A 67 year old man with history of smoking for 20 pack years presents to hospital repeatedly with cough, shortness of breath and wheezing. This time he presents again with the same symptoms. His respiratory rate is 32/minute and pulse 106/minute. He looks cachectic. You note an increased anteroposterior diameter, distant heart sounds, and expiratory wheezing.
• What is the diagnosis?
• How will you manage the patient?
CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Prof. Mutti Ullah Khan
Head of Department
Medical Unit-II
Holy Family Hospital
Rawalpindi Medical College
Learning Objectives

- Introduction.
- Causes.
- Risk factors.
- Pathophysiology.
- Clinical features.
- Diagnosis.
- Complications.
- Management.
Chronic obstructive pulmonary disease

- COPD is also known as chronic obstructive lung disease (COLD), chronic obstructive airway disease (COAD), chronic airflow limitation (CAL) and chronic obstructive respiratory disease (CORD).
- Chronic obstructive pulmonary disease (COPD) refers to chronic bronchitis and emphysema, a pair of two commonly co-existing diseases of the lungs in which the airways become narrowed. This leads to a limitation of the flow of air to and from the lungs causing shortness of breath.
In COPD, less air flows in and out of the airways because of one or more of the following:

- The airways and air sacs lose their elastic quality.
- The walls between many of the air sacs are destroyed.
- The walls of the airways become thick and inflamed.
- The airways make more mucus than usual, which tends to clog them.
**Normal Lungs**

- Trachea (windpipe)
- Airways
- Right lung
- Left lung
- Bronchioles (tiny airways)
- Alveoli (air sacs)

**Lungs With COPD**

- Bronchioles lose their shape and become clogged with mucus
- Walls of alveoli are destroyed, forming fewer larger alveoli

Detailed view of lung cross-section
Incidence

- It is the 4\textsuperscript{th} leading cause of mortality and 12\textsuperscript{th} leading cause of disability in the United States.
- In 2020 COPD is the 3\textsuperscript{rd} leading cause of death.
Causes

- 1) Smoking.
- 2) Occupational exposures - exposure to workplace dusts found in coal mining, gold mining, and the cotton textile industry and chemicals such as cadmium, isocyanates, and fumes from welding have been implicated in the development of airflow obstruction.
- 3) Air pollution.
- 4) Sudden airway constriction in response to inhaled irritants.
- 5) Bronchial hyper-responsiveness, is a characteristic of asthma.
6) Genetics-Alpha 1-antitrypsin deficiency is a genetic condition that is responsible for about 2% of cases of COPD. In this condition, the body does not make enough of a protein, alpha 1-antitrypsin. Alpha 1-antitrypsin protects the lungs from damage caused by protease enzymes, such as elastase and trypsin, that can be released as a result of an inflammatory response to tobacco smoke.
RISK FACTORS FOR COPD

- Cigarette smoke
- Occupational dust and chemicals
- Environmental tobacco smoke (ETS)
- Indoor and outdoor air pollution

AGING POPULATION

NUTRITION

INFECTIONS

SOCIO ECONOMIC STATUS
Abnormal inflammatory response of the lungs due to toxic gases.

Response occurs in the airways, parenchyma, and pulmonary vasculature.

Narrowing of the airway takes place.

Destruction of parenchyma leads to emphysema.
Destruction of lung parenchyma leads to an imbalance of proteinases/antiproteinases.

(this proteinases inhibitors prevents the destructive process)

- Pulmonary vascular changes
  - Thickening of vessels
  - Collagen deposit
  - Destruction of capillary beds.

- Mucus hypersecretion (cilia dysfunction, airflow limitation, cor pulmonale (RVF))

- Chronic cough and sputum production
Chronic bronchitis

- Chronic bronchitis is a **chronic inflammation** of the bronchi (**medium-size airways**) in the lungs.
- It is generally considered one of the two forms of chronic obstructive pulmonary disease (**COPD**), the other being **emphysema**.
- It is defined clinically as a **persistent cough** that produces sputum and mucus, for at least three months per year in two consecutive years.
• Irritants irritate the airway
  • Excess mucus production
  • Inflammation
  • Cause the mucus secreting glands and goblet cells to increase in number.
  • Ciliary function is reduced.
  • More mucus production

Bronchial walls become thickened and lumen narrows and mucus plug the airway.
Alveoli adjacent to the bronchioles may become damaged and fibrosed.

Alter function of alveolar macrophages.

infection
Emphysema

Emphysema is defined as enlargement of the spaces distal to the terminal bronchioles, with destruction of their walls of the alveoli.

- As the alveoli are destroyed the alveolar surface area in contact with the capillaries decreases.
- Causing dead spaces (no gas exchange takes place).
• Leads to hypoxia.
• In later stages:
  • CO2 elimination is disturbed and increase in CO2 tension in arterial blood causing
  • Respiratory acidosis
Classification

- **Centrilobular**-The respiratory bronchiole (proximal and central part of the acinus) is expanded. The distal acinus or alveoli are unchanged. Occurs more commonly in the upper lobes.
• Panlobular - The entire respiratory acinus, from respiratory bronchiole to alveoli, is expanded. Occurs more commonly in the lower lobes, especially basal segments, and anterior margins of the lungs.
CLINICAL FEATURES

- Symptoms include *cough, sputum, dyspnoea, and wheeze.*
- Signs: **Pink puffers & blue bloaters** (2 ends of a spectrum).

Patients who have chronic cough and sputum production with a history of exposure to risk factors should be tested for airflow limitation, even if they do not have dyspnea.
SYMPTOMS TYPICAL OF COPD

- History of heavy smoking for many years.
- Cough and sputum production for many years.
- Cough often present only on waking at first; later cough occurs throughout the day.
- Sputum usually mucoid – becomes purulent with exacerbation of disease, but not excessive.
- Cough and sputum often worse in winter due to infection.
- Insidious onset of breathlessness on exertion with wheezing or tightness of chest.
SYMPTOMS TYPICAL OF COPD (CONTD.)

- Some develop increasingly severe exacerbations of disease leading to chronic respiratory failure and heart failure – the “blue bloater’ type of COPD.
- Others have little or no sputum or hypoxia at rest, but breathlessness and wheezing is severe and emphysema is prominent – the pink puffer’ type of COPD. These patients are commonly underweight.
- Most patients with COPD present with a mixed pattern rather than the ‘blue bloater’ or ‘pink puffer’ extremes.
SYMPTOMS NOT TYPICAL OF COPD

- **Haemoptysis** – can occur due to COPD alone, but its appearance is such a patient suggests the possibility of malignancy, which must be carefully sought.
- **Seasonal exacerbations in spring or summer** are more likely in asthma.
- Excellent response to bronchodilators or steroids with definite symptom-free intervals is suggestive of asthma, not COPD.
SYMPTOMS NOT TYPICAL OF COPD (CONTD).

- Continuous expectoration of **purulent sputum** is more typical of bronchiectasis than COPD.
- **Breathlessness without productive cough or wheezing** is more typical of cardiac disease or of other lung diseases such as interstitial pulmonary fibrosis.
Difference between COPD and Asthma

- **In COPD** there is permanent damage to the airways. The narrowed airways are fixed, and so symptoms are chronic (persistent). Treatment to open up the airways, is therefore limited.

- **In asthma** there is inflammation in the airways which makes the muscles in the airways constrict. This causes the airways to narrow. The symptoms tend to come and go, and vary in severity from time to time. Treatment to reduce inflammation and to open up the airways usually works well.

- **COPD** is more likely than asthma to cause a chronic (ongoing) cough with sputum.
Difference between COPD and asthma (cont…)

- Night time waking with breathlessness or wheeze is common in asthma and uncommon in COPD.

- **COPD** is rare before the age of 35 whilst asthma is common in under-35.
PHYSICAL EXAMINATION

- Large, barrel-shaped chest.
- Prominent accessory respiratory muscles in neck.
- Low, flat diaphragm causing costal margin retractions on inspiration.
- Diminished breath sounds, distant heart sounds.
- Prolonged expiration with generalized wheezing predominantly on expiration.
PHYSICAL EXAMINATION (CONTD).

- **Depressed liver**, which is not enlarged.
- The ‘**blue bloater**’ type of COPD patient may also have:
  - Cyanosis at rest or mild exertion.
  - Oedema of ankles
  - Crackles at lung bases.
  - Loud second heart sound in pulmonary area (difficult to hear in COPD).
- The ‘**pink puffer**’ type of COPD patient may also have:--.
  - Expiratory pursed-lip breathing, thin body build and tendency to lean forward over a support to assist breathing.
Systemic Effects of COPD

Angina
Acute coronary syndromes

Diabetes
Metabolic syndrome

Lung Infections
Lung Cancer

Weight loss
Muscle weakness

Osteoporosis

Peptic ulceration

Systemic Inflammation
Oxidative Stress

Fabbri, ERJ, 2008
Diagnosis

a) History.
b) PFT.
c) Spirometry-to find out airflow obstruction.
d) ABG analysis.
e) HRCT/CT scan of the lung.
f) Screening of alpha antitrypsin deficiency.
g) X-ray radiography.
h) Sputum sample showing neutrophil granulocytes (inflammatory white blood cells) and Check for pathogenic microorganisms such as Streptococcus spp.
Complications

- Respiratory insufficiency
- Respiratory failure
- Pneumonia
- Pneumothorax
- Pulmonary artery hypertension.
Objectives of COPD Management

- Prevent disease progression.
- Relieve symptoms.
- Improve exercise tolerance.
- Improve health status.
- Prevent and treat exacerbations.
- Prevent and treat complications.
- Reduce mortality.
- Minimize side effects from treatment.
TREATMENT OPTIONS FOR COPD

Self-Management Education and Smoking Cessation
Bronchodilators
Inhaled Corticosteroids
Pulmonary Rehabilitation
Oxygen
Surgery

Increasing severity
Manage Exacerbations

Common Causes of Acute Exacerbations of COPD

Primary
- Tracheobronchial infection
- Air pollution

Secondary
- Pneumonia
- Pulmonary embolism
- Pneumothorax
- Rib fractures/chest trauma
- Inappropriate use of sedatives, narcotics, beta-blocking agents
- Right and/or left heart failure or arrhythmias
Management of Acute COPD

Controlled oxygen therapy
Start at 24-28%; vary according to ABG
Aim for a PaO2 >8.0 kPa with a rise in PaCo2 <1.5kPa

Nebulized bronchodilators
Salbutamol 5mg/4h and Ipratropium 500 µg/6h

Steroids
I/V hydrocortisone 200 mg and Oral Prednisolone 30-40 mg
Management of Acute COPD (Contd.)

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**Antibiotics**

Use of evidence of infection: e.g. amoxicillin 500 mg/6h P.O.

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**Physiotherapy** to aid sputum expectoration

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If no response: Repeat nebulizers and consider I/V aminophylline
Management of Acute COPD (Contd.)

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If no response:

1. Consider **nasal intermittent positive pressure ventilation** if respiratory rate >30 or pH <7.35. I is delivered by nasal mask and a flow generator

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2. Consider **intubation & ventilation** if pH<7.26 and PaCO2 is rising

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3. Consider **respiratory stimulant drug** e.g. doxapram 1-2 mg/min IV. SE: agitation, confusion, tachycardia, nausea
Only for patients who are not suitable for mechanical ventilation
A short – term measure only
Management of complications

- Acute exacerbations.
- Chronic respiratory failure
- Acute respiratory failure
- COR pulmonale
PULMONARY REHABILITATION

1. Education about the disease process.
2. Breathing retraining.
3. Exercise training.
4. Proper use of medications and oxygen.
5. Nutritional support.
6. Psychological support.
Future trends

• New technologies i.e. (NIPPV)
• Early detection.
• New therapies:
  1. $\alpha_1$— antitrypsin replacement therapy.
  2. New anticholinergics. i.e. Tiotropium bromide.
  3. Enzyme/mediator inhibitors i.e. Specific neutrophil elastase inhibitors.
  4. Anti-inflammatory treatment i.e. phosphodiesterase (PDE) type 4 inhibitors.
SELF MANAGEMENT OF COPD

- TAKE YOUR MEDICATIONS REGULARLY.

- EXERCISE REGULARLY EVERYDAY OR ELSE ATLEAST 4 OUT OF 7 DAYS.
REMEMBER TAKE YOUR VACCINATION REGULARLY
STAY AWAY FROM INFECTIONS BY MAINTAINING GOOD HYGIENE
QUIT SMOKING
EAT A REGULAR BALANCED DIET
DRINK PLENTY OF PLAIN FRESH WATER AT LEAST 1.5L/DAY
DRINK CAFFEINATED DRINKS AND ALCOHOL IN MODERATION
GET PLENTY OF SLEEP
Questions

- What is emphysema?
• What is Chronic Bronchitis?
What are the examination findings in patients with COPD?
• How will you manage a patient with COPD?
THANK YOU!