

DYSPNEA

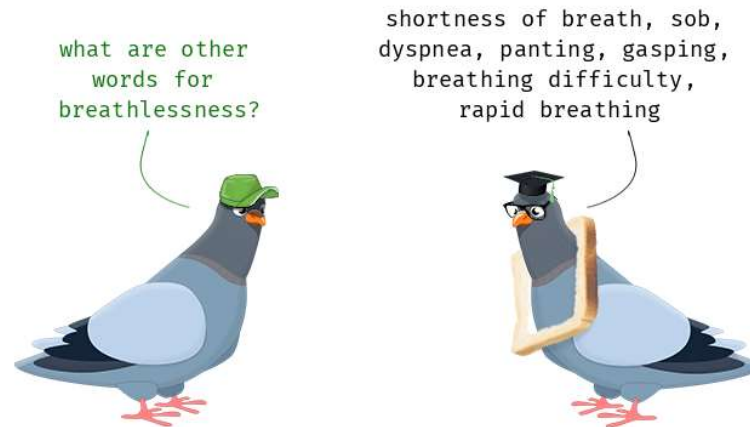


RENATA GŁÓWCZYŃSKA, AGATA TYMIŃSKA

Dyspnea - definition

Abnormal or uncomfortable awareness of breathing in the context of what is normal for a person according to his or her level of exertional threshold for breathlessness.

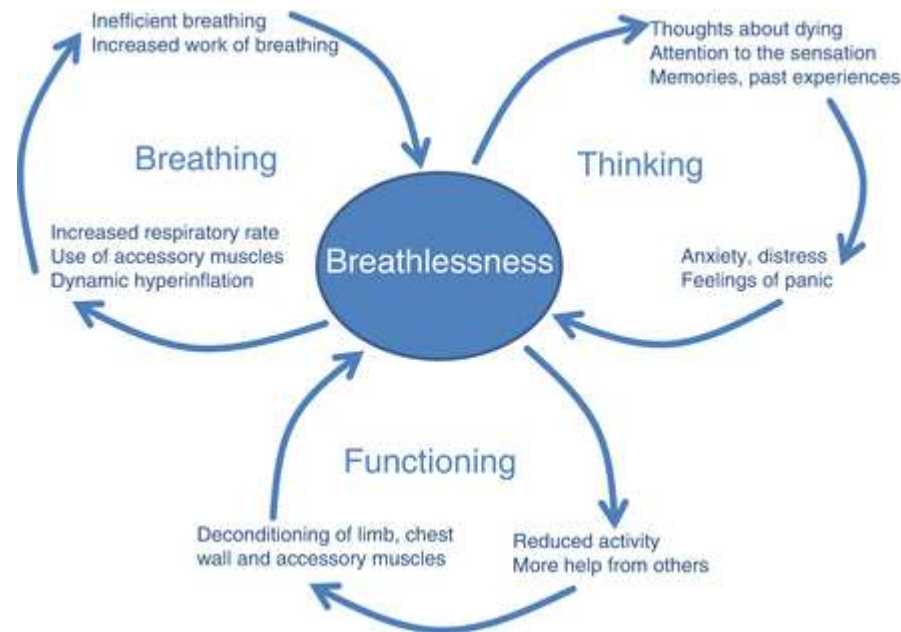
Is **the most common complaint** of patients with cardiopulmonary diseases („shortness of breath” or „breathlessness”)



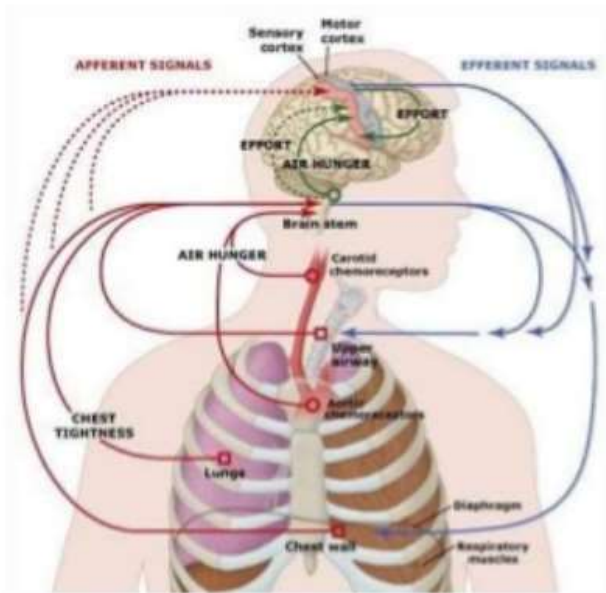
Pathophysiology of Dyspnea

Imbalance between the perceived need to breathe and the perceived ability to breathe

CO₂ build-up and oxygen deprivation were the critical factors that result in dyspnea



Patophysiology



Dyspnea happens when a “mismatch” occurs between afferent and efferent signaling.

As the brain receives afferent ventilation information, it is able to compare it to the current level of respiration by the efferent signals.

If the level of respiration is inappropriate for the body’s status and need, then dyspnea might occur

Patophysiology

RECEPTORS AND SIGNALS

The pathway that leads to dyspnea via specific acid-sensing ion channels, mechanoreceptors and lung receptors located in different zones of the respiratory apparatus.

Chemoreceptors

In the carotid bodies and medulla supply information with regard to the blood gas levels of O₂, CO₂ and H⁺

Juxtacapillary receptors

Sensitive to pulmonary interstitial oedema

Stretch receptors

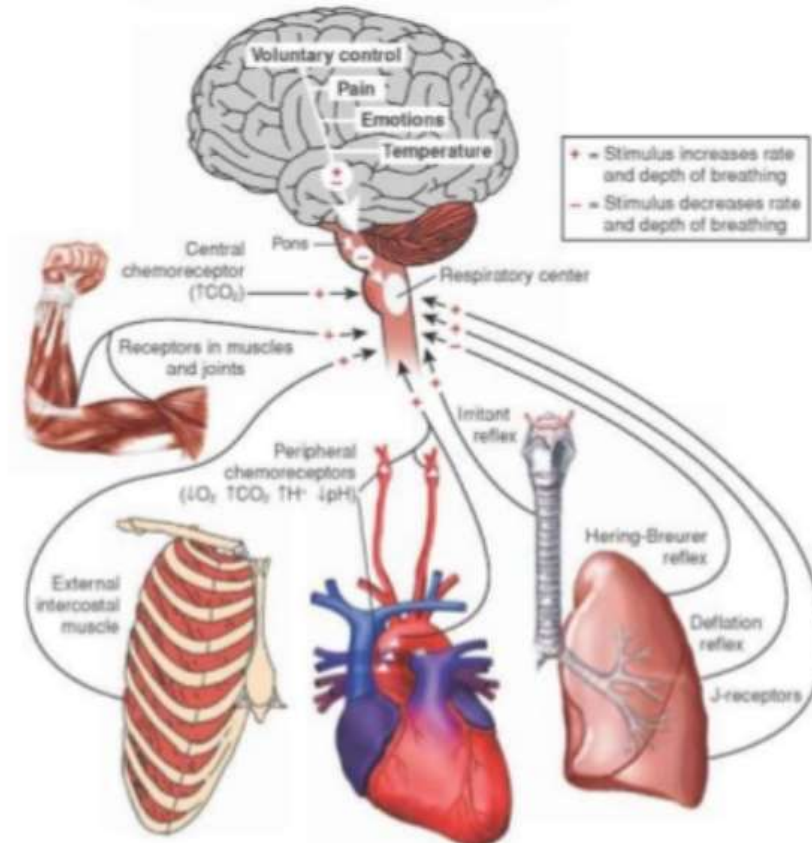
Hering-breuer reflex

Muscle spindles in the chest wall

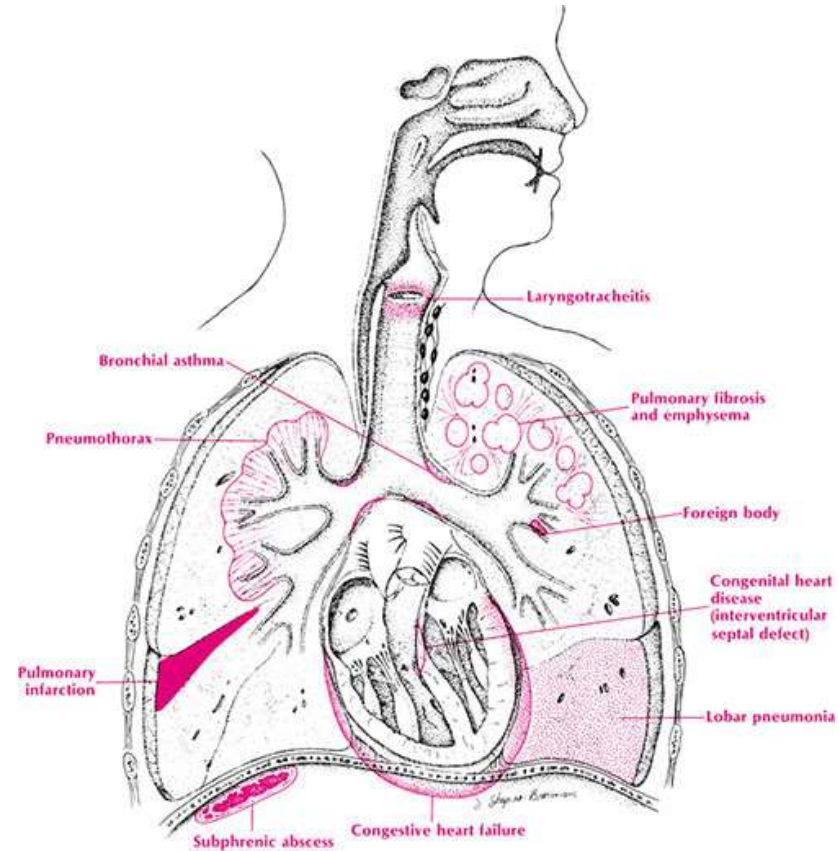
Signals the stretch and tension of the respiratory muscles

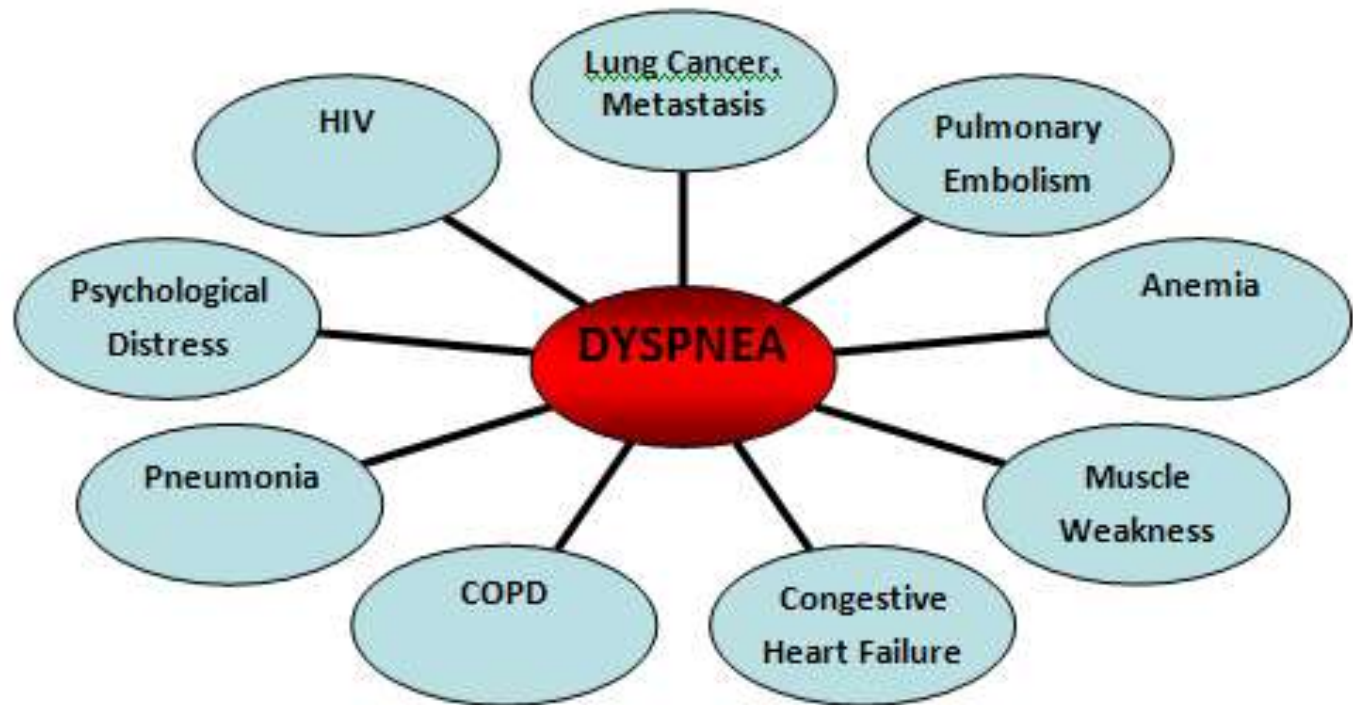
EFFERENT SIGNALS

Motor neuronal signals descending to the respiratory muscles, the most important being the **diaphragm**



Dyspnea – multiple etiologies





2/3 of cases – cardiac or pulmonary

Main groups of causes

FOUR GENERATIVE CATEGORIES

CARDIAC

- Congestive cardiac failure
- Coronary artery disease
- Cardiomyopathy
- Valvular dysfunction
- Pericarditis
- Arrhythmias

PULMONARY

- COPD
- Asthma
- Restrictive lung disease
- Pneumothorax

CARDIAC + PULMONARY

- COPD with pulmonary hypertension and cor pulmonale
- Chronic pulmonary emboli

NON CARDIAC NON PULMONARY

- Metabolic condition (acidosis)
- Pain in chest wall
- Neurovascular disorders
- Otorhinolaryngeal disorders
- Others

Life-threatening causes of dyspnea

Myocardial infarction

Ventricular tachycardia

Acute heart failure

Status asthmaticus

Pulmonary embolism

Tension pneumothorax

Anaphylactic laryngeal edema

Airway obstruction

Diabetic ketoacidosis

Guillain-Barre syndrome

Carbon monoxide poisoning

Salicylate poisoning



Pulmonary

- COPD
- Asthma
- Restrictive lung disorders
- Hereditary lung disorders
- Pneumonia
- Pneumothorax



Cardiac

- Congestive heart failure (right, left or biventricular)
- Coronary artery disease
- Myocardial infarction
- Cardiomyopathy
- Valvular dysfunction
- Left ventricular hypertrophy
- Asymmetric septal hypertrophy
- Pericarditis
- Arrhythmias



Mixed cardiac or pulmonary

- COPD with pulmonary hypertension and/or cor pulmonale
- Chronic pulmonary emboli
- Pleural effusion



Noncardiac or nonpulmonary

- Metabolic conditions (e.g. acidosis, anemia, diabetic ketoacidosis)
- Trauma
- Neuromuscular disorders (multiple sclerosis and muscular dystrophy)
- Otorhinolaryngeal disorders (nasal obstruction - polyps, septal deviation, supraglottic or subglottic airway stricture)
- Functional (anxiety, panic disorders, hyperventilation)
- Chemical exposure

Investigations

Diagnostic Evaluation of Dyspnea

History



Acute / Chronic

At rest / on exertion

Exacerbating / relieving factors

Accompanied by other symptoms?



Acute dyspnea

ACUTE CAUSES (within minutes)

RESPIRATORY

1. Acute exacerbation of asthma
2. Pneumothorax
3. Pulmonary embolism
4. Foreign body
5. Laryngeal edema

CARDIAC

1. Acute MI
2. Congestive heart failure
3. Pericardial tamponade
4. Acute valvular insufficiency
5. Aortic dissection
6. Complete heart block

Subacute dyspnea

SUBACUTE CAUSES		
Within hours	Within days	Within weeks
<ol style="list-style-type: none">1. Asthma2. Left heart failure3. Pneumonia	<ol style="list-style-type: none">1. Pneumonia2. ARDS3. Left heart failure	<ol style="list-style-type: none">1. Pleural effusion2. Anemia3. Muscle weakness4. Tumors

Chronic dyspnea

CHRONIC PULMONARY CAUSES			
Airways	Pleural	Parenchymal	Vascular
<ol style="list-style-type: none">1. COPD2. Asthma3. Chronic bronchitis4. Empyema5. Cystic fibrosis	<ol style="list-style-type: none">1. Effusion2. Malignancy3. Fibrosis	<ol style="list-style-type: none">1. Interstitial lung disease	<ol style="list-style-type: none">1. Vasculitis2. A-V malformation

History

Onset Sudden onset

→ consider PE, pneumothorax

Associated chest pain?

→ consider MI, PE, Pneumothorax, Pneumonia

Orthopnea

→ CHF, ascites, pregnancy, resp. muscle weakness

Nocturnal dyspnea

→ consider CHF, GERD, asthma

Platypnea

→ AV malformations at lung bases, interarterial shunts, cirrhosis

Dyspnea on exertion

→ cardiac/pulmonary



History

Systemic symptoms?

- Fever
- Weight loss
- Night sweats
- Anxiety



History

Past medical history:

- Cardiovascular risk factors (smoking, hypertension, hypercholesterolaemia, diabetes, previous history of myocardial infarction)
- Asthma, COPD
- CHF
- Cancer
- HIV
- PE risk factors (previous history of thromboembolic disease, thrombophilia, malignancy, immobility, recent surgery or long-haul flight, oral contraceptive pill use)
- Thyroid disease
- Renal disease



Helpful questions

„Do you remember the last blood pressure measurement?“

„Have you had your cholesterol level checked?“

„Have you ever had an ultrasound scan of the heart? What did it show?“

„ What medications do you take?“

„Do you have any medical problems?“

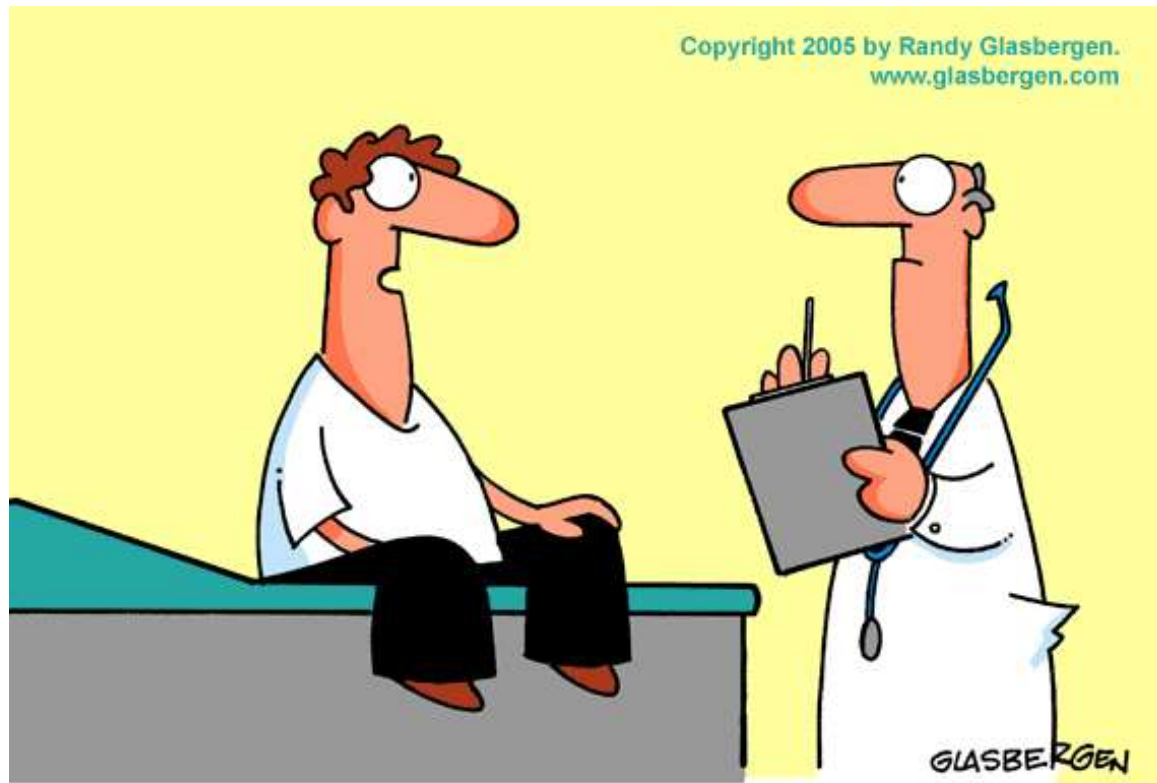
„Have you had unintentional weight loss, night sweats or fatigue?“

„Do you traveled in the past year?“

„Do you have any known allergies?“

Enquire about job. *„What is you occupation?“*

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**“I already diagnosed myself on the Internet.
I’m only here for a second opinion.”**

Physical examination

Evidence of airways obstruction?

Hyperinflation?

Respiratory rate

Assess air movement and quality of breath sounds

Signs of volume overload?

Evidence of DVT?

Edema?



Beware: all that wheezes is not asthma

Pulmonary edema („cardiac wheezing“)

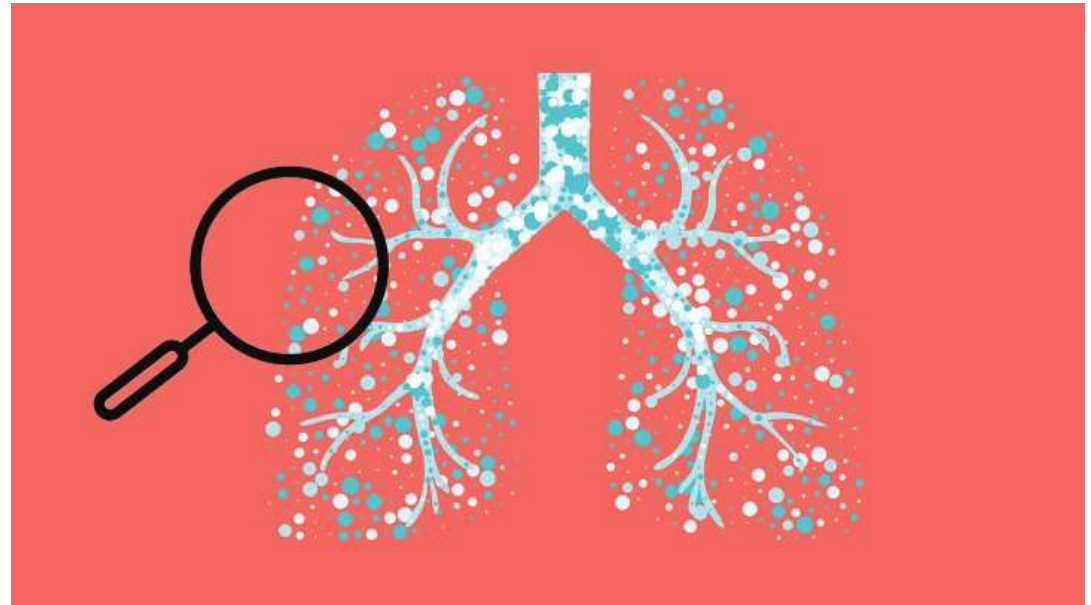
Foreign body

Pulmonary infection

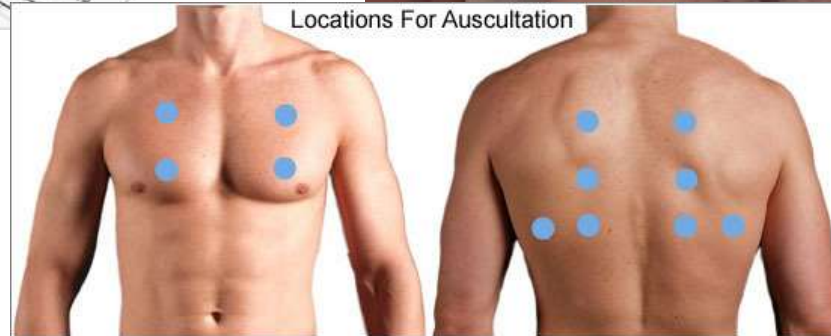
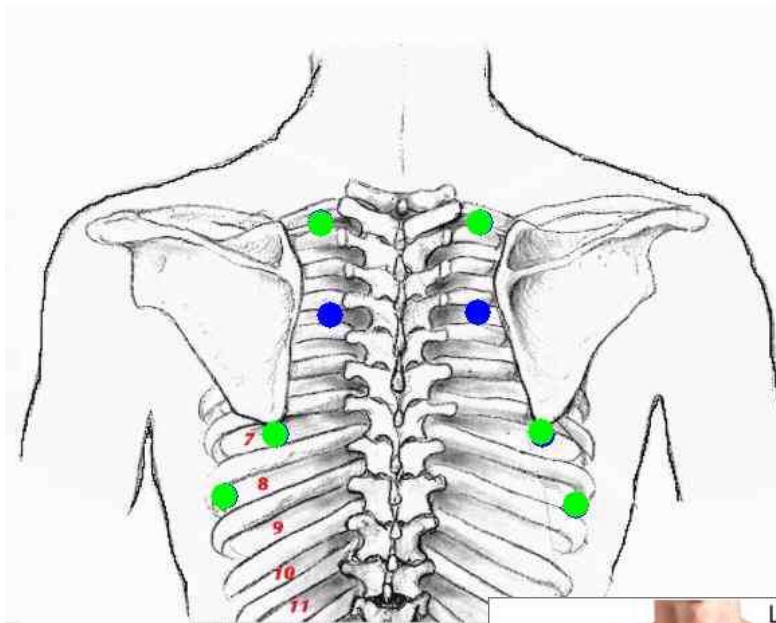
PE

Anaphylaxis

Many others



Thorax auscultation



Breath sounds

Crackles:

Explosive, sharp, discrete bursts of interrupted sound.

Their pattern is remarkably constant and cannot be destroyed by coughing.

Crackles are divided into two types depending on their acoustic properties.

Wheezes:

continuous, high-pitched sound heard throughout respiration

Rhonchi:

Low-pitched sounds

Frequently disappear following a cough

Pleural rub:

the sound produced by the motion of inflamed pleurae

the two thickened surfaces produce vibrations as they move irregularly over each other.

Crackles

Fine Crackles

sounds like the crackling noise made when salt is heated on a frying pan.

On auscultation fine crackles are in general higher pitched, less intense and of shorter duration than coarse crackles.

The **probable mechanism** for the production of fine crackles is as follows. During inspiration, the air pressure on the "upstream" (mouth) side increases until it is able to overcome the forces that are closing the bronchiole. When this occurs, the airway snaps open as the pressure between the bronchiole and the alveolus is equalized . The resulting vibration in the airway causes a discrete, sharp sound of very short duration.

Fine crackles are usually appreciated only during inspiration.

Coarse Crackles

sound of water being poured from a bottle.

coarse crackles are in general lower pitched, less intense and of longer duration than fine crackles.

The bubbling sound of coarse crackles is produced when air passes over secretions in the larger airways (trachea and bronchi).

Since air flows through the airways during inspiration and expiration, **coarse crackles are more likely to be detected during both phases of the respiratory cycle.**

The most common conditions associated with **coarse crackles** are **congestive heart failure and pneumonia, Bronchiectasis.**

Physical signs in dyspnic patient



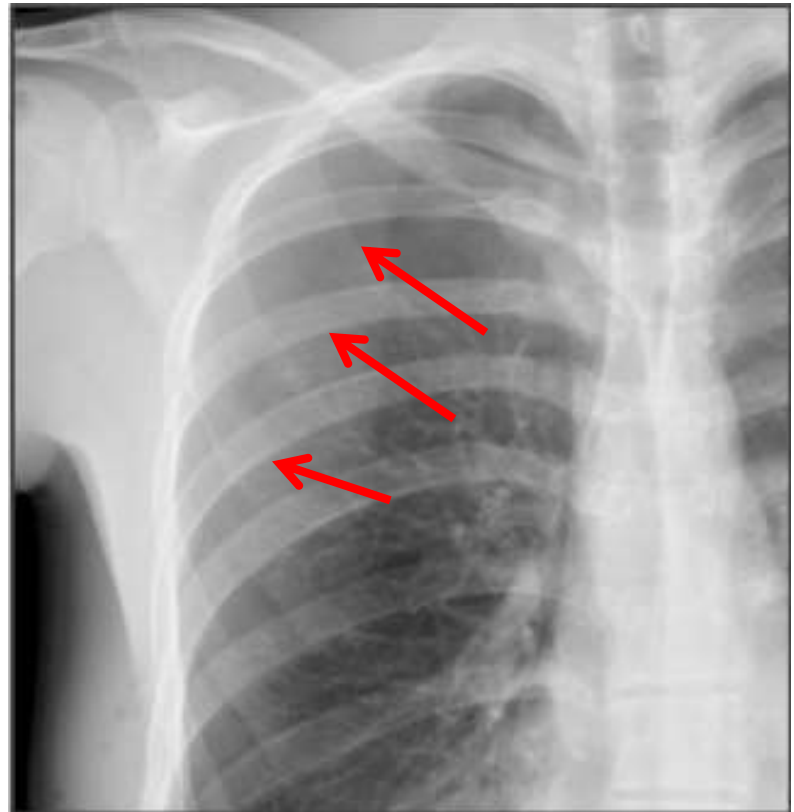
Ancillary Testing

CXR

Helpful for most patients with acute SOB

- Infiltrates
- Effusions
- Pneumothorax
- Pulmonary edema
- Foreign bodies
- Masses

CXR is not necessary in asthma exacerbations unless complication or alternative diagnosis suspected



Additional exams

If cardiac etiology suspected:

- ECG
- BNP/NT-proBNP
- ECHO
- Coronary angiography
- Standard exercise treadmill testing/ or cardiopulmonary exercise testing?

if PE suspected:

- D-dimer or CT scan

If pulmonary causes suspected:

- Spirometry
- Complete pulmonary function test (PFT)
- CT scan
- Lung biopsy

Arterial Blood Gases Test

Commonly used to evaluate acute dyspnea

Can provide information about altered pH, hypercapnia, hypocapnia or hypoxemia

Remember: normal ABGs do not exclude cardiac/pulmonary diagnosis as cause of dyspnea !

Elevations in carbon dioxide levels appear to stimulate dyspnea more than do low oxygen levels

Oxygen saturation

Advantages:

- rapid,
- widely available,
- noninvasive

Desadvanteges:

- insensitive in identifying patients with dyspnea (may be normal in acute dyspnea)
- the % of oxygen saturation does not always correspond to paO_2
- lacks in specificity as a predictor of dyspnea
- The hemoglobin desaturation curve can be shifted depending on the pH, temperature or arterial carbon monoxide or cardbon dioxide levels

CHF

Left sided failure – fluid back-up into the lungs result in:

- SOB
- Fatigue
- Cough (especially at night)
- Paroxysmal nocturnal dyspnea
- Orthopnea

Pulmonary oedema



CHF

Right sided failure: build-up fluid in the veins

- Edema of feet, legs, ankles
- May effect liver/portal circulation and 3rd spacing into soft tissue/ascites/pleural effusion

Causes of CHF

Variety of cardiac diseases

Most common - CAD

NYHA Classification

Class I – no limitations. Ordinary physical activity does not cause dyspnea

Class II – slight limitation of physical activity

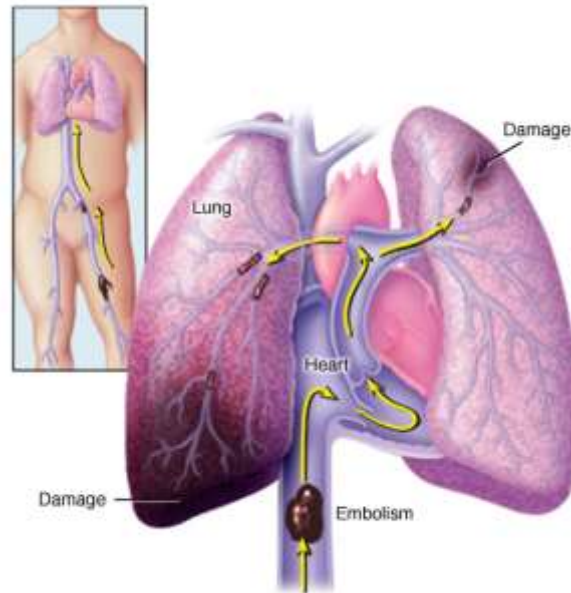
Class III – marked limitation of physical activity

Class IV – dyspnea at rest

Pulmonary embolism

Definition

obstruction of the pulmonary artery or one of its branches by material (eg, thrombus, tumor, air, or fat) that originated elsewhere in the body



Risk factors

ACQUIRED DISORDERS

Malignancy
Presence of a central venous catheter
Surgery, especially orthopedic
Trauma
Pregnancy
Oral contraceptives
Hormone replacement therapy
Tamoxifen, Thalidomide, Lenalidomide
Immobilization
Congestive failure
Antiphospholipid antibody syndrome
Myeloproliferative disorders
Polycythemia vera
Essential thrombocythemia
Paroxysmal nocturnal hemoglobinuria

INHERITED THROMBOPHILIA

Factor V Leiden mutation
Prothrombin gene mutation
Protein S deficiency
Protein C deficiency
Antithrombin (AT) deficiency
Rare disorders
Dysfibrinogenemia

RISK FACTORS
SURGERY
◦ MAJOR ABDOMINAL/PELVIC
◦ ORTHOPAEDIC
OBSTETRICS
◦ PREGNANCY
CARDIORESPIRATORY
◦ COPD
◦ CONGESTIVE HEART FAIL
LOWER LIMB PROBLEMS
◦ VARICOSE VEINS
◦ FRACTURES
MALIGNANT DISEASE
INCREASING AGE
IMMOBILITY
THROMBOTIC DISORDERS

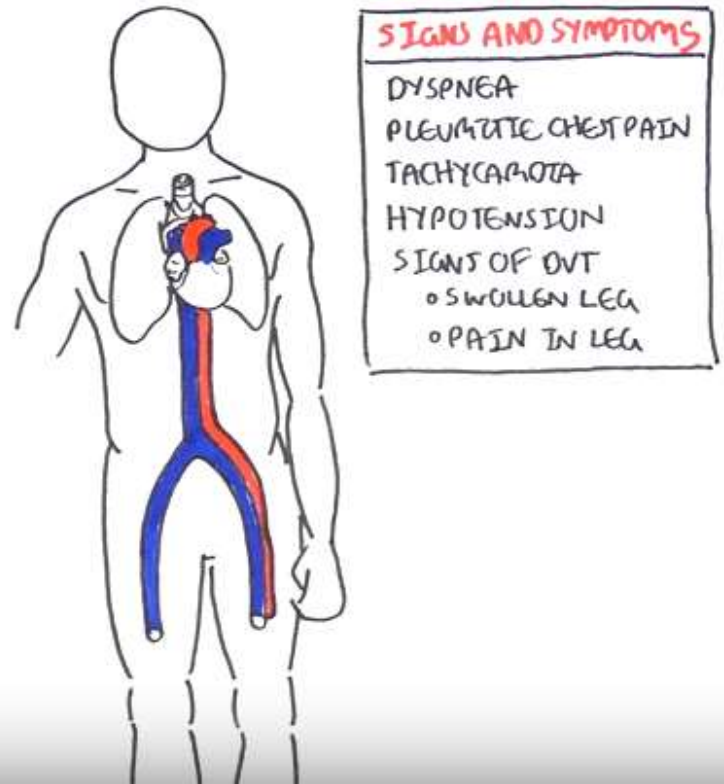
Common symptoms

Dyspnea (73%)

Pleuritic chest pain (66%)

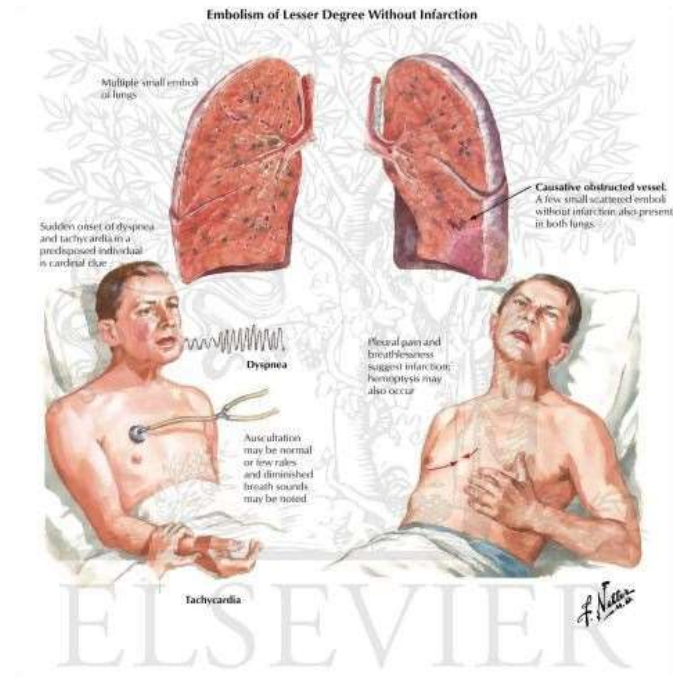
Cough (37%)

Hemoptysis (13%)



Common signs

- Tachypnea (respiratory rate >16/min) - 96%
- Rales - 58%
- Accentuated second heart sound - 53%
- Tachycardia (heart rate >100/min) - 44%
- Fever (temperature >37.8°C [100.04°F]) - 43%
- Diaphoresis - 36%
- S₃ or S₄ gallop - 34%
- Clinical signs and symptoms suggesting
- thrombophlebitis - 32%
- Lower extremity edema - 24%
- Cardiac murmur - 23%
- Cyanosis - 19%



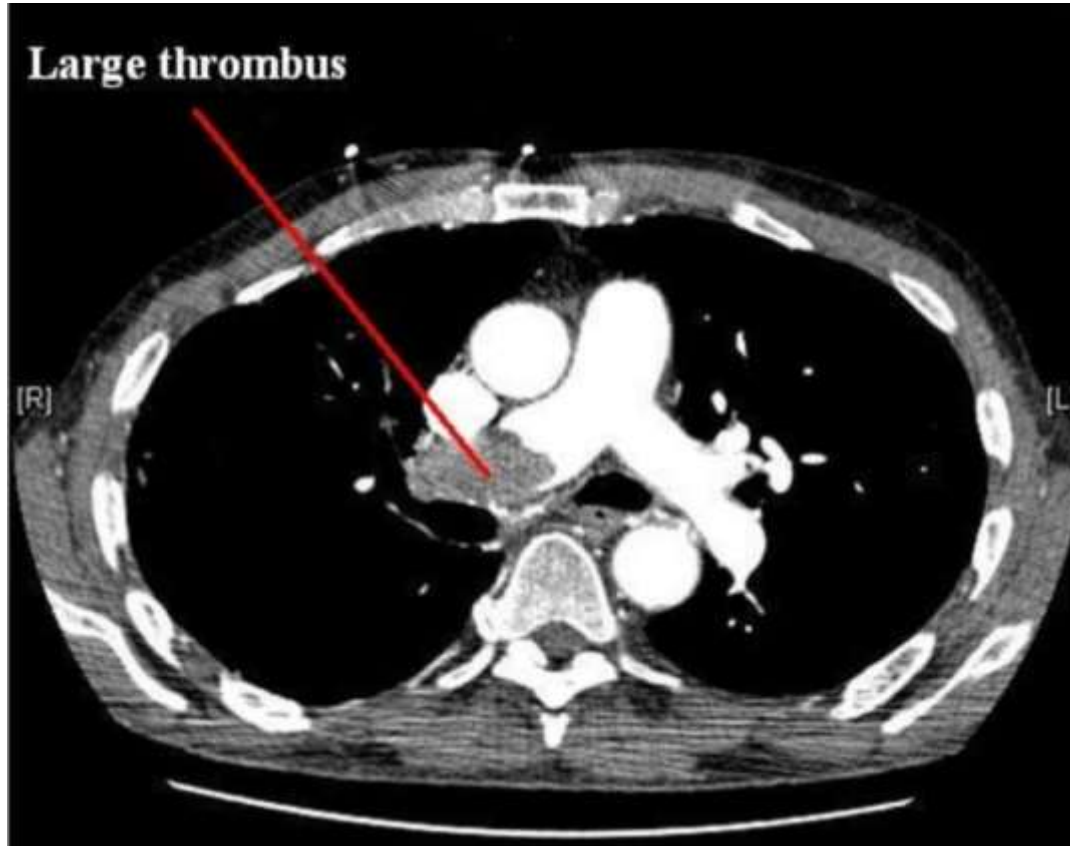
Labs

- ABGs
 - Hypoxemia
 - Hypocapnia
 - Respiratory alkalosis
 - Hypercapnia, Resp acidosis (if massive)
 - Metabolic acidosis (if massive)
- Troponin

D dimer

- Fibrin degradation product
- Is elevated in most patients with PE
- High negative predictive value
- i.e. useful to rule out PE in patients with low to intermediate pretest probability

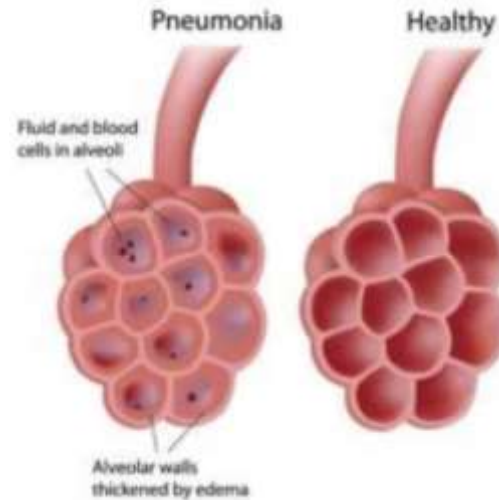
CT



Pneumonia

Definition

Pneumonia – this is an inflammation in the lung parenchyma caused by bacteria, viruses or fungi which is characterized by intraalveolar exudation



Pneumonia

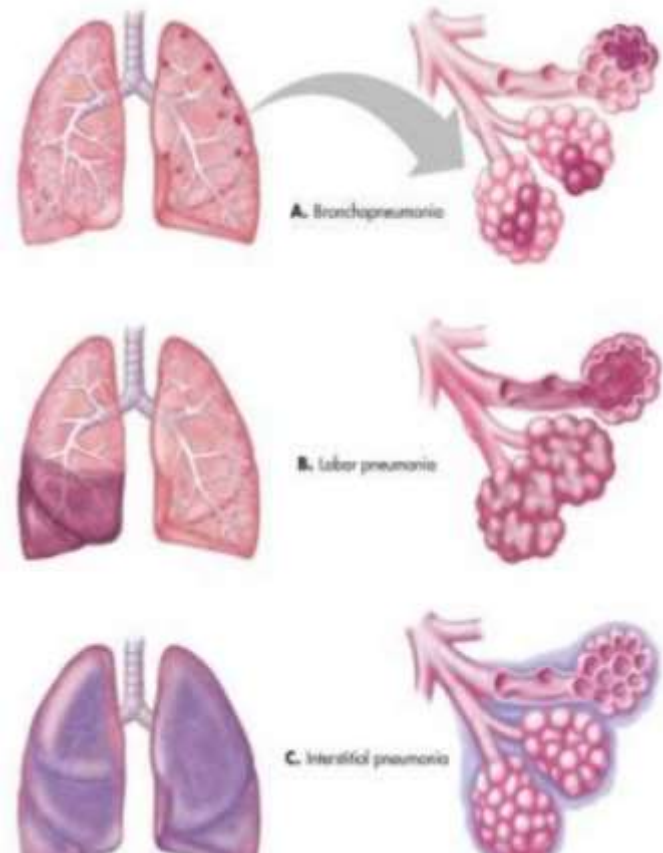
General symptoms:

High grade fever

Cough – productive

Pleuritic chest pain

Breathlessness



Pneumonia

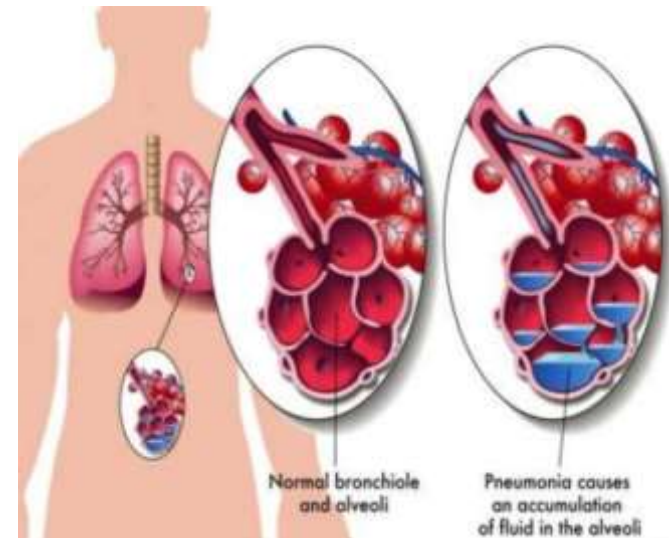
Additional symptoms:

Sharp or stabbing chest pain

Excessive sweating

Headache

Confusion (in elderly pts)



Diagnostic criteria

Predisposition – CHF, diabetes, alcoholism, COPD

Classic symptoms – cough, fever, sputum production, dyspnea

Clinical syndrome – fever, pleuritic chest pain, productive cough with mucopurulent sputum

Focal pulmonary findings (rales, crackles or signs of consolidation) – less sensitive than CXR

General blood analysis – increased ESR, leucocytosis, shift to the left

Sputum analysis – causative microorganism and its sensitivity to antibiotics may be found

General signs

- Febrile
- Tachypnoea
- Tachycardia
- Cyanosis-central
- Hypotension
- Altered sensorium
- Use of accessory muscles of respiration
- Confusion- advanced cases

Signs of consolidation

- Percussion-dull
- Bronchial Breath sounds
- Crackles
- Increased VF & VR
- Aegophony & Whispering Pectoriloquy
- Pleural Rub

Diagnostic criteria

CXR with infiltrates – diagnosis “pneumonia” is invalid without it



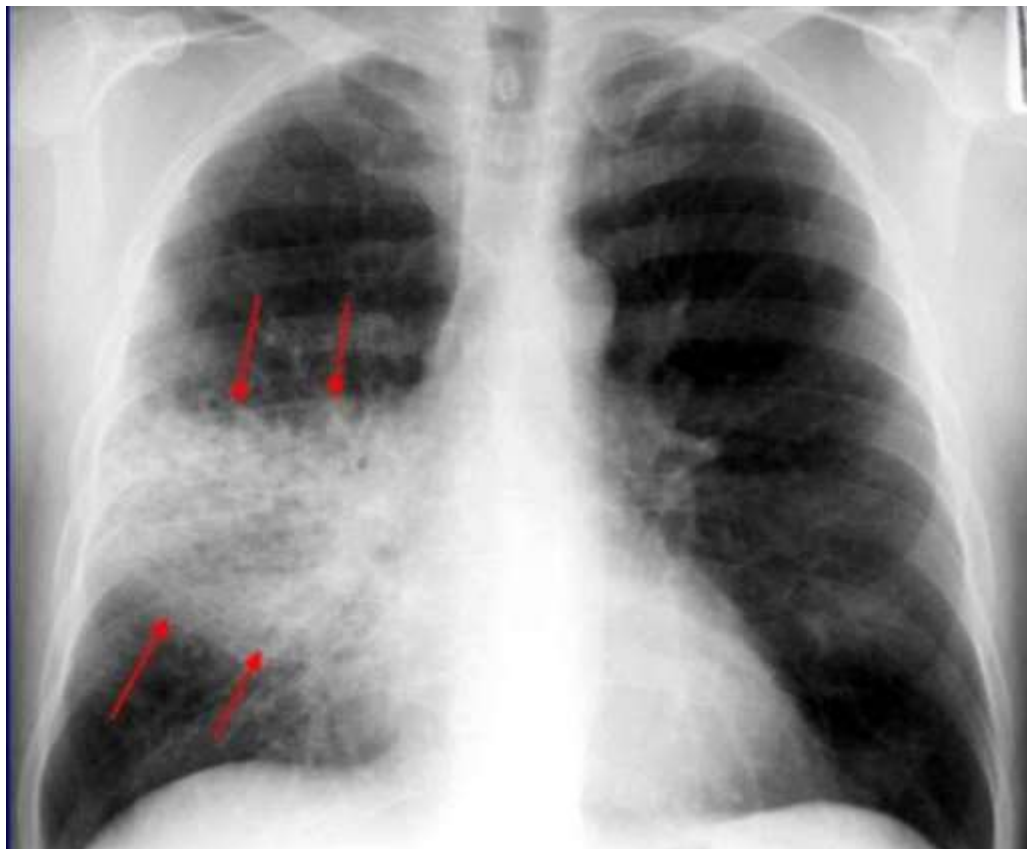
CXR



CXR



CXR



CXR



ASTHMA



Chronic disease of the airways that may cause:

- Wheezing
- Breathlessness
- Chest tightness
- Nighttime or early morning coughing

It is characterized by variable and recurring symptoms, reversible airflow obstruction, and bronchospasm.

Why asthma makes it hard to breathe

Air enters the respiratory system from the nose and mouth and travels through the bronchial tubes.

In an asthmatic person, the muscles of the bronchial tubes tighten and thicken, and the air passages become inflamed and mucus-filled, making it difficult for air to move.

In a non-asthmatic person, the muscles around the bronchial tubes are relaxed and the tissue thin, allowing for easy airflow.



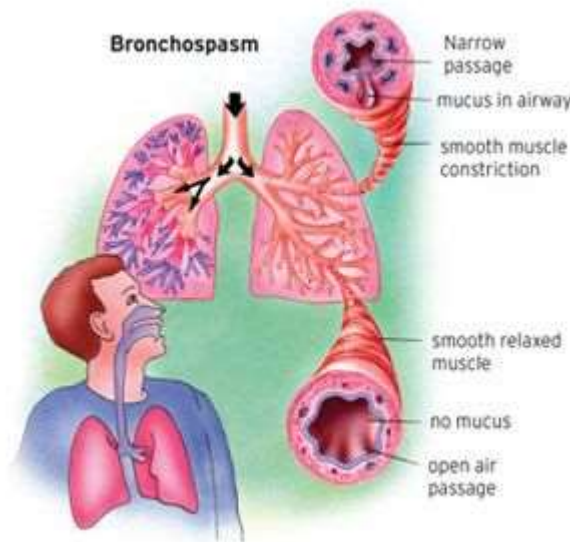
Inflamed bronchial tube of an asthmatic

Normal bronchial tube

Bronchospasm

Bronchospasm of the acute asthmatic attack is typically reversible

Depending on the person, they may become worse at night or with exercise



Asthma Triggers

Immunologic reaction

Viral respiratory/sinus infections

Change in temperature/humidity

Drugs/Chemicals (aspirin, NSAIDs)

Excercise

GE reflux

Laughing/coughing

Environmental factors (strong odors, pollutants, dust, fumes)



Patient Examination

Wheezing

Use of accessory muscles of inspiration

Paradoxical respirations (reflect impending ventilatory failure)

Altered mental status



Remember!

The intensity of the wheeze may not correlate with the severity of airflow obstruction

„quiet chest” – very severe airflow obstruction



COPD - symptoms

Hallmark symptom – dyspnea

Chronic productive cough


Minor hemoptysis



COPD

WHAT CAUSES COPD? SAVE +

**CIGARETTE SMOKING CAUSES ABOUT
80%-90% OF ALL COPD CASES**



OCCUPATIONAL EXPOSURE TO CERTAIN INDUSTRIAL POLLUTANTS IS RESPONSIBLE FOR APPROXIMATELY 20%

The largest cause of COPD is a history of smoking cigarettes. Habitual smoking can inflame the linings of the airways in the lungs and can make the airways lose their elastic quality. Other external factors that put you at risk of developing COPD are exposure to air pollution, secondhand smoke, and occupational dust or chemicals. Heredity can also play a role. Scientists have discovered what's known as an alpha-1-antitrypsin deficiency, which is the source of a small proportion of cases of COPD. Researchers also suspect that other genetic factors may make certain smokers predisposed to the disease.

COPD Phenotypes



Pink Puffer



Blue Bloater

COPD – Physical Findings

Tachypnea

Accessory respiratory muscle use

Pursed lip exhalation

Weight loss due to poor dietary intake and excessive caloric expenditure for work of breathing

Tremor

Cyanosis/ secondary polycythemia

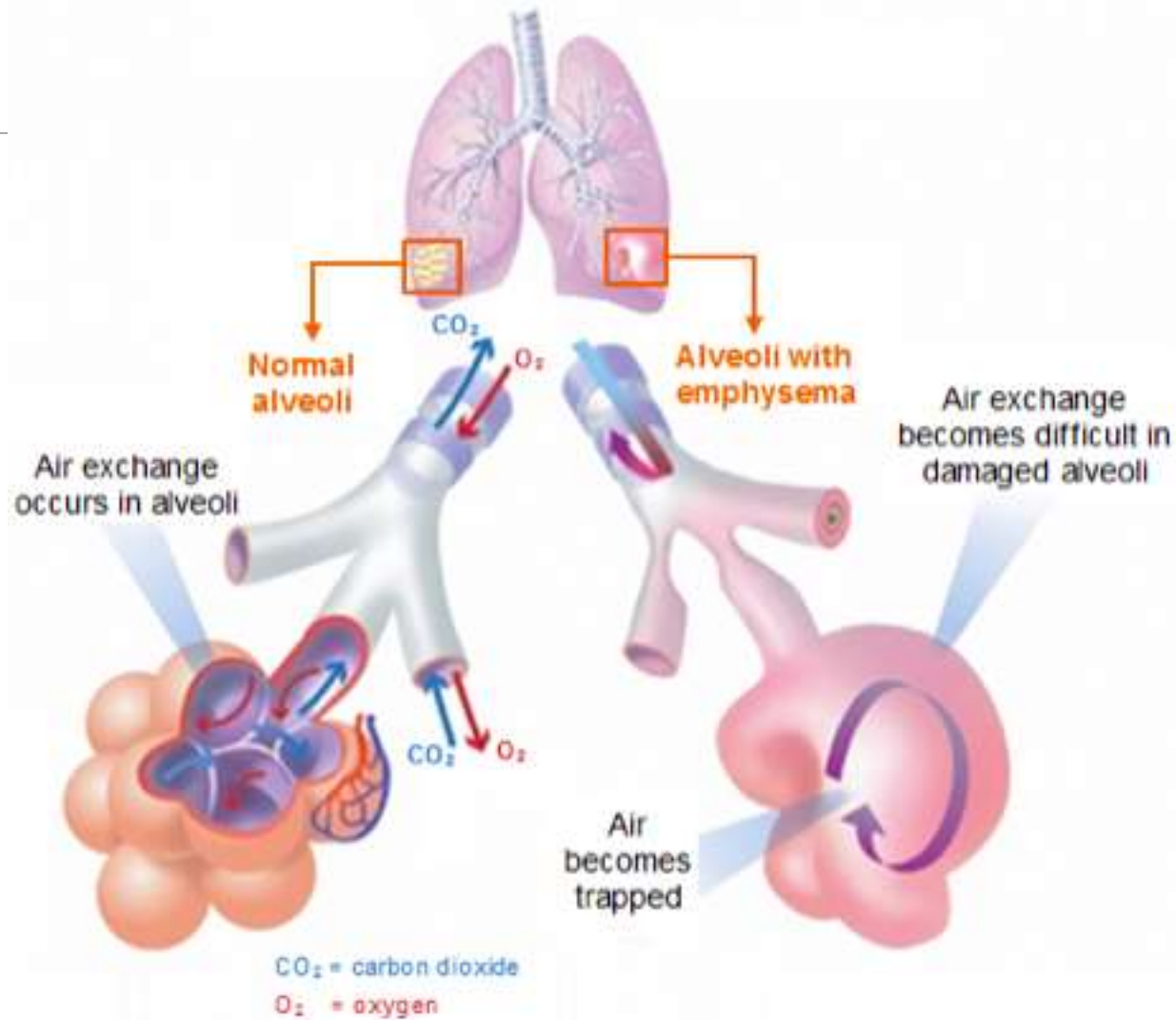
Somnolence and confusion due to hypercarbia

Secondary pulmonary HTN or cor pulmonale

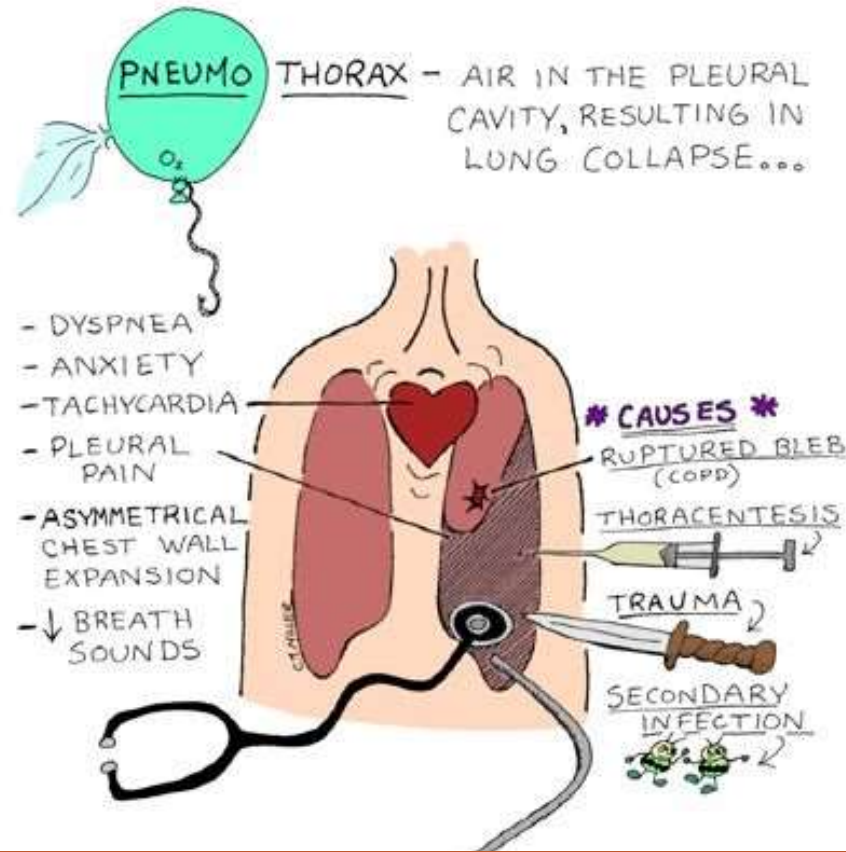
COPD - pulmonary hyperinflation



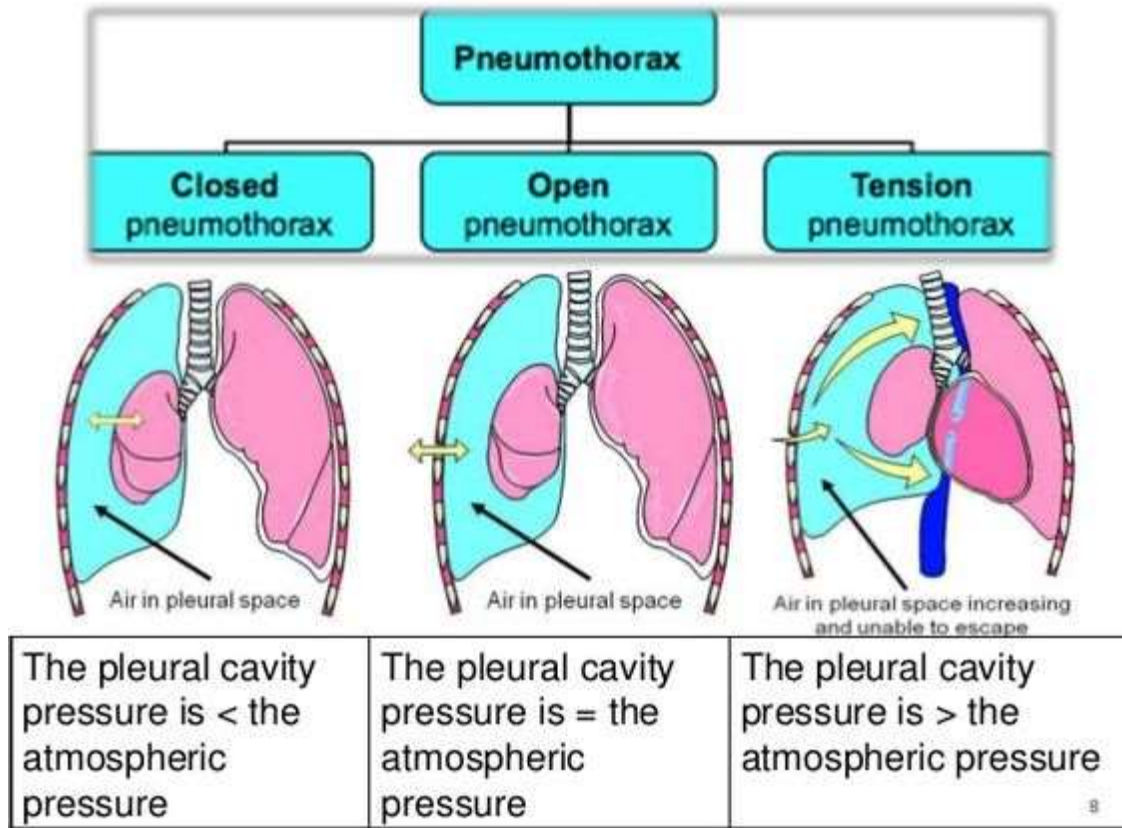
Emphysema



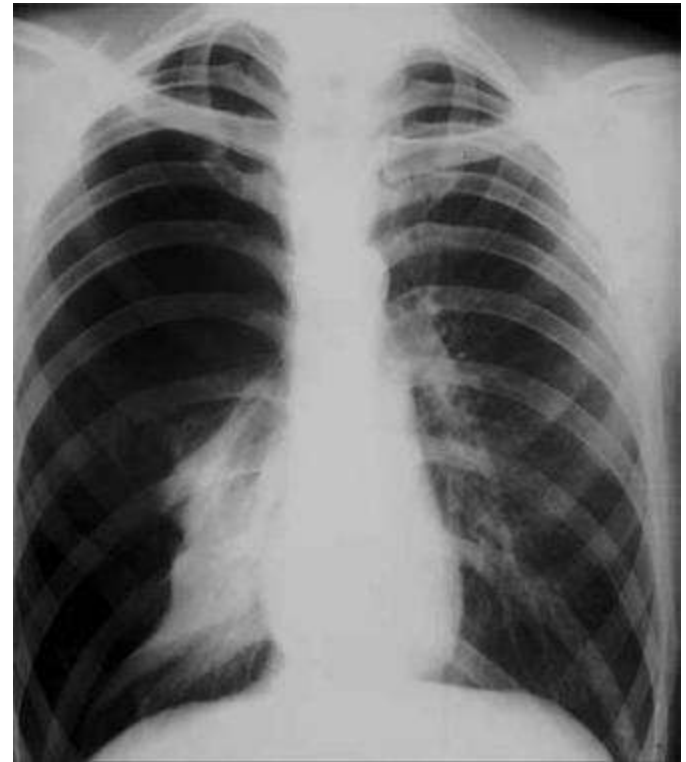
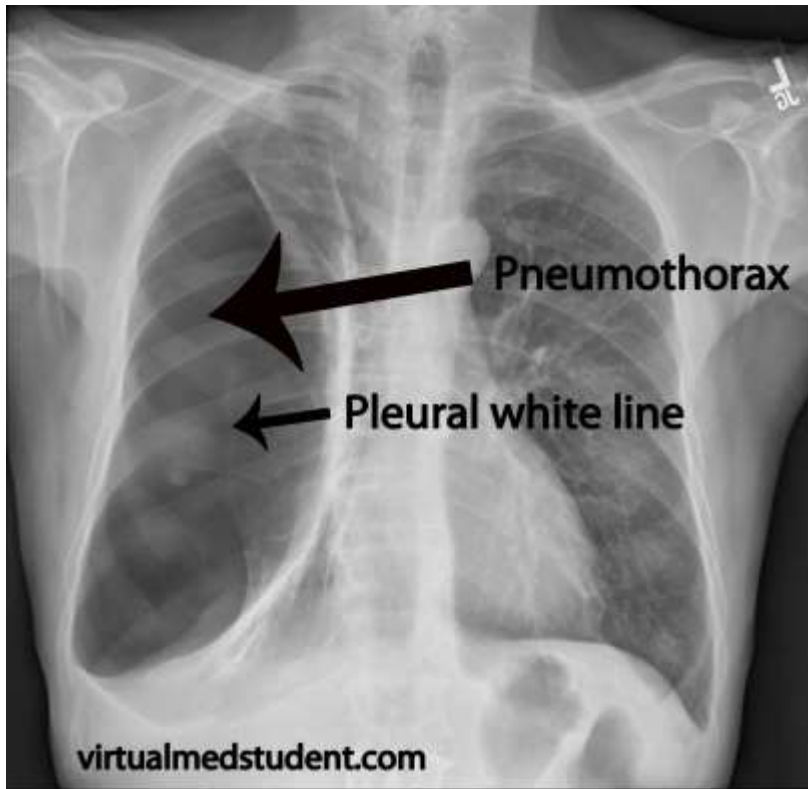
Pneumothorax



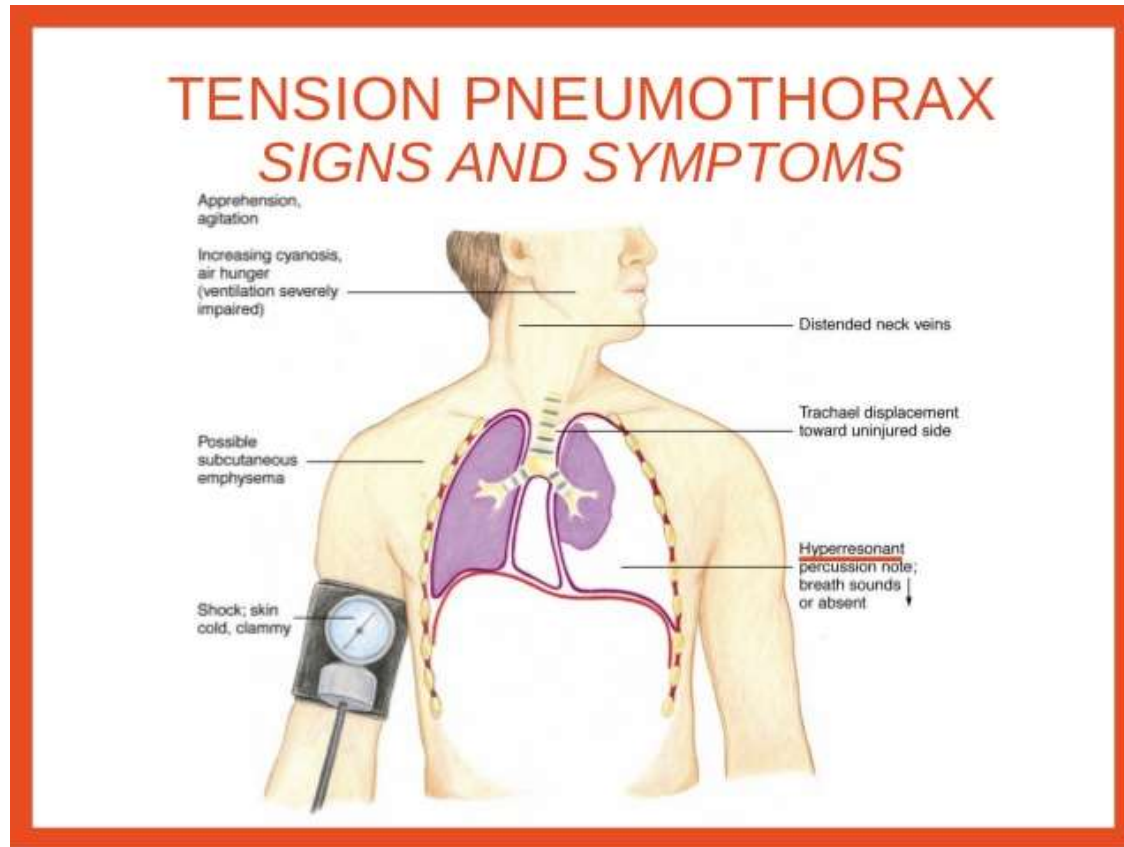
Pneumothorax



Pneumothorax - CRX



Pneumothorax – signs & symptoms



Thank you

