

# The respiratory system

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Clinical examination

- Respiratory symptoms
- Past medical history/family history/  
smoking
- Clinical examination:
  - Inspection
  - Palpation
  - Percussion
  - Auscultation

# Auscultation

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- **Auscultation of the lungs is the most important examining technique for assessing air flow through the tracheo-bronchial tree.**
- **Together with percussion, it also helps the clinician to assess the condition of the surrounding lungs and pleural space.**
- **The stethoscope usually has two heads: the bell and the diaphragm.**
- **The bell is used to detect low-pitched sounds, and the diaphragm is better at detecting higher pitched sounds.**

- **The bell must be applied loosely to the skin; if it is pressed too tightly, the skin acts as a diaphragm, and the lower pitched sounds are filtered out.**
- **In contrast, the diaphragm is applied firmly to the skin.**
- **It is never acceptable to listen through clothing.**
- **The bell or the diaphragm of the stethoscope must always be in contact with the skin.**

## ○ Auscultation involves:

- listening to the sounds generated by **breathing**
- listening for any **adventitious (added) sounds**, and
- if abnormalities are suspected, listening to the sounds of the patient's spoken or whispered voice as they are transmitted through the chest wall, **vocal resonance**.

# Technique of auscultation

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- **Auscultation should be performed in a quiet environment.**
- **Because most breath sounds are high-pitched, the diaphragm is used to evaluate lung sounds.**
- **Ask the patient to take deep breaths in and out through the mouth.**
- **Listen to both inspiration and expiration.**
- **Listen over the same areas percussed, comparing left to right. If an abnormality is found, examine more carefully and define borders.**
- **Listen for the breath sounds and any added sounds, and note at which point in the respiratory cycle they occur.**

# Breath Sounds (Lung Sounds)

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## ○ Normal Vesicular :

- **Produced by airflow in the large airways and larynx and altered by passage through the small airways before reaching the stethoscope.**
- **Often described as “rustling”.**
- **Heard especially well in inspiration and early expiration.**
- **Heard over most of both lungs.**

# Pathological changes

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## ○ **Reduced or absent vesicular sound:**

- **when air flow is decreased (as by obstructive lung disease or muscular weakness) or**
- **when the transmission of sound is poor (as in pleural effusion, pneumothorax, or emphysema).**

## ● **Global:**

- **COPD or asthma (the “silent chest” is a sign of a life threatening asthma-attack).**

## ● **Local:**

- **nasal polyps**
- **diphtheria**
- **laryngeal spasm**
- **pleural effusion**
- **tumour**
- **pneumothorax**
- **pneumonia**
- **lung collapse.**

## ○ **Increased vesicular sound:**

- **Hyperventilation (after exercise, compensatory hyperventilation)**
- **Narrowing of the tracheobronchial tree (bronchitis, asthma, COPD)**

# Bronchial breathing

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- It is caused by an increased density of matter in the peripheral lung allowing sound from the larynx to the stethoscope unchanged.
- Has a “hollow, blowing” quality, heard equally in inspiration and expiration, often with a brief pause between.
- A similar sound can be heard **by listening over the trachea** in the neck and sometimes normally in the **right intervertebro-scapular area**.

○ **Pathological conditions** in which it can be heard (air-filled lung has been replaced by fluid-filled or solid lung tissue ).

- **Consolidation (lobar pneumonia, pulmonary infarction)**
- **Lung abscess at the chest wall and dense fibrosis.**
- **The upper border of a pleural effusion.**
- **Caverna if is large, superficial communicating with bronchus**
- **Compressive atelectasis**

# Adventitious (Added) Sounds

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- ◉ Listen for any added, or adventitious, sounds that are superimposed on the usual breath sounds.
- ◉ Detection of adventitious **sounds—crackles (sometimes called rales), wheezes, rhonchi, rub** - is an important part of your examination, often leading to diagnosis of cardiac and pulmonary conditions.

# **CRACKLES, CREPITATIONS OR RALES**

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- **They are intermittent, brief, discontinuous nonmusical sounds.**
- **They are caused by air entering collapsed airways and alveoli producing an opening snap.**
- **Heard in inspiration.**

○ **Fine crackles** are soft, high pitched, and very brief (5–10 msec) occur later in inspiration. The sound can be reproduced by rolling the hair at your temples between the thumb and forefinger.

○ **Coarse crackles** are somewhat louder, lower in pitch, and not quite so brief (20–30 msec). They are made by larger airways opening and sound like the snap and pop of a certain breakfast cereal.

## ○ Crackles have **two leading explanations**

- They result from a series of tiny explosions when **small airways, deflated during expiration, pop open during inspiration.**
  - This mechanism probably explains the late inspiratory crackles of **interstitial lung disease and early congestive heart failure.**
- Crackles result from **air bubbles flowing through secretions or lightly closed airways during respiration.**
  - This mechanism probably explains at least some coarse crackles.

- **Crackles are often a normal finding at the lung bases.**
- **They can also occur after prolonged recumbency in dependent portions of the lungs . If so, they will clear after asking the patient to cough.**
- **Crackles may be due to abnormalities of the lungs (pneumonia, fibrosis, early congestive heart failure) or of the airways (bronchitis, bronchiectasis).**

○ **Late inspiratory crackles** may begin in the first half of inspiration but must continue into late inspiration.

- They are usually fine and fairly profuse, and persist from breath to breath.
- These crackles appear first at the bases of the lungs, spread upward as the condition worsens, and shift to dependent regions with changes in posture.
- **Causes** include:
  - interstitial lung disease (such as fibrosis)
  - early congestive heart failure.

• **Early inspiratory crackles** appear soon after the start of inspiration and do not continue into late inspiration.

- They are often but not always coarse and are relatively few in number.
- Expiratory crackles are sometimes associated.
- Causes include **chronic bronchitis and asthma**.

• **Midinspiratory and expiratory crackles** are heard in **bronchiectasis** but are not specific for this diagnosis.

- Usually they are heard constantly in the same lung area.
- Wheezes and rhonchi may be associated.

# WHEEZES AND RHONCHI

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- They are **continuous** sounds > 250 msec, notably longer than crackles, but do not necessarily persist throughout the respiratory cycle.
- They are **musical whistling** sounds caused by narrowed airways, often audible at the mouth as well as through the chest wall.
- Heard easier in **expiration**.
- **Wheezes** are relatively **high pitched** (around 400 Hz or higher) and have a hissing or shrill quality.
- They suggest **narrowed airways**
- This narrowing may be caused by swelling, secretions, spasm, tumor, or foreign body.
- Most frequently are heard in asthma, COPD, or bronchitis, cardiac asthma and are generalized throughout the chest.

- Different calibre airways = different pitch note
- Asthma and COPD can cause a chorus of notes termed **“polyphonic wheeze”**.
- A partial obstruction of a bronchus, as by a tumor or foreign body causes **“monophonic”** persistent **localized wheeze**.
- It may be inspiratory, expiratory, or both.
- A **wheeze** that is entirely or predominantly **inspiratory** is called **stridor**. It is often louder in the neck than over the chest wall. It indicates a **partial obstruction of the larynx or trachea, and demands immediate attention**.

- **Rhonchi** are relatively **low pitched** (around 200 Hz or lower) and have a snoring quality.
- They are produced by transient mucus plugging and poor movement of airway secretions.
- They suggest **secretions in large airways**.
- Clearing of crackles, wheezes, or rhonchi after cough suggests that secretions caused them, as in bronchitis or atelectasis.
- **PLEURAL RUB:**  
Creaking sound likened to the bending of new leather or the **creak of a footstep in fresh snow**.
- Caused by inflamed pleural surfaces rubbing against each other.

- Is usually confined to a **relatively small area** of the chest wall, and typically is heard in **both phases of respiration, usually at the end of inspiration and at the beginning of expiration.**
- When inflamed pleural surfaces are separated by fluid, the rub often disappears.

## **Transmitted Voice Sounds.**

- **If abnormalities are suspected, listening to the sounds of the patient's spoken or whispered voice as they are transmitted through the chest wall, **vocal resonance.****
- **With a stethoscope, listen in symmetric areas over the chest wall as you:**
- **Ask the patient to say "ninety-nine."**
  - Normally the sounds transmitted through the chest wall are muffled and indistinct.
- **Increased transmission of voice sounds suggests that air-filled lung has become airless.**

- Louder, clearer voice sounds are called **bronchophony**.
- Ask the patient to **say “ee.”** You will normally hear a muffled long E sound. When “ee” is heard as “ay,” an E-to-A change (**egophony**) is present, as in **lobar consolidation** from pneumonia. The quality sounds nasal.
- Ask the patient to whisper “ninety-nine” or “one-two-three.” The whispered voice is normally heard faintly and indistinctly, if at all.
- Louder, clearer whispered sounds are called **whispered pectoriloquy**, and they appear in **the presence of consolidation of the lung**.

- **One of the most important principles concerning the examination of the chest is to correlate the findings of percussion, palpation, and auscultation.**