

STATION 1: RESPIRATORY

STEPS OF EXAMINATION

(1) APPROACH THE PATIENT

1. Read the instructions carefully for clues
2. Approach the right hand side of the patient, shake hands, introduce yourself
3. Ask permission to examine him “I would like to examine your chest and lungs, if it is all right with you”
4. Adjust the backrest so that the patient reclines at 45° to the mattress
5. Expose the chest completely

(2) GENERAL INSPECTION

STEPS	POSSIBLE FINDINGS
1. Scan the bedside locker .	➤ Sputum pot (see theoretical notes for types of sputum), inhaler, nebulizer , oxygen (what rate per minute), temperature chart, peak flow chart, peak flow machine
2. Scan the patient .	➤ Nutritional status: under/average built or overweight ➤ Abnormal facies: plethoric complexion (polycythaemia), Cushingoid facies (steroid therapy) ➤ Dyspnoea (tachypnoea + use of accessory muscles of respiration; the scalene and the sternocleidomastoid)
3. Examine the eyes . Pull down the eyelid.	➤ Anaemia (pallor) in the conjunctivae at the guttering between the eyeball and the lower lid ➤ Polythyaemia → markedly engorged conjunctival vessels ➤ See theoretical notes for examples of eye conditions in respiratory disease
4. Examine the mouth . Ask the patient to protrude his tongue.	➤ Lip pursing (indicates chronic small airways obstruction) ➤ Central cyanosis in the under-surface of the tongue
5. Examine the hands : tell the patient “outstretch your hands like this (dorsum facing upwards)”... then “like this (palms facing upwards)”... demonstrate.	➤ Clubbing (consider pulmonary fibrosis, malignancy, or bronchiectasis) ➤ Cyanosis in the nail bed (could be peripheral or central) ➤ Tobacco staining (consider airways disease or malignancy) ➤ Rheumatoid arthritis (consider rheumatoid lung)
6. Fine tremors : tell the patient “Hold your arms outstretched in front of you, like this (dorsum facing upwards and fingers spread out), and maintain this position” (demonstrate)	➤ Fine tremors (fine trembling of the hand and fingers) may indicate β-antagonist therapy
7. Flapping tremors (asterixis): ask patient to maintain his hand in dorsiflexion and fingers spread out (demonstrate)	➤ Jerky flapping tremor (the hands are periodically dropped and then resume their position every 2-3 seconds) may indicate severe ventilatory failure and CO2 retention
8. Feel the radial pulse (and count the respiratory rate if patient looks dyspnoeic).	➤ Warm hand and bounding pulse may indicate CO2 retention ➤ See theoretical notes for causes of abnormal RR
9. Examine the neck veins .	➤ Raised venous pressure with prominent v waves indicates RVF/cor pulmonale ➤ Fixed distension of the neck veins indicates SVC obstruction

(3) TRACHEA

STEPS	POSSIBLE FINDINGS
1. Ask patient to sit forward and look directly forward and place the index and ring fingers over the prominent points on either side of the manubrium sternae. Use the middle finger to feel the tracheal rings to detect tracheal deviation and tracheal tug if any.	<ul style="list-style-type: none"> ➤ Tracheal deviation: your middle finger should rest equidistant from the index and ring fingers if the trachea is central. The trachea may be slightly deviated to the right in normal people due to the straightness of the right main bronchus. See theoretical notes for causes of abnormal tracheal deviation ➤ Tracheal tug: the middle finger is pushed upwards against the trachea by the upward movement of the chest wall
2. Measure the notch-cricoid distance	➤ A notch-cricoid distance < 3 fingers indicates hyperinflation

(4) LOCAL INSPECTION:

STEPS	POSSIBLE FINDINGS
1. Stand at end of bed and observe chest.	<ul style="list-style-type: none"> ➤ Scars (thoracotomy, thoracoplasty, thoracoscopic biopsy, scar of phrenic nerve crush in the supraclavicular fossa) ➤ Radiotherapy stigmata: field markings (Indian ink marks), radiation burns, telangiectasia ➤ Subcutaneous nodules (metastases) ➤ Engorged superficial veins (SVC obstruction) ➤ Deformities: <ul style="list-style-type: none"> ▪ Hyperinflation/barrel chest (increased A-P diameter compared with the lateral diameter) → emphysema ▪ Localized apical flattening suggestive of underlying fibrosis → old TB or pneumonectomy ▪ Kyphoscoliosis (idiopathic or secondary to polio) ▪ Pigeon chest (pectus carinatum – outward bowing of the sternum) → chronic childhood respiratory illness or rickets ▪ Funnel chest (pectus excavatum – depression of the sternum) → developmental defect ➤ Indrawing: <ul style="list-style-type: none"> ▪ Generalized indrawing of the intercostal muscles and supraclavicular fossae on inspiration → hyperinflation ▪ Indrawing of the lower ribs on inspiration → low, flat diaphragm in emphysema ▪ Localized indrawing of the intercostal muscles → bronchial obstruction
2. Assess the chest wall movement (expansion). Ask the patient to take a deep breath in and out.	<ul style="list-style-type: none"> ➤ Look carefully for asymmetry and the direction of movement of chest wall and abdomen: <ul style="list-style-type: none"> ▪ Asymmetrical chest movement → unilateral pathology on the side with reduced ventilation (fibrosis, collapse, pneumonectomy, pleural effusion, or pneumothorax). ▪ Symmetry is maintained → consider pulmonary fibrosis, bronchiectasis, or airways disease. ▪ Chest movement is mainly upwards → emphysema ▪ Paradoxical movement of the abdomen → phrenic nerve palsy

(5) LOCALIZATION OF THE APEX BEAT:

STEPS	POSSIBLE FINDINGS
<p>1. Localize the apex beat first by inspection (the most inferior and most lateral point of cardiac pulsation) then by laying your fingers on the chest parallel to the intercostal spaces (If you cannot feel it, ask the patient to roll onto the left side).</p> <p>2. Then stand the index finger on it to localize the point of maximum impulse.</p>	<ul style="list-style-type: none"> ➤ A normal apical impulse is localized in the 5th ICS medial to the left MCL. ➤ Apex may be displaced (indicates mediastinal displacement) if it is either pushed by pleural effusion or pneumothorax; or pulled by collapse, fibrosis or pneumonectomy. ➤ Impalpable apex may be due to hyperinflation (other causes are obesity, pericardial effusion or dextrocardia)

(6) PALPATION

STEPS	POSSIBLE FINDINGS
<p>1. Chest expansion:</p> <ul style="list-style-type: none"> ▪ Upper chest expansion: rest one hand lightly on either side of the front of the chest just below the clavicle. Alternatively you may assess the expansion of the upper chest by observing the clavicles from behind during tidal breathing ▪ Lower chest expansion: Grip the chest symmetrically with the fingertips in the rib spaces on either side and approximate the thumbs to meet in the middle in a straight horizontal line in the inframammary regions. Keep your thumbs slightly lifted off the chest so they are free to move with respiration. Ask the patient to take a deep breath. Note the distance between both thumbs and compare the distance between your thumb and the midline on each side. 	<ul style="list-style-type: none"> ➤ On palpating for upper chest expansion, normally you should feel your hands rise anteriorly and upwards symmetrically. ➤ On palpating for lower chest expansion, normally the distance between both thumbs should be at least 5 cm and the distance between your thumb and the midline on each side should be symmetrical ➤ Reduced expansion could be due to effusion, fibrosis, pneumonectomy, collapse, or pneumothorax.
<p>2. Tactile vocal fremitus (TVF): ask the patient to say “one, one, one” whilst placing the ulnar aspect of your hand on the chest wall. Use both hands simultaneously to compare right with left, moving from above downwards (4 levels in the anterior chest wall and 3 levels in the axilla). You may wish to skip checking for TVF and tell the examiner that you would prefer to do vocal resonance, as an alternative, because it gives the same information and is more reliable.</p>	<ul style="list-style-type: none"> ➤ Normally, vibration produced by spoken sounds is transmitted to the chest wall and is felt as fremitus. ➤ TVF becomes more palpable whenever normal lung tissue is replaced by uniformly conducting tissue (same causes of bronchial breathing and increase vocal resonance).

(7) PERCUSSION

STEPS	POSSIBLE FINDINGS
<ol style="list-style-type: none"> 1. The percussing finger should tap lightly, springing away after contact, to elicit signs effectively. 2. Consider starting your percussion by locating the upper border of the liver (see Ch 3. Abdomen) 3. You may wish to proceed to percuss the supraclavicular fossa or is preferably deferred to start with in percussion of the back of chest 4. Proceed to percuss the clavicles within its medial third 5. Then percuss the chest anteriorly from above downwards in zigzag manner comparing right with left and superior with inferior in 4 levels (left → right at same level → right inferiorly → left at same level → left inferiorly → right at same level and so on) 6. Then percuss the axillae from above downwards in zigzag manner in 3 levels 	<ul style="list-style-type: none"> ➤ Percussion note: <ul style="list-style-type: none"> ▪ Resonant → normal lung ▪ Hyper-resonant → pneumothorax ▪ Dull → pulmonary consolidation, pulmonary collapse, or severe pulmonary fibrosis ▪ Stony dull → pleural effusion, haemothorax ➤ Normally, on the right side, there is loss of resonance inferiorly as the liver is encountered (at the level of the 5th rib in the MCL), while on the left side, the lower border overlaps the stomach so there is a transition from lung resonance to tympanic stomach resonance ➤ Avoid percussion of the clavicle laterally; as it merely produces dullness from the muscles of the shoulder ➤ Axilla is the only place where the upper, middle (lingual on the left) and lower lobes can be examined together)

(8) AUSCULTATION

STEPS	POSSIBLE FINDINGS
<ol style="list-style-type: none"> 1. Ask the patient to keep breathing regularly, deeply through the mouth, but not noisily (demonstrate). 2. Auscultate anteriorly from above downwards in zigzag manner comparing right with left and superior with inferior in 4 levels from the lung apex down to the 6th rib (avoiding the midline). You may wish to start with auscultation of the supraclavicular fossa or is preferably deferred to start with in auscultation of the back of chest 3. Then auscultate the axillae from above downwards in zigzag manner in 3 levels down to the 8th rib. 4. If breath sounds appear reduced ask the patient to cough, and repeat the auscultation (breath sounds become more audible after coughing if it is reduced due to bronchial obstruction by secretions) 5. If you hear crackles, ask the patient to cough, and repeat the auscultation, then ask the patient to lean forward (in case of basal crackles), and again repeat the auscultation. 	<ul style="list-style-type: none"> ➤ You should note the following: <ul style="list-style-type: none"> ▪ Type of breath sounds: see theoretical notes ▪ Intensity of breath sounds: see theoretical notes ▪ Added sounds: see theoretical notes ➤ Avoid auscultation within 3 cm of the midline anteriorly or posteriorly as these areas may transmit sounds directly from the trachea or main bronchi
<ol style="list-style-type: none"> 6. Vocal resonance: ask the patient to say “one, one, one” whilst auscultating the chest wall moving from above downwards in a zigzag manner as for conventional auscultation. 	<ul style="list-style-type: none"> ➤ Normally, Vibration produced by spoken sounds is transmitted to the chest wall and is just audible as resonant sound. Vocal resonance becomes much louder (bronchophony) whenever normal lung tissue is replaced by uniformly conducting tissue (same causes of bronchial breathing and increase TVF).
<ol style="list-style-type: none"> 7. Whispering pectoraliquy: If you found an area of bronchial breathing, ask the patient to whisper “one, one, one”. 	<ul style="list-style-type: none"> ➤ In the normal lung, a whispered note will not be heard, but over consolidated lung, the sound is transmitted producing "whispering pectoraliquy".
<ol style="list-style-type: none"> 8. Aegophony: You may check for aegophony above the level of a pleural effusion (and possibly over an area of consolidation) by asking the patient to say "ee" continuously. 	<ul style="list-style-type: none"> ➤ You should normally hear a muffled "ee" sound. Above the level of a pleural effusion or in some cases over an area of consolidation, the voice may sound nasal or bleating "ay" sound, this is referred to as aegophony, but is an unusual physical finding.

(9) EXAMINATION OF THE BACK OF CHEST:

1. Ask patient to fold his arms in front of his chest (to move the scapulae laterally).
2. Look for asymmetry, scars or deformities
3. Assess expansion posteriorly: grip the chest symmetrically with the fingertips in the rib spaces on either side (below the scapulae) and approximate the thumbs to meet in the middle in a straight horizontal line.
4. Tactile vocal fremitus (preferably skipped)
5. Percuss posteriorly (include percussion of the supraclavicular area and axilla if not done during examination of anterior chest):
 - Start by percussing the upper posterior chest (above the scapulae) from medial to lateral in 1-3 lines on both sides (with the left middle finger applied to the chest parallel to the spine)
 - Then Percuss from above downwards (medial to, and then below the scapulae) in 4 levels on both sides (with the left middle finger applied to the chest parallel to the ribs)
 - Avoid percussing near the midline as this produces a dull note from the solid structures of the thoracic spine and paravertebral musculature
6. Auscultate posteriorly down to the level of the 11th rib (include auscultation of the supraclavicular area and axilla if not done during examination of anterior chest)
7. Auscultate for vocal resonance, whispering pectoraliquy and aegophony

(10) LYMPHADENOPATHY

- Supraclavicular → cervical → axillary (see Ch 17. Endocrine - neck)

(11) ADDITIONAL SIGNS

1. Sacral or lower limb edema, and features suggestive of DVT
2. You may check for forced expiratory time (If your diagnosis is COAD) by asking the patient to exhale forcefully after full inspiration while you are listening over the trachea. If exhalation takes more than 6 seconds, airway disease is indicated.
3. Tell the examiner that you would like to perform a Bedside respiratory function test (ward spirometry).

(12) THANK THE PATIENT AND COVER HIM (HER)

THEORETICAL NOTES

TYPES OF SPUTUM

Type	Appearance	Cause
Serous	Clear, watery	Acute pulmonary oedema
	Frothy, pink	Alveolar cell cancer
Mucoid	Clear, grey	Chronic bronchitis / COPD
	White, viscid	Asthma
Purulent	Yellow, green	Bronchopulmonary infection: <ul style="list-style-type: none"> ▪ pneumonia ▪ bronchiectasis (copious mucopurulent sputum) ▪ cystic fibrosis ▪ lung abscess
Rusty	Rusty, golden yellow	Pneumococcal pneumonia

EXAMPLES OF EYE CONDITIONS IN RESPIRATORY DISEASE

Condition	Respiratory disorder
Horner's syndrome	Apical lung cancer
Iridocyclitis	Tuberculosis Sarcoidosis
Chemosis, conjunctival and retinal vein dilatation	Carbon dioxide retention SVC obstruction
Choroidal tubercles	Miliary tuberculosis
Choroidal metastases	Disseminated cancer

CAUSES OF ABNORMAL RESPIRATORY RATE

- Tachypnoea is an **RR > 15/min** (caused by increased respiratory drive as in fever, asthma, and COPD, or reduced ventilatory capacity as in pneumonia, pulmonary oedema, and interstitial lung disease. An **RR > 30/min** is the most important prognostic sign associated with death in community-acquired pneumonia.
- A slow RR can occur in association with opioid toxicity, hypothyroidism, raised ICP, hypothalamic lesions, and hypercapnia

CAUSES OF ABNORMAL TRACHEAL DEVIATION

- Towards the side of the lung lesion
 - Upper lobe or lung collapse
 - Upper lobe fibrosis
 - Pneumonectomy
- Away from the side of the lung lesion
 - Tension pneumothorax
 - Massive pleural effusion
 - Upper mediastinal mass
 - Retrosternal goitre
 - Lymphoma
 - Lung cancer

PATTERNS OF BREATH SOUNDS

- **Normal (vesicular)** breath sounds:
 - Have a rustling quality and are described as "vesicular".
 - There is no gap between inspiration and expiration
 - During expiration, normal breath sounds rapidly fade because of decreasing airflow
- **Bronchial breathing** (noise transmitted from a large airway directly to the chest wall, e.g. over an area of consolidation, at the top of an effusion or over an area of dense fibrosis or collapse with the underlying major bronchus is patent):
 - High pitched with hollow or blowing quality
 - Have equal inspiratory and expiratory component
 - The expiratory sound has a more sibilant (hissing) character than the inspiratory one and lasts for most of the expiratory phase

INTENSITY OF BREATH SOUNDS

- Diminished vesicular breathing occurs either due to reduced conduction or reduced airflow:
 - **Reduced conduction**
 1. Obesity/thick chest wall
 2. Pleural effusion or marked pleural thickening
 3. Pneumothorax
 - **Reduced air flow**
 1. Generalized, e.g. hyperinflation due to COPD
 2. Localized, e.g. over an area of collapse due to obstruction of a major bronchus (occluding lung cancer).

ADDED SOUNDS

- **Crackles** are interrupted non-musical sounds. They are either fine or coarse, and either early, mid or end inspiratory (and may be expiratory). Common patterns of crackles are:

Early inspiratory	Small airways disease as in chronic bronchitis and asthma
Mid/late inspiratory	<ul style="list-style-type: none"> ▪ Restrictive lung disease, e.g. fibrosing alveolitis (fine crackles; reduced if the patient is made to lean forward thereby the compressed dependent alveoli, which crackle-open in late inspiration, are relieved of the pressure of the lungs) ▪ Pulmonary edema (fine/medium crackles) ▪ Lung abscess, tubercular lung cavities and bronchial secretions in COPD, pneumonia, etc. (coarse crackles)
Early and mid-inspiratory and recurring on expiration (biphasic)	Bronchiectasis (coarse crackles; altered by coughing)

- **Wheezes** are musical sounds associated with airway narrowing (always expiratory – mono or polyphonic)
- **Stridor:** harsh, rasping or cracking noise, which may be aggravated by coughing (always inspiratory, and indicate extrathoracic obstruction)
- **Pleural rub** is a creaking sound produced when inflamed parietal and visceral pleura move over one another → pleurisy secondary to a pulmonary embolus or pneumonia
- **Pneumothorax click** is a rhythmical sound synchronous with cardiac systole, produced when there is air between the two layers of pleura overlying the heart

SIGNS OF HYPERINFLATION:

- By **inspection**:
 1. Increased A-P chest diameter
 2. Flattening of the subcostal angle
 3. Indrawing of the intercostal muscles and supraclavicular fossae
- By **palpation**:
 1. Decreased chest expansion
 2. Shortened cricoid-notch distance (normally greater than 3 finger breadths)
- By **percussion**:
 1. Attenuation of heart and liver dullness (with liver descent)
 2. Hyper-resonance

SUMMARY OF CLINICAL FINDINGS IN COMMON RESPIRATORY CASES:

	Trachea	Expansion	Percussion	TVF / VR	Breath sounds
Interstitial lung disease	No change	Reduced bilaterally	No change	No change	Fine end-inspiratory crackles
COPD	No change	Reduced bilaterally (hyperinflated)	No change (hyper-resonant in case of emphysema)	No change	Variable; quiet ± wheeze
Effusion	Pushed away if very large effusion (pulled in case of underlying collapse)	Reduced unilaterally	Stony dull	Reduced (bronchophony, whispering pectoraliquy and aegophony at the top)	Absent/reduced (bronchial at the top)
Consolidation	No change	Reduced unilaterally	Impaired note	Increased (bronchophony, whispering pectoraliquy and aegophony)	Bronchial breathing + crackles
Collapse, local fibrosis, pneumonectomy	Pulled towards lesion	Reduced unilaterally (nil in case of pneumonectomy)	Impaired note	Reduced (zones of increased TVF/VR in case of fibrocavitary lesion)	Quiet (zones of bronchial breathing in case of fibrocavitary lesion)
Pneumothorax (large)	Pushed away if tension pneumothorax	Reduced unilaterally	Hyper-resonant	Reduced	Absent/reduced

ANATOMICAL LANDMARKS OF LOBES AND FISSURES OF THE LUNG:

- **Bifurcation of the trachea**: anteriorly at the level of the sternal angle (junction of the body of the sternum and the manubrium sterni), and posteriorly at the level of the disc between the 4th and 5th thoracic vertebrae. (N.B. The large bump on the back of the lower part of the neck is the spinous process of C7, called Vertebra prominens).
- **Oblique fissure** (major interlobar fissure): a line from the 2nd thoracic spine to the 6th rib in the mammary line
- **Horizontal fissure** (minor interlobar fissure): a horizontal line from the sternum at the level of the 4th costal cartilage, drawn to meet the line of the oblique fissure (on the right side only)