Practical Guide to Pulmonary Examination
(Lung Exam)

See online here

The clinical examination of the lungs is important for every patient anamnesis done in internal medicine. As a pulmonologist, your main focus will be on studying and examining the lungs. A dependable strategy to be followed during examinations enables routine work, helps to stay on top of things, and prevents a physician from forgetting anything during daily clinical practice. E.g., what is auscultated in case of pneumothorax or pleural effusion? What are the different shapes of the thorax? How can tuberculosis be recognized from examining the patient's skin? Below you will find a checklist to be used during your practical work and oral exams!

General Observation of the Patient

1. Does the patient look systematically unwell? Do they have a fever?
2. What is their level of consciousness?
3. Do they have difficulty in breathing at rest? Look for:
   - Abnormal breathing patterns
   - Use of accessory muscles
   - Pursed lip breathing
   - Intercostal recession
4. Any visible chest wall/ general abnormalities?

**Some abnormal types of breathing patterns**

**Prolonged expiratory phase** — indicates airways obstruction

**Cheyne-Stokes breathing** — alternating slow/fast respiratory rate occurs in pulmonary edema and brain stem lesions

**Kussmaul** — rapid sighing respiration caused by metabolic acidosis

**Irregular breathing pattern** — indicative of imminent cardiorespiratory arrest

**Audible stridor** — an inspiratory wheeze suggesting significant major airways obstruction

**Excess abdominal movements on inspiration** — occurs in chronic obstructive pulmonary disease (COPD)

**Paradoxical abdominal movements** — indrawing of the abdomen on inspiration, indicates diaphragmatic weakness

**Some visible general/ chest wall abnormalities**

**Cachexia** — occurs in cancer, severe COPD, and chronic infection

**Obesity** — increased risk of asthma, obstructive sleep apnoea, obesity, and hypoventilation

**Shrunken lung** — visibly smaller hemithorax and flattening of the upper anterior chest

**Surgical scars** — thoracotomy, pleural drains, mediastinoscopy, and sternotomy

**Hyperexpanded chest** — severe airways obstruction: increased anterior/posterior diameter and horizontal ribs

**Kyphoscoliosis** — anterior and lateral curvature of the spine, affects the mechanics of ventilation

**Chest wall masses** — lipomas are common; tumors can occasionally erode

**Inspection**

The following can be studied just by looking at a patient:

- Tachypnea (> 20/min), stridor, coughing, hoarseness, and dyspnea.
- Breathing pattern: Kussmaul-breathing, Cheyne-Strokes breathing, and Biot breathing.
- Accessory respiratory muscles and withdrawal
- The symmetry of the thorax.
- The shape of the thorax: barrel chest, kyphoscoliosis, gibbus, pectus excavatum, and pectus carinatum
Respiratory abnormalities — abnormal breathing patterns that can help diagnose or discover the underlying cause of pathological breathing.

**Normal respiration**

**Biot’s respiration**
aka atactic respiration
- Periodic breathing: hyperpnoea (or normopnoea) and apnoea
- Poor prognosis
- Neuron damage

**Kussmaul breathing**
- Metabolic acidosis (Diabetes mellitus)
- Hyperpnoea
K = Ketones (Diabetic ketoacidosis)
U = Uremia
S = Sepsis
S = Salicylates
M = Methanol
A = Aldehydes
L = Lactic acid/lactic acidosis

**Cheyne-Stokes respiration**
- Periodic breathing: Gradual hypopnoea/hypopnoea and Apnoea
- Sleep/Hypoxemia/Drugs
- Hypoperfusion of the brain (respiratory center)

Image: ‘Respiratory abnormalities — abnormal breathing patterns that can help diagnose or discover the underlying cause of pathological breathing.’ By Sav vas. License: CC BY-SA 3.0

**Palpation**
- Is the trachea in the middle?
- Spinal column/ribs: pain upon percussion, fracture, Tietze syndrome, and rachitis
- Skin emphysema
- Symmetric excursion
Pain upon compression

What was that again…?

**Vocal fremitus:** Place your hands laterally on the thorax of the patient and ask him/her to say the number “99” (loud and resounding). Palpable vibrations during the infiltration of the lung (pneumonia, bronchiectasis, and pulmonary congestion) are pathologically intensified. A weakened fremitus can be felt in cases where air or liquids are trapped in the pleural cavity (pneumothorax, pleural effusion).

**Percussion**

1. The poor technique (e.g., raised finger of the chest wall)
2. Pleural effusion — classically very dull and described as “stony dull”
3. Lobar/total lung collapse
4. Previous pneumonectomy or lobectomy
5. Extensive consolidation due to pneumonia
6. Pleural thickening/mesothelioma
7. Obesity (relative, falsely dull)
8. Raised hemidiaphragm (due to loss of lung volume or phrenic palsy)
9. Normally over the liver and heart

**Quality of percussion sound:**

<table>
<thead>
<tr>
<th>Hyper Sonor</th>
<th>emphysema, pneumothorax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonor</td>
<td>normal, bronchitis, central pneumonia, pulmonary edema</td>
</tr>
<tr>
<td>Hypo Sonor</td>
<td>pleural effusion, infiltrate, tumor, pleural</td>
</tr>
</tbody>
</table>

**Auscultation**

- Respiratory sounds: tracheal, bronchial, bronchovesicular, and vesicular (normal findings are known from many clinical reports: vesicular respiratory sounds)
- Weakened/missing respiratory sounds: emphysema, status asthmaticus, pneumothorax, effusion, pleural fibrosis, and tumor
- Bronchial breath sounds: consolidation (in case of pneumonia, hemorrhages, and edema)
- Pleural rub (pleuritis)

**Adventitious breath sounds:**

- Continuous wheezing and humming
- Discontinuous: **Fine bubbling rales** are usually of high frequency and occur due to an opening of the small airways – pulmonary fibrosis or beginning lung edema. **Coarse bubble rales** are usually of low frequency and occur due to trapped liquid in the small airways: bronchitis or lung edema
- **Bronchophony:** Examination of the forwarding of higher tones. Ask your patient to say the number “66” in a high (slightly hissing) voice. The number can be heard better via infiltrated areas (pneumonia) due to better forwarding. In the case of pneumothorax or pleural effusion, you might hear little or nothing at all!

**Inspiratory/expiratory breath sounds**
The ratio of inspiration to expiration on breathing
- Normally inspiration is slightly longer than the expiration

Breath sounds — added sounds and their common causes

<table>
<thead>
<tr>
<th>Speed of onset</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crepitations</td>
<td>Consolidation due to pneumonia (asymmetric, coarse)</td>
</tr>
<tr>
<td></td>
<td>Pulmonary fibrosis and other interstitial lung diseases (fine)</td>
</tr>
<tr>
<td></td>
<td>Pulmonary edema (fine)</td>
</tr>
<tr>
<td></td>
<td>Bronchiectasis (coarse)</td>
</tr>
<tr>
<td>Wheeze</td>
<td>Asthma exacerbation</td>
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<tr>
<td></td>
<td>COPD</td>
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<tr>
<td></td>
<td>Bronchiectasis</td>
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<tr>
<td></td>
<td>Partial obstruction of a major bronchus (monophonic)</td>
</tr>
<tr>
<td></td>
<td>Pulmonary edema ('cardiac asthma')</td>
</tr>
<tr>
<td></td>
<td>Upper airways obstruction (inspiratory – stridor)</td>
</tr>
<tr>
<td>Pleural rub</td>
<td>Pleural infection</td>
</tr>
<tr>
<td></td>
<td>Overconsolidated lung in pneumonia</td>
</tr>
<tr>
<td></td>
<td>Pulmonary embolism</td>
</tr>
<tr>
<td></td>
<td>Other inflammatory effusions, e.g., Dressler’s syndrome</td>
</tr>
<tr>
<td></td>
<td>Recently drained pleural effusions</td>
</tr>
</tbody>
</table>

Systemic Examination

The lung is not the only organ that can give indications of pulmonary diseases.

**Hands:** The typical signs of chronic hypoxia are Hippocratic fingers and Hippocratic nails. Pay attention to venous filling and the heart rate!
Head: Color reveals a lot: Anemia, jaundice, cyanosis of the lips? How do the veins on the base of the tongue and the buccal mucosa look like?

Extremities: Sarcoidosis or hypertrophic osteoarthropathy are examples of diseases that can present symptoms of frequent pulmonary manifestation in other parts of the body. Are there signs of thrombosis on the lower leg? >> lung embolism. Edema would be a sign of right ventricular insufficiency with a backlog of blood and other problems with the lungs.

Skin:
- Erythema multiforme: *Mycoplasma pneumoniae*
- Erythema nodosum: tuberculosis, sarcoidosis and histoplasmosis
- Purpura: vasculitis
- Lupus pernio: sarcoidosis
- Lupus vulgaris: tuberculosis

For the Pocket in your Doctor’s Coat: Everything Important at One Glance

<table>
<thead>
<tr>
<th>Disease</th>
<th>Inspection</th>
<th>Palpation</th>
<th>Percussion</th>
<th>Auscultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status asthmaticus</td>
<td>Hyperinflation, auxiliary respiratory muscles</td>
<td>Fremitus</td>
<td>Hyperresonant, depression of the diaphragm</td>
<td>Expiration, wheezes</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>Excursion</td>
<td>Fremitus, shift of the trachea to the healthy side</td>
<td>Hyperresonant</td>
<td>Faint/no respiratory sound</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>Excursion</td>
<td>Fremitus, shift of the trachea to the healthy side</td>
<td>Damped</td>
<td>Faint respiratory sound</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>Excursion</td>
<td>Fremitus, shift of the trachea to the diseased side</td>
<td>Damped</td>
<td>Faint respiratory sound</td>
</tr>
<tr>
<td>Consolidation</td>
<td>Excursion</td>
<td>Fremitus</td>
<td>Damped</td>
<td>Bronchial breath sounds, bronchophony</td>
</tr>
</tbody>
</table>
Fixed airway obstruction — COPD

**Observation**

- Increased respiratory rate
- Using accessory muscles: sternocleidomastoids, trapezius, etc.
- Excessive abdominal movement on inspiration
- Pursed lip breathing

**Auscultation throughout both lungs**

- Quiet breath sounds
- Prolonged expiratory phase
- +/- expiratory wheeze

**Hyperexpanded lungs (hyperexpansion)**

- Horizontal angle to the ribs
- ‘Barrel chest’: increased anterior-posterior diameter
- Tracheal lung
- Bilateral reduced chest expansion

Trachea central

**Percussion note:** resonant over liver and heart and below T10

**Severe disease:** central cyanosis, evidence of *cor pulmonale*

**References**


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Notes