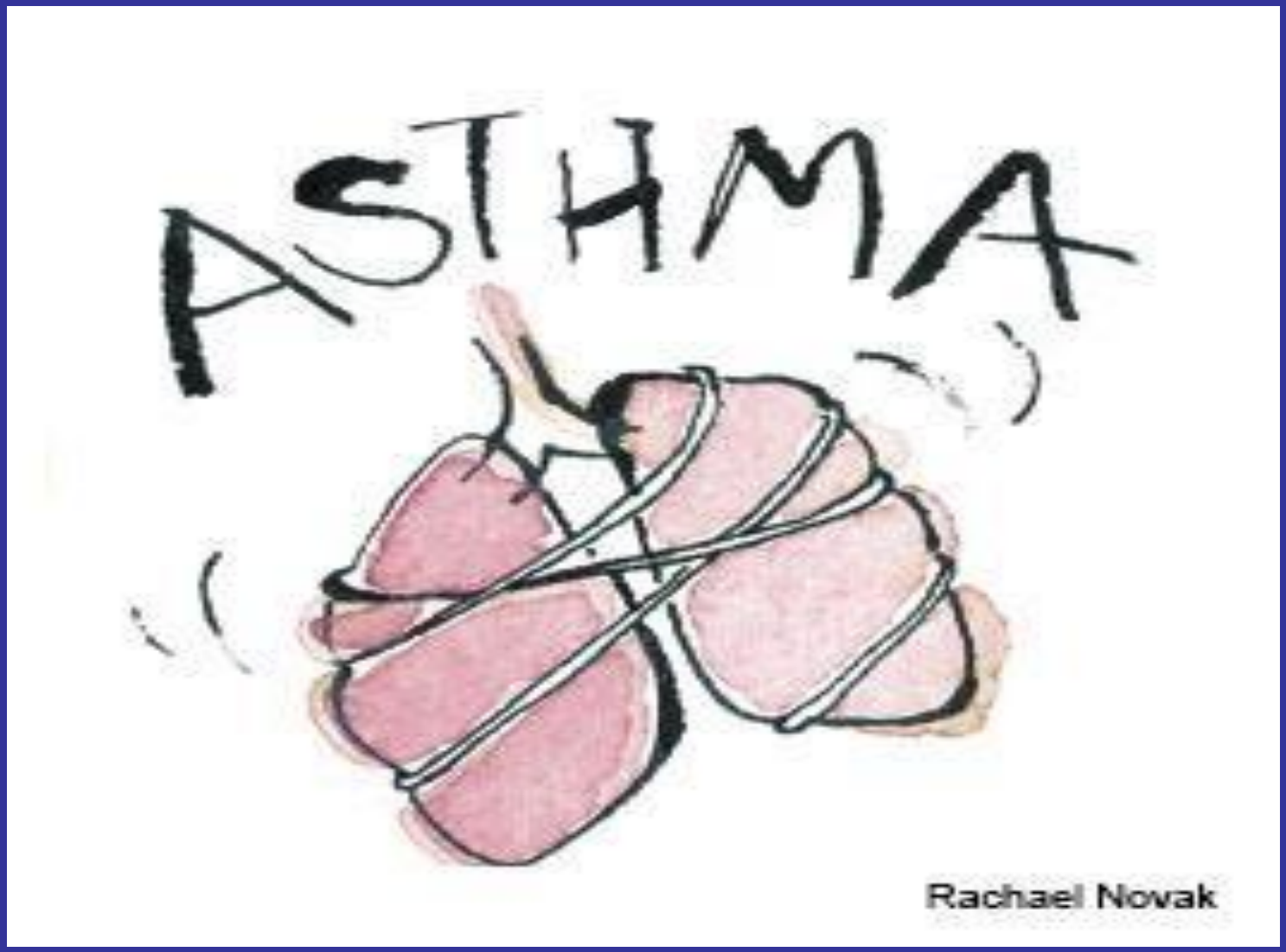
Management of Severe Asthma and COPD

PROF. ABDULAZIZ H. ALZEER


ASTHMA
Rachael Novak

Learning Objectives

Asthma

- Definition
- Pathology and Pathophysiology
- Factors that triggers Asthma
- Manifestation and How To assess the severity of Asthma
- Treatment

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Definition:

- Asthma is a chronic lung disease due to inflammation of the airways resulted into airway obstruction. The obstruction is reversible.
- Asthma is the most common chronic disease particularly among children.
- Any thing in medicine is inflammation, surgery is inflammation, any disease is basically an inflammation, infection is inflammation, trauma is an inflammation, asthma is an inflammatory disease of the airwayThe hall mark of asthma are tow things inflammation and airway obstruction

Symptom:

- Cough
- Wheeze
- Tightness in the chest
- Shortness of breath
- Sometimes nocturnal symptoms Very important night symptoms is suggestive that asthma is not will controlled

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Acute Severe Attack of Asthma (StatusAsthmaticus):

- Severe asthmatic attack unresponsive to repetitive courses of beta-agonist therapy
- A medical emergency that requires immediate recognition and treatment

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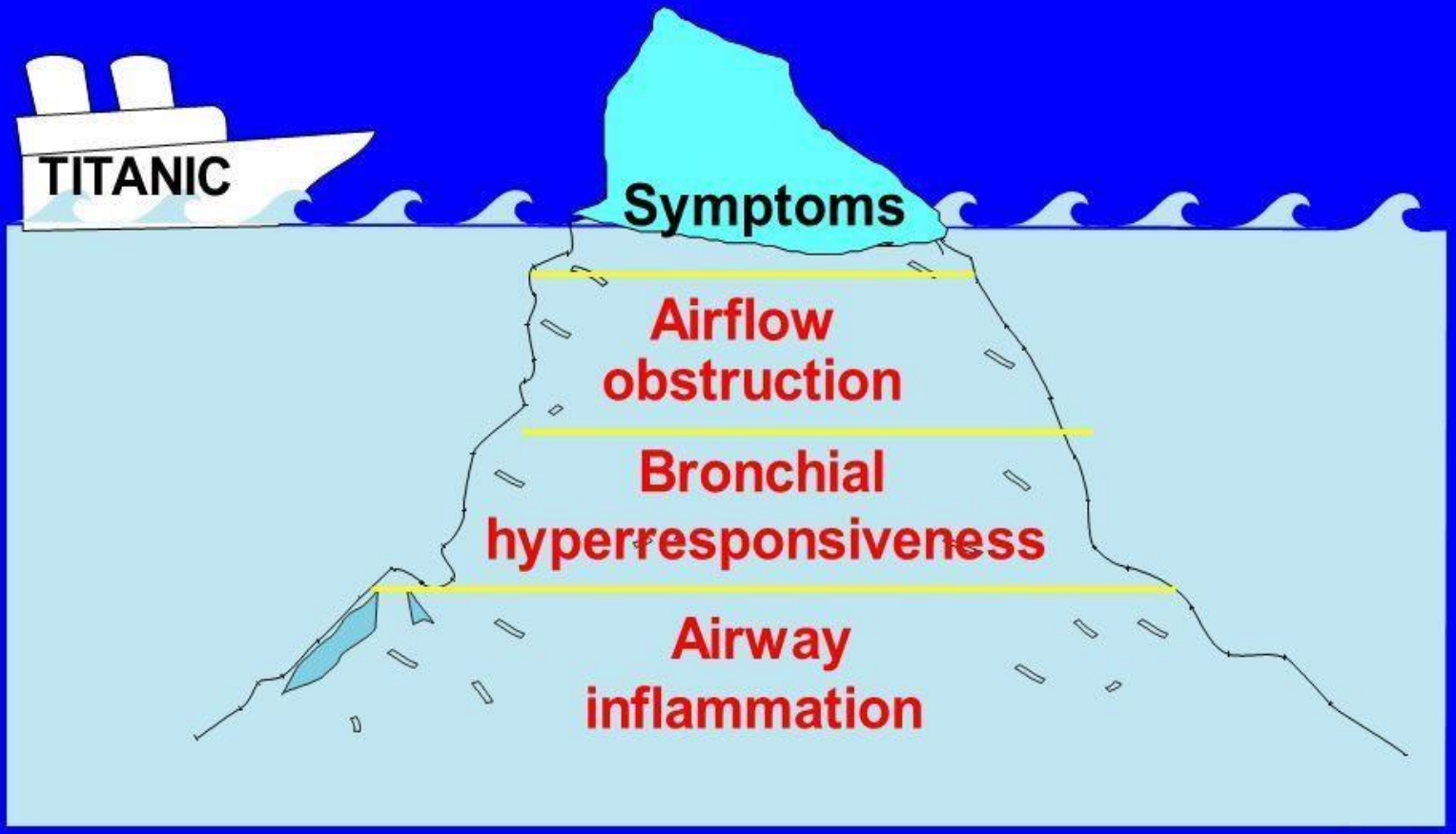
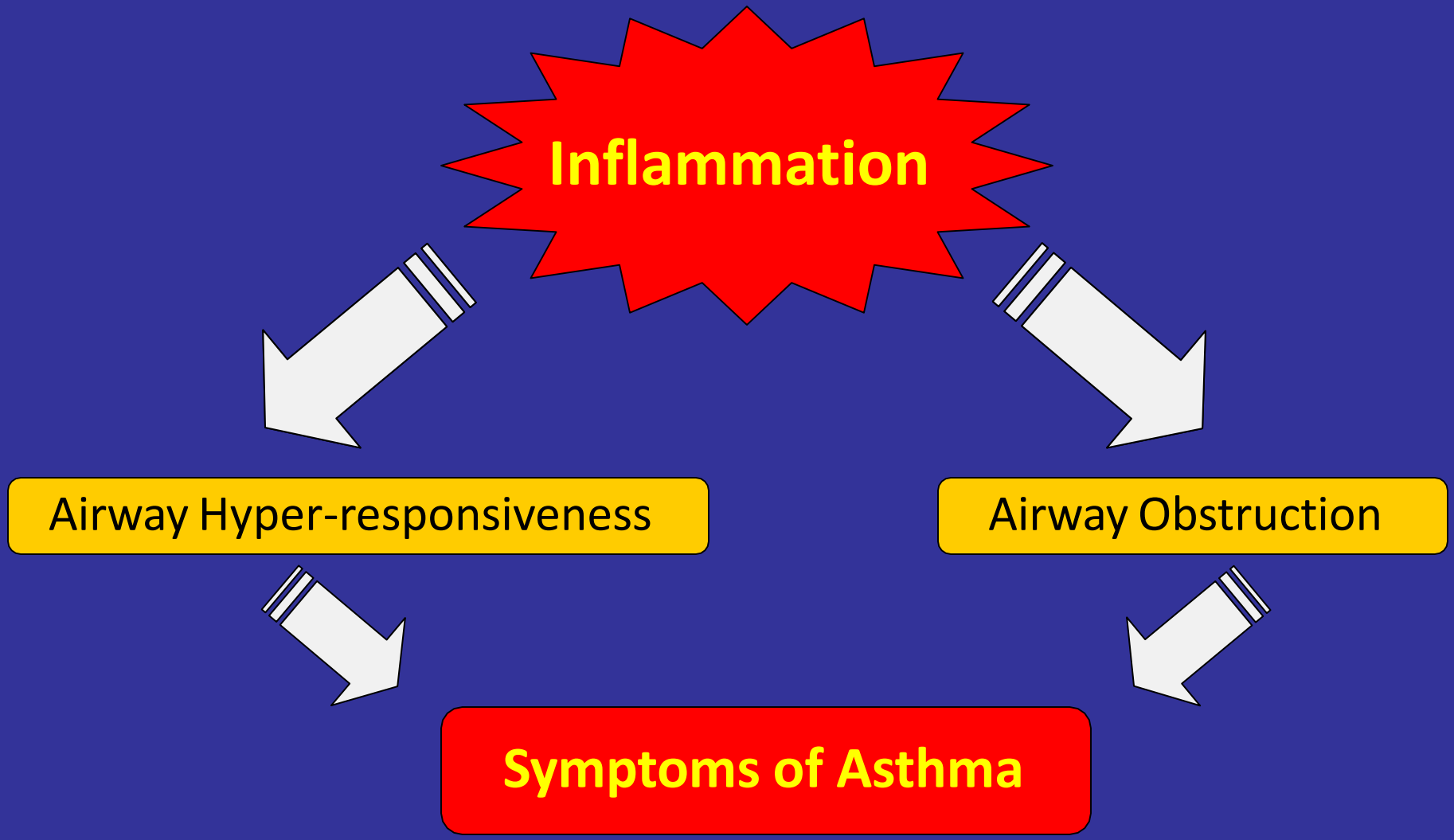
The "Tip" of the Iceberg



Pathology of Asthma



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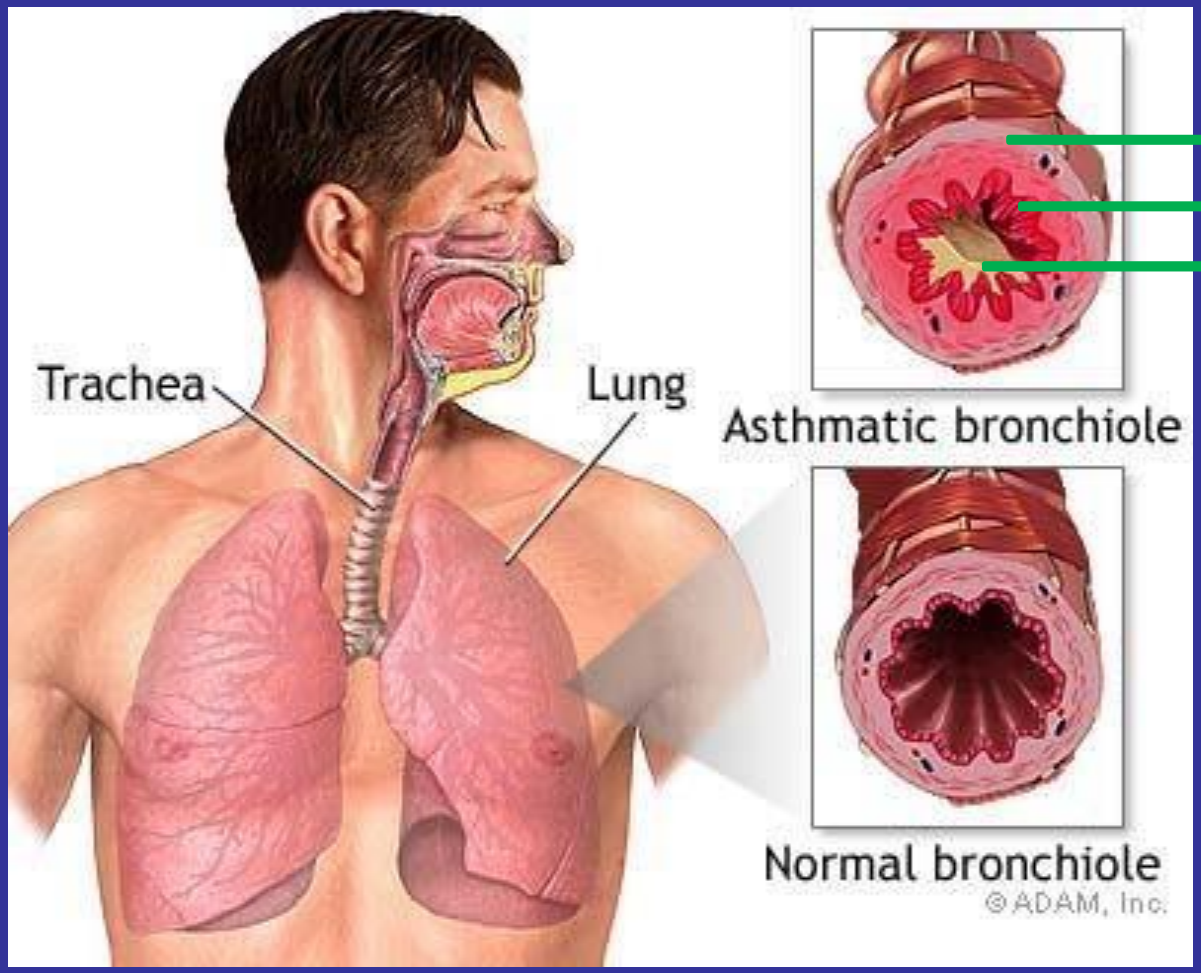


Smooth muscle contraction

Mucosal edema

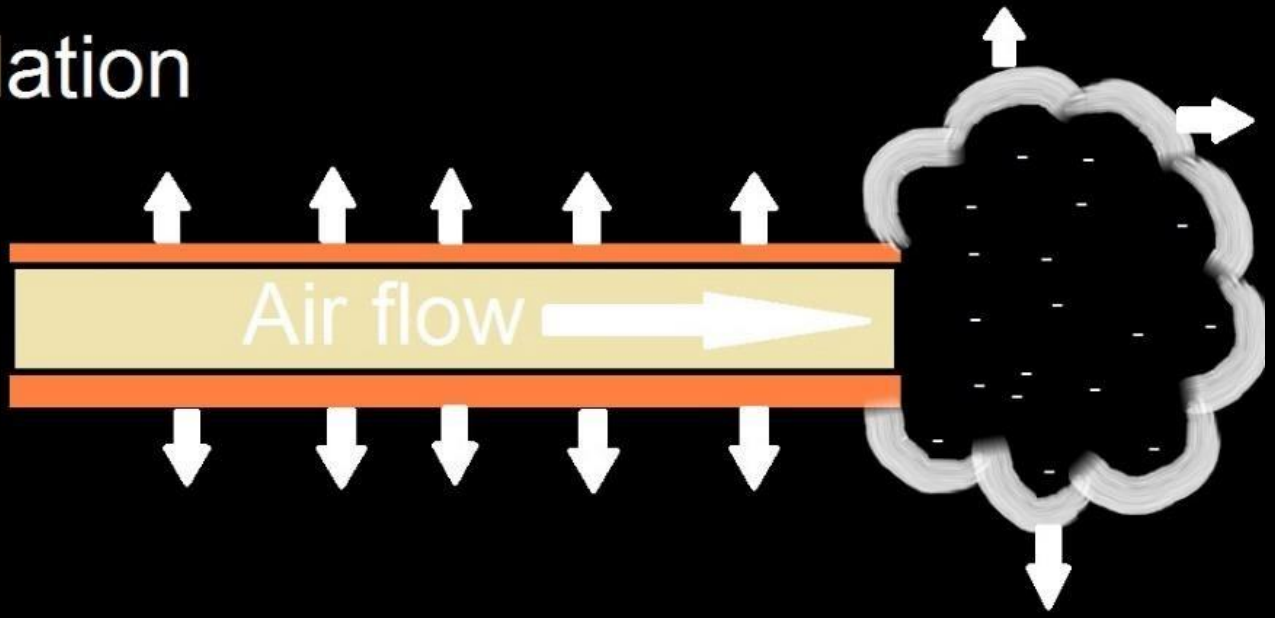
Excessive secretions

excessive secretion contributes to air flow obstruction it is an immediate problem in sever asthma and they call it mucus impaction it obstruct airway and causing very sever obstruction symptoms and sometime it is difficult to treat these patients thats why sometimes we need to do bronchoscopy

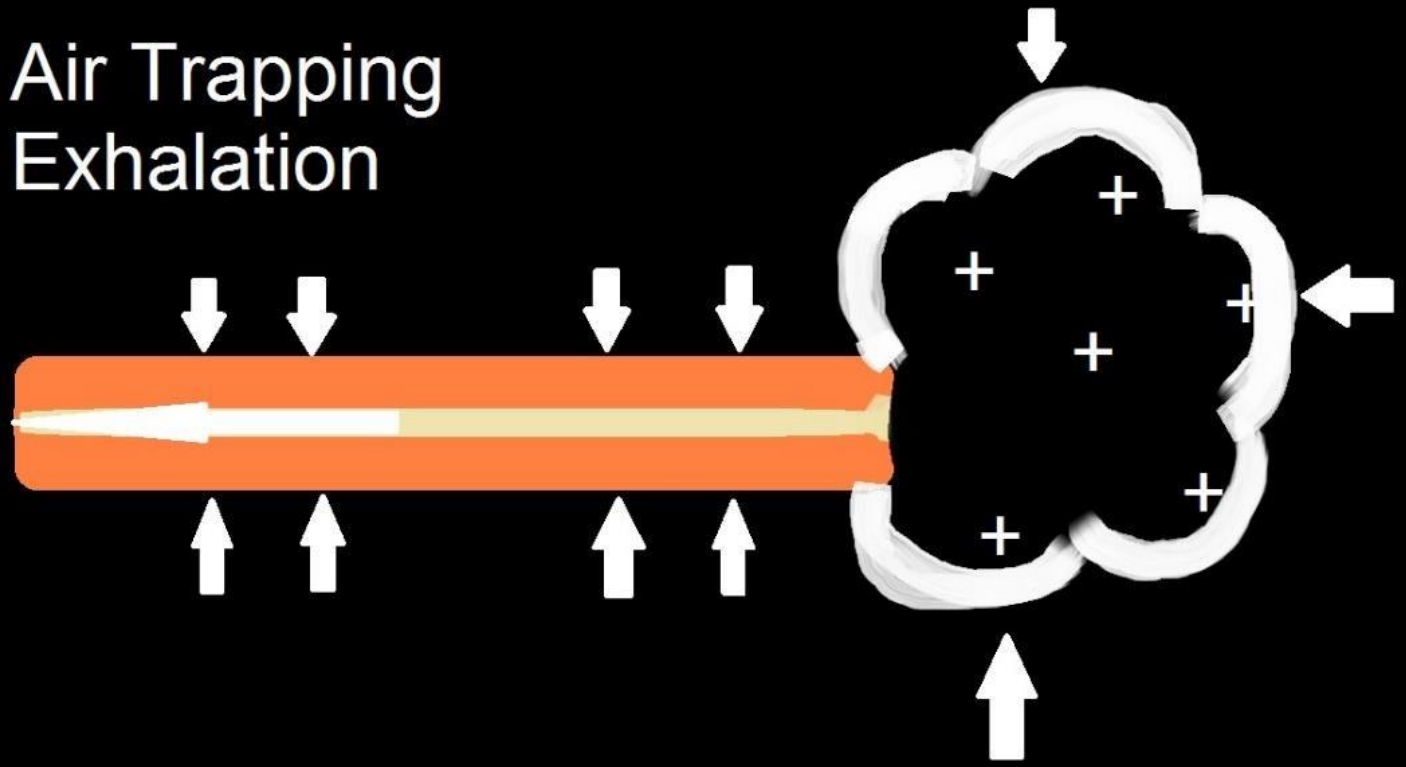
Other thing that contributes to air way obstruction is mucusal erythema

Third one is smooth muscle contractions So when you treat these patients you have to target these factors

Inhalation

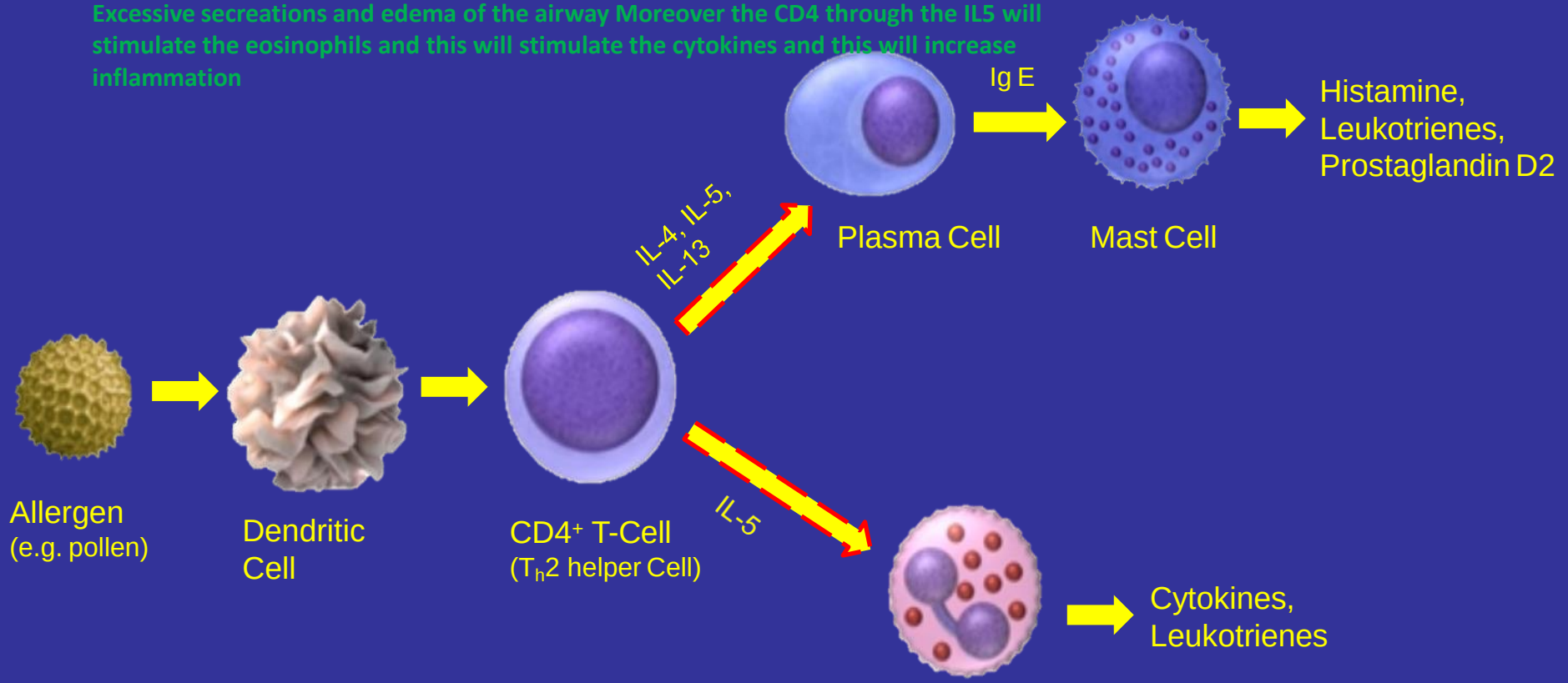


Usually inhalation is an active process during inhalation there is reduction of intrathoracic pressure and air will flow into alveoli and what happen in asthma they inhale without any problem the problem is in expiration it is obstructed you see the air is trapped and there is positive pressure the patient is Trying to push the air out of the alveoli and this is why they have hyperinflation and air trapping inside the lung and that is not comfortable because The lung is not relaxed so they have to put more energy more effort to empty the air from the lung.

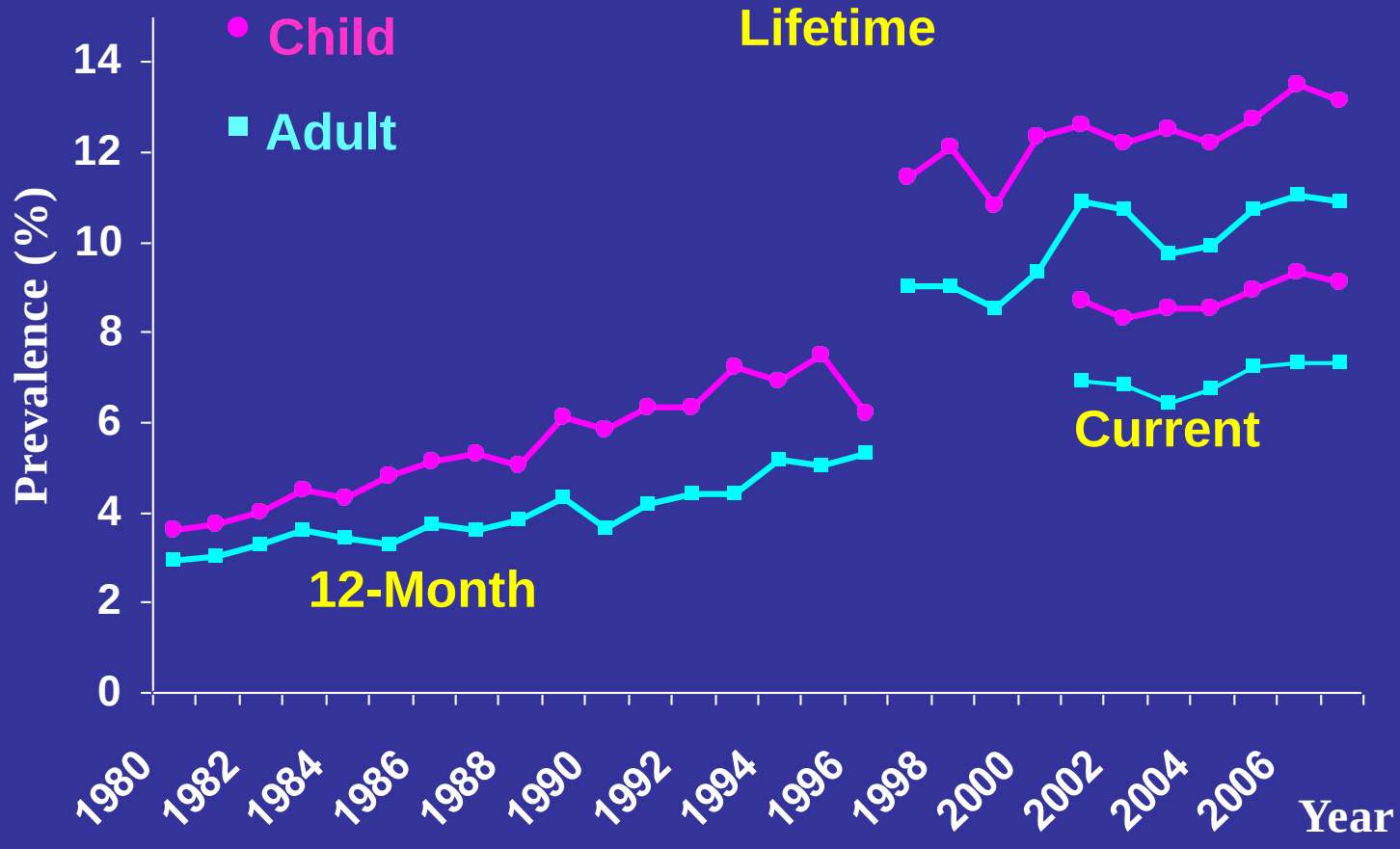


Pathogenesis of Asthma

Allergen will be trapped by dendritic cell as you all know dendritic cell is an antigen presenting cell then the dendritic cell will present it to CD4 cells, then IL4, IL5, IL13 will produce plasma cell and it will produce antibodies which is ige and this will stimulate mast cell to produce histamine and prostaglandins then it will cause muscle contraction, Excessive secreations and edema of the airway Moreover the CD4 through the IL5 will stimulate the eosinophils and this will stimulate the cytokines and this will increase inflammation

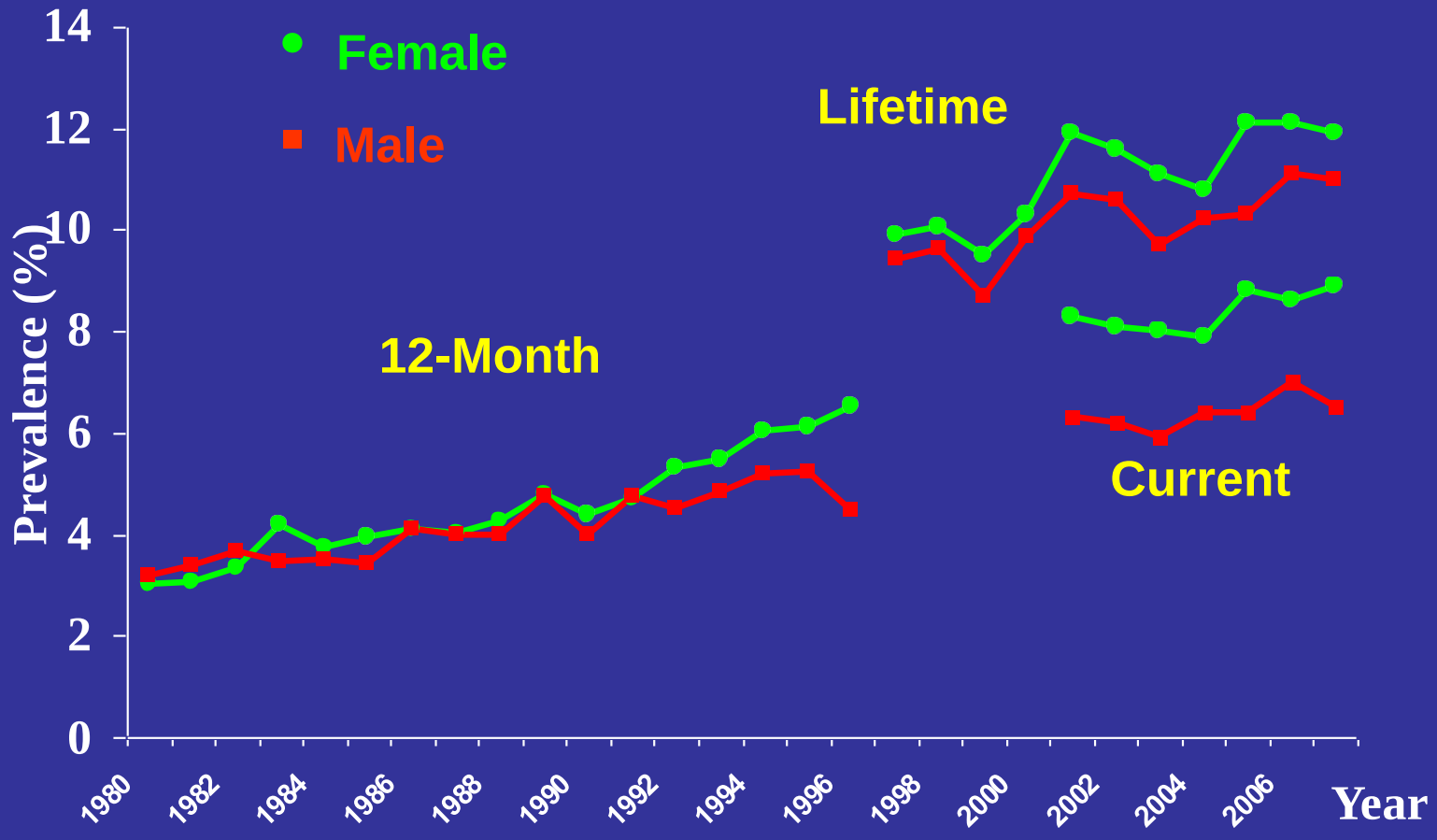


Child and Adult Asthma Prevalence United States, 1980-2007



Source: National Health Interview Survey; CDC National Center for Health Statistics

Asthma Prevalence by Sex United States, 1980-2007



Source: National Health Interview Survey; CDC National Center for Health Statistics

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Causes:

- Genetic
- Atopy If someone have allergic rhinitis or dermatitis is more likely to have asthma
- Childhood respiratory infections
- Exposure to allergens
- Drugs Aspirin, non steroidal anti-inflammatory drugs, B-blockers

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Asthma Triggers:

Types of substance	Example
Air pollutants	Tobacco smoke, perfumes, wood dusts, gases, chemicals, solvents, paints
Pollen	Trees, flowers, weeds, plants
Animal dander	Birds, cats, dogs
Medication	Aspirin, anti-inflammatory drugs, B-blockers
Food	Eggs, nuts, wheat

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MANIFESTATION OF SEVERE ASTHMA

History of

- Past history of sudden severe exacerbation
- prior intubation and mechanical ventilation for asthma
- prior admission to ICU due to severe attack of asthma
- three or more emergency visits for asthma in the past year
- use of more than 2 canisters per month of inhaled short acting β2 agonist
- current use or recent withdrawal from systemic corticosteroids

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SEVERE ASTHMA:

Physical Examination

HR > 115/min

- RR > 30/min
- Pulsus paradoxus > 10 mmHg
- Unable to speak Because They breath in high volume
- Cyanosis
- Silent chest This is very bad sign means the patient is in severe airway obstruction
- change in mental status This is very important means the patient is severely hypoxic and acidimic and hypercapnic and need immediate treatment
- peak expiratory flow meter <200 L/min

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Flowmeter

Expiratory flow meter

Asthma

Arterial Blood Gases

Acideamia

Hypoxiamia

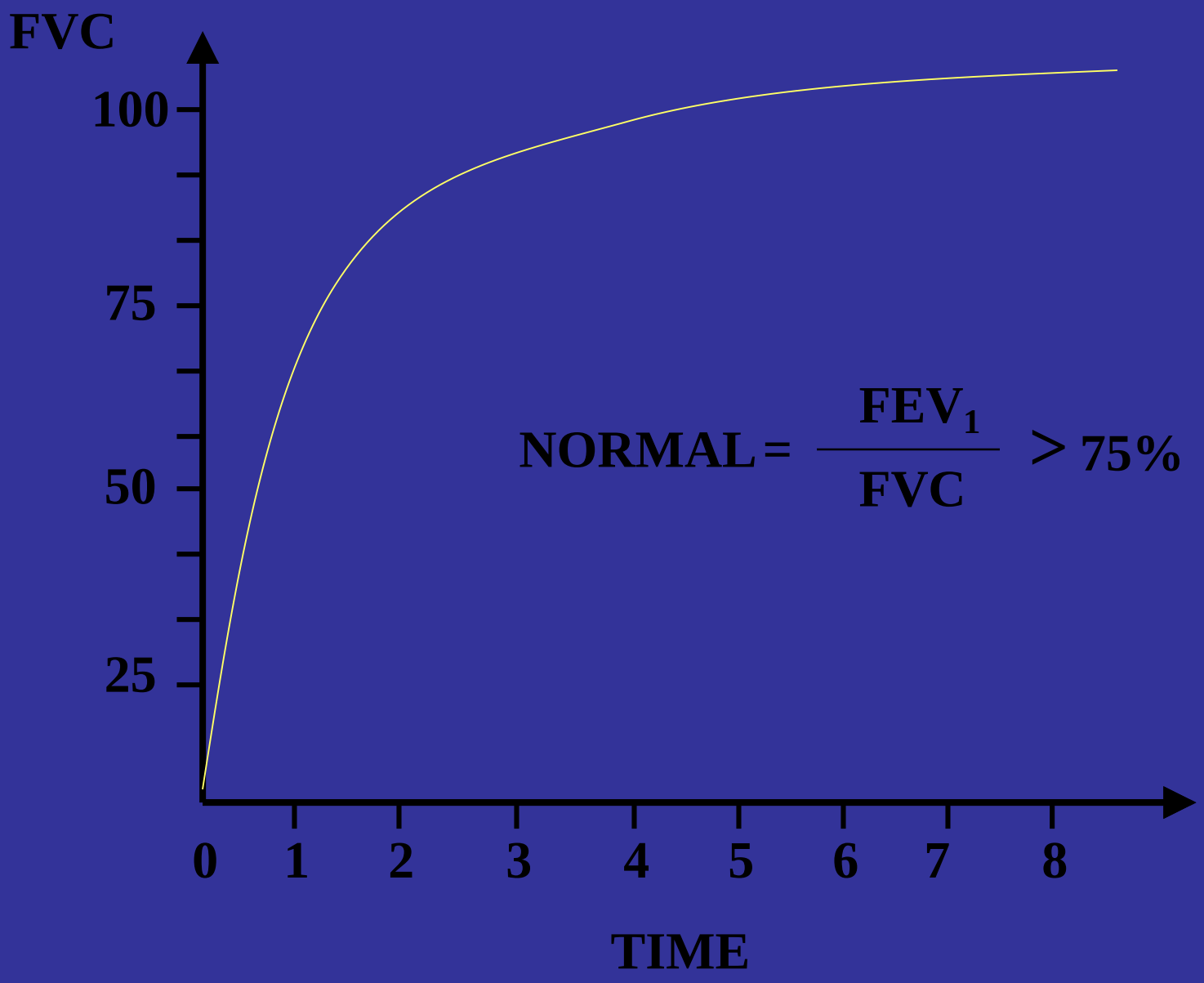
1-When tha patient presented to ER with asthmatic attack and you do blood gases and you find PH is high means the patient is in alkalosis and he patient pco2 is lower than normal so it is respiratory alkalosis this is stage one if you didn't read the situation the patient will go to stage 2

Stage 2 the ph will become normal if the patient is in sever asthma and the PH is normal you have to be careful this mean the patient severely troubled because he is in stage 2 and if pco is normalize it is not a good sign because the patient is going into more severe attack and now he start to retain co2 and typically here you will find and po is low this is very bad if you don't read this situation he will go to stage 3

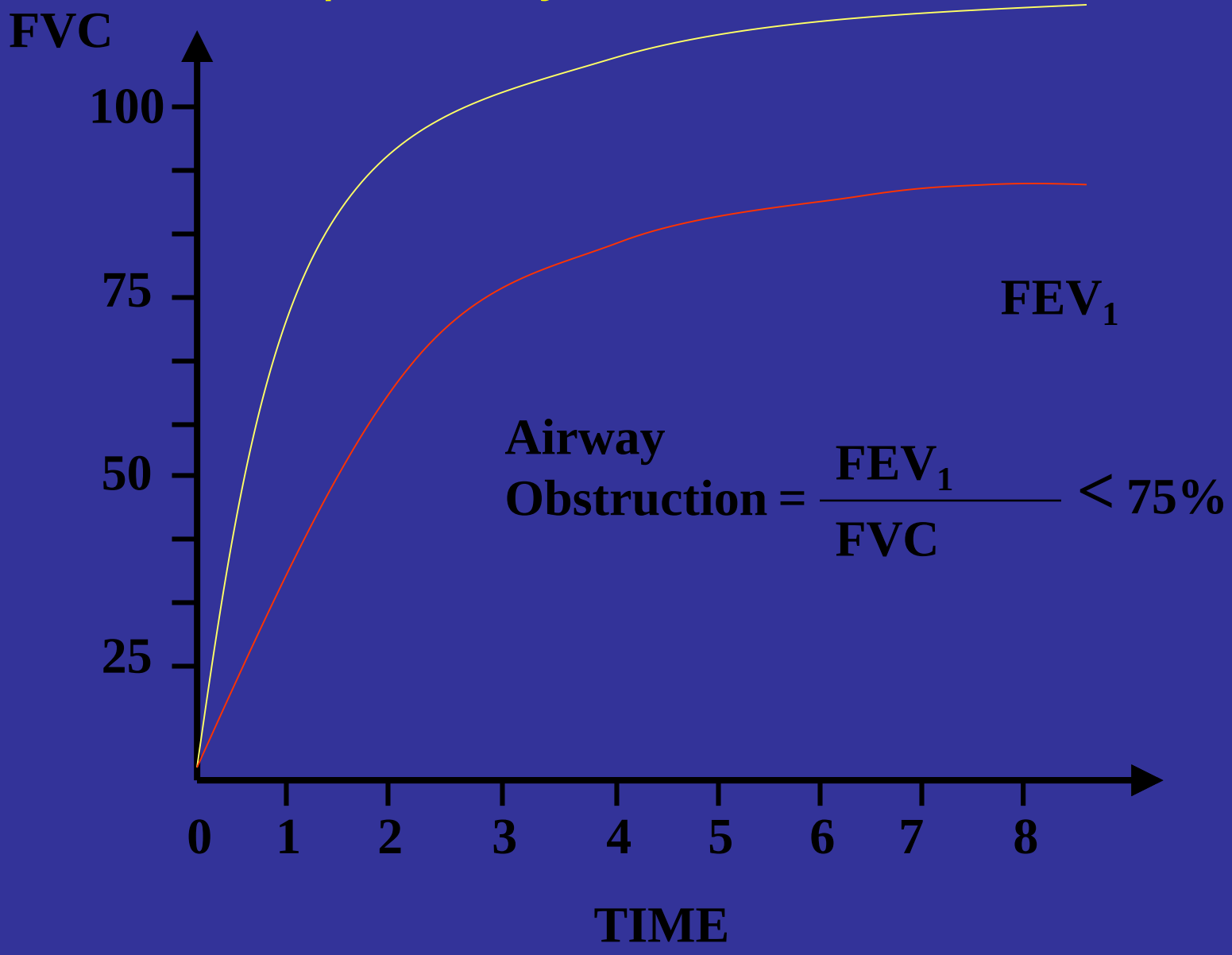
Stage 3 when the PH is becoming low the patient is acidimic this means he has respiratory acidosis and obviously more hypoxicIn ER when the patient present with normal ph and pco2 it means he will progress to stage 3 it not normal

	pH	PCO_2	PO_2
1.	↑	↓	N or ↓
2.	N	N	↓
3.	↓	↑	↓↓

Spirometry Performed for Stable Asthmatics



Spirometry for Stable Asthmatics



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Treatment for Stable Patient:

Patient/Doctor Relationship

- Educate continually **Educate theme to avoid allergen and How to use inhalers**
- Include the family **Specially in children**
- Provide information about asthma
- Provide training in self-management skills

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Treatment for Stable Patient:

Exposure Risk

- Reduce exposure to indoor allergens
- Avoid tobacco smoke
- Avoid vehicle emission
- Identify irritants in the workplace

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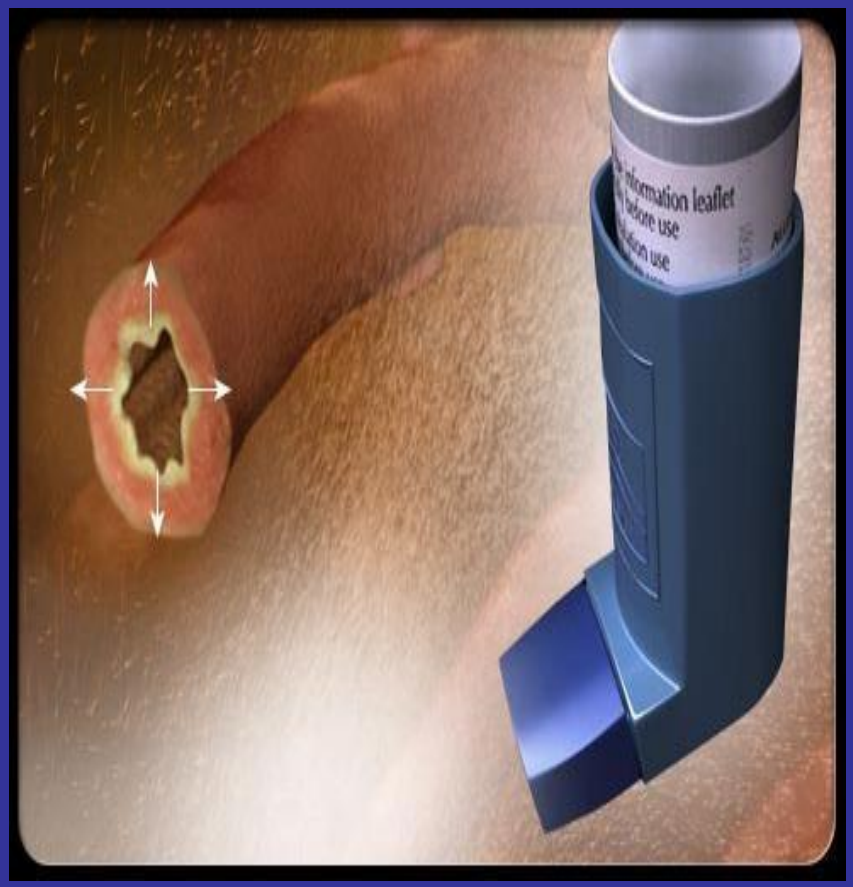

Quick Reliever

- Used in acute attacks
- Short acting beta$_{2}$- agonists
- Begins to work immediately and peaks at 5-10 minutes

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Inhalers and Spacers

Spacers can help patients who have difficulty with inhaler use and can reduce potential for adverse effects from medication.

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Nebulizers

- Machine produces a mist of medication
- Used for small children or for severe asthma
- No evidence that it is more effective than an inhaler used with spacers

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Inhaled Corticosteroids

- Main stay treatment of asthma
- Reduce airway inflammation

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Anti- Ig E

Anti-IL 5

- For treatment of moderate to severe allergic asthma
- For treatment of those who do not respond to high dose of corticosteroids

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Treatment of Severe Asthma

- Oxygen
- High doses of bronchodilator **Usually We give ventolin back to back in 3 doses We give it every 20 minuts**
- Systemic corticosteroids
- Intravenous fluids
- ICU management

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Initial Assessment

Treatment

- Oxygen

High concentration of oxygen to achieve O2 Sat >92%

Failure to achieve appropriate oxygenation and acidemia

↓

assisted ventilation

2 things kill the patient hypoxia and acidemia Hypercapnia will not kill the patient So correct o2 and PH

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High doses of inhaled bronchodilator

- Short acting B2 agonist **Every 20 minutes**
  - via nebulizer OR
  - via metered dose inhaler through a spacer device
- An inhaled anticholinergics

  (Ipratropium bromide)

  It has synergistic effect with B2 agonist

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Systemic Corticosteroids Give it orally if the patient is stable but generally we give it iv

- intravenous hydrocortisone for those who are unable to swallow or in case of vomiting or disturb level of consciousness
  - It decreases mucus production
  - Improves oxygenation
  - Decreases bronchial hypersensitivity

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Intravenous Fluids

- To correct dehydration and acidosis
- Normal saline + sodium bicarbonate/lactate infusion
- Potassium supplement to treat hypokalemia induced by salbutamol Beta 2 agonist and steroid will reduce k levels

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Treatment of Acute Attack of Asthma: If the previous meds didn't work

For severe cases consider:

- IV Mg SO_4

  Relaxes smooth muscles

- Heliox Low density gas it can improve the laminar flow as you know the flow in asthma is turbulent flow يعني مخربط كذا The laminar flow طبقي يعني

  Improves laminar flow

- Ketamine

  Anesthetic agent induced bronchodilation

  It has anti-cholinergic effects

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Non-invasive Mechanical Ventilation Treatment

If the patient is not responding we can use non invasive mechanical ventilation We can put a mask this is c pap machine It can improve certain patient

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Indication for ICU Admission

- Drowsiness
- Confusion
- Silent chest
- Worsening hypoxemia despite supplemental oxygen
- Acidemia and hypercapnia

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Mechanical Ventilation

Initial Goals:

- To correct hypoxemia
- To achieve adequate alveolar ventilation
- To minimize circulatory collapse
- To buy time for medical management to work

Indication:

- Coma
- Respiratory arrest
- Deterioration of arterial gas despite optimal therapy
- Exhaustion, confusion, drowsiness

COPD

Chronic Obstructive Pulmonary Disease

Learning Objectives

Chronic Obstructive Pulmonary Disease (COPD)

- Definition
- Risk Factors
- Emphysema
- Chronic Bronchitis
- Treatment and Prevention

Chronic Obstructive Pulmonary Disease (COPD)

- Limitation of expiratory flow
- Chronic progressive disease
- Associated with airway inflammation
- Generally irreversible airflow obstruction
- Related to smoking

Chronic Obstructive Pulmonary Disease (COPD)

COPD Exacerbation:

- an event in the natural course of the disease characterized by a change in the patient's baseline dyspnea, cough and/or sputum that is beyond day to day variation and is acute in onset.

www.goldcopd,org

Chronic Obstructive Pulmonary Disease (COPD)

- Emphysema
- Chronic bronchitis
- Small airway disease

COPD

COPD Facts:

- COPD is the 4th leading cause of death in the United States
- COPD has higher mortality rate than asthma
- Leading cause of hospitalization in the US
- 2nd leading cause of disability

COPD

COPD Risk Factors

- Smoking: most common cause
- Environmental exposure
  - chemicals. Dust, fumes
  - second hand smoke
- Alpha-1 anti-trypsin (AAT) deficiency

It will Come in any exam I'm telling you
It is a protein produced by the liver from hepatocytes it is anti proteas in fact WBC produce proteases which is toxins And it destroys the elastic recoil of the lung so if it deficient basically the elastic recoil will be destroyed and the patient will develop COPD So it is rare disease but if you See a patient with emphysema at young age group and particularly not smokers you have to think of AAT

Chronic Obstructive Pulmonary Disease (COPD)

COPD

Alpha 1 Anti-Trypsin (AAT)

- is a serine protease inhibitors
- Inhibit neutrophil elastase which break down elastin
- Synthesized and secreted by hepatocytes
- PiZZ phenotype is associated with low plasma concentration of AAT

  i.e. associated with development of emphysema

Emphysema

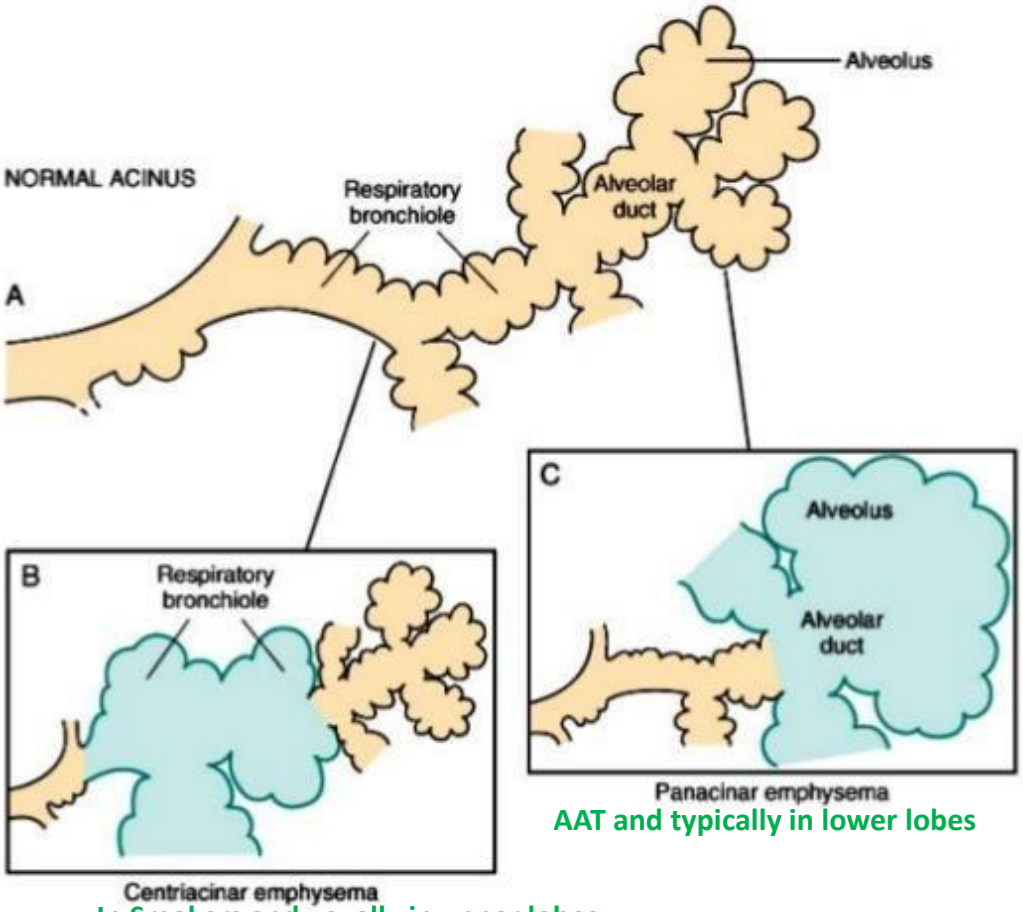
Emphysema

Definition: Abnormal permanent enlargement of the airspaces distal to the terminal bronchiole, accompanied by destruction of their walls and without obvious fibrosis.

Basically it is not an airway disease it is an alveolar disease

Spaces in parenchyma > 1mm = Abnormal

Emphysema



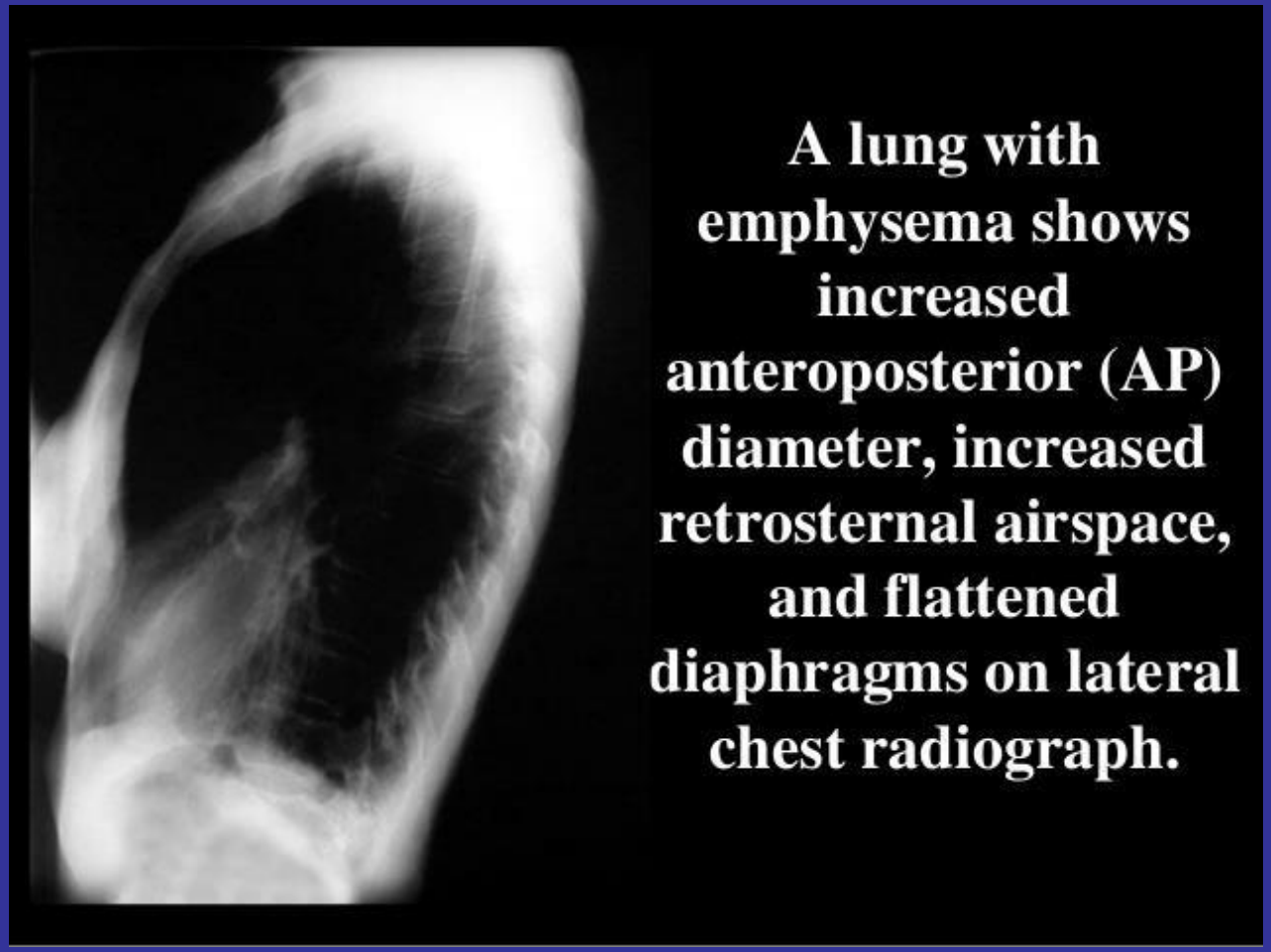
AAT and typically in lower lobes

In Smokers and usually in upper lobes

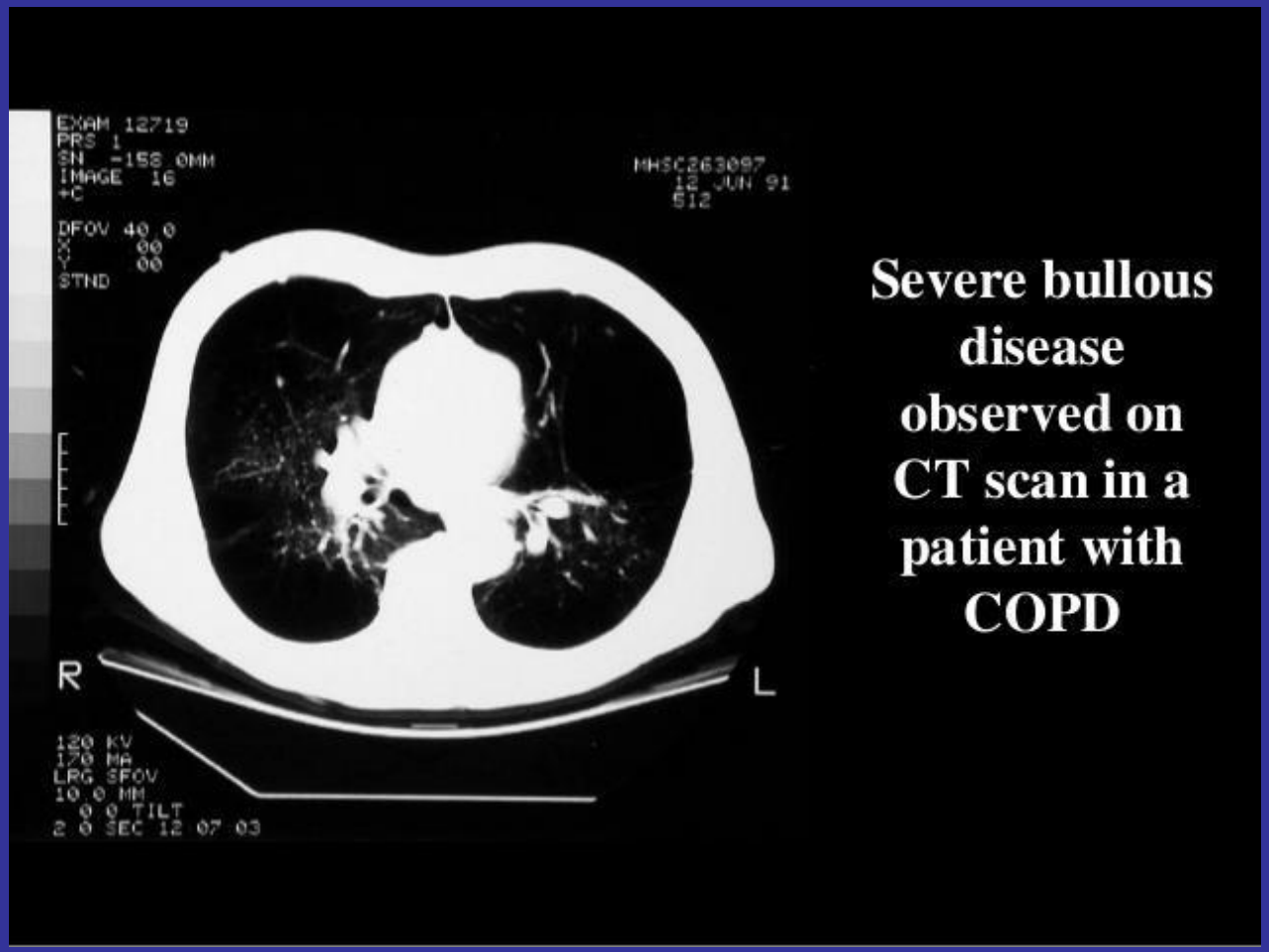
Emphysema

Posteroanterior (PA) and lateral chest radiograph in a patient with severe chronic obstructive pulmonary disease (COPD). Hyperinflation, depressed diaphragms, increased retrosternal space, and hypovascularity of lung parenchyma is demonstrated.

Emphysema


A lung with emphysema shows increased anteroposterior (AP) diameter, increased retrosternal airspace, and flattened diaphragms on lateral chest radiograph.

Emphysema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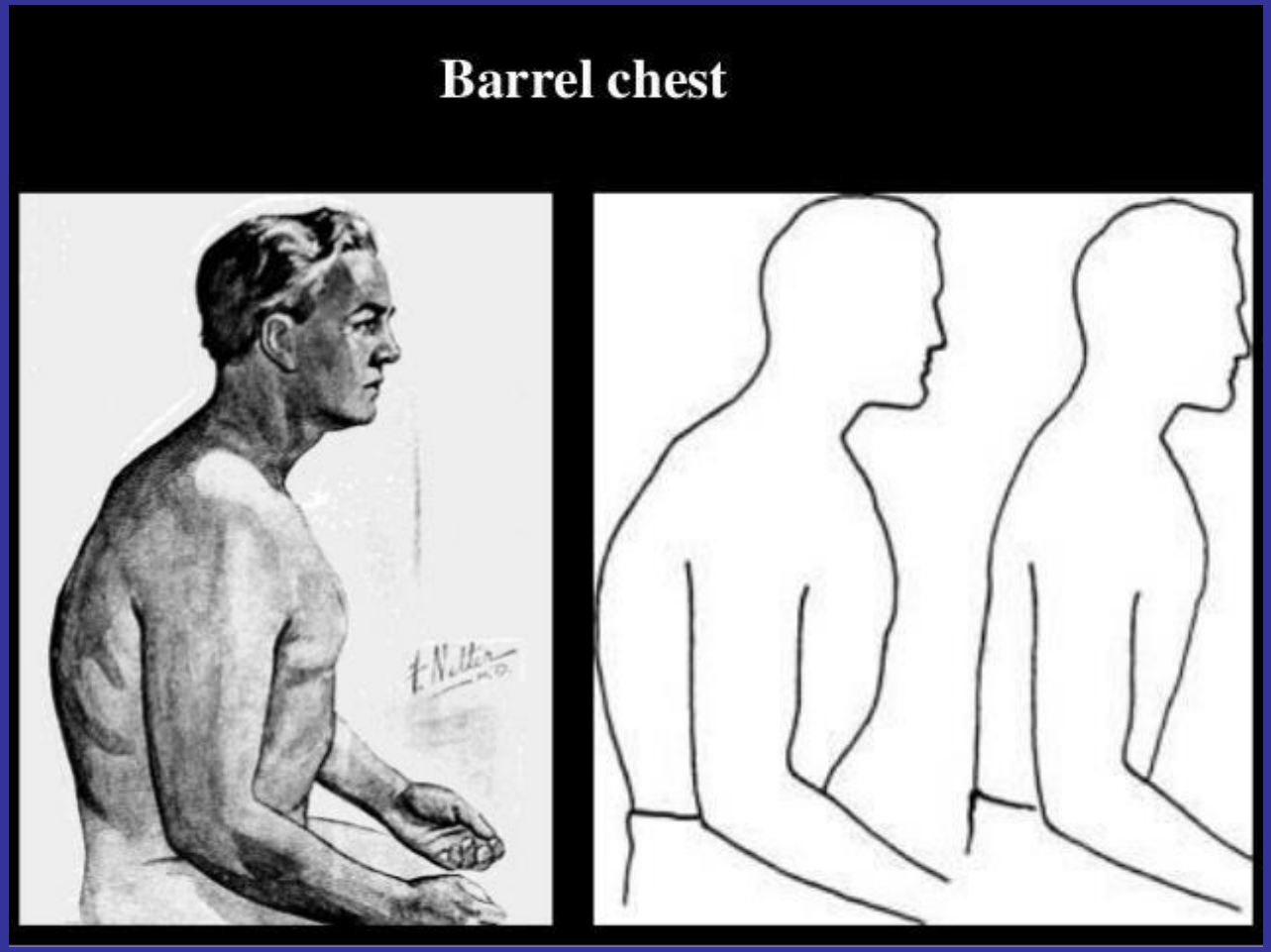
Severe bullous disease observed on CT scan in a patient with COPD

Emphysema

COPD



Anteroposterior diameter is prolonged

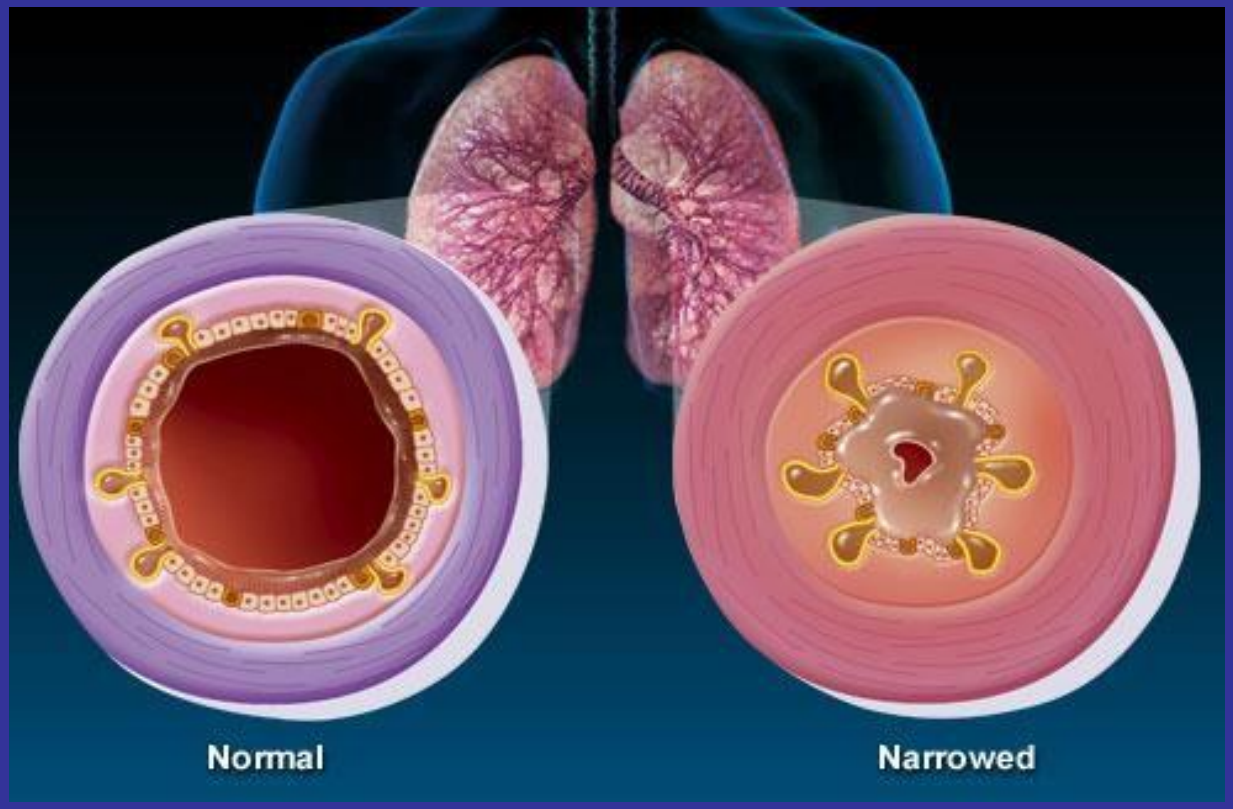
Chronic Bronchitis

Definition

- Cough for 3 months in a year for 2 consecutive year

Bronchitis is clinical diagnosis, unlike emphysema which is histological diagnosis or radiological
In bronchitis You can predict the diagnosis By history

Chronic Bronchitis



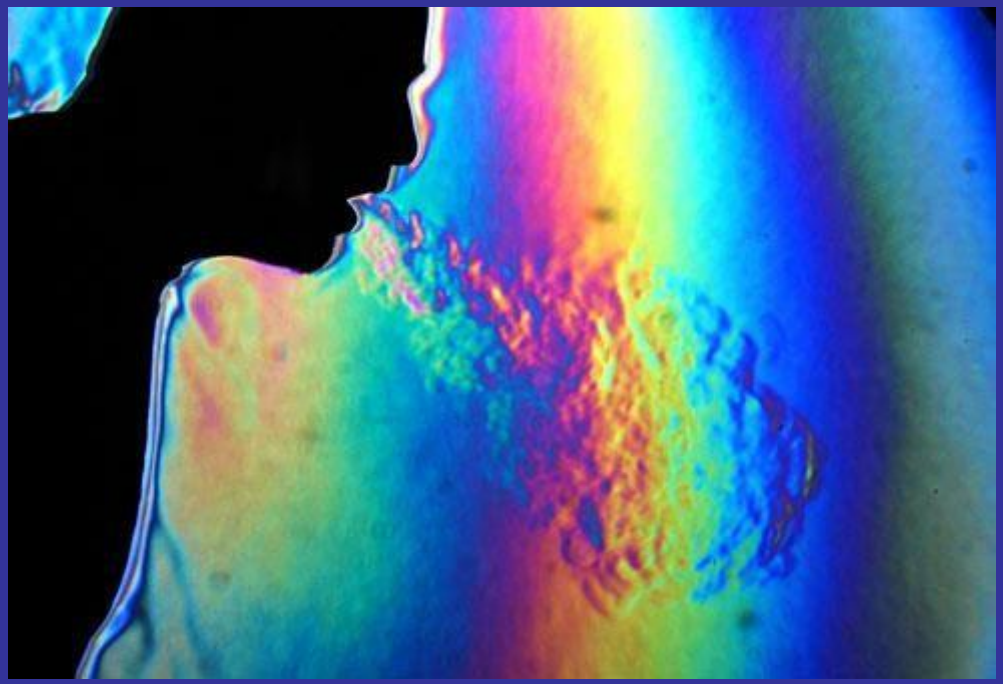
They cough particularly in the morning because the sputum stays for 6-8 hours in there airway when they wake up in the morning they start to cough because the sputum irritates there airway

COPD

Clinical Picture

- Dyspnea-progressive
- Cough with or without expectoration
- Wheezing
- Loss of weight
- Hypercapnia>changes in central nervous system
- Barrel chest

Chronic Bronchitis



COPD
Oxygen Therapy

One of most important therapies of copd

COPD

Home Oxygen Therapy

COPD

Oxygen therapy

For COPD with severe hypoxemia

- It improves survival
- It improves quality of life
- Indicated in patient with $PaO_2 < 60$ mmHg

COPD

Treatment of Acute Attack of COPD

- Oxygen therapy

  Low flow of oxygen to keep the $SO_2 \approx 90\%$
  to avoid oxygen induced hypercapnia

  Not like asthma in asthma we give high flow the reason to avoid o2 induced hypercapnia because in these people the hypoxemia stimulate the brain, if you blunt the hypoxemia with high flow O2 the patient may not be able to breath and may go to hypercapnia and respiratory failure

- Inhaled bronchodilators
- Inhaled corticosteroids
- Inhaled anti-cholinergic
- Theophylline therapy
- Antibiotics **Improve survival particularly who have excessive putum production**

COPD

Indication for ICU Admission

- Severe dyspnea that respond inadequately to initial emergency therapy
- Change in mental status (confusion, coma)
- Persistent or worsening hypoxemia $PO_2 < 50mmHg$ and / OR worsening respiratory acidosis $pH < 7.25$
- Need for mechanical ventilation e.g: apnea or respiratory arrest
- Hemodynamic instability-need for vasopressor

COPD

Indication for Non-Invasive Mechanical Ventilation (NIV) Here it is really indicated not like asthma

At least of the following:

- Respiratory acidosis

  $PCO_2 \geq 45mmHg$ and $pH < 7.35$

- Severe dyspnea with clinical degree suggestive of respiratory muscle fatigue
- Persistent hypoxemia despite supplemental oxygen therapy

COPD

Non-Invasive Mechanical Ventilation

- **Both within the ICU and the ward environment have been showing in RCTs and systematic reviews:**
- **To reduce intubation rate and mortality in COPD patients with decompensated respiratory acidosis.**

COPD

Non-invasive Mechanical Ventilation Treatment

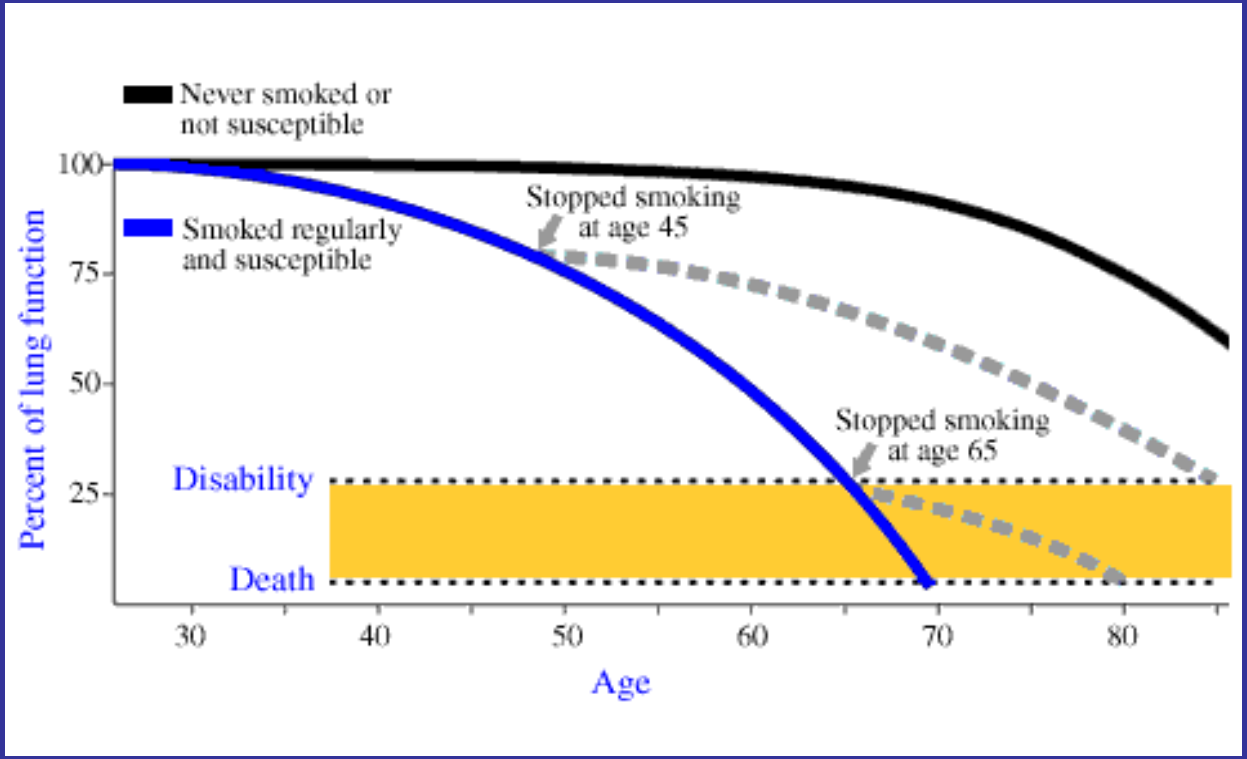
COPD

Rehabilitation program

- Decreased symptoms
- Decreased anxiety an depression improved quality of life
- Decreased hospitalization
- Increase exercise capacity

Indication of invasive ventilation like asthma

COPD



Changes in FEV_1 with Aging (Smoker vs Non-Smoker)

END