MED437
KING SAUD UNIVERSITY

Medicine
TEAM 437

Investigation of lung diseases

Objectives :

1. Types of pulmonary diagnostic procedures.
2. Role of various specialized pulmonary procedures in diagnosing lung disease
3. When to apply specific tests

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437 slides, 436 team, 435 team, Davidson.

Types of pulmonary diagnostic procedures

A detailed history, thorough examination and basic hematological and biochemical tests usually indicate the likely diagnosis and differential. A number of other investigations are normally required to confirm the diagnosis and/or monitor disease activity.

Pulmonary Diagnostic Procedures	
Imaging	**Chest X-ray:** This is performed on the majority of patients suspected of having chest disease.
	Computed tomography: A. HRCT **B**. CT Angiography **C**.Normal CT with contrast > for "lymph node & pathologies in mediastinum
Pleural aspiration	**Thoracentesis: removing fluid from the space between pleura and the wall of the chest.**
Intercostal drainage	Chest tube
Pleural biopsy	Sampling of the pleura
Endoscopic examination	**Bronchoscopy:** Visualization of the central airways down to subsegmental level.
Pulmonary function test	Clinically used for assessing the airflow limitation.
Scintigraphic imaging	**Lung Scans:** V/Q (Ventilation/Perfusion).

Thoracentesis

- Is a procedure to remove fluid from the **(pleura space)** for diagnostic or therapeutic purposes.
Ex: Pleural effusion and Empyema[1] .

- Fluid is removed (drained) from the pleural cavity with a needle (aspiration).

Chest tube

Different than thoracentesis, It is a **large bore tube** (27-28 french diameter). thoracentesis is mainly made for diagnostic purposes but sometimes it's for symptomatic relief.
We use chest tube when there's fluid that needs to be evacuated immediately. (pus, infection, blood) .

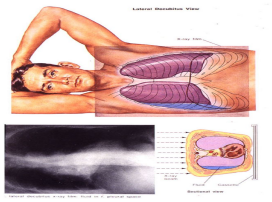
Indication for chest tube insertion:

1. **Empyema** (pus in the pleural cavity)
2. Complicated parapneumonic effusion[2]
3. Symptomatic pleural effusion (that cannot be drained by thoracentesis)
4. Hemothorax[3]
5. Pneumothorax[4]

1 Pus in pleural cavity
2 Type of pleural effusion that arises as a result of pneumonia.
3 Blood collect between the chest wall and the lungs.
4 Abnormal collection of air in the pleural space between the lung and the chest wall.

Step one

Before doing the procedure you have to do:	
ABC rule	Make sure of the (Airway, Breathing, Circulation) the patient must be stable
Laboratory test (baseline investigations)	1.Complete blood count: (Look for everything, WBC, platelets and hemoglobin) if the platelets count is less than 50,000 mcL, you will not insert your needle
	2.coagulation profile: PT, INR, APTT + make sure that this patient does not have bleeding diathesis. Ask the patient is taking any coagulation modifiers. (never perform a thoracentesis until you correct any coagulation problem)
	3.kidney function:Check for uremia → it can affect bleeding time.
	4.Liver function.
Confirm pleural effusion	1.Ultrasound (best way to determine level of fluid, it is widely available) it allows you to see fluid and how deep the needle can go.
	2.Decubitus film (You will see a layer of pleural fluid. If more than 2 cm then it's relatively safe to insert needle) (if less than 2 cm then it's not safe, b/c you might cause severe complications) Can determine whether fluid is free flowing or loculated, fluid have to be >1cm



Confirm pleural effusion

Step two

What to look for in thoracentesis?

1. Appearance (color): Blood → Hemothorax, Pus→ Empyema (indicating infection)

2. Gram stain, and cultures: If positive→ complicated parapneumonic effusion (infected pleura)

3. pH: If acidotic → empyema, renal failure (analyze exactly like ABG)

4. Chemistry: (glucose, amylase, LDH[5] , protein)

5. Cytology.

What are the complications of thoracentesis?

- Pneumothorax
- Bleeding (inserting the needle underneath the rib (where the vessels are) which leads to bleeding)
- Infection
- Hypotension (if you drain too much fluid)
- Hypoxemia (can happen due to hypotension)
- Air embolism
- Splenic laceration (a lousy physician who doesn't know his anatomy can stab the spleen causing severe damage)

NEVER do thoracentesis for a patient with collapsed lungs → you will cause pneumothorax on top of collapse. Instead, do bronchoscopy.

5 Lactate dehydrogenase

Step Three

Type of Fluids			
Light's Criteria		**Transudate**	**Exudate**
	Effusion protein/serum protein ratio	<0.5	>0.5
	Effusion LDH/serum LDH ratio	<0.6	>0.6
	Effusion LDH level greater than two-thirds the upper limit of the laboratory's reference range of serum LDH		

IMP: If the fluid's gross appearance is **Pus** OR **Gram stain is positive** OR **pH is below 7.2** → **Chest tube immediately**

(if you wait too long it can lead to fibrosis which restricts lung expansion, this can be catastrophic especially for a young patient because it can lead to him using a wheelchair for the rest of his life)

-You have to drain it immediately or else it will heal by fibrosis (fibrothorax)
-only needs 1 to be positive to be classified.

Scenario (1):

A **30 y/o gentleman** presented to the **ER** complaining of **SOB** and **fever for 1 week .** On examination, the pt is **tachypneic, O2 saturation is 89%, reduced chest expansion on the affected side, stony dullness** to percussion, and area of **bronchial breath sounds** on the specific area. On the front examination, the **trachea is shifted** to the opposite side. Based on this clinical scenario, **what am I dealing with?**

From the history:	-**SOB + fever** > **indicate infection**, and -**tachypnea + O2 saturation of 89%** > **make this patient unstable**
On examination & investigation	-**Stony dullness** > **pleural effusion,** -**bronchial breath sound** > supportive to your suspicion of **pleural effusion,** -**tracheal shifting to the right side** > could either mean that something is **pushing the trachea** from the left side OR something is **pulling the trachea** to the right side - **CXR** > it's more likely that something is **pushing** > **pleural effusion**.
After confirming the diagnosis:	1.**stabilize the patient.** 2.**ALWAYS** mention that you want to do your **ABCs.** (Airway, Breathing, and Circulation) + (O2 saturation, Establish IV access…) + CBC, coagulation profile, liver and kidneys function test. 3.Order the **investigation** that confirms what you are dealing with > **Thoracentesis**

Pleural Biopsy

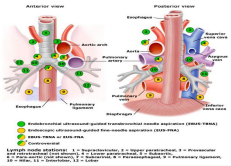
A procedure in which a **sample of the pleura (parietal)** is **removed** with a special biopsy needle or during surgery to determine if Granulomatous disease, malignancy or another condition is present.
We use this for TB because it has high yield. You need a large amount of fluid to diagnose TB.

When is a pleural biopsy indicated?
1.Granulomatous disease. Ex(TB)
2.Malignancy
3.Exudative effusion without pus or blood, gram stain and pH is 7.20.
4.Recurrent pleural effusions of unknown etiology.
5.Pleural mass or thickening.

Scenario (2):
A 45 y/o gentleman, reported history of **fever** and **weight loss** over the past six months. He was in prison for 5 months. On examination, he was **cachectic,** BP and all vitals signs were stable. **O2 saturation was 96%**. Lung examination revealed **chest expansion is affected** on the same side and **stony dullness** to percussion on that area.

From the history:	**-Fever + Weight loss > infection "TB"** or **malignancy.** **-O2 saturation of 96%> patient is stable.**
On examination & investigation	- **Stony dullness** > **pleural effusion,** - **CXR** > **no mediastinal shift, blunted costophrenic angle on the left side** > **pleural effusion.** **..! - why is it different from the 1st scenario?** It's chronic.
After confirming the diagnosis:	1.You don't need to stabilize the patient because **he is already stable,** 2.**ALWAYS** mention that you want to do your **ABCs.** (Airway, Breathing, and Circulation) + (O2 saturation, Establish IV access…) + CBC, coagulation profile, liver and kidneys function test. even if patient is stable 3.Order the **investigations** that confirm what you are dealing with > **Thoracentesis + pleural biopsy** " if dealing with **TB or malignancy"** 4.**Ultrasound or decubitus film.**

Bronchoscopy



Is an instrument (flexible fiber-optic material that has a light source and a camera on the end) which is used for diagnostic[6] and therapeutic purposes.

If you want to see outside the luminal cavity (e.g. lymph nodes), you can use endobronchial ultrasound. If the patient is a smoker and the X-Ray or CT shows a mass then you always have to think of malignancy first.
Do a bronchoscopy and biopsy to confirm suspicion.

Diagnostic indications:	Therapeutic indication:
1) Suspected lung cancer 2) Abnormal CXR. (collapsed lobes or segments) 3) Hemoptysis. 4) Refractory or Unexplained cough. 5) Localized wheeze or Stridor. 6) Positive sputum cytology. 7) Mediastinal lymph nodes. 8) Unexplained pleural effusion. 9) Lung abscess. 10) Obtain culture material. 11) Airway trauma. 12) Tracheoesophageal fistula. 13) Diffuse lung disease 14) Staging of lung cancer.	1) Remove foreign bodies. • in an elderly patient, look for broken dentures • And in children, think of toys • In the mid range around 25-30, think of a slow growing tumor. 2) Remove abnormal endobronchial tissue 3) Difficult endotracheal tube intubation. 4) Endobronchial stent placement.

Scenario (3):
A 30 y/o gentleman presented with **SOB** over the past 3 hours and he denied any history of fever. On examination, he's **hypoxic**, **O2 saturation is 80%**, **BP is 90/60**. Lung examination reveals **reduced chest expansion**, **tracheal shift** to the affected side, **dullness** to percussion, and **absent breath sound.**

From the history:	**-Sudden SOB,** **-O2 saturation is 80%** here , **BP is 90/60 (hypoxic + hypotensive) > patient is unstable (in shock)**
On examination & investigation	**Dullness** > against pneumothorax (would be hyperresonant). **-Absent breath sound**[7] **> lung collapse** here **-CXR > pulled trachea** > against tension pneumothorax (b/c tension pneumothorax will push)
After confirming the diagnosis:	1.You need to **stabilize** the patient because. (treat hypotension and O2 saturation) 2.**ALWAYS** mention that you want to do your **ABCs.** (Airway, Breathing, and Circulation) + (O2 saturation, Establish IV access…) + CBC, coagulation profile, liver and kidneys function test. 3.Order the **investigation** that confirms what you are dealing with > **Bronchoscopy**[8]

6 Abnormal tissue in the bronchial lumen or wall can be biopsied, and bronchial brushings, washings or aspirates can be taken for cytological or bacteriological examination
7 could be pneumothorax .. but see other signs.
8 We think it's inside so we do bronchoscopy.

Collapse: (implying obstruction of the lobar bronchus) is accompanied by loss of volume and displacement of the mediastinum towards the affected side.

-What is the source of this collapse?

Something in the airway (inside the lumen)	Something in the wall of the airway	Something in the outer wall of the airway
e.g. foreign body, mucus plugging or malignancy	e.g. inflammation, granuloma, tumor	ass that is causing a significant loss of volume or compression by enlarged lymph nodes

In this case "scenario 3" We don't know what is the exact pathology . . But the CXR hints that there is an abrupt cut off sign on the left mainstem bronchus (you can see it abruptly disappear after the bifurcation by a little in the image) > a hint that there is an endobronchial mass

Pulmonary function test (PFT)

★ **Includes:** Spirometry, Lung volumes, Diffusion capacity, Respiratory muscle strength.

★ **Mainly for:**

1) Categorization of different types of lung diseases: knowing whether it's restrictive or obstructive.
2) Assessment of diseases severity: e.g. pre-operation or stage of obstruction.
3) Post-treatment evaluations of lung function: easement of drug efficacy.

Spirometry

What it used for:	Measuring what?
-Measures the amount (**volume**) and/or speed (**flow**) of air that can be inhaled and exhaled. **based on the age, gender, height and weight for each individual we have a predicted number for each individual** -Assess abnormality in airways: 1.Can **diagnose obstructive** lung disease 2.Can suggest restrictive lung disease but can't diagnose. Indication: patients suspected to have asthma on COPD	1.**FEV1 (L)** (forced expiratory volume in 1st second) should be > 90% of the predicted value 2.**FVC (L)** (forced vital capacity): predicted > 90% 3.**FEV1/FVC (ratio)** ≥ 70 -If **ratio** is **less than 75** → **obstructive** -If **ratio normal or more than 75** → suggest **restrictive** **(but must confirm restrictive with → lung volume test)**

What do mean by obstructive and restrictive?	
1.Obstructive: -Decreased both FVC and FEV1, but FEV1 is decreased **more** than FVC → The FEV1/FVC (ratio) decreased -Increased resistance to expiratory airflow.	2.Restrictive: Decreased both FVC and FEV1, but FEV1 is decreased **less** than FVC → The FEV1/FVC (ratio) normal or increased.

Lung volume

What it used for:	Measuring what?
-Measures Lung capacity. -Can **diagnose restrictive** lung disease. -Can diagnose air trapping. -Can suggest obstructive lung disease.	1-**Total lung capacity (TLC):** the total amount of air in the lungs after taking the deepest breath possible; >90% predicted. 2-**Residual Volume (RV):** lung volume representing the amount of air left in the lungs after a forced exhalation; > 90% predicted. 3-**Vital capacity (VC):** the maximum amount of air that can be expelled from the lungs after the deepest possible breath; >90% predicted. - If TLC, VC, RV < 90% → restrictive.

Diffusion capacity (DLCO)

What it used for:	Measuring what?
-Measures the ability of gases to diffuse from the alveoli into the pulmonary capillary blood. -To measure the capacity of the lungs to exchange gas, patients inhale a test mixture of 0.3% carbon monoxide(CO), which is taken up avidly by haemoglobin in pulmonary capillaries. - Carbon monoxide is not normally present in the lung but it's more soluble in blood than lung tissue •Inhalation of small amount of CO Reflect loss or damage to the gas exchanging surface of the lung. Normal: >80% -More soluble in blood than lung tissues. -Dlco In lung disease the diffusing capacity (DLCo) also depends on the **V/Q** relationship as well as on the area and **thickness of the alveolar membrane.**	**Transfer factor (DLco):** - Decreased DLco reflects loss or damage to the gas exchanging surface of the lung, the defect is either in the alveoli e.g."emphysema", capillary membrane or both of them -e.g. Emphysema (distinguish emphysema from chronic bronchitis or chronic asthma), -Interstitial lung diseases -Pulmonary vascular disease. . Normal value in diseases that affect upper part of respiratory system e.g. chronic bronchitis .Low in patients with interstitial lung disease and pulmonary fibrosis .DLCO is normal or increased in Asthmatics .Increased DLCO in: alveolar hemorrhage that is caused by (wegener disease, goodpasture syndrome and SLE).

Respiratory muscle strength

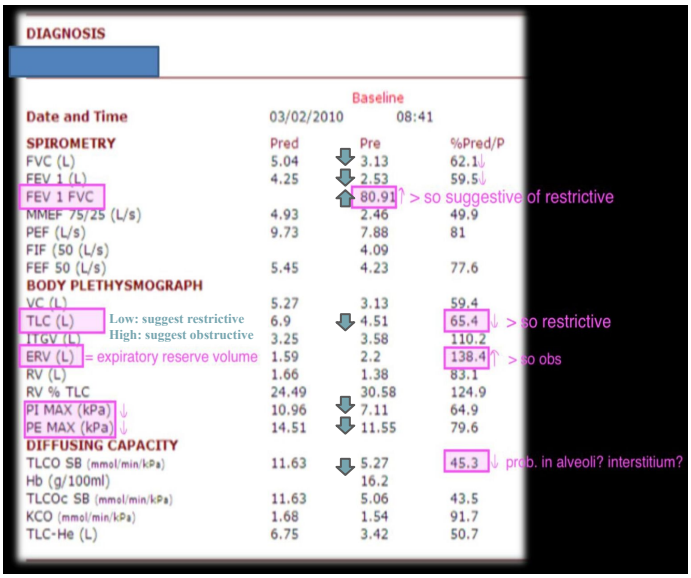
What it used for:	Measuring what?
-Measured by pressure transducer at the mouth when subject make a maximal inspiratory effort from full expiration or maximal expiration effort from full inspiration. -Diagnosing diseases that affect the muscle in the respiratory system; -Motor neuron disease, Guillain-Barré Syndrome. Metabolic disease , C.T disease (myositis), Drugs (steroids for long period of time), can also be caused by autoimmune disorders (SLE)	**PImax, PEmax:** -PI→ reflect inspiratory muscles as diaphragm. -PE → expiratory muscles as abdominal muscles.

★ How do we approach Pulmonary function tests?

- First, we differentiate whether it is obstructive or restrictive → by **spirometry**.
- Second, we give **bronchodilator** short-acting β2 adrenoceptor agonists (e.g. salbutamol); to know if it's reversible (asthma: large improvement in FEV1 (over 400 mL) and variability in peak flow over time are features of) or irreversible (COPD).
- Lastly →**DLCO** to know what type of COPD is it (emphysema → **decreased**, bronchitis → **normal**).
- Measure the inspiratory "diaphragm"/expiratory muscles, if all the tests are normal and SOB is present. Example, connective tissue dis/autoimmune dis (SLE, scleroderma, dermatomyositis, polymyositis) affecting muscles.
- If the patient is known to have connective tissue disease + progressive SOB→ MIP and MEP will show very low muscles strength, particularly EP "expiratory".

The patient is stable, so steroids intake is usually the cause of his myopathy! "Which is the reason behind his dyspnea"

So we always have to think about drugs since they reduce muscle force.



Nonsmoker pt. Has this lab results.
Findings include:
1) restrictive
2) obstructive
3) reduced DLCO
4) reduced muscles strength.

He probably has a systemic disease "SARCOIDOSIS"

Sarcoidosis: (a connective tissue disease) It is an autoimmune disease that affects all body organs : - can damage the interstitium >causing fibrosis , and cause airway disease that mimics bronchial asthma or COPD. " restrictive + obstructive " - its Granuloma can affect/attack the muscle → affecting diaphragm and expiratory muscles. " reduced muscles strength." - And by interstitium damage or by pulmonary hypertension secondary to sarcoidosis →" reduce DC "

Causes of interstitial lung disease?

1. Autoimmune
2. Idiopathic
3. Drugs
4. Environment
5. Genetics
6. Granulomatous lesion (sarcoidosis)

CXR: Suggestive of ILD

Scenario (4): 50 yr old male with SOB and cough >3yrs.

- On Investigation:

- Exam: clubbing and bilateral inspiratory crackles (character of interstitial lung disease)
- CXR: reticulation bilateral (Thickening of the interstitium)
- ABG: hypoxic respiratory failure
- PFT: restrictive defect with significant impairment in DLco.

Next step is order CT (HRCT) for lung parenchyma and take lung biopsy.

CT imaging

★ Computed tomography (CT):

Provides detailed images of the pulmonary parenchyma, mediastinum, pleura and bony structures. Used for patients suspected to have interstitial lung disease.

3 modalities of CT scan:

1. HRCT : high resolution with no contrast (interested in lung parenchyma)
2. CT with contrast: if interested in the mediastinum or pleura
3. CT Angio: interested in the pulmonary vasculature

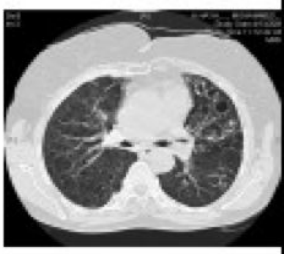
1. HRCT (high resolution CT scan):

Designed for detailed evaluation of interstitial structures of the lung .

- Assessment of diffuse inflammatory and infective parenchymal processes.
- Uses narrow slice thickness (1-2 mm) compared with 5-10 mm for routine scan.

- **Principal indications:**

Suspected interstitial lung disease
Characterization of interstitial lung disease
Characterization of solitary pulmonary nodules
Diagnosis of **bronchiectasis**; it has a sensitivity and specificity of greater than 90%.
Diagnosis of lymphangitis carcinomatosa. is the term given to tumour spread through the lymphatics of the lung and is most commonly seen secondary to adenocarcinoma

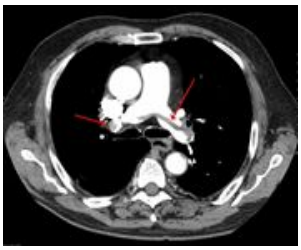
			
1-In Cross-section: abnormal lung parenchyma indicates that the patient probably has interstitial lung disease, pulmonary fibrosis to be precise. 2-In coronal view: distribution of fibrosis.	Here it shows pulmonary fibrosis as well but at a very advanced stage. This is what happens when PF is not diagnosed early on. (there's destruction of lung parenchyma & thickening of septa)	**Hypersensitivity Pneumonitis** : mosaic pattern (=air trapping), ground-glass opacity, (normal & abnormal areas)	Here it shows cystic type bronchiectasis

2. CT Angiography:

- Image data are acquired continuously as the tube and detector rotate within the gantry and the patient moves continuously through the gantry.

If the filling defect is present we diagnose the patient with Pulmonary Embolism. The patient undergoes CT angiography with contrast which is white in images. We detect filling defects when there is stoppage of contrast movement, which appears as black colored spaces in images.

Advantages	Contraindications
1.Critically ill patients 2.Children 3.Less volume of intravenous contrast 4.Permits greater processing of the raw data	**Renal failure** Allergy to contrast Pregnancy



Scenario (5):

A 45 years old female with **Right sided chest pain** for **1 day.**

- on Investigation:

1- ABG : pH 7.32, PaCO2 28, PaO2 50, **O_2sat 88%**

2- ECG : sinus tachycardia.

3- CXR : normal

4- Spiral: CT

5- V/Q: Scan

Answer: Diagnosis is most likely **pulmonary embolism** → confirm by ***CT angiography****.

**CT angiography*: red arrows: multiple filling defects both at the bifurcation of pulmonary trunk "hypodense" ("saddle" pulmonary embolism).

Scintigraphic imaging

Widely used for detecting pulmonary emboli although it is now performed less often owing to widespread use of D-dimer measurements and CT pulmonary angiography.

★ Lung Scans V/Q (Ventilation/Perfusion):

Ventilation	Perfusion
Radioactive tracer gas inhaled to lungs → picture here shows areas of lung that are not receiving enough air or retain too much air.	Radioactive substance injected into the vein→ to lungs → shows areas in lung which are not receiving enough blood.

To assess perfusion: Technetium (Tc) 99m radionuclide is tagged to macroaggregated human albumin to make small radioactive particles.

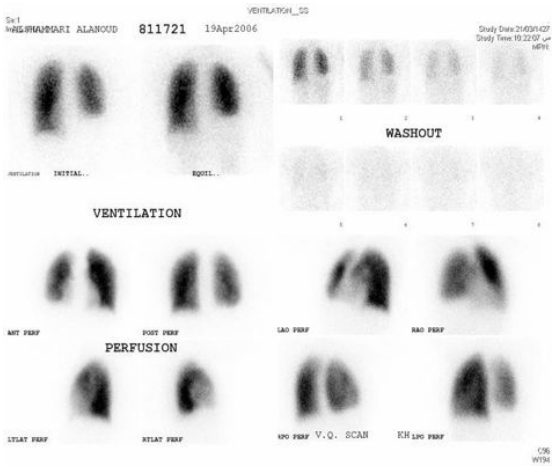
- is injected intravenously → they impact in pulmonary capillaries, where they remain for a few hours. → When Tc decays→ it emits a gamma ray detected by the nuclear medicine gamma camera → a nuclear medicine image is formed by detection of many gamma rays.
- The resultant pattern indicates the distribution of pulmonary blood flow; **cold areas** occur where there is defective blood flow (e.g. in pulmonary emboli).

Lung scan: normal perfusion:

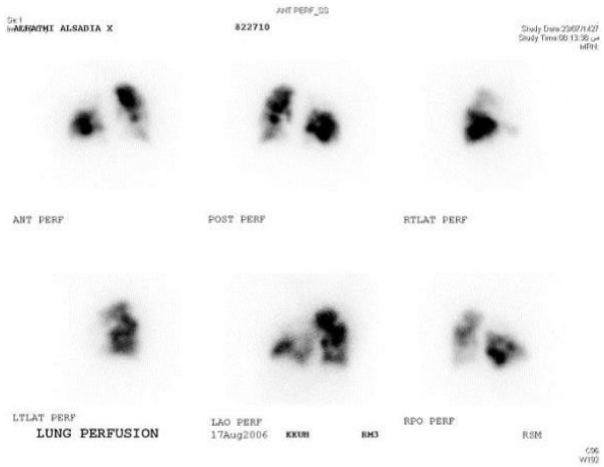
- When injected via peripheral venous site, the first capillaries encountered are the **pulmonary capillaries**. if **perfusion is present** at the capillary level of the lungs, nuclear medicine perfusion image would demonstrates "activity in the periphery of the lungs"

Lung scan: perfusion defect:

- If there is an **obstructing vascular lesion** in the pulmonary arterial circulation → **blocked perfusion** to the distal capillary level → nuclear medicine perfusion image would demonstrate "no activity in the periphery of the lungs"



Normal



PE (note the decreased perfusion)

summary

DON'T FORGET YOUR ABCs

1.stabilize the patient
2.if he's stable then do your tests (CBC, , coagulation, LFT, RFT)
3. confirm pleural effusion by either ultrasound or decubitus film
4. then and only then you can do your procedure. (thoracentesis, bronchoscopy, etc..)

Thoracentesis And Chest tube

- 1.Thoracentesis is the procedure where you aspirate fluid from the pleural cavity. It is used for diagnostic and therapeutic purposes.
- 2. chest tube is a large bore tube used to drain pleural fluid. We use chest tube when there is blood, pus, pH <7.2 or any fluid that requires immediate evacuation.

Pleural biopsy

- pleural biopsy is the procedure where a part of the pleura is removed for diagnostic purposes, is it especially important if the patient is suspected to have TB or malignancy like our old friend in scenario 2

Bronchoscopy

- bronchoscopy is a procedure that's done when you need to look inside the airway. (yes, it's that simple). It's used for both diagnostic and therapeutic purposes. (like removing foreign objects)

Pulmonary function test

- Pulmonary function tests are mainly used to differentiate between obstructive and restrictive diseases.We use spirometry to diagnose Obstructive lung diseases because the main issue with OLD is that the air can't leave the lung because of an obstruction (obviously), while we use lung volumes to diagnose restrictive lung disease. Because the problem here is not that the air can't leave because it's even going in. I'll tell you why, because the lung can't expand normally so that prevents it from filling entirely. It's not that difficult, huh?
- -Ok, imagine that we performed spirometry on a patient. We know it's COPD but we're not sure if he has emphysema or chronic bronchitis. In this case we use DLco, it. Basically tells us if the gas exchange capability in the lung is low. (which is basically what emphysema does)

Respiratory muscle strength

- Respiratory muscle strength test is used to evaluate the strength of the muscles we use when we breathe forcefully. Its Measured by pressure transducer at the mouth when subject make a maximal inspiratory effort from full/maximal expiration effort from full inspiration. Low PIMax or Pemax means the patient has a problem in the respiratory muscle (can be myopathy, drug related or autoimmune).

CT

- CT can be HRCT or CT angiography.
- we use HRCT to evaluate interstitial structures of the lung. It's used to diagnose bronchiectasis
- CT angiography is the gold standard to diagnose PE. But it uses IV contrast so it's absolutely contraindicated in RENAL FAILURE. If that's the case then you can use V/Q instead!

V/Q

- we use lung scans V/Q to detect lack of blood flow in the lung or cold areas.
- The ventilation part: Radioactive tracer gas inhaled to lungs → picture here shows areas of lung that are not receiving enough air or retain too much air.
- The perfusion part: Radioactive substance injected into the vein→ to lungs → shows areas in lung which are not receiving enough blood. If the lung is receiving oxygen but there is no perfusion that is called V/Q mismatch. Which means that blood isn't taking the oxygen from the lung because of a PE possibly

Examine Yourself!!

1- Which of the following is a potential complication of thoracentesis
A. Hemothorax
B. Localized infection at the injection side
C. Pneumothorax
D. All of the above are potential complications

2- Which of the following is **NOT** a contraindication to perform thoracentesis ?
A. Herpes Zoster over the proposed injection site
B. Dyspnea due to a large pleural effusion in palliative lung cancer
C. Severe hemodynamic compromise
D. Uncontrolled bleeding

3- 67 y\o male patient presented to the emergency department with a severe dyspnea, his vitals were T:38.7 , HR:115 , RR:28 , BP:107\87 , O2: 89%, chest X-ray showed a fluid in the pleural cavity and thoracentesis was performed. How are exudative pleural fluids differentiated from transudative pleural fluids following thoracentesis?
A. If the Fluid\Serum LDH ratio 0.5
B. If the Fluid\Serum protein ratio 0.7
C. If fluid LDH level within the upper one third of the normal serum LDH
D. By blood culture

4- 55 y\o male diabetic patient went to Jazan in a trip with his family, after 3 weeks he presented to the hospital with chest pain, hemoptysis, weight loss and night sweats. Which of the following methods is the best to diagnose this patient ?
A. Thoracentesis
B. Chest tube
C. Pleural biopsy
D. Bronchoscopy

5- What is the second step in approaching Pulmonary Function Test in a patient with COPD ?
A. Spirometry
B. DLC0
C. Chest X-Ray
D. Bronchodilator

6- You see a 68-year-old man in clinic, with a 40 (cigarette) pack year history, who has been experiencing breathlessness on exertion and a productive cough of white sputum over the last four months. You assess his spirometry results which reveal an FEV1/FVC of 51 per cent with minimal reversibility after a 2-week trial of oral steroids. Cardiological investigations are normal. Which of the following is the most likely diagnosis?
A. Asthma
B. Chronic obstructive pulmonary disease (COPD)
C. Left ventricular failure
D. Chronic bronchitis

7. A 54-year-old woman is seen in clinic with a history of weight loss, loss of appetite and shortness of breath. Her respiratory rate is 19 and oxygen saturations (on room air) range between 93 and 95 per cent. On examination, there is reduced air entry and dullness to percussion on the lower to mid zones of the right lung. There is also reduced chest expansion on the right. From the list below, select the most likely diagnosis:
A. Pulmonary embolism
B. Right-sided pleural effusion
C. Right-sided bronchial carcinoma
D. Right lower lobe pneumonia.

8. You are discussing a patient with your registrar who has become acutely short of breath on the ward. After performing an arterial blood gas, you have high clinical suspicion that the patient has a pulmonary embolism. Which of the following is the investigation of choice for detecting pulmonary embolism?
A. Magnetic resonance imaging (MRI) of the chest
B. High-resolution CT chest (HRCT)
C. Chest x-ray
D. CT pulmonary angiogram (CT-Pa)

9. You see a 28-year-old man, with no past medical history, in accident and emergency who developed an acute onset of pleuritic chest pain and shortness of breath while playing football. On examination, oxygen saturations are 93 percent on room air, respiratory rate 20 and temperature is 37.1°C. There is decreased expansion of the chest on the left side, hyper-resonant to percussion and reduced air entry on the left. The most likely diagnosis is:
A. Left-sided pneumothorax
B. Left-sided pneumonia
C. Left-sided pleural effusion
D. Lung fibrosis

10. You are asked to request imaging for a patient with a suspected pneumothorax who you have just examined in accident and emergency. Which of the following would be the most appropriate first step imaging modality?
A. CT-chest
B. Chest x-ray
C. Ultrasound chest
D. V/Q scan

Answer key:
1.D
2.B
3.B
4.C
5.D
6.B
7.B
8. D
9.A
10.B