



UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
“NICOLAE TESTEMIȚANU” DIN REPUBLICA MOLDOVA

**Departament of Internal Medicine,
Discipline of internal medicine - semiology**

Lung consolidation syndrome (condensation)

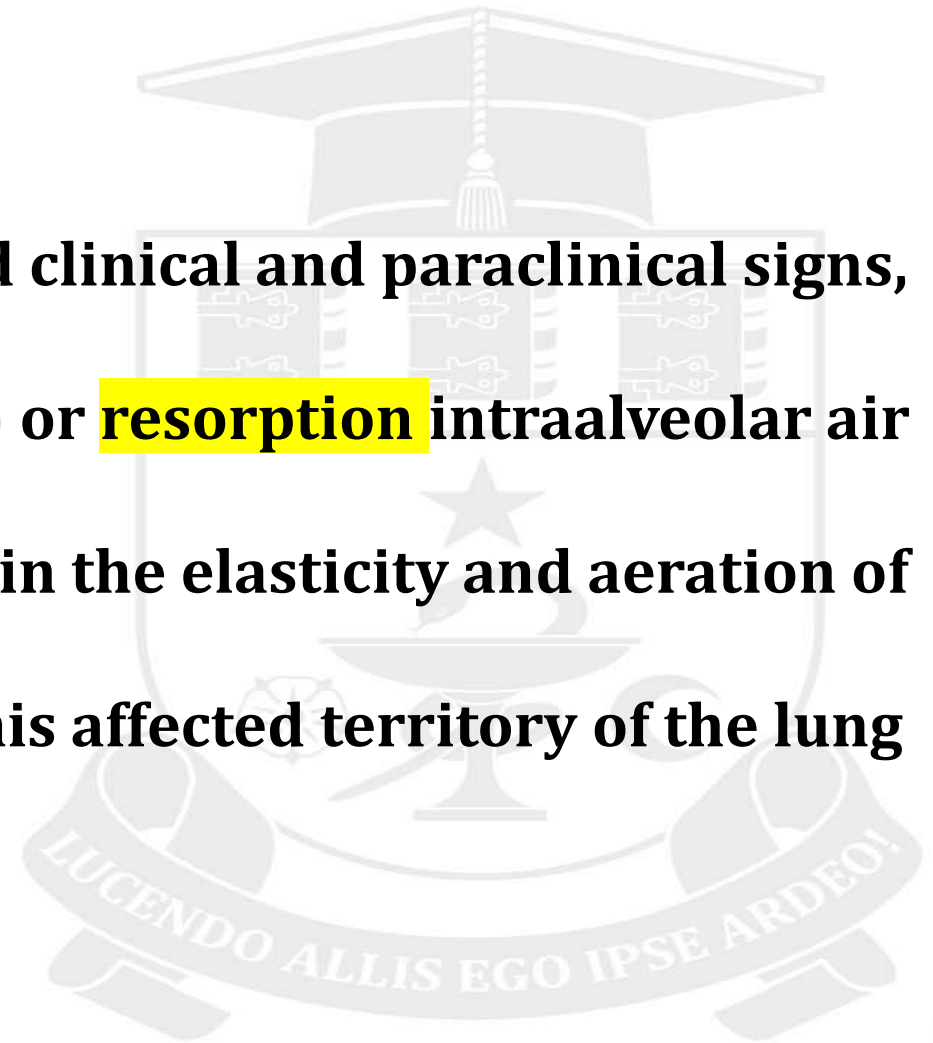
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DEFINITION

- represents a totality of symptoms and clinical and paraclinical signs, caused by **substitution** (replacement) or **resorption** intraalveolar air of a segment or lobe, with a decrease in the elasticity and aeration of the lung tissue and the exclusion of this affected territory of the lung parenchyma from breathing.





The air in the alveoli can be:

Replaced with:

1. – fibrinous inflammatory **exudate**
2. – **blood** (pulmonary infarction)
3. – **connective tissue** (fibrosis, pulmonary pneumosclerosis)
4. – **tumor** (neoplastic) – in the case of bronchopulmonary cancer

Resorbed

**Into the
PULMONARY
capillary circulation**

**= to alveoli collapse
in PULMONARY
atelectasis**



- So, **pulmonary consolidation** can be mainly caused by **4 causes** :
 - 1.- **infiltration inflammatory** bronchoalveolar in nature
 - specific (*pulmonary tuberculosis*);
 - non-specific (*viral, bacterial, fungal and mixed infections*);
 2. – pulmonary **thromboses and thromboembolisms** (*pulmonary infarction*);
 3. – benign **neoplastic process** (*hydatid cyst*);
 - malignant (*bronchopulmonary cancer*);
 4. – **bronchial obstruction** - resulting in pulmonary



Clinico-radiological classification of pulmonary consolidation syndrome :

non-retractable

and

retractile

Both clinical and radiological forms have common manifestations that characterize pulmonary condensation (induration) syndrome.

pulmonary condensation syndrome

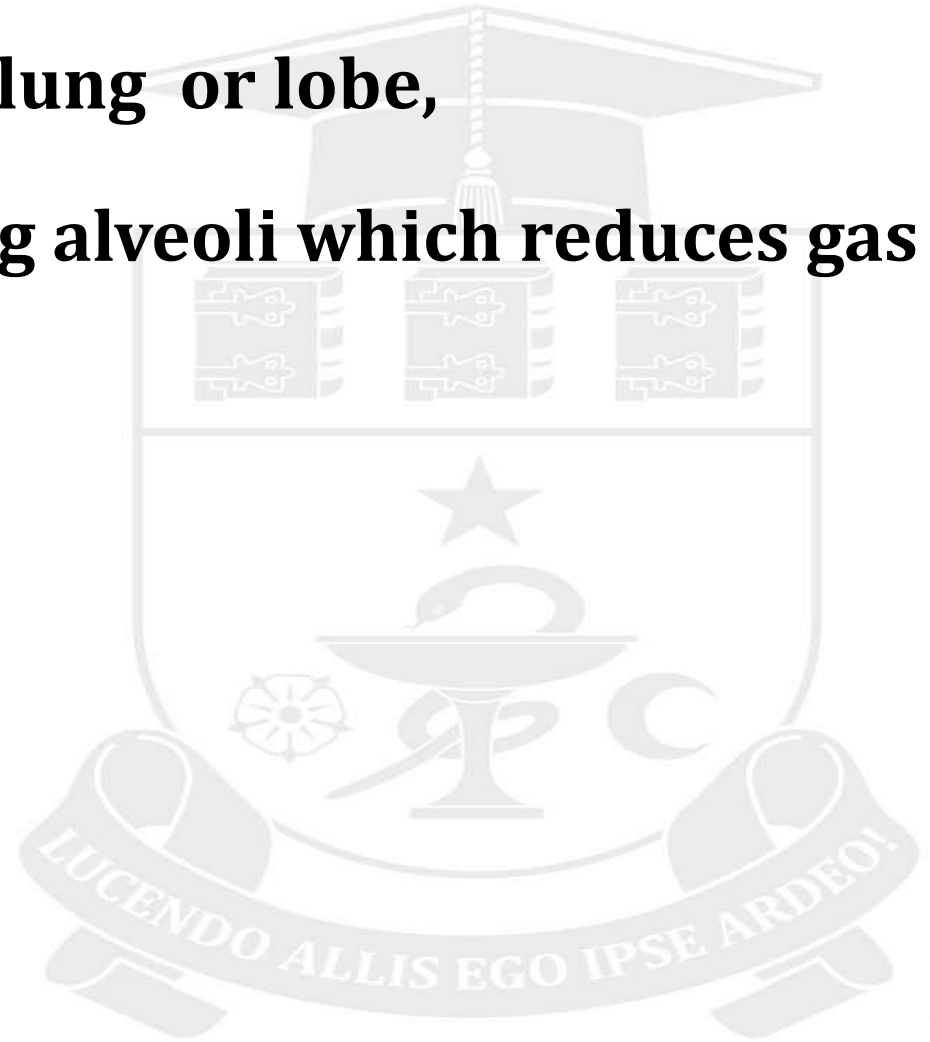




ATELECTASIS

is partial or total COLLAPSE of A lung or lobe,

- caused by the collapse of the lung alveoli which reduces gas exchange and oxygen intake**





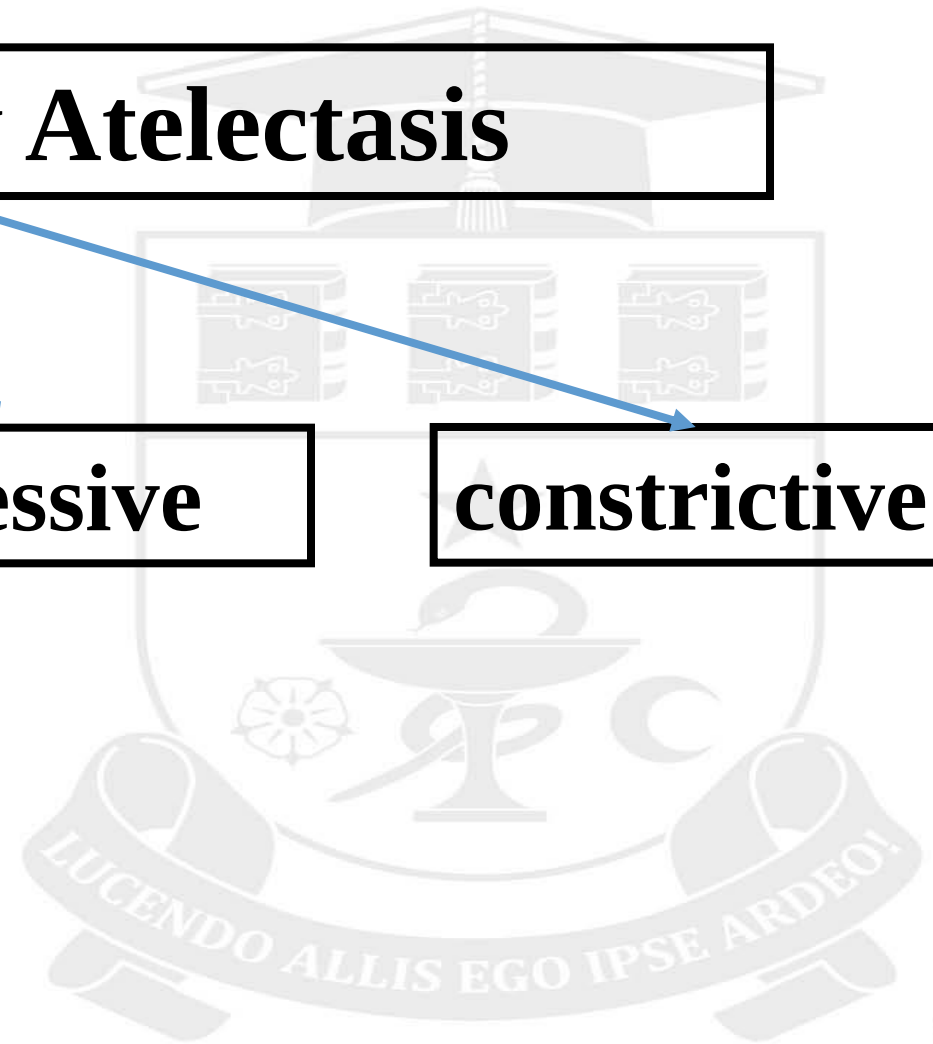


Types of Pulmonary Atelectasis

obturative

compressive

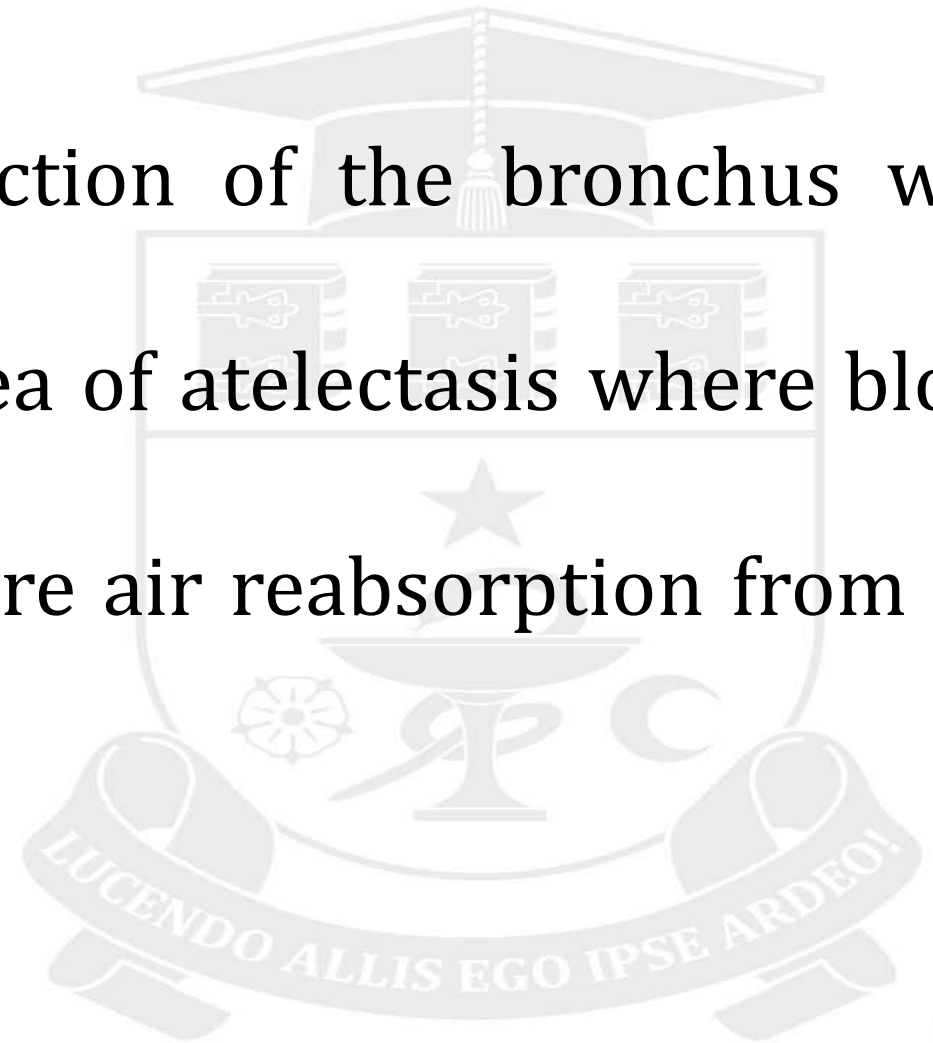
constrictive





Obstructive (resorption) atelectasis

It occurs as a result of obstruction of the bronchus with blockage of ventilation in the area of atelectasis where blood circulation is preserved and where air reabsorption from the collapsed alveoli





Obstructive (resorption) atelectasis

- frequently appears in:
- Bronchial Asthma, COPD, bronchiectasis,
- postoperative Aspiration of gastric acid resulting in pneumonia or Pulmonary edema e with severe bronchospasm
- foreign body in the respiratory tract
- bronchial tumor processes





COMPRESSION ATELECTASIS

may develop as a result of partial or total filling of the pleural cavity

with:

fluid (exudate or transudate)

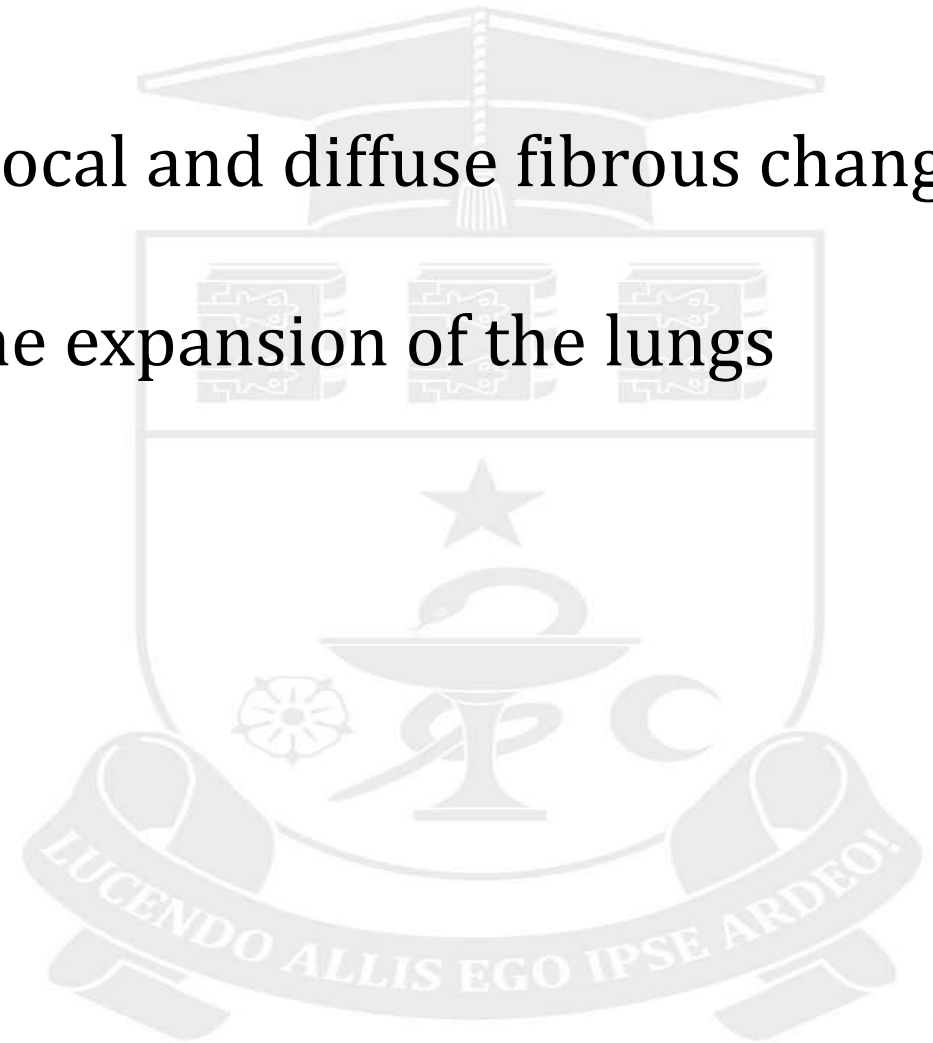
- blood, air, or tumor.





CONSTRUCTIVE ATELECTASIS

occurs in the presence of irreversible local and diffuse fibrous changes in the lungs and pleura, which block the expansion of the lungs

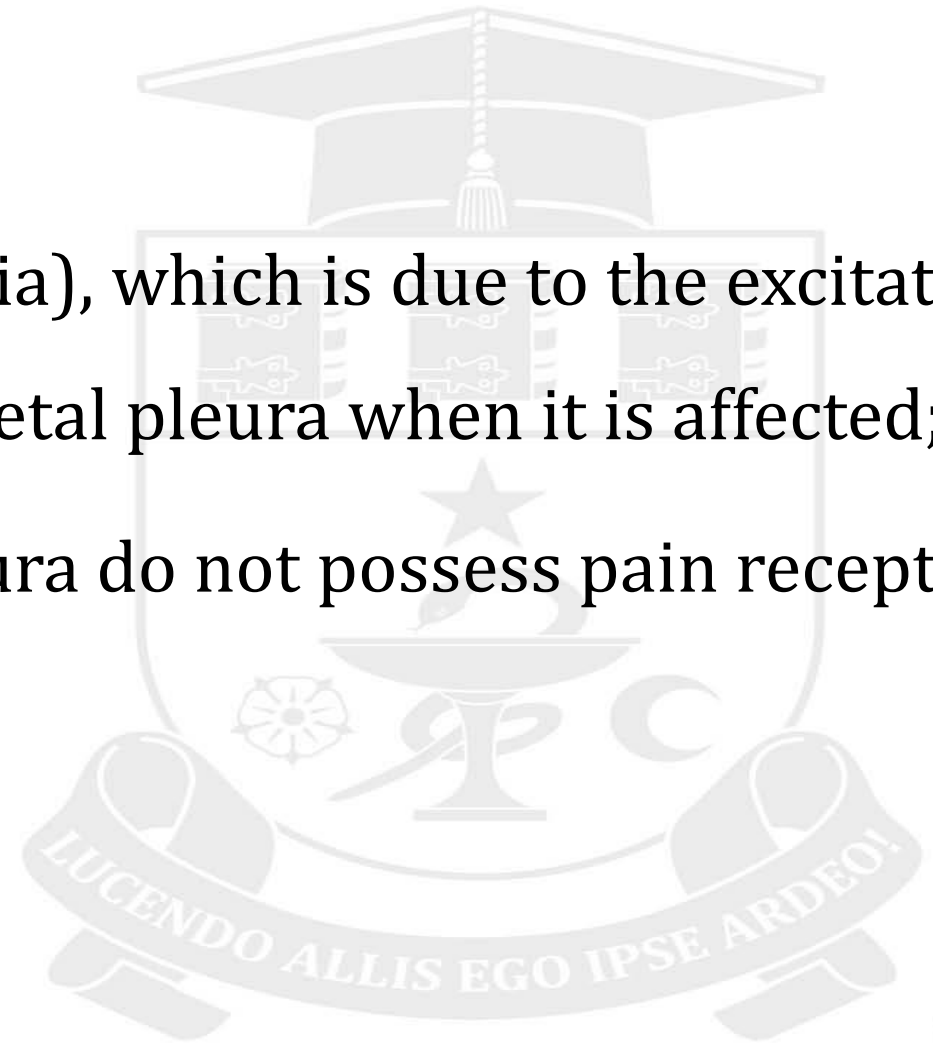




PHYSICAL EXAMINATION

Main complaints (symptoms):

- pain in the affected chest (thoracalgia), which is due to the excitation of pain receptors located in the parietal pleura when it is affected;!!!
- The lung tissue and the visceral pleura do not possess pain receptors and are not sensitive to pain





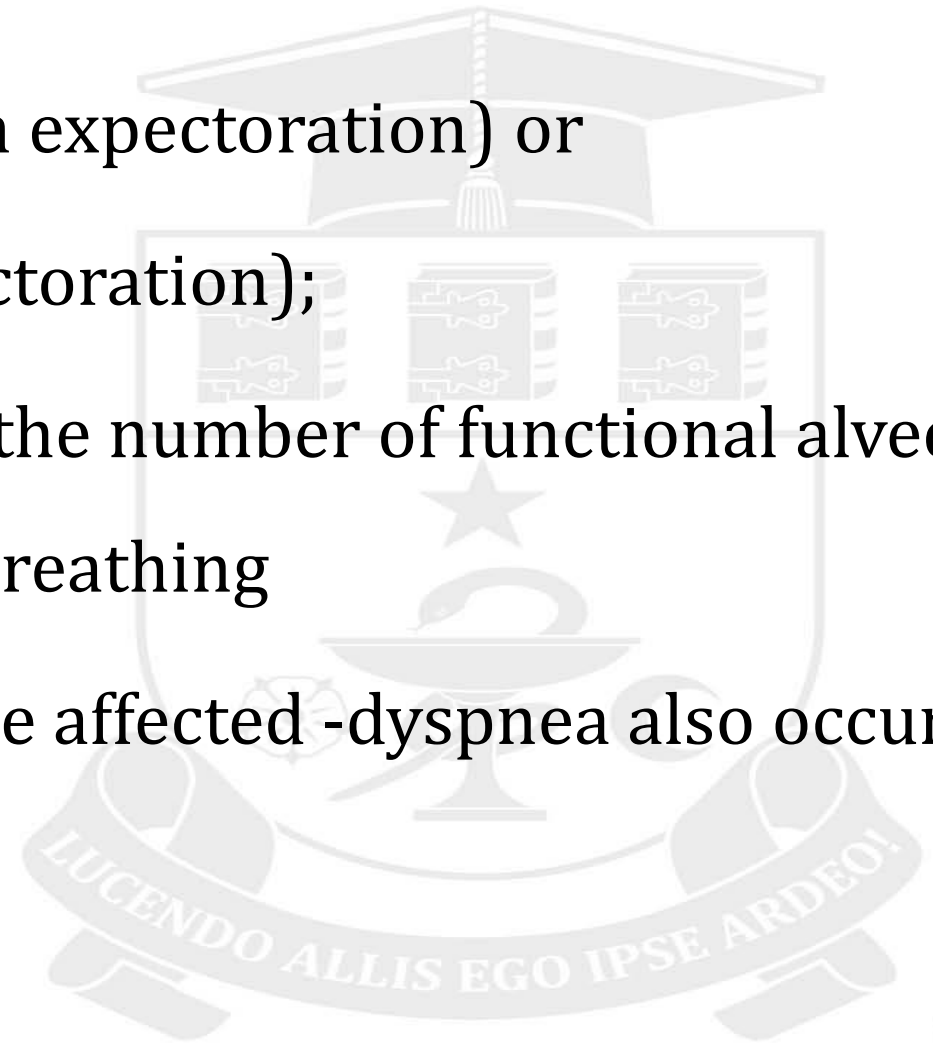
THORACALGIA

- is characteristic for lobar pneumonia because the inflammatory process also includes the pleura
- The peculiarities of thoracic pain are:
 - = localization in the projection of the affected region, or the lower part of the sternum when the diaphragmatic nerve is irritated
 - = the pain often appears suddenly and intensifies at the maximum of inspiration
 - = the pain has an acute, of stabbing character
 - = the pain correlates with breathing, movement, coughing



Main complaints (symptoms):

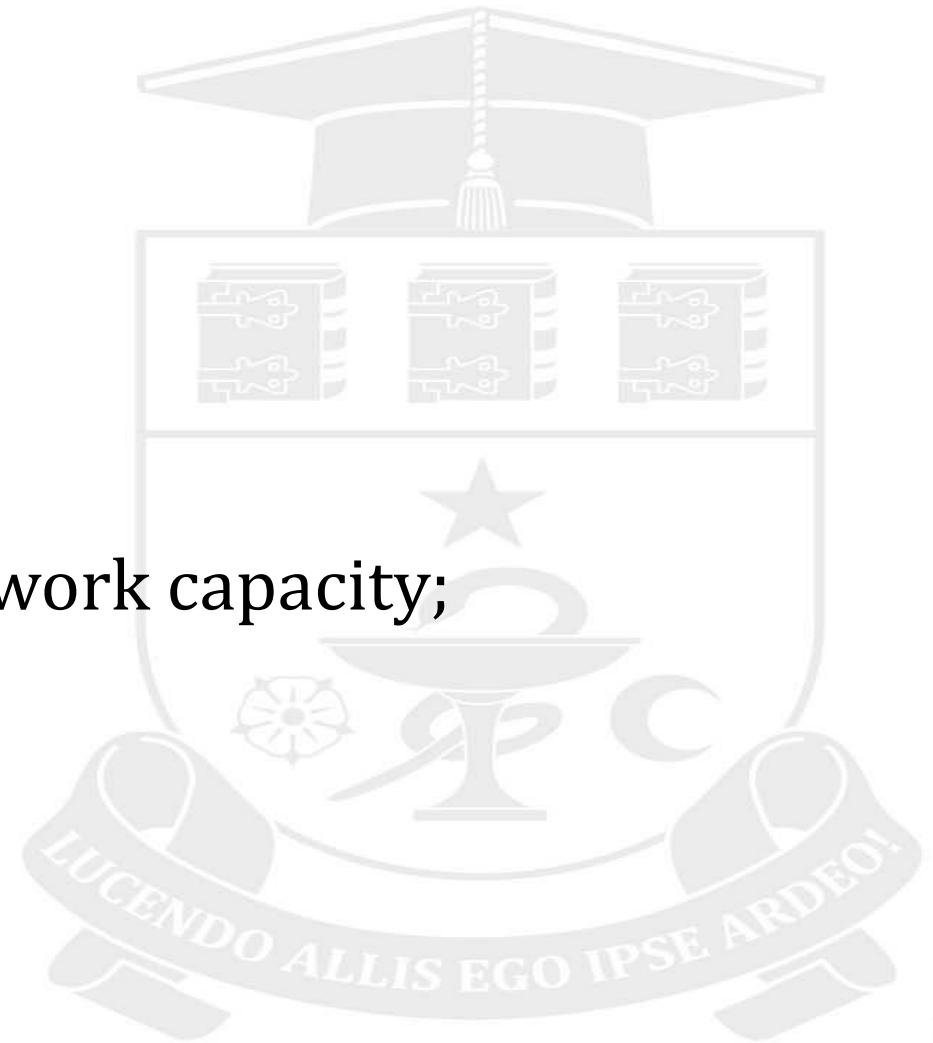
- productive cough (wet, with sputum expectoration) or
- Non productive (dry - without expectoration);
- dyspnea - is due to the reduction in the number of functional alveoli and their exclusion from the act of breathing
- If a lobe or several lung segments are affected -dyspnea also occurs at rest.





General complaints (symptoms

- fever ($\uparrow t^{\circ} +38$)
- asthenia (weakness, fatigue)
- sweating (abundant skin moisture);
- decreased physical and intellectual work capacity;
- decreased appetite (inappetence);
- worsening quality of life.





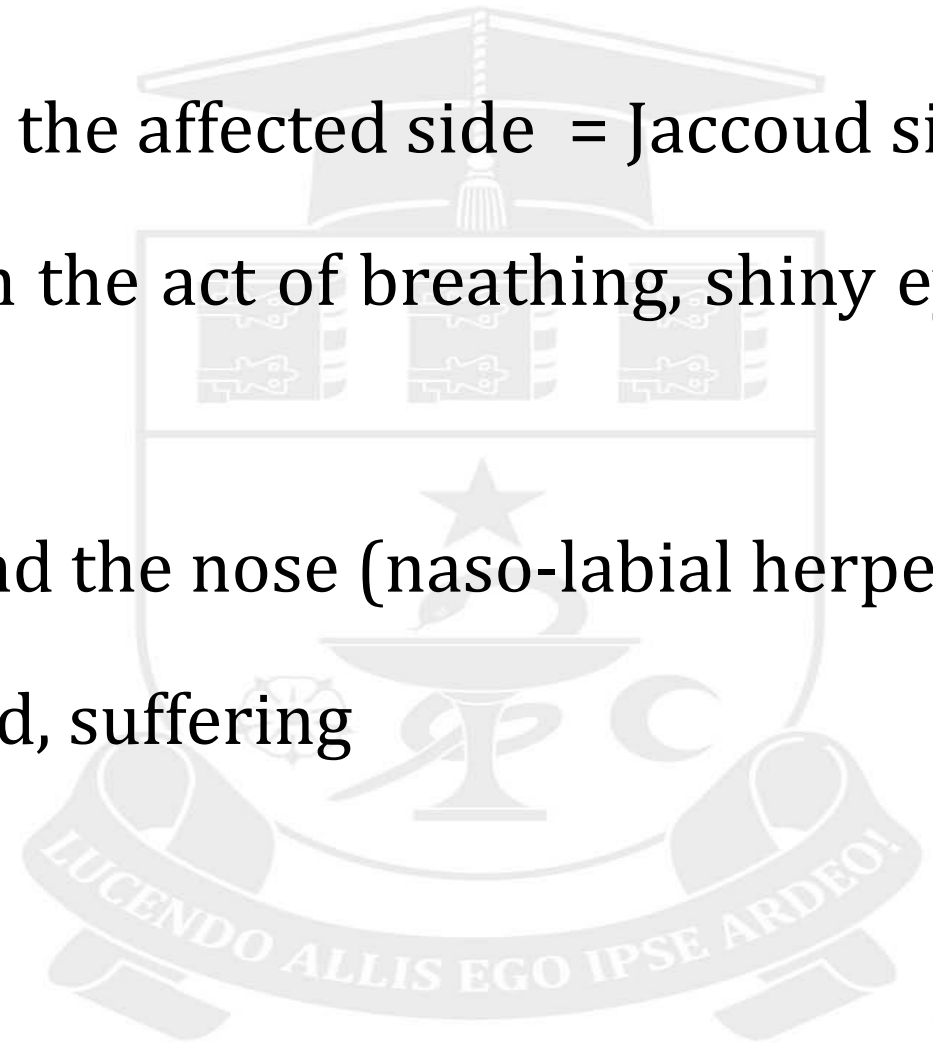
GENERAL INSPECTION

- the patient's general condition can be satisfactory, medium severity, severe or very severe, depending on the volume, type, severity of the respiratory disease;
- the patient's consciousness, can be: Alert - in a mild course of the disease;
Affected = state of stupor, sopor or coma in serious and terminal cases
- Hallucinations – in the case of damage to the central nervous system by toxins of pathogenic infectious agents, or other toxic substances – non-inactivated metabolites in alcoholism;



GENERAL INSPECTION

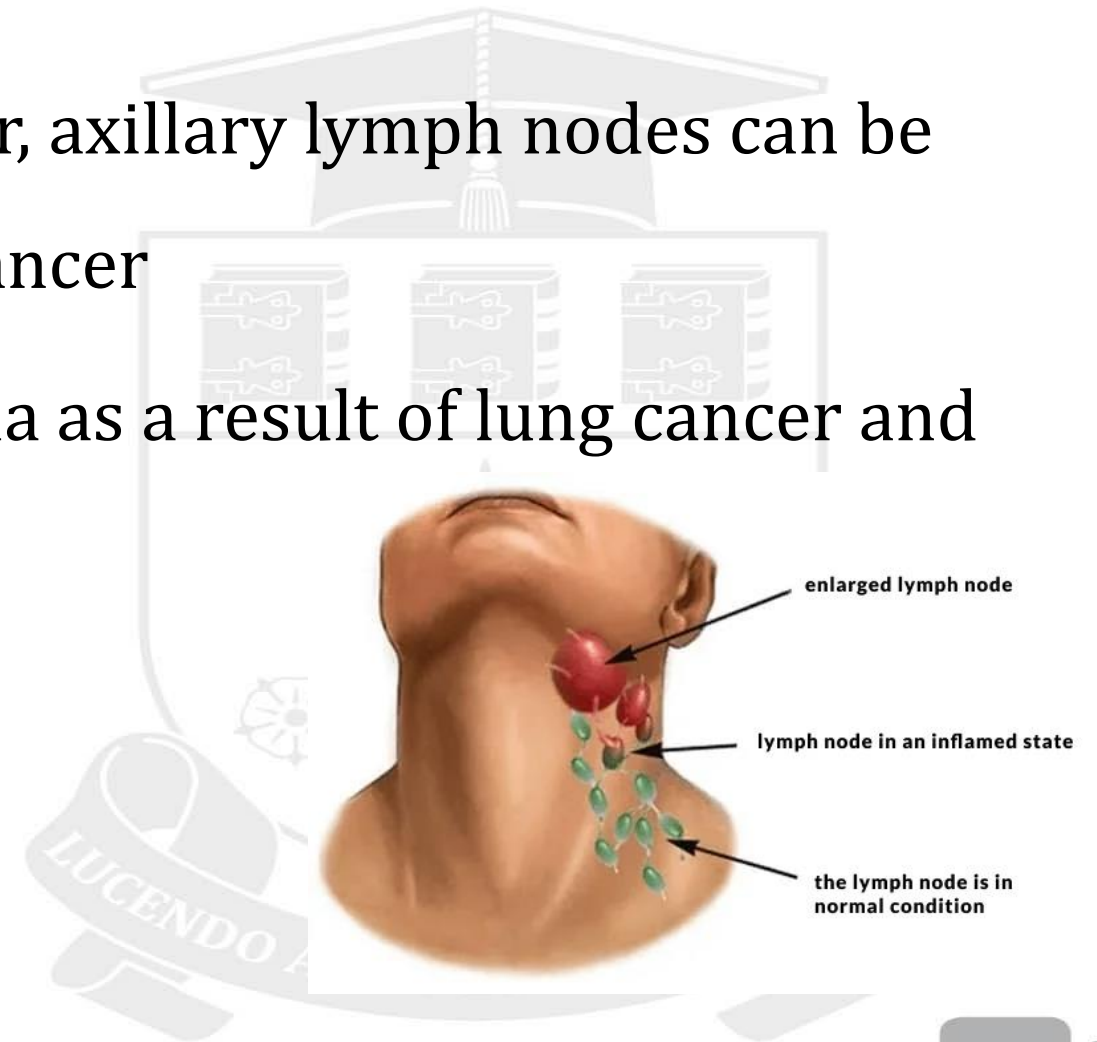
- Redness (erythema) of the cheek on the affected side = Jaccoud sign
- The wings of the nose participate in the act of breathing, shiny eyes, dry lips
- Herpetic eruptions on the lips around the nose (naso-labial herpes)
- The expression of the face is irritated, suffering
- Sweaty face





GENERAL INSPECTION

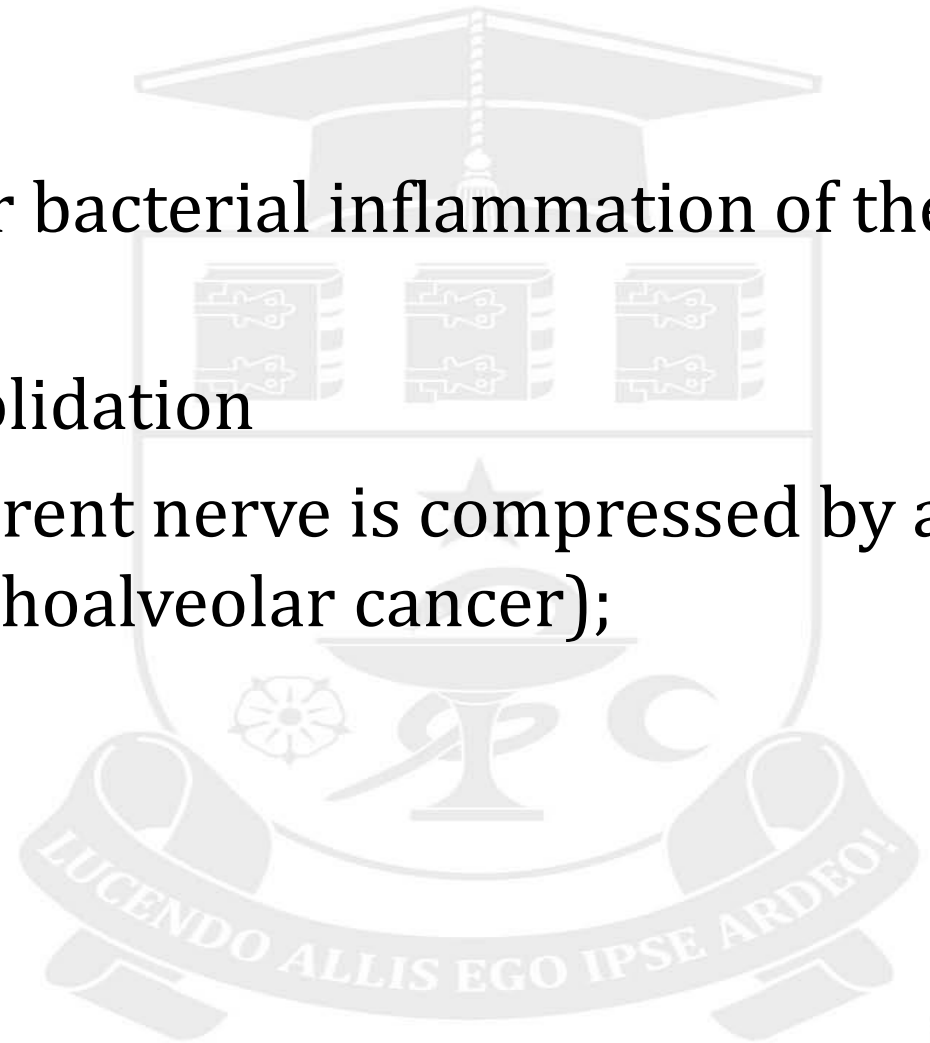
- Neck area, supra- and infraclavicular, axillary lymph nodes can be enlarged in tuberculosis and lung cancer
- Muscular atrophy in case of cachexia as a result of lung cancer and tuberculous





GENERAL INSPECTION

- Voice hoarseness:
- in the presence of laryngitis (viral or bacterial inflammation of the upper respiratory tract);
- the initial stage of pulmonary consolidation
- Aphonia - can occur when the recurrent nerve is compressed by a tumor (mediastinal or central bronchoalveolar cancer);





CHEST INSPECTION

- shape: - in non-retractile pulmonary condensation processes the chest has normal appearance or, in very rare cases, may be slightly bulging, intercostal spaces unchanged;
- Asymmetrical chest by retraction of the hemithorax and narrowing of the intercostal spaces on the affected side= in retractile pulmonary condensation processes:
- asymmetrical chest: bulging hemithorax in hydrothorax (atelectasis by compression = retractile condensation syndrome



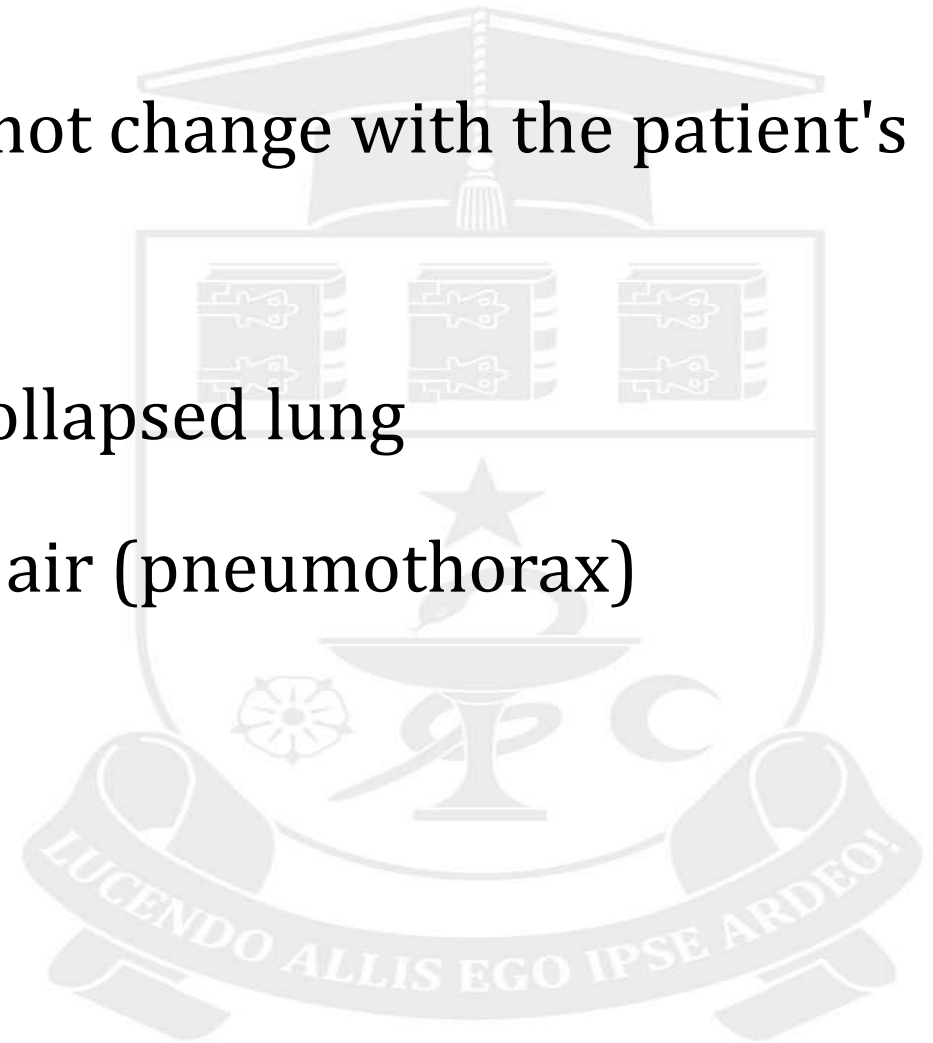
PALPATION OF THE CHEST

- painful palpation on the affected side;
- elasticity (resistance) of the rib cage is reduced
- asymmetry on the affected side of the chest, predominantly in retractile consolidation syndrome
- increased vocal vibration - in the case of non-retractile (pneumonia)
- reduced or absent in the case of retractile consolidation syndrome (obstructive or compression atelectasis)



COMPARATIVE PERCUSSION

- dullness (subdullness), which does not change with the patient's position in non-retractile S C P
- subdullness or dullness above the collapsed lung
- tympany above the accumulation of air (pneumothorax)





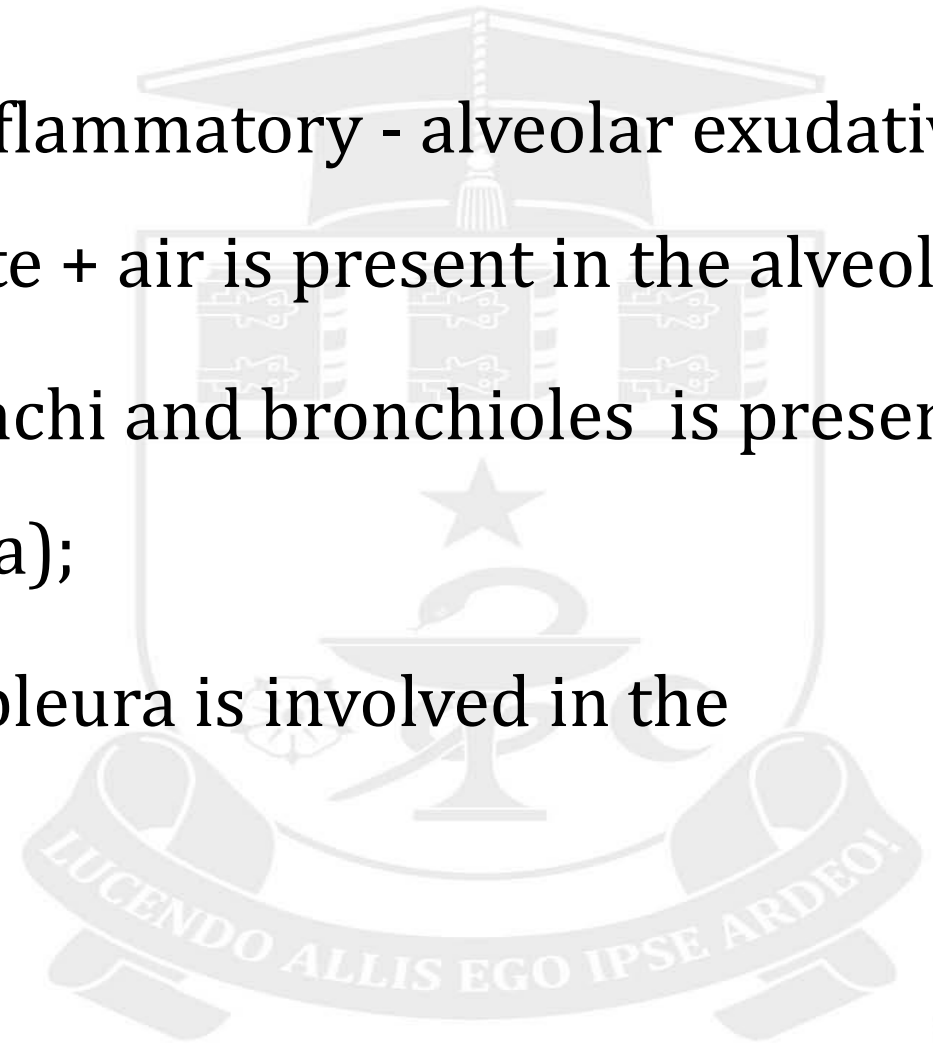
AUSCULTATION

- normal vesicular breathing is diminished and/or replaced by a pathological bronchial breathing in the typical case of lobar pneumonia
- harsh breathing is present when the bronchi are involved in the inflammatory process;
- normal vesicular breathing diminished or absent in compressional atelectasis = Pneumothorax
- normal vesicular breathing abolished in obstructive atelectasis



AUSCULTATION

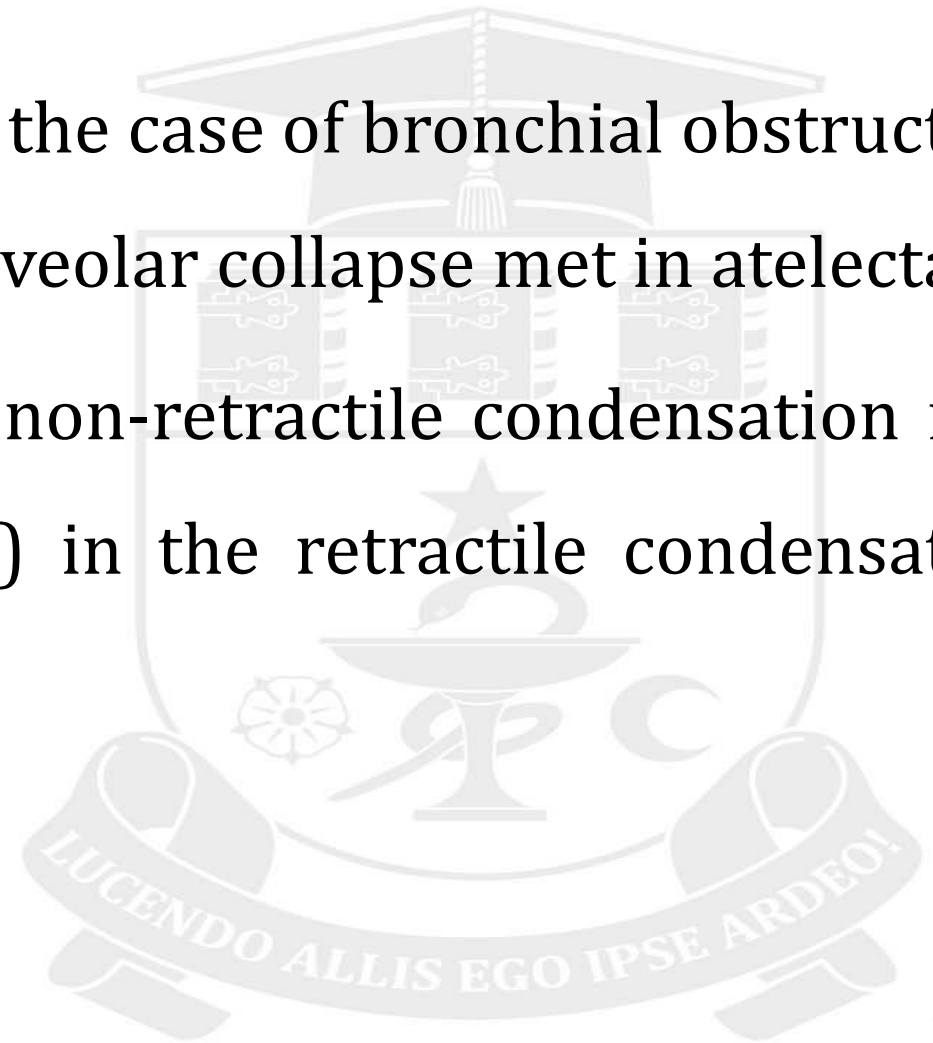
- Crepitant rhales, in the case of an inflammatory - alveolar exudative process (when inflammatory exudate + air is present in the alveoli);
- Moist rhales, when in the small bronchi and bronchioles is present liquid secretion (bronchopneumonia);
- fine pleural friction rub - when the pleura is involved in the inflammatory process





AUSCULTATION

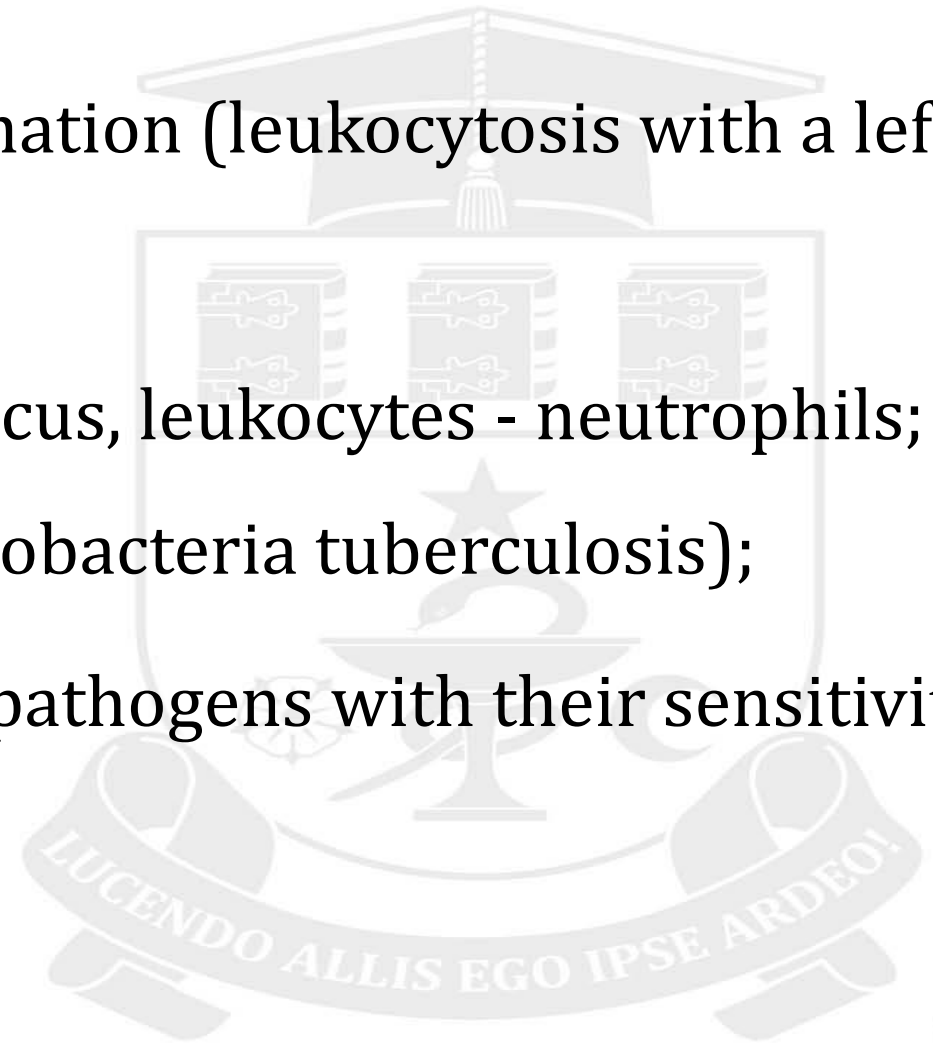
- The added sounds may be absent in the case of bronchial obstruction by a cancerous process, with total alveolar collapse met in atelectasis
- BRONCHOPHONIA - in the area of non-retractile condensation it is increased or It is missing (absent) in the retractile condensation (obstructive atelectasis)





LAB TESTS

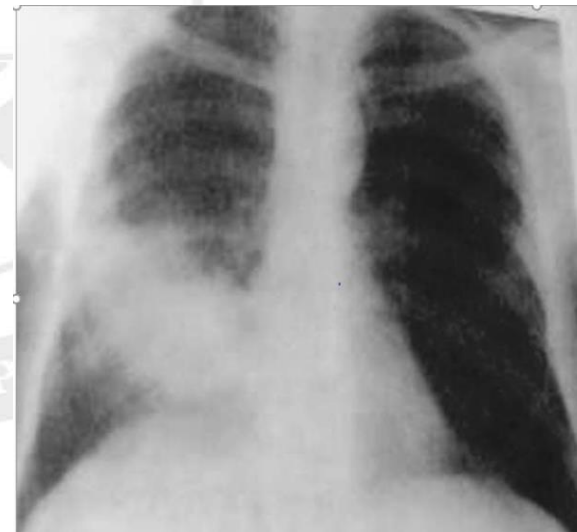
- General blood test - signs of inflammation (leukocytosis with a left shift, ESR - elevated);
- General sputum test - can detect mucus, leukocytes - neutrophils; microflora and especially MBT (mycobacteria tuberculosis);
- Microbiological testing - can detect pathogens with their sensitivity to antibiotics (antibioticogram);





INVESTIGATIONS

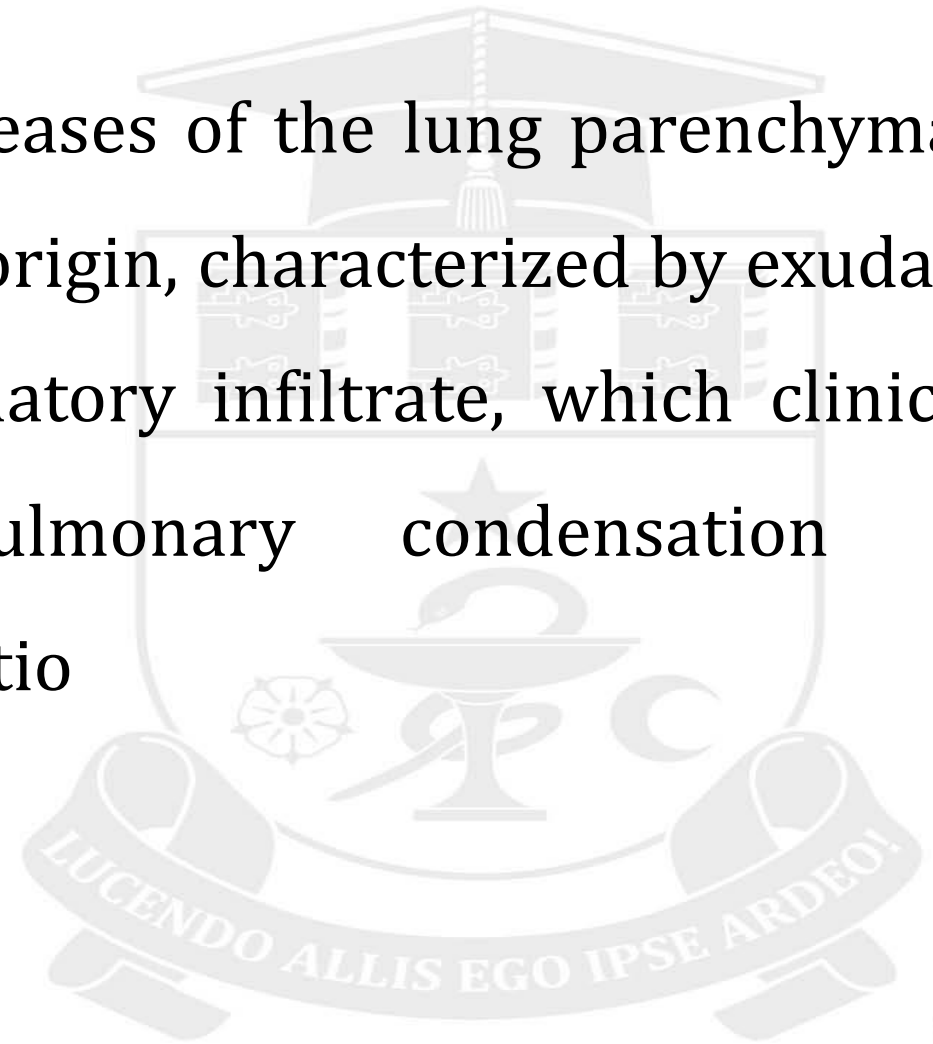
- Spirography – detects signs of restrictive disorders with reduced pulmonary vital capacity - depending on the extent of the pulmonary condensation process
- Chest Xray: in the case of non-retractile pulmonary infiltration: dense, homogeneous opacity with clear boundaries, affecting a lobe or a lung segment, without traction of the mediastinum or chest wall on the diseased side
- Chest Xray: **in the case of atelectasis:** - in addition to the radiological signs of condensation, those of retraction are present:
 - retraction of the chest wall, with narrowing of the intercostal spaces,
 - displacement of the trachea, mediastinum (heart) and
 - ascension of the diaphragm towards the diseased side





PNEUMONIA

is a group of acute inflammatory diseases of the lung parenchyma of various infectious (usually bacterial) origin, characterized by exudative alveolitis and/or interstitial inflammatory infiltrate, which clinically and radiologically produces pulmonary condensation and manifestations of infectious impregnatio





PNEUMONIA

Types of Pneumonia

Based on Source of Infection

Community-acquired pneumonia

Hospital-acquired pneumonia

Ventilator-acquired pneumonia

Based on Microbes

Bacterial

Viral

Fungal

Parasitic

Based on Anatomy

Bronchopneumonia

Lobar pneumonia

www.wecaregolp.com



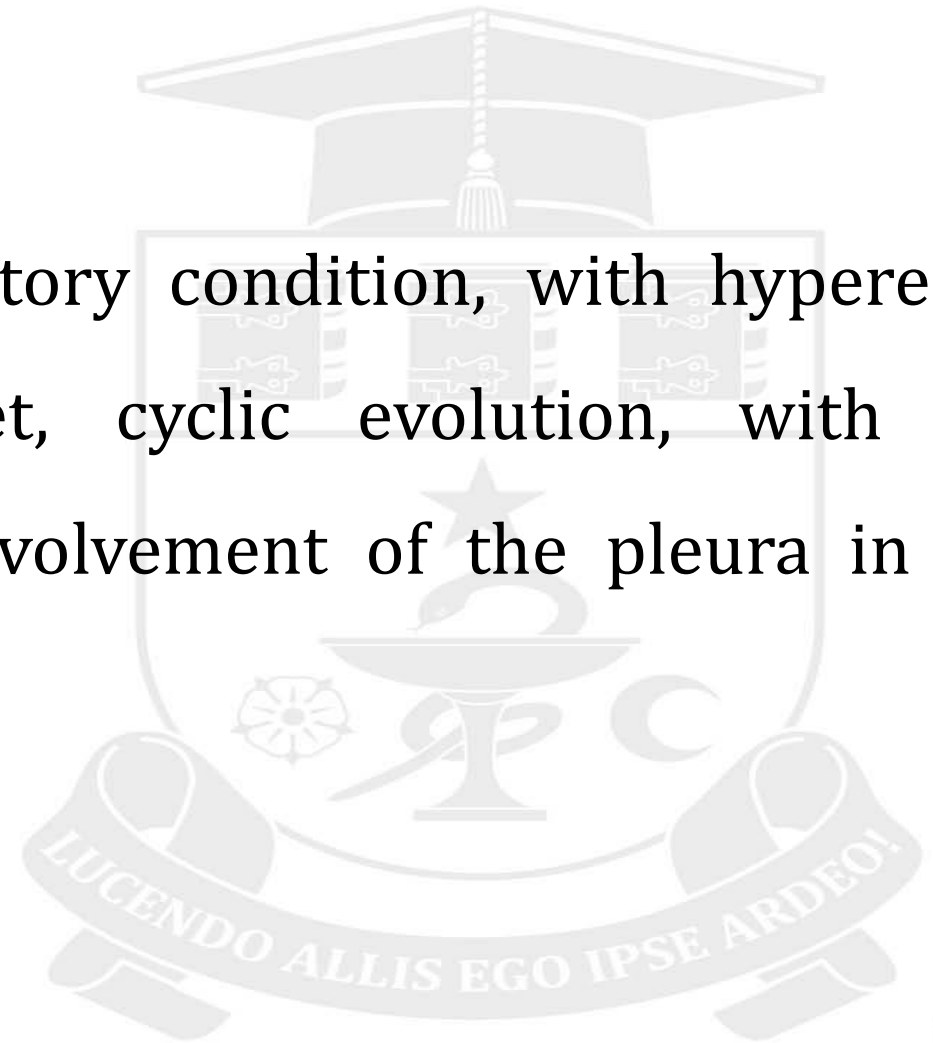
Patient Type	Etiology
Outpatient	<i>Streptococcus pneumoniae</i> , <i>Mycoplasma pneumoniae</i> , <i>Haemophilus influenzae</i> , <i>Chlamydophila pneumoniae</i> , respiratory viruses
Inpatient	<i>S pneumoniae</i> , <i>M pneumoniae</i> , <i>H influenzae</i> , <i>C pneumoniae</i> , respiratory viruses (influenza A and B, adenovirus, respiratory syncytial virus, parainfluenza), <i>Legionella</i> species, aspiration
Inpatient (ICU)	<i>Streptococcus aureus</i> , <i>S pneumoniae</i> , <i>H influenzae</i> , <i>Legionella</i> species, gram-negative bacilli

Source: Reference 11.



LOBAR PNEUMONIA

- pneumococcal, pleuropneumonia
- Definition - is an acute inflammatory condition, with hyperergic reaction, acute and rapid onset, cyclic evolution, with the involvement of a lobe and the involvement of the pleura in the inflammatory process





LOBAR PNEUMONIA-pathogeny

- It develops in previously healthy people
- More frequently in men, in cold and humid seasons (winter, spring),
- Pneumococci, aspirated from the oropharynx to the pulmonary alveoli, cause a hyperergic inflammatory reaction, with the production of an alveolar exudate rich in proteins, which allows the rapid proliferation of germs and their spread



LOBAR PNEUMONIA-pathogeny

1. Congestion stage – characterized by the formation of a catarrhal alveolitis, with alveolar space occupied by protein-rich exudate, desquamated cells, rare neutrophils and numerous germs. The capillaries are hyperemic, distinct, and the alveolar walls thickened (lasts 2-3 days)
2. Red hepatization stage with the presence in the alveolar space of fibrin, extravasated erythrocytes, numerous neutrophils and germs; the exudate occupies the entire alveolar space;- macroscopically the affected lung is indurated, without air, having a liver-like appearance (1-3 days)



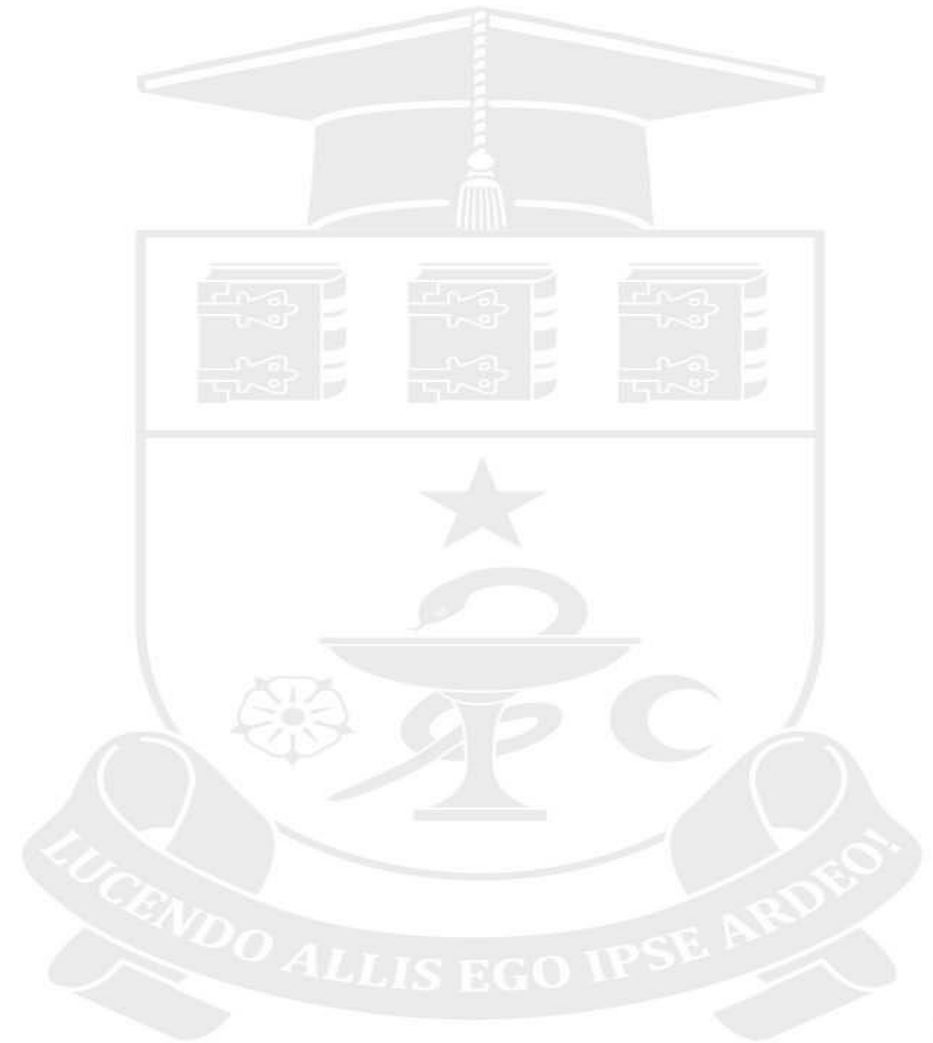
LOBAR PNEUMONIA-pathogeny

3. The gray hepatization stage – marks the beginning of the resorption process and in which the destruction of erythrocytes and leukocytes takes place, the phagocytosis of germs by alveolar macrophages and the lysis of the fibrin network under the action of leukocyte enzymes (2-3 days)
4. Resorption stage - Alveolar exudate is destroyed and is reabsorbed by the lymphatic system, or eliminated cough, the normal alveolar structure is progressively restored by:- the intervention of alveolar macrophages,- restoration of the alveolar epithelium, and - restoration of surfactant.



Clinical picture- Lobar pneumonia

- the onset is sudden
- pronounced chills
- fever
- chest pain
- cough
- dyspnea





LOBAR PNEUMONIA: general inspection

- * *The patient's general condition* is serious, sometimes agitated, with altered consciousness (**delirium**), drowsiness
- *Position* is forced - on the affected part
- * Warm and moist *skin* ; - *hyperemia* of cheekbones, on the affected side
- nasolabial herpes
- * *Mucous membranes*: - **hyperemia of the sclera** on the side affected



Lung examination

1. Clinical stage of onset (corresponds to the morphological stage of congestion):

1. Inspection of the rib cage - possible retention in the act of breathing of the hemithorax on the affected side;
2. Palpation – vocal vibrations unchanged or slightly **intensified**;
3. Percussion – **subdull sound** (maybe with a tympanic nuance)
4. Auscultation – **diminished vesicular breathing** + **inaudible** crepitating rales of induction (“crepitatio indux”), possible pleural friction rub



Lung examination

- II. Clinical stage of the disease state (classical condensation stage, corresponds to the morphological stages of red + gray hepatization)
- Inspection of the chest – pronounced retention of the affected hemithorax during breathing
- Palpation – exaggerated vocal vibration
- Percussion – dull sound
- Auscultation – pathological bronchial breathing+pleural friction
- Bronchophony and pectoriloquy – increased, spoken and whispered words are clearly distinguishable



Lung examination

- III. Clinical stage of resorption (corresponds to the morphological stage of resorption)
- Inspection of the chest – returns to normal
- Palpation – less exaggerated vocal vibration, then returns to normal
- Percussion – subdull sound, then returns to resonant
- Auscultation – bronchovesicular breathing, then returns to normal breathing + audible crackling rales (“crepitatio redux”), possibly small moist subcrepitating rales
- Bronchophony – exaggerated then unclear



Changes in other organs

Cardiovascular system: (signs of myocarditis)

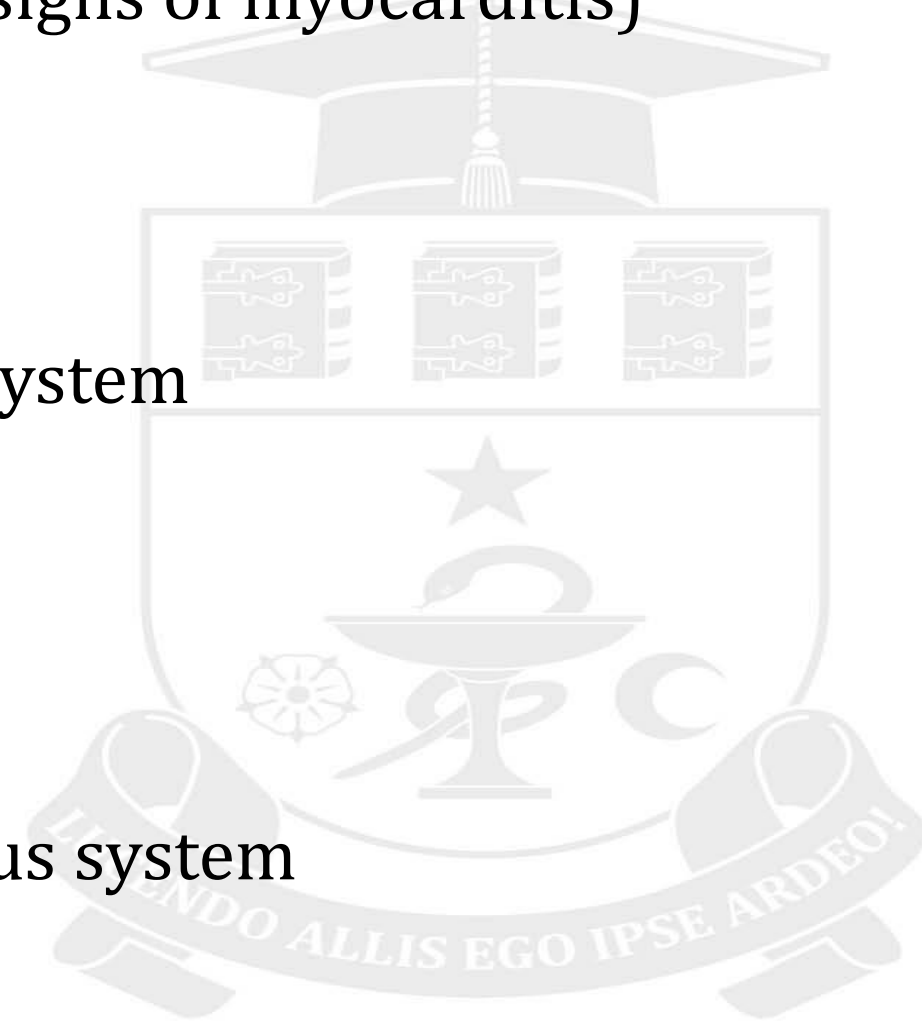
- Tachycardia
- Decreased heart sounds
- Decreased BP

Digestive system

- Nausea, vomiting, constipation,
- epigastric pain
- Subicteric sclerae
- Enlarged liver

Central nervous system

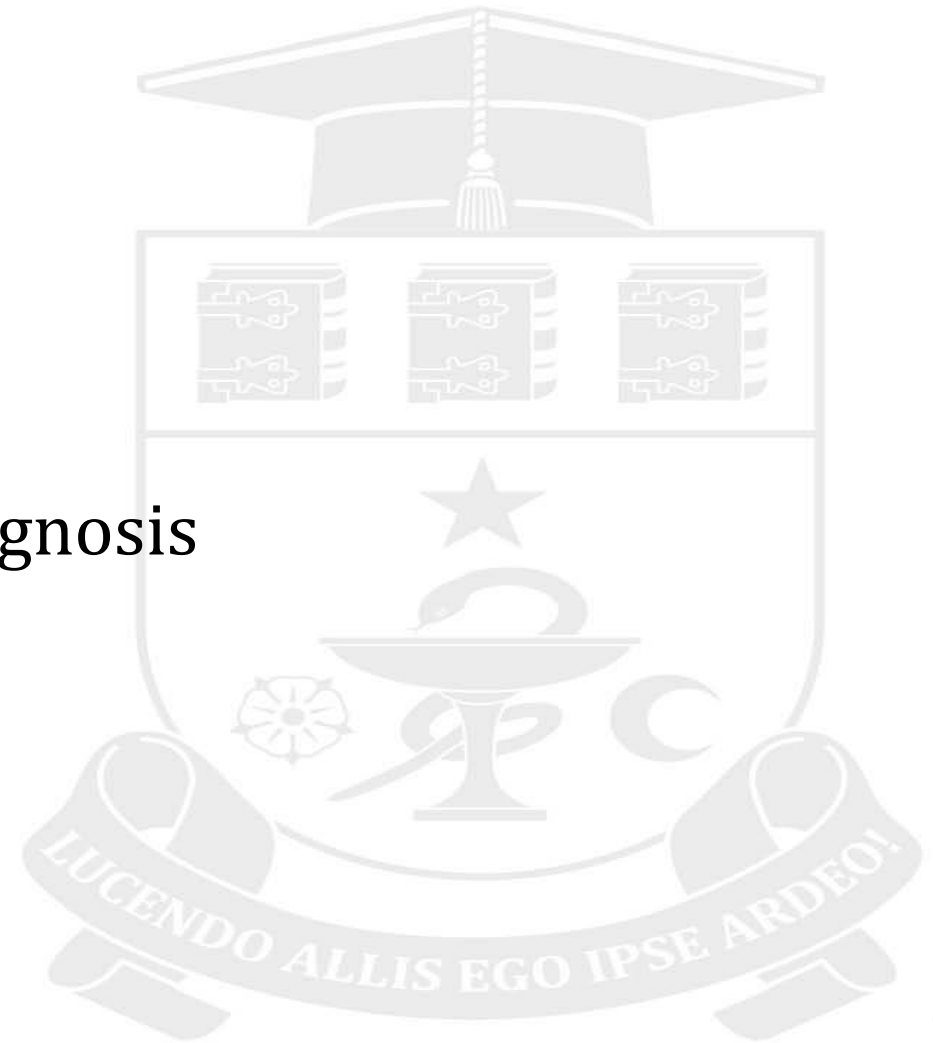
- Meningism
- Psychiatric disorders





Laboratory findings

- leukocytosis with a shift to the left
- thrombocytopenia
- elevated ESR
- disappearance of eosinophils
- leukopenia – indicator of a poor prognosis
- elevated “C” reactive protein
- increase of fibrinogen
- increase in α_2 and γ -globulins
- increase in IgG and decrease in IgA

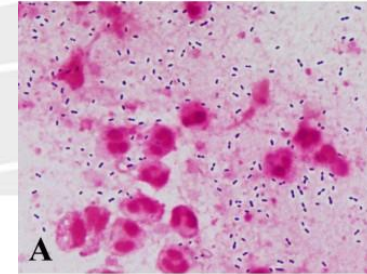




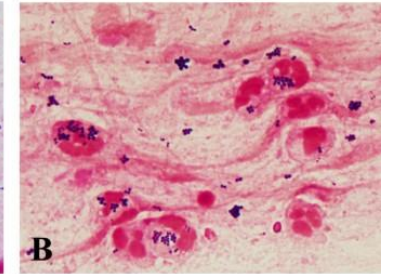
Sputum analysis

Gram-stained smears, red blood cells, partially damaged, neutrophilic leukocytes in large numbers and Gram-positive cocci, partly phagocytized by neutrophils, are identified

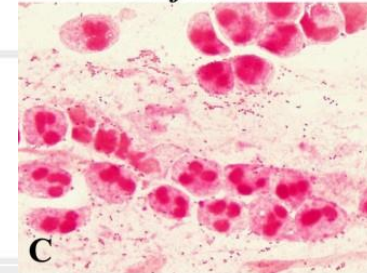
S. pneumoniae



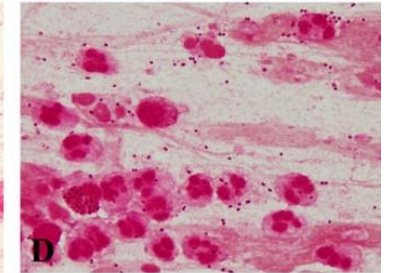
S. aureus



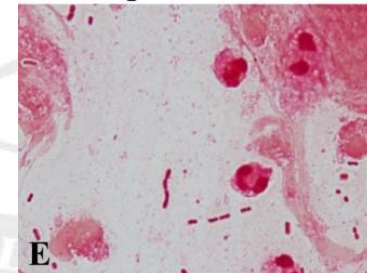
H. influenzae



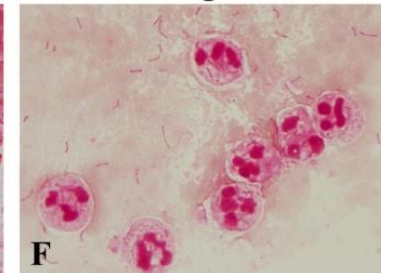
M. catarrhalis



K. pneumoniae



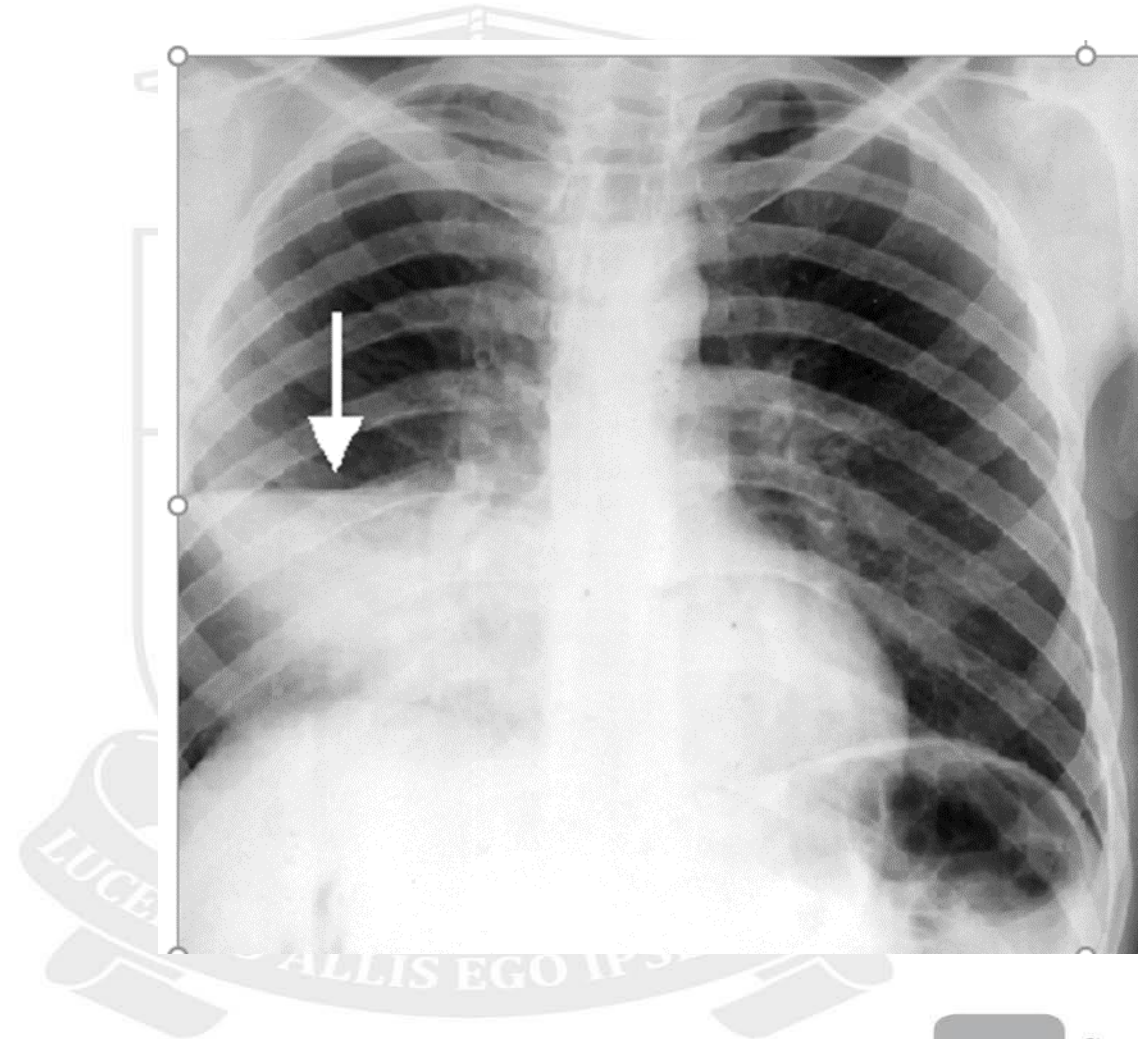
P. aeruginosa





CHEST X-RAY

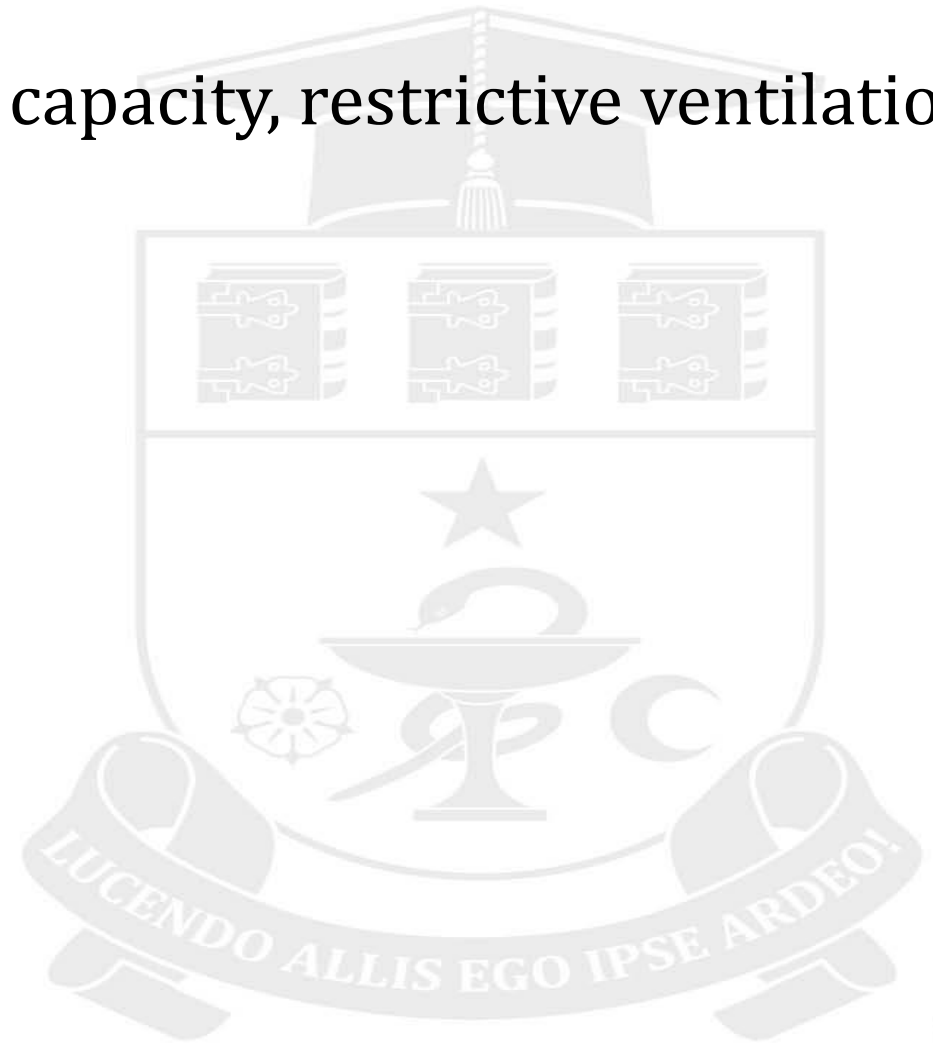
- opacity, of a lobe
- well delimited
- homogeneous
- of subcostal intensity





Functional paraclinical explorations

- Spirography – decrease in vital lung capacity, restrictive ventilation disorders
- ECG – may be:
 - Decrease in T wave
 - ST interval depression
 - Conductivity disorders





Complications of lobar pneumonia

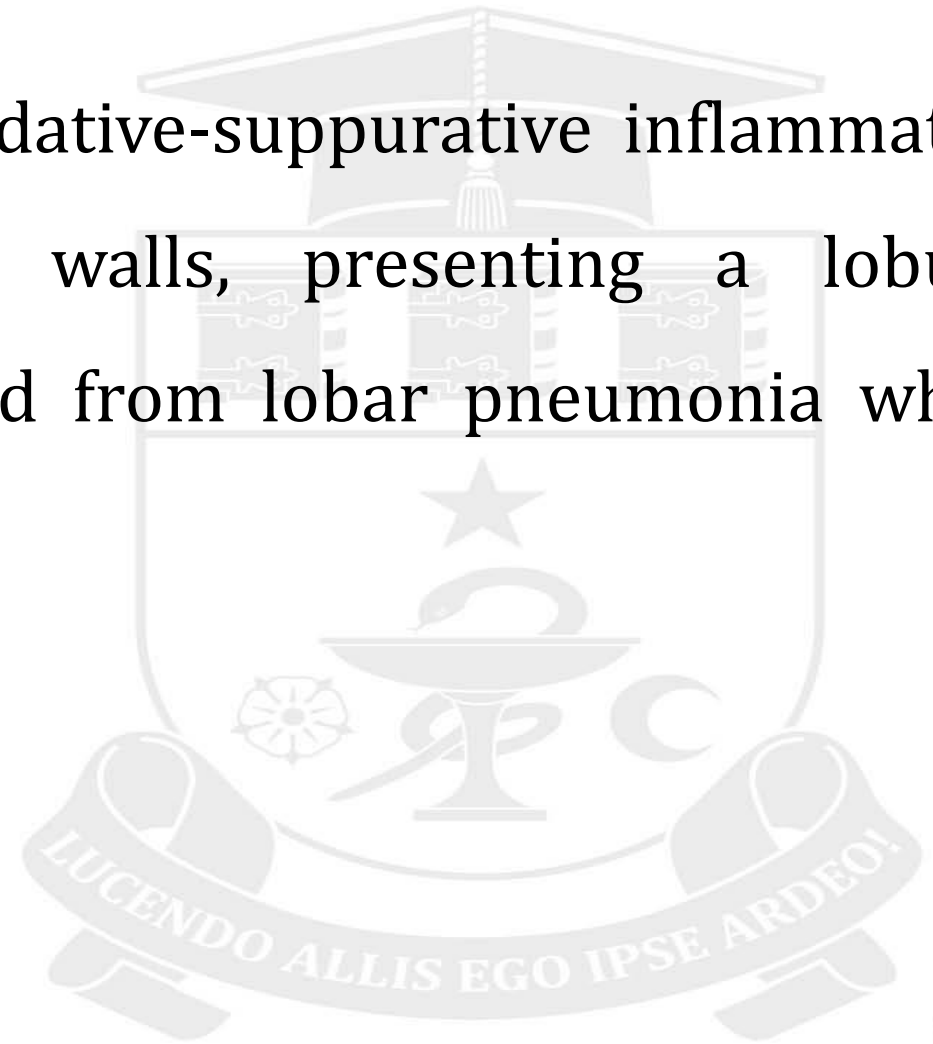
- Pleurisy
- Purulent pleurisy - (empyema)
- Lung abscess
- Superinfection
- Acute heart failure
- Delayed resorption (more than 4 weeks)
- Purulent pericarditis
- Pneumococcal endocarditis
- Pneumococcal meningitis
- Glomerulonephritis





BRONCHOPNEUMONIA

"pneumonia in foci" is an acute exudative-suppurative inflammation predominantly of the bronchiole walls, presenting a lobular topography (it must be differentiated from lobar pneumonia which presents a lobar topography)





BRONCHOPNEUMONIA

It is caused by various pathogens, especially of bacterial origin (staphylococcus, streptococcus, Haemophilus influenzae, proteus, Escherichia coli), forming isolated foci of acute condensation (with Ø of 1-3 cm, centered by bronchioles) surrounded by aerated pulmonary parenchyma, with hyperdistension

In children up to 2 years of age there is a tendency for confluence, resulting in a large condensation area (pseudolobar pneumonia)

The risk of bronchopneumonia is higher in the elderly (over 65 years and under 2 years), in whom complications frequently occur

Also, medical personnel and those with chronic lung diseases are more prone to developing bronchopneumonia



Bronchopneumonia: peculiarities

- frequently bilateral and basal
- peribronchiolar inflammation may extend through Kohn pores (small communications between adjacent pulmonary alveoli, which provide a collateral pathway for aeration)
- varied etiology and the age, concomitant diseases determine the polymorphism of clinical manifestations
- the onset of the viral etiology can be acute, similar to a cold (flu syndrome), the symptoms progressively worsening within a few days.
- the onset of the disease of bacterial origin is more insidious than lobar pneumonia (after a few days of bronchitis manifestations, the cough worsens, fever and other manifestations of intoxication syndrome appear)



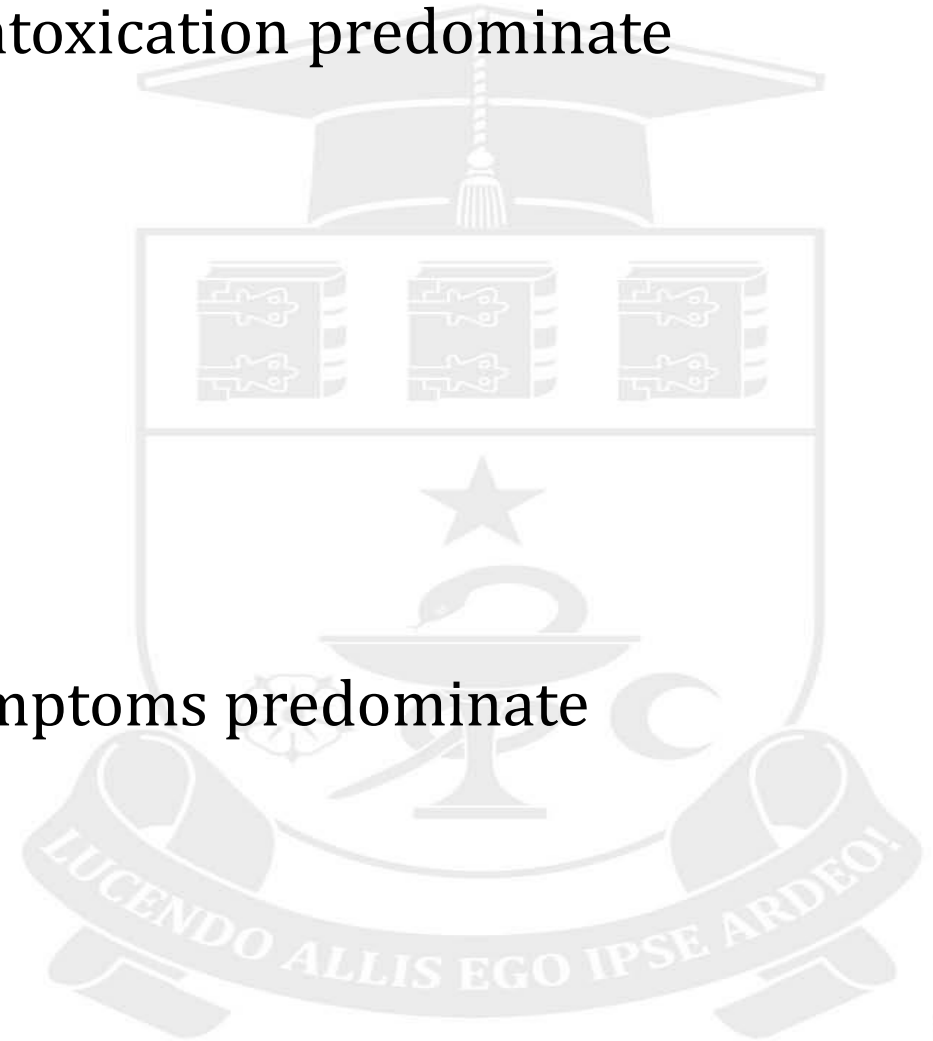
Bronchopneumonia: Particularities of clinical manifestations

Sometimes signs of general intoxication predominate

- fever,
- chills,
- asthenia,
- sweating,
- headache,
- confusion;

Sometimes respiratory symptoms predominate

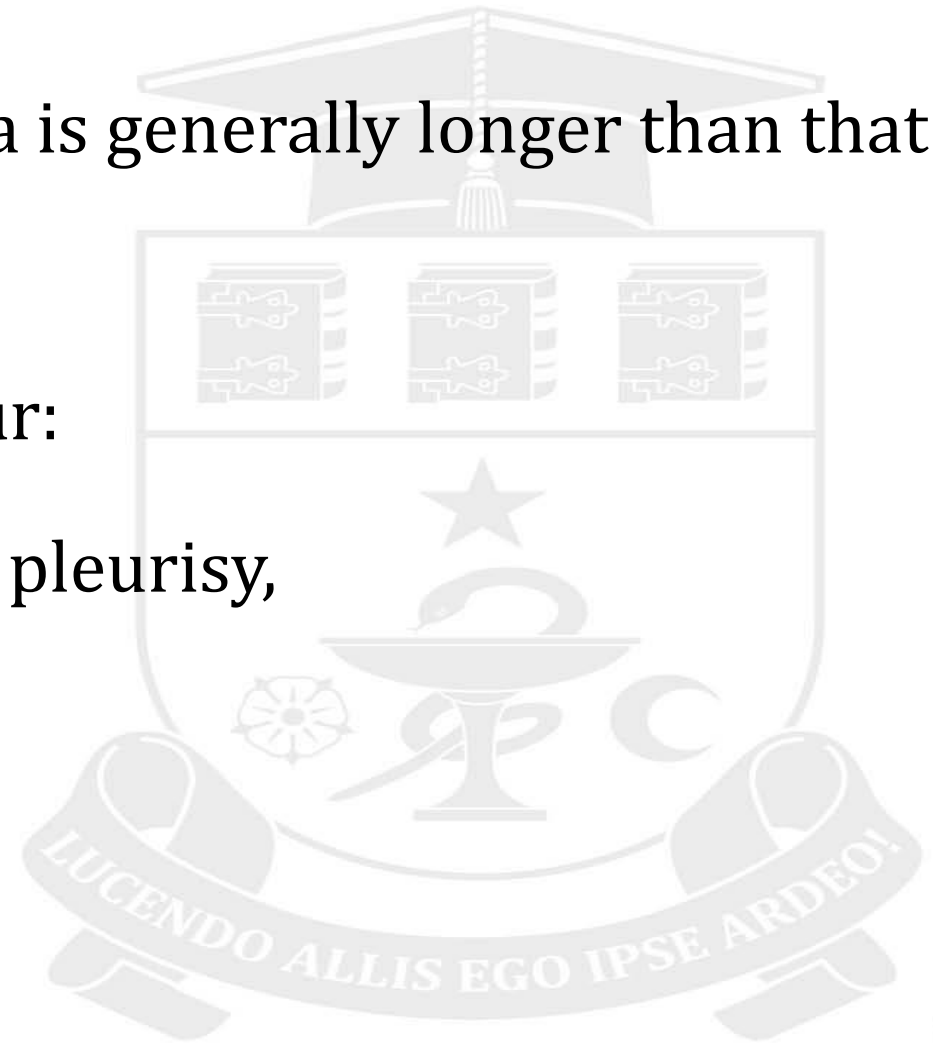
- cough,
- dyspnea,
- rarely chest pain
- or even signs of acute respiratory failure.





Bronchopneumonia: evolutionary particularities

- The evolution of bronchopneumonia is generally longer than that of lobar pneumonia
- Local septic complications may occur:
 - purulent para- and metapneumonic pleurisy,
 - lung abscess,
 - pericarditis





BRONCHOPNEUMONIA: Clinical physical examination

On inspection and palpation:

- Asymmetry with retention on the affected side in the case of polysegmental confluent bronchopneumonia
- Locally intensified vocal vibration
- Asymmetry of percussion sound with a subdull sound
- Local diminution of inspiration with tightening of expiration in the same area
- Single small bullous rales (subcrepitant) and fine, noiseless crepitus in a limited area



BRONCHOPNEUMONIA

Chest X-ray- usually shows:

- multiple nodular or reticulonodular opacities, relatively small in size, disseminated, unevenly distributed and tending to coalesce
- The distribution is frequently bilateral (lesions in both lungs), asymmetric and predominantly basal





Retractable pulmonary consolidation syndrome

ATELECTASIS

- Atelectasis (collapse) represents a change occurring in the lung parenchyma through the resorption of intraalveolar air, in which two elements are associated:
 1. Upon obstruction of a bronchus and as a result of a ventilation defect in the respective territory (but with preservation of perfusion) the collapse of the pulmonary alveoli occurs, which become flattened (collapsed)
 2. The existence of a retraction phenomenon – the respective lung territory is reduced in volume and involves the neighboring areas in a retraction process
- Regarding the mechanism of atelectasis formation, we distinguish:
 1. Atelectasis by obstruction
 2. Atelectasis by compression

The most common mechanism encountered is bronchial obstruction (bronchopulmonary cancer, foreign body, mucus plugs, blood)



Clinical picture

Complains:

- Chest pain
- - Cough (rare)
- - Dyspnea

Physical examination:

On inspection:

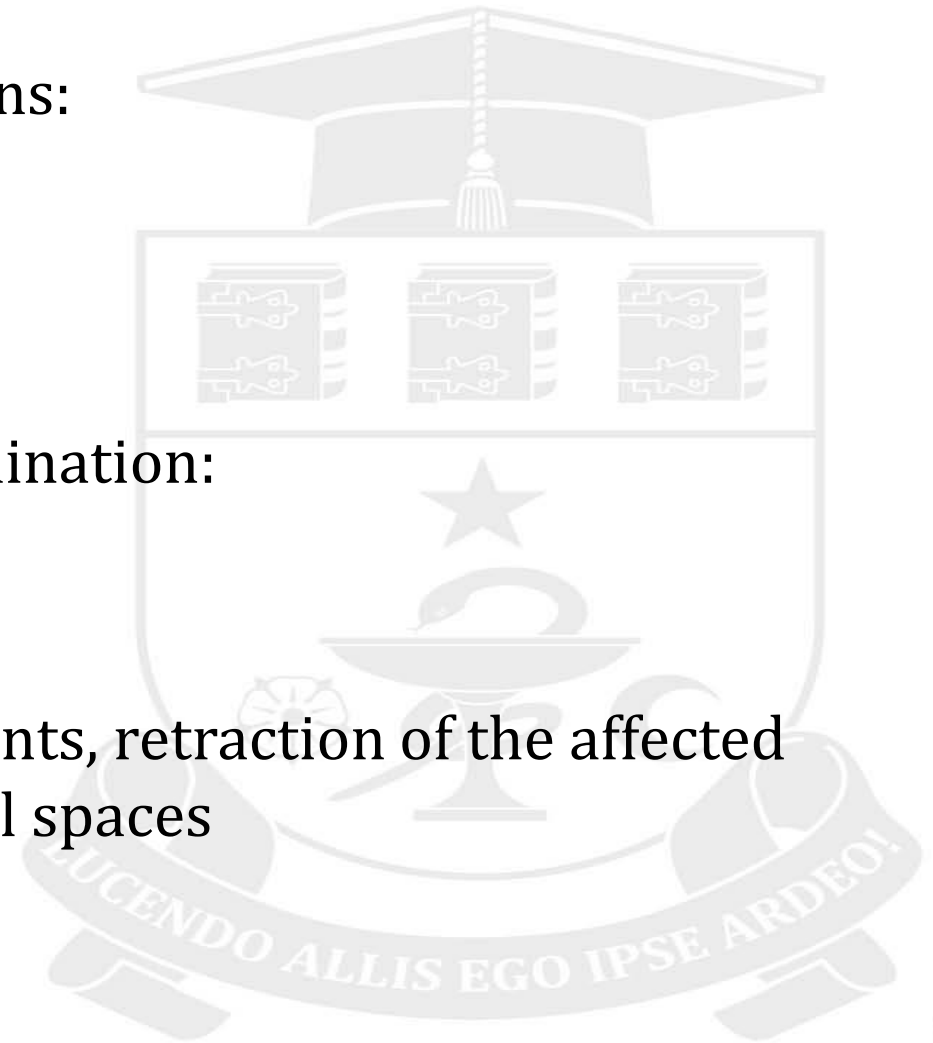
Obvious asymmetry of the chest

Decreased amplitude of respiratory movements, retraction of the affected hemithorax with narrowing of the intercostal spaces

Palpation – vocal vibrations absent

Percussion - dull sound

Auscultation – absence of vesicular breathing





X-ray

Signs of condensation:

homogeneous opacity

triangular in shape

with the apex at the hilum

corresponding to a segment, a lobe or an entire lung;

Signs of retraction:

trachea, heart shadow and diaphragm-
drawn to the affected side,

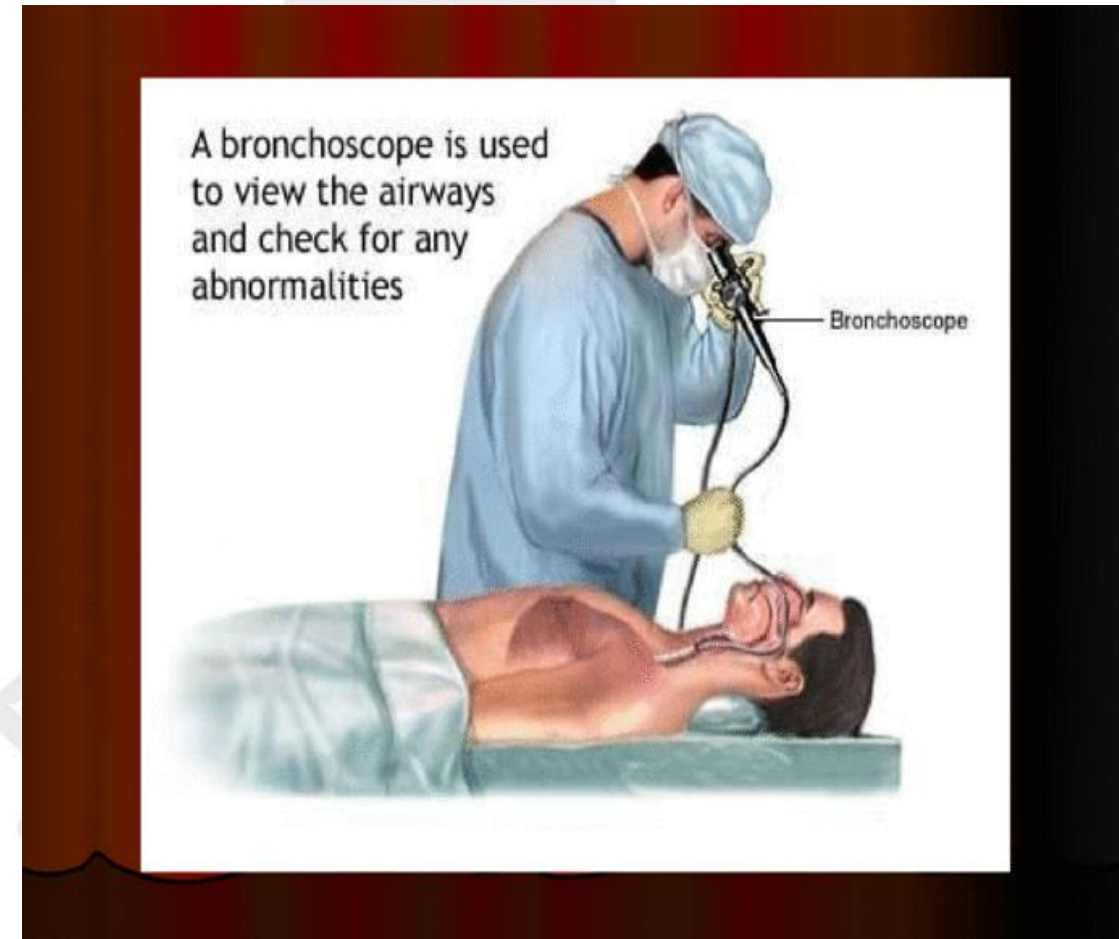
intercostal spaces are narrowed and more
oblique





Bronchoscopy

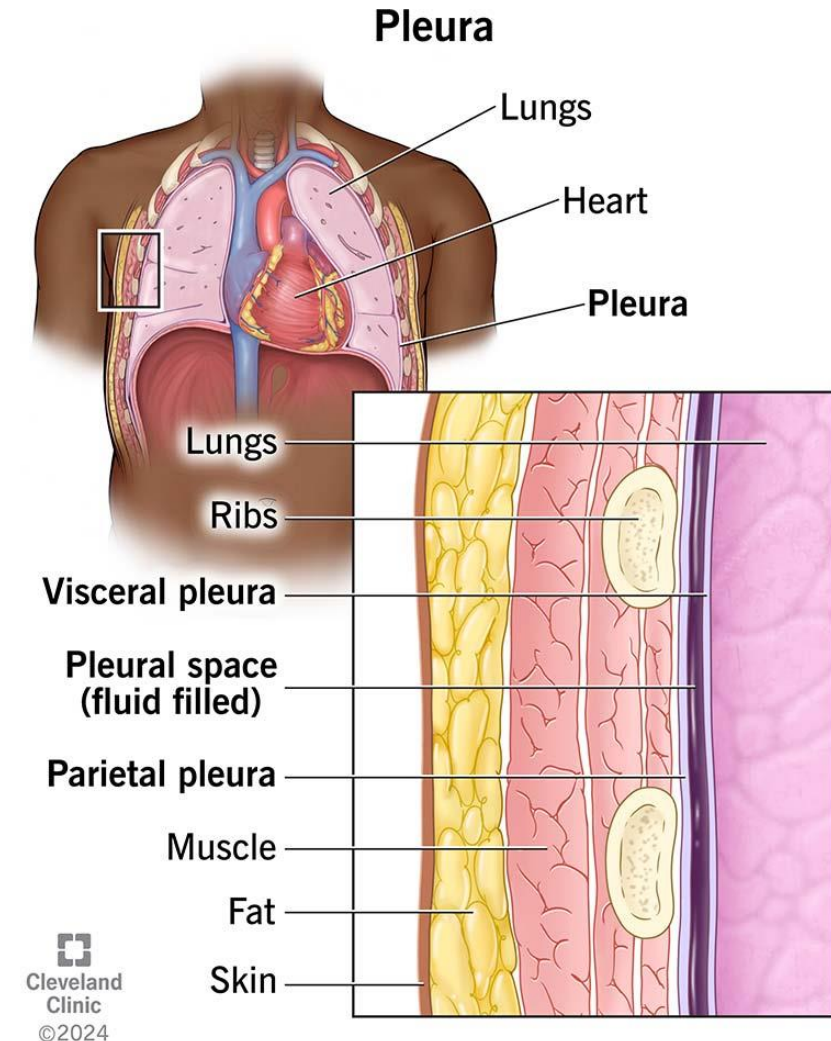
has a diagnostic and sometimes therapeutic role (removes the cause)





Pleural Syndrome

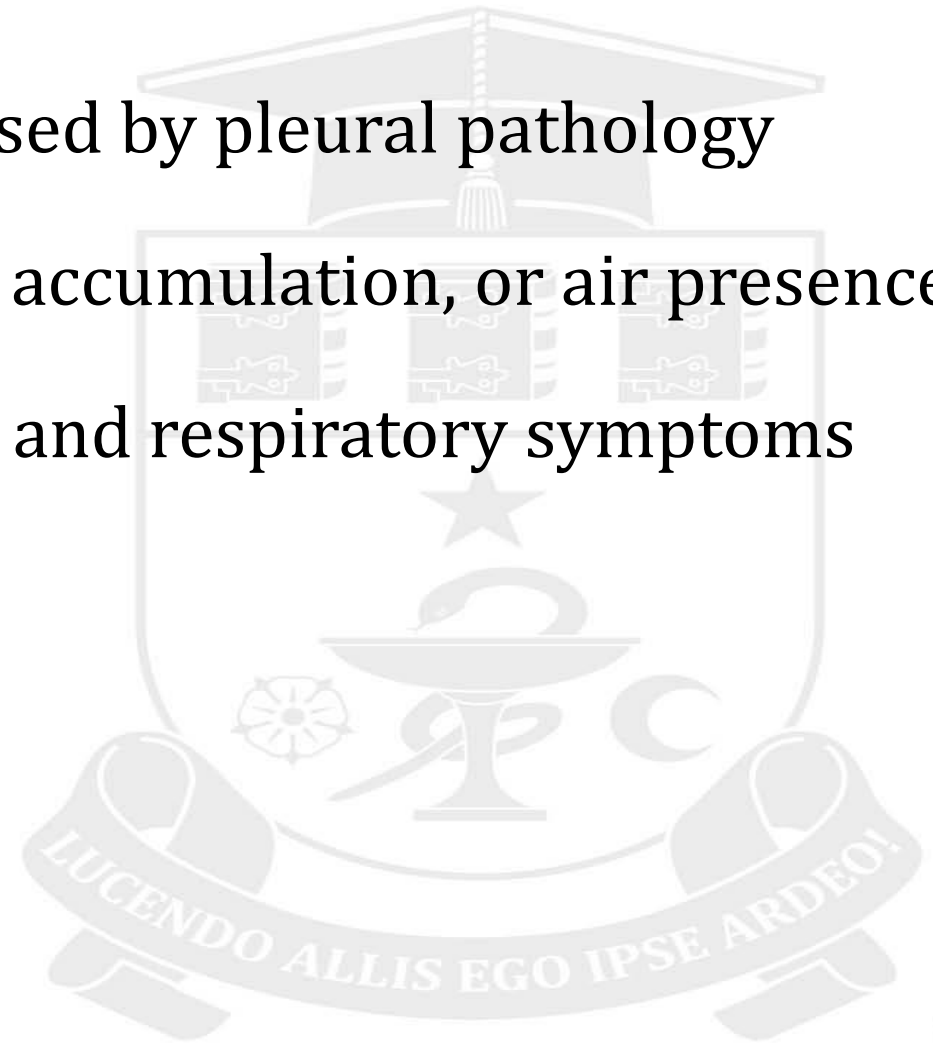
- Pleura = serous membrane covering lungs and chest wall
- Visceral pleura covers lungs
- Parietal pleura lines thoracic cavity
- Pleural space contains small amount of fluid for lubrication





Definition of Pleural Syndrome

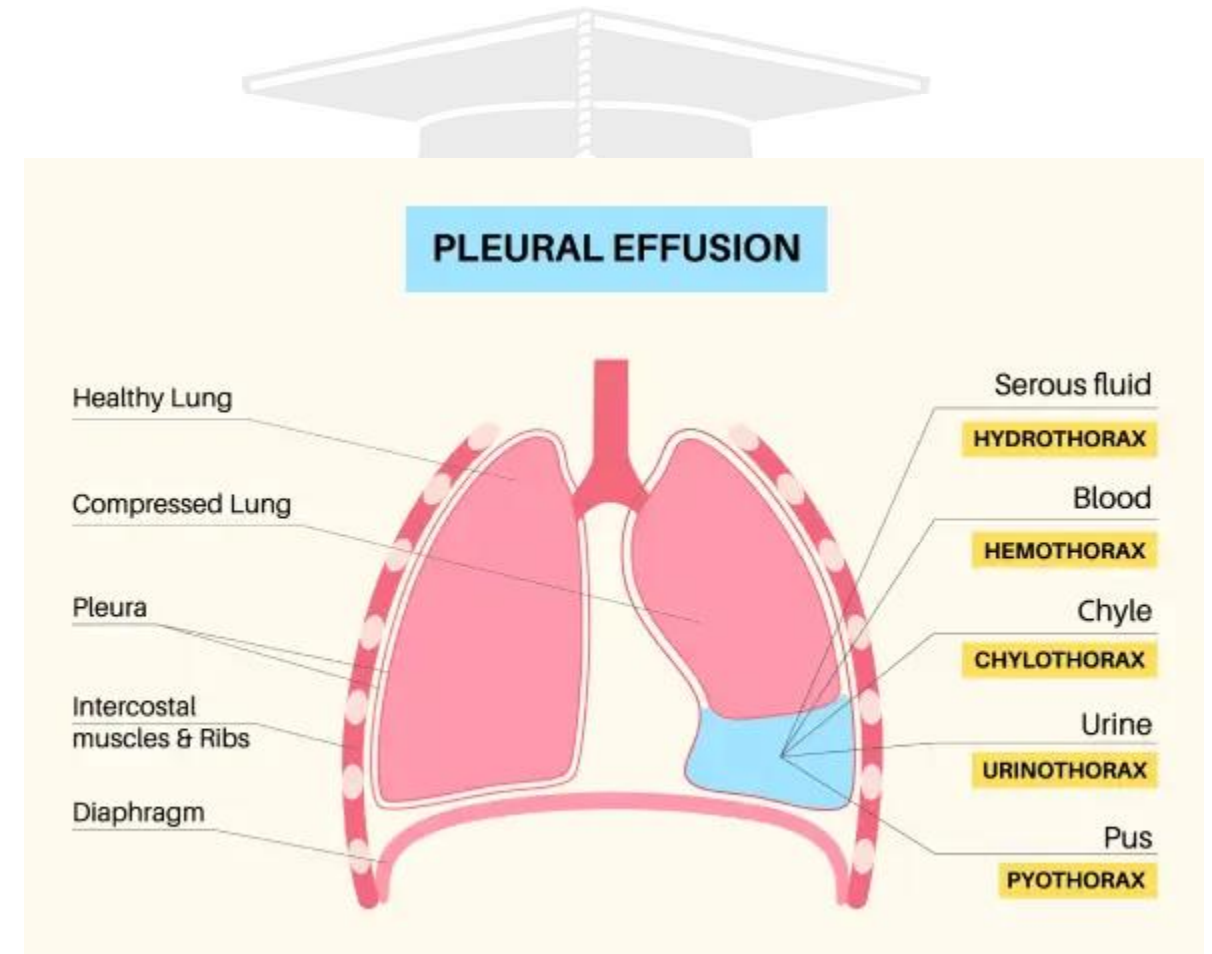
- Group of clinical manifestations caused by pleural pathology
- Includes pleural inflammation, fluid accumulation, or air presence
- Commonly presents with chest pain and respiratory symptoms





Types of Pleural Syndrome

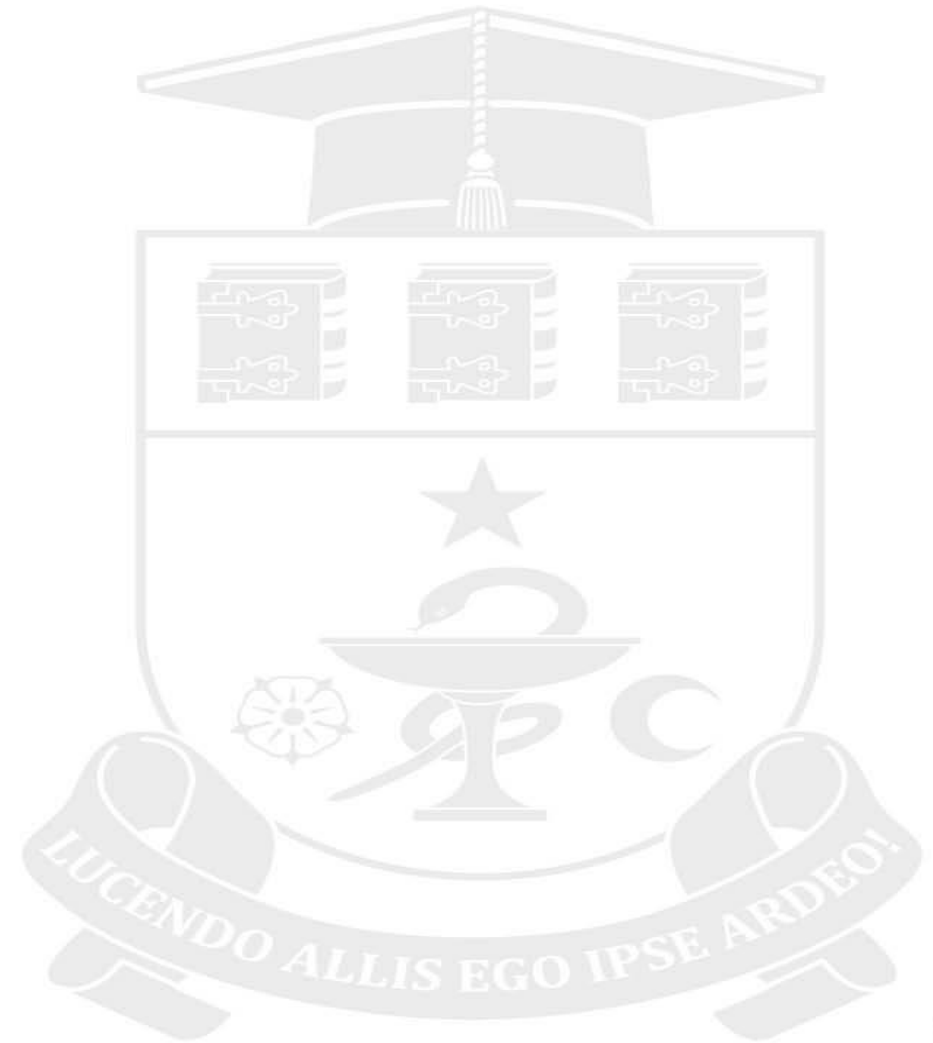
- Pleural effusion
- Pneumothorax
- Hemothorax
- Empyema
- Pleuritis





Etiology of Pleural Effusion

- Congestive heart failure
- Pneumonia
- Malignancy
- Pulmonary embolism
- Tuberculosis
- Autoimmune diseases





Transudate vs Exudate

Transudate:

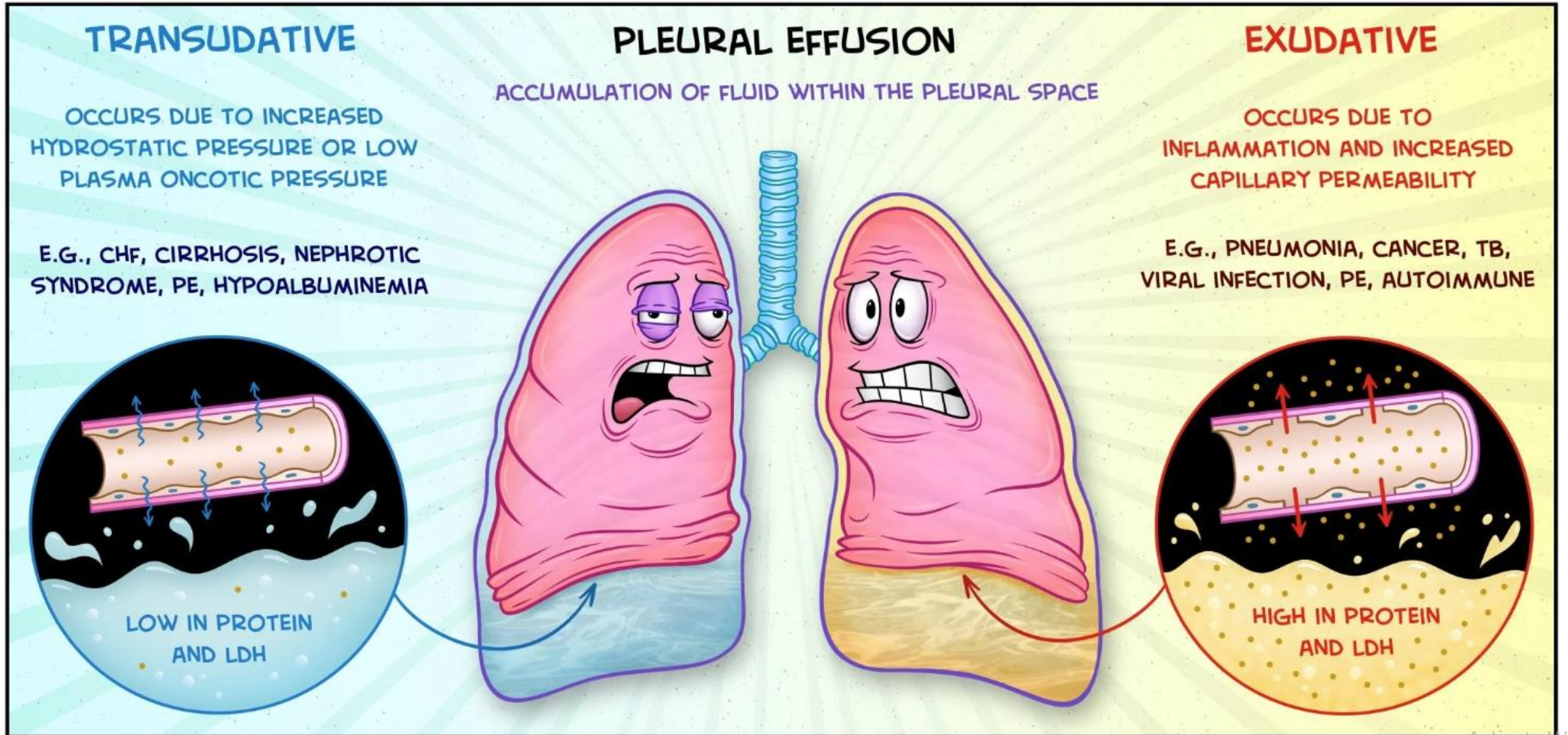
- Caused by systemic factors
- Low protein content

Exudate:

- Caused by inflammation or malignancy
- High protein content



Pleural Effusions: Transudate vs. Exudate





Pneumothorax

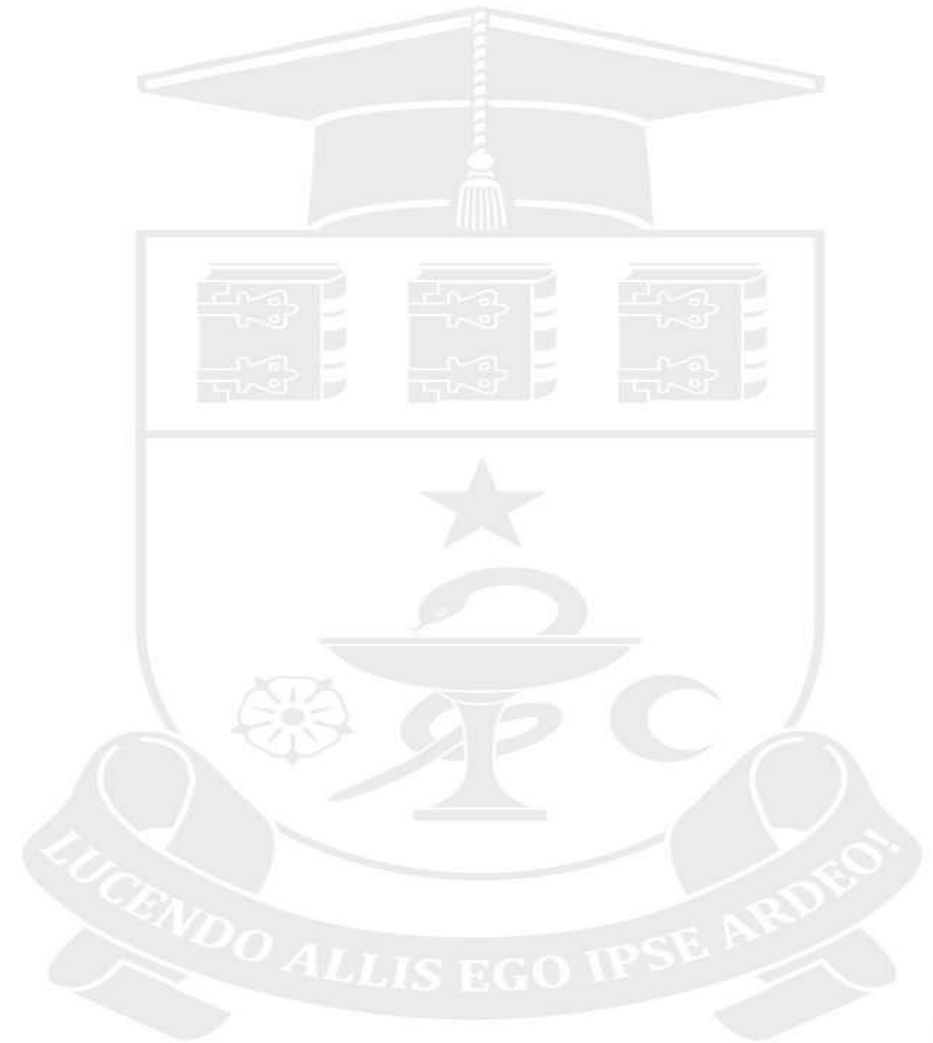
- Presence of air in pleural space
- Causes lung collapse
- Types: spontaneous, traumatic, tension pneumothorax





Clinical Manifestations

- Sharp pleuritic chest pain
- Dyspnea
- Dry cough
- Reduced breath sounds
- Fever (in infections)





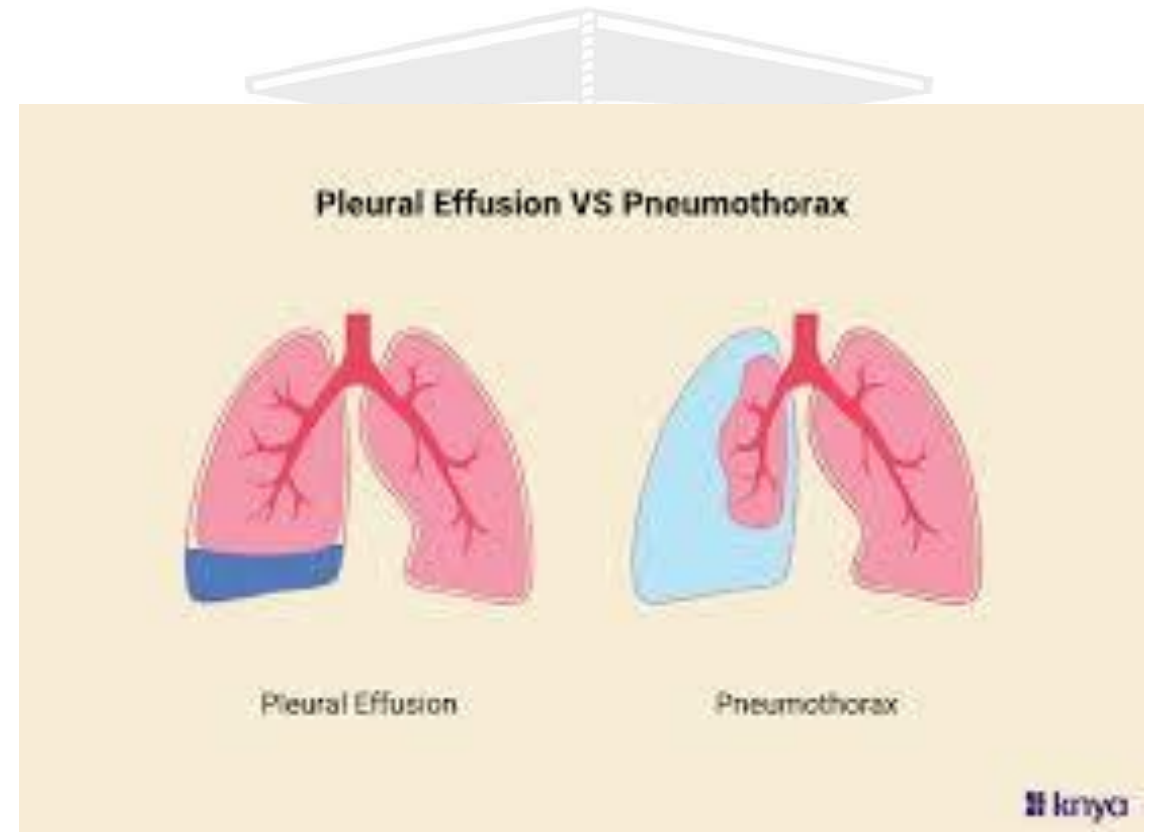
Physical Examination Findings

Pleural Effusion:

- Dullness to percussion
- Reduced breath sounds

Pneumothorax:

- Hyperresonance
- Decreased chest expansion





Diagnostic Methods

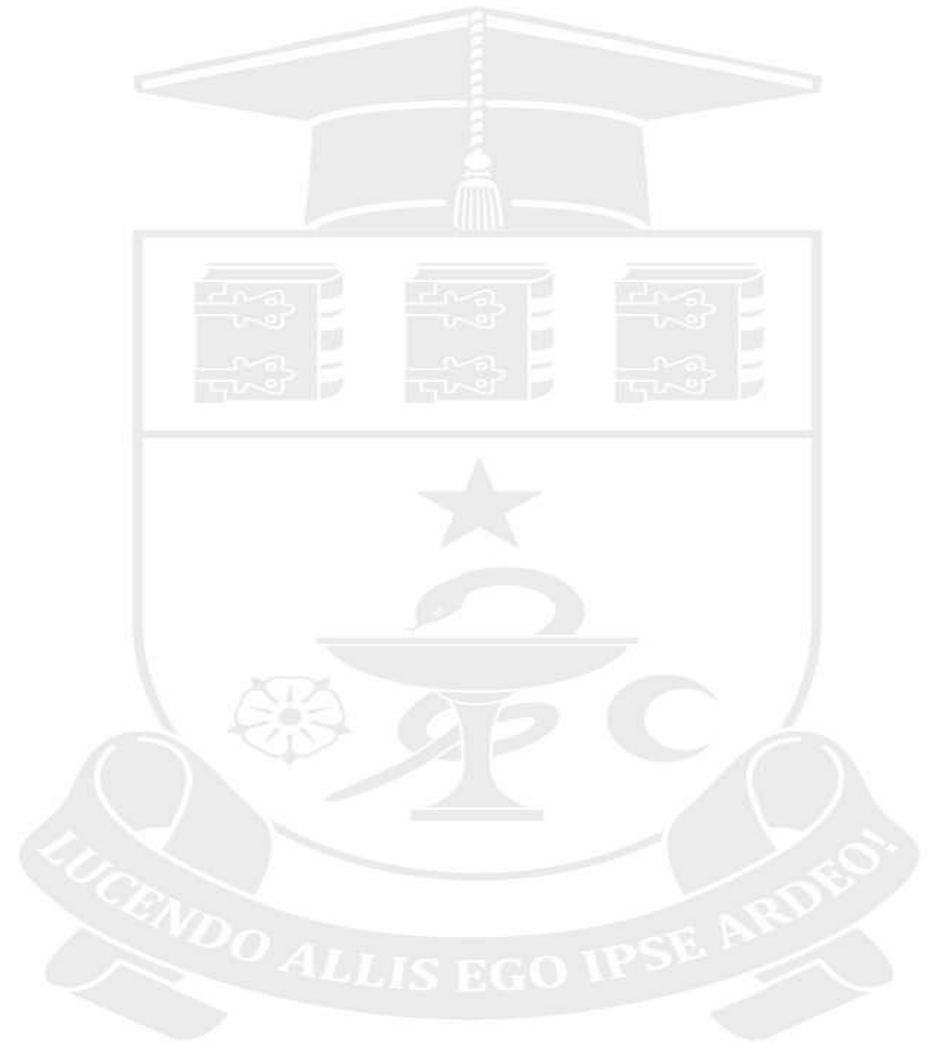
- Chest X-ray
- Thoracic ultrasound
- CT scan
- Thoracentesis with fluid analysis





Pleural Fluid Analysis

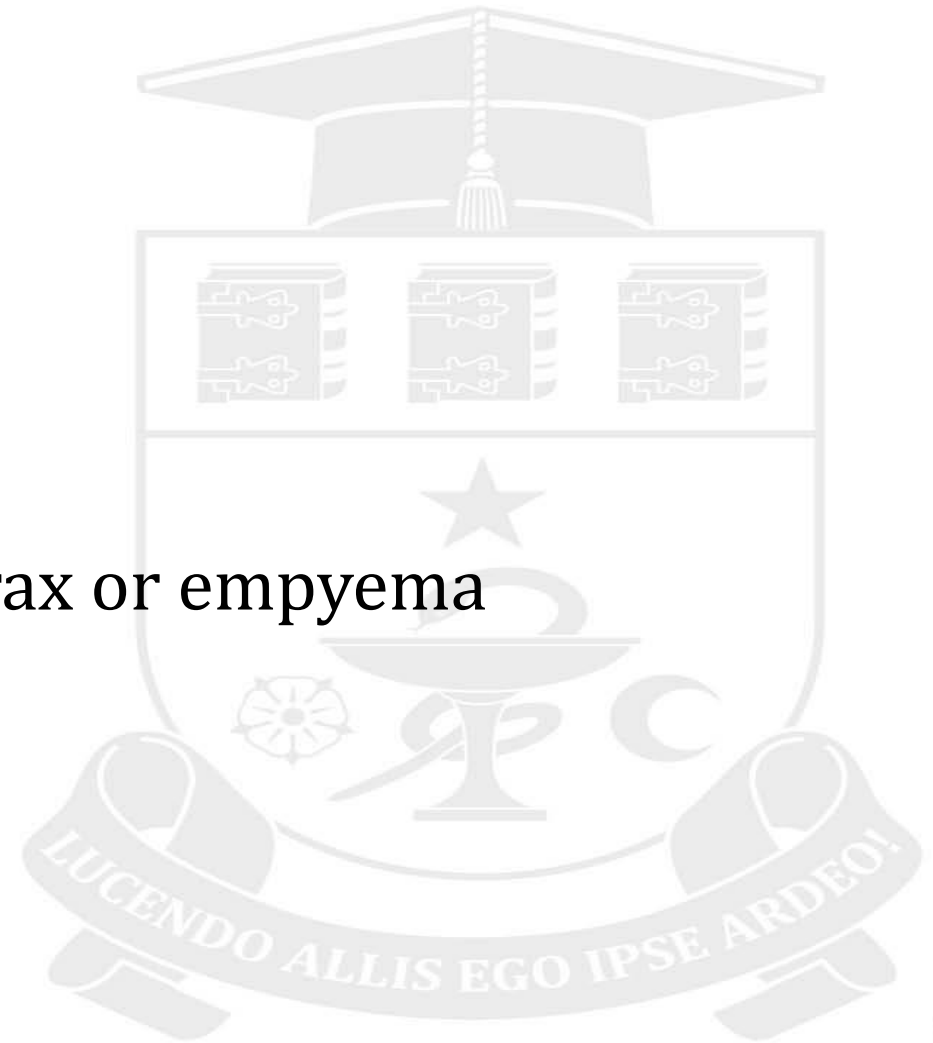
- Appearance
- Protein and LDH levels
- Glucose concentration
- Cytology
- Microbiology testing





Management Principles

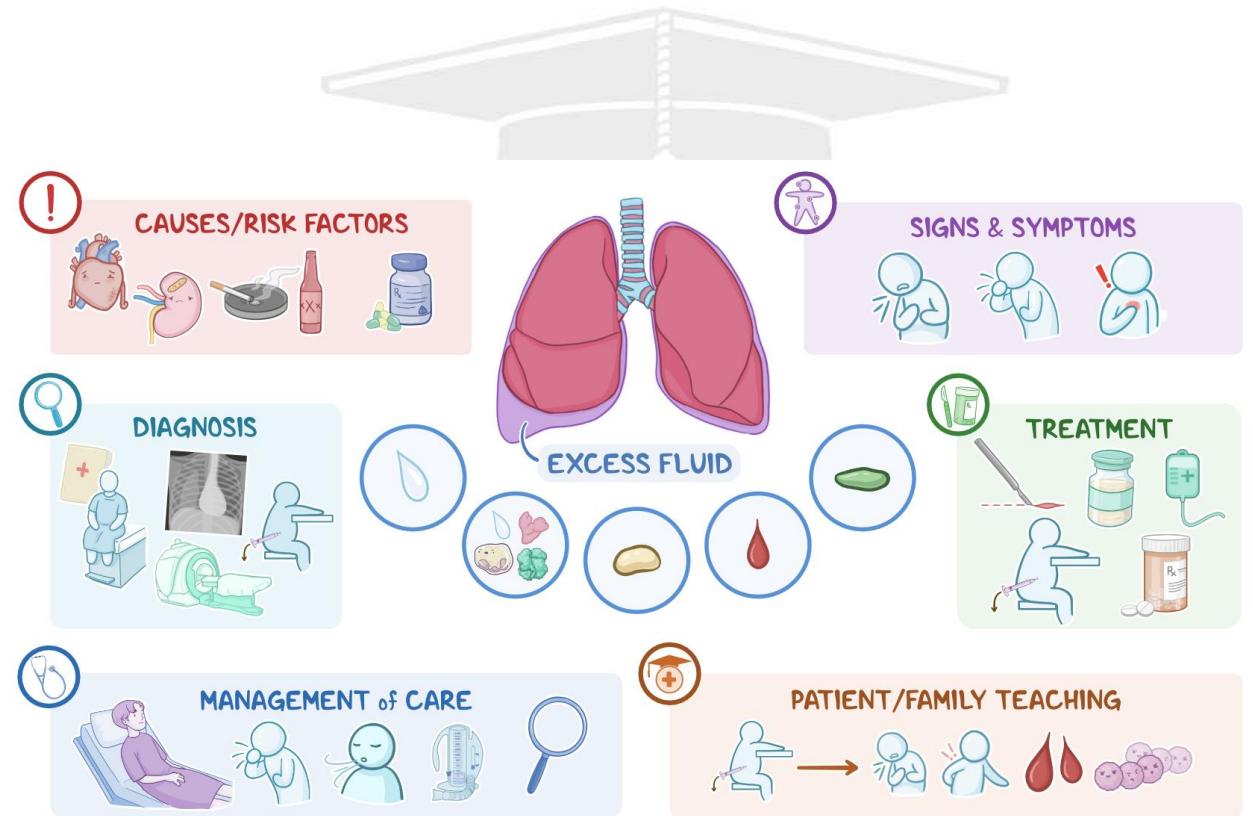
- Treat underlying cause
- Drain pleural fluid when necessary
- Oxygen therapy
- Chest tube insertion for pneumothorax or empyema





Complications

- Respiratory failure
- Fibrosis
- Recurrent effusions
- Sepsis



OSMOSIS from Elsevier

