Syndromes from Fluid Accumulation in the Pleural Cavity to Respiratory Failure

SIGNS AND SYMPTOMS OF RESPIRATORY SYSTEM DISEASES

LECTURE IN INTERNAL MEDICINE PROPAEDEUTICS

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Preamble:
the importance of the respiratory system

- Since our childhood we all are aware that food, water and oxygen are the basic necessities of life and we cannot survive without them
- An average person can live without food for 3-4 weeks
- We cannot survive without water for more that 3-5 days
- Oxygen is crucial to sustain life, and 3 minutes is the maximum time where person can stay alive without breathing

http://www.justforhearts.org/2013/08/for-how-long-a-person-can-survive-without-oxygen-water-food/
http://assets-s3.mensjournal.com/img/article/you-re-breathing-all-wrong/298_298_you-re-breathing-all-wrong.jpg

USMLE STEP 1

A 78-year-old woman with a past medical history of heavy alcohol and tobacco use, esophageal cancer and chronic pancreatitis presents to the emergency room with shortness of breath. Her blood pressure is 165/94, heart rate is 118 beats per minute, respiratory rate is 31 breaths per minute, and SpO2 is 78% on room air. She then undergoes a thoracentesis for evaluation of the left-sided pleural effusion. Which of the following results is consistent with a pleural effusion secondary to an esophageal perforation?

1. Fluid (Lactate Dehydrogenase) LDH : serum LDH ratio of 0.5:1, 2. Fluid LDH of 50 IU/L (normal <300), 3. Fluid protein : serum protein ratio of 0.6:1, 4. Fluid protein of 10 g/L (normal <25), 5. A gram stain is needed in order to evaluate this question.

https://www.medbullets.com/step1-respiratory/17045/emphysema

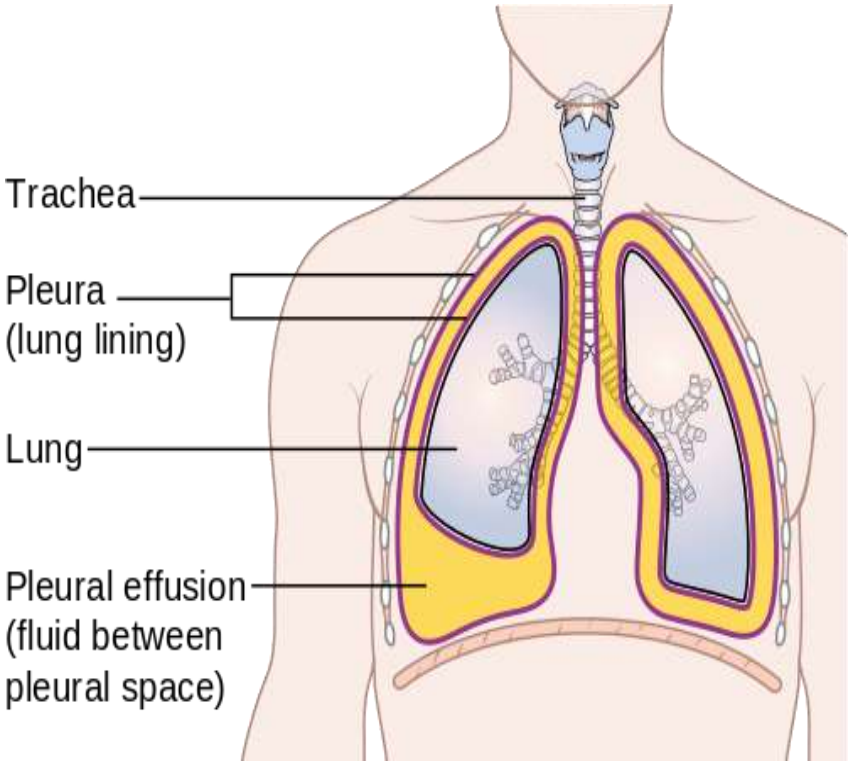
USMLE STEP 1

Correct answer 3: Pleural effusions secondary to esophageal tears are exudative in nature, consistent with a fluid : serum protein ratio of >0.5:1 by Light's Criteria.

Incorrect answers: 1, 2, 4: These data suggest a transudative effusion., 5: Gram stain is not needed to determine whether an effusion is transudative or exudative, but may be helpful to determine the microbiological character of an effusion.

https://www.medbullets.com/step1-respiratory/17045/emphysema

Plan of the lecture



- Dry and exudative pleuritis
- The pleural effusion
- The lung compression syndrome
- Obstructive sleep apnea
- Acute respiratory distress syndrome
- Respiratory failure

http://monsterologist.blogspot.com/2014/11/pleural-effusion.html

Dry and exudative pleurites definition

- Pleurites (pleurisy) is inflammation of the pleurae that surround the lungs and line the chest cavity and can result in a sharp chest pain with breathing shortness of breath, cough, fever, or weight loss depending on the underlying cause
- Ordinary distinguish the dry form (dry pleurisy) and wet form (exudative pleurisy) of pleurites
- The wet form of pleurites is accompanied by a pleural effusion; the dry of pleurites often precedes exudative of pleurites (pleural effusion).

http://www.rayur.com/pleurisy-iinflammation-of-the-pleura.html https://en.wikipedia.org/wiki/Pleurisy

Dry and exudative pleurites:
accent on causes

- The most common cause is a viral infection
- Other causes include pneumonia, pulmonary embolism, autoimmune disorders, lung cancer following heart surgery, pancreatitis, chest trauma, and asbestosis
- Occasionally the cause remains unknown.

https://en.wikipedia.org/wiki/Pleurisy

Dry and exudative pleurites symptoms and signs 1

- The defining symptom of pleurites is a sudden sharp, stabbing, burning or dull pain in the right or left side of the chest during breathing, especially when one inhales and exhales
- Pain feels worse with deep breathing, coughing, sneezing, or laughing
- The pain may stay in one place, or it may spread to the shoulder or back

https://en.wikipedia.org/wiki/Pleurisy#Signs_and_symptoms

Dry and exudative pleurites symptoms and signs 2

- Sometimes, pain becomes a fairly constant dull ache
- Depending on its cause, pleuritic chest pain may be accompanied by other symptoms (dry cough; fever and chills; rapid, shallow breathing; shortness of breath; tachycardia; sore throat followed by pain and swelling in the joints).

https://en.wikipedia.org/wiki/Pleurisy#Signs_and_symptoms

Dry and exudative pleurites: diagnosis 1

- History taking into account the patient's symptoms
- Auscultation and percussion of the lungs: when dry pleurites, physician may hear noises pleural friction characteristics
- Chest X-ray: the pleural effusion
- Laboratory findings: inflammatory parameters (white blood cells, blood sedimentation rate, C-reactive protein), that are generally increased during inflammation

http://www.rayur.com/pleurisy-iinflammation-of-the-pleura.html

Dry and exudative pleurites: diagnosis 2

- Identification of the pathogen
- In case of autoimmune disease, antibodies can be measured
- Puncture of the pleural effusion and microscopic and chemical analyzes of the liquid.

http://www.rayur.com/pleurisy-iinflammation-of-the-pleura.html

The pleural effusion: definition and types 1

- Pleural effusion is excess fluid that accumulates in the pleural cavity, the fluid-filled space that surrounds the lungs
- The fluid excess can impair breathing by limiting the expansion of the lungs (>500 ml)

http://images.radiopaedia.org/images/4431478/8e49879424380b75830066020b6d35.jpg https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: definition and types 2

- Various kinds of pleural effusion, depending on the nature of the fluid and what caused its entry into the pleural space, are hydrothorax (serous fluid),
  hemothorax (blood), urinothorax (urin e), chylothorax (chyle),
  or pyothorax (pus).

http://images.radiopaedia.org/images/4431478/8e49879424380b75830066020b6d35.jpg https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: transudative causes of pleural effusion

- Congestive Heart Failure (CHF)
- Liver cirrhosis
- Hypoproteinemia
- Nephrotic syndrome
- Acute atelectasis
- Myxedema
- Peritoneal dialysis
- Obstructive uropathy
- End-stage kidney disease.

The ovoid or lenticular opacity in the right upper lung zone is an interlobar effusion collected in the minor fissure; such effusions are sometimes mistaken for tumors of the lung parenchyma. Interlobar effusions resolve with treatment of the heart failure; hence, they are sometimes called vanishing tumors, or pseudotumors.

http://what-when-how.com/acp-medicine/disorders-of-the-pleura-hila-and-medistinum-part-2/ http:// https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: exudative causes of pleural effusion

- Pneumonia
- Cancer
- Pulmonary embolism
- Kidney disease
- Inflammatory disease

A left lower lobe consolidation, representing pneumonia.
The meniscus in the left costophrenic angle indicating a parapneumonic left pleural effusion.

https://www.med-ed.virginia.edu/courses/rad/peds/chest_images/PA_CXR_LLL_with_pleural_fluid.jpg http://my.clevelandclinic.org/health/diseases_conditions/pleural-effusion

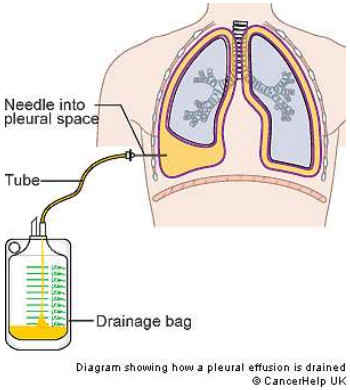
The pleural effusion: other less common causes

- Tuberculosis
- Autoimmune disease
- Bleeding (due to chest trauma)
- Chylothorax (due to trauma)
- Rare chest and abdominal infections
- Asbestos pleural effusion (due to exposure to asbestos)
- Meig's syndrome (due to a benign ovarian tumor)
- Ovarian hyperstimulation syndrome.

http://images.radiopaedia.org/images/4776608/ca8d9c7359b3700b0b63df0dc63b3b.JPEG http://my.clevelandclinic.org/health/diseases_conditions/pleural-effusion

The pleural effusion: symptoms

- Pleural effusions often cause no symptoms
- Symptoms are more likely when a pleural effusion is moderate or large-sized, or if inflammation is present
- Symptoms of pleural effusions may include: shortness of breath; chest pain, especially on breathing in deeply (pleurisy, or pleuritic pain); fever; cough.



Drain of fluid in lungs after heart surgery

http://http://www.heart-valve-surgery.com/Images/pleural_effusion_drain.gif http://my.clevelandclinic.org/health/diseases_conditions/pleural-effusion

The pleural effusion: diagnosis 1

- Pleural effusion is usually diagnosed on the basis of medical history and physical exam, and confirmed by chest x-ray
- Above the effusion, where the lung is compressed, there may be bronchial breathing and egophony
- A large effusion there may cause tracheal deviation away from the effusion

https://en.wikipedia.org/wiki/Pleural_effusion

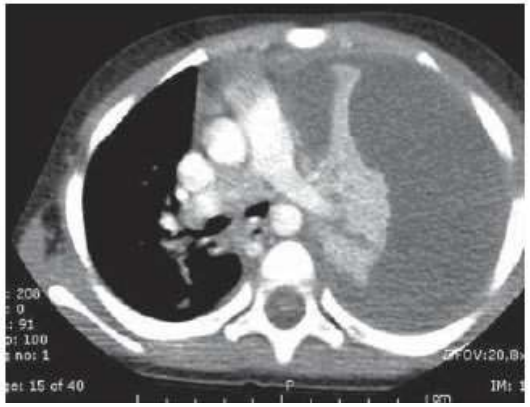
The pleural effusion: diagnosis 2

- Once accumulated fluid is more than 300 ml, there are usually detectable clinical signs in the patient, such as decreased movement of the chest on the affected side, stony dullness to percussion over the fluid, diminished breath sounds on the affected side, decreased vocal resonance and fremitus (though this is an inconsistent and unreliable sign), and pleural friction rub.

https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: the commonly used tests

- Chest x-ray
- Computed tomography (CT) scan of the chest
- Ultrasound of the chest
- Thoracentesis
- Pleural fluid analysis (an examination of the fluid removed from the pleura space).

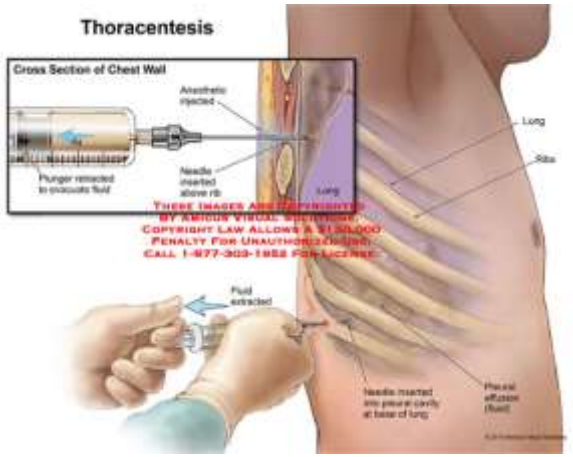


CT chest scan showing massive left pleural effusion

http://www.turkishjournalpediatrics.org/pediatrics/images/figure_TJP_780_0.jpg https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: thoracentesis 1

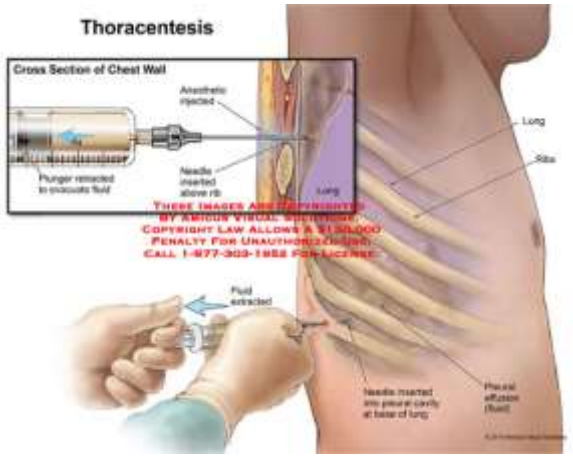
- Pleural fluid is drawn out of the pleural space in a process called thoracentesis, and it should be done in almost all patients who have pleural fluid that is ≥ 10 mm in thickness



http://www.medicalexhibits.com/obrasky/2010/10052_06A.jpg https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: thoracentesis 2

- In thoracentesis, a needle is inserted through the back of the chest wall in the sixth, seventh, or eighth intercostal space on the mid axillary line, into the pleural space.



http://www.medicalexhibits.com/obrasky/2010/10052_06A.jpg https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: pleural fluid investigation 1

- Pleural fluid red cell counts are elevated in cases of bloody effusions (e.g., after heart surgery or hemothorax)
- Pleural fluid amylase is elevated in cases of esophageal rupture, pancreatic pleural effusion, or cancer
- Glucose is decreased with cancer, bacterial infections, or rheumatoid pleuritis
- Pleural fluid pH is low in empyema (<7.2) and may be low in cancer

http:// https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: pleural fluid investigation 2

- If cancer is suspected, the pleural fluid is sent for cytology; if cytology is negative, either a thoracoscopy, or needle biopsy of the pleura may be performed
- The fluid is also sent for Gram staining and culture, and, if suspicious for tuberculosis, examination for TB markers (adenosine deaminase > 45 IU/L, interferon gamma > 140 pg/mL, or positive polymerase chain reaction (PCR) for tuberculous DNA)

http:// https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: pleural fluid investigation 3

- Once pleural effusion identified as exudative, additional evaluation is needed to determine the cause of the excess fluid, and pleural fluid is sampled for amylase, glucose, pH and cell counts.

http:// https://en.wikipedia.org/wiki/Pleural_effusion

The pleural effusion: light's criteria transudate vs. exudate

Parameters	Transudate	Exudate
Main causes	↑ hydrostatic pressure, ↓ colloid osmotic pressure	Inflammation-increased pascular permeability
Appearance	Clear	Cloudy
Specific gravity	< 1.012	> 1.020
Protein content	< 2.5 g/dL	> 2.9 g/dL
fluid protein/serum protein	< 0.5	> 0.5
Difference of albumin content with blood albumin	> 1.2 g/dL	< 1.2 g/dL
fluid LDH upper limit for serum	< 0.6 or < $^{2}/_{3}$	> 0.6 or > $^{2}/_{3}$
Cholesterol content	< 45 mg/dL	> 45 mg/dL

http:// https://en.wikipedia.org/wiki/Pleural_effusion

USMLE STEP 1

A 54-year-old female presents to the emergency department complaining of shortness of breath. She does not speak English and her medical history is unknown. Her temperature is 100.1°F (37.8°C), blood pressure is 130/85 mmHg, pulse is 105/min, and respirations are 24/min. Physical examination reveals bilateral rales and dullness to percussion at the lung bases that is worse on the left. Hepatosplenomegaly is noted. A chest radiograph is shown in Figure A. A thoracentesis and hematologic analysis are performed, with the following results: Pleural lactate dehydrogenase: 54 U/L, Serum lactate dehydrogenase: 82 U/L, Proteins, serum (total): 7.0 g/dL, Proteins, pleural fluid: 3.8 g/dL. Which of the following conditions is most strongly associated with these findings?

1. Pulmonary embolism, 2. Cirrhosis, 3. Nephrotic syndrome
4. Protein losing enteropathy, 5. Congestive heart failure.

https://www.medbullets.com/step1-respiratory/17045/emphysema

USMLE STEP 1

Correct answer 1: The patient in this vignette presents with dyspnea, tachypnea, dullness to percussion, radiographic blunting of the costophrenic angle, and lab values suggestive of a pleural effusion, which could be caused by a pulmonary embolism.

Incorrect answers: 2, 3, 4: Cirrhosis, nephrotic syndrome, and protein losing enteropathy can all cause transudative pleural effusions due to decreased oncotic pressure. The positive findings by Light's criteria mean this patient is more likely to have a exudative pleural effusion., 5: Congestive heart failure can cause transudative pleural effusions due to an increase of pulmonary capillary wedge pressure leading to buildup of fluid in the lungs. The positive findings by Light's criteria mean this patient is more likely to have a exudative pleural effusion.

https://www.medbullets.com/step1-respiratory/17045/emphysema

The lung compression syndrome: atelectasis (definition and types) 1

- Atelectasis is defined as the collapse of part or all of the lungs; when this occurs, for whatever reason, fresh air does not reach the tiniest of airways, and oxygen and carbon dioxide can't be exchanged; this, in turn, can lead to decreased levels of oxygen being delivered to the organs and tissues of the body (hypoxia)

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm http://www.mayoclinic.org/diseases-conditions/atelectasis/basics/causes/con-20034847

The lung compression syndrome: atelectasis (definition and types) 2

- Atelectasis may be acute, occurring suddenly over a matter of minutes, or chronic, developing over a period of days to weeks
- Atelectasis may be the result of a blocked airway (obstructive) or of pressure from outside the lung (nonobstructive)
- Almost everyone who has surgery has some atelectasis from anesthesia
- Atelectasis is particularly prominent after heart bypass surgery.

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm http://www.mayoclinic.org/diseases-conditions/atelectasis/basics/causes/con-20034847

The lung compression syndrome: atelectasis (mechanisms) 1

1. Obstruction: blockage of an airway, either from inside (by a foreign body that is aspirated, or a mucous plug), or the outside (e.g., by a lung cancer pressing on the airway)

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (mechanisms) 2

2. Compression: compression of the airways in the lungs can be caused by fluid or air surrounding the lungs (as in a pleural effusion or a pneumothorax); by enlargement or an aneurysm of the heart; by tumors such as cancers metastatic to the lungs, lymphomas, or enlarged lymph nodes; or by abdominal distention which causes pressure on the lungs

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (mechanisms) 3

3. Adhesion: when the surfactant is lacking, the lungs lose surface tension and can collapse; this is the cause of respiratory distress in newborns and can also occur in adults with adult respiratory distress syndrome (ARDS), smoke inhalation, and kidney failure

4. Hypoventilation: failure to take deep breaths can result in collapse of part of the lungs during surgery, especially with general anesthesia, and when breathing is shallow due to pain (such as with rib fractures)

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (obstructive atelectasis causes) 1

- Mucus plug after accumulation of mucus in airways, often occurring during and after surgery, in children, people with cystic fibrosis and during severe asthma attacks
- Foreign body is common in children who have inhaled an object, such as a peanut or small toy part, into their lungs

Lower lobe atelectasis

http://www.radiologyassistant.nl/data/bin/w440/a50d998498e4df_11b-rll-atelectasis.jpg http://www.mayoclinic.org/diseases-conditions/atelectasis/basics/causes/con-20034847

The lung compression syndrome: atelectasis (obstructive atelectasis causes) 2

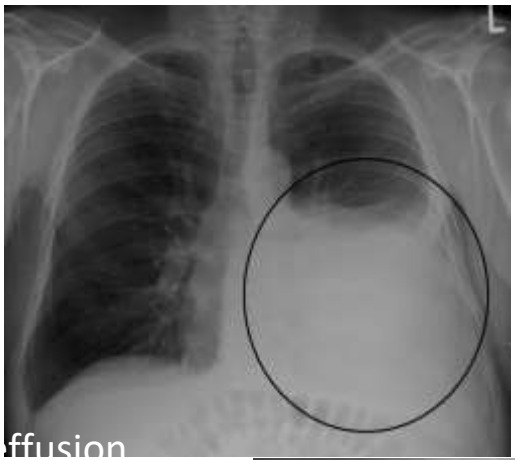
- Narrowing of major airways from disease (chronic infections, including fungal infections, tuberculosis and other diseases)
- Tumor in a major airway
- Blood clot after significant bleeding into the lungs that can't be coughed out.

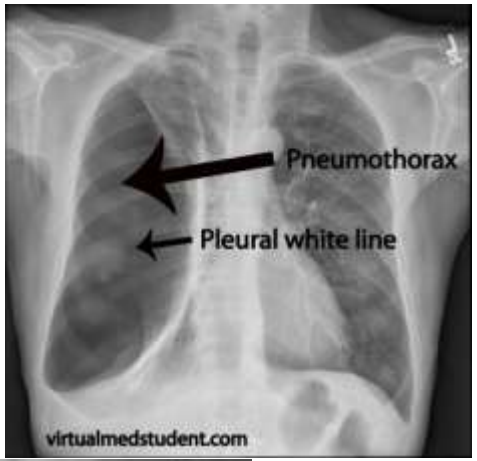
Lower lobe atelectasis

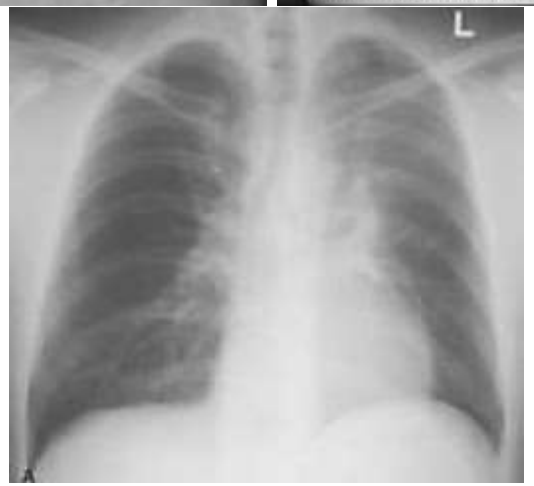
http://www.radiologyassistant.nl/data/bin/w440/a50d998498e4df_11b-rll-atelectasis.jpg http://www.mayoclinic.org/diseases-conditions/atelectasis/basics/causes/con-20034847

The lung compression syndrome: atelectasis (nonobstructive atelectasis causes)

- Injury (chest trauma)
- Pleural effusion
- Pneumonia
- Pneumothorax
- Scarring of lung tissue
- Tumor.







https://en.wikipedia.org/wiki/Pleural_effusion http://www.virtualmedstudent.com/images/pneumothorax_xray_marked.jpg http://dvirtualdoctor.hubpages.com/
http://www.mayoclinic.org/diseases-conditions/atelectasis/basics/causes/con-20034847

The lung compression syndrome: atelectasis (symptoms) 1

- Atelectasis may have few or no symptoms if it develops slowly or involves only a small portion of the lungs
- Conversely, if the condition affects a large portion of the lungs, or develops rapidly, symptoms may be dramatic and may even progress to shock

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (symptoms) 2

- Common symptoms include:
  - Shortness of breath: the most common symptom
  - Coughing: often described as “hacking” and is most often non-productive, meaning that no mucous is coughed up
  - Pleurisy: chest pain that is sharp and worsens with a deep breath or coughing (pleuritic chest pain) may occur
  - Fever: at one time, it was thought that fever was a sign.

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (diagnosis) 1

- Physical exam: findings may include quiet or absent breath sounds
- Chest x-ray: the trachea and heart may be deviated towards the side of the chest where a lung is partially collapsed; the diaphragm may also be elevated on the side of the collapse
- Chest CT scan: may further define an area of possible atelectasis and to look for other causes of obstruction, such as tumors or enlarged lymph nodes

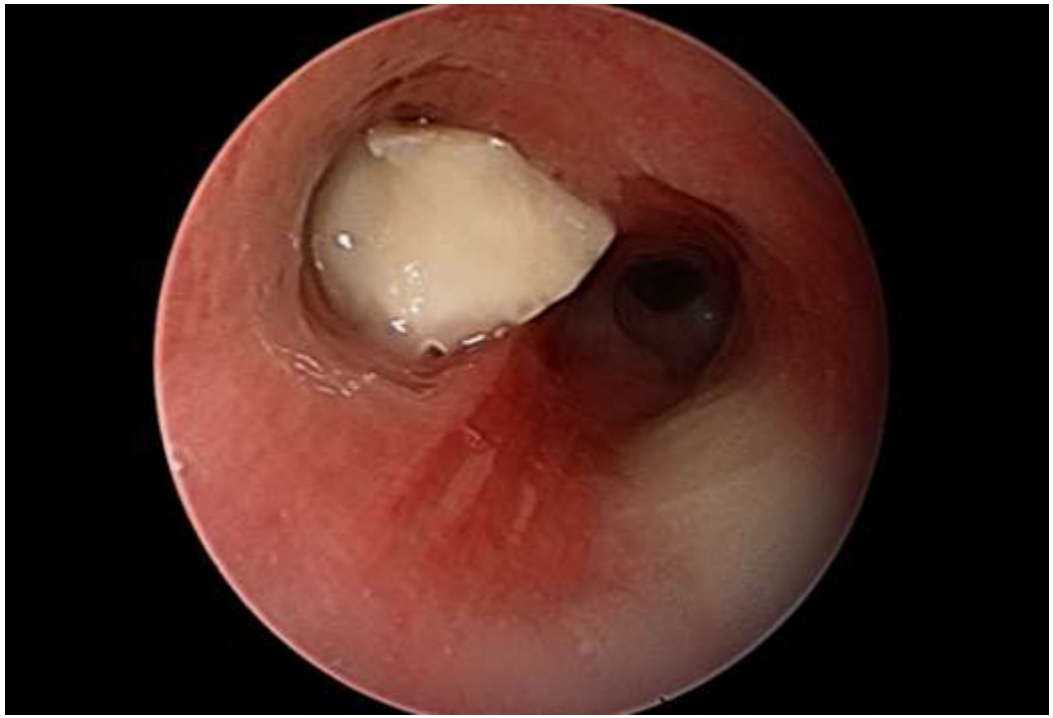
http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (diagnosis) 2

- Bronchoscopy: may be used to determine the cause of a bronchial obstruction
- Blood gases or oximetry: may be done to determine how much atelectasis is interfering with the ability to get oxygen to your tissues
- Other tests may be ordered depending upon the condition; for example, a bloodwork to evaluate kidney function.

http://lungcancer.about.com/od/Respiratory-Symptoms/a/Atelectasis.htm

The lung compression syndrome: atelectasis (bronchoscopy)



A peanut in the left main bronchus.

http://img.medscape.com/pi/features/slideshow-slide/pediatric-ENT-surgery/fig15.jpg

USMLE STEP 1

A 37-year-old male is brought to the emergency department following a motor vehicle accident. On arrival, respirations are shallow. Blood pressure is 80/60 mmHg, pulse is 122/min, and respiratory rate is 29/min. Physical examination demonstrates absent breath sounds on the patient's left side. Chest radiograph is shown in Figure. Which of the following is the most appropriate next step in management?

1. Echocardiography, 2. Needle thoracostomy of the left second intercostal space, 3. Chest tube placement in the left fourth intercostal space, 4. Transfusion of packed red blood cells, 5. Endotracheal intubation.

https://www.medbullets.com/step1-respiratory/17045/emphysema

USMLE STEP 1

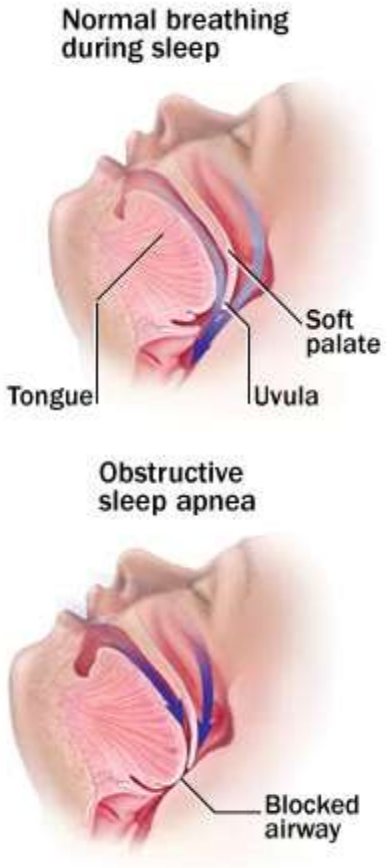
Correct answer 2: The patient's chest radiograph demonstrates a tension pneumothorax. Needle thoracostomy in the left second intercostal space should be performed urgently.

Incorrect answers: 1, 4 and 5: Echocardiography, blood transfusions, and endotracheal intubation may all be necessary in trauma patients. However, in the case of tension pneumothorax, needle thoracostomy is the most urgent priority., 3: Chest tube placement is indicated to prevent tension pneumothorax recurrence following needle thoracostomy.

https://www.medbullets.com/step1-respiratory/17045/emphysema

Obstructive sleep apnea: definition, causes 1

- Obstructive sleep apnea (OSA) is caused by obstruction of the upper airway
- OSA is characterized by repetitive pauses (apneas) in breathing during sleep, which typically last 20 to 40 seconds despite the effort to breathe.
- OSA is usually associated with a reduction in blood oxygen saturation



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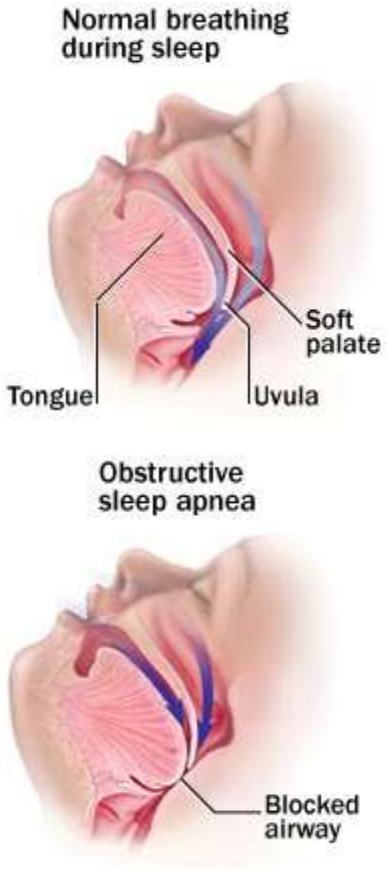
http://ptsddiary.com/wp-content/uploads/2012/10/Screen-shot-2012-10-08-at-1.32.59-PM.png

Obstructive sleep apnea: definition, causes 2

- OSA is commonly accompanied with snoring
- The main causes of OSA are old age, temporary or permanent brain injury, decreased muscle tone, excess soft tissue around the airway (common with obese patients), something physical in the throat or mouth/jaw shape.



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http://ptsddiary.com/wp-content/uploads/2012/10/Screen-shot-2012-10-08-at-1.32.59-PM.png

Obstructive sleep apnea: symptoms 1

- Excessive daytime sleepiness
- Loud snoring
- Episodes of breathing cessation in sleep
- Abrupt awakenings by shortness of breath
- Awakening with a dry mouth or sore throat

http://www.mayoclinic.org/diseases-conditions/obstructive-sleep-apnea/basics/definition/con-20027941 http://www.parmardmd.com/images/Symptoms-of-Sleep-Apnea-Slide.jpg

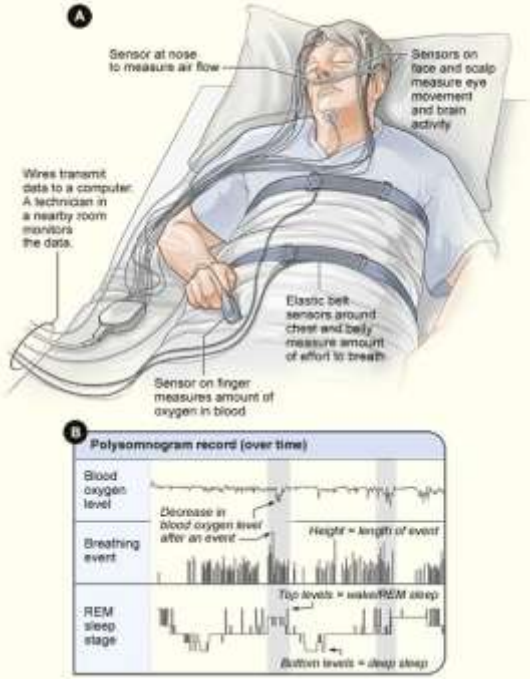
Obstructive sleep apnea: symptoms 2

- Awakening with chest pain
- Morning headache
- Difficulty concentrating during the day
- Experiencing mood changes
- Difficulty staying asleep
- High blood pressure

http://www.mayoclinic.org/diseases-conditions/obstructive-sleep-apnea/basics/definition/con-20027941 http://www.parmardmd.com/images/Symptoms-of-Sleep-Apnea-Slide.jpg

Obstructive sleep apnea: diagnosis 1

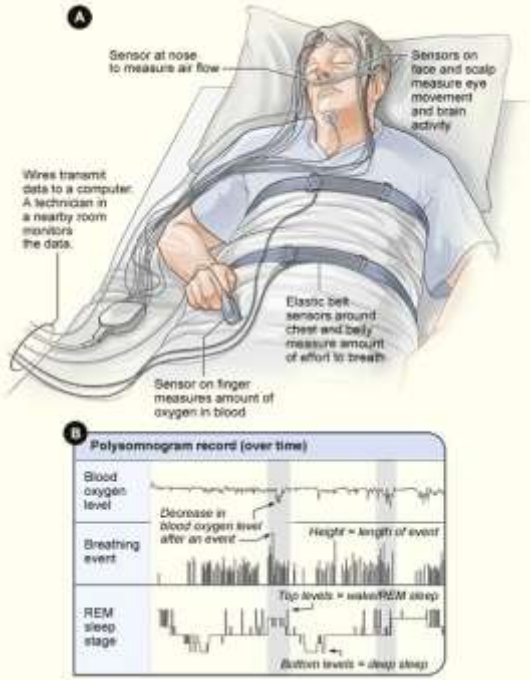
- Nocturnal polysomnography - records brain wave changes, eye movements, leg movements, blood oxygen levels, muscle tone, heart rhythms and respiration during sleep
- Oximetry
- Epworth sleepiness scale - to measure the patient's level of daytime sleepiness



http://www.dentist-charlotte-north-carolina-nc.com/images/sleep-study-1.jpg http://www.medicalnewstoday.com/articles/178633.php

Obstructive sleep apnea: diagnosis 2

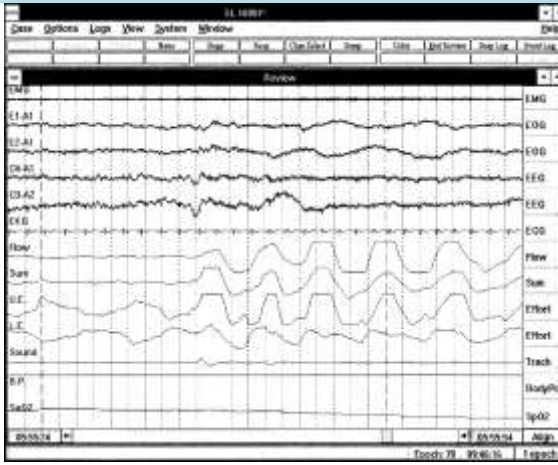
- The three ratings for OSA:
  - Mild - 5-14 episodes of apnea or hypopnea per hour
  - Moderate - 15 to 30 episodes of apnea or hypopnea per hour
  - Severe - over 30 episodes of apnea or hypopnea per hour.



http://www.dentist-charlotte-north-carolina-nc.com/images/sleep-study-1.jpg http://www.medicalnewstoday.com/articles/178633.php

Obstructive sleep apnea: nocturnal polysomnography 1

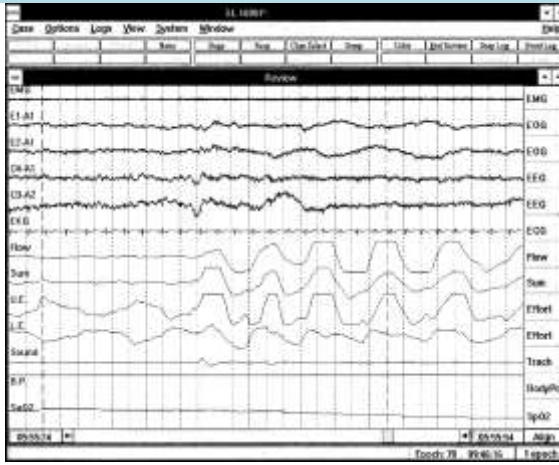
- 30-second epoch of a polysomnographic recording in the 13 channels muscular tension (EMG), eye movements (EOG), bioelectrical brain function (EEG), heart rate (ECG), breathing (flow, sum, upper and lower effort), snoring (Trach), body position (BodyPos) and oxygen saturation (SPO2) are recorded



http://www.schlaflabor-saletu.at/tl_files/Schlaflabor_Saletu/Schlaflabor_Abb/polysomnogramm.gif

Obstructive sleep apnea: nocturnal polysomnography 2

- During the first 10 seconds an obstructive apnea (cessation of breathing) is clearly visible as a flat line in the flow channel.



http://www.schlaflabor-saletu.at/tl_files/Schlaflabor_Saletu/Schlaflabor_Abb/polysomnogramm.gif

Obstructive sleep apnea: Epworth sleepiness scale' questions

Situations	0. Would never fall asleep	1. Slight chance of fall asleep	2. Moderate chance of fall asleep	3. High chance of fall asleep
Sitting and reading				
Watching TV				
Sitting inactive in a public place				
As a passenger in a car for an hour without a break				
Lying down to rest in the afternoon when circumstances permit				
Sitting and talking to someone				
Sitting quietly after lunch without alcohol				
In a car, whilst stopped for a few minutes in traffic				
Sex				
Age				

http://online-epworth.co.uk/

USMLE STEP 1

A 63-year-old man presents to physician complaining of excessive daytime sleepiness. This problem has worsened slowly over the past few years but is now interfering with his ability to play with his grandchildren. He worked previously as an overnight train conductor, but he has been retired for the past 3 years. His wife notes that he often snores loudly during sleep. He has also been experiencing headaches in the morning and endorses a depressed mood. His physical exam is most notable for his large body habitus, BMI of 34. What is the best description of the underlying mechanism for this patient's excessive daytime sleepiness?

1. Insufficient sleep duration, 2. Circadian rhythm sleep-wake disorder, 3. Poor oropharyngeal tone, 4. Deficiency of the neuropeptides, orexin-A and orexin-B, 5. Psychiatric disorder.

https://www.medbullets.com/step1-respiratory/17045/emphysema

USMLE STEP 1

Correct answer 3: This clinical presentation is consistent with obstructive sleep apnea (OSA), the most common cause of daytime sleepiness in the USA. OSA results from poor oropharyngeal tone and is also associated with depression and morning headaches.

Incorrect answers: 1: Insufficient sleep duration is unlikely to be the cause of this patient's daytime sleepiness, as he is sleeping for 8-9 hours (albeit with disruption due to apnea)., 2: A circadian rhythm sleep-wake disorder would include syndromes such as jet lag or delayed sleep-wake phase disorder; these are not likely given the clinical history., 4: Deficiency of the neuropeptides, orexin-A and orexin-B, describes the pathophysiology of narcolepsy, which this patient does not have (e.g. no loss of muscle tone nor hypnopompic hallucinations)., 5: Daytime sleepiness can be associated with primary psychiatric disorders such as depression; however, in this case the patient's depression likely stems first and foremost from his underlying OSA.

https://www.medbullets.com/step1-respiratory/17045/emphysema

Acute respiratory distress syndrome (ARDS): definition and causes 1

- Acute respiratory distress syndrome (respiratory distress syndrome (RDS), acute lung injury, adult respiratory distress syndrome, shock lung) is a severe, life-threatening medical condition characterized by widespread inflammation in the lungs
- Common causes of ARDS include sepsis, pneumonia, trauma, multiple blood transfusions, babesiosis, lung contusion, aspiration of stomach contents, and drug abuse or overdose

http://3.bp.blogspot.com/_https://en.wikipedia.org/wiki/Acute_respiratory_distress_syndrome

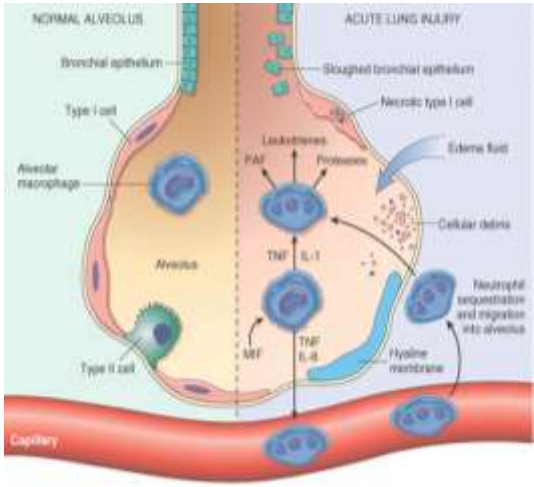
Acute respiratory distress syndrome (ARDS): definition and causes 2

- Other causes of ARDS include burns, pancreatitis, near drowning, or the inhalation of chemical irritants such as smoke, phosgene, or chlorine gas
- Some cases of ARDS are linked to large volumes of fluid used during post-trauma resuscitation
- The syndrome has a high mortality between 20 and 50%.

http://3.bp.blogspot.com/_https://en.wikipedia.org/wiki/Acute_respiratory_distress_syndrome

Acute respiratory distress syndrome (ARDS): mechanisms 1

- ARDS is a pathology of the microscopic air sacs of the lungs (alveoli) that leads to decreased exchange of oxygen and carbon dioxide (gas exchange)



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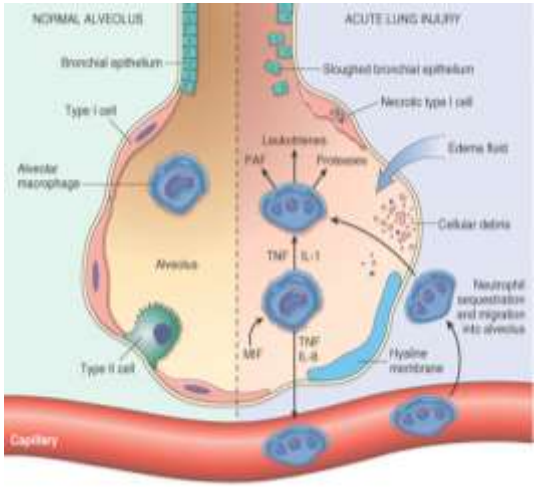
Acute respiratory distress syndrome (ARDS): mechanisms 2

- ARDS is associated with several pathologic changes: the release of inflammatory chemicals, breakdown of the cells lining the lung's blood vessels, surfactant loss leading to increased surface tension in the lung, fluid accumulation in the lung, and excessive fibrous connective tissue formation.



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Acute respiratory distress syndrome (ARDS): signs and symptoms 1

- The signs and symptoms usually begin within 72 hours of the initial insult or injury to the lung and may include severe shortness of breath, fast breathing, cough, and a low oxygen level in the blood
- A chest x-ray frequently demonstrates generalized infiltrates or opacities in both lungs, which represent fluid accumulation in the lungs

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Acute respiratory distress syndrome (ARDS): signs and symptoms 2

- Other signs and symptoms may be associated with the underlying disease process (e.g., low blood pressure and fever).

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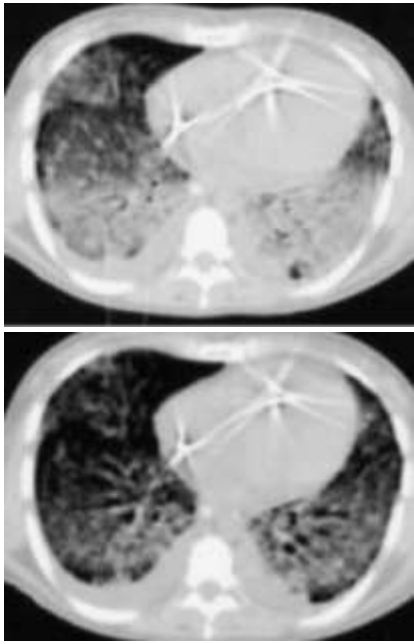
Acute respiratory distress syndrome (ARDS): diagnosis 1



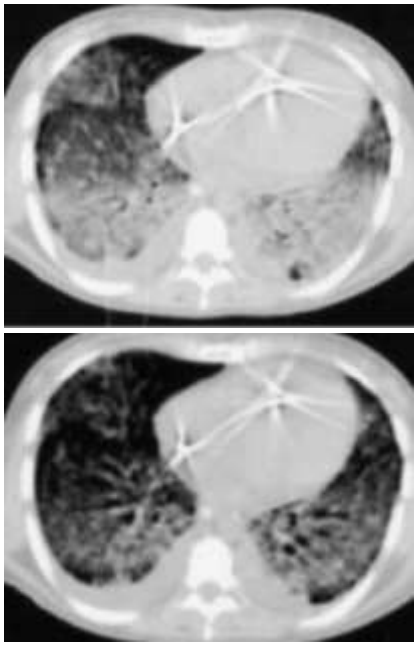
The "Berlin criteria" of 2012 proposed by the European Society of Intensive Care Medicine, endorsed by the American Thoracic Society and the Society of Critical Care Medicine:

- Acute onset
- Bilateral infiltrates on chest radiograph sparing costophrenic angles

http:// www.ersj.org.uk/content/20/4/1017/F2.large.jpg https://en.wikipedia.org/wiki/Acute_respiratory_distress_syndrome

Acute respiratory distress syndrome (ARDS): diagnosis 2

- Pulmonary artery wedge pressure < 18 mmHg (obtained by pulmonary artery catheterization), if this information is available; if unavailable, then lack of clinical evidence of left atrial hypertension
- if PaO2:FiO2 < 300 mmHg (40 kPa) acute lung injury (ALI) is considered to be present



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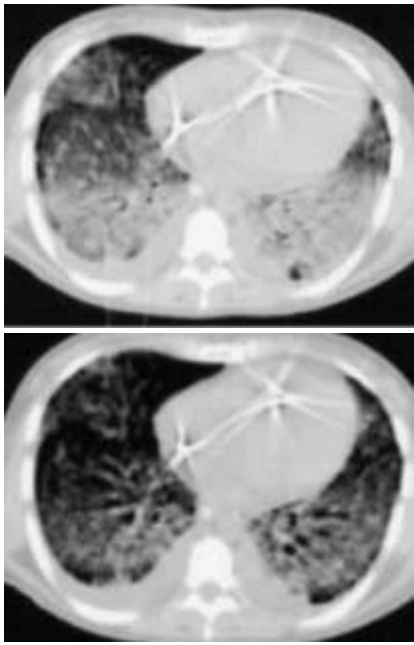
Acute respiratory distress syndrome (ARDS): diagnosis 3

- if PaO2:FiO2 < 200 mmHg (26.7 kPa) acute respiratory distress syndrome (ARDS) is considered to be present



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USMLE STEP 1

A 48-year-old female suffers a traumatic brain injury while skiing in a remote area. Upon her arrival to the ER, she is severely hypoxemic and not responsive to O2 therapy. She is started on a mechanical ventilator and 2 days later upon auscultation, you note late inspiratory crackles. Which of the following is most likely normal in this patient?

1. Type I pneumocytes, 2. Type II pneumocytes, 3. Chest X-ray, 4. Alveolar-arterial gradient, 5. Left atrial pressure.

https://www.medbullets.com/step1-respiratory/17045/emphysema

USMLE STEP 1

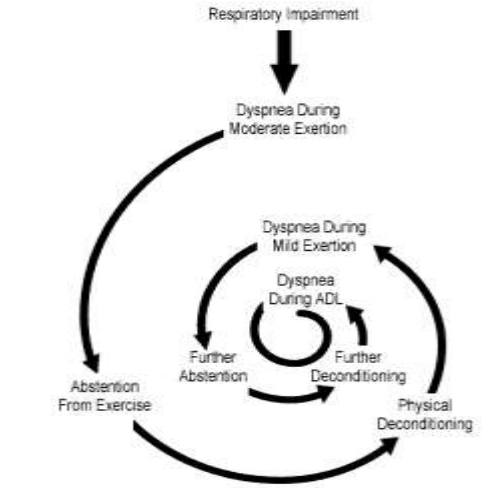
Correct answer 5: This patient is suffering from acute respiratory distress syndrome (ARDS). One of the main criteria for ARDS is the absence of cardiogenic pulmonary edema, and hence the left atrial pressure would be normal.

Incorrect answers: 1: Neutrophils damage type I pneumocytes in the acute inflammatory process., 2: Neutrophils damage type II pneumocytes in the acute inflammatory process., 3: A chest x-ray will show bilateral infiltrates, progressing to widespread alveolar consolidation in ARDS., 4: The A-a gradient is elevated in ARDS due to a V/Q mismatch.

https://www.medbullets.com/step1-respiratory/17045/emphysema

Respiratory failure: definition

- Respiratory failure occurs when the respiratory system fails in oxygenation and/or carbon dioxide (CO_2) elimination
- It may be acute (develops over minutes to hours) or chronic (develops over several weeks-months (clinical markers include polycythemia and cor pulmonale))

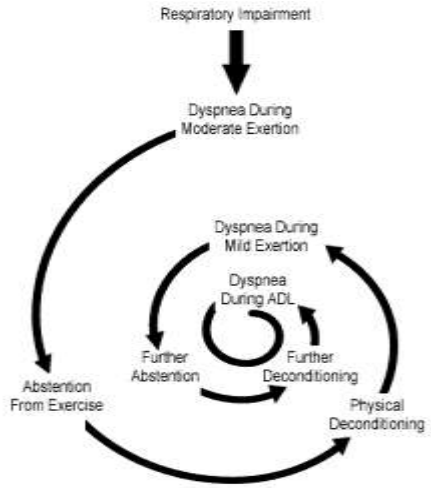


https://gardenrain.files.wordpress.com/2009/05/respiratory-impairment.gif http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: types

I - Hypoxemic (PaO_2 is less than 60 mm Hg (8 kPa) with a normal or low $PaCO_2$) is caused by ventilation-perfusion mismatch

II - Hypercapnic ($PaCO_2$ is more than 50 mm Hg (6.5 kPa) and indicates inadequate alveolar ventilation)



https://gardenrain.files.wordpress.com/2009/05/respiratory-impairment.gif http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: causes 1

Type I

- Chronic obstructive pulmonary disease (COPD)
- Pneumonia
- Pulmonary oedema
- Pulmonary fibrosis
- Asthma
- Pneumothorax
- Pulmonary embolism

Type II

- Pulmonary hypertension
- Cyanotic congenital heart disease
- Bronchiectasis
- Acute respiratory distress syndrome
- Kyphoscoliosis
- Obesity.

https://gardenrain.files.wordpress.com/2009/05/respiratory-impairment.gif http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: causes 1

Type I

- COPD
- Severe asthma
- Drug overdose, poisoning
- Myasthenia gravis
- Polyneuropathy
- Poliomyelitis
- Muscle disorders
- Head injuries

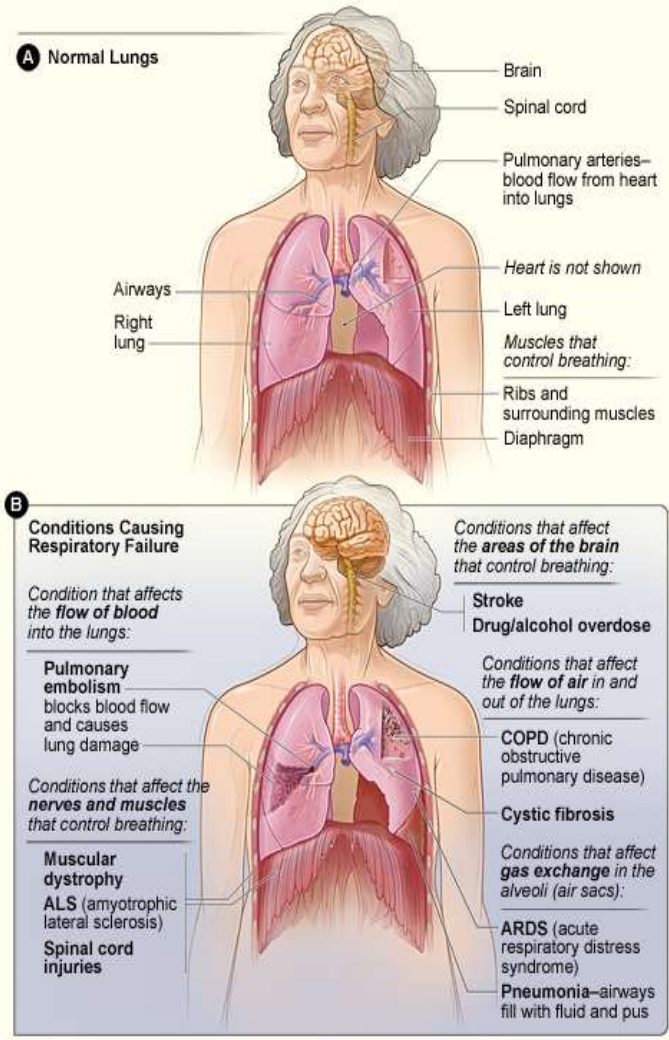
Type II

- Neck injuries
- Obesity
- Pulmonary oedema
- Adult respiratory distress syndrome
- Hypothyroidism.

https://gardenrain.files.wordpress.com/2009/05/respiratory-impairment.gif http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: causes 1

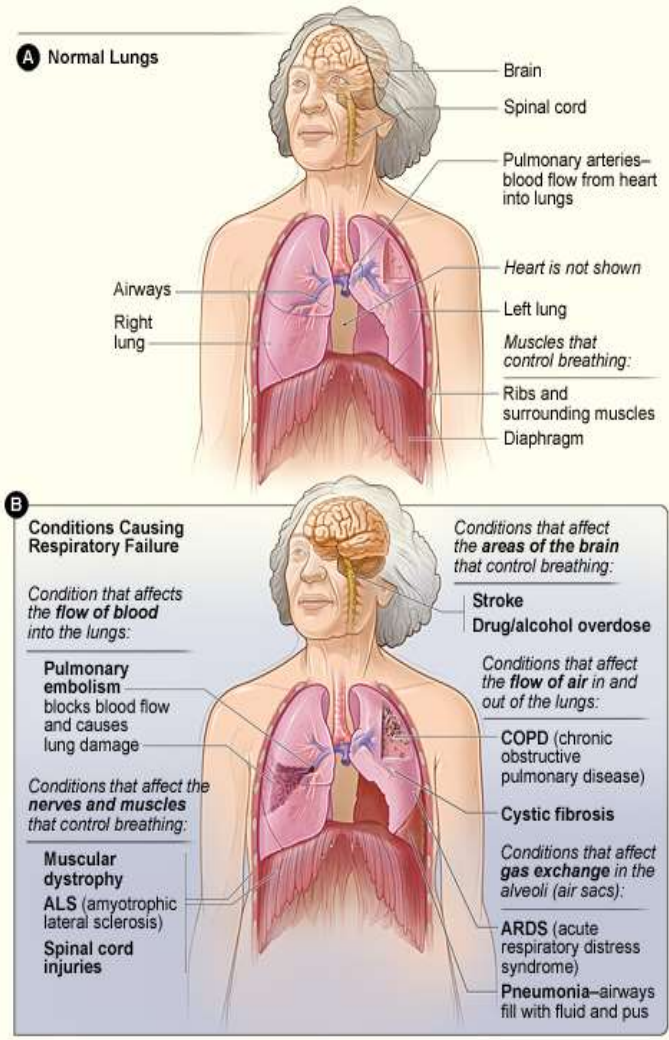
- Conditions that affect the nerves and muscles that control breathing (examples include muscular dystrophy, amyotrophic lateral sclerosis (ALS), spinal cord injuries, and stroke)
- Damage to the tissues and ribs around the lungs



http://www.nhlbi.nih.gov/sites/www.nhlbi.nih.gov/files/images_287

Respiratory failure: causes 2

- Problems with the spine, such as scoliosis (a curve in the spine)
- Drug or alcohol overdose (an overdose affects the area of the brain that controls breathing)



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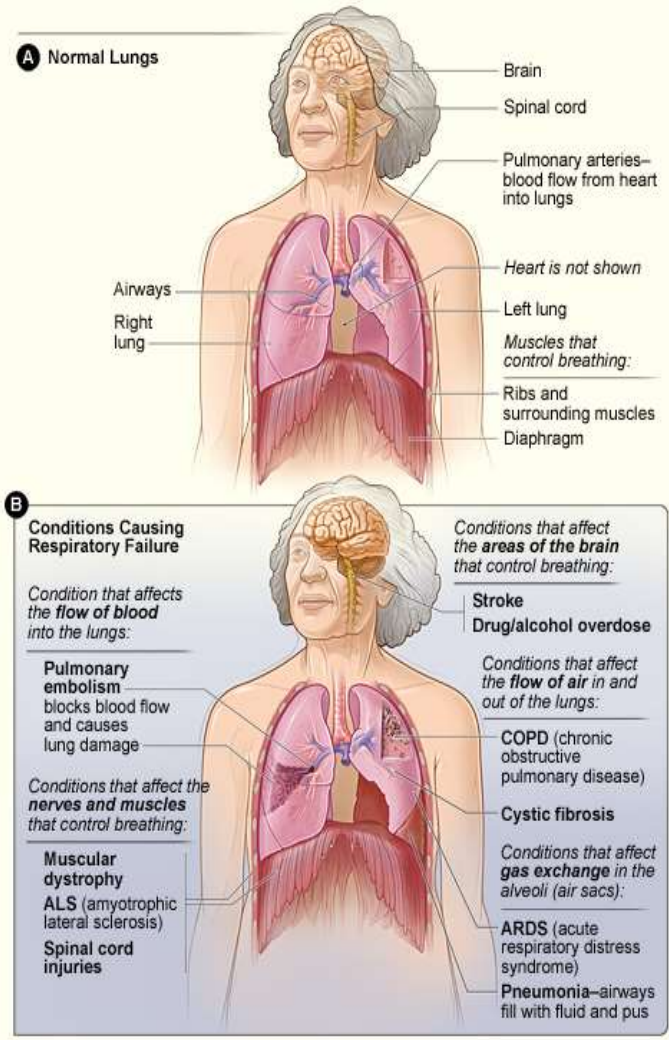
Respiratory failure: causes 3

- Lung diseases and conditions, such as chronic obstructive pulmonary disease, pneumonia, acute respiratory distress syndrome (ARDS), pulmonary embolism, and cystic_fibrosis
- Acute lung injuries (e.g., inhaling harmful fumes or smoke).



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Respiratory failure: signs and symptoms 1

- Paroxysmal nocturnal dyspnoea
- Orthopnoea
- Pulmonary oedema
- Cyanosis
- Confusion and reduced consciousness
- Localised pulmonary findings
- Tachycardia and cardiac arrhythmias

A transverse section of the heart from a patient with primary (idiopathic) pulmonary hypertension

http://5minuteconsult.com/data/GbosContainer/49/m_91731.fig11.27.jpeg https://gardenrain.files.wordpress.com/2009/05/respiratory-impairment.gif
http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: signs and symptoms 2

- Hypoxemia
- Acidosis
- Cor pulmonale (pulmonary hypertension, right ventricular failure, hepatomegaly and peripheral oedema).

A transverse section of the heart from a patient with primary (idiopathic) pulmonary hypertension

http://5minuteconsult.com/data/GbosContainer/49/m_91731.fig11.27.jpeg https://gardenrain.files.wordpress.com/2009/05/respiratory-impairment.gif
http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: diagnostic tests 1

- Pulmonary function tests (spirometry, arterial blood gas test, etc.)
- Chest X-ray
- Full Blood Count (anemia contributes to hypoxia, polycythemia contributes to chronic hypoxemic respiratory failure)
- Renal and liver function tests (may provide clues to the etiology or identify complications associated with respiratory failure)

http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: diagnostic tests 2

- Serum creatine kinase and troponin I (to help exclude recent myocardial infarction)
- Thyroid Function Test (hypothyroid chronic hypercapnic respiratory failure)
- Echocardiography (cardiac cause of acute respiratory failure)
- ECG (cardiovascular cause, dysrhythmias resulting from severe hypoxaemia or acidosis)

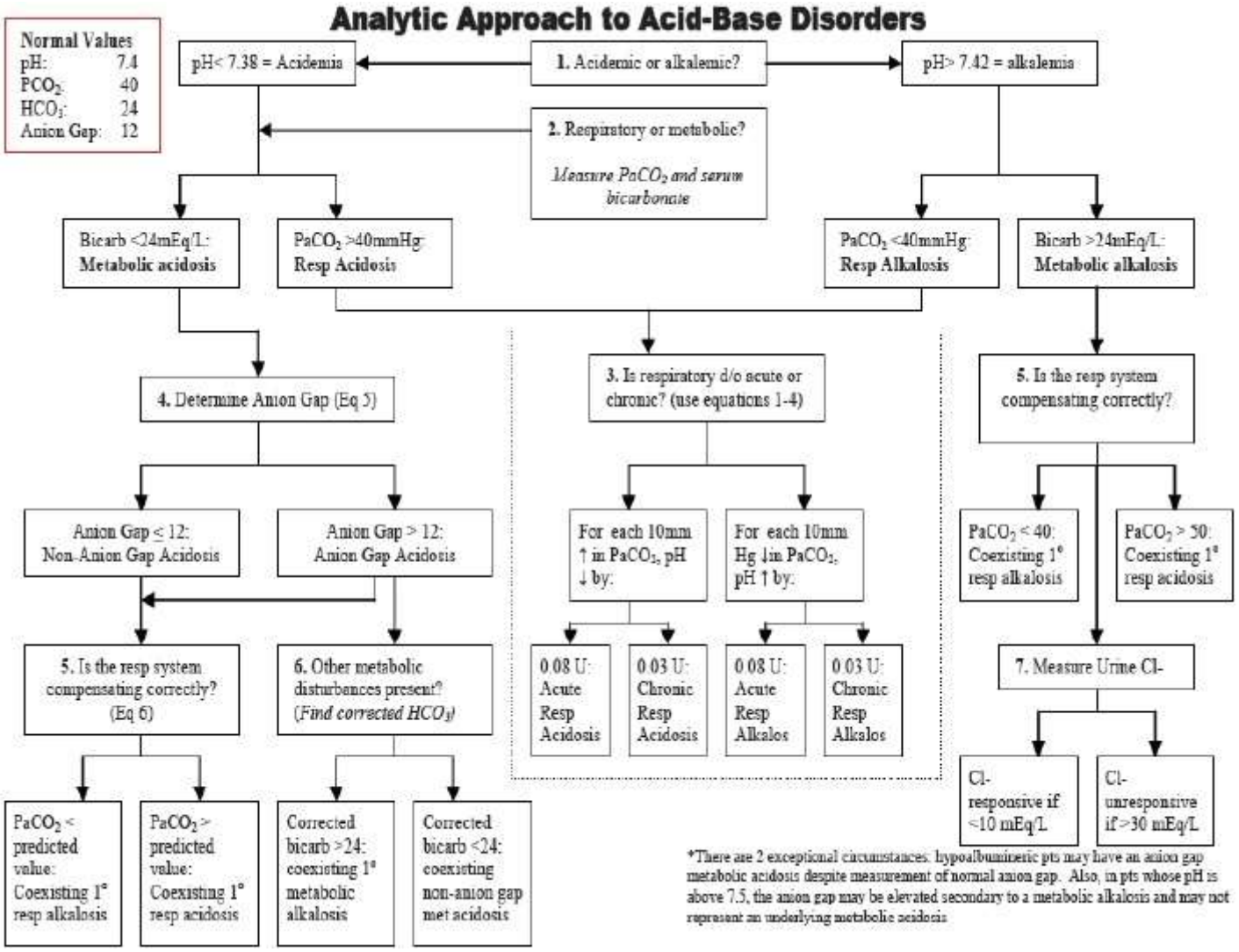
http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: diagnostic tests 3

- Right heart catheterisation (if there is uncertainty about cardiac function)
- Pulmonary capillary wedge pressure (distinguishing cardiogenic from noncardiogenic edema).

http://patient.info/doctor/Respiratory-Failure.htm

Respiratory failure: arterial blood gas test



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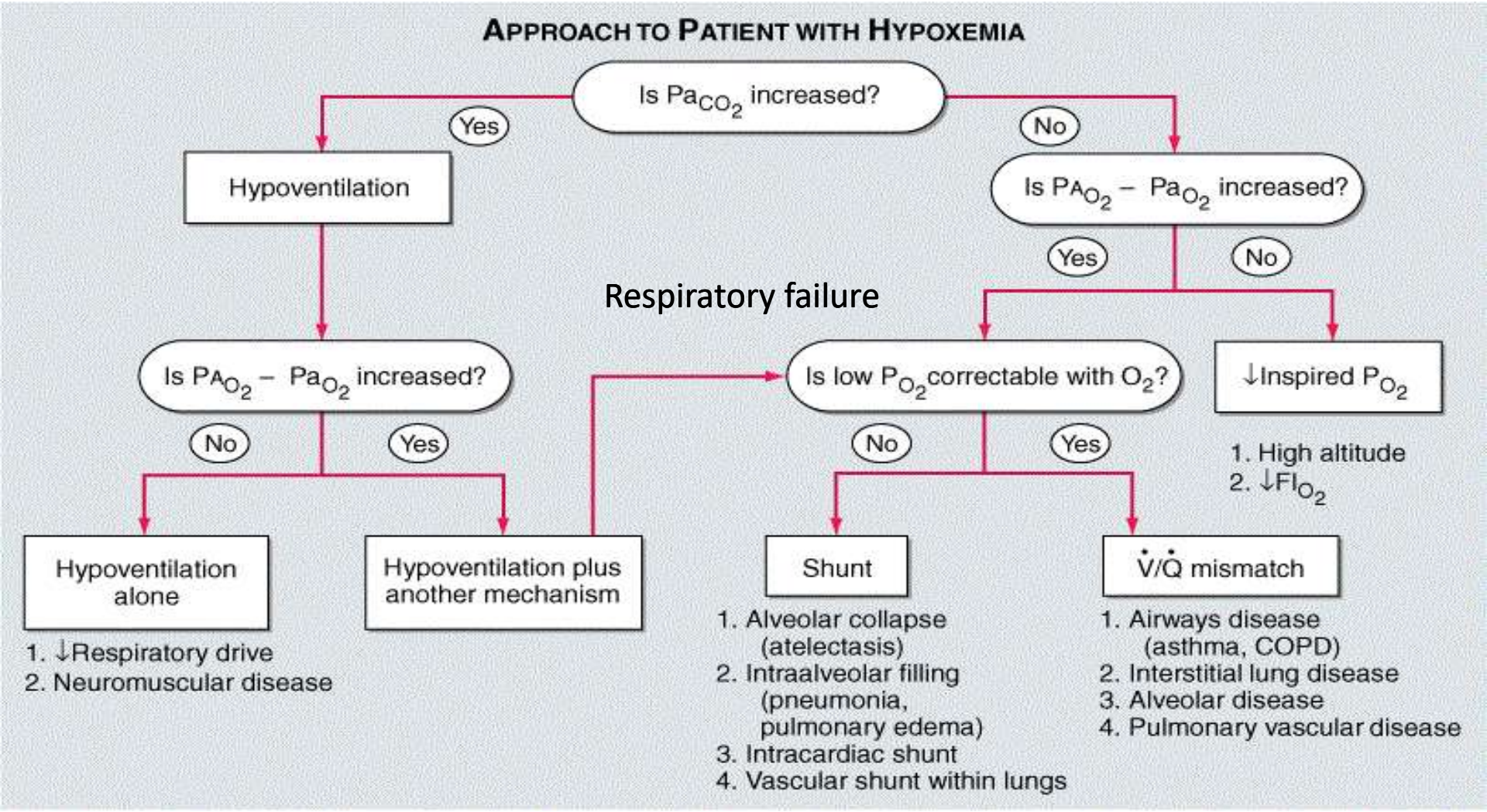
Respiratory failure: arterial blood gas test



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USMLE STEP 1

A 50-year-old Caucasian male presents to the Emergency Department complaining of shortness of breath and unintentional weight loss over the past several months. On physical examination, the patient appears quite thin and breathes through pursed lips. Breath sounds are decreased in all lung fields. Which of the following findings is expected on spirometry?

1. Increased FEV1, 2. Decreased FEV1/FVC, 3. Decreased TLC, 4. Normal FEV1 but increased FVC, 5. Normal lung values.

https://www.medbullets.com/step1-respiratory/17045/emphysema

USMLE STEP 1

Correct answer 2: The patient described above is suffering from Chronic Obstructive Pulmonary Disease (COPD), specifically emphysema. In emphysema, both FEV1 (forced expiratory volume in 1 second) and FVC (forced vital capacity) are decreased, however, FEV1 is decreased more, therefore FEV1/FVC is decreased.

Incorrect answers: 1 and 3: Both increased FEV1 and decreased TLC (total lung capacity) would be more consistent with a restrictive lung disease., Answer 4 and 5: Patients with COPD have a decreased FEV1 and a decreased FVC.

https://www.medbullets.com/step1-respiratory/17045/emphysema