

## **PBL – RESPIRATORY SYSTEM – DR. NATHEER OBAIDAT**

Dr started to talk about his specialty at the hospital which is (ICU-Pulmonary-Internal Medicine). Pulmonary medical branch is a subspecialty of internal medicine. Intensive Care branch could be mostly related to pulmonologists (ex: mechanical ventilation) but it is not exclusive for them as other specialties have something to do with ICU.

Our major topic is about COPD as organized but Dr preferred to talk about respiratory system in general.

Q : what do you know about respiratory system elements?

We all know about conductive system (nasal cavity + pharynx + larynx + trachea + bronchi + terminal bronchiole) .

But it is not enough , we need lung to do respiratory process through alveoli and interstitial fluid in order to exchange gases.

What do we need also ???

Diaphragm including nerves supplying it, as well as circulation which provides us with blood.

Have you ever heard about Pump system?

Pump system is that system that creates pressure difference between external atmosphere and alveoli (lung) through conducting system. It contains Diaphragm, respiratory muscles, abdominal muscles, external, internal intercostals muscles and ribs.

We still need an addition to manage ventilation that we need control system. What do you think this control system contains?

Brain through (respiratory center) gives orders to control ventilation, but these orders are all based on stimulus and signals. There are specific receptors provides these signals depending on significant signs like hypercapnia and hypoxia and maybe pH .

We call these receptors (chemo receptors) of two types: central and peripheral (carotid body). They look for hypercapnia mainly then hypoxia.

In some pathological cases they look for hypoxia first, that what would happen if the patient had COPD, so he /she would suffer from hypoventilation. The worst procedure a physician would do is giving the patient high concentrated Oxygen >> NO STIMULUS >> NO VENTILATION >> CO2 NARCOSIS (due to hypercapnia) .

So that was an introduction about the elements of respiratory system. Any disturbances of these elements would cause respiratory failure, they are basically:

1-conducting system

2-Pump system

3-Lungs

4-control system

### **Obstructive lung diseases :-**

Now let's talk about airway disease (COPD/ASTHMA):

COPD is one of the airway diseases affecting small bronchi caused by cigarettes smoking.

Pneumonia –for example- is not an airway disease and we call it lower respiratory tract infection it infects alveoli and if it affects more proximal parts then we call it bronchitis.

Q : what is the most common airway disease?

Asthma followed by COPD. COPD has two faces: Emphysema and chronic bronchitis, they are very different but both of them caused mainly by smoking. However, asthma also has two types: typical and atypical.

VERY IMPORTANT: Major differences between asthma and COPD:

1-Asthma is **REVERSIBLE** while COPD is **FIXED** (probably fibrosis). This is the most important point to differentiate between the two diseases.

2- Asthma affects all ages while COPD affects mostly people over 40 .

3-Asthma affects smooth muscles more than COPD .

4-Atypical asthma is allergenic while COPD not and they have different inflammatory response .

5-(important) Asthma comes as attacks/episodes ( not curable ) then back to normal while COPD never comes back normal .

note : Chronic asthma occur after many attacks of asthma , remodeling is associated with it .

Asthma and COPD share:

1- Being genetically affected .

2- They share narrowing of passages BUT we call this physiologically:

**AIR FLOW LIMITATION**, so they share air flow limitation.

Dr explained the last point, he said: you know when a patient has COPD or Asthma, FEV1 will decrease while FVC will not be affected in both diseases, so if the Ratio FEV1/FVC is decreased less than 80% we call this air flow limitation in both.

But how would we specify if it is COPD or Asthma depending on that Ratio?

Basically we use reversibility feature but we won't wait until asthma's attack ends because it will take us long time. We give the patient **BETA AGOINST** (sympathetic effect and bronchodilatation). we use short acting beta-2 agonist then we repeat the test and if the result changes by more than 12% then it is reversible so it is Asthma , otherwise it's irreversible .

They are different with regard to inflammatory response and if we discover that it is Asthma then the treatment will be related to inflammatory response more than COPD of course, so the major treatment is **STEROIDS**.

Steroids are not short acting (4-6 hours) and it consists of:

- 1- GLUCOCORTICOIDS (CORTISONE/CORTISOL)
- 2- MINERALOCORTICOIDS (for hypotension and adrenal problems)
- 3- SEX STEROIDS (ANDROGENS)

We mostly use glucocorticoids (hydrocortisone by IV) followed by other steroid given orally and we should monitor serum sodium and serum potassium as hypokalemia causes arrhythmia .

Another important point: **AIRWAY HYPER RESPONSIVENESS**

We test this by putting patient in front of challenge .we give the patient beta blocker or HISTAMINE to induce hyper responsiveness ,however they stopped using it because it leads to anaphylaxis and now it is replaced by methacholine test (when inhaled causes bronchospasm) :

If the lung function decreased by 20% per 8 mg then the test is positive >> COPD or Asthma.

Symptoms of airway diseases:

Cough, Wheezes, Short breath, and Chest tightness

However cough is caused by sinusitis and GERD so it is not specific and in this case we need tests like we learned. GERD and Sinusitis are negative at Methacholine test. These tests help us to exclude COPD and Asthma in case we have the same symptoms for other diseases. But we can't differentiate between COPD and Asthma themselves depending on previous tests because they share inflammation, infra limitation, atopy and hyper responsiveness (there are other pathological changes they share).

Other obstructive airway diseases : bronchiolitis obliterans affecting small airways (terminal bronchiole) causing organization due to fibrosis .

## **Restrictive lung diseases :-**

decrease in FEV1 and decrease in FVC so the ratio will be normal (80%) .

e.g. lung fibrosis , all the diseases that affect the interstitium (interstitial lung diseases) , pneumothorax and pneumonia (which is of two types infectious and non-infectious) .

now the non infectious pneumonia is autoimmune disease ; while the infectious pneumonia is classified depending upon the causative agent (bacteria, virus or fungi) .

notes : -

1- fungal infections is common in immunocompromised patients .

2- most common bacteria causing pneumonia is S. Pneumoniae , also it's the most common cause of severe pneumonia.

If we take 100 patients having S. Pneumoniae , 100 patients having Staph and 100 patients having legionella , then most of the patients having severe pneumonia is affected by Staph. and legionella .

while if we take 100 patients having severe pneumonia then most of them is due to S. Pneumoniae.

Now Bacterial pneumonia is divided into community acquired (most common S. Pneumoniae , H. Influenzae , Mycoplasma esp. in young adults) and hospitalized acquired (most common gram -ive bacteria , e.g. E. Coli , klebsiella , Pseudomonas etc) .

3- viral pneumonia ; most commonly Influenza and usually viral pneumonia is with bad prognosis (develop into severe pneumonia)

the last pandemic was due to H1N1 before it the avian influenza (H5N1) .

other viruses VZV , measles , CMV , Corona (SARS and MERS) .

4- Adeno virus has 5 clinical patterns : Pharyngitis , conjunctivitis , Pneumonia , Gastroenteritis , hemorrhagic cystitis .

Q : When do we say that the patient is having pneumonia ?

When the patient is having a new respiratory symptoms and new infiltrate chest x-ray (Typical x-ray infiltrate is called consolidation) .

Q : During ER what are the questions that you ask the patient to confirm he's having pneumonia ?

Checking proper oxygen delivery (to grade the severity of his pneumonia .. hypoxia , dyspnea) .

and we use CURP 65 (British system) :

note : each one scores a point we accordingly we can classify them into a scale .

1- Confusion .

2- high urea and abnormal renal function .

3- Respiratory more than 18 or 20 .

4- Systolic pressure less than 90 .

5- Age is more than 65 .

- If more than 3 points then it's severe pneumonia .

- 0-1 mild pneumonia (treated outside the hospital) .

- 1-2 is treated in the floor of the hospital .

- 3-5 is treated in the ICU .

notes : -

1- We don't do sputum culture due to contamination with normal flora .

2- Problems with blood culture is not diagnostic as only positive in 30% of the patients having pneumonia .

3- Modern diagnostic test for pneumonia is PCR , especially for viral , mycoplasma , chlamydia .

4- While S. Pneumoniae and legionella called urine antigen for legionella and strep.

Other restrictive lung diseases : lung fibrosis , interstitial lung diseases , ARDS and lose of lung volume (e.g. collapse , atelectasis) , congenital hypoplasia of the lung (called Mcloayd syndrome -not sure about the spelling-) --> pulmonary artery is not well developed and small lung , also surgery can lead to restrictive lung diseases .

Q : What's the difference between collapse and atelectasis ?

atelectasis is closure of the alveoli while collapse is closure of many alveoli (intralumen lesions due to secretions , tumor , blood clot or compressed from outside due to tumor or lymph nodes) .