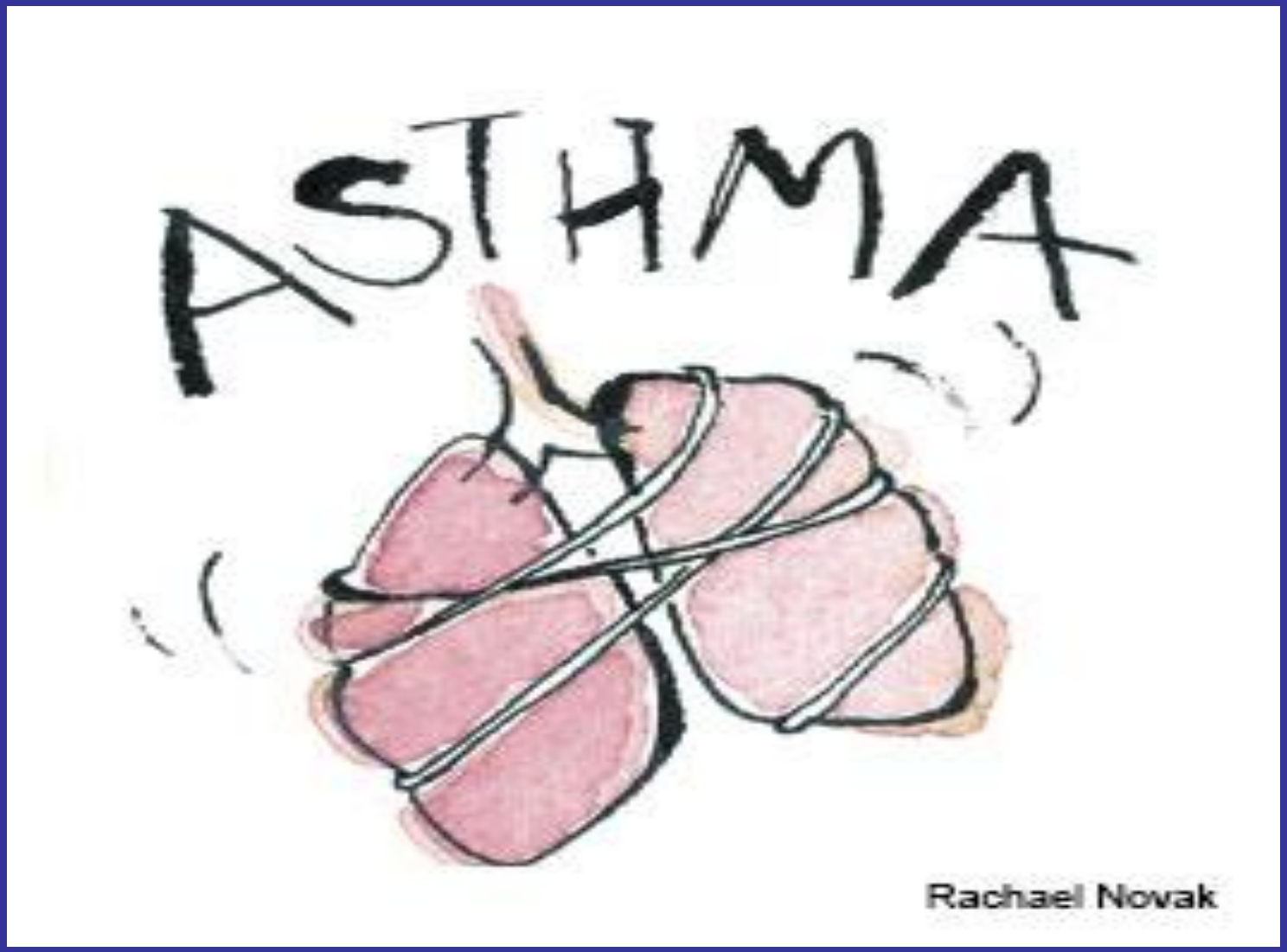
Management of Severe Asthma and COPD

PROF. ABDULAZIZ H. ALZEER


ASTHMA
Rachael Novak

Learning Objectives

Asthma

- Definition
- 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.

Symptom:

- Cough
- Wheeze
- Tightness in the chest
- Shortness of breath
- Sometimes nocturnal symptoms

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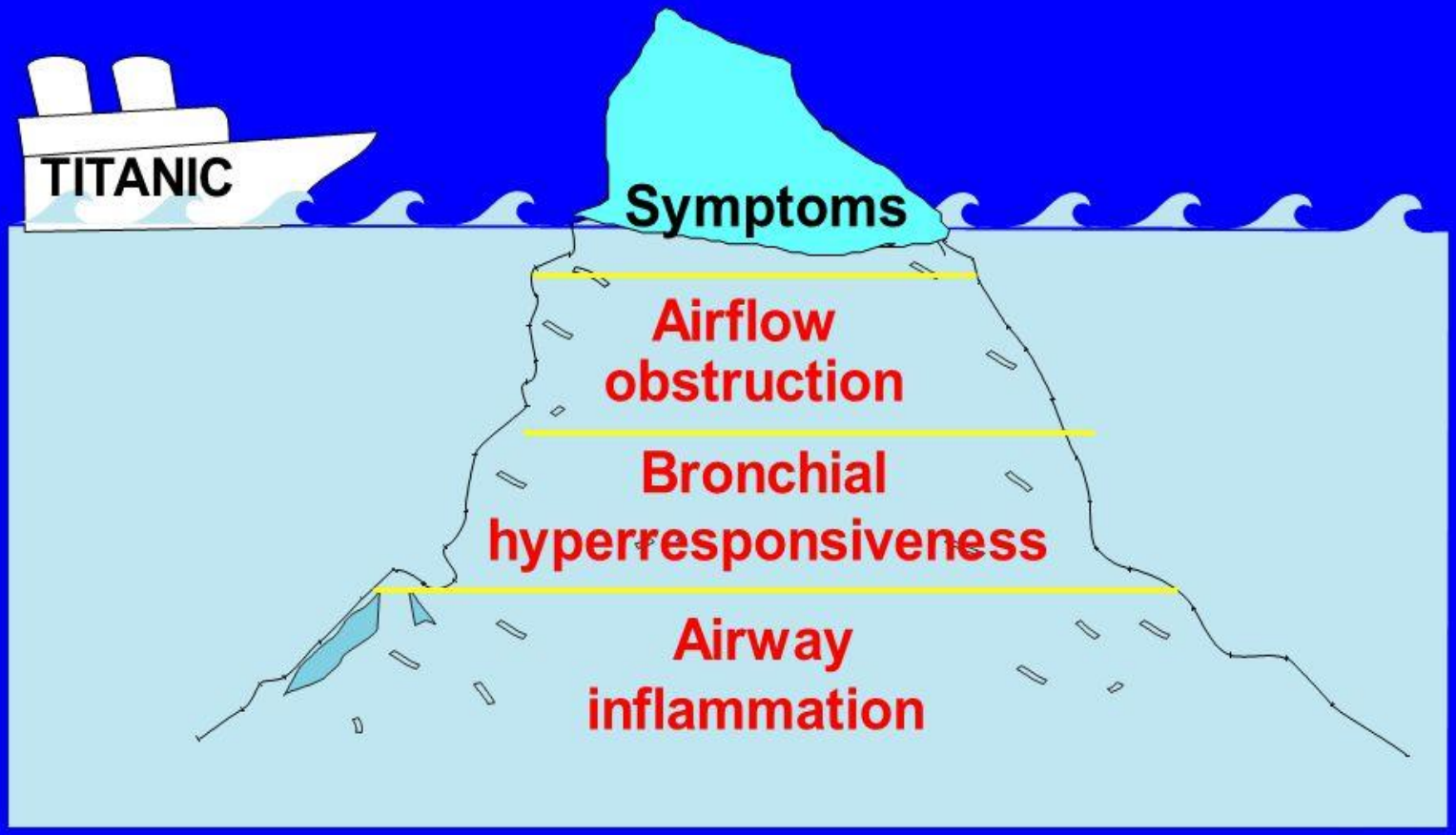
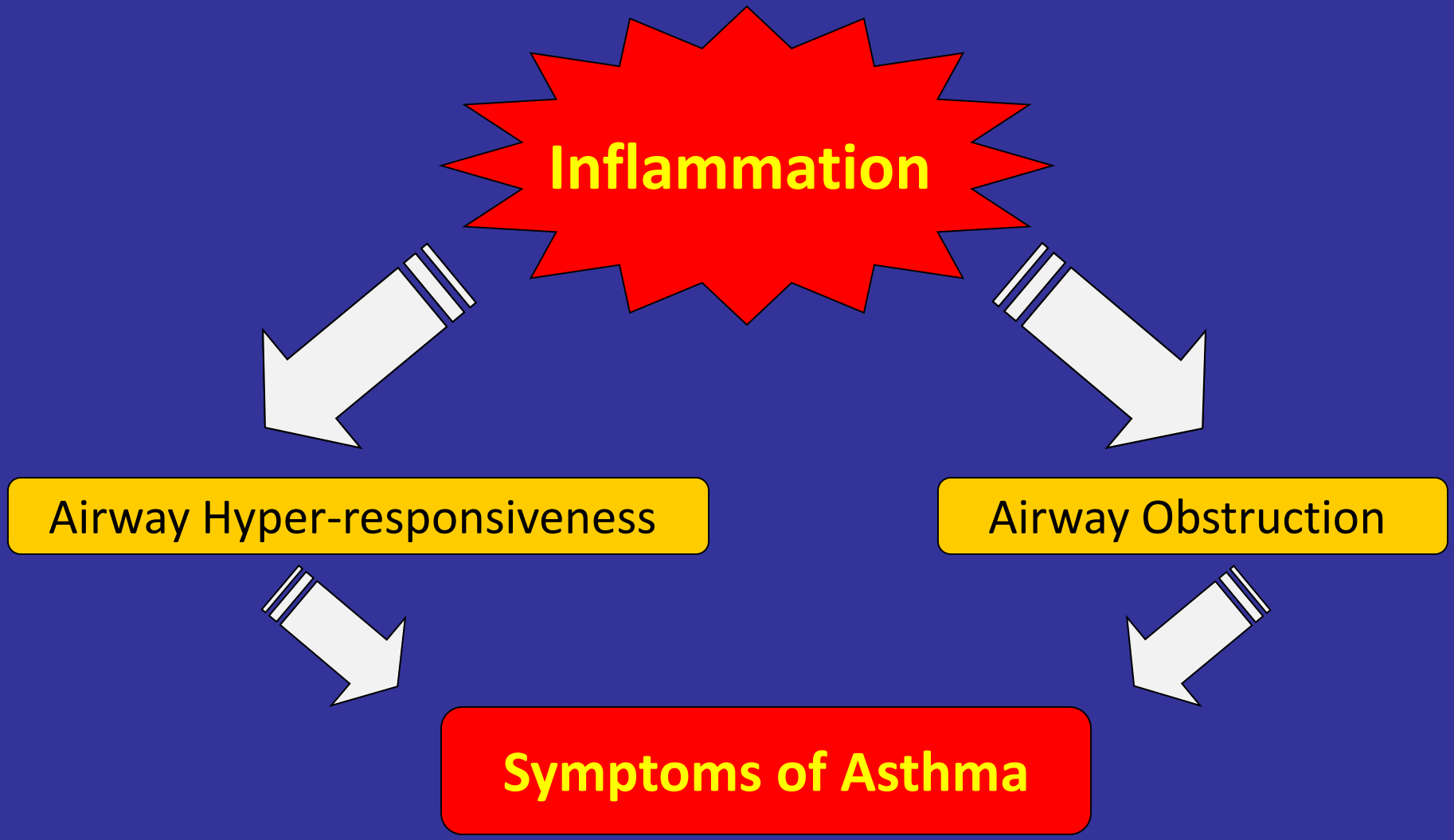
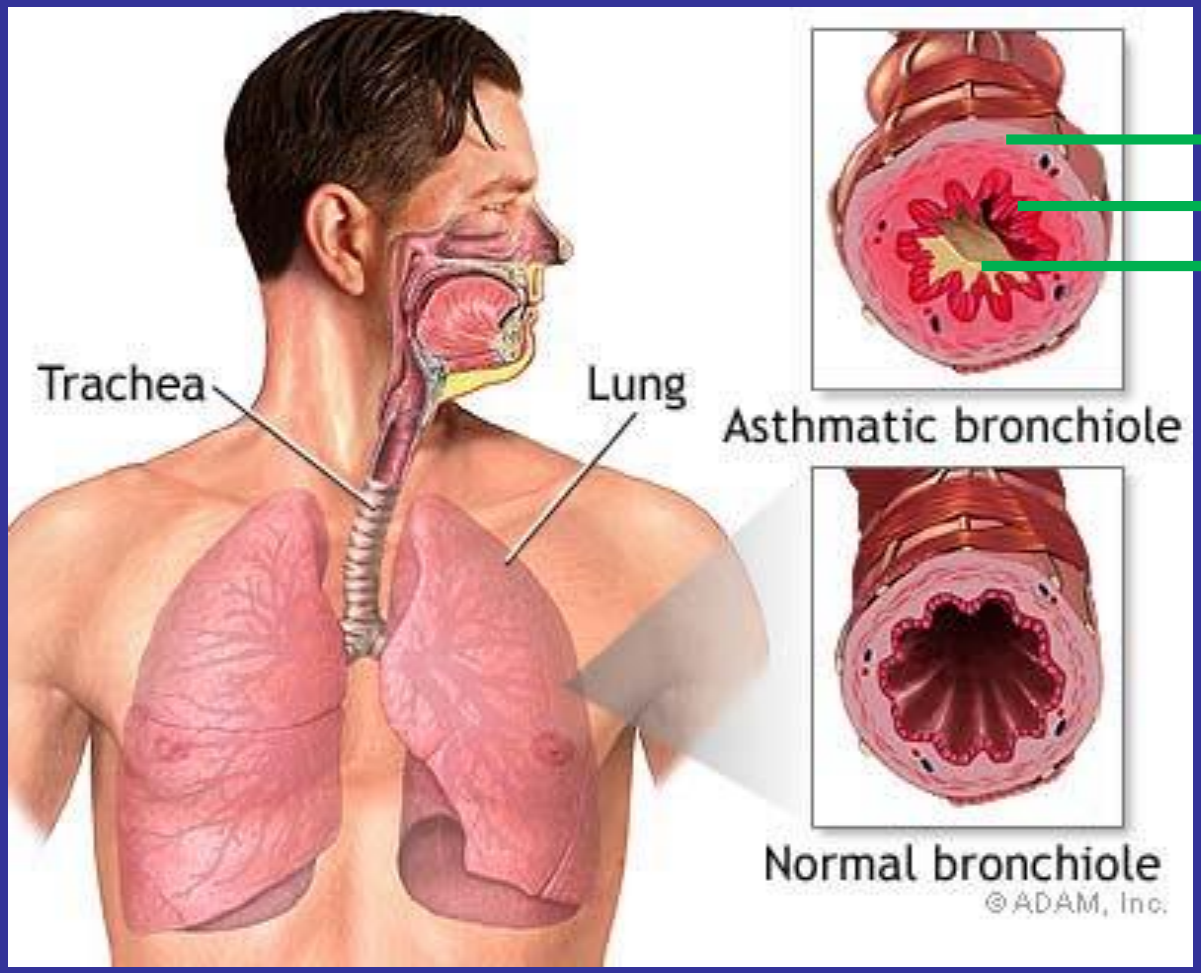
The "Tip" of the Iceberg



Pathology of Asthma



ASTHMA

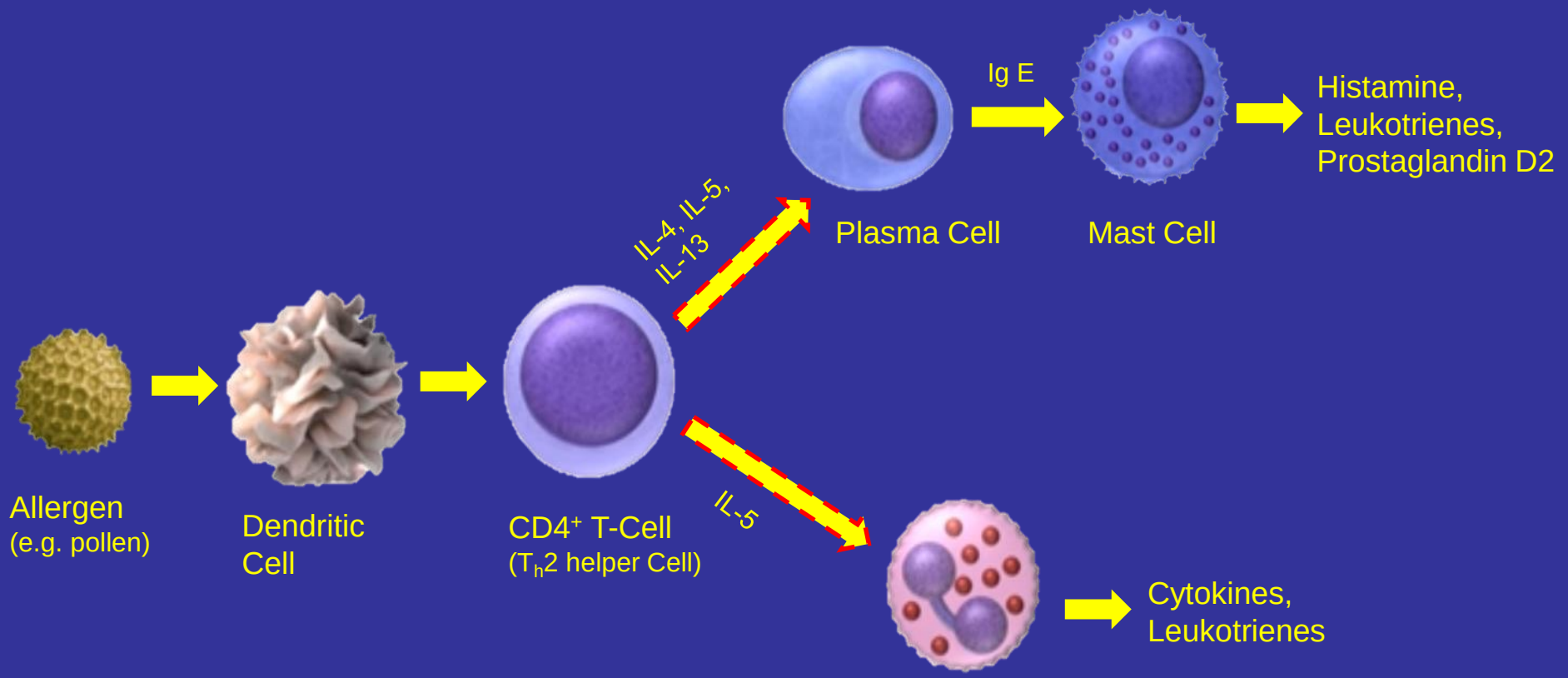


Smooth muscle contraction

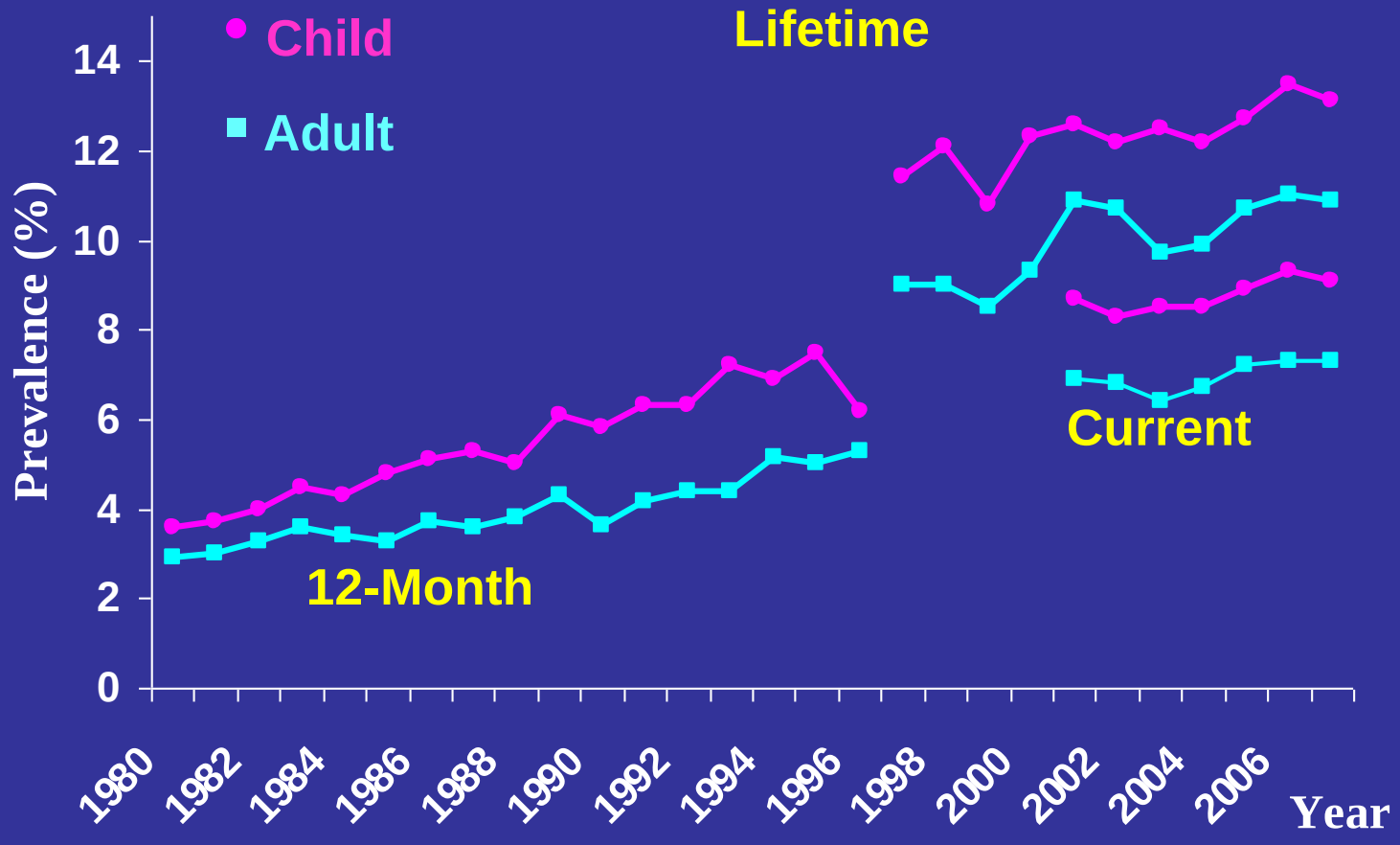
Mucosal edema

Excessive secretions

Pathogenesis of Asthma

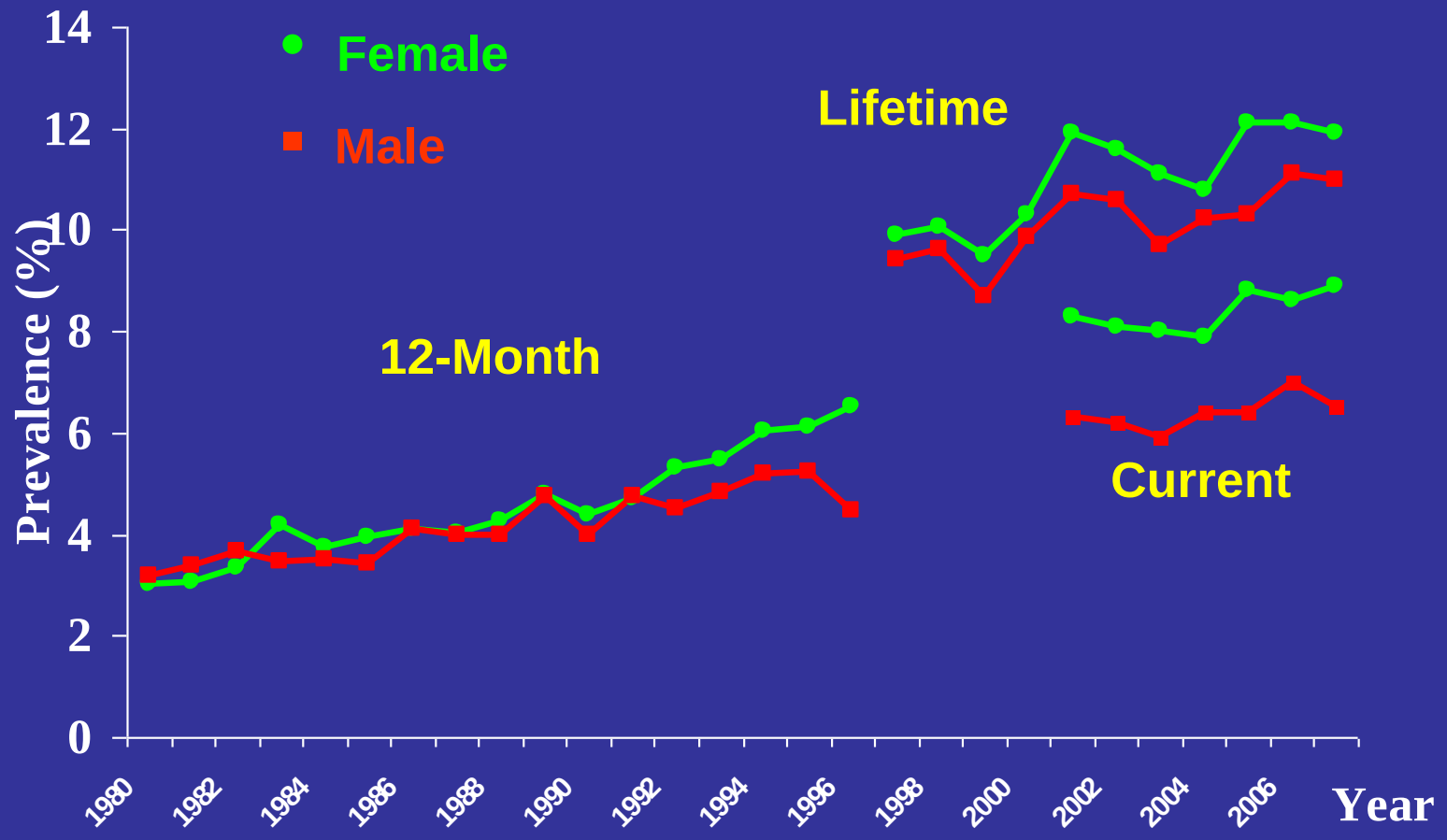


Child and Adult Asthma Prevalence United States, 1980-2007



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
- Childhood respiratory infections
- Exposure to allergens
- Drugs

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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
- Cyanosis
- Silent chest
- change in mental status
- peak expiratory flow meter >200 L/min

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Spirometer

Asthma

Arterial Blood Gases

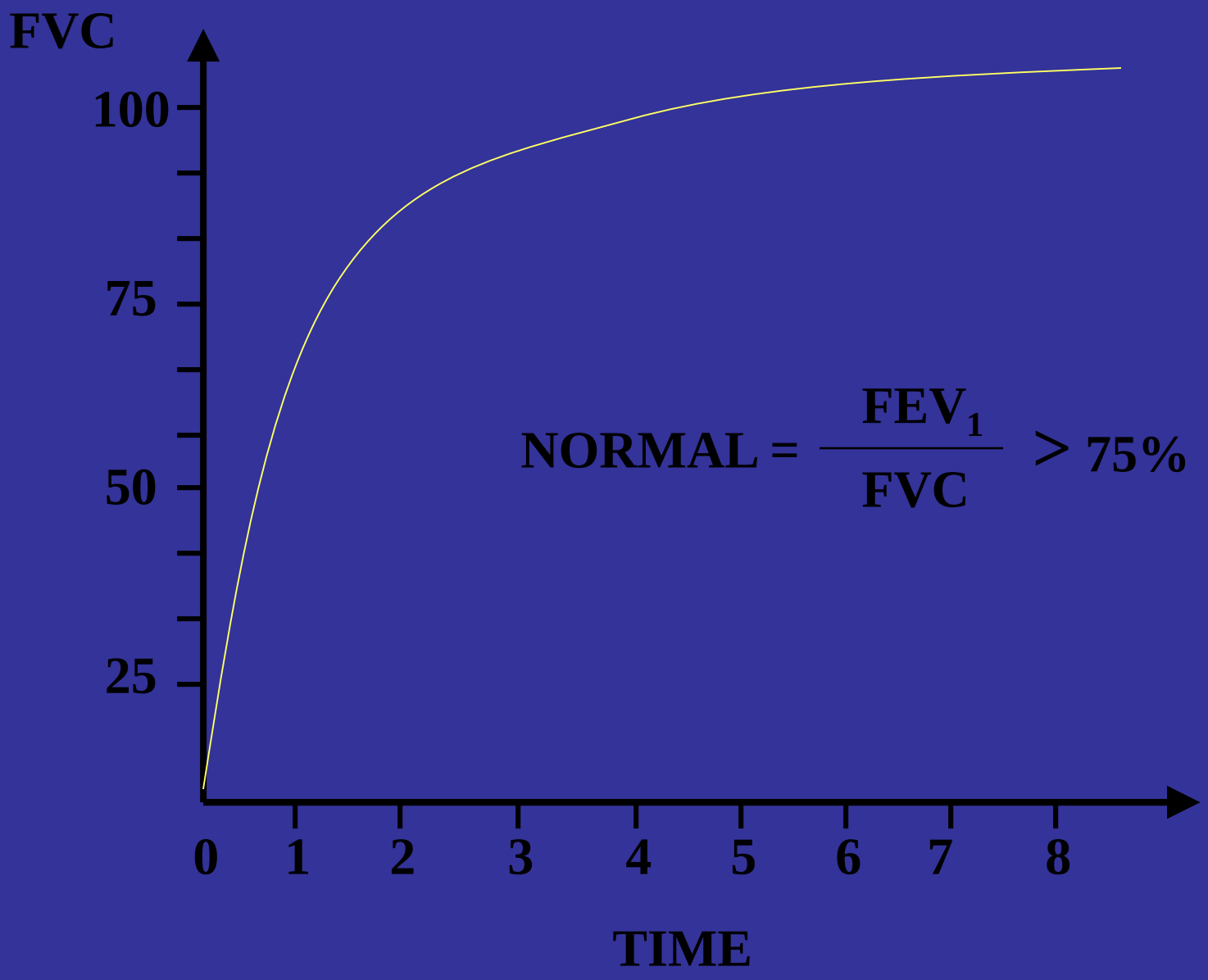
Acideamia

Hypoxiamia

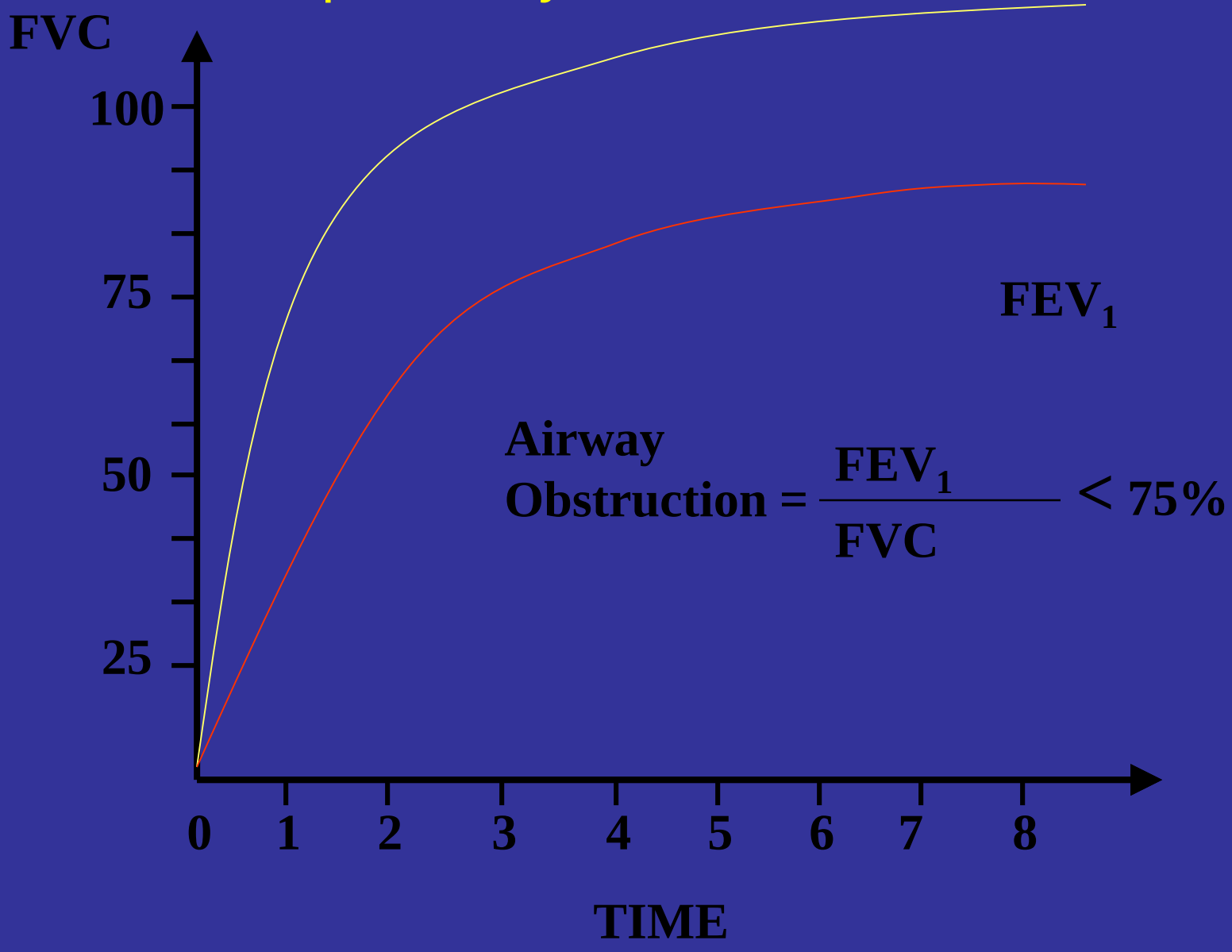
Hypercarpia

	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
- Include the family
- 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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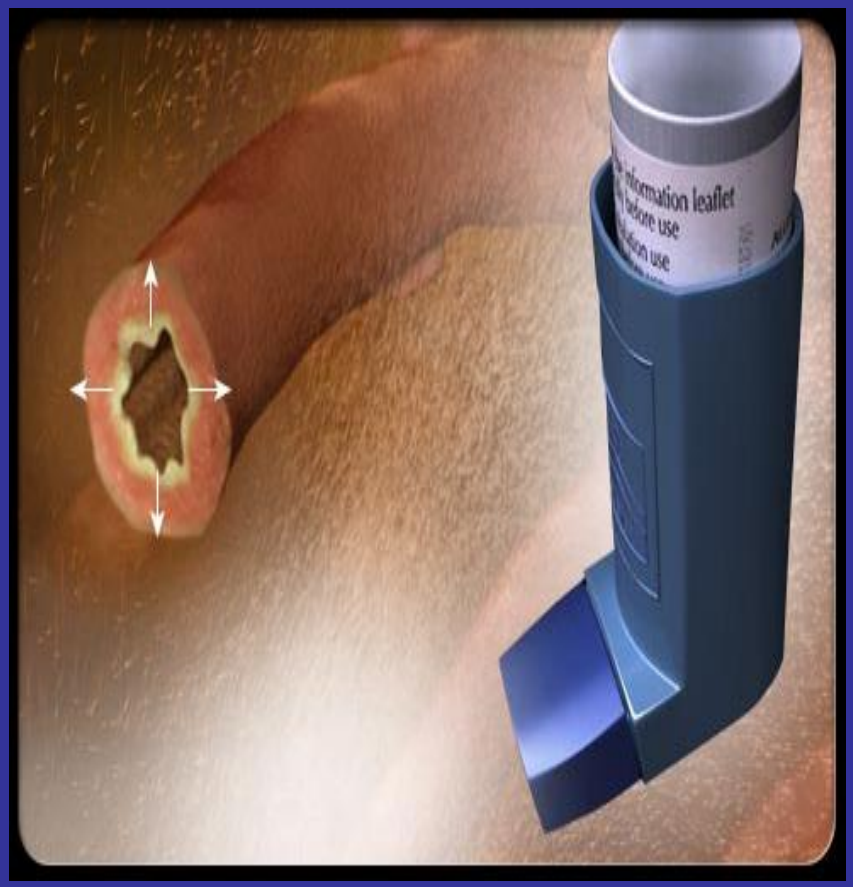

Quick Reliever

- 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
- 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

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High doses of inhaled bronchodilator

- Short acting B2 agonist
  - 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

- 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

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Treatment of Acute Attack of Asthma:

For severe cases consider:

- IV Mg SO_4

  Relaxes smooth muscles

- Heliox

  Improves laminar flow

- BiPAP

- Mechanical Ventilation – for those who do not respond the above treatments.

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Non-invasive Mechanical Ventilation Treatment

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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)

- 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

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

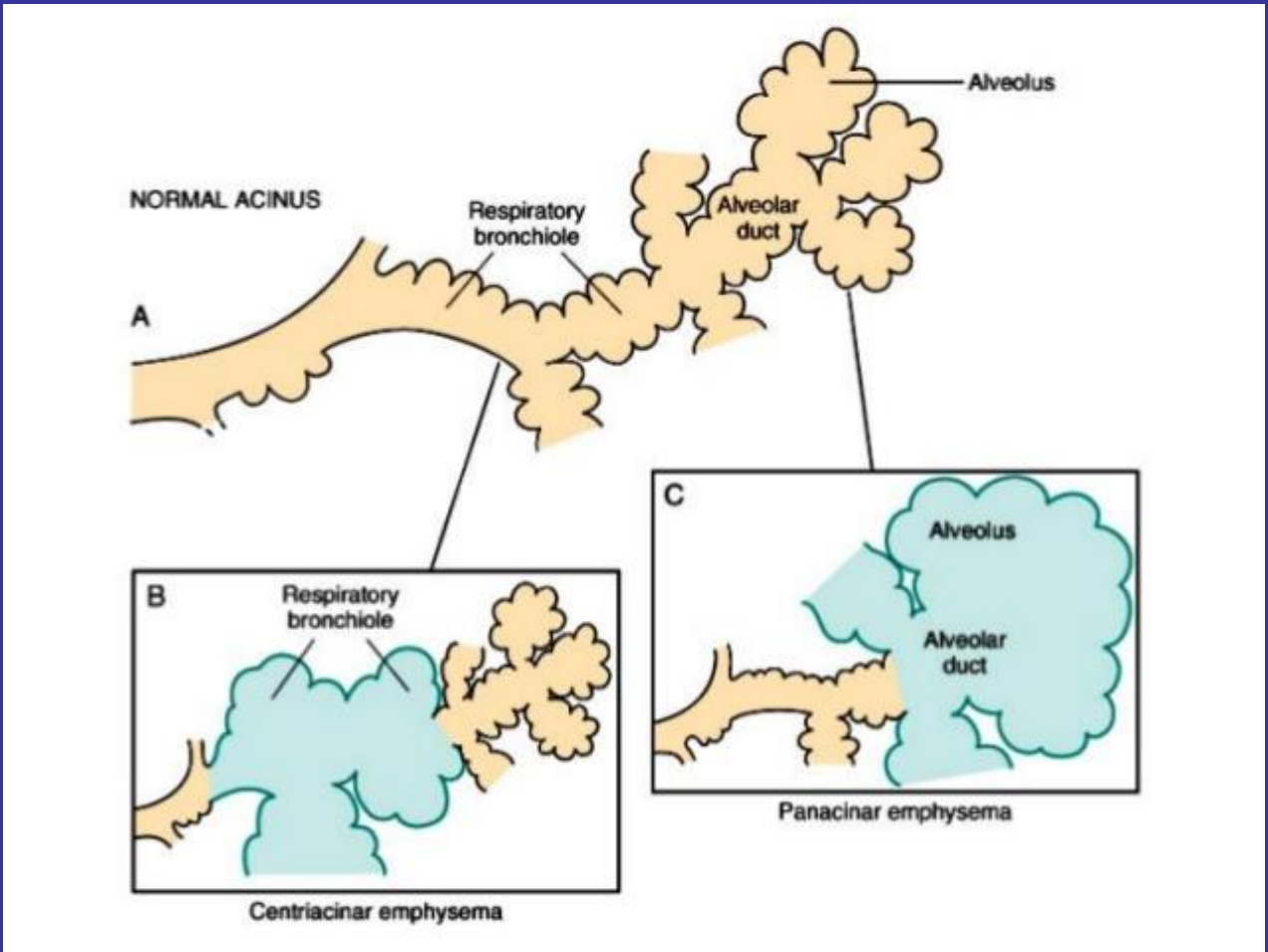
Emphysema

Emphysema

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

Spaces in parenchyma > 1mm = Abnormal

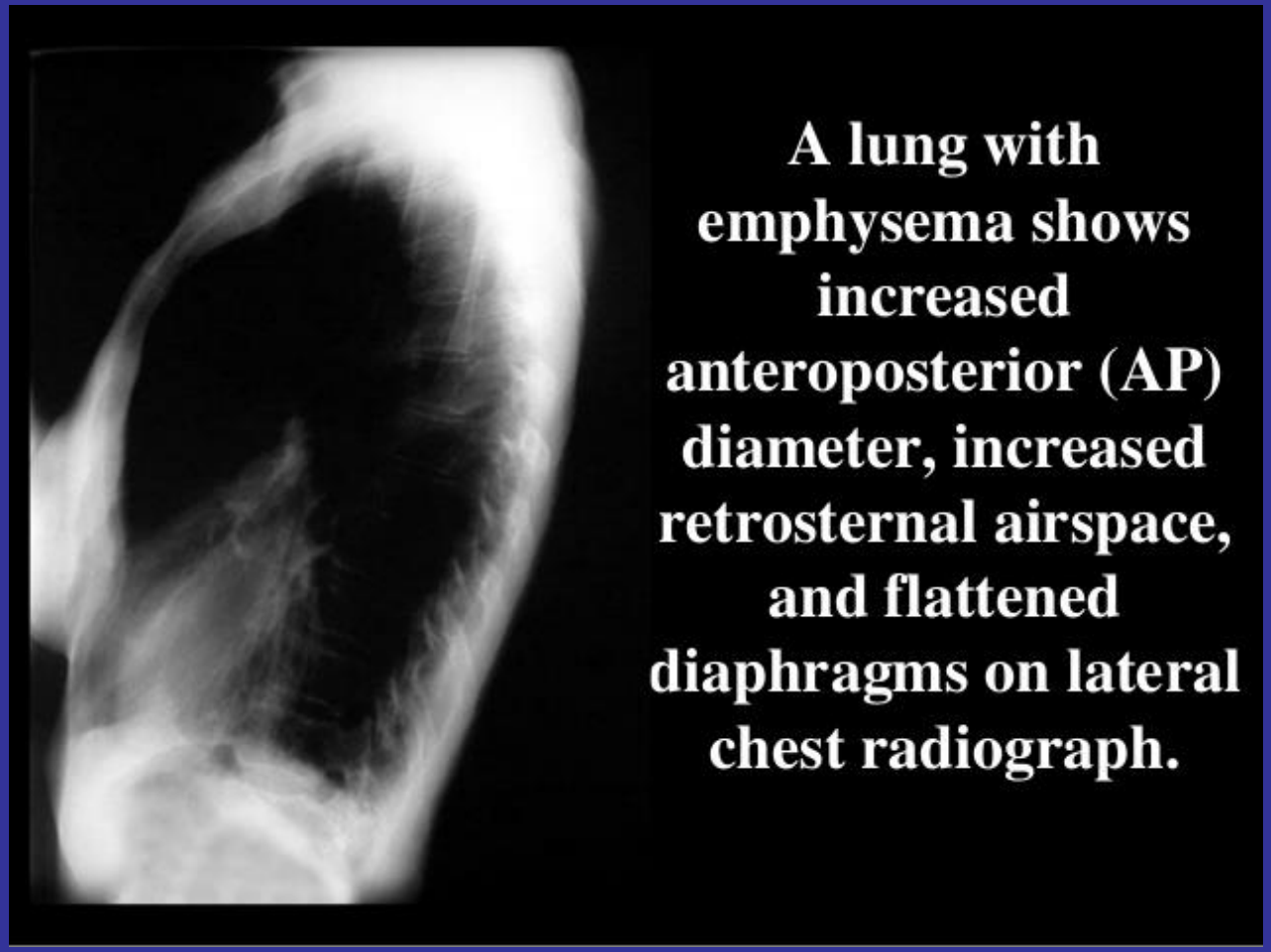
Emphysema


Alveolus
NORMAL ACINUS
Respiratory bronchiole
Alveolar duct
A
B
Respiratory bronchiole
C
Alveolus
Alveolar duct
Panacinar emphysema
Centriacinar emphysema

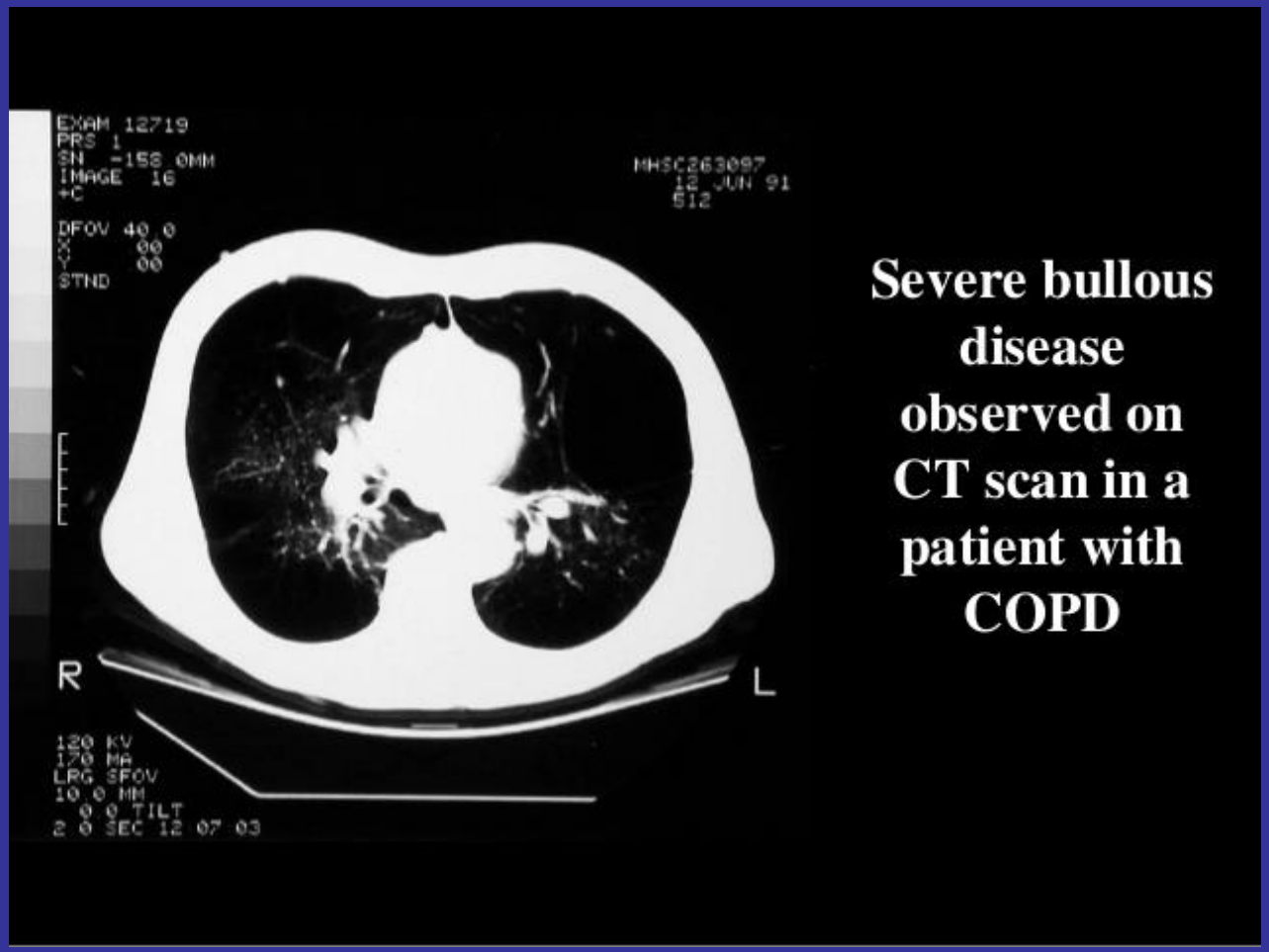
Emphysema

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

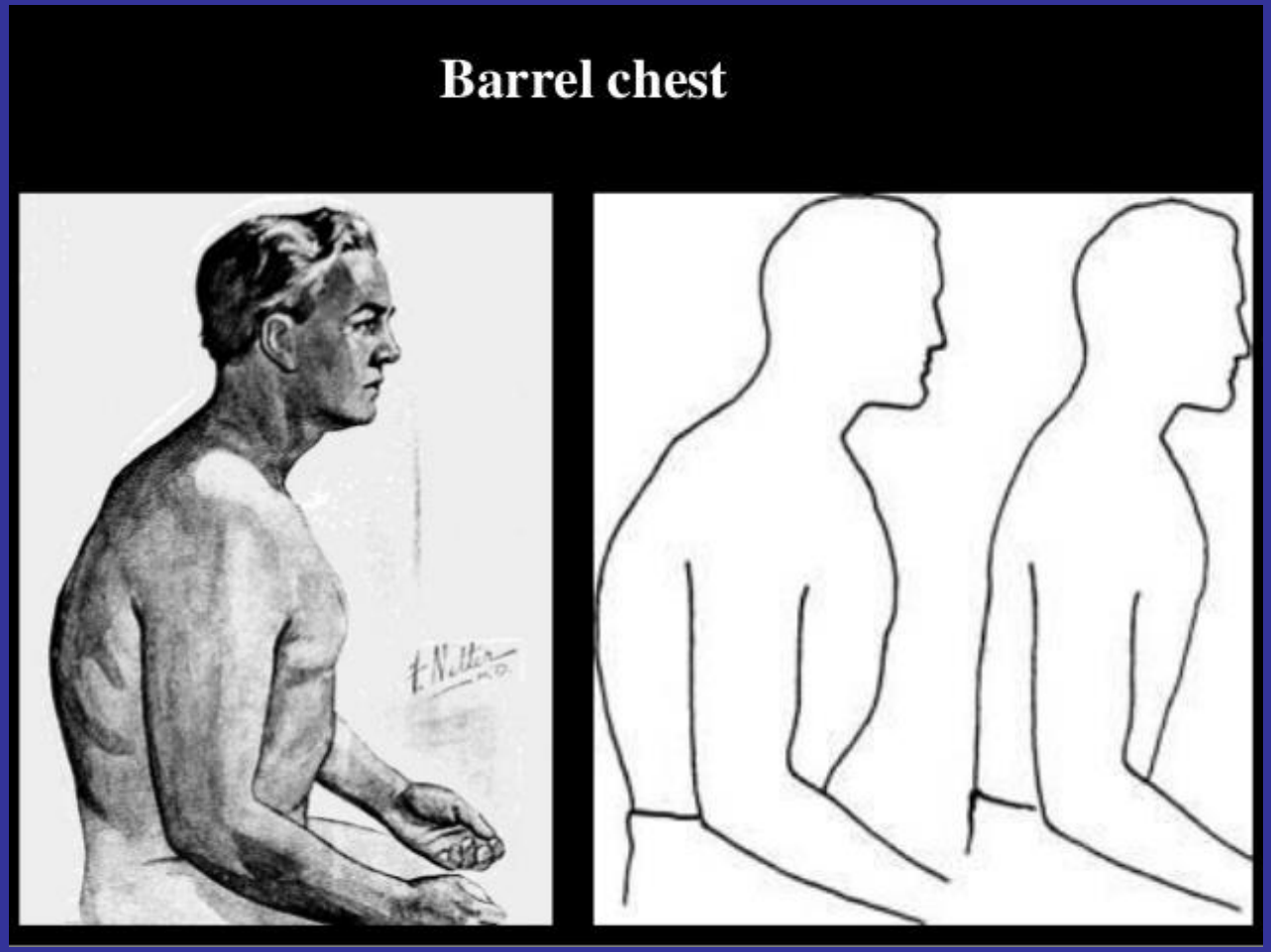
Emphysema

COPD

Clinical Picture

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

COPD

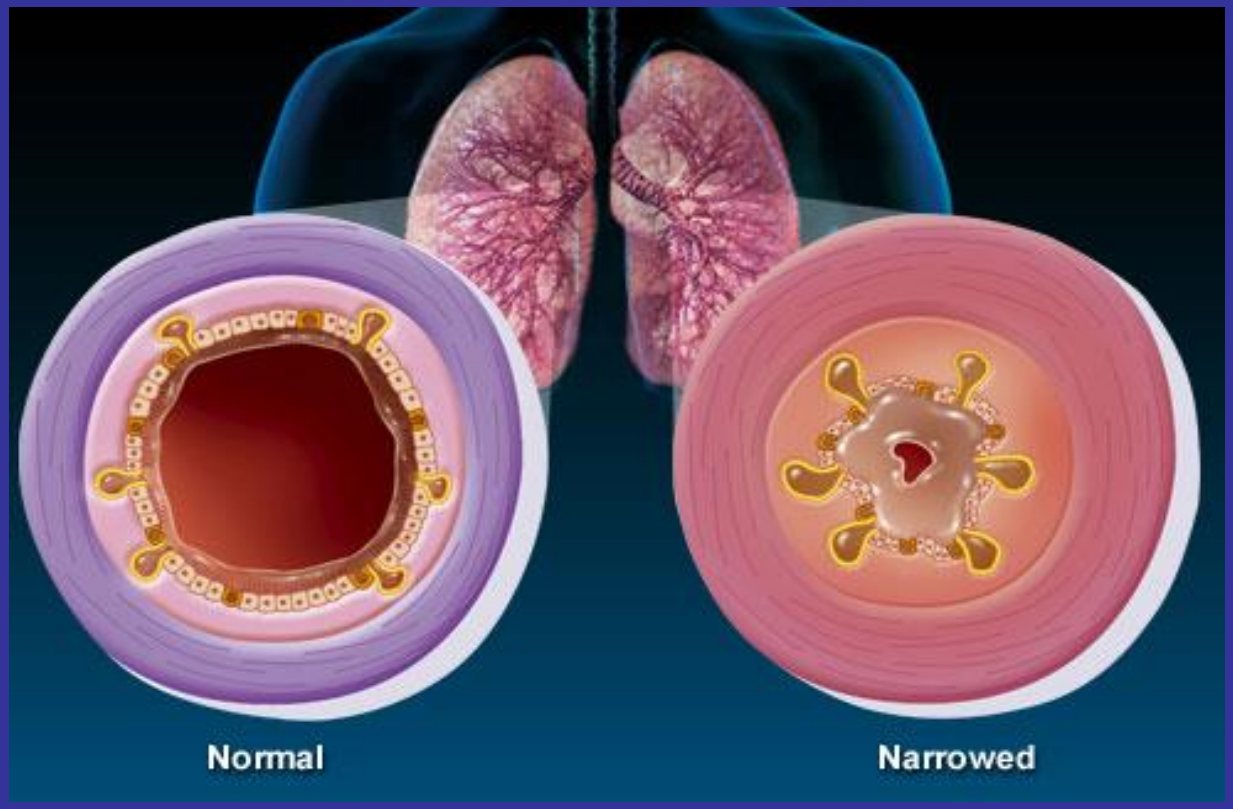


Chronic Bronchitis

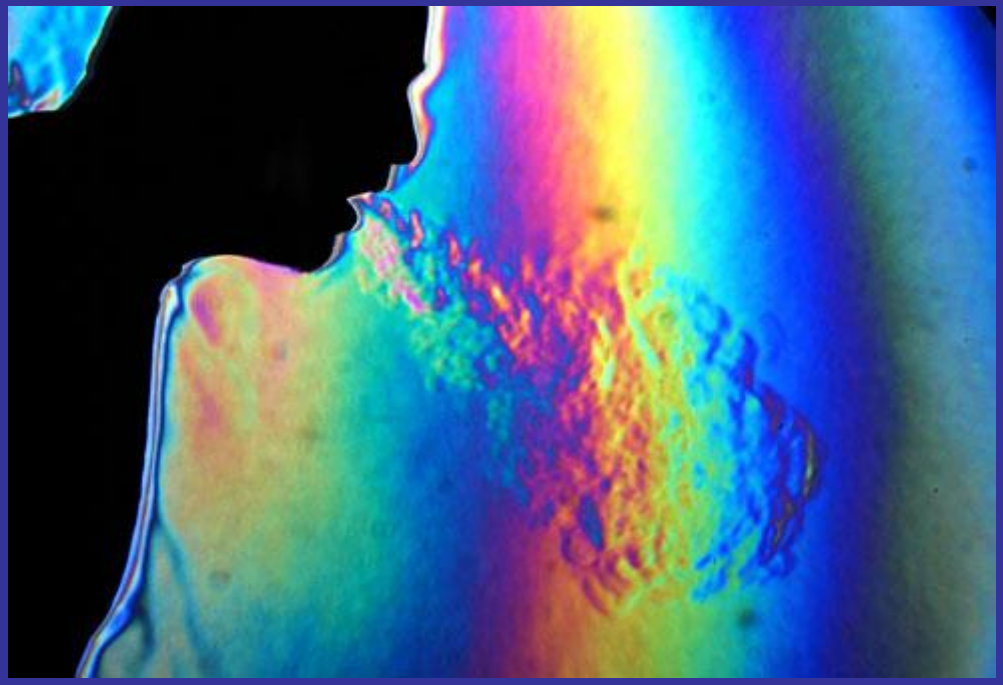
Definition

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

Chronic Bronchitis



Chronic Bronchitis



COPD
Oxygen Therapy

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
- Inhaled bronchodilators
- Inhaled corticosteroids
- Inhaled anti-cholinergic
- Theophylline therapy
- Antibiotics

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)

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

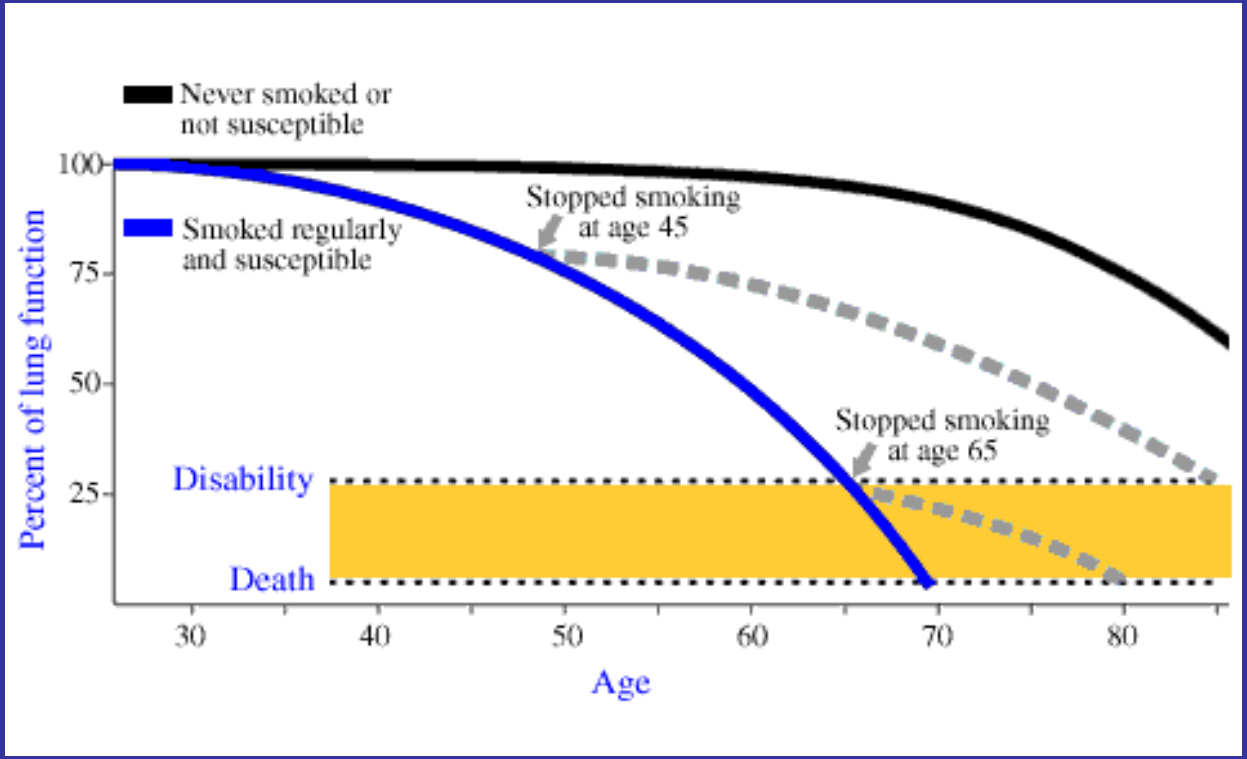
Non-invasive Mechanical Ventilation Treatment

COPD

Rehabilitation program

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

COPD



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

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