L13: investigations of lung diseases

Medicine433@yahoo.com

MED 433

MEDICINE 433

objectives

1. Type of pulmonary diagnostic procedures.

2. Role of various specialized pulmonary procedures in diagnosing lung diseases.

3. When to apply specific tests.

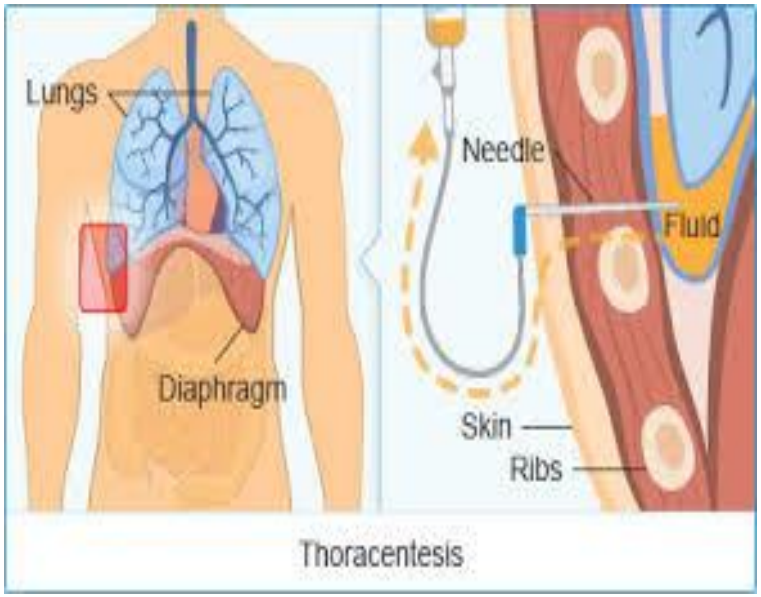
Pulmonary Diagnostic Procedures

1. Thoracentesis
2. Chest tube
3. Pleural biopsy
4. Bronchoscopy
5. Pulmonary function tests
6. Computed tomography
7. Lung Scans: V/Q
8. CXR
9. Ultrasound
10. Ventilation–perfusion imaging
11. Pulmonary angiography
12. Positron emission tomography (PET)
13. Exercise tests

1- Thoracentesis

When removing the fluid, detect that :

- Appearance.
- Gram stain, and cultures.
- PH.
- Chemistry (glucose, amylase, LDH, protein).
- Cytology.



Before doing thoracentesis, we should do :

1. ABC (Airway, Breathing ,Circulation)
2. CBC , to check the Platelete.
3. Coagulation test.
4. Consent for patient.

1- Thoracentesis (cont.)

Findings in Exudates pleural effusion:

- Pleural fluid protein divided by the serum protein greater than 0.5.
- Pleural fluid LDH divided by the serum LDH greater than 0.6.
- Pleural fluid LDH greater than two-thirds of the upper limit of normal for the serum LDH.
- Gross appearance is pus.
- Gram stain positive.
- PH below 7.20.

Complication of Thoracentesis		
	Pneumothorax.	Bleeding
	Infection	Hypotension
	Hypoxemia	Air embolism
	Splenic laceration	

in thoracentesis, in appearance:

- ❑ if we find blood or pus , it is emergency.
- ❑ if Gram stain positive or pH below 7.20, Chest tube for drainage is needed directly, because if we leave it , it will lead to fibrosis (fibrothorax).

2- Chest tube

Indication for chest tube insertion:

- Empyema.
- Complicated parapneumonic effusion.
- Symptomatic pleural effusion.
- Hemothorax.
- Pneumothorax.

3- Pleural biopsy

Indication for pleural biopsy :

- Granulomatous disease
- Malignanancy

❖We do thoracentesis in acute and chronic conditions but in chronic , biopsy is needed.
❖In chronic conditions, When the culture is negative , we exclude TB. And when the biopsy is negative , we exclude tumor.

4- Bronchoscopy

Indication for bronchoscopy as

1- diagnostic

- ✓ Suspected lung cancer
- ✓ Abnormal CXR
- ✓ Hemoptysis
- ✓ Unexplained cough
- ✓ Localized wheeze
- ✓ Positive sputum cytology
- ✓ Mediastinal lymph nodes
- ✓ Refractory cough
- ✓ Unexplained pleural effusion
- ✓ Lung abscess
- ✓ Staging of lung cancer
- ✓ Obtain culture material
- ✓ Airway trauma
- ✓ Tracheoesophageal fistula
- ✓ Diffuse lung disease

2- theraputic

- ✓ Remove foreign bodies.
- ✓ Remove abnormal endobronchial tissue.
- ✓ Difficult endotracheal tube intubation.
- ✓ Endobronchial stent placement.

In condition of collapse , bronchoscopy is needed , it can be diagnostic and therapeutic.

5- Pulmonary function tests

A. Spirometry.

B. Lung volumes.

C. Respiratory muscle strength.

D. Diffusion capacity.

5- Pulmonary function tests

		Indications
A. Spirometry	• FVC (L) predicted >90% • FEV1(L) predicted >90% • FEV1/FVC >75 (FVC) is the volume of air that can forcibly be blown out after full inspiration FEV1 is the volume of air that can forcibly be blown out in one second, after full inspiration	1. Diagnose obstructive lung disease 2. Suggest restrictive lung disease
B. Lung volumes	• TLC (L) >90% predicted • RV (L) > 90% predicted TLC Total lung capacity RV the volume of air remaining in the lungs after a maximal exhalation	1. Diagnose restrictive lung disease 2. Diagnose air trapping
C. Respiratory muscle strength	• PImax, Pemax • Measured by pressure transducer at the mouth when subject make a maximal inspiratory effort from full expiration or maximal expiratory effort from full inspiration • PI reflect inspiratory muscles (diaphragm) • PE expiratory muscles including abdominal • Motor neuron disease, Guillian Barre syndrom	

5- Pulmonary function tests

		Indications
D. Diffusing capacity (DL):	• Measure the ability of gases to diffuse from the alveoli into the pulmonary capillary blood. • Decreased DLco reflect loss or damage to the gas exchanging surface of the lung. (**DLco**) is the test that determines how much oxygen travels from the alveoli of the lungs to the blood stream	1. Emphysema: distinguishes emphysema from chronic bronchitis or chronic asthma. 2. Interstitial lung disease. 3. Pulmonary vascular disease.

DIAGNOSIS

SARCOIDOSIS

		Baseline	
Date and Time	03/02/2010	08:41	
SPIROMETRY	Pred	Pre	%Pred/P
FVC (L)	5.04	3.13	62.1
FEV 1 (L)	4.25	2.53	59.5
FEV 1 FVC		80.91	
MMEF 75/25 (L/s)	4.93	2.46	49.9
PEF (L/s)	9.73	7.88	81
FIF (50 (L/s)		4.09	
FEF 50 (L/s)	5.45	4.23	77.6
BODY PLETHYSMOGRAPH			
VC (L)	5.27	3.13	59.4
TLC (L)	6.9	4.51	65.4
ITGV (L)	3.25	3.58	110.2
ERV (L)	1.59	2.2	138.4
RV (L)	1.66	1.38	83.1
RV % TLC	24.49	30.58	124.9
PI MAX (kPa)	10.96	7.11	64.9
PE MAX (kPa)	14.51	11.55	79.6
DIFFUSING CAPACITY			
TLCO SB (mmol/min/kPa)	11.63	5.27	45.3
Hb (g/100ml)		16.2	
TLCOc SB (mmol/min/kPa)	11.63	5.06	43.5
KCO (mmol/min/kPa)	1.68	1.54	91.7
TLC-He (L)	6.75	3.42	50.7

6- computed tomography (CT)

CT provides detailed images of the pulmonary parenchyma, mediastinum, pleura and bony structures . The displayed range of densities can be adjusted to highlight different structures such as the lung parenchyma, the mediastinal vascular structure or bone.

A. (HRCT) High-resolution computed tomography	B. (CTPA)CT pulmonary angiography
✓Designed for detailed evaluation of interstitial structures of the lung. ✓Use narrow slice thickness (1-2 mm) compared with 5-10 mm for routine scans.	✓ Image data are acquired continuously as the tube and detector rotate within the gantry and the patient moves continuously through the gantry.
Indications	**Advantages**
1. Suspected interstitial lung disease. 2. Characterization of interstitial lung disease. 3. Characterization of solitary pulmonary nodules. 4. Diagnosis of bronchiectasis.	1. Critically ill patients 2. Children 3. Less volume of intravenous contrast 4. Permits greater processing of the raw data

A. uses thin sections to:
1. provide detailed images of the pulmonary parenchyma
2. particularly useful in assessing diffuse parenchymal lung disease
3. extent of emphysema

B. 1-used increasingly in the diagnosis of pulmonary thromboembolism , when it may either confirm the suspected embolism or highlight an alternative diagnosis.
2- useful in pre-operative assessment for lung resection surgery.

7- Lung Scans: V/Q

- A **lung scan** is a nuclear **scanning** test that is most commonly used to detect a blood clot that is preventing normal blood flow to part of a **lung.**
- (Tc) Technetium 99 m radionuclide is tagged to macroaggregated albumin to make small radioactive particles
- 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.

normal perfusion Q:

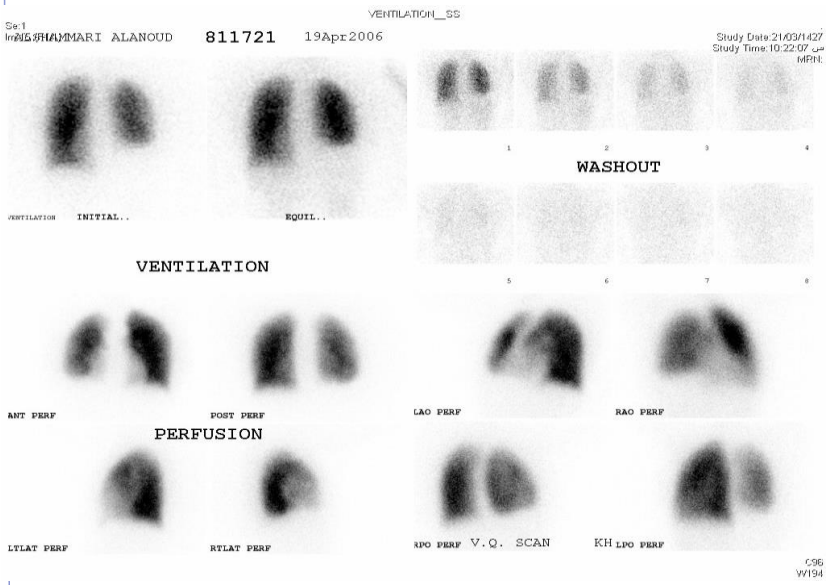
- When injected via peripheral venous site, the first capillaries encountered are the pulmonary capillaries
- If perfusion is present at the capillary level of the lungs, nuclear medicine perfusion image demonstrate activity in the periphery of the lungs

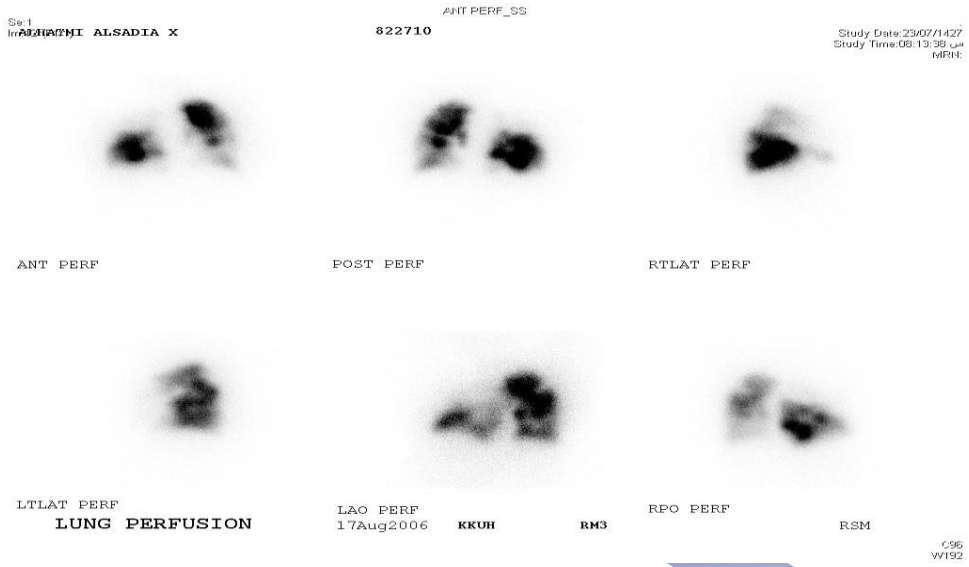
Defected perfusion Q:

- If there is an obstructing vascular lesion in the pulmonary arterial circulation:

blocked perfusion to the distal capillary level then → nuclear medicine perfusion image demonstrate no activity in the periphery of the lungs

Lung Scans: V/Q

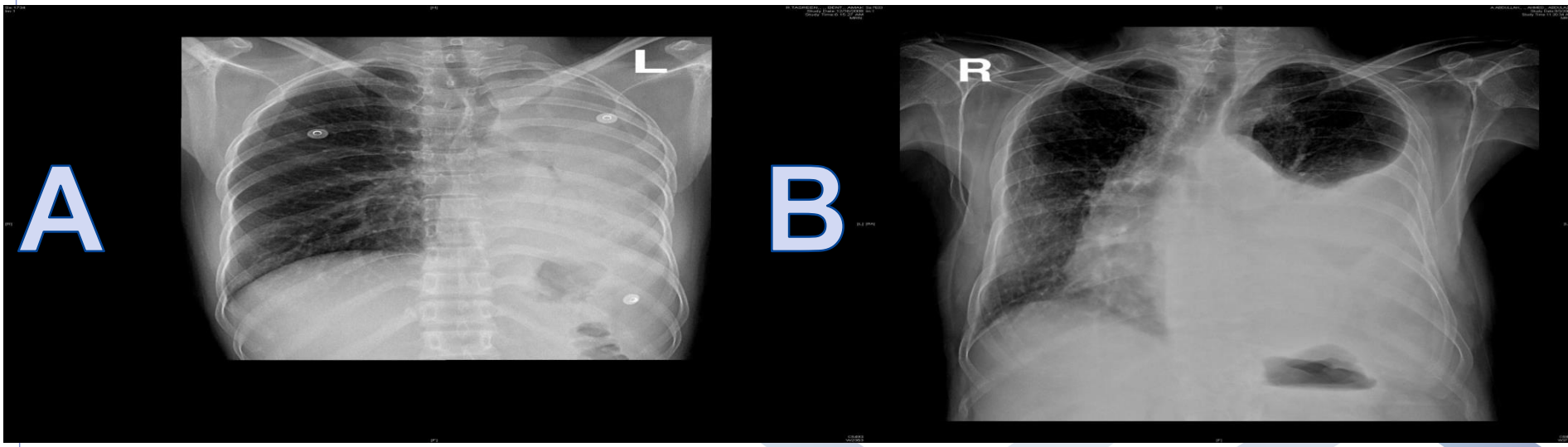




8- chest X-ray

- This is performed on the majority of patients suspected of having chest disease

A postero-anterior (PA) film provides information on the lung fields, heart, mediastinum, vascular structures and the thoracic cage.
lateral film, provides information if pathology is suspected behind the heart shadow or deep in the diaphragmatic sulci.



A: COLLAPSE

B :Pleural effusion

9- Ultrasound

1. sensitive at detecting pleural fluid
2. used to investigate the anatomy of an empyema cavity to facilitate directed drainage, and to guide needle biopsy of superficial lymph node or chest wall masses.
3. Endobronchial ultrasound is now possible using specialised bronchoscopes, and is used for imaging and sampling peribronchial lymph nodes. And Assessment of the mediastinum. We use it to determine the disease extent.

10- Ventilation–perfusion imaging

the utility of this technique is limited in patients with underlying lung disease, in whom up to 70% of scans may be indeterminate. It is increasingly being replaced by CTPA.

11- Pulmonary angiography

rarely used, particularly now that CTPA is widely available but is still useful in selected settings or to deliver catheter-based therapy.

12- Positron emission tomography (PET)

useful in the investigation of pulmonary nodules, and in staging mediastinal lymph nodes and distal metastatic disease in patients with lung cancer. The negative predictive value is high; however, the positive predictive value is poor.

13- Exercise tests

- Resting measurements are sometimes unhelpful in early disease or in patients complaining only of exercise-induced symptoms.
- can be helpful in demonstrating exercise-induced asthma.

MCQs

Case 1- A 32-year-old gentlemen presented to the ER with cough and shortness of breath for 1 week. From clinical examination: oxygen saturation is 91% in a room air, Blood pressure is normal, his temperature is 38.4, decreased chest expansion, stony dullness to percussion, abscess of breath sounds & the trachea shifted to the opposite side.

1. What is the most likely diagnosis?

a. Pleural effusion due to pneumonia
b. Lung collapse due pneumonia
c. Mass (tumor)
d. Consolidated lung

2. Mention one confirmatory test in this case.

a. Spiral CT scan
b. Chest x-ray
c. Later decubitus x-ray (or ultra sound)
d. MRI

Case 2- A 23-year-old man is seen in the ER for sudden onset, right-sided pleuratic chest pain that developed 30 minutes ago while he was watching TV. The patient also complains of difficulty breathing. He has no prior medical history, denies smoking and IV drugs. BB is 130/82 mmHg, pulse is 92/min, regular respiratory rate 20/min. Oxygen saturation is 98% on a room air. His body mass index is 18 kg/m2, Diminished breath sounds, hyperresonance dulnness, and decrease tactile fermitus are prominent in the right lung field. X-ray shows a 10% pneumothorax on the right.

3. Which of the following is the most appropriate initial management?

a. Needle decompression
b. Observation with supplemental oxygen
c. Open thoracotomy with oversewing of the pleural blebs and scarification of the pleura
d. Thoracoscpy with stapling blebs
e. Tube Thoracotomy with doxycycline pleurodesis

MCQs

Case 3- A 30-year-old athlete presented to your office complaining of intermitten wheezing. This wheezing begins shortly after running. The patient admits to smoking 1 to 2 packs of cigarettes per day for 5 years.

4. What finding would be consistent with asthma?

a. Hyperinflation on the chest x-ray
b. Improvement in FEV1 after bronchodilator
c. Low oxygen saturation on finger oximetry
d. Decreased FVC on PFT testing
e. Dyspnea on assuming a supine position

Case 4- A 64-year-old woman is found to have a right sided pleural effusion on chest x ray. Analysis of the pleural fluid reveals pleural fluid to serum protein ratio of 0.38, a lactate dehydrogenase (LDH) levels of 110 IU (normal 100-190), and plural fluid to serum LDH ratio of 0.46.

5. Which of the following disorders is most likely in this patient

a. Bronchogenic carcinoma
b. Congestive heart failure
c. Pulmonary embolism
d. Sarcoidosis
e. Systemic lopus erythematous

MCQs

Case 5- A 60-year-old man complains of shortness of breath 2 days after a cholecystectomy. He denies fever, chills, sputum production and pleuritic chest pain. On physical examination, tempreture is 37.2C (99F), pulse is 75, respiratory rate is 20, and blood pressure is 120/70. There are diminished breath sounds and dullness over the left base. Trachea is shifted to the left side. A chest x-ray shows a retrocardiac opacity that silhouettes the left diaphragm.

6. Which of the following is the most likely anatomical problem in this patient?

a. Postoperative pneumonia
b. Left lower lobe mass
c. Postoperative atelectasis
d. Acute bronchospasm
e. Tension pneumothorax

Case 6- A 30-year-old patient with history of mild persistent asthma (baseline peak expiration flow rate of 85%) presents to emergency department with shortness of breath and wheezing that has not relieved by her albuterol inhaler for past 12 hours. She was able to tolerate pulmonary function tests and a set was preformed.

7. Which of the following is the most likely test results?

a. Decreased FEV1, normal/increased FVC, decreased FEV1:FVC ratio, with bronchodilator FEV1 increased by 13%.
b. Decreased residual volume and total ling capacity
c. Increased FEV1, increased FVC, normal FEV1:FVC ratio
d. Increased residual volume, increased total lung capacity, increased FEV1.
e. Normal FEV1. decreased FVC, increased FEV1/FVC ratio.

Answers : 1-A 2-C 3-B 4-B 5-B 6-C 7-A

DONE BY

Faroq Abdulfattah	Raneem AlOtaibi
Ahmed Alhussain	Hajar AlOtaibi
Turky Alotaibi	Yara Alanazi

Medicine is a science of uncertainty and an art of probability

MEDICINE 433