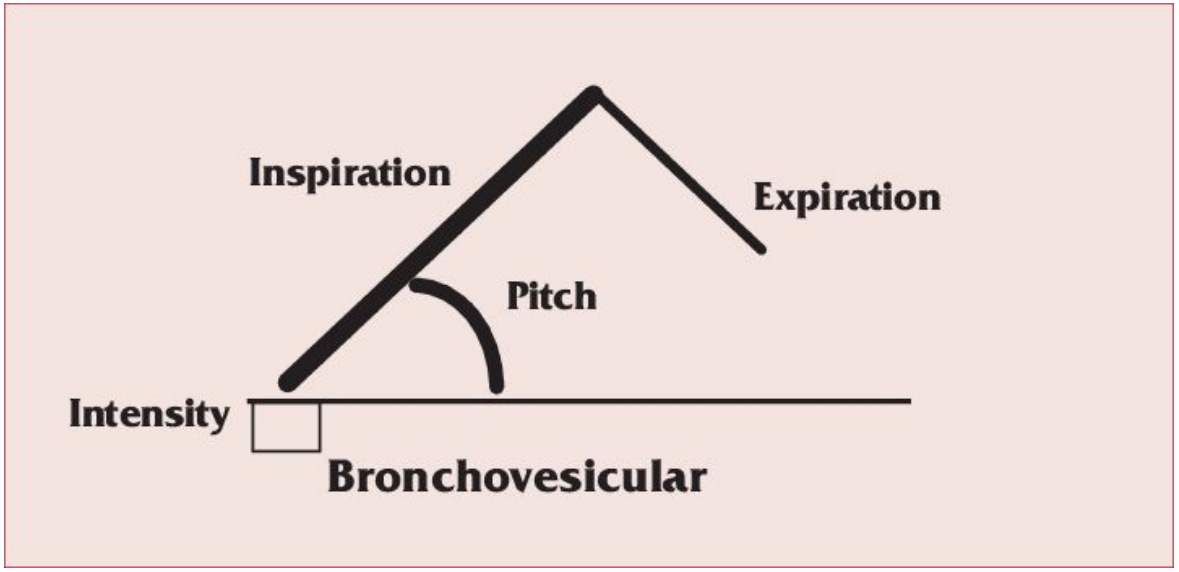
The expiratory phase of bronchial breath sounds is shorter and there is no pause between inhalation and exhalation.



What are Bronchovesicular Breath Sounds?

Bronchovesicular breath sounds are normal sounds heard in the mid-chest area or over the shoulder blade (scapula). Unlike other normal breath sounds, bronchovesicular breath sounds have tubular quality. These sounds are the combination of bronchial breath sounds heard near the trachea and vesicular sound in the alveoli.

Bronchovesicular breath sounds have equal periods of inhalation and exhalation (ratio is 1:1). However, the differences in pitch and intensity are often audible during the expiratory phase.



What are Diminished Breath Sounds?

Diminished breath sounds, also known as diminished vesicular sounds, are soft, distant lung sounds of lower intensity. These sounds are normally heard in patients with decreased air volume, such as in critically ill and obese patients, and those with increased muscle mass, air or fluid around the lungs, increased chest wall thickness, and lung hyperinflation. The ratio of the inspiratory phase to the expiratory phase is 3:1.

When are Coarse Breath Sounds Heard?

Coarse breath sounds are actually a type of crackles/rales. These sounds are clicking, bubbling, or rattling sounds that occur during the inspiratory process when air opens closed spaces in the lungs. Coarse breath sounds are louder, low-pitched and have longer duration.

Most patients with copious amounts of secretions exhibit coarse breath sounds during auscultation of the affected lung area.

When are Pneumonia Breath Sounds Heard?

Pneumonia is a respiratory infection caused by harmful microorganisms and is characterized by a productive cough, often with greenish to yellowish mucus secretions. If you have pneumonia, your healthcare provider may hear crackling, bubbling, or rumbling sounds as well as wheezing in some areas of your chest during auscultation.

Crackles in patients with pneumonia are often heard only on one side of the chest or when lying down. In addition to crackles and wheezes, low-pitch lung sounds called rhonchi are also audible during the expiratory phase in patients with pneumonia.

What are Stridor Breath Sounds?

Stridor is a high-pitched lung sound created by airway obstruction and is mostly audible during inhalation but can also be heard during exhalation in patients with deteriorating condition. These sounds commonly occur in extubated patients as a complication of endotracheal intubation.[i] In children, stridor is very audible when lying on the back (supine position).

Common causes of stridor are croup, pertussis, aspirations, epiglottis, choking, severe shock (anaphylactic shock), tonsillitis, laryngitis, lung cancer, deviated septum, and blood transfusion reactions.

How to Perform Auscultation?

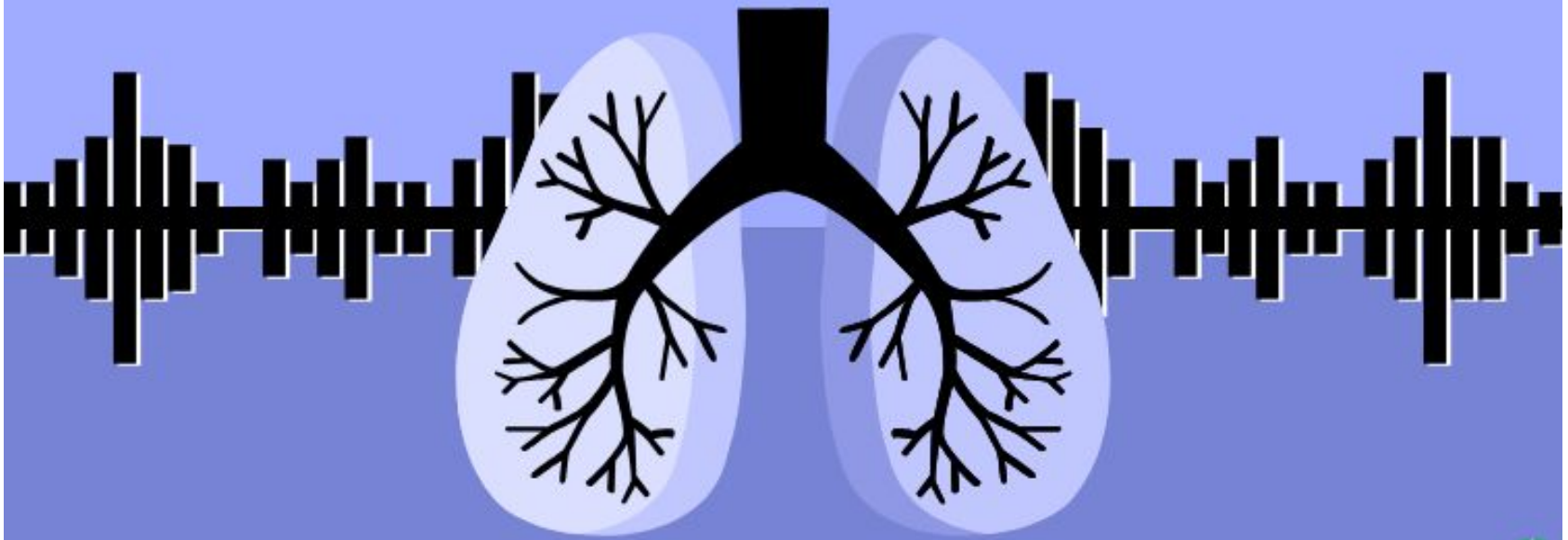
In order to assess breath sounds, your healthcare provider performs auscultation using a stethoscope. This technique is commonly used to examine the heart and lungs but can also be used in the abdomen and body areas with major blood vessels.

The following are the steps in performing a proper auscultation:

1. Explain the procedure to the patient to establish trust and rapport.
2. Stand close to the patient to gain access to the target body part.
3. Place the eartips of the stethoscope in your ears and adjust them as desired.
4. Use the diaphragm (flat part at the end of the tubing which has a thin plastic) to check for high-pitched sounds.
5. Use the bell (smaller, round device attached to the diaphragm) to check for low-pitched sounds.
6. Hold the diaphragm or bell firmly against the patient's skin with enough pressure (must have a round mark on the skin after placement to ensure high quality sounds).
7. Listen to the sounds and try to identify their intensity, location, strength, pattern, and duration.
8. Locate normal and abnormal sounds by gliding the diaphragm or bell over the body area.
9. Compare one side with the other (e.g. compare the sound on the front of the patient's chest with his or her back).
10. Document the findings.

Breathing Patterns

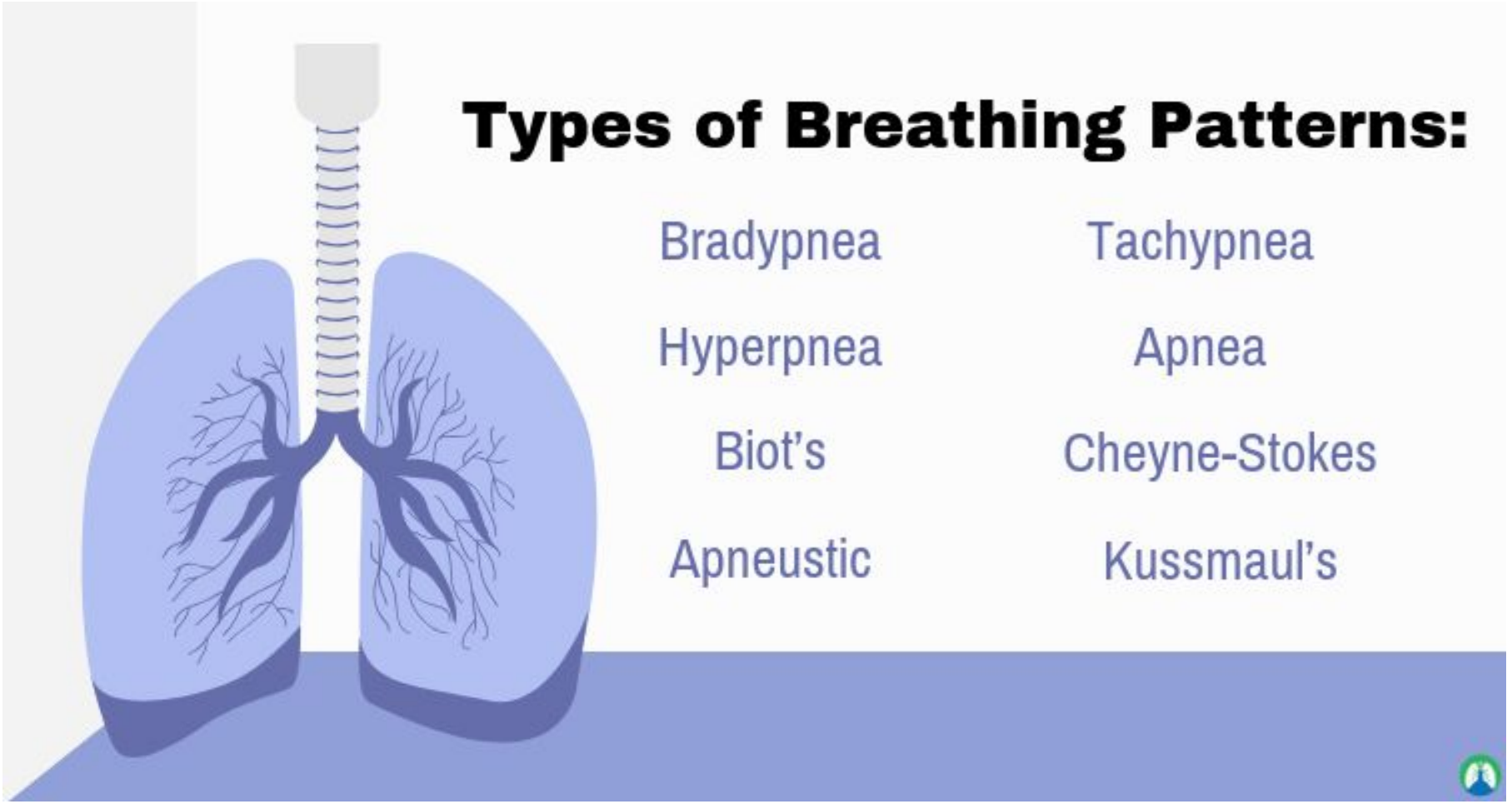
Abnormal and Irregular Patterns



What is a Breathing Pattern?

As humans, our breathing pattern is similar to our heartbeat in that we do not have to consciously think about it — it just occurs automatically. This response is generated by the medullary respiratory center in the brain.

Although this stimulus comes from the brain, there are quite a few conditions that can abnormal and irregular breathing patterns. We are going to talk about those below.


Types of Breathing Patterns:
Bradypnea
Tachypnea
Hyperpnea
Apnea
Biot's
Cheyne-Stokes
Apneustic
Kussmaul's

Breathing Pattern	Description	Associated Conditions
Eupnea	Normal breathing, including a normal respiratory rate (12 -20 breaths per minute), depth, and rhythm.	Normal, healthy people.
Tachypnea	Increased respiratory rate greater than 20 breaths per minute.	Hypoxemia, respiratory distress, fever, pain, anxiety.
Bradypnea	Decreased respiratory rate less than 12 breaths per minute.	Sedation, alcohol, fatigue, drug overdose.
Apnea	No breathing.	Cardiac arrest, respiratory arrest, airway obstruction, drug overdose, sleep apnea.

Hyperpnea	Increased respiratory rate, rhythm, and depth of breathing.	CHF, metabolic or CNS disorders.
Cheyne-stokes	An abnormal breathing pattern with periods of progressively deeper breaths alternating with periods of shallow breathing and apnea.	Increased intracranial pressure, brain stem injuries.
Biot's	Breathing characterized by irregular periods of apnea alternating with periods in which four or five breaths of identical depth are taken. Similar to Cheyne-Stokes except that each breath has the SAME depth.	Increased intracranial pressure, meningitis.

Kussmaul's	Remember: DEEP and FAST. Increased respiratory rate and depth, with an irregular rhythm. This is a labored form of breathing that is usually associated with diabetic ketoacidosis.	Diabetic ketoacidosis, renal failure.
Apneustic	An abnormal pattern of breathing characterized by deep, gasping inspiration with a pause at full inspiration followed by a brief, insufficient release.	Head trauma, severe brain hypoxia, lack of blood flow to the brain.
Orthopnea	Difficulty breathing while lying down.	CHF, fluid overload, chronic lung disease.

Table 1. **Breathing patterns**

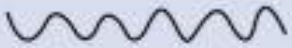
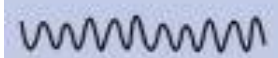
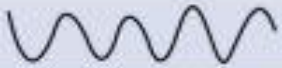
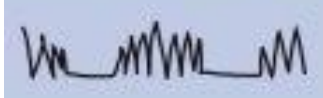
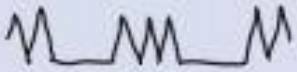
Pattern	Condition	Description
	Eupnoea	Normal breathing rate and pattern
	Tachypnoea	Increased respiratory rate
	Bradypnoea	Decreased respiratory rate
	Apnoea	Absence of breathing
	Hyperpnoea	Increased depth and rate of breathing
	Cheyne-Stokes	Gradual increases and decreases in respirations with periods of apnoea
	Biot's	Abnormal breathing pattern with groups/clusters of rapid respiration of equal depth and regular apnoea periods
	Kussmaul's	Tachypnoea and hyperpnoea
	Apneustic	Prolonged inspiratory phase with a prolonged expiratory phase

Table 2. **Causes of abnormal respiratory rate**

Observation	Respiratory changes	Possible causes
Chest symmetry	One side of the anterior chest moves more with normal tidal breaths than the other	• Unilateral consolidation • Pneumothorax • Pleural effusion • Fractured ribs (flail chest) • Blocked chest drain • Partial diaphragm paralysis • Sputum plugging
Paradoxical chest and abdominal movement	Chest moves in opposite direction to the abdomen during normal tidal breathing	• Neuromuscular disorder • Spinal injury • Diaphragmatic paralysis
Rapid and increased depth of breathing	Tachypnoea and deep inspiratory breaths	• Metabolic acidosis such as diabetic ketoacidosis (Kussmaul's breathing) or renal failure • Sepsis • After exercise
Rapid and shallow depth of breathing	Tachypnoea and shallow inspiratory breath	• Chest pain • Abdominal pain • Fractured ribs (pain) • Sleep-disordered breathing pattern • Cerebral lesion • Shock • Anxiety/stress • Medication
Slow and increased depth of breathing	Bradypnoea with deep tidal breath, for example: • Apneustic breathing • Cheyne-Stokes respirations • Biot's respiration	• Brainstem lesion, impending death • Damage to the pons (respiratory centre in the brainstem that controls breathing) • Congestive heart failure, neurological insult (after, for example, a stroke) • Elevated intracranial pressure, for example, meningitis • Sleep apnoea
Slow and shallow depth of breathing	Bradypnoea with shallow tidal breath	• Neuromuscular disorders • Opioid toxicity • Hypopnoea (a partial blockage of the airway resulting in airflow reduction of >50% for ≥10 seconds) • Hypothyroidism