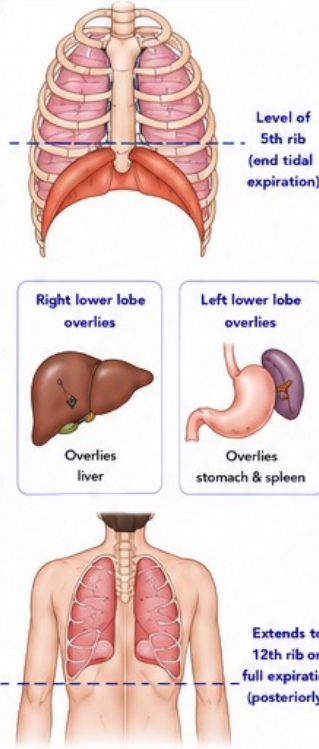


RESPIRATORY TRACT SYSTEM – CHAPTER 5

ANATOMY & PHYSIOLOGY – KEY POINTS

- At the end of tidal expiration, the dome of the diaphragm ascends high in the thorax at the level with the inferior end of the 5th rib, and is slightly lower on the left side.
- The lower lobes overlie the liver on the right, and on the left overlie the stomach and spleen.
- The parietal pleura extends lower than the lungs along the lateral chest wall.
- Posteriorly, the lungs extend much lower; posteriorly they extend to the 12th rib on full expiration.
- The apex lies beneath the brachial plexus. Any apical tumor may:
 - Disrupt T1 → pain, numbness in the inner aspect of the upper arm, wasting of the small hand muscles.
 - Compromise upper thoracic sympathetic outflow to the eye → constricted pupil, ptosis, anhidrosis (Horner syndrome).
- Mid and lower mediastinal tumors may invade or compromise the pericardium, atria, and esophagus.
- To optimize gas exchange in lungs, we must match regional ventilation with perfusion. Airway and parenchymal diseases disrupt this matching → hypoxia and cyanosis.
- This stimulates breathing via afferent neurons → breathlessness and tachypnea on examination.



COMMON PRESENTING SYMPTOMS – RESPIRATORY

1) BREATHLESSNESS (DYSPNEA)

Breathlessness (dyspnea) is the uncomfortable need to breathe. Dys = difficulty, pnea = breathing.

- Hard to quantify: generally subjective.
- Multiple non-respiratory causes: cardiac, anemia, psychological, etc.

Mechanism (in respiratory disease):

- Stimulates intrapulmonary afferent neurons by:
 - Interstitial inflammation or thromboembolism
 - Mechanical loading of respiratory muscles (airflow obstruction)
 - Reduced compliance of lungs (fibrosis)
 - Hypoxia due to V/Q mismatch
- Leads to breathlessness and tachypnea on examination.

MRC BREATHLESSNESS SCALE

- Breathless only on strenuous exercise
- Breathless when hurrying on the level or walking up a slight hill
- Walks slower than people of the same age on the level, or stops for breath after walking 15 minutes / 1 mile
- Stops for breath after walking about 100 yards (≈ 90 m)
- Too breathless to dress or leave the house

QUESTIONS TO ASK – BREATHLESSNESS (Use SOC RATES – skip non-applicable)

- Onset**
When did it start? How did it start? (Instant / hours / insidious)
- Timing**
 - Wakes up at night? (Asthma)
 - Sleeps through it? (COPD)
 - Orthopnea / needs pillows? (Heart failure)
 - Variation during day? Episodic or continuous?
 - Variable: Asthma
 - Continuous: ILD or COPD
- Exacerbating factors**
What brings it on? (e.g., walking, exertion)
- Associated symptoms / Relieving factors**
Anything that relieves it? (coughing, rest, inhalers, position?)
Angina? Fever? Leg swelling?
- Onset details**
What were you doing when it started?
- Something else**
"I can't get enough air" with normal vitals may suggest psychological etiology.

2) WHEEZING

High-pitched musical sound produced by turbulent airflow through the small airways during expiration (from constriction + inflammation / secretions).

- Different from stridor (inspiratory, upper airway).
- Patient may be unaware of nocturnal wheeze (noticed by bed partner).

QUESTIONS TO ASK – WHEEZING

- Onset**
- Associated symptoms**
(fever / allergies / atopy?)
- Timing**
 - During or after exercise? (Asthma)
 - At night?
 - Worse on waking? Relieved by clearing sputum? (COPD / bronchitis)
- Exacerbating factors**
(Allergens? Cold air? Exercise?)
- Relieving factors**
(Inhalers? Rest? Coughing up sputum?)

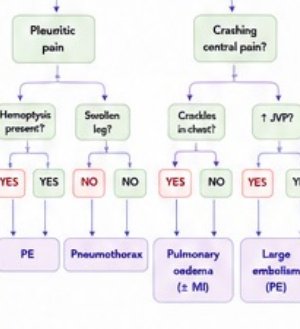
BREATHLESSNESS – DIAGNOSTIC APPROACH

A. ACUTE BREATHLESSNESS

1) INSTANT (Sudden onset)

Think: PE / Pneumothorax / Pulmonary oedema / Large embolism

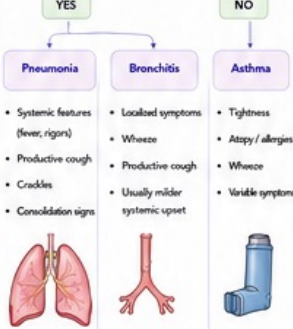
Ask: Type of pain?



2) HOURS – TO DAYS

Think: Pneumonia / Bronchitis / Asthma

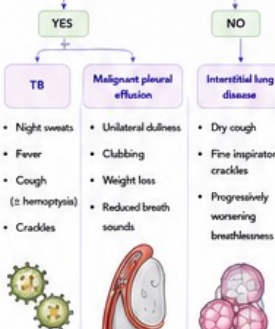
Ask: Fever? Green sputum?



3) INSIDIOUS (Weeks)

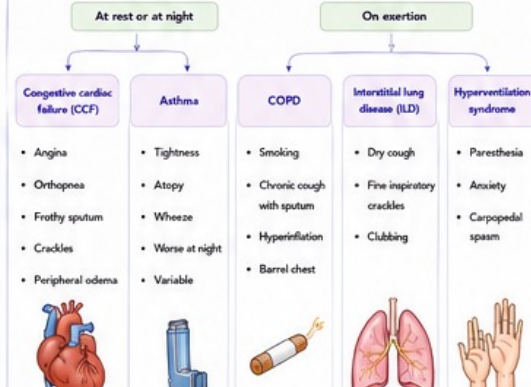
Think: TB / Malignant pleural effusion / Interstitial lung disease

Ask: Weight loss?



B. CHRONIC BREATHLESSNESS (≥ 3 months)

First: Occurs at rest / at night OR on exertion?



COUGH

A reflex that evolved to dislodge any foreign material that reaches the central airways.

- Inspiration
- Expiratory effort against closed glottis
- Sudden opening of glottis



- 1–2 weeks: most commonly acute viral bronchitis.
- > 3 weeks: consider other underlying respiratory diseases.

QUESTIONS TO ASK – COUGH (Use SOC RATES)

- S** Site: Where do you feel it? (throat / chest)
- O** Onset: When did it start? How did it start?
- C** Character: Dry / productive? Nature of cough?
- R** Radiation: Any spread? (usually N/A)
- A** Associated symptoms: Sputum? Hemoptysis? Fever? Weight loss? Wheeze? Dyspnea? Nasal symptoms? Heartburn?
- T** Timing: Day / night? Episodic or continuous? Worse on waking? Seasonal variation?
- E** Exacerbating factors: Smoking? Exercise? Cold air? Lying down? Eating? Talking?
- S** Something relieves it? Clearing sputum? Inhalers? Position? Medication?

SPUTUM – ASK ABOUT

- Quantity (scanty / copious)
- Color (clear, white, yellow, green, rust, blood-stained)
- Consistency (thin, thick, frothy, purulent)
- Taste / odor
- Presence of blood (hemoptysis)



Relieved by clearing it out? Often suggests infection.

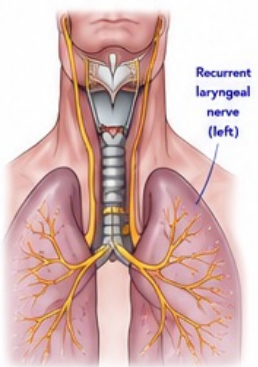


CAUSES OF CHRONIC COUGH

Cause	Key features	Clues / Keywords
Asthma (esp. in children)	Wakes at night, atopy, wheeze, tightness	Atopy, nocturnal, wheeze, tightness
COPD (chronic bronchitis)	Smoking, intermittent sputum, exertional dyspnea	Smoker, chronic productive cough
Acute bronchitis	Recent infection, productive cough	Recent URTI, sputum
Bronchiectasis	Chronic productive cough, purulent sputum	Recurrent infections, purulent sputum
Whooping cough	Paroxysmal cough with "whoop", post-tussive vomiting	Prolonged cough, children
Lung cancer	Hemoptysis, smoker, persistent cough	Smoker, hemoptysis, persistent
Pneumonia not cleared	Cough persists > 4–6 weeks	Inadequate treatment / compic, pneumonia
Post-nasal drip (upper airway cough syndrome)	Nasal blockage, sneezing, secretions at back of throat	Nasal symptoms, throat clearing
Gastroesophageal reflux (GERD)	Acid reflux, heartburn (after eating), worse when lying or bending	Acid taste, nocturnal / daytime cough
Drug effects	ACE inhibitors	Dry cough after starting ACEI
Interstitial lung disease	Dry cough, fine inspiratory crackles	Fine crackles, progressive dyspnea
Idiopathic cough	By exclusion	No cause found after evaluation

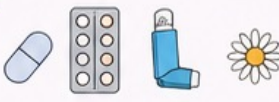
SPECIAL CLINICAL POINT

In patients with malignancy at the left hilum, this may damage the recurrent laryngeal nerve → paralysis of the left vocal cord → hoarse, forced expiration.



This is called:
BOVINE COUGH

1. PAST MEDICAL HISTORY – CLUES TO RESPIRATORY DISEASE		
History	Current implications	
 Eczema, hay fever	Allergic tendency relevant to asthma	
 Childhood asthma	Many wheezy children do not have asthma as adults, yet many adults with asthma had childhood wheeze	
 Whooping cough, inhaled foreign body, measles	Recognised causes of bronchiectasis, especially if complicated by pneumonia	
 Pneumonia, pleurisy	Recurrent episodes may be a manifestation of bronchiectasis. Some pneumonias may cause bronchiectasis	
 Tuberculosis (TB)	Reactivation if not previously treated effectively Post-tuberculous bronchiectasis - sputum, haemoptysis. Aspergilloma in lung cavity may present with haemoptysis	
 Connective tissue disorders, e.g., rheumatoid arthritis	Many have respiratory manifestations, e.g., pulmonary fibrosis, effusions, bronchiectasis. Immunomodulatory treatments for rheumatic diseases may cause pulmonary toxicity and make patients susceptible to respiratory infection	
 Previous malignancy	Recurrence, metastatic/pleural disease Chemotherapy can cause pulmonary fibrosis (e.g., bleomycin) Radiotherapy-induced pulmonary	
 Cancer, recent travel, surgery or immobility	Pulmonary thromboembolism (PE)	
 Recent surgery or loss of consciousness	Aspiration of foreign body or gastric contents leading to pneumonia, lung abscess	
 Neuromuscular disorders	Respiratory failure and aspiration	

2. DRUG & ALLERGY HISTORY		
All drugs should be noted: inhalers, nebulizer therapy, domiciliary oxygen, non-prescriptive remedies, and recreational drugs.		
DRUGS THAT CAN CAUSE RESPIRATORY PROBLEMS		
Respiratory Problem	Drugs / Agents	Examples
Bronchoconstriction 	Analgesics Beta blockers	NSAIDs, opioids (e.g., ibuprofen, aspirin, codeine) Non-selective beta blockers (e.g. propranolol)
Cough 	ACE inhibitors	ACEIs (e.g. enalapril, lisinopril)
Bronchiolitis obliterans 	Penicillamine	Penicillamine
Diffuse parenchymal lung disease 	Cytotoxic Anti-rheumatic Cardiovascular Antibiotics	Methotrexate, bleomycin Sulfasalazine, penicillamine, aspirin Amiodarone, hydralazine Nitrofurantoin
Pulmonary embolism (PE) 	Estrogens	Oral contraceptives, Hormone replacement therapy
Pulmonary hypertension 	Estrogens Imidazoline derivatives	Estrogens Dexfenfluramine, fenfluramine
Pleural effusion 	Cardiac Antibiotics Seizure meds Cytotoxic Others	Amiodarone Nitrofurantoin Phenytoin Methotrexate Pergolide
Respiratory depression 	Psychological meds	Opioids, benzodiazepines
Tuberculosis (reactivation) 	Immunosuppressants	Glucocorticoids, anti-rheumatic drugs, biological immunomodulators
3. ALLERGY HISTORY		
Ask about drug allergies (e.g., β-lactams), aspirin sensitivity (may cause bronchospasm), and environmental allergies (hay fever, eczema) that increase risk of asthma.		
		

5. SOCIAL HISTORY	
 Passive smoking, burning biomass fuels → increase risk of bronchitis and COPD.	
 Domestic pets (birds), feathers, duvets, mold infestation → hypersensitivity pneumonitis or suboptimal asthma control.	
 Where you live (ground floor vs upper floors) affects accessibility and impact of respiratory disability.	
 Smoking – ask in detail - Cigarettes (tobacco) - Cannabis (may be without tobacco, e.g. bong) - Water pipes (shisha) – tobacco, cannabis, or flavored tobacco - E-cigarettes / vaping – increasingly common	

7. KEY EXPOSURE – QUICK MEMORY	
 Inhalation of organic antigens → Hypersensitivity pneumonitis (birds, droppings, feathers, metal working fluids, hay, mold)	
 Inhalation of inorganic dusts (asbestos, silica, coal, metals) → Pneumoconiosis	
 Organic bacteria (animals, sewage) → Pneumonia (e.g. S. pneumoniae, Q fever, psittacosis, leptospirosis)	
 Silica exposure (stone cutting) → COPD, TB, pneumoconiosis, lung cancer, connective tissue diseases	
 Coke dust exposure (coke oven workers) → COPD and lung cancer	
 Asbestos exposure (former ladders) → Pneumoconiosis, pleural disease, lung cancer	

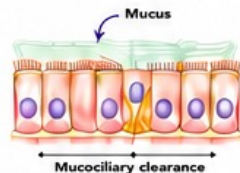
6. OCCUPATIONAL HISTORY – JOBS, TOXINS & RESPIRATORY DISEASES			
Respiratory Disease	Jobs / Occupations (Examples)	Toxic / Causative Agents	Key Points to Remember
 Asthma & Rhino-conjunctivitis	- Spray painters - Baking industry workers - Laboratory & veterinary workers - Joiners (carpenters) 	- Isocyanates (paints) - Flour, grain dust, enzymes - Animal urine, dander - Wood dust	Spray painter – isocyanates Baking – flour, grain, enzymes Vet/lab – animal urine, dander Joiners – wood dust
 COPD	- Welders - Underground miners - Stone cutters - Coke oven workers 	- Cadmium (fumes) - Coal dust - Silica dust - Coke dust	Think metals, fumes, dusts
 Byssinosis	Flax workers (textile industry) 	Cotton / flax dust	Also called “Monday fever”
 Pneumoconiosis	- Miners - Stone cutters - Asbestos workers - Iron / metal workers, welders - Tin miners / workers 	- Coal dust - Silica dust - Asbestos fibers - Iron / metal dust - Tin dust	Pneumoconiosis = diseases of the lung caused by inorganic (mineral) dusts
 Hypersensitivity pneumonitis	- Farmers - Grain workers - Mushroom pickers - Bird fanciers - Machinists (metal workers) 	- Bacteria (thermophilic) e.g. moldy hay / grain - Mushroom compost - Avian serum & excreta - Metal working fluids	Organic exposures – moldy, avian, microbes, metal working fluids
 Pneumonia	- Poultry workers - Dairy farmers - Abattoir workers - Sewage workers 	- Streptococcus pneumoniae - Coxiella burnetii (Q fever) - Chlamydia psittaci (psittacosis) - Leptospira	Think bacteria from animals, sewage
 Tuberculosis	- Stone cutters - Miners 	Silica dust	Silica exposure ↑ risk of TB (reactivation)
 Granulomatous disease	- Nuclear industry workers - Aerospace workers - Oil & gas workers 	Beryllium	Beryllium → granulomatosis
 Pleural disease	Former ladders (insulation workers) 	Asbestos	Asbestos → pleural plaques, effusion
 Lung cancer	- Former ladders (asbestos) - Stone cutters - Coke oven workers 	- Asbestos - Silica - Coke dust	Asbestos, silica, coke dust all increase lung cancer risk
 Connective tissue disorders	Stone cutters 	Silica dust	Silica → ↑ risk of CTDs (e.g. RA, SLE)
High-yield overlaps: Silica (stone cutting) → COPD, TB, pneumoconiosis, lung cancer, CTDs Coal dust: COPD, lung cancer Asbestos (former ladders) → pneumoconiosis, pleural disease, lung cancer			

8. SYSTEMATIC INQUIRY – DON'T MISS EXTRAPULMONARY CLUES		
 Morning headaches Could indicate elevated PaCO ₂ (hypercapnia).	 Dysphagia May follow stroke and increase the risk of aspiration pneumonia.	 Joint pains May indicate a connective tissue disorder that explains underlying pleural or parenchymal lung disease.

HIGH-YIELD OVERLAP	
★ Silica – COPD, TB, pneumoconiosis, lung cancer, CTDs	
★ Coke dust – COPD, lung cancer	
★ Asbestos → pneumoconiosis, pleural disease, lung cancer	

1) SPUTUM

- A fluid coats the tracheobronchial tree and ascends to the larynx via the mucociliary mechanism.
- In disease, accumulation of inflammatory cells, mucus and proteinous secretions results in cough with sputum.



THINGS TO ASK ABOUT

- Colour
- Volume
- Consistency
- Taste
- Smell

- ! Focus on any changes in colour, consistency or volume, as these indicate a new or acute infection. Always compare with the baseline.



A. COLOUR

Colour	Description	Common causes
Clear (mucoid)	Transparent	COPD, bronchiectasis (no current infection)
Yellow	Mucopurulent	Acute lower respiratory tract infection, asthma (eosinophilia)
Green	Purulent	Current infection – chronic disease (e.g. COPD, bronchiectasis) or acute
Red-brown (rusty)	Blood-tinged, rusty	Pneumococcal pneumonia
Pink (serous/frothy)	Watery, pink, frothy	Acute pulmonary oedema

B. VOLUME

- Establish amount produced over 24 hours in a measurable way (e.g. spoons, cups).
- Always compare with the baseline.

C. CONSISTENCY

- Increase in viscosity or stickiness → exacerbated symptoms of bronchiectasis.
- Firm plugs → asthma.
- Frothy secretions → heart disease; also uncommon with bronchioloalveolar cell carcinoma.

2) HEMOPTYSIS

Hemoptysis = coughing up blood. May be complicated by forceful cough.

- ! Never consider it benign – exclude more harmful causes first.

A. EXCLUDE OTHER SOURCES OF BLOOD

From chest (hemoptysis)	From mouth (hematemesis)	From nose (epistaxis)	From gums (gingivitis)

B. HISTORY – Use SOCRATES (skip non-applicable)

S Site	Did the blood come from the chest or from the nose, mouth, or gums?
O Onset	When did it start?
C Character	(Not usually applicable)
R Radiation	(Not usually applicable)
A Associated symptoms	Fever? Weight loss? Chest pain? Breathlessness? etc.
T Timing	How long does it last? Is it recurrent or continuous?
E Exacerbating factors	What brings it on? (e.g. exercise, infection, coughing)
S Something relieves it	Anything that relieves it?

C. INTERPRETATION

- Fever → signs of infection.
- Recurrent blood streaks with clear sputum → think lung cancer.
- Recurrent blood streaks with purulent sputum over years → bronchiectasis.
- Sudden episode of hemoptysis with pleuritic pain → pulmonary embolism.
- Large amounts of hemoptysis may be due to:
 - Lung cancer
 - Erosion of a pulmonary vessel
 - Bronchiectasis
 - Cavitary diseases (e.g. aspergilloma, tuberculosis)
 - Pulmonary vasculitis
 - Pulmonary arteriovenous malformation

3) STRIDOR

A non-musical, hoarse, grating sound originating from the main (major) bronchi or airways.

- Caused by compression from a tumour or an inhaled foreign body.

Type of stridor	Site / Origin
Inspiratory stridor	Extrathoracic trachea
Expiratory stridor	Intrathoracic trachea
Biphasic stridor	Thoracic inlet



→ 8) sleepiness OSA/OSA-SH
More Common in:

- Men
- Obese
- Large necks (collar size > 17 inches)
- Worse with alcohol

4) CHEST PAIN

Chest pain can be explored using SOCRATES.

Pain may arise from: chest wall, pleura, tracheobronchial tree, pericardium, esophagus, or subdiaphragmatic organs.

Pain does NOT originate from the lung parenchyma or visceral pleura (they have only autonomic nerve supply).

A. IMPORTANT POINT

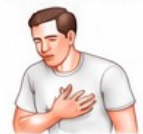
- Pulmonary embolism can manifest as an angina-like pain.
- Due to increased pressure / work on the right ventricle.
- Reduced coronary oxygen delivery → ischemia.

B. PLEURITIC PAIN

- Usually worse on inspiration.
 - Described as sharp, stabbing or knife-like.
- Causes:
- Pneumonia
 - Pulmonary infarct (PE)
 - Pneumothorax

D. OTHER CAUSES

- Lung cancer
- Musculoskeletal chest pain (due to trauma, forceful coughing or connective tissue disorders) – tends to be tender on palpation.



C. CRUSHING CENTRAL PAIN

- Seen in:
- Myocardial infarction with pulmonary oedema
 - Large pulmonary embolism

5) OTHER UNCOMMON CONDITIONS

A. BORNHOLM DISEASE

- Caused by enterovirus (Coxsackie B). Acute, self-limiting viral illness.
- Inflammation of intercostal muscles → episodes of unilateral intercostal myalgia.



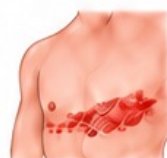
B. COSTOCHONDRITIS (TIETZ SYNDROME)

- Idiopathic inflammation of costochondral junctions.
- Costochondral swelling is present.
- Eased by analgesia.



C. HERPES ZOSTER

- Superficial skin and thoracic dermatome rash.



6) OTHER (NON-PLEURITIC / RETROSTERNAL) PAIN

Burning retrosternal pain worse with eating and relieved by antacids

GI in nature (oesophagitis)

Central, constant, progressive, non-pleuritic pain + sleep disturbance

Mediastinal disease (malignancy)

Pleuritic pain

PE or pneumothorax

Crushing central pain

PE or MI with pulmonary oedema

7) NON-CONSTITUTIONAL (SYSTEMIC) SYMPTOMS

A. FEVER

- Seen in infections, lung cancer, lymphoma, vasculitis.



B. RIGORS

- Uncontrollable episodes of vigorous body shaking that last a few minutes.
- Despite high fever, patient complains of feeling cold.

Common causes:

- Bacterial sepsis
- Lower pneumonia
- Acute pyelonephritis



C. NIGHT SWEATS

- Commonly associated with tuberculosis or malignancies (such as lymphomas).
- Occasional episodes are not enough – should be persistent.



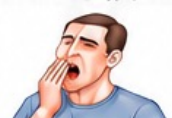
D. WEIGHT LOSS

- Causes: lung cancer, COPD, interstitial lung disease, tuberculosis, bronchiectasis.
- May be due to infection because of diminished appetite.
- Important to know extent and duration.



E. SLEEPINESS

- Sign of possible sleep-related breathing disorder (OSA – (obstructive sleep apnea) or OSA-SH (sleep hypopnea).



- Collapse of upper airways intermittently and repeatedly during sleep.
- Partial obstruction → snoring.
- Complete collapse → transient waking.
- Repeated episodes → daytime sleepiness and poor concentration.

QUESTIONS TO ASK

- Normal sleeping habits – does it allow for reasonable rest?
 - Type of work – is it shift or night work?
 - Do they wake up feeling refreshed or exhausted?
 - Have they struggled to stay awake in the day?
 - Ask bed partner for description of nighttime breathing disturbances.
 - Use validated sleepiness scores (e.g., Epworth Sleepiness Scale).
 - to quantify daytime sleepiness and consider referral to a sleep clinic.
- ! Always advise cessation of driving if under investigation for OSA.

Epworth Sleepiness Scale

Use the validated Epworth Sleepiness Scale to quantify daytime sleepiness.

PHYSICAL EXAMINATION: INSPECTION

- Watch out if the patient is conversing easily or if they are coughing repeatedly.
- Patient position: sitting in a semi-sitting position (~45°).
- Exposure: from the neck to the umbilicus (exposure of the thorax).
- The inspection occurs at the end of the bed as well as at the right side of the bed.

Some maneuvers are done at the end of the bed and some at the right side.

1. General appearance and equipment

- Presence of nebulizer inhalers.
- Oxygen therapy and cyanosis.
- Sputum pots: note the color and viscosity of the sputum, the presence of blood. Foul-smelling sputum usually indicates an anaerobic infection.
- Look for asymmetry of the chest: deformities, surgical scars, chest drains.



Oxygen therapy and nebulizer inhaler

2. Respiratory rate

- Observe the respiratory rate for 15 seconds without drawing the patient's attention (or act as if following the radial pulse).
- Normal: 12–15 breaths/min.
- Anxious: 15–20 breaths/min.
- Abnormal: >20 breaths/min.
- Elderly patients and patients with heart failure in the final stages of dying may have Cheyne–Stokes respiration (alternating deep and shallow breathing) due to abnormal feedback from the carotid chemoreceptors.
- Subcutaneous metastasis from lung tumors often permits rapid biopsy.
- In the legs: painful, dusky red lesions of erythema nodosum indicate sarcoidosis; asymmetrical swelling could signal venous thrombosis.



Sputum pot



Counting respiratory rate for 15 seconds

3. Chest wall shape and respiratory movements

- Look at the normal shape and symmetry of the chest wall.
- Assess the respiratory movements.
- In hyperinflation (seen in COPD):
 - Prolonged expiration relative to inspiration.
 - Pursed-lips breathing on expiration.
 - Forceful inspiration may cause:
 - Indrawing of the intercostal spaces during mid-inspiration.
 - Recruitment of muscles not normally involved: sternocleidomastoid (lifts the sternum), trapezius and scalenes (lift the shoulder girdle).
- Some patients brace their arms on a surface and use the pectoralis major.
- In contrast, interstitial diseases cause small, stiff lungs that diminish thoracic volume and raise respiratory rates.



Pursed-lips breathing



Use of accessory muscles and indrawing of intercostal spaces

4. Chest deformity

- Pectus excavatum: congenital (inward displacement of the sternum — cave-like).
- Pectus carinatum: not congenital (outward displacement of the sternum with prominence; often due to severe airflow obstruction in early childhood).



Pectus excavatum



Pectus carinatum

5. Asymmetry of the chest may be secondary to:

- Scoliosis.
- Shrinkage of scarred lung following tuberculosis.
- Prior surgical resection of the lungs and/or the ribs.

HANDS

- Examine the hands for finger clubbing, tar staining, nail discoloration, and cyanosis.
- Ask the patient to extend their arms out, measure respiratory rate while feeling the pulse, and check for any tenderness.
- Fine tremor is common due to high-dose beta-agonist bronchodilators.
- With CO₂ retention → coarse flapping tremor of the outstretched hands (asterixis).



Clubbing



Cyanosis

Finger clubbing

- Overgrowth of soft tissue in the terminal phalanx increases curvature of the nail, raising it above the underlying bone.
- Fluctuation may be present.
- Consider lung cancer or pulmonary fibrosis (adults); in younger patients, think of chronic suppurative lung diseases such as cystic fibrosis.
- May be accompanied by hypertrophic pulmonary osteoarthropathy with swelling of wrists and ankles. X-rays of distal forearms show new bone formation.

Other important signs

- Cyanosis
- Tar staining
- Small muscle wasting (T1 root damage by an apical lung tumor)
- Yellow-brown discoloration of nails (yellow nail syndrome)
- Vasculitis in nail bed

FACE

- Superior vena cava obstruction causes a dusky generalized swelling of the head, neck, and face.
- Subconjunctival edema may indicate tumor invasion of the upper thorax.
- Tumors at the root of the neck disturb the sympathetic nerves to the eye → unilateral ptosis, anhidrosis, and miosis (Horner's syndrome).
- Central cyanosis: blue-gray discoloration of the tongue and mucosa; harder to detect in anemia than in polycythemia. Methemoglobinemia may cause cyanosis.



SVC obstruction



Ptosis (Horner's syndrome)



Central cyanosis

Examine:

- Conjunctiva (pallor/anemia)
- Tongue (blue-gray discoloration, central cyanosis)
- Eyes for ptosis and pupil asymmetry
- Jaw and mouth (macroglossia, small mandible, large tonsils)

NECK

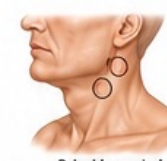
- Look at the jugular venous pressure (JVP). Raised in pulmonary hypertension, tension pneumothorax, large pulmonary embolism. In SVC obstruction, it may be raised above the angle of the jaw and pulsatility is invisible. If sternocleidomastoid is used, JVP is often impossible to see.
- Tracheal deviation:
 - Away from the affected side (e.g. tension pneumothorax, large effusion).
 - Towards the affected side (loss of lung volume, fibrotic scarring, collapse after lobectomy or pneumonectomy).
- Look for tracheal tug (systolic inward movement) in aortic aneurysm (rare).
- Palpable cervical lymph nodes: metastatic disease from lung cancer; also tuberculosis and lymphoma.



Raised JVP



Tracheal deviation



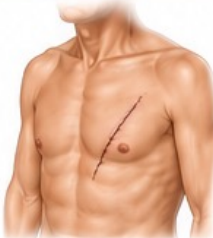
Palpable cervical lymph nodes

EXAMINATION SEQUENCE (NECK)

1. Relax the patient's head with a pillow to allow true relaxation of accessory muscles such as the sternocleidomastoid.
2. Use a light source to examine the jugular venous pressure.
3. Check for tracheal deviation by advancing a single finger in the central notch (between the two sternocleidomastoid heads).
4. Check the cricosternal distance (vertical distance between the sternal notch and the cricoid cartilage, the first ridge above the tracheal rings). Three average fingers fit in this space.
5. Examine cervical lymph nodes from behind with the patient sitting forward.

THORAX (CHEST WALL)

- Inspect the chest closely for abnormalities.
- Scars:
 - In the pectoral fold → thoracotomy scar.
 - In the lateral and posterior walls → scars from pleural biopsies and drains. (A thoracotomy may be visible from the side.)
- In patients with a thin chest wall and increased respiratory drive, visible indrawing of the skin in the intercostal spaces during inspiration may be seen.



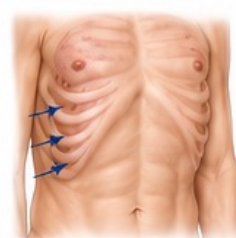
Thoracotomy scar in pectoral fold



Thoracotomy scar (visible from the side)



Scars from pleural drains



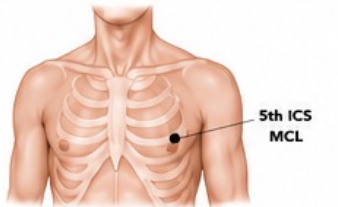
Indrawing of intercostal spaces during inspiration

PHYSICAL EXAMINATION: RESPIRATORY SYSTEM

PALPATION

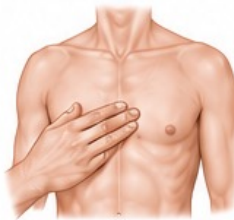
1. Locate the apex beat.

- Found in the 5th intercostal space in the midclavicular line.
- See where the 2nd rib is attached to the manubriosternal junction.



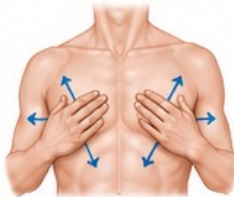
2. Palpate for right ventricular heave.

- Displaced by dilation of the ventricles or leftward displacement in the mediastinum.
- In patients with significant hyperinflation, the beat may be impalpable because the lingula expands between the heart and the chest wall.
- In pulmonary hypertension, the lower sternum is lifted by a right ventricular heave, and a finger gently placed over the pulmonary area may detect closure of the pulmonary valve (palpable P2).



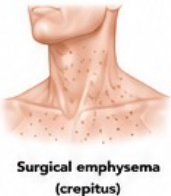
3. Examination sequence.

- Face first, place the palms over the precordial region with the heels of the hands over the midline.
- Ask the patient to take a deep breath and watch as your fingers spread. Push your hands toward the middle.
- Ask the patient to take another deep breath and observe finger spread again.
- Check for any asymmetry between the expansion of both sides.



4. Additional points.

- In COPD with hyperinflation, the normal outward movement of the lower ribs on inspiration is replaced by paradoxical inward movement (Hoover's sign) due to a contraction of the abnormally low, flat diaphragm.
- Palpation of the chest wall may rarely reveal surgical emphysema (air trapping in the subcutaneous tissue); most commonly complicates pneumothorax with chest drainage or rib fracture (palpable crackling under the skin of the upper thorax, subclavicular fossa, and neck).
- Finally, examine for any tumor deposits. Mesothelioma may grow down the track left from a pleural biopsy or chest drain and present as a firm lump at the scar site.



PERCUSSION

- If correctly performed, generates a hollow, ringing sound (resonance) over air-filled lungs.
- A dull thud percussion note occurs over consolidation.
- Valuable in detection of asymmetry of resonance between left and right.
- Quality and volume vary with muscularity and subcutaneous fat.

Technique

- Place the non-dominant hand on the area.
- Tap the middle finger of the dominant hand.
- Movement should be from the wrist, not the elbow.
- Compare right and left mirror-image sides.
- Posteriorly, the scapula and spine obstruct percussion — percuss a few centimeters lateral to the spine.
- Percuss the lateral chest wall in the mid-axillary line.



Percussion notes and their clinical significance

Condition	Percussion Note	Breath Sounds	Vocal Resonance
Consolidation	Dull	Bronchial	Increased (loud & clear)
Pulmonary fibrosis	Dull	Bronchial	Increased (loud & clear)
Pleural effusion	Stony dull	Absent / decreased	Absent
Pneumothorax	Hyperresonant	Absent / decreased	Decreased / absent
Emphysema	Hyperresonant	Decreased	Decreased

- Clear resonance or hyperresonance is a finding of pneumothorax.
- The difference between a normal lung and pneumothorax is subtle.
- Resonance on percussion with unilateral absent breath sounds is pneumothorax.

AUSCULTATION

Origin of breath sounds

- Tracheobronchial tree branches ~23 times → exponential rise in number of airways.
- ~5 L of air passing the larynx and trachea moves fast → turbulence → vibration of airway wall → sound.
- In distal airways, 5 L can pass at a slow rate (laminar flow) → silence.
- Bronchial sound (harsh), generated by the major airways, can be appreciated over the larynx (diaphragm of stethoscope).
- Most sounds heard over the chest wall originate in the large central airways but are muffled and modified by passage through overlying air-filled alveolar tissue (vesicular sound).
- In consolidation (pneumonia) or fibrotic scarring (e.g., post-tuberculosis), sound conduction is improved (easier through solids) → bronchial breath sounds.
- In lobar collapse from proximal bronchial obstruction → diminished breath sounds and dullness to percussion.
- When lung tissue is separated from chest by air (pneumothorax) or fluid → sound conduction is impaired → breath sounds usually very quiet or absent.



- Key points**
- Wear the stethoscope facing forwards to align with your auditory canal.
 - Cachectic chest wall with sunken intercostal spaces or a hairy chest wall may require the bell.
 - Breath sounds are greatly affected by the thickness, muscularity, and fluid content of the chest wall.

Examination sequence

- Auscultate the apices.
- Ask the patient to take slow, deep breaths through the mouth.
- Auscultate the entire anterior chest wall (use same sites as for percussion).
- Note any muffling, absence, loudness and harshness, and any asymmetry.
- Auscultate the lateral chest wall in the mid-axillary line to compare left and right.

ADDED SOUNDS

- Wheeze:** expiratory, musical; accompanies narrowing of small airways.
 - Polyphonic: sign of asthma, bronchitis, or COPD.
 - Monophonic: does not clear with coughing; due to fixed bronchial obstruction; may indicate cancer.
- Crackles:** non-musical; more heard in inspiration.
 - Due to sudden opening of small airways, secretions in airways, or underlying interstitial fibrosis.
 - May clear with deliberate cough.
 - Persist after several breaths and a cough → pathological.
 - Fine (soft, multiple): shower-like; resemble peeling a Velcro fastener. Characteristic of interstitial pulmonary fibrosis. Also occur in pulmonary edema and viral pneumonias.
 - Coarse (loud, scanty): seen in purulent airway secretions in bronchopneumonia or bronchiectasis.
 - Inspiratory crackles may be heard in completely inflated lung above pleural effusion.
- Rub:** rasping, grating sound with each breath; superficial with stethoscope.
 - Indicates pleural inflammation (infection or infarction).
 - Accompanied by pleuritic chest pain.
 - In pneumonia, a rub if parapneumonic effusion or empyema develops.
- Rare clicking or crunching sounds:** heard with the heart rate; indicating a normal mediastinum.

VOCAL RESONANCE

- Normally reveals the presence of consolidation or fibrotic scarring (bronchial breath sound where vesicular is expected).
- Fluid, air, or both → absent breath sounds.
- Confirm by asking the patient to generate laryngeal sounds (e.g., "one-one-one").
- Listen in the same sequence: muffled is normal; loud and clear in consolidation or fibrotic scar tissue; absent in pneumothorax or pleural effusion.
- Whispering pectoriloquy:** same changes in sound conduction; muffled by normal lung but heard over consolidation or scar tissue.

SOUND CONDUCTION: SUMMARY

Condition	Percussion Note	Vocal Resonance
Consolidation / Pulmonary fibrosis	Dull	Increased (loud & clear)
Pleural effusion	Stony dull	Absent
Pneumothorax	Hyperresonant	Decreased / absent
Emphysema	Hyperresonant	Decreased

CONDITIONS: SUGGESTIVE FINDINGS

CONDITION	HISTORY	EXAMINATION
Acute bronchitis	- Polyphonic wheeze - Cough, sputum - Acute on chronic dyspnea	Polyphonic wheeze
Exacerbation of COPD	- Mucopurulent sputum - Ankle swelling - Cough	- Hyperinflation - Quiet breath sounds - Polyphonic wheeze - Flapping tremor - Ankle edema
Pneumonia	- Fever, rigors - Pleuritic pain - Rusty sputum - Loss of appetite	- Dull percussion - Bronchial breathing - Increased vocal resonance
Malignancy	- Insidious onset - Weight loss - Cough, hemoptysis	- Cervical lymphadenopathy - Finger clubbing - Signs of metastasis - Inspiratory fine crackles at base
Pulmonary fibrosis	- Progressive dyspnea - Cough	- Tachypnea - Finger clubbing - Central cyanosis - Unilateral basal dullness - Reduced breath sounds
Pleural effusion	Progressive dyspnea	
Embolism	- Large: sudden dyspnea - Medium: episodic pleuritic pain, hemoptysis - Multiple small: progressive dyspnea	- Large: normal breath sounds - Medium: pleural rub or crackles - Multiple small: raised JVP and RV heave + loud P2
Asthma	- Atopy, hay fever, pet ownership - Variable wheeze - Disturbance of sleep	- Polyphonic expiratory wheeze - Eczema