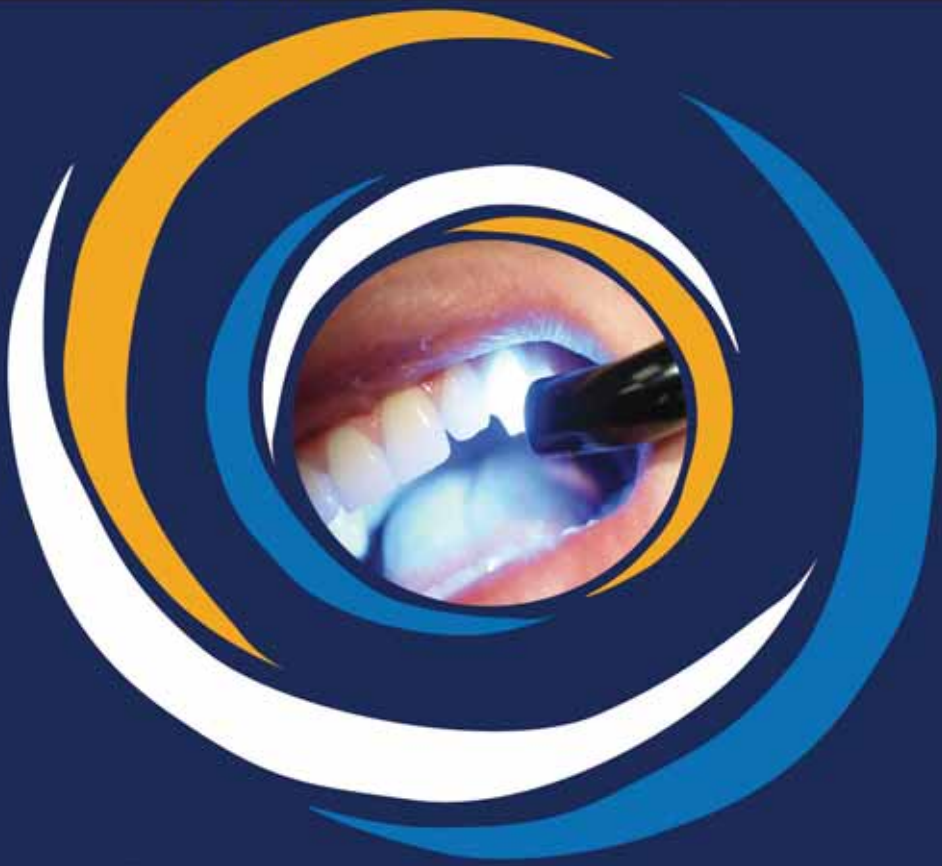
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Comprehensive MEDICINE for DENTAL Students

From Theory to Clinics in One Book

HIGHLIGHTS

- All course outcomes of the DCI Outcome-Based Education (OBE) format covered
- Detailed clinical examination section with images
- Sections on medical emergencies, viva voce, laboratory data interpretation included
- A book-shelf ready reckoner for Dental Practitioners.

Archith Boloor
Mohammed Shaheen

Forewords
V Surendra Shetty
Dilip G Naik

JAYPEE

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4

CHAPTER

Respiratory System Examination

CHAPTER OUTLINE

- Case Sheet Format
- Diagnosis Format
- Discussion on Cardinal Symptoms
- Discussion on Examination

RESPIRATORY SYSTEM: CASE SHEET FORMAT

History Taking

- ❒ Name:
- ❒ Age:
- ❒ Sex:
- ❒ Residence:
- ❒ Occupation:

Chief Complaints

1. _____ × days
2. _____ × days

History of Presenting Illness

Cough:

- ❒ Duration
- ❒ Onset
- ❒ Progression
- ❒ **Variation:**
  - Diurnal variation
  - Seasonal variation
  - Postural variation
- ❒ Aggravating factors
- ❒ Relieving factors

Expectoration:

- ❒ Duration
- ❒ Onset
- ❒ Progression
- ❒ **Variation:**
  - Diurnal variation
  - Seasonal variation
  - Positional variation
- ❒ Aggravating and relieving factors
- ❒ Quantity of sputum
- ❒ Color
- ❒ Smell
- ❒ **Blood tinged:**
  - How often
  - Quantity
  - Fresh or altered
  - Associated epistaxis

Dyspnea:

- ❒ Duration
- ❒ Onset
- ❒ Grade
- ❒ Progression
- ❒ Aggravating factors
- ❒ Relieving factors
- ❒ Orthopnea
- ❒ Trepopnea
- ❒ Platypnea
- ❒ Paroxysmal nocturnal dyspnea (PND)

Any respiratory system complaints:

- ❒ Wheeze
- ❒ Cough with expectoration

Chest pain:

- ❒ Duration
- ❒ Onset
- ❒ Site
- ❒ Type of pain
- ❒ Radiation
- ❒ Diurnal variation (nocturnal angina)
- ❒ Variation with respiration
- ❒ Aggravating factors
- ❒ Relieving factors
- ❒ **Associated symptoms:** Nausea, vomiting, and sweating
- ❒ Dyspepsia
- ❒ Local tenderness

Wheeze:

- ❒ Duration
- ❒ Onset

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Table 4.7: Differences between hemoptysis and hematemesis.

Hemoptysis	Hematemesis
Coughing of blood. Cough precedes hemoptysis	Vomiting of blood. Nausea and vomiting precedes hematemesis
History of cardiopulmonary disease	History of gastrointestinal disease
Bright red in color	Dark brown in color
Sputum remains blood stained after the attack for few days	Usually followed by melena
Mixed with sputum	Mixed with gastric contents
Blood is frothy due to admixture of air	Airless and not frothy
Alkaline	Acidic
Sputum contains hemosiderin laden macrophages	No
Melena absent	Melena present

Mechanism of Dyspnea

Chemoreceptors

- **Peripheral:** Carotid and aortic bodies (sensitive to changes pO_2, pCO_2 and H^+)
- **Central:** Medulla (sensitive only to changes pCO_2, not pO_2, change in pH of CSF).

Increased work of breathing:

- **Airflow obstruction:** Bronchial asthma, COPD, tracheal obstruction
- **Decreased pulmonary compliance:** Pulmonary edema, fibrosis, allergic alveolitis
- **Restricted chest expansion:** Ankylosing spondylitis, respiratory paralysis, and kyphoscoliosis.

Increased ventilatory drive

- **Increased physiological dead space (V/Q mismatch):** Consolidation, collapse, pulmonary embolism (PE), pulmonary edema

Hyperventilation due to receptor stimulation

- **Chemoreceptors:** Acidosis, hypoxia (shock, pneumonia), hypercapnia
- **J receptors at alveolo-capillary junction:** Pulmonary edema, pulmonary embolism, pulmonary congestion (activates Hering-Breuer reflex, which terminates inspiratory effort before full inspiration is achieved—rapid and shallow)
- **Muscle spindles in intercostal muscles:** Tension-length disparity
- **Central:** Exertion, anxiety, thyrotoxicosis, pheochromocytoma

Impaired respiratory muscle function

- **Diseases with impaired muscle function:** Poliomyelitis, Guillain-Barre syndrome (GBS), myasthenia gravis.

Orthopnea

Dyspnea develops in recumbent position and is relieved by sitting up or by elevation of the head with pillows.

The severity can be graded by the number of pillow used at night, e.g., three pillow orthopnea

Mechanism:

- Pulmonary congestion during recumbency (cannot be pumped out of LV) seen in congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), and bronchial asthma.
- Increased venous return.
- Diaphragm elevation leading to decreased vital capacity.

Seen in:

Orthopnea is classically seen in left heart failure but can also occur in constrictive pericarditis, COPD, bilateral diaphragmatic palsy, asthma triggered by gastric reflux, and gross ascites.

Paroxysmal Nocturnal Dyspnea (PND)

Attacks of dyspnea occur at night and awaken the patient from sleep.

Mechanism

- It is due to decreased responsiveness of respiratory center in brain during sleep and pulmonary congestion (due to increased sympathetic activity during REM sleep) 2–3 hours after onset of sleep.
- Absorption of edema fluid with increase in right ventricular output causing over filling the lungs
- Takes 10–30 minutes for recovery after upright posture **(Fig. 4.1)**.

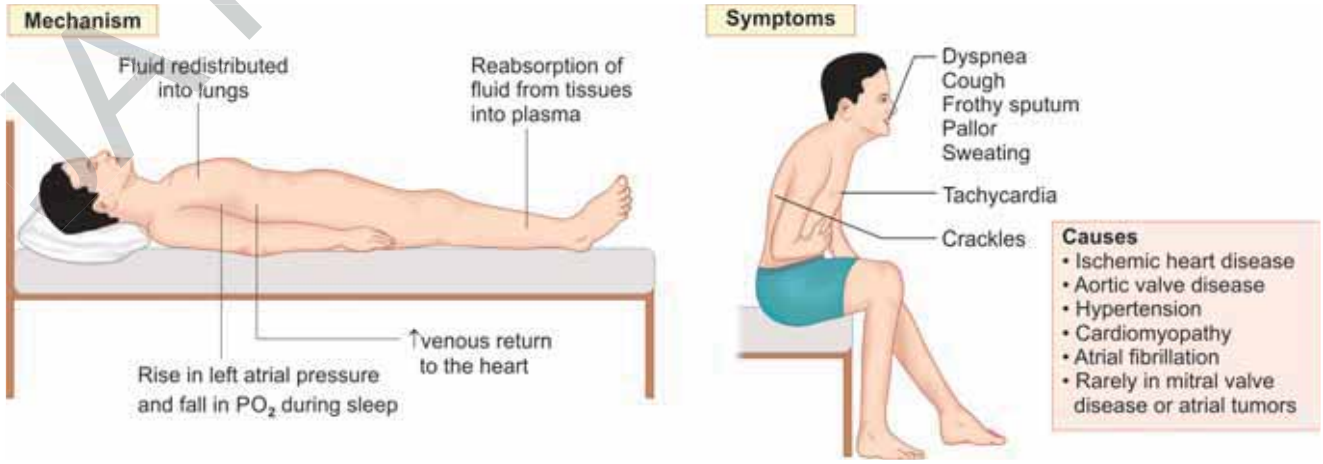


Fig. 4.1: Mechanism of paroxysmal nocturnal dyspnea.

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Fig. 4.2: A patient sits in a chair, bends at the waist, and touches his/her feet. Bendopnea is considered present, if dyspnea occurs within 30 seconds of bending.

Grading Systems

Grading system are explained in **Box 4.1** and **Table 4.9**.

Pitfalls of mMRC Grading

- The mMRC dyspnea scale quantifies disability attributable to breathlessness, and is useful for characterizing baseline dyspnea in patients with respiratory diseases.
- Describes baseline dyspnea, but does not accurately quantify response to treatment of COPD.

Box 4.1: MRC grading of breathlessness.

Medical Research Council (MRC) grading of severity of dyspnea

1. Not troubled by breathlessness except on strenuous exertion
2. Short of breath when hurrying on level ground or walking up slight hill
3. Walks slower than people of same age or stops after 15 minutes when walking at own pace on level
4. Stops after 100 yards (90 m) or after few minutes in level ground
5. Too breathless to leave house, dress or undress

Table 4.9: mMRC grading of breathlessness.

Grade	Description of breathlessness
Grade 0	I only get breathless with strenuous exercise
Grade 1	I get short of breath when hurrying on level ground or walking up a slight hill
Grade 2	On level ground, I walk slower than people of the same age because of breathlessness, or I have to stop for breath when walking at my own pace on the level
Grade 3	I stop for breath after walking about 100 yards or after a few minutes on level ground
Grade 4	I am too breathless to leave the house or I am breathless when dressing

New York Heart Association (NYHA) Classification

Classification by New York Heart Association is described in **Table 4.10.**

Causes of Acute and Chronic Dyspnea

Causes of acute and chronic dyspnea are shown in **Table 4.11.**

Acute Severe Breathlessness

- Pulmonary edema
- Massive pulmonary embolism
- Acute severe asthma

Table 4.10: NYHA classification.

NYHA Class	Patients with cardiac disease (Description of HF related symptoms)
Class I (Mild)	Patients with cardiac disease but without resulting in limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or angina pain
Class II (Mild)	Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or angina pain
Class III (Moderate)	Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea, or angina pain
Class IV (Severe)	Patients with cardiac disease resulting in the inability to carry on any physical activity without discomfort. Symptoms of heart failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased

Table 4.11: Causes of acute and chronic dyspnea.

Acute dyspnea	Chronic dyspnea
Cardiovascular system	
Cardiogenic acute pulmonary edema	Chronic heart failure, myocardial ischemia
Respiratory system	
• Acute severe bronchial asthma • Acute exacerbation of COPD • Spontaneous pneumothorax • Pneumonia • Acute pulmonary embolism • ARDS • Inhaled foreign body (especially in children) • Lobar collapse • Laryngeal edema (e.g., anaphylaxis) or obstruction • Metabolic acidosis (e.g., diabetic ketoacidosis, lactic acidosis, uremia, overdose of salicylates, ethylene glycol poisoning) • Psychogenic hyperventilation (anxiety or panic-related)	• COPD • Chronic bronchial asthma • Bronchial carcinoma • Interstitial lung disease (e.g., sarcoidosis, fibrosing alveolitis, extrinsic allergic alveolitis, pneumoconiosis) • Chronic pulmonary thromboembolism • Lymphatic carcinomatosis • Large pleural effusion(s) • Severe anemia • Obesity • Deconditioning

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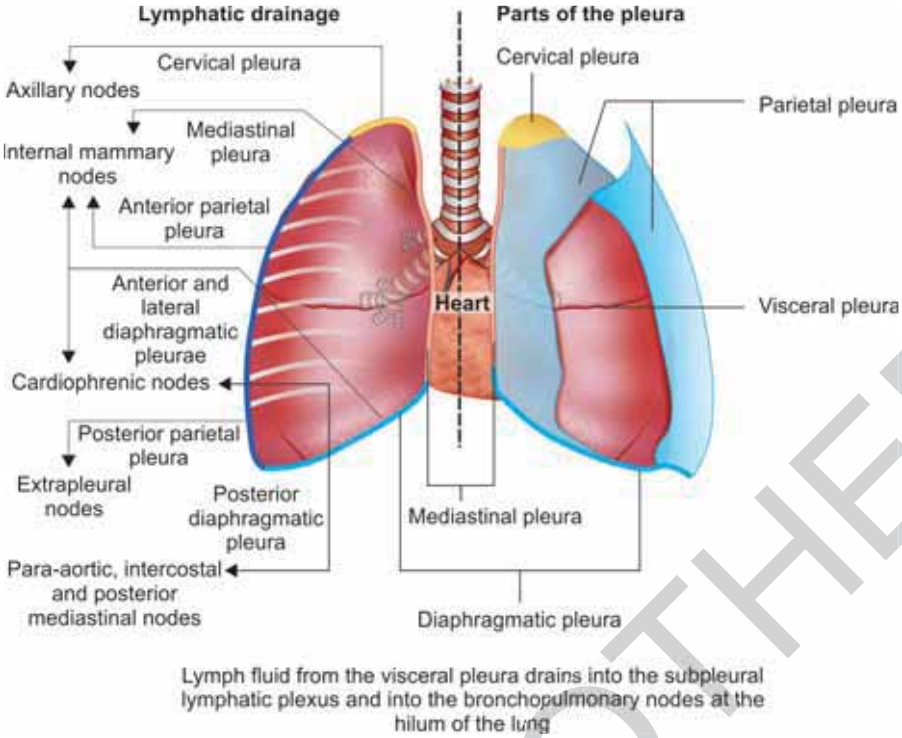


Fig. 4.3: Parts of pleura with corresponding lymphatic drainage.

- ❒ Hard lymph nodes
- ❒ Acanthosis nigricans
- ❒ Horner's syndrome
- ❒ SVC obstruction features

Features of Respiratory Failure

Features of respiratory failure are shown in **Table 4.12**.

Features of Cor-pulmonale

- ❒ Right ventricular dilatation
  - Parasternal heave
  - Epigastric pulsation
- ❒ Right ventricular failure
  - Raised JVP
  - Pedal edema
  - Tender hepatomegaly
  - Ascites
  - Positive hepatojugular reflex is first sign of RVF

EXAMINATION OF RESPIRATORY SYSTEM

Examination of Upper Respiratory Tract System

Demarcation of URTI and LRTI

- ❒ Externally: demarcated by cricoid cartilage
- ❒ Internally: demarcated by glottis

LRTI Diseases Associated with URTI

- ❒ Nasal turbinate hypertrophy or polyps causing airway obstruction
- ❒ Sinus tenderness suggestive of sinusitis
- ❒ Kartageners syndrome:
  - Recurrent sinusitis with ciliary dyskinesia
  - Bronchiectasis

Table 4.12: Features of respiratory failure.

	Type 1	Type 2
Definition	Hypoxemic respiratory failure (type I) is characterized by an arterial oxygen tension (PaO_2) lower than 60 mm Hg with a normal or low arterial carbon dioxide tension ($PaCO_2$)	Hypercapnic respiratory failure (type II) is characterized by a $PaCO_2$ higher than 50 mm Hg
Sensorium	Anxious agitated	Drowsy to comatose
Peripheries	Cold	Warm
Pulse	Feeble	Bounding
Blood pressure	Low	Wide pulse pressure
Cyanosis	+	-
Asterixis	-	+
Respiratory rate	Tachypneic	Normal to low
Papilledema	-	+
Cause	ARDS Pneumonia Acute severe asthma Tension pneumothorax	COPD Obesity Respiratory paralysis
***Type 3 (Perioperative)*:** Functional residual capacity falls below closing volume as a result of atelectasis in post-operative patients. This is generally a subset of type 1 failure but is sometimes considered separately because it is common. ***Type 4 (Shock)*:** Secondary to cardiovascular instability.		

(ARDS: acute respiratory distress syndrome; COPD: chronic obstructive pulmonary disease)

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- Situs inversus
- Male infertility

❒ **Wegeners granulomatosis:** Necrotizing granuloma

❒ **Samter's triad:**
- Aspirin sensitivity
- Bronchial asthma
- Ethmoidal polyps

❒ **Young's syndrome:**
- Sinopulmonary disease
- Azoospermia

❒ **Churg-Strauss syndrome:**
- Asthma
- Eosinophilia
- Vasculitis
- Granuloma

Inspection (Lower Respiratory Tract)

Surface Marking of Lung

Right side three lobes	Left side two lobes
• Right upper lobe (RUL) • Right middle lobe (RML) • Right lower lobe (RLL)	• Left upper lobe (LUL) • Left lower lobe (LLL)

Demarcating Lower Lobe of Either Side (Figs. 4.4 to 4.7)

Lower lobe of either lung can be demarcated from other lobes by drawing a curvilinear line (major interlobar fissure/oblique fissure) joining three bony points:

1. Starting from T2/T3 spinous process, curvilinear line along the medial border of scapula
2. Crossing the 5th rib in the mid-axillary line
3. Reaching the 6th rib in mid-clavicular line

Part of lung below this line is lower lobe

Marking right middle lobe

Draw a straight line (Minor IL fissure/horizontal fissure) from the 4th rib at right sternal border toward the MAL cutting the major inter lobar fissure at 5th rib. The triangular area represents RML.

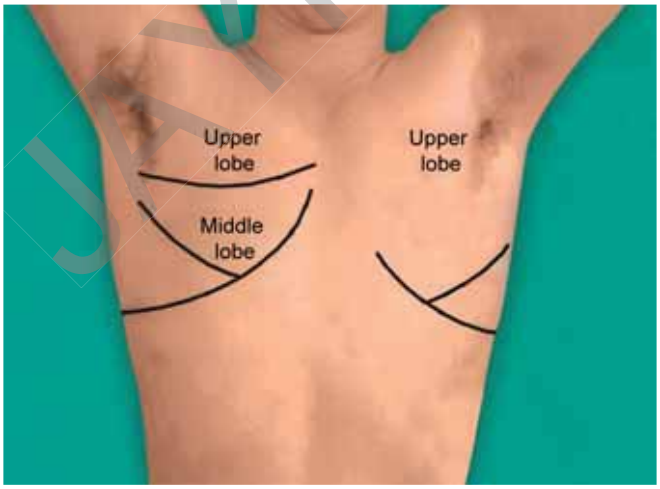


Fig. 4.4: Anterior view of chest showing surface marking of lung lobes.

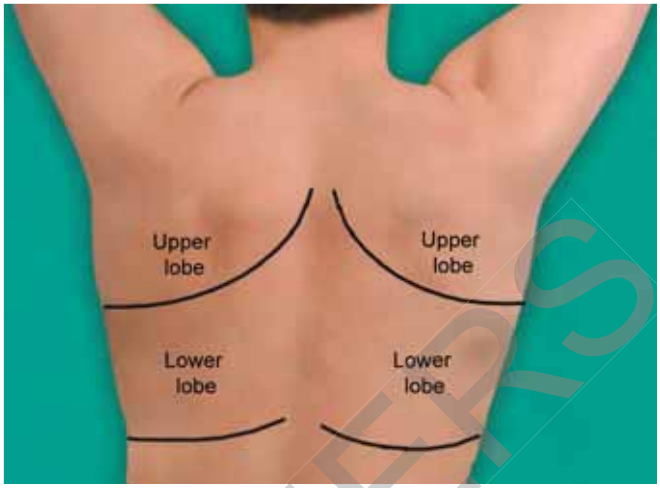


Fig. 4.5: Posterior view of chest showing surface marking of lung lobes.

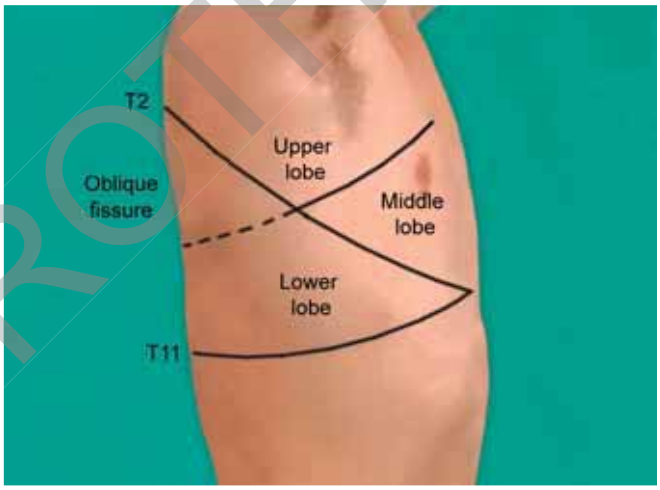


Fig. 4.6: Right lateral view of chest showing right major interlobar fissure and right minor interlobar fissure.

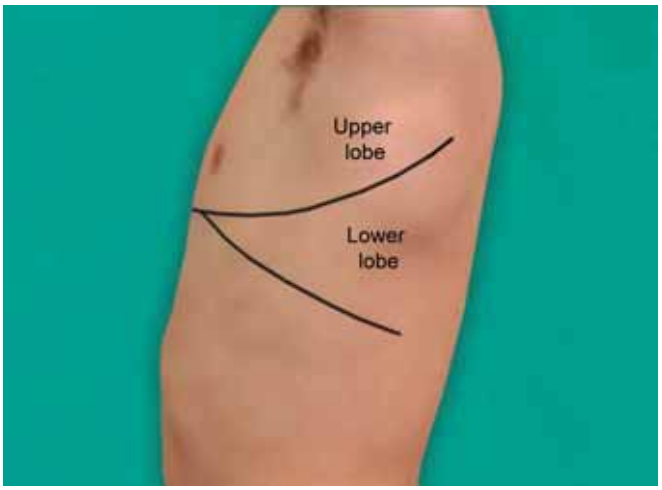


Fig. 4.7: Left lateral view of chest showing left major interlobar fissure.

Level of lower border	MCL	MAL	Scapular
Lung **(Figs. 4.8 and 4.9)**	6th rib	8th rib	10th rib
Pleura	8th rib	10th rib	12th rib

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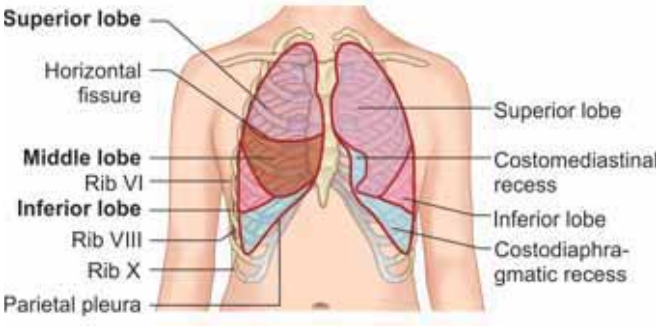


Fig. 4.8: Lower margin of lung in MCL and MAL.

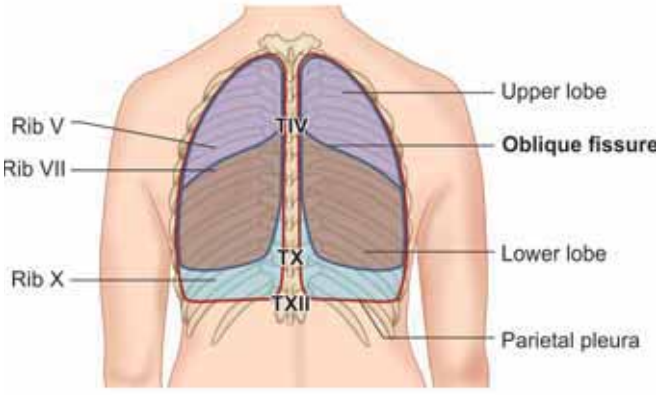


Fig. 4.9: Lower margin of lung in scapular line.

Table 4.13: Chest examination.

Front examination	Back examination	Axillary examination
Predominantly to look for upper and middle lobe	Predominantly to look for lower lobe pathology	All three lobes can be assessed
Examined in Sitting upright with hand by the side	Examined in Sitting upright with hands placed on the opposite shoulder and neck flexed	Examined in the sitting position with hands raised opposite the shoulder and placed on the occiput

Examination of Chest

Chest examination is described in **Table 4.13.**

Position of patient during examination can be

- ❒ Sitting—most of the examination is done in this position
- ❒ Standing—spine and shoulder droop
- ❒ Supine—shifting dullness

Normal Chest (Fig. 4.10)

- ❒ Spine central
- ❒ Shape
  - Circular: infants and early childhood
  - Elliptical: adults
  - Circular: old age
- ❒ Vertical >transverse >AP
- ❒ Transverse: AP = 7:5 (called as **Hutchinson's index**)
- ❒ Subcostal angle ≤ 90 (more acute in males)

Deformities of Chest

Chest deformities are described in **Table 4.14.**

Asymmetry of Chest

Asymmetry of chest is shown in **Table 4.15.**

Trachea

Normally central or slightly deviated to right

Trails Sign (Fig. 4.12)

In the presence of tracheal deviation, there is prominence of the clavicular head of sternocleidomastoid of same side.

The investing layer of cervical fascia splits to enclose the sternocleidomastoid and then falls back and continues as the pretracheal fascia. When there is tracheal shift to one side, the fascia covering the ipsilateral sternocleidomastoid relaxes. The sternocleidomastoid goes into a state of contraction making the clavicular head prominent.

- ❒ Clinical implication of tracheal shift: It suggests upper mediastinal shift.
- ❒ Indicates upper lobe fibrosis or collapse

Apical Impulse

- ❒ Normally 10 cm from sternal margin.
- ❒ Clinical implication—suggests lower mediastinal shift

Examination of Drooping of Shoulder (Fig. 4.13)

Examine the standing patient from behind to look for position of shoulder. Drooping of shoulder indicates volume loss on that side (collapse/fibrosis/fibrothorax/pneumonectomy). It can be seen rarely with paralysis of trapezius.

Associated features include:

- ❒ Prominent medial border of scapula on the affected side
- ❒ Space between medial border of scapula and spine is decreased
- ❒ Inferior angle of scapula is at the lower lever (normally it is at level of T_7 vertebra)

Examination of Spine

- ❒ Look for position of spine
- ❒ Look for scoliosis/kyphosis/lordosis/gibbus **(Fig. 4.14)**
- ❒ In emphysema, there is exaggerated thoracic kyphosis

Causes of Scoliosis

Causes of scoliosis are shown in **Table 4.16.**

Differentiation of congenital versus acquired scoliosis

On bending forward acquired scoliosis disappears but congenital scoliosis persists.

Respiratory Movements

(Describe as equal/diminished in a particular area)

Area	Right	Left
Supraclavicular		
Infraclavicular (Arbitrarily up to 3rd rib)		
Mammary (Arbitrarily 3rd to 6th rib)		
Axillary (Up to 6th rib)		
Infra-axillary (Beyond 6th rib)		
Suprascapular		
Infrascapular		
Interscapular		
Scapular (Mentioned in some books)		

Note: That there is no inframammary area.

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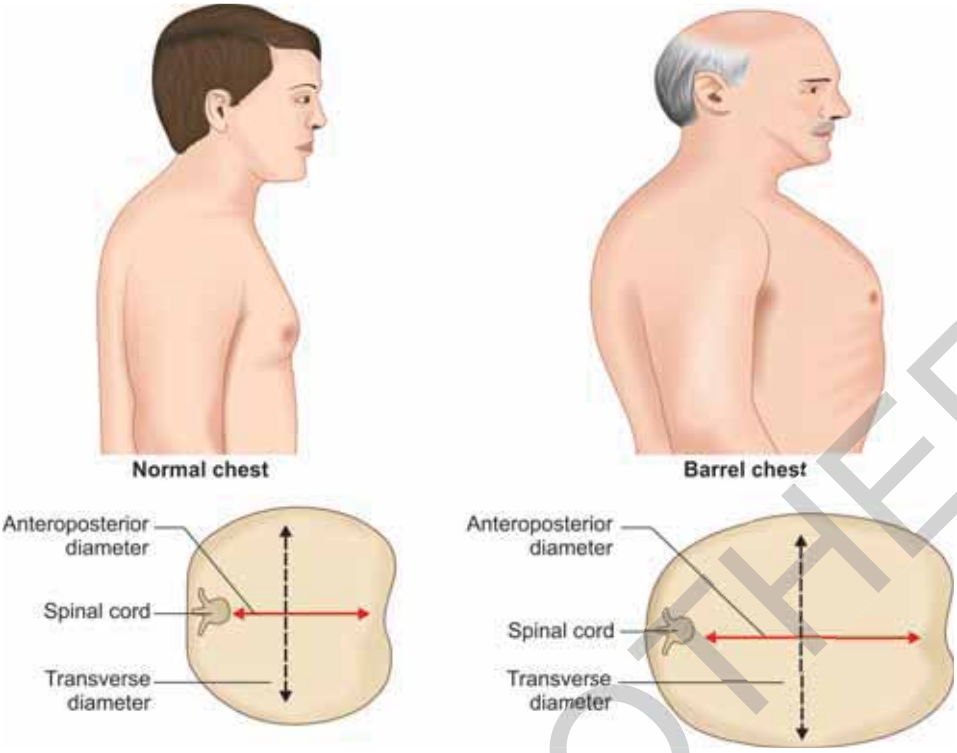
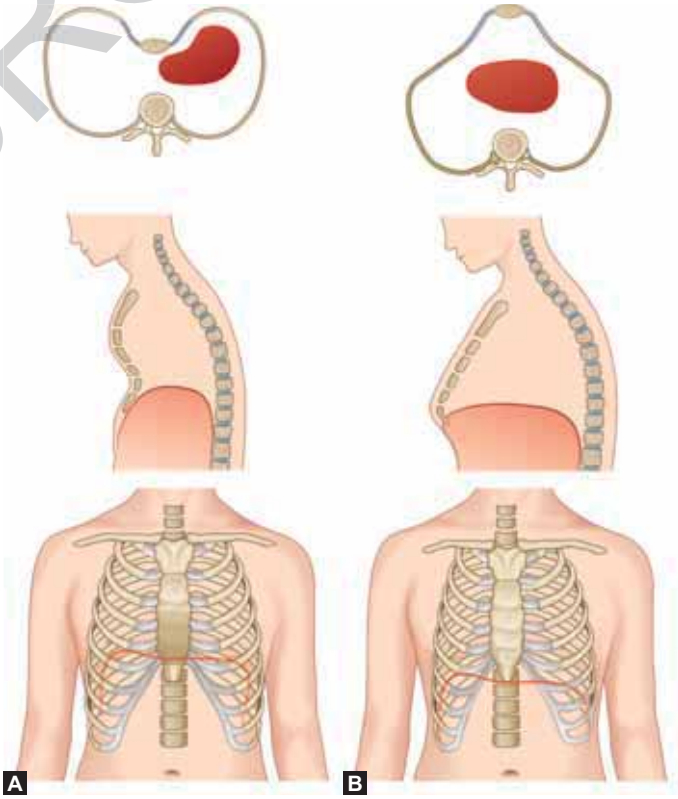


Fig. 4.10: Normal and barrel-shaped chest.

Table 4.14: Chest deformities.

Deformities of chest	
1. Flat chest (alar chest)	Anteroposterior ratio is 2:1
2. Pectus carinatum (Figs. 4.11A and B) (Pigeon chest/ keel chest)	Forward protrusion of sternum seen in rickets and childhood respiratory disease, such as asthma. Can also be seen in Marfan's syndrome
3. Pectus excavatum (Figs. 4.11A and B) (Funnel chest, cobbler's chest)	Funnel-like depression. At the lower end of the chest, seen in Marfan's syndrome. Displaces the heart to the left. Ventilation capacity of the lung is restricted
4. Rachitic chest	Funnel-shaped Keel breast Harrison sulci (horizontal groove where the diaphragm attaches to the ribs—seen in rickets, chronic asthma, and COPD) Vertical grooves on either side of sternum Rachitic rosary (bead-like enlargement of costochondral enlargement especially 4/5/6 ribs)—painless and seen in vitamin D deficiency
5. Scorbutic rosary	Sharp angulation of the ribs arising due to backward displacement of sternum Painful and seen in vitamin C deficiency
6. Barrel-shaped chest (Fig. 4.10)	COPD—emphysema • Anteroposterior: Transverse diameter is 1:1 • Exaggerated thoracic kyphosis • Wide subcostal angle
7. Phthinoid chest	Combination of alar and flat chest
8. Flail chest	Paradoxical movement of the chest in fracture of three or more consecutive ribs
9. Shield-like chest	Turners and Noonan syndrome



Figs. 4.11A and B: (A) Pectus excavatum; (B) Pectus carinatum.

Abnormal signs in respiratory system

Abnormal signs in respiratory system are shown in **Table 4.17**.

Inspiratory Intercostal Retraction (Fig. 4.16)

- Mild degree of intercostal retraction in the lower chest is normal

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Table 4.15: Asymmetry of chest.

Asymmetry	Features
Deformity of spine	• Scoliosis • Kyphoscoliosis • Gibbus
U/L bulge	• Pleural effusion • Pneumothorax • Compensatory hypertrophy • Malignancy of lung or pleura
U/L flattening	• Fibrosis • Collapse • Fibrothorax • Pneumonectomy • Agenesis of one lung (McLeod's syndrome/ Swyer-James syndrome) • Mastectomy • Absent pectoralis (Poland's syndrome)
Local bulging (fullness)	• Supraclavicular fullness (Pancoast tumor/ lymphadenopathy/massive pleural effusion/ tension pneumothorax) • Empyema necessitans (cough impulse present) • Aortic aneurysm • Malignant infiltration • Pericardial effusion • Surgical emphysema
Local retraction	• Apical TB (Mohrenheim's fossa/infraclavicular fossa) • Lung fibrosis



Fig. 4.12: Trail's sign showing undue prominence of sternocleidomastoid on the right side due to tracheal shift to right.



Fig. 4.13: Shoulder drooping on right side.

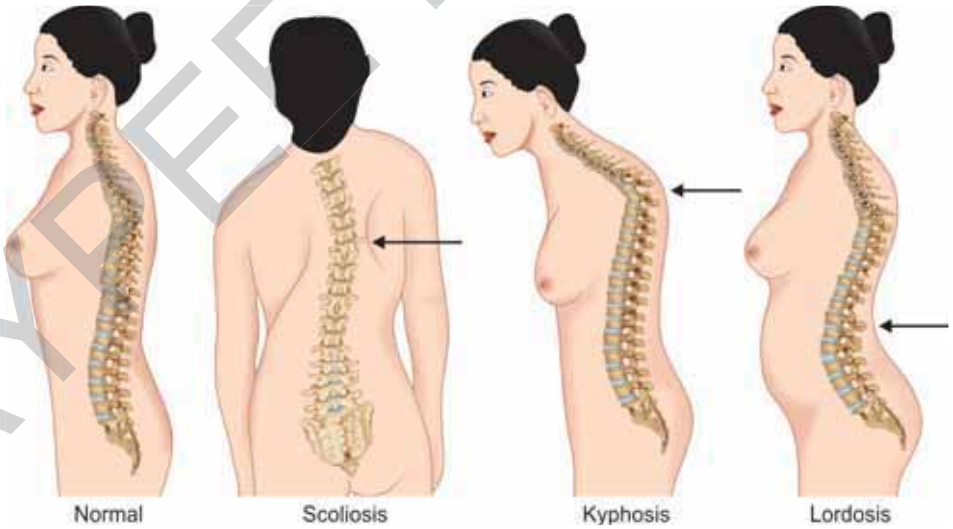


Fig. 4.14: Spine deformities.

❒ Differences between unilateral and bilateral intercostal retraction is shown in **Table 4.18**.

Visible Pulsations/Scars/Sinuses

Visible pulsation or vessels:

❒ **Collaterals around scapula:** Coarctation of Aorta **(Suzman's sign)**

❒ **Engorged veins over the anterior part of chest**
- **SVC obstruction**
  - Bronchogenic carcinoma
  - Mediastinal growth
  - Mediastinal lymphnodes
  - Aortic aneurysm
  - Chronic mediastinal fibrosis

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- **Pulsatile swelling in anterior chest wall:** Aortic aneurysm.

Visible scars:
- Previous surgery (lobectomy)
- Pleural fluid aspiration site
- Lymphnode biopsy site

Sinuses:
- Abscess draining points
- Empyema thoracis (usually in tuberculosis/actinomycosis))

Palpation (Lower Respiratory Tract)

Trachea

- Normal length: 4–5 cm above suprasternal notch

Table 4.16: Causes of scoliosis.

Scoliosis	Causes
Neuromuscular causes	• Spina bifida • Marfan's syndrome • Cerebral palsy • Federick's ataxia • Spinocerebellar degenerations • Charcot marie tooth disease • Syringomyelia • Poliomyelitis • Muscular dystrophy (Duchene's, Fascioscapulo humeral, Myotonic dystrophy)
Degenerative	Osteoporosis Postspine surgery
Osteopathic	Klippel feil syndrome
Congenital scoliosis	Down's syndrome Prader-Willi syndrome
Respiratory diseases	Fibrosis Fibrothorax
Idiopathic	-

- Normal cricoid to suprasternal notch distance is 3–4 finger breadth (decreased in COPD due to hyperinflation)

Method of Palpation

Keep the index and ring finger of the right hand on medial ends of the clavicle
↓
With middle finger trace the trachea from above downward **(Fig. 4.17)**
↓
Then, insinuate the middle finger between the trachea and sternal head of sternocleidomastoid, and feel for resistance **(Fig. 4.18)**

Implication of tracheal shift: Upper mediastinal shift

Oliver's Sign (Tracheal Tug Sign) (Fig. 4.19)

- Stand behind patient and hold cricoid cartilage give a slight upward thrust.

Positive test	Downward pull with each heart beat suggestive of aortic aneurysm
Negative test	Normal
False positive	Mediastinal tumor attached to abdominal aorta
False negative	Thrombosed aortic aneurysm

- **Tracheal descent on inspiration (Campbell sign):** Due to downward pull of the depressed diaphragm in long-standing hyperinflation of lung.
- **Laryngeal fixation:** Increased pressure on cricoid cartilage due to inflammatory or neoplastic lesion in mediastinum.

Apical Impulse

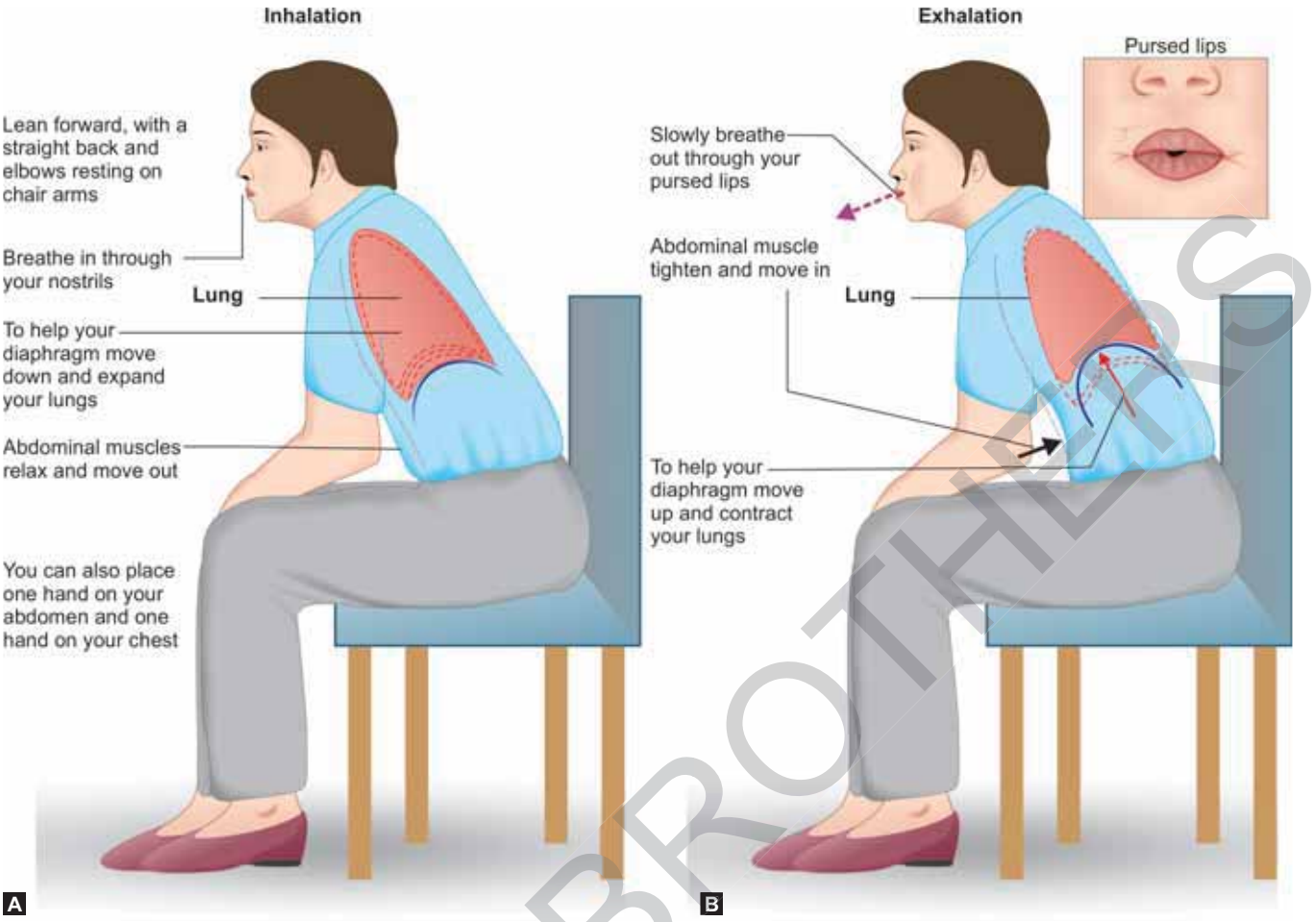
- Confirm the position of apex
- Comment on character
- Watch for thrills and other palpable heart sounds
- Implication of apical shift: it suggests lower mediastinal shift

Table 4.17: Abnormal signs of respiratory system.

Abnormal signs	Description
Sitting up and catching the edge	Described in COPD where the patient sits up and fixes shoulders to use latissimus dorsi for expiration
Tripod position (Fig. 4.15A)	Patient is sitting in leading forward posture with their outstretched hands on their knees. This position fixes and lifts the shoulder girdle and improves the function of pectoralis major and minor
Hoover sign	It paradoxical inspiratory indrawing of lateral rib cage (costal margin). It is a sign of chronic airflow obstruction. Pulmonary hyperinflation leads to loss of apposition of the diaphragmatic fibers resulting in horizontal orientation of fires. When these horizontally oriented fibers contract, the costal margins gets pulled inwards
Pursed lip breathing (Fig. 4.15B)	Seen in COPD to increase the intra-alveolar pressure to maintain a positive intraluminal pressure, which reduces the airway collapse, air way resistance, and residual volume and hence improves ventilation
Dahl's sign	Patches of hyperpigmentation/bruising above the knees due to constant tenting position of the hands and elbows
Littens sign	To look for the diaphragmatic movement Sit to one side of the patient lying in supine position and look at the diaphragmatic movements
Excessive usage of SCM and scalene	COPD or asthma
Paradoxical respiration	Indrawing of abdominal wall when the rib case moves outwards. Best felt by bimanual palpation with one hand over the patient's chest and other on the abdomen. Indicates respiratory muscle weakness

(COPD: chronic obstructive pulmonary disease)

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Figs. 4.15A and B: Tripod position with pursed lip breathing.



Fig. 4.16: Intercostal retractions.



Fig. 4.17: Tracing the trachea down with the middle finger.

Table 4.18: Differences between unilateral and bilateral intercostal retraction.

Unilateral intercostal retraction	Bilateral intercostal retraction
• Collapse • Fibrosis • Adherent pericarditis (Broadbent's sign–indrawing of lower anterior chest wall with each ventricular systole)	• Indicates upper air way obstruction (adenoids/ foreign body) • Hyperinflation of chest

Apex not felt/seen in respiratory diseases:
- ❒ Emphysema
- ❒ Left-sided pleural effusion
- ❒ Left-sided pneumothorax

Mediastinal shift with respect to respiratory disease

Mediastinal shift with respect to respiratory disease is shown in **Table 4.19**.

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Fig. 4.18: Insinuate the middle finger between the trachea and sternal head of sternocleidomastoid, and feel for resistance.



Fig. 4.19: Demonstration of Oliver's sign.

Table 4.19: Mediastinal shift with respect to respiratory diseases.

Mediastinal shift	Disease
Shift to same side	Fibrosis Collapse
Shift to opposite side	Pleural effusion Pneumothorax Tumor or mass
No shift of mediastinum	Unilateral disease • Pneumonia disease • Bilateral disease • COPD • Asthma • Bronchiectasis • Interstitial lung disease

Examination of respiratory movements	
Upper anterior chest (Fig. 4.20)	• Examined by placing the palms in the infraclavicular areas • Look for superio-anterior movement of the palms • This examines the pump handle movement of the upper lobes.

Contd...

Contd...

Examination of respiratory movements	
Lower anterior chest (Fig. 4.21)	• Grasp the sides of the chest and approximate the tips of the thumbs in the mammary area with loose fold of skin in between • Watch for separation of the thumbs and compare the movements with each respiration • It demonstrates the buckle handle movements of the lower chest
Upper posterior chest (Fig. 4.22)	• Examine from the back by placing hand in the supraclavicular fossa and watch for movements superiorly • This demonstrates the movement of the apical segment
Lower posterior chest (Fig. 4.23)	• Grasp the sides of the chest and approximate the tips of the thumbs in the infrascapular area with loose fold of skin in between • Watch for separation of the thumbs and compare the movements with each respiration • This demonstrate the lower lobe movements



Fig. 4.20: Examination of respiratory movements of upper anterior chest.



Fig. 4.21: Examination of respiratory movements of lower anterior chest.

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Fig. 4.22: Examination of respiratory movements of upper posterior chest.

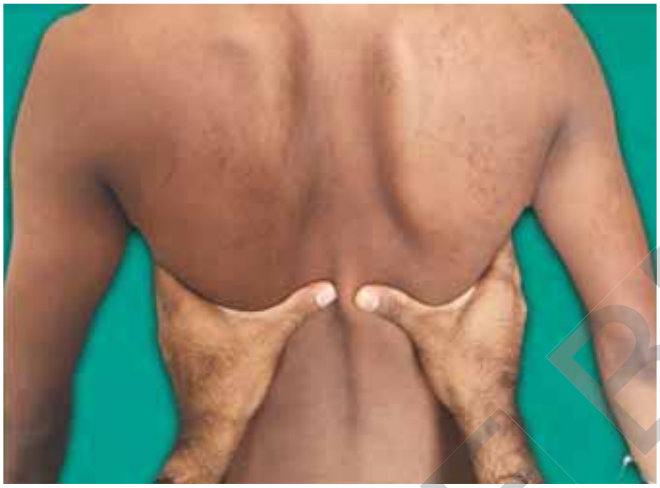


Fig. 4.23: Examination of respiratory movements of lower posterior chest.



Fig. 4.24: Examination of diaphragmatic movements.

Diaphragmatic movements:

- Place one hand on chest and other hand on the abdomen **(Fig. 4.24)**
- Normally both hands are lifted during inspiration
- If chest (rise) but abdomen (static)—suggests and abdominal pathology, which is fixing the abdomen
- If chest (rises) but abdomen (retracts)—suggests diaphragmatic palsy

Table 4.20: Causes of decreased chest movements.

Unilateral	Bilateral
• Pleural effusion • Empyema • Pneumothorax • Fibrosis • Collapse	• COPD • Asthma • ILD • Ankylosing spondylosis • Systemic sclerosis

Table 4.21: Measurement of chest movement.

Measurements	Description
AP diameter **(Fig. 4.25)**	Use two cardboards and place as shown in the Figure 4.25 Normal ratio of AP to T = 5:7
Transverse diameter **(Fig. 4.26)**	
Chest expansion **(Fig. 4.27)**	Normal = 5–8 cm (adult), decreases with age (e.g., 60 year ≥ 3 cm is considered normal) COPD/ILD expansion is <1.5 cm
Hemithorax expansion **(Figs. 4.28A and B)**	Stand on one side and place the tape from spine to mid sternal as shown in **Figures 4.28A and B**

Note: Chest expansion should be assessed as the difference of measurement between deep inspiration and deep expiration.

"The most important examination finding is to check for hemithorax expansion and hemithorax measurement".

Causes of chest movements

The causes of decreased chest movements are shown in **Table 4.20**.

Measurements of chest dynamics

Table 4.21 shows measurement of chest movements.

Remember: *"The side that moves less is the site of disease".*

Increased hemithorax size with decreased hemithorax movement	Decreased hemithorax size with decreased hemithorax movement	Normal hemithorax size with decreased hemithorax movement
Pleural effusion Pneumothorax	Fibrosis Collapse	Consolidation

Examination of Spinoscapular Distance (Fig. 4.29)

It is the distance between the spine and the scapular line (scapular line is the vertical line passing through the inferior angle of scapula).

Examination of Spino-acromion Distance (Fig. 4.30)

It is the distance measured between the spine and the tip of acromion process.

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Fig. 4.31: Demonstration of vocal fremitus.



Fig. 4.32: Examination of rib crowding.

Vocal fremitus	
Increased	**Decreased**
• Consolidation • Large cavity • Bronchopleural fistula	• Pleural effusion • Pneumothorax • Fibrosis • Collapse • Asthma • Emphysema • Thick pleura

Tactile Fremitus

- These are palpable adventitious sounds
- It could be coarse crepitations or rhonchi

Friction Fremitus

These include palpable pericardial rub or pleural rub (e.g., dry pleurisy)

Tenderness

Seen in

- Empyema (intercostal tenderness)
- Local inflammation of soft tissue
- Osteomyelitis/rib fractures/costeochondritis (Tietz syndrome)
- Tumor infiltration
- Amebic liver abscess
- Subphrenic abscess

Detection of Subcutaneous Emphysema

Spongy crepitant feeling on palpation:

- Injury to chest wall
- Pneumothorax
- Rupture of esophagus

Rib Crowding/Intercostal Widening

- Stand behind the patient and place the fingers in the intercostal spaces simultaneously on both sides as shown in **Figure 4.32.**
- Observe for the separation of the fingers

Rib crowding		Intercostal widening	
u/L	B/L	U/L	B/L
Atelectasis Collapse Fibrosis Pneumonectomy	ILD Fibrosis (bilateral)	Pneumothorax Pleural effusion	Emphysema

Percussion (Lower Respiratory Tract)

Preferably done in sitting position, supine position is needed for demonstrating shifting dullness.

Position of Patient for Percussion

- **Anterior chest (Fig. 4.33):** Sits up straight with hands by his side
- **Axilla (Fig. 4.34):** Raise the arm over the head and place over the back of head
- **Back of chest (Fig. 4.35):** Sits up with hands crossed and placed over the opposite shoulders.



Fig. 4.33: Demonstration of percussion of anterior chest.

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Fig. 4.34: Demonstration of percussion of axillary area.



Fig. 4.35: Demonstration of percussion over the posterior chest.

Rules of Percussion

- **Direction of percussion:** Always percuss from resonant to nonresonant area.
- **Pleximeter** is usually the middle phalynx of middle finger of left/non dominant hand) is firmly placed on the surface while rest of fingers are slightly lifted off.
- **Plexor/plessor** (percussing finger) is middle finger of the right/dominant hand.
- The movement of the plexor hand should be sudden and originating from the wrist.
- The pleximeter must be kept parallel to the border to be percussed.
- Percuss around 2–3 time over each area.
- Percussion has to be heard as well as felt.
- Always percuss the identical areas of chest for comparison.
- The distance between the pleximeter finger and the ear should preferably maintained.

Types of Percussion

Types of percussion are described in **Table 4.22**.

Table 4.22: Types of percussion.

Heavy percussion	Light percussion
Posterior part of chest	Anterior part of chest and abdomen

Direct percussion	Indirect percussion	Auscultatory percussion
Directly over the bony structures like clavicle	By percussing the pleximeter finger with the plexor/plessor	Was first described by Laennec and used to delineate the size of organs by placing the stethoscope directly above the structure to be outlined, followed by percussion from the periphery toward the organ of interest

Direct percussion (Fig. 4.36)

- Percuss the middle third of the clavicle with plexor finger.
- Stretch the skin over the clavicle using the left hand as shown in **Figure 4.36**.
- Normally middle third of the clavicle is resonant whereas the medial and lateral thirds are dull (because of muscles attached).

Impaired note	Heard in apical fibrosis
Dull note	Mass lesion-like Pancoast tumor
Widening of zone of resonance	Heard in seen in pneumothorax or emphysema

Lung resonance:

Normal:

- Vesicular resonance
- Front of chest more resonant
- Lesion >5 cm from chest wall or <2–3 cm in size will not alter the percussion note

Abnormal Types of Percussion Note

Abnormal types of percussion note are described in **Table 4.23**.



Fig. 4.36: Demonstration of direct clavicular percussion.

Table 4.23: Abnormal types of percussion note.

Quantitative	Qualitative
1. Tympanic note 2. Subtympanic note 3. Hyperresonant note 4. Impaired note 5. Dull/woody dull note 6. Stony dull note	1. Crackpot 2. Amphoric 3. Bell tympany

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Quantitative types:

- **Tympanic:**
  - It is a drum-like note
  - Normally seen over the stomach, intestine—Traube's space.
  - In chest—superficial cavity, subcutaneous emphysema (metallic tympanic note)
- **Sub-tympanic (skodiac):**
  - It is Boxy quality
  - Seen just above pleural effusion
- **Hyper-resonant:**
  - Intermediate between normal and tympanic note
  - B/L—emphysema
  - U/L—pneumothorax, compensatory emphysema
  - Large bullae
- **Impaired note:** Airless areas (fibrosis, collapse)
- **Dull note:**
  - Consolidation
  - Thick pleura
- **Flat dull:**
  - Elicted by percussing the thigh
  - Seen in pleural effusion
- **Stony dullness:**
  - Pain over the pleximeter finger with resistance felt by plexor
  - Large pleural effusion
  - Large solid tumor

Qualitative types

- **Cracked pot resonance:**
  - Normally seen in chest of infants or child during the act of crying
  - Pathological slung cavity with communication with bronchus due to sudden expulsion of air form the cavity to bronchus
  - Artificially imitated by beating clasped hands over the knee
- **Amphoric:**
  - Low-pitched hollow note
  - Normal seen in trachea and cheek distented with air
  - Pathologically seen in pneumothorax and large cavity
- **Bell tympany:**
  - High pitched metallic or tympanic note
  - Seen in massive pneumothorax
  - Place coin on effected side of chest and percuss with another coin while simultaneously auscultating the back.
- **Dullness in presence of fluid in lung:**
  - Straight line dullness: Hydropneumothorax
  - S-shaped curve of ellis: Pleural effusion

5-7-9 rule

The upper border of liver dullness is at 5th ICS in mid clavicular line, 7th ICS in the midaxiallary line, and 9th ICS in the scapular line.

Topographical Percussion of Lung

Apical percussion:

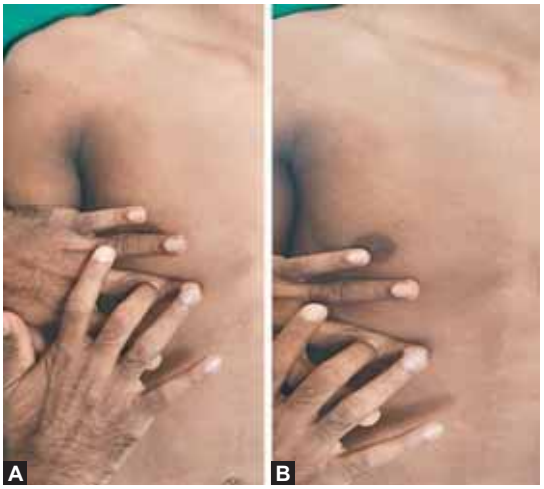
- **Kronigs isthmus:** It is band of resonance in the supra-clavicular area bounded anteriorly by the posterior border of the clavicle, medially by the neck muscles, posteriorly by the anterior border of trapezius, extended laterally till the acromioclavicular joint.
- Stand behind the patient, place the pleximeter finger over the neck and percuss from lateral to medial as shown in **Figure 4.37**.
- On percussion there is dull zone medially and laterally, and only middle part is resonant.
- Dullness in this area suggests apical tuberculosis, Pancoast tumor or apical fibrosis.
- The zone of resonance may be widened in emphysema or apical pneumothorax.

Tidal percussion

- Tidal percussion is measure of diaphragmatic excursion
- It is used to differentiate whether the causes of dullness are above the diaphragm (subpulmonic effusion) or below (sub phrenic collections).
- Patient in sitting position, percuss the right side of the chest from above downward till you get the liver dullness. Normally, it is in 5th Intercostal space.
- Ask the patient to take deep inspiration and hold his breath.
- Now percuss the same area
- Normally, dullness moves down by 1–2 intercostal spaces as shown in **Figures 4.38A and B**.



Fig. 4.37: Percussion of apical area (Kronig's isthmus).



Figs. 4.38A and B: Demonstration of tidal percussion: (A) Expiration; (B) Inspiration.

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Fig. 4.39: Percussion of Traube's space.

- Tidal percussion is negative in subpulmonic effusion, diaphragmatic paralysis.
- In emphysema, since the lung is already fully expanded tidal percussion will be negative

Percussion of Traube's Space (Fig. 4.39)

- It is a semilunar space in the left anterior chest bounded by
  - Above by 6th rib
  - Below by left-costal margin
  - Laterally by midaxillary line

Normal traube's space percussion	Tympanic note
Obliteration of Traube's space	• Left-sided pleural effusion • Pericardial effusion • Massive splenomegaly • Enlarged left lobe of the liver • Full stomach or fundic mass
Upward shift of Traube's space	• Left diaphragmatic paralysis • Left lower lobe collapse or fibrosis

Shifting dullness

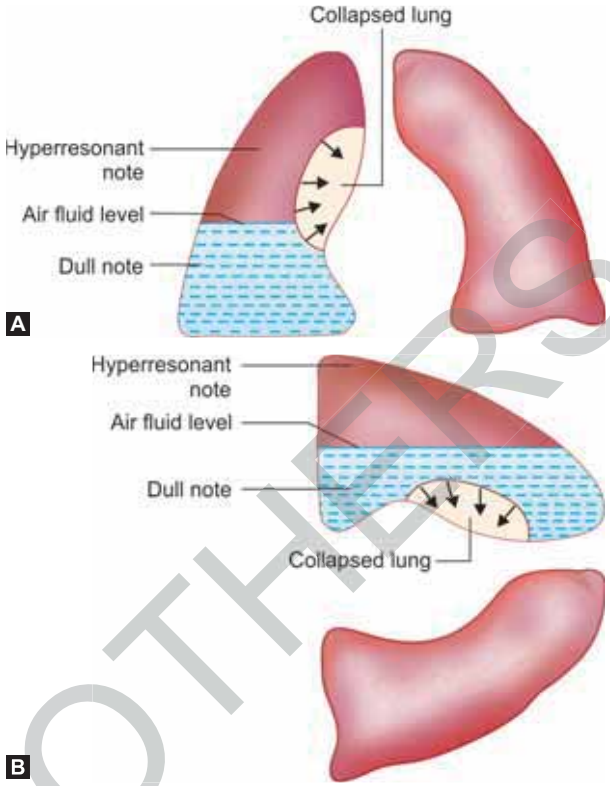
Classically described for hydropneumothorax. It can also be demonstrated in pleural effusion.

Steps:

- Percuss the anterior chest in sitting position, from above downwards to get upper border of dullness. You will get a level of straight line dullness perpendicular to long axis of body as shown in **Figure 4.40A**. Mark this level.
- Now, make the patient lie down in opposite lateral position for approximately 5–10 minutes (may take around 30–40 minutes in case of pleural effusion). Now, note the change in the straight line dullness which will now be parallel to long axis of body as shown in **Figure 4.40B**.

Special findings in percussion

Special findings with clinical condition in percussion are shown in **Table 4.24**.



Figs. 4.40A and B: (A) Sitting position; (B) Left lateral position.

Table 4.24: Special findings in percussion.

Special finding	Clinical condition
Shifting dullness	Hydropneumothorax
S-shaped curve of Ellis (Damoiseau curve)	Pleural effusion (moderate)
Obliteration of Traube's space	Pleural effusion (left sided)

Auscultation

Position of Patient

In upright position	Front	Sitting or standing
	Back	Preferably sitting and leaning forward with neck flexed and arms crossed in front
In recumbent position	Back	Turn the patient sideways or slip the steth underneath the patient

Breathing Advice

Ask the patient to breathe through the mouth. If not cooperating, ask the patient to count numbers or cough successively and then observe during the deep inspiration.

Normal Physiology of Breath Sounds

Table 4.25 shows the mechanism of sound production.

Grading of breath sound intensity

0: Absent breath sounds
1: Barely audible breath sound
2: Faint but definitely audible breath sound

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Archith Boloor MBBS MD (Internal Medicine) is an Additional Professor, Department of Medicine, Kasturba Medical College, Mangaluru, Karnataka, India. He is a distinguished alumnus from the Manipal Academy of Higher Education. He has earned the 'Best Teacher Award' five times in a short teaching career of 13 years. As the "Best Outgoing Student in Internal Medicine" during his MD in 2008, he has distinguished himself as an enthusiastic teacher and a skilled clinician with awards in Best Audio-Visual Teaching Methods and innumerable research publications in high impact journals such as Nature and Lancet. He recently won the award for Excellence in Book Production by the Federation of Indian Publishers for his book: *The Insiders' Guide to Clinical Medicine*. He has years of experience shining through multiple books, such as *Exam Preparatory Manual for Undergraduates—Medicine, An Insider's Guide to Clinical Medicine, Mastering Medicine—MRCP Made Easy* and some big projects yet to be released.

Mohammed Shaheen MBBS is an alumnus of Kasturba Medical College, Mangaluru, Karnataka, India. He is presently working in COVID-19 control with the Ministry of Public Health and Hamad Medical Corporation, Doha, Qatar. A highly analytical thinker and excellent writer, he is adept in research and writing, both medical and non-medical. He has won many national and international accolades for both academic and extracurricular events. He has contributed chapters for *Exam Preparatory Manual for Undergraduates—Medicine and Mastering Medicine—MRCP Made Easy*. With his unique perspective towards medical education, he has made this book a palatable delight for all students.

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