

Adventitious Sounds

Adventitious sounds refer to sounds that are heard in addition to the expected breath sounds mentioned above. The most commonly heard adventitious sounds include crackles, rhonchi, and wheezes. Stridor and rubs will also be discussed here. There are *many* other terms that are used to describe adventitious sounds, which are too numerous to cover. These terms are generally redundant with, or sub-categories of, the ones noted below. For instance, crackles and rales refer to the same finding; many terms are used interchangeably and vary by the clinician and geographic location of the practice.

The first trait that assists in the classification of adventitious sounds is whether the sounds are continuous or intermittent. For example, rhonchi and wheezes are continuous sounds whereas crackles are not. Crackles could be counted by the examiner as discrete acoustic events [$<25\text{ms}$, interrupted, like dropping a marble on the floor], whereas rhonchi and wheezes are somewhat inseparable noise [$>250\text{ms}$, constant, like the whirring of a fan]. The next thing to note is the pitch: wheezes and fine crackles are high pitched, whereas rhonchi and coarse crackles are low pitched.

Crackles are generated by small airways snapping open on inspiration.[2] Therefore, they are predominantly inspiratory. The difference between the coarse and fine crackles is believed to come from the size of the airway snapping open (larger airways, deeper pitched, coarser crackles). Some have compared to separating hook-and-loop fasteners (e.g., velcro).

Wheezes and rhonchi, which have the same pathology and are separated only by pitch, are produced by the fluttering of narrowed airways and the air that flows through them.[3] Wheezes are musical sounds caused by air movement through constricted small airways, such as bronchioles. Rhonchi are coarse, loud sounds caused by constricted larger airways, including the tracheobronchial passages. These sounds occur during expiration, or both inspiration and expiration, but they do not occur in inspiration alone. Interestingly, physicians often agree on auscultation of wheezing, but less so for other findings, such as crackles.[4]

Stridor is a high-pitched sound originating from the upper airway and occurring on inspiration. It is distinguished from other sounds by its intensity in the neck more so than the chest, timing (inspiratory), and pitch (high). Like wheezes, stridor is produced by airway narrowing, but only in the upper airways.

A rub is a grating sound coming from inflamed pleura rubbing against one another. It is usually louder than other lung sounds due to its generation closer to the chest wall. Rubs usually occur during both inspiration and expiration at a mirrored point in the respiratory cycle.[5] Rubs are most often confused with crackles but are distinguished by the rub's biphasic, localized quality, often with overlying point pain on the chest wall.

Using a stethoscope, YOU may hear normal breathing sounds, decreased or absent breath sounds, and abnormal breath sounds.

Absent or decreased sounds can mean:

- Air or fluid in or around the lungs (such as pneumonia, heart failure, and pleural effusion)
- Increased thickness of the chest wall
- Over-inflation of a part of the lungs (emphysema can cause this)
- Reduced airflow to part of the lungs

There are several types of abnormal breath sounds. The 4 most common are:

- Rales. Small clicking, bubbling, or rattling sounds in the lungs. They are heard when a person breathes in (inhales). They are believed to occur when air opens closed air spaces. Rales can be further described as moist, dry, fine, or coarse.
- Rhonchi. Sounds that resemble snoring. They occur when air is blocked or air flow becomes rough through the large airways.
- Stridor. Wheeze-like sound heard when a person breathes. Usually it is due to a blockage of airflow in the windpipe (trachea) or in the back of the throat.
- Wheezing. High-pitched sounds produced by narrowed airways. Wheezing and other abnormal sounds can sometimes be heard without a stethoscope.

Respiratory

Sound	Mechanisms	Origin	Acoustics	Relevance
Basic Sounds				
Normal lung sound (<i>vesicular</i>)	Turbulent flow vortices, unknown mechanisms	Central airways (expiration), lobar to segmental airway (inspiration)	Low-pass filtered noise (range <100 to 1000 Hz)	Regional ventilation, airway caliber
Normal tracheal sound (<i>tubular</i>)	Turbulent flow, flow impinging on airway walls	Pharynx, larynx, trachea, large airways	Noise with resonances (range <100 to >3000 Hz)	Upper airway configuration
Adventitious Sounds				
Wheeze	Airway wall flutter, vortex shedding	Central and lower airways	Sinusoid (range ~100 to >1000 Hz; duration, typically >80 ms)	Airway obstruction, flow limitation
Rhonchus	Rupture of fluid films, airway wall vibrations	Large airways	Series of rapidly dampened sinusoids (typically <300 Hz and duration >100 ms)	Secretions, abnormal airway collapsibility
Crackle	Airway wall stress-relaxation	Central and lower airways	Rapidly dampened wave deflection (typical duration <20 ms)	Airway closure, secretions

*This table lists only the major categories of respiratory sounds and does not include other sounds, such as squawks, friction rubs, grunting, snoring, or cough. Current concepts about sound mechanisms and origin are listed, but these concepts may be incomplete and unconfirmed.

(Adapted from Pasterkamp H, et al: Respiratory sounds. Am J Respir Crit Care Med 156: 974-987, 1997.)