First Of all:

What do we mean by COPD?

- It is a disease state characterized by :
  - Limitation of airflow that is not fully reversible.
  - The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases..

NOTE:

- The differences between COPD and Asthma is :
  -COPD is a problem with: parenchyma + air ways, while asthma is with airways **only**!
  -Asthma is not a common cause of severe chronic respiratory failure in non-smokers

- There are two classic types of COPD: **chronic bronchitis** and **emphysema.**

Chronic bronchitis is a clinical diagnosis: chronic cough +productive of sputum for at least 3 months per year for at least 2 consecutive years.
(Note: if asthma or bronchiactasis are suspected they must be ruled out by CT scan which is the most useful modality for them)

Emphysema is a pathologic diagnosis: permanent enlargement of air spaces distal to terminal bronchioles due to destruction of alveolar walls without obvious fibrosis.

The two often coexist together. Pure emphysema or pure chronic bronchitis is rare.

Risk factors and causes

- Tobacco smoke (indicated in almost 90% of COPD cases).
- α1-Antitrypsin deficiency—risk, and it's worse if combined with smoking.
- Environmental factors (e.g., Passive **smoking** -the inhalation of **smoke-**).
- Chronic asthma—speculated by some to be an independent risk factor.

Pathogenesis:

Chronic bronchitis:

- Excess mucus production narrows the airways; patient often has a **productive cough**.
- Inflammation and scarring in airways, enlargement in mucous glands, and smooth muscle hyperplasia lead to **obstruction**.

Emphysema:

First :

What's PMN's , Elastase , α1-antitrypsin ?

- In normal cases : Elastase is released from PMNs and inhibited by α1-antitrypsin to keep balance , when elastase is increased and α1-antitrypsin is decreased it causes destruction of alveolar wall because the macrophages start to digest the lung !
- Tobacco smoke increases the number of activated PMNs and macrophages + inhibits α1-antitrypsin, and increases oxidative stress on the lung by free radical production.

Note :

- TNF is the most important inflammatory mediator in cigarette smoking inflammation
- Emphysema usually classified into :

❖ **Centrilobular emphysema:**
  - Most common type, seen in smokers (rarely in nonsmokers)
  - Destruction limited to respiratory bronchioles (proximal acini) with little change in distal acini.
  - Predilection for upper lung zones

❖ **Panlobular emphysema:**
  - Seen in patients with α1-antitrypsin deficiency.
  - Destruction involves both proximal and distal acini.
  - Predilection for lung bases

Clinical features:

Symptoms

- Any combination of cough, sputum production, and dyspnea (on exertion or at rest, depending on severity) may be present.
- The presentation depends on the relative contributions of chronic bronchitis and emphysema. Most patients have features of both.

Signs

- Prolonged forced expiratory time. (Time of full exhalation of vital capacity ≥6 seconds).
- During auscultation, end-expiratory wheezes on forced expiration, decreased breath sounds, and/or inspiratory crackles
- Tachypnea, tachycardia
- Cyanosis
- Use of accessory respiratory muscles
- Hyperresonance on percussion (because the lung is full with trapped air)
- Signs of corpulmonale !
- in COPD: the FEV1/FEV ratio is <0.75–0.80.
- **N.B.** FEV1 is the amount of air that can be forced out of the lungs in 1 sec

Other symptoms and signs

- Muscle wasting.
- Cachexia (due to release of TNF in the inflammatory process of COPD).
- Cardiac deconditioning.
- Osteoporosis (because increased inflammatory markers induces oesteoclasts).
- Depression.
- Social isolation.

Diagnosis

- **Pulmonary function testing (spirometry)**
  - This is the definitive diagnostic test.
  - Obstruction is evident based on the following:
    - Decreased FEV1 and decreased FEV1/FVC ratio—If FEV1 is reduced to 70% of predicted value, mild disease is suggested. If FEV1 is reduced to 50% or less of predicted value, severe disease is present. Values in between indicate moderate disease.
    - Increased total lung capacity (TLC), residual volume, and functional reserve capacity (FRC) (indicating air trapping).
    - Decreased vital capacity.
- **Chest radiograph (CXR)**
  - Low sensitivity for diagnosing COPD; only severe, advanced emphysema will show the typical changes, which include:
    - Hyperinflation, flattened diaphragm, enlarged retrosternal space
    - Diminished vascular markings.
  - Useful in an acute exacerbation to rule out complications such as pneumonia or pneumothorax.
- **Measure α1-antitrypsin**levels in patients with a personal or family history of premature emphysema (≤50 years old).

Note:
- in carbon monoxide diffusing capacity test (DLCO) (=KCO), the diffusion of CO to blood is decreased in COPD (but normal in asthma) because of the reduction of the number of functioning alveoli
- In other words: The diffusing lung capacity (Dlco) is a sign of number of functioning alveoli

Differential diagnosis with asthma:

- Age of onset (in asthma is usually less than 40 while COPD usually starts at older age).
- History of atopy (in asthma only..atopy is a form of allergy).
- Eosinophilia and IgE(more in asthma.. and that's why inhalated cortisol is more effective which is directed mainly on eosinophilia and not good in COPD).
  - Note:COPD is mediated by neutrophils mainly
- Bullae (only in COPD).
- Chronic respiratory failure (only in COPD).
- Diffusing capacity (affected in COPD mainly & almost normal in asthma).
- Trial of **inhaled** corticosteroids (not effective in COPD except for frequent exacerbations).

Note :

- Bulli is an area where alveoli are lost (eaten).
- Asthma is reversible while COPD is quite irreversible.

◈Treatment

- **Modalities**
  - Smoking cessation - the most important intervention
    - Disease progression is accelerated by continued smoking and can be greatly slowed by its cessation.

- Inhaled β2-agonists (e.g., albuterol): bronchodilators Provide symptomatic relief. Use long-acting agents (e.g., salmeterol) for patients requiring frequent use.
- Inhaled anticholinergic drugs (e.g., ipratropium bromide): bronchodilators
  - Slower onset of action than the β-agonists, but last longer
  - Combination of β-agonist albuterol with ipratropium bromide is more efficacious than either agent alone in bronchodilation
- Inhaled corticosteroids (e.g., budesonide, fluticasone): anti-inflammatory
  - May minimally slow down the decrease in FEV1 over time; however, many studies have failed to show any benefit in pulmonary function
  - Reserved for patients whose symptoms are not controlled by bronchodilators
- Theophylline (oral)—role is controversial
  - May improve mucociliary clearance and central respiratory drive
  - Narrow therapeutic index, so serum levels must be monitored
- Oxygen therapy
  - Shown to improve survival and quality of life in patients with COPD and chronic hypoxemia
  - Some patients need continuous oxygen, whereas others only require it during exertion or sleep. Get an ABG **arterial blood gas** to determine need for oxygen
  - Long-standing hypoxemia may lead to pulmonary HTN and ultimately cor pulmonale. Continuous oxygen therapy for ≥18 hr/day has been shown to reduce mortality in patients with these complications by controlling pulmonary HTN.

- Pulmonary rehabilitation—education, exercise, physiotherapy: A major goal is to improve exercise tolerance and fitness. (specially grade 3-5 SOB)
  - note: the lower limbs are more important in being fit than the upper limbs and respiratory muscles
- Vaccination
  - Influenza vaccination annually
  - Vaccination against Streptococcus pneumoniae every 5 to 6 years
- Surgery—may be beneficial in selected patients; carefully weigh potential benefits with risks. Options include:
  - Lung resection (lung volume reduction surgery)LVRS→ predominantly upper lobe emphysema
  - Lung transplantation !
  - bullectomy →multiples bulla
- Mucolytics every winter

◈Exacerbations:

A. Acute COPD exacerbation

- Definition: a persistent increase in dyspnea (not relieved with bronchodilators). Increased sputum production and cough are common. Acute COPD exacerbation can lead to acute respiratory failure requiring hospitalization, and possibly mechanical ventilation; potentially fatal.
- It includes:
  1. viral infection followed by bacterial activity

- 1/3 associated with virus(rhinovirus or influenza).
- Bacterial colonization:
  - 20-30% during remission
  - 30-50% during exacerbations
  - Haemophilus influenzae & parainfluenzae
  - Sterpt. pneumonia
  - Branhamella catarrhalis

2- bronchospasm: pollution or occupational.

3- minor causes:
- Pneumonia.
- Lt or Rt cardiac failure.
- pneumothorax

- **Note :** The most common causes of acute exacerbations are infection, noncompliance with therapy, and cardiac disease.

B. life threatening exacerbations:

- Deterioration of consciousness
- Marked distress
- Paradoxical thoracoabdominal movement.
- Worsening ABGs in spite of oxygen & bronchodilators (Po2=50,Pco2=70, PH=7.3)
- Other co-morbidities.
- Social support.

C. Management of exacerbations:

- Systemic corticosteroids are used for patients requiring hospitalization (IV methylprednisolone is a common choice). Taper with oral prednisone on clinical improvement. Do not use inhaled corticosteroids in acute exacerbations.
- Antibiotics (azithromycin or levofloxacin): Studies have shown that patients who receive broad-spectrum antibiotics do slightly better than a placebo group.
- Supplemental oxygen is used to keep O2 saturation above 90%. Start with a nasal cannula; a face mask may need to be used.
- β-Blockers are generally contraindicated in acute COPD or asthma exacerbations.
- Pulmonary infection (Streptococcus pneumoniae, Haemophilus influenzae, Mycoplasma pneumoniae, Moraxella catarrhalis, and viruses are the most common organisms.) is one of the main precipitants of a COPD exacerbation.
- If a patient presents with COPD exacerbation, the following steps are appropriate:
  1. CXR
  2. β2-agonist and anticholinergic inhalers
  3. Systemic corticosteroids
  4. Antibiotics
  5. Supplemental oxygen
  6. Noninvasive positive-pressure ventilation (NPPV) if needed

◈ Complications:

- respiratory failure.
- Bacterial colonization
- Hemoptysis
- Pneumothorax
- extrapulmonary
- Secondary polycythemia (Hct >55% in men or >47% in women)—compensatory response to chronic hypoxemia
- Pulmonary HTN and cor pulmonale — may occur in patients with severe, long-standing COPD who have chronic hypoxemia

Note:
Arterial Blood Gases may be normal or show ↓PaO_2 and ↑$PaCO_2$ in advanced stages, accompanied by increase in HCO_3 to compensate the acidosis.