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4th Edition

JAYPEE

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CHAPTER 3

Respiratory System

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Name: Age: Sex: Address: Occupation:

PRESENTING ILLNESS

Cough

Onset, duration, progress, dry/productive, thick viscid or frothy, how long, diurnal or postural variation, aggravated by dust, pollen, or cold air, associated pain.

Sputum

Thick, viscid, frothy, color, consistency, amount, copious or not, diurnal or postural variation, foul smelling or not.

Hemoptysis

Onset, duration, progress, fresh/altered blood, quantity, purulent sputum or not, any chest pain, hematuria, or any bleeding tendencies.

Breathlessness

- Onset, duration, progress (class 1–4)
- Aggravating/relieving factors
- Associated symptoms like cough with expectoration, wheeze, chest pain.
- History of paroxysmal nocturnal dyspnea, orthopnea, trepopnea, platypnea.

Chest Pain

Onset, site, duration, radiation, brought on by, lasts for, character, aggravating/relieving factors, associated symptoms like vomiting, sweating, nausea, heartburns, associated with food intake, respiration.

Swelling of Feet

- Limited to face/legs—unilateral or bilateral/abdomen, generalized
- Aggravating/relieving factors, duration.

Symptoms of Cor Pulmonale

Anorexia, nausea, vomiting, abdominal distention, decreased urine output, right hypochondrial pain, nocturia, anasarca.

Symptoms of Tuberculosis

Loss of weight, appetite, evening rise of temperature, night sweats.

Symptoms of SVC Syndrome

Facial swelling, radicular pain in arm, hoarseness, dysphagia, dilated veins.

Symptoms of Malignancy

Loss of weight, appetite, chest wall tenderness.

PAST HISTORY

Previous similar episodes, history of DM, HT, IHD, TB, STD, RHD. History of hemoptysis, bronchial asthma or chronic obstructive pulmonary disease (COPD).

PERSONAL HISTORY

- Sleep, appetite, bowel and bladder habits
- Any addictions—smoking, alcohol, IVDA (in detail if one is seen).
- *Smoking*: No. of cigarettes/beedies per day, age at which habit was started, if stopped/reason. History of snuff, tobacco, betel nut chewing.

FAMILY HISTORY

- Any similar illness in the family
- Any history of TB, asthma DM, IHD, HT.

SOCIOECONOMIC HISTORY

Earning member of family, living in what type of house, any overcrowding or not, good sanitary facilities, good well, etc.

GENERAL EXAMINATION

- Conscious, cooperative, comfortable/dyspneic at rest, build and nourishment.
- *Pallor, cyanosis, jaundice, clubbing, pedal edema, LNE*:
  - *Pulse*: Rate, rhythm, volume, character, peripheral vessels, thickening, radiofemoral delay, pulse deficit, carotid bruit.
  - *Respiration*: Rate, rhythm, character, depth
  - *Blood pressure*: mm Hg, in which limb (UL/LL) posture, whether on antihypertensive
  - *Temperature*: Record if febrile
- Look for external markers of TB
- Marfan's syndrome (in pneumothorax).

EXAMINATION OF RESPIRATORY SYSTEM

Upper Respiratory Tract

- *Nose*: Deviated nasal septum, nasal polyps, sinus tenderness, nasal alae.
- *Oral cavity*: Oral hygiene, dental caries, oral thrush, and tonsils.
- *Pharynx*: Postnasal drip and congestion.

RESPIRATORY SYSTEM PROPER

Inspection

- Position of trachea (Trail's sign), apical impulse
- Chest wall deformity—kyphoscoliosis, pectus excavatum (funnel/Cobbler's chest), pectus carinatum (pigeon/keeled chest), flail chest, barrel chest, rickety and scorbutic rosary, Harrison's sulcus, flat chest.
- Chest wall symmetry—look for evidence of volume loss such as drooping, rib crowding, hollowing, decreased spinoscapular distance, kyphoscoliosis, flattening retraction. Any evidence of mass lesion bulging, fullness.
- Movements of chest wall—rate, rhythm, equality, type, intercostals retraction, accessory muscles of respiration.
- Skin over chest wall—dilated veins, pulsations, scar discharging sinus, intercostals swelling, shiny skin.

PALPATION

- Position of trachea, apical impulse may be confirmed.
- Swelling, chest wall, subcutaneous emphysema or intercostal tenderness.
- Movement of chest wall, chest expansion (total, both hemithorax)
- Fremitus (tactile vocal)
- Tracheal tug and inspiratory tracheal descent.

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PERCUSSION

- Anteriorly

Right side	*Left side*
Kronig's isthmus	Kronig's isthmus
Clavicular percussion	Clavicular percussion
Infraclavicular area	Infraclavicular area
Mammary area	Mammary area
Liver dullness	Cardiac dullness
Tidal percussion	Traube's space

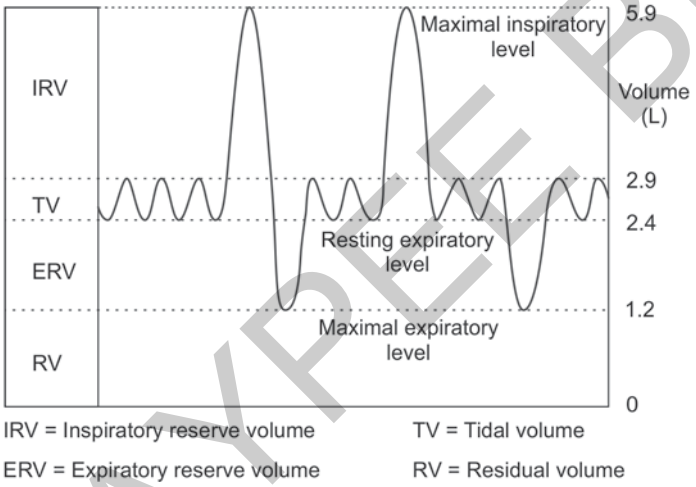
- *Axilla*: axillary, infra-axillary area on both sides
- *Posteriorly*: subscapular, interscapular, intrascapular area.
- Straight line dullness, shifting dullness (hydropneumothorax)
- Skodaic resonance, crackpot resonance
- Percussion tenderness, percussion myokymia.

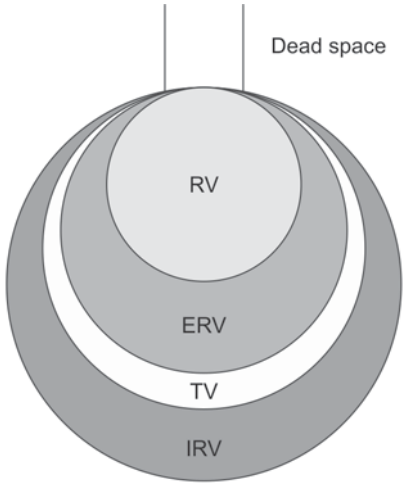
AUSCULTATION

- *Breath sound*: Intensity (loud, normal, decreased)
- *Quality*: Vesicular, bronchial (tubular, cavernous, amphoric), bronchovesicular
- *Added sounds*: Crepitations (fine/coarse, early/mid/late inspiratory, post-tussive), bronchi, pleural rub
- *Vocal resonance*: Increased/decreased, bronchophony, egophony, whispering pectoriloquy
- *Other features*: Post-tussive suction, post-tussive creps, coin sound, succession splash, Hamman's crunch, stridor.

Examination of other systems: CVS/Abdomen/CNS

SPIROMETRY





DISCUSSION

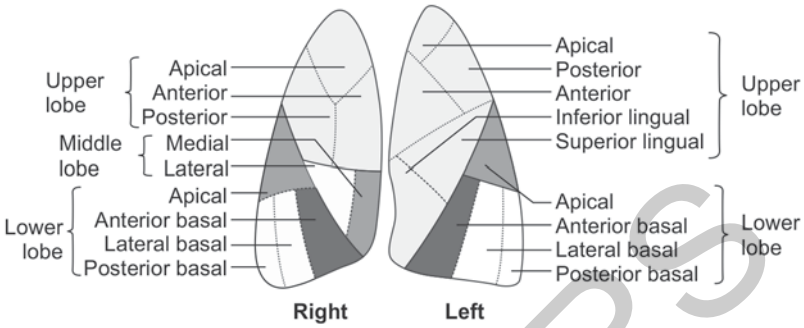
ANATOMY

- *Lungs*: 6th, 8th, 10th intercostal space
- *Pleura*: 8th, 10th,12th intercostal space in the midclavicular line, midaxillary line and posterior scapular line, respectively.
- *Major interlobar fissure*: From T2 spine, medial border of scapula (with arm hyperabducted) to 6th costochondral junction.
- *Minor interlobar fissure*: From 4th costochondral junction to major fissure.
- Bronchopulmonary segment:

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Right lung:

Upper lobe: Apical
Anterior
Posterior
Middle lobe: Medial
Lateral
Lower lobe: Apical
Anterior basal
Posterior basal
Medial basal
Lateral basal



Left lung:

Upper lobe: Apical
Anterior
Posterior
Lingular segment: Superior lingualar
Inferior lingualar
Lower lobe: Apical
Anterior basal
Posterior basal
Medial basal
Lateral basal.

LYMPHATIC DRAINAGE

- *Whole right lung and left lower lobe*: Right supraclavicular lymph node
- *Left upper lobe*: Left supraclavicular lymph node
- *Parietal pleura*: Axillary lymph node.

AREAS

Anteriorly: 1. Above clavicle—supraclavicular area/Kronig's isthmus
2. Up to 3rd rib—infraclavicular area
3. Up to 6th rib—mammary area
Axilla: 4. Up to 6th rib—axillary area
5. Below 6th rib—infra-axillary area
Posteriorly: 6. Above T2—suprascapular area
7. T2–T7—interscapular area
8. Below T7—infrascapular area

Findings of all lobes are obtained in the axilla.
In pleural effusion, patchy dullness beyond the boundaries of a lobe is obtained.

Dull Kronig's isthmus

- Pancoast tumor
- Large lymph node
- Apical fibrosis

Muscles of respiration	Accessory muscles of respiration
Inspiratory: • External intercostal muscle • Internal intercostal muscle • Diaphragm *Expiratory*: Internal intercostal muscle *Hoover's sign*: On inspiration ↓ Negative intrathoracic pressure and positive atmospheric pressure ↓ Intercostal indrawing	**Mnemonic—PASS SALT** • Pectoralis major • Alae nasi • Sternocleidomastoid • Scalenus anterior • Serratus anterior • Abdominal muscle • Latissimus dorsi • Trapezius

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CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

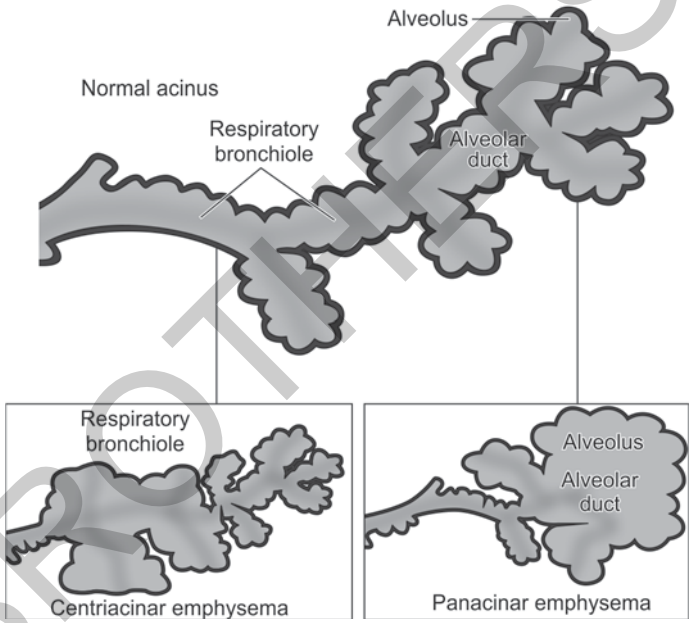
Emphysema-Bronchitis-Bronchiolitis

EMPHYSEMA

Abnormal permanent enlargement of air spaces distal to the terminal bronchiole accompanied by destruction of their wall without obvious fibrosis.

Four Types

1. Centriacinar—smoker
2. Panacinar—alpha-1-antitrypsin deficiency
3. Paraseptal
4. Irregular.



BRONCHITIS

Persistent cough with sputum production for at least 3 months in at least 2 consecutive years in absence of any other identifiable cause.

GOLD CRITERIA FOR COPD

0 – At risk; cough, sputum production
1 – Mild; FEV1/FVC <70%
FEV1 > = 80%
2 – Moderate; FEV1/FVC <70%
FEV1 50%–80%
3 – Severe; FEV1/FVC <70%
FEV1 30–50%
4 – Very severe; FEV1/FVC <70%
FEV1 <30%
OR
FEV1 <50% + respiratory failure/heart failure

CLINICAL FEATURES OF COPD

General Examination

- Tripod posture
- Conjunctival congestion (polycythemia)
- Pedal edema—cor pulmonale
- Respiratory failure
- Flapping tremor
- Warm extremities
- Bounding pulse
- In COPD, do not forget to look for washing.

Respiratory System

- Pursed lip breathing
- Accessory muscles working
- Barrel-shaped chest
- Widened subcostal angle
- Decreased cricosternal distance
- Horizontality of ribs.

Other System

- Cor pulmonale
- Pulsatile JVP
- Tender hepatomegaly.

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COR PULMONALE

Right ventricular enlargement with/without right ventricular failure due to problem in lung or ventilatory apparatus with left side being normal.

Etiology of Cor Pulmonale

- COPD
- ILD
- Bronchiectasis
- Ankylosing spondylitis
- Kyphoscoliosis.

Features of Cor Pulmonale

- Bloated up facies
- Pulsatile JVP
- Tender hepatomegaly
- B/L pedal edema
- Most common cause of RVF-LVF
- Most common cause of LVF-IHD
- Acute cor pulmonale—pulmonary thromboembolism.

Respiratory Failure

- Type 1—hypoxia + hypocapnea, e.g. emphysema
- Type 2—hypoxia + hypercapnea
- Type 3—postoperative atelectasis
- Type 4—shock (hypoperfusion of respiratory muscle in shock).

Complications of COPD

- Respiratory failure
- Cor pulmonale

Systemic complications:

- Weight loss, muscular weakness, osteoporosis
- Spontaneous pneumothorax

Type 1 PaO_2 <60 mm Hg, $PaCO_2$ <50 mm Hg

- Alcoholic type
- Irritable
- Emphysema—pink puffer
- Mental confusion

Type 2 PaO_2 <60 mm Hg. $PaCO_2$ <50 mm Hg

- Anesthetic type
- Altered sensorium
- Hypercapnea
- Warm extremities
- Bounding pulse
- Flapping tremor

PNEUMONIA

DEFINITION

Acute respiratory illness characterized radiologically by pulmonary shadowing which may be segmental, lobar or multilobar.

Lobar Pneumonia

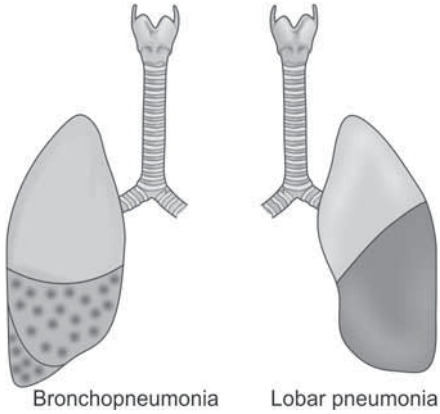
Homogenous consolidation of one or more lung lobes often associated with pleural inflammation.

Bronchopneumonia

Patchy alveolar consolidation associated with bronchial and bronchiolar inflammation often affecting both lower lobes.

Types

- *Community-acquired pneumonia (CAP)*: *Pneumococcus*, *H. Influenzae*
- *Hospital-acquired pneumonia (HAP)*: *E. coli*, *Staphylococci*, *Pseudomonas, Klebsiella*
- *Ventilation-associated pneumonia (VAP)*:
- *Pneumonia in immunocompromised*: *Pneumocystis jiroveci.*



Pneumococcal Pneumonia

- Commonest
- Herpes labialis present
- Rusty sputum
- Rapid onset, high fever, pleuritic pain.

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Klebsiella

- Upper lobe
- Red currant jelly sputum
- Bulging fissure sign, pneumatocele
- Seen in: alcoholic, diabetes, leukopenia, thrombocytopenia

Atypical Pneumonia

Dry cough + extrapulmonary manifestation (Diarrhea, hemolytic anemia, erythema nodosum GBS, pericarditis)

- *Legionella*:
  - Diarrhea
  - Neurological manifestations like headache, confusion, malaise
- *Mycoplasma*: Autoimmune hemolytic anemia, GBS
- *Chlamydia Pneumonia*: Perihepatitis (Fitz-Hugh-Curtis syndrome).

DD's of pneumonia

- Pulmonary infarction
- Pulmonary TB
- Pulmonary edema
- Bronchoalveolar carcinoma.

Respiratory defense mechanism

- Cough reflex
- Mucociliary apparatus
- Alveolar macrophage

Any breech in normal respiratory defense mechanism leads to pneumonia

Investigations

- Routine blood (CBC, Hb, ESR)
- X-ray chest—air bronchogram
- Gram staining

S. pneumoniae complications

- Pneumatocele
- Infectious endocarditis associated
- Empyema

MANAGEMENT

Treatment

- Oxygen therapy
  PaO_2 >60 mm Hg and SaO_2 >92% should be maintained
- IV fluids
- Assess CURB-65
- Antibiotics

Gram +ve	— Pencillin/1st generation cephalosporin
Gram –ve	— Aminoglycosides/3rd generation cephalosporin/Fluoroquinolones
Anaerobes	— Metronidazole
Staphylococci	— Cloxacillin/vancomycin/Linezolid/imipenem
Atypical	— Azithromycin
Klebsiella	— Ciprofloxacin + aminoglycoside.

- For pleural pain
  Paracetamol/NSAID
- Physiotherapy — To assist expectorations.

Chest X-ray

- *Air bronchogram*: Air inside terminal bronchiole
- *Hilar adenopathy*: Mycoplasma
- *Cavitation*: Staphylococcal pneumonia
- *Mottled opacity in lower lobe*: Bronchopneumonia

Delayed Resolution

- Sign >2 weeks
- CXR >4 weeks

} Even after antibiotic therapy

Causes

- Incorrect diagnosis
- Inadequate drugs/dose

Complications

- Pleural effusion
- Empyema
- Lung abscess
- Cavity
- Lobar collapse due to retention of sputum
- Pneumothorax—*S.aureus*
- Others:
  Acute respiratory distress syndrome (ARDS), renal failure, multiorgan failure toxic hepatitis, toxic gastric dilatation, metastatic abscess, osteomyelitis, meningioencephalitis

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- Complications
- Diabetes or other immunocompromised conditions
- Underlying TB, malignancy
- Drug resistance.

CURB 65

- Confusion
- Urea >7 mmol/L
- Respiratory rate >30/min
- *Blood pressure*:
  - Systolic: <90 mm of Hg
  - Diastolic: <60 mm of Hg
- Age >65 years.

Score: 1 point for each feature present.

Score 0 or 1—likely to be suitable for home treatment
Score 2—short stay inpatient or hospital supervised OP
Score 3 or > manage in hospital as severe pneumonia
ICU admission if score >4

PLEURAL EFFUSION

The accumulation of serous fluid within the pleural space is termed as pleural effusion.

- Clinically—>500 mL
- X-ray–200 mL.

Types

- Exudative: Due to increased microvascular pressure due to disease of the pleural surface or injury in the adjacent lung.
- Transudative: Due to increased hydrostatic pressure or due to decreased oncotic pressure.

Bilateral exudative pleural effusion

- Effusion
- Rheumatoid arthritis
- SLE
- Lymphoma
- Leukemia
- Pulmonary infarction

Predominant left-sided pleural effusion

- Acute pancreatitis
- Esophageal rupture
- Dressler's syndrome (post MI syndrome)
- Aortic dissection

Drug-induced pleural effusion (DAMB)

- Amiodarone
- Bromocriptine
- Dantrolene sodium
- Methysergide

Predominant right-sided pleural effusion

- Amebic liver abscess
- Cirrhosis of liver
- CCF
- Meigs' syndrome

Trachea shifted to same side in pleural effusion

- Same-sided fibrosis
- Same-sided collapse
- Mesothelioma.

Gardland's triangle

Area above the level of pleural effusion
Findings

- Bronchial breath sound
- Increased vocal resonance
- Egophony.

Pleural effusion + trachea in midline

- Mild pleural effusion
- Malignant pleural effusion secondary to bronchogenic carcinoma
- Encysted pleural effusion
- Bilateral pleural effusion
- Pleural effusion associated with mesothelioma

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In case of pleural effusion look for 5S

1. Shifting dullness
2. Straight line dullness
3. Succussion splash
4. Sound of coin
5. Shift of mediastinum.

Recurrent pleural effusion even after thoracentesis
- Bronchogenic carcinoma
- Pulmonary TB
- CCF
- Lymphoma

Red flag sign in pleural effusion

- Trachea shifted to same side
- Developing into empyema thoracis.

EXUDATIVE PLEURAL EFFUSION

Causes

- Pneumonia
- Tuberculosis
- Bronchogenic carcinoma
- Pulmonary infarction
- Collagen vascular disease—rheumatoid arthritis, SLE
- Mesothelioma
- Lymphoma
- Meigs' syndrome
- Pancreatitis, subphrenic abscess, liver abscess.

TRANSUDATIVE PLEURAL EFFUSION

Causes

- Nephrotic syndrome
- Congestive cardiac failure
- Cirrhosis of liver
- Myxedema
- Constrictive pericarditis
- Pericardial effusion.

Remember: **Transudative pleural effusion is usually bilateral (hydrothorax).**

HEMORRHAGIC PLEURAL EFFUSION
- Malignancy
- Tuberculosis
- Bleeding diathesis
- Pulmonary infarction

MANAGEMENT OF PLEURAL EFFUSION

Investigations

- CXR
- Mantoux test
- *Pleural fluid analysis*:
  - Appearance-serous, bloody, pus, milky
  - *Cytology*:
    - Lymphocyte—TB or lymphoma
    - Neutrophils—pneumonia
    - Very high neutrophils—empyema
  - Proteins—high in exudative
  - *Sugar*:
    - Low—all conditions except uncontrolled diabetes
    - Very low—rheumatoid arthritis, empyema
  - Adenosine deaminase (ADA)
    45 IU/L
    ADA –ve not tuberculosis
    (only –ve predictive value
  - AFB in pleural fluid—TB empyema.

Empyema

Presence of pus in pleural space

Etiology
- Pneumonia
- Tuberculosis
- Secondary infection in pleural effusion
- Rupture of subphrenic abscess
- Rupture of lung abscess

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Light's Criteria

Pleural fluid is an exudates if one or more of the following criteria are met:

- *Pleural fluid protein*: Serum protein ratio >0.5
- *Pleural fluid LDH*: Serum LDH ratio >0.6
- Pleural fluid LDH >2/3 of the upper limit of normal serum LDH.

Roth's Criteria

Serum albumin—pleural fluid albumin >1.2

↓

Transudative

Treatment

- ICD tube
- Thrombolysis—to prevent adhesions
- Pleurodesis
- Thoracotomy and decortications
- NSAID-pain

ICD tube in area of maximum dullness

OR

6th, 7th, 8th ICS in MAL

ICD tube removal—< 30 mL/day for 3 consecutive day.

Indication for ICD tube

- Pus
- +ve gram stain
- Very high count
- Very low glucose
- Very low pH
- Encystment of pleural effusion

PNEUMOTHORAX

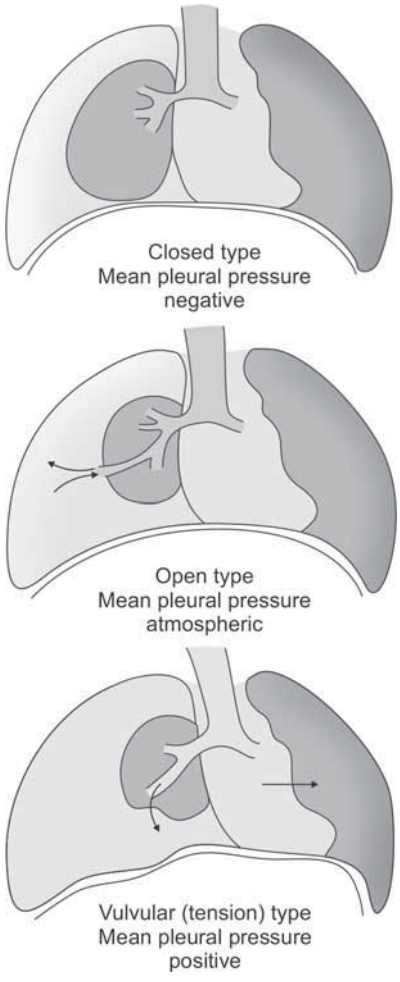
Pneumothorax is the presence of air in the pleural space.

Classification

- Spontaneous
- Traumatic

- **Spontaneous pneumothorax**
  - *Primary*
    Affect males aged 15–30 in whom tall stature, smoking and presence of apical subpleural blebs are additional risk factors.
    ↓
    Air escapes from the lung into the pleural space through rupture of a small subpleural emphysematous bulla.
  - *Secondary*
    Underlying lung disease.
    For example, COPD, TB, bronchial asthma, lung abscess, bronchogenic carcinoma, all forms of fibrotic and cystic lung diseases.

- **Traumatic pneumothorax**
  - Non-iatrogenic
  - Iatrogenic.



Types of Pneumothorax

- Closed
- Open
- Tension.

TENSION PNEUMOTHORAX

Communication between the airway and pleura is small. It can act as a one-way valve allowing air to enter the pleural space during inspiration but not to escape on expiration.

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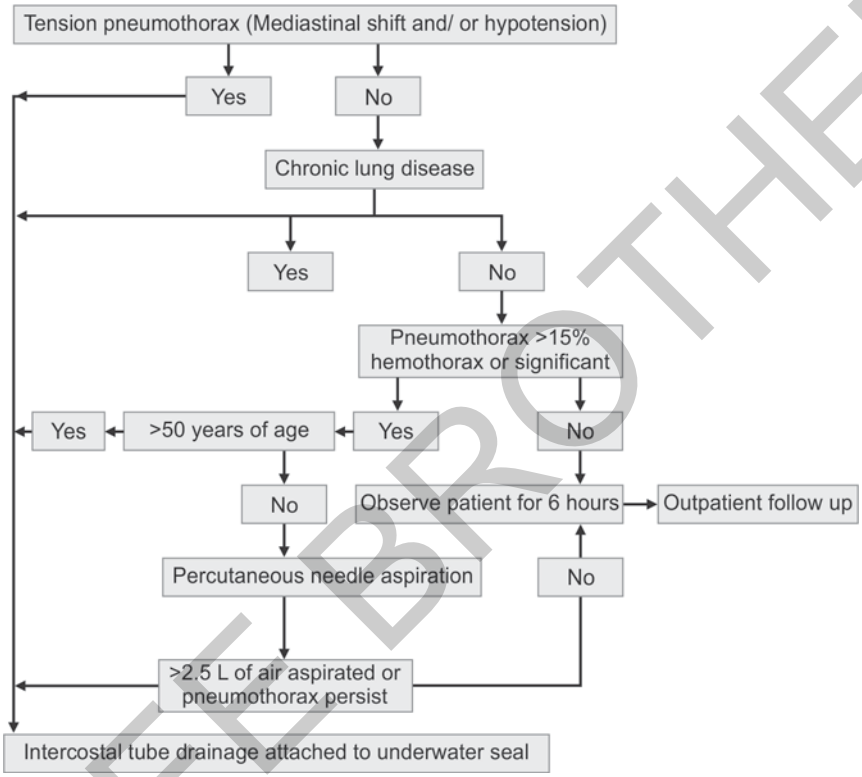
CLOSED PNEUMOTHORAX

When the communication between the lung and pleural space seals off as the lung deflates and does not reopen.

OPEN PNEUMOTHORAX (BRONCHOPLEURAL FISTULA)

Communication fails to seal and air continues to transfer freely between the lung and pleural space.

FLOWCHART IN MANAGEMENT OF SPONTANEOUS PNEUMOTHORAX



INVESTIGATIONS

- X-ray.

TREATMENT

- In case of tension pneumothorax immediate decompression is required prior to insertion of intercostal drain.
- Aspirate in the 2nd intercostal space anteriorly in the midclavicular line using 16 F cannula.

TUBERCULOSIS

In children: Primary tuberculosis → Ghon focus → Ghon complex → Ranke complex

Primary Tuberculosis

It includes:

- Progressive primary tuberculosis (dissemination within lung)
- Miliary tuberculosis
- Meningitis.

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ISBN 978-93-5465-850-1