Clinical Practice Guideline for COPD Diagnosis, Management, and Prevention

Chronic obstructive pulmonary disease (COPD) is a slowly progressive lung disease involving the airways and/or pulmonary parenchyma, resulting in a gradual loss of lung function. The symptoms of COPD range from chronic cough, sputum production, and wheezing to more severe symptoms, such as dyspnea, poor exercise tolerance, and signs or symptoms of right-sided heart failure. In the United States, COPD affects more than 5% of the adult population and is the 4th leading cause of death and the 12th leading cause of morbidity.

Risk Factors

- Tobacco smoke (cigarette, pipe, cigar, and other types of tobacco)
- Prolonged exposure to occupational dusts and chemicals (vapors, irritants, and fumes)
- Indoor air pollution (biomass fuel used for heating and cooking in poorly vented dwellings)
- Outdoor air pollution
- Any factor that affects lung growth during gestation and childhood (low birth weight, respiratory infections, etc)
- Genetic risk factor is a severe hereditary deficiency of alpha-1 antitrypsin

Key Indicators for Considering a COPD Diagnosis

Consider COPD and perform spirometry if any of the following indicators are present in an individual over age 40:

- Dyspnea that is progressive, worse with exercise, persistent (present every day) and described by the patient as an "increased effort to breathe, "heaviness", "gasping", etc.
- Chronic cough: may be intermittent and may be unproductive
- Chronic sputum production
- History of exposure to risk factors

Note: The diagnosis should be confirmed by spirometry. When performing spirometry, measure Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV_1). Calculate FEV_1/FVC ratio. Spirometric results are expressed as % Predicted using appropriate normal values for the person's sex, age, and height.

Stages of COPD

Stage I: Mild COPD

Mild airflow limitation (FEV_1/FVC < 70%; $FEV_1 \geq 80\%$ predicted) and sometimes, but not always, chronic cough and sputum production. At this stage, the individual may not be aware that his or her lung function is abnormal.

Stage II: Moderate COPD

Worsening airflow limitation (FEV_1/FVC < 70%; $50\% \leq FEV_1 < 80\%$ predicted) with shortness of breath typically developing on exertion. This is the stage at which patients typically seek medical attention because of chronic respiratory symptoms or an exacerbation of their disease.

Stage III: Severe COPD

Further worsening of airflow limitation (FEV_1/FVC < 70%; $30\% \leq FEV_1 < 50$ % predicted), greater shortness of breath, reduced exercise capacity, and repeated exacerbations which have an impact on patient's quality of life.

Stage IV: Very Severe COPD

Severe airflow limitation (FEV_1/FVC < 70%; FEV_1 < 30% predicted) or FEV_1 < 50% predicted plus chronic respiratory failure. Patients may have *Very Severe* (Stage IV) COPD even if the FEV_1 > 30% predicted, whenever this complication is present. At this stage, quality of life is very appreciably impaired and exacerbations may be life-threatening.

Differential Diagnosis of COPD

COPD: Onset in mid-life; symptoms slowly progressive; long smoking history; dyspnea during exercise; largely irreversible airflow limitation

Asthma: onset early in life; symptoms vary from day to day; symptoms at night/early morning; allergy, rhinitis and/or eczema also present; family history of asthma; largely reversible airflow limitation

Congestive Heart Failure: fine basilar crackles on auscultation; chest X-ray shows dilated heart, pulmonary edema; pulmonary function tests indicate volume restriction, not airflow limitation

Bronchiectasis: large volumes of purulent sputum; commonly associated with bacterial infection; coarse crackles/clubbing on auscultation; chest X-ray/CT shows bronchial dilation, bronchial wall thickening

Tuberculosis: onset all ages; chest X-ray shows lung infiltration or nodular lesions; microbiological confirmation; high local prevalence of tuberculosis

Obliterative Bronchiolitis: onset in younger age; non smokers; may have history of rheumatoid arthritis or fume exposure; CT on expiration shows hypodense areas

Diffuse Panbronchiolitis: most patients are male and nonsmokers; almost all have chronic sinusitis; chest X-ray and HRCT show diffuse small centrilobular nodular opacities and hyperinflation

Components of Care: A COPD Management Program

Component 1: Assess and Monitor Disease

A detailed medical history of a new patient known or thought to have COPD should assess:

- Exposure to risk factors, including intensity and duration
- Past medical history, including asthma, allergy, sinusitis or nasal polyps, respiratory infections in childhood, and other respiratory diseases
- Family history of COPD or other chronic respiratory disease
- Pattern of symptom development
- History of exacerbations or previous hospitalizations for respiratory disorder
- Presence of comorbidities, such as heart disease, malignancies, osteoporosis, and musculoskeletal disorders, which may also contribute to restriction of activity
- Appropriateness of current medical treatments
- Impact of disease on patient's life, including limitation of activity, missed work and economic impact; effect on family routines,; and feelings of depression and anxiety
- Social and family support available to the patient
- Possibilities for reducing risk factors, especially smoking cessation

In addition to spirometry, the following tests should be undertaken for the assessment of a patient with Stage II-IV COPD:

- Bronchodilator reversibility testing
- Chest X-ray
- Arterial blood gas measurement (in patients with FEV1 < 50% predicted or signs of respiratory or right heart failure)
- Alpha-1 antitrypsin deficiency screening (in patients of Caucasian descent under 45 years or with strong family history of COPD)

Component 2: Reduce Risk Factors

Smoking cessation is the single most effective-and cost effective- intervention to reduce the risk of developing COPD and slow its progression.

- Counsel and aid the patient on smoking cessation
- Pharmacotherapy (nicotine replacement, buproprion/nortryptiline, and/or varenicline) is recommended when counseling is not sufficient. Special consideration should be given before using pharmacotherapy in people smoking fewer than 10 cigarettes per day, pregnant women, adolescents, and those with medical contraindications (unstable coronary artery disease, untreated peptic ulcer, and recent myocardial infarction or stroke for nicotine replacement; and history of seizures for buproprion)

Other possibilities for reducing risk factors include smoking prevention, reducing occupational exposures and avoiding indoor and outdoor air pollution.

Component 3: Manage Stable COPD

Management of stable COPD should be guided by the following general principles:

- Determine disease severity on an individual basis by taking into account the patient's symptoms, airflow limitation, frequency and severity of exacerbations, complications, respiratory failure, comorbidities, and general health status
- Implement a stepwise treatment plan that reflects this assessment of disease severity
- Choose treatments according to national and cultural preferences, the patient's skills and preferences, and the local availability of medications

Patient education can help improve skills, ability to cope with illness, and health status. It is an effective way to accomplish smoking cessation, initiate discussions and understanding of advance directives and end-of-life issues, and improve responses to acute exacerbations.

Pharmacologic treatment can control and prevent symptoms, reduce the frequency and severity of exacerbations, improve health status and improve exercise tolerance.

- Bronchodilators
  - Inhaled therapy is preferred
  - Give "as needed" to relieve intermittent or worsening symptoms, and on a regular basis to prevent or reduce persistent symptoms
  - The choice between β_2-agonists, anticholinergics, methylxanthines, and combination therapy depends on the availability of medications and each patient's individual response in terms of both symptom relief and side effects
  - Regular treatment with long-acting bronchodilators is more effective and convenient than treatment with short-acting bronchodilators
  - Combining bronchodilators may improve efficacy and decrease the risk of side effects compared to increasing the dose of a single bronchodilator

- Glucocorticosteroids
  - Regular treatment with inhaled Glucocorticosteroids is only appropriate for patients with an $FEV_1 < 50\%$ predicted and repeated exacerbations (for example, 3 in the past year). This treatment reduces the frequency of exacerbations but does not modify the long-term decline in FEV_1.
  - Treatment with inhaled Glucocorticosteroids increases the likelihood of pneumonia and has no significant effects on mortality
  - Long-term treatment with oral Glucocorticosteroids is NOT recommended

- Vaccines
  - Influenza vaccines reduce serious illness and death in COPD patients by 50%. Vaccines should be given

once per year.
    - Pneumococcal polysaccharide vaccine is recommended for COPD patients 65 years and older, and has been shown to reduce community-acquired pneumonia in those under age 65 with FEV_1 < 40% predicted.
- Antibiotics
    - Not recommended except for treatment of infectious exacerbations and other bacterial infections

- Mucolytic (Mucokinetic, Mucoregulator) Agents
    - Patients with viscous sputum may benefit from mucolytics, but overall benefits are very small. Use is not recommended.

- Antitussives
    - Regular use contraindicated in stable COPD

Non-Pharmacologic Treatment includes rehabilitation, oxygen therapy, and surgical interventions.

- Rehabilitation programs should include, at a minimum:
    - Exercise training
    - Nutrition counseling
    - Education

Note: The minimum length of an effective rehabilitation program in six weeks. Benefit does wane after a rehabilitation program ends, but if exercise training is maintained at home the patient's health status remains above pre-rehabilitation levels.

- Oxygen Therapy
    - The long-term administration of oxygen (> 15 hours per day) to patients with chronic respiratory failure increases survival and has a beneficial impact on pulmonary hemodynamics, hematologic characteristics, exercise capacity, lung mechanics, and mental state.
    - Initiate oxygen therapy for patients with Stage IV COPD if:
        - PaO_2 is at or below 7.3 kPa (55 mm Hg) or SaO_2 is at or below 88% with or without hypercapnia; OR,
        - $PaCO_2$ is between 7.3 kPa (55 mm Hg) and 8.0 kPa (60 mm Hg) or SaO_2 is 88%, if there is evidence of pulmonary hypertension, peripheral edema suggesting congestive heart failure, or polycythemia (hematocrit > 55%).

- Surgical Treatments
    - Bullectomy and lung transplantation may be considered in carefully selected patients with Stage IV COPD. There is currently no sufficient evidence that would support the widespread use of lung volume reduction surgery (LVRS).

Note: There is no convincing evidence that mechanical ventilatory support has a role in the routine management of stable COPD.

<u>Component 4: Manage Exacerbations</u>

An exacerbation of COPD is defined as 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 normal day-to-day variations, is acute in onset, and may warrant a change in regular medication in a patient with underlying COPD.

The most common causes of an exacerbation are infection of the tracheobronchial tree and air pollution, but the cause of about one-third of severe exacerbations cannot be identified.

How to Assess the Severity of an Exacerbation

Arterial blood gas measurements (in hospital):

- PaO_2 < 8.0 kPa (60 mm Hg) and/or SaO_2 < 90% with or without $PaCO_2$ > 6.7 kPa (50 mm Hg) when breathing room air indicates respiratory failure.
- Moderate-to-severe acidosis (pH < 7.36) plus hypercapnia (PaCO2 > 6-8 kPa, 45-60 mm Hg) in a patient with respiratory failure is an indication for mechanical ventilation.

Chest X-ray:

- Chest radiographs (posterior/anterior plus lateral) identify alternative diagnoses that can mimic the symptoms of an exacerbation.

ECG:

- Aids in the diagnosis of right ventricular hypertrophy, arrhythmias, and ischemic episodes.

Other Laboratory Tests:

- Sputum culture and antibiogram to identify infection if there is no response to initial antibiotic treatment
- Biochemical tests to detect electrolyte disturbances, diabetes, and poor nutrition
- Whole blood count can identify polycythemia or bleeding

Home Management

- Bronchodilators: Increase dose and/or frequency of existing short-acting bronchodilator therapy, preferably with β_2-agonists. If not already used, add anticholinergics until symptoms improve.
- Glucocorticosteroids: If baseline FEV_1 < 50% predicted, add 30-40 mg oral prednisolone per day for 7-10 days to the bronchodilator regimen. Nebulized budesonide may be an alternative to oral Glucocorticosteroids in the treatment of nonacidotic exacerbations.

Hospital Management

Patients with the characteristics listed below should be hospitalized:

- Marked increase in intensity of symptoms, such as sudden development of resting dyspnea
- Severe background COPD
- Onset of new physical signs (e.g., cyanosis, peripheral edema)
- Failure of exacerbation to respond to initial medical management
- Significant comorbidities
- Frequent exacerbations
- Newly occurring arrhythmias
- Diagnostic uncertainty
- Older age
- Insufficient home support

Antibiotics should be given to patients:

- With the following three cardinal symptoms: increased dyspnea, increased sputum volume, increased sputum purulence
- With increased sputum purulence and one other cardinal symptom
- Who require mechanical ventilation

References

Global Initiative for Chronic Obstructive Lung Disease: World Health Organization, National Heart, Lung and Blood Institute. Global Strategy for Diagnosis, Management, and Prevention of COPD. December, 2008.

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