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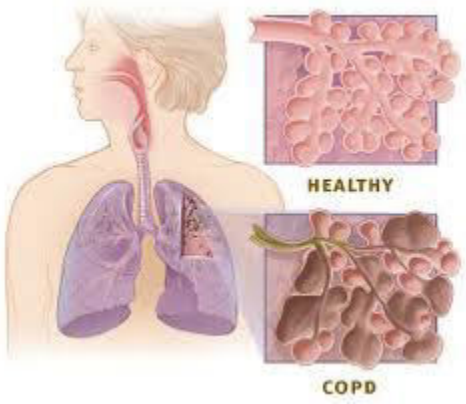
CHRONIC OBSTRUCTIVE PULMONARY DISEASE

1. DEFINITION:

COPD refers to a disease characterized by airflow limitation that is not fully reversible. The airflow limitation is generally progressive and is normally associated with an inflammatory response of the lungs due to irritants. COPD includes chronic bronchitis and emphysema. Asthma is not considered part of COPD due to its reversibility.

Chronic bronchitis is a chronic inflammation of the lower respiratory tract characterized by excessive mucus secretion, cough, and dyspnea associated with recurring infections of the lower respiratory tract.

Emphysema is a complex lung disease characterized by destruction of the alveoli, enlargement of distal airspaces, and a breakdown of alveolar walls. There is a slowly progressive deterioration of lung function for many years before the development of illness.



2.ETIOLOGY:

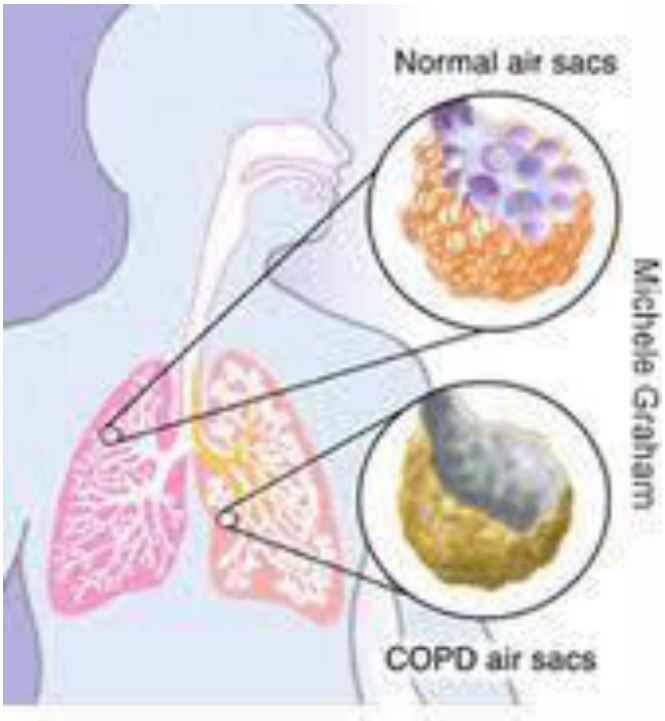
The etiology of COPD includes:

- Cigarette smoking.
- Air pollution, occupational exposure.
- Allergy, autoimmunity.
- Infection.
- Genetic predisposition, aging.

Alpha$_1$-antitrypsin deficiency is a genetically determined cause of emphysema and occasionally liver disease. Alpha1-antitrypsin serves primarily as an inhibitor of neutrophil elastase, an elastin-degrading protease released by neutrophils. When alveolar structures are left unprotected from exposure to elastase, progressive destruction of elastin tissues results in the development of emphysema.

3. PATHOPHYSIOLOGY:

- The person with COPD may have:
  - Excessive secretion of mucus and chronic infection within the airways (bronchitis)—infection, irritation, hypersensitivity→local hyperemia→hypertrophy of mucus glands→increase in size and number of mucusproducing elements in bronchi (mucus glands and goblet cells)→inflammation and edema→narrowing and obstruction of airflow.
  - Increase in size of airspaces distal to the terminal bronchioles, with loss of alveolar walls and elastic recoil of the lungs (emphysema) with hyperinflation.
  - There may be an overlap of these conditions.
- As a result of these conditions, there is a subsequent derangement of airway dynamics (eg, obstruction to airflow).



Noxious particles or gases

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Abnormal inflammatory response of the lungs (airways, parenchyma, and pulmonary vasculature)

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Due to chronic inflammation the body tries to repair it, narrowing occurs in the small peripheral airways

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Over time, this injury repair process causes scar tissue formation and narrowing of the airway lumen

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In addition to that, imbalance between proteinases and antiproteinases in the lung takes place

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Damage the parenchyma of the lungs

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The inflammatory response causes pulmonary vasculature changes that are characterized by thickening of the vessel wall

4. CLINICAL MANIFESTATIONS:

Chronic Bronchitis

Usually insidious, developing over a period of years

- Presence of a productive cough lasting at least 3 months per year for 2 successive years
- Production of thick, gelatinous sputum; greater amounts produced during superimposed infections
- Wheezing and dyspnea as disease progresses

Emphysema

Gradual in onset and steadily progressive

- Dyspnea (particularly with stairs or inclines), decreased exercise tolerance.
- Cough may be minimal, except with respiratory infection.
- Sputum expectoration—mild.
- Increased anteroposterior diameter of chest (barrel chest) due to air trapping, causing diaphragmatic flattening.

Exacerbation of COPD

Episodic and often recurrent, contributing to disease worsening.

- Acute change in the patient's baseline dyspnea, cough, or sputum, which requires a change in treatment.
- Triggers may include viral and/or bacterial infection, air pollution, allergens, sedatives, heart failure, and pulmonary embolism.
- Increasing sputum purulence is associated with bacterial infection.
- Treatment often includes bronchodilators, systemic corticosteroids, antibiotics, supplemental oxygen and, possibly, non-invasive mechanical ventilation or intubation with mechanical ventilation.

5. DIAGNOSTIC EVALUATION:

- PFTs demonstrate airflow obstruction—reduced FVC, FEV_1, FEV_1 to FVC ratio; increased residual volume to total lung capacity (TLC) ratio, possibly increased TLC. Post-bronchodilator measurement determines severity of COPD.
  - Stage I (mild)—$FEV_1/FVC < 0.7$; $FEV_1 \geq 80\%$ predicted
  - Stage II (moderate)—$FEV_1/FVC < 0.7$; FEV_1 50% to 79% predicted
  - Stage III (severe)—$FEV_1/FVC < 0.7$; FEV_1 30% to 49% predicted
  - Stage IV (very severe)—$FEV_1/FVC < 0.7$; $FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted plus chronic respiratory failure
- ABG levels—decreased PaO_2, pH, SaO_2, and increased CO_2
- Chest X-ray—in late stages, hyperinflation, flattened diaphragm, increased retrosternal space, decreased vascular markings, possible bullae
- $Alpha_1$-antitrypsin assay useful in identifying genetically determined deficiency in emphysema

6. MANAGEMENT:

The goals of COPD management are to relieve symptoms, prevent disease progression, reduce mortality, improve exercise tolerance, improve health status, and prevent and treat complications and exacerbations. Goals of acute care include reversing airflow obstruction. Treatment regimens are based on severity.

- Smoking cessation is essential to stop injury to the respiratory epithelium.

- Inhaled bronchodilators reduce dyspnea and bronchospasm; delivered by metered dose inhalers (MDI), dry powder inhalers, or handheld or mask nebulizer devices.
  - Anticholinergics such as tiotropium (Spiriva), ipratropium (Atrovent)
  - Short-acting beta-adrenergic agonists such as albuterol (Proventil, Ventolin), levobuterol (Xopenex)
  - Long-acting beta-adrenergic agonists such as salmeterol (Serevent), formoterol (Foradil), arformoterol (Brovana)
- Methylxanthines, such as theophylline (Theo-Dur), given orally as sustained-release formulation for chronic maintenance therapy (not first-line treatment).
- Inhaled corticosteroids are recommended for patients with symptomatic COPD with FEV_1 that is less than 50% of the predicted value and repeated exacerbations (three within the last 3 years).
- Oral corticosteroids are used in acute exacerbations for anti-inflammatory effect; may also be given I.V. in severe cases. Long-term treatment with systemic corticosteroids is not recommended due to adverse effects.
- For retained secretions, chest physical therapy, including postural drainage for secretion clearance; and breathing retraining may be used for improved ventilation and control of dyspnea.
- Supplemental oxygen therapy for patients with hypoxemia. CO_2 must be monitored to determine increased CO_2 retention.
- Pulmonary rehabilitation to improve function, strength, symptom control, disease self-management techniques, independence, and quality of life.
  - Studies on pulmonary rehabilitation demonstrate increased strength, function, independence, ADL management, and improved symptom control, coping, well-being, and quality of life as well as decreased facility admissions and decreased length of stay.
  - Improved survival in COPD is associated with supplemental O_2 use and smoking cessation.
- Antimicrobial agents for episodes of respiratory infection.
- Lung volume reduction surgery is a potential option for treatment of upper lobe emphysema in patients with poor exercise capacity.
- Influenza (annual) and pneumococcal vaccination.
- Lung transplantation may be considered for people with advanced COPD.
- Self-management strategies such as management of exacerbations.
- Treatment for alpha1-antitrypsin deficiency:

- Regular I.V. infusions (normally every week) of human alpha1-antitrypsin (Prolastin, Zemaira, or Aralast) as replacement therapy to correct the antiprotease imbalance in the lungs.
- Quitting smoking.
- Lung transplantation may be considered for people with severely disabling alpha1-antitrypsin disease.

7.1. NURSING MANAGEMENT:

Nursing Assessment

- Determine smoking history, exposure history, positive family history of respiratory disease, onset of dyspnea.
- Note amount, color, and consistency of sputum.
- Inspect for use of accessory muscles during respiration and use of abdominal muscles during expiration; note increase of anteroposterior diameter of chest.
- Auscultate for decreased/absent breath sounds, crackles, decreased heart sounds.
- Determine level of dyspnea, how it compares to patient's baseline.
- Determine oxygen saturation, pulse and respiratory rate at rest and with activity.

Nursing Diagnoses

- Ineffective Breathing Pattern related to chronic airflow limitation
- Ineffective Airway Clearance related to bronchoconstriction, increased mucus production, ineffective cough, possible bronchopulmonary infection
- Risk for Infection related to compromised pulmonary function, retained secretions, and compromised defense mechanisms
- Impaired Gas Exchange related to chronic pulmonary obstruction, V/Q abnormalities due to destruction of alveolar capillary membrane
- Imbalanced Nutrition: Less Than Body Requirements related to increased work of breathing, air swallowing, drug effects with resultant wasting of respiratory and skeletal muscles
- Activity Intolerance related to compromised pulmonary function, resulting in shortness of breath and fatigue
- Disturbed Sleep Pattern related to hypoxemia and hypercapnia

- Ineffective Coping related to the stress of living with chronic disease, loss of independence, depression, anxiety disorder

Nursing Interventions

Improving Airway Clearance

- Eliminate pulmonary irritants, particularly cigarette smoking.
  - Cessation of smoking usually results in less pulmonary irritation, sputum production, and cough, and may slow progression of COPD and improve survival.
  - Keep patient's room as dust-free as possible.
  - Add moisture (humidifier, vaporizer) to indoor environment, if appropriate.
- Administer bronchodilators to control bronchospasm and dyspnea and assist with raising sputum.
  - Assess for adverse effects—tremulousness, tachycardia, cardiac dysrhythmias, CNS stimulation, hypertension.
  - Auscultate the chest after administration of aerosol bronchodilators to assess for improvement of aeration and reduction of adventitious breath sounds.
  - Observe if patient has reduction in dyspnea.
  - Monitor serum theophylline level, as ordered, to ensure therapeutic level and prevent toxicity.
- Mobilize the patient when stable. Use postural drainage positions to aid in clearance of secretions, if mucopurulent secretions are responsible for airway obstruction.
- Use controlled coughing.
- Keep secretions liquid.
  - Encourage fluid intake within level of cardiac reserve.
  - Give continuous aerolized sterile water or nebulized normal saline to humidify bronchial tree and liquefy sputum if appropriate.
  - Avoid dairy products if these increase sputum production.

Improving Breathing Pattern

- Teach and supervise breathing retraining exercises to improve dyspnea and decrease work of breathing.

- Teach diaphragmatic, lower costal, and abdominal breathing, using a slow and relaxed breathing pattern to reduce respiratory rate and decrease energy cost of breathing.
- Use pursed-lip breathing at intervals and during periods of dyspnea to control rate and depth of respiration and improve respiratory muscle coordination. Pursed-lip and diaphragmatic breathing should be practiced for 10 breaths four times daily before meals and before sleep. Inspiratory to expiratory ratio should be 1:2.

- Discuss and demonstrate relaxation exercises to reduce stress, tension, and anxiety.
- Encourage patient to assume position of comfort to decrease dyspnea. Positions might include leaning trunk forward with arms supported on a fixed object, sleeping with two or three pillows, or sitting upright.

Controlling Infection

- Recognize early manifestations of respiratory infection—increased dyspnea, fatigue; change in color, amount, and character of sputum including purulence; anxiety, irritability; low-grade fever.
- Obtain sputum for Gram stain and culture and sensitivity.
- Administer prescribed antimicrobials to control secondary bacterial infections in the bronchial tree, thus clearing the airways.

Improving Gas Exchange

- Watch for and report excessive somnolence, restlessness, aggressiveness, anxiety, headaches, or confusion; central cyanosis; and shortness of breath at rest, which is commonly caused by acute respiratory insufficiency and may signal respiratory failure.
- Review ABG levels; record values on a flow sheet so comparisons can be made over time.
- Monitor oxygen saturation and give supplemental oxygen, as ordered, to correct hypoxemia in a controlled manner. Monitor and minimize CO_2 retention. Patients that experience CO_2 retention may need lower oxygen flow rates.
- Be prepared to assist with non-invasive ventilation or intubation and mechanical ventilation if acute respiratory failure and significant CO_2 retention occur.

Improving Nutrition

- Take nutritional history, weight, and height.
- Encourage frequent small meals if patient is dyspneic and/or low weight; even a small increase in abdominal contents may press on diaphragm and impede breathing. Encourage snacking on high-calorie, high-protein snacks, such as cheese, nuts.
- Offer liquid nutritional supplements to improve caloric intake and counteract weight loss.
- Avoid foods producing gas and abdominal discomfort.
- Employ good oral hygiene before meals to sharpen taste sensations.
- Encourage pursed-lip breathing between bites if patient is short of breath; rest after meals.
- Give supplemental oxygen while patient is eating to relieve dyspnea as directed.
- Monitor body weight.

Increasing Activity Tolerance

- Reemphasize the importance of graded exercise and physical conditioning programs (may enhance delivery of oxygen to tissues; allows a higher level of functioning and independence with greater comfort). This may be part of a pulmonary rehabilitation program or a referral to physical therapy.
  - Discuss walking, stationary bicycling, swimming.
  - Encourage use of portable lightweight oxygen system for ambulation for patients with hypoxemia.
- Encourage patient to carry out regular exercise program 3 to 7 days per week to increase physical endurance, but to discuss with physician before beginning program.
- Train patient in energy-conservation techniques and pacing of activities.

Improving Sleep Patterns

- Maintain a balanced schedule of activity and rest.
- Use nocturnal oxygen therapy when appropriate.
- Avoid use of sedatives and hypnotics that may cause respiratory depression.

Enhancing Coping

- Understand that the constant shortness of breath and fatigue make the patient irritable, apprehensive, anxious, and depressed, with feelings of helplessness and hopelessness.
- Assess the patient for reactive behaviors (anger, depression, acceptance).
- Demonstrate a positive and interested approach to the patient.
  - Be a good listener and show that you care.
  - Be sensitive to patient's fears, anxiety, and depression; may provide emotional relief and insight.
  - Provide patient with control of as many aspects of care as possible.
- Strengthen the patient's self-image.
- Allow the patient to express feelings. Be aware that (within a controlled degree) the mechanisms of denial and repression may be useful defense mechanisms.
- Be aware that dyspnea, fatigue, and altered self-image may lead to discomfort with sexuality and intimacy in patients with COPD. Encourage discussion of concerns and fears, and clarify misunderstandings. Encourage patient to use a bronchodilator and secretion-clearance techniques before sexual activity, plan for sexual relations at time of day when patient has highest level of energy, use supplemental oxygen if needed, and consider alternative displays of affection to loved one.
- Support spouse/family members. Refer to local or national support groups (American Lung Association 1-800-LUNG-USA; www.lungusa.org).

8. COMMUNITY AND HOME CARE CONSIDERATIONS:

- Help to relax and work at a slower pace. Obtain occupational therapy consult to help employ work simplification techniques, such as sitting for tasks, pacing activities, using dressing aids (grabber, sock aid, long-handled shoe horn), shower bench, and handheld shower head.
- Encourage enrollment in a pulmonary rehabilitation program where available and Better Breathers club or other support group found through the American Association for Cardiovascular and Pulmonary Rehabilitation at 312-321-5146 (www.aacvpr.org/). Components include breathing retraining techniques, proper use of medications and inhalers, secretion-clearance techniques, prevention and management of respiratory infection, panic control, controlling dyspnea with ADLs

and stair climbing, control of pulmonary irritants, monitored and supervised exercise, proper use of oxygen systems, and group support.

- Suggest vocational counseling to help patient maintain gainful employment within his physical limits for as long as possible.
- Warn patient to avoid excessive fatigue, which is a factor in producing respiratory distress.
- Advise to adjust activities per individual fatigue patterns.
- Advise to try to cope with emotional stress as positively as possible. Such stress triggers attacks of dyspnea. Teach coping strategies, such as relaxation techniques, meditation, guided imagery.
- Stress that progression of worsening lung function may be slowed through close medical follow-up for rest of life.
- For patients who use oxygen or who are hypoxic, promote use of portable lightweight oxygen systems.

9. COMPLICATIONS:

Exacerbation

- Respiratory failure
- Pneumonia, overwhelming respiratory infection
- Right-sided heart failure, dysrhythmias
- Depression, anxiety disorder
- Skeletal muscle dysfunction

10. PATIENT EDUCATION AND HEALTH MAINTENANCE:

General Education

- Give the patient a clear explanation of the disease, what to expect, how to treat and live with it. Reinforce by frequent explanations, reading material, demonstrations, and question and answer sessions. (See Patient Education Guidelines, page 318.)
- Review with the patient the objectives of treatment and nursing management.
- Work with the patient to set goals (eg, stair climbing, return to work).

- Encourage patient involvement in disease self-management techniques, such as identification and prompt reporting of respiratory infection or respiratory deterioration. Encourage patient to have open communication and partnership and regular follow-up with primary care provider.

Avoid Exposure to Respiratory Irritants

- Advise patient to stop smoking and avoid exposure to secondhand smoke.
- Advise patient to avoid sweeping, dusting, and exposure to paint, aerosols, bleaches, ammonia, strong odors, and other respiratory irritants.
- Advise patient to keep entire house well-ventilated.
- Warn patient to stay out of extremely hot/cold weather to avoid bronchospasm and dyspnea.
  - Avoid cold air and use a scarf over nose and mouth, and drink a warm beverage to warm inspired air in cold weather.
  - Stay indoors and exercise indoors with air conditioning when air pollution level is high.
  - Try to avoid abrupt environmental changes.
  - Shower in warm (not hot) water.
- Instruct patient to humidify indoor air in winter; maintain 30% to 50% humidity for optimal mucociliary function.
- Encourage opening windows at home to promote ventilation. Suggest the use of a HEPA air cleaner to remove dust, pollen, and other particles, if sensitive.

Prevent and Treat Respiratory Infections

- Warn against exposure to people with respiratory infections; a respiratory infection makes symptoms worse and can produce further irreversible damage.
- Advise patient to avoid crowds and areas with poor ventilation.
- Teach patient how to recognize and report evidence of respiratory infection promptly—changes in character of sputum (amount, color, or consistency—becoming purulent), increasing shortness of breath, increasing cough, wheezing, fever, chills, increasing difficulty in raising sputum, chest pain.
- Instruct patient to discuss with health care provider taking prescribed antimicrobial at first sign of a pulmonary infection and adding oral corticosteroids for exacerbation of COPD.

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