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An update on COPD prevention, diagnosis, and management: The 2024 GOLD Report

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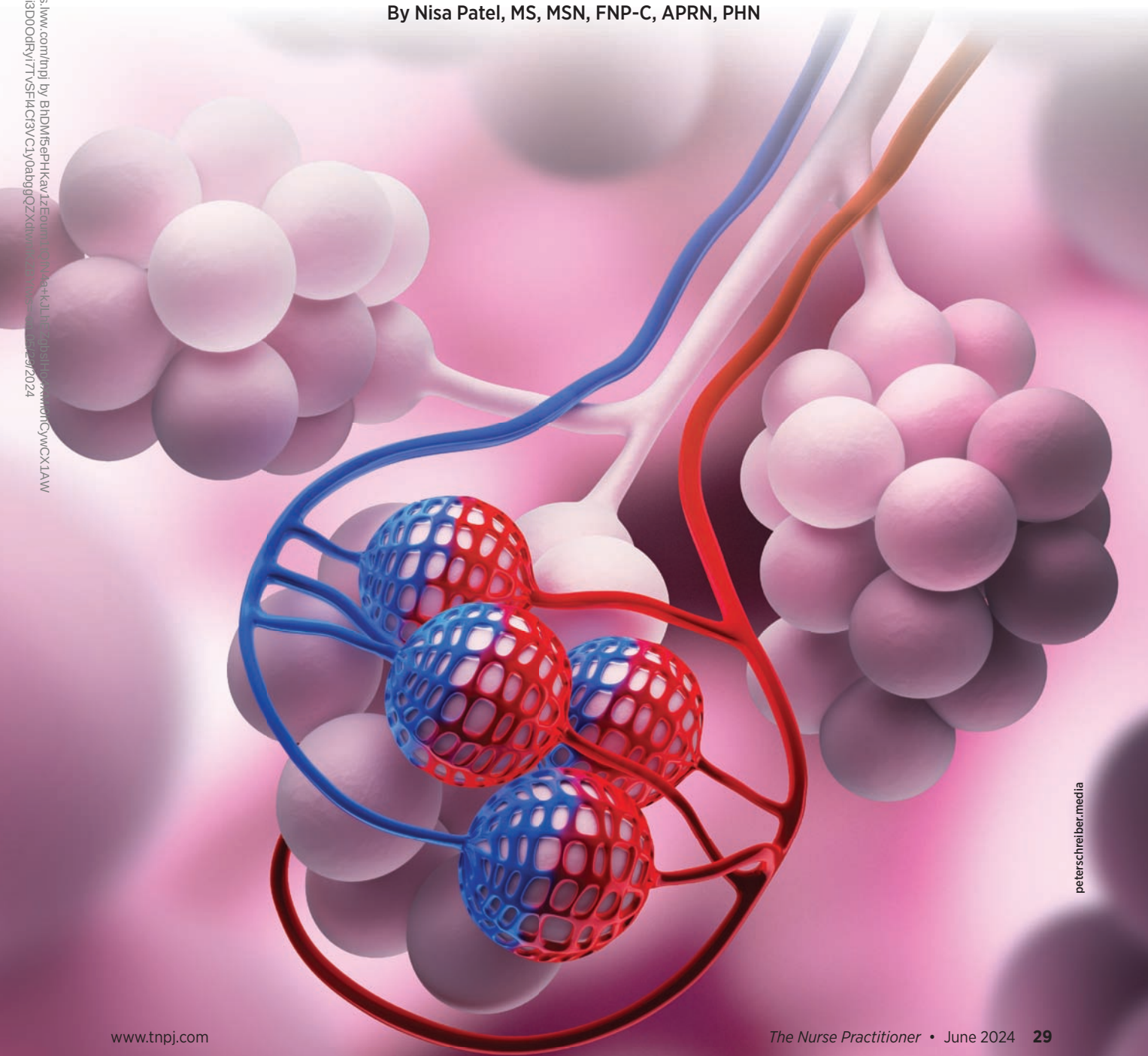

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ABSTRACT

Chronic obstructive pulmonary disease (COPD) is one of the top three causes of death throughout the world. Because of the preventable and treatable nature of the disease along with its prevalence, COPD represents a major public health challenge. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) Report provides a review of the most current evidence for prevention of COPD as well as the assessment, diagnosis, and treatment of people with the disease. The purpose of this article is to provide a summary of the 2024 revised GOLD Report and current best practices in accordance with the evidence.

Keywords: chronic obstructive pulmonary disease (COPD), COPD diagnosis, COPD exacerbations, COPD management, COPD prevention, GOLD Report, pulmonology

Chronic obstructive pulmonary disease (COPD) is a major cause of ailment and death globally. Throughout the world, populations endure long-term consequences from this disease, and many people suffer untimely deaths due to its complications.[1] Concerningly, the encumbrance from this disease is expected to rise due to increasing COPD risk factors and aging of the population. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) publishes an annual report on the state of the science relating to COPD.[2] This article aims to highlight the 2024 GOLD Report, entitled *Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease*. Of note, this article does not provide a comprehensive summary of the entire 2024 report. Providers are encouraged to review the report for more information.

BACKGROUND

COPD is a lung condition characterized by "chronic respiratory symptoms (dyspnea, cough, sputum production and/or exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction."[2] Patients with COPD typically report dyspnea, wheezing, chest tightness, fatigue, activity limitation, and/or cough with or without sputum production. They may also experience exacerbations of their COPD. Exacerbations constitute serious events characterized by increased respiratory symptoms requiring specific preventive and therapeutic measures to prevent adverse outcomes.

COPD diagnosis is typically made by the presence of a non-fully reversible airflow limitation (defined as a postbronchodilation ratio of forced expiratory volume in 1 second [FEV1]/forced vital capacity [FVC] of less than 0.7) as measured by spirometry.[2] FEV1 calculates the amount of air that a person can force out of their lungs in 1 second. FVC is the amount of air that an individual can forcibly exhale from their lungs after taking the deepest breath they can. Some individuals may present differently based on the stage of the disease. Outcomes can be improved with prevention, timely diagnosis, and timely treatment.[3]

COPD is thought to result from a gene (G)-environment (E) interaction over the lifetime (T) of an individual. This is referred to as "GETomics." It is believed that the G-E interaction leads to damage in the lungs and/or alters the normal development and aging processes.[2,4] The main environmental factors leading to COPD are tobacco smoking, inhalation of toxic particles, and inhalation of gases from indoor and outdoor air pollution.[2,4] Abnormal lung development also increases the likelihood of developing COPD.[2,4,5] On the genetic brim, rare mutations in the *SERPINA1* gene lead to the hereditary disorder alpha-1 antitrypsin deficiency (AATD), which is an identified risk factor for COPD.[5] Although some studies have found other genetic variants to be associated with reduced lung function and increased risk for COPD, the effect sizes of these studies are considerably smaller. Additionally, it is unknown whether these genes contribute to COPD development or are indicators of other causal genes.[2] Other risk factors for COPD include asthma or a history of severe childhood respiratory infections.

Chronic bronchitis is common among patients with COPD. The typical presentation of chronic bronchitis includes a chronic cough and sputum production for at least 3 months per year for 2 consecutive years in the absence of any other condition that could explain the aforementioned symptoms.[2] Among patients with COPD, an increased prevalence of chronic bronchitis exists in those who are male, are younger in age, have had greater pack-years of smoking, have severe airflow obstruction, and have increased occupational exposures, as well as in those who reside in rural areas.[2]

Some studies have found increased mucus production from chronic bronchitis in COPD to be associated with increased hospitalization and mortality.[2]

With understanding of the heterogeneity of COPD beyond one type solely caused by cigarette smoking, the GOLD Report emphasizes the importance of expanding on the classifications of COPD. The GOLD update includes a table that combines two recent taxonomic proposals developed independently to highlight etiotypes of COPD.[2,6,7] These etiotypes include genetically determined COPD, such as that caused by AATD; COPD due to abnormal lung development, such as that resulting from premature birth; environmental COPD, including disease resulting from cigarette smoking and disease resulting from biomass or pollution exposure; and others.

SCREENING

Screening spirometry for the diagnosis of COPD is not recommended in asymptomatic individuals without any significant exposures to tobacco or in the absence of other risk factors.[2] However, active case-finding using spirometry should be considered in those with COPD-akin symptoms or risk factors such as more than 20 pack-years of smoking, recurrent chest infections, and/or early-life events (including maternal smoking during pregnancy, prematurity, low birth weight, and/or exposure to secondhand smoke during infancy). Researchers have found that the combination of questionnaires with simple physiologic measurements can guide identification of COPD, which has been historically underdiagnosed, including in a significant percentage of patients with mild disease.[8-13]

A new recommendation of the 2024 GOLD guideline is that patients undergoing low-dose computed tomography (CT) scans for lung cancer screening should be evaluated for COPD through symptom assessment and spirometry, as the two conditions have many risk factors in common.[2] Furthermore, when patients with COPD risk factors other than smoking, such as those with developmental or genetic risk factors or environmental exposures, undergo lung imaging for respiratory symptoms, any abnormal findings that may point to COPD should trigger evaluation of symptoms and consideration of spirometry.

DIAGNOSIS

Providers should suspect COPD in any patient who reports dyspnea, chronic cough or sputum production, and/or a history of exposure to disease risk factors. However, forced spirometry demonstrating a postbronchodilator FEV1/FVC of less than 0.7 is required for diagnosis.[2,14]

Forced spirometry is the most reproducible and impartial measurement of airflow obstruction.[2] When preparing to perform spirometry, it is important to have an optimally trained technician, maximal effort on the patient's part, and a mechanism to account for any technical errors. Spirometry should be performed according to national recommendations: Expiratory volume/time traces should be smooth, the pause between inspiration and expiration should be less than 1 second, and the recording should be of a sufficient duration to reach a volume plateau. Both FVC and FEV1 should be the largest obtained from any one of three technically satisfactory curves, and the FVC and FEV1 values in the three curves should vary by no more than 5% or 150 mL, whichever is greater. The FEV1/FVC ratio should be taken from an acceptable curve with the largest sum of FVC and FEV1. When considering bronchodilation during spirometry, patients already on bronchodilator treatment do not need to discontinue it for the purpose of spirometry. FEV1 should be measured 10 to 15 minutes after administration of short-acting beta agonist or 30 to 45 minutes after short-acting anticholinergic or a combination of both classes. Spirometry measurements are evaluated by comparison of the results with appropriate reference values based on age, height, and sex. The presence of a postbronchodilator FEV1/FVC of less than 0.7 confirms non-fully reversible airflow obstruction.

It is important to recall that a chest radiograph cannot diagnose the disease. However, chest radiography can be useful in ruling out other diagnoses and detecting changes associated with COPD such as lung hyperinflation and hyperlucency.[2] Chest CT is also not a prerequisite for COPD diagnosis. Nevertheless, it is used as an evaluation tool for findings such as pulmonary nodules, coexisting lung disease, and lung cancer screening in patients with COPD.[2] A chest CT can also provide information of potential clinical relevance including presence, severity, and distribution of emphysema as well as potential comorbidities or airway abnormalities.[2] Therefore, the GOLD Report recommends use of chest CT in patients with confirmed COPD who have persistent exacerbations, significant airflow obstruction, symptoms incongruous with disease severity, or characteristics

that meet criteria for lung cancer screening.[2] Chest CT has added importance in decision-making as it relates to lung volume reduction surgery or endobronchial valve placement.[2]

Upon COPD diagnosis, providers should determine airflow obstruction severity (from mild to very severe) using the postbronchodilator FEV1.[2] Symptoms should be assessed using a validated questionnaire. In particular, providers should use the modified Medical Research Council (mMRC) dyspnea scale and/or the COPD Assessment Test (CAT). Providers should assess for a history of previous exacerbations. Additionally, it is prudent to measure blood eosinophil count in patients with COPD, as it predicts the impact of inhaled corticosteroids (ICSs) on COPD maintenance, as discussed later in this article.

In 2023, the assessment tool previously known as the ABCD Assessment Tool was revised to the ABE Assessment Tool in an effort to recognize and emphasize the clinical significance of exacerbations in the disease.[2] Patients can be classified into one of three groups (A, B, or E) based on exacerbation history and symptoms. Patients experiencing one or no moderate exacerbations per year (none of which require hospitalization) fall into either group A, if they have CAT scores of less than 10 or mMRC scores between 0 and 1, or group B, if they have CAT scores of 10 or more or mMRC scores greater than or equal to 2. Patients experiencing two or more moderate exacerbations per year or one or more exacerbations leading to hospitalization per year comprise group E. (Prior to 2023, group E had been divided into two groups based on symptom severity.)

PREVENTING EXACERBATION THROUGH VACCINATION

To prevent COPD exacerbations, the GOLD Report emphasizes the importance of vaccination in people with COPD according to related local guidelines. For patients in the US, the GOLD Report suggests that people with COPD follow all CDC vaccination recommendations.[2] Patients with stable COPD, therefore, should receive the latest influenza vaccine annually; appropriate doses of the latest COVID-19 vaccine at the recommended interval; a one-time dose of respiratory syncytial virus (RSV) vaccine for those ages 60 years and older; and either A) a one-time dose of the 20-valent pneumococcal conjugate vaccine or B) a one-time dose of the 15-valent pneumococcal conjugate vaccine followed by a one-time dose of the 23-valent pneumococcal polysaccharide vaccine. Additionally, tetanus/diphtheria/pertussis (Tdap) vaccination is recommended for patients who did not receive it at or after age 11 years. Finally, routine zoster vaccination is recommended for those older than age 50 years.

TREATMENT

Pharmacotherapy

The positioning of long-acting beta-2 agonist (LABA)+long-acting muscarinic antagonist (LAMA) as well as that of LABA+ICS changed in the 2023 GOLD Report. All patients in group A should be offered either a short- or long-acting bronchodilator treatment.[2] For patients in group B, treatment should be initiated with a LABA+LAMA combination. If LABA+LAMA is not considered appropriate, the choice between LABA or LAMA depends on the perceived symptom relief for the individual patient. For patients in group E, LABA+LAMA is favored; however, if the patient's eosinophil count is greater than or equal to 300 cells/mcL, then use of ICS is also indicated for an ultimate regimen of LABA+LAMA+ICS.

To prevent exacerbations, the GOLD Report emphasizes the importance of vaccination according to local guidelines.

For patients on monotherapy with LABA or LAMA who are experiencing exacerbations, changing the regimen to LABA+LAMA should be considered for those with a blood eosinophil count of less than 300 cells/mcL and to LABA+LAMA+ICS for those with an eosinophil count of 300 cells/mcL or higher.[2] For patients already being treated with LABA+LAMA who are experiencing exacerbations, an ICS may be added to the regimen for those with a blood eosinophil count of 100 cells/mcL or higher, or the addition of roflumilast or azithromycin may be considered for those with a blood eosinophil count of less than 100 cells/mcL. For patients already being treated with LABA+LAMA+ICS who are still experiencing exacerbations, then the addition of roflumilast, the addition of a macrolide, and/or (in certain cases) withdrawal of the ICS should be considered.[2,15,16] For patients experiencing dyspnea while on either LABA or LAMA, escalation to LABA+LAMA should be considered. Providers may

also consider changing the inhaler device or drug, adjusting nonpharmacologic interventions, and evaluating for other causes for the dyspnea.[2] During follow-up, it is important to review symptoms, exacerbation risk, inhaler technique, and medication adherence to guide appropriate adjustment.[2]

Inhalers and inhaled medications. Most COPD treatments are inhaled.[2] Currently, according to the 2024 GOLD Report, 33 different inhaled therapies containing short- or long-acting bronchodilators and ICSs, either alone or in combination, are available. Moreover, there are at least 22 different types of available inhaler devices, which differ in size, portability, required steps for preparation and use, force needed to load, time to deliver medication, cleaning, and maintenance.[2,17,18] Variance among these devices affects patient adherence, with poor adherence associated with poor health outcomes. Therefore, when choosing a device, it is critical to consider the individual patient and their ability to adhere, particularly in view of any barriers such as socioeconomic factors, immigration status, living alone, and medication availability. Each of these factors can affect inhaled medication adherence and disease control.[19-21] Choice of inhaler depends on, among other considerations, availability of the drug used in the device, patient preference and ability (including cognition, dexterity, and strength), and provider knowledge of the inhaler option (*Figure 1*).[2]

Importantly, because inhaled therapies require proper technique for effective use, it is critical to provide effective education to the patient if their treatment plan includes an inhaler device. Interventions entailing education with motivational and/or behavioral components delivered by health professionals may improve adherence, as can involving the patient in developing a tailored plan.[22] Likewise, when new therapy is needed, it is helpful to select the same device that the patient has already been using, if they have been using it correctly.[22] Use of the "teach-back"

Figure 1. Inhalation device comparison and selection guidance[2]

Device types

DPIs
- Require forceful, deep inhalation
- Require some dexterity for loading

MDIs
- Require slow, deep inhalation
- Require coordination (patients must be able to time device activation with inhalation appropriately)
- Can be modified with an added spacer or valved holding chamber to allow for more optimal medication inhalation in certain patients

SMIs
- Require slow, deep inhalation
- Require coordination, though less than MDIs (patients must be able to time device activation with inhalation appropriately)

Device selection guidance

- Ascertain whether patients are able to inhale suitably for effective use of any of the above-listed devices prior to prescribing them.
- For any patient unable to use the above-listed devices, consider prescription of a nebulizer.
- Education on proper use of the device is critical upon prescription.
  - Training that has motivational and/or behavioral components may improve adherence.
  - Use of the "teach-back" method may help to impart proper technique.
- Avoid switching the device at any point if the patient has been using it effectively and, wherever possible, prescribing multiple device types. Use of a single device type prevents the need for the patient to adjust technique and lowers the chance of accidental misuse.
- Shared decision-making is key to selecting an inhalation device, and patient preferences should always be considered along with ability.
- Additional considerations
  - Device availability, size, portability, and cost
  - Drug availability (for the device in question)

Abbreviations: DPI, dry powder inhaler; MDI, metered-dose inhaler; SMI, soft mist inhaler.

method was strongly supported as effective in one study; other studies suggest that physical training and video- or web-based training are helpful, though benefits may not persist.[2]

Nonpharmacologic therapy

The 2024 GOLD Report features recommendations for nonpharmacotherapeutic interventions to be used either alone or together with pharmacotherapeutic interventions; these include smoking cessation, physical activity, and self-management education for all patients.[2] Pulmonary rehabilitation is recommended for patients with significant symptoms or elevated exacerbation risk.[2] Long-term oxygen therapy is recommended for patients with partial pressure of oxygen in the arterial blood (PaO_2) of less than or equal to 55 mm Hg (or arterial oxygen saturation [SaO_2] of less than or equal to 88%) or in those with a PaO_2 between 55 and 60 mm Hg in the setting of pulmonary hypertension, right heart failure, peripheral edema presumed to be due to congestive heart failure, or secondary polycythemia. Continuous positive airway pressure should be used for patients with COPD and obstructive sleep apnea, as it has been found to have a survival benefit and to reduce the risk of hospitalization.[2]

Pharmacotherapy for smoking cessation

The 2024 GOLD Report contains a new section on pharmacotherapeutic options for smoking cessation, which is critical for the approximately 40% of patients with COPD who continue to smoke.[2] Available data suggest that counseling in combination with pharmacotherapy targeted to smoking cessation constitutes best practice. The GOLD Report includes guidance on use of nicotine replacement therapy, bupropion, and varenicline as possible pharmacotherapeutic options to aid in smoking cessation. Specifically, one meta-analysis showed that the chances of abstinence from tobacco use was higher in patients with COPD who underwent bupropion, varenicline, or nicotine replacement therapy as opposed to placebo; in a different study, bupropion and varenicline supported abstinence better than nicotine patch therapy. Nicotine replacement products have in several studies been shown to help patients with abstinence from smoking, with results indicating that their use is significantly more effective than that of placebo. Finally, the use of vapes or e-cigarettes delivering nicotine for the purpose of smoking cessation is discussed; however, despite results of a meta-analysis of five clinical trials that supported the superiority of vapes or e-cigarettes to nicotine replacement products for smoking cessation, the 2024 GOLD Report does not recommend their use for this purpose owing to amassed evidence, including findings from a CDC investigation, that points to various harmful effects of these devices.

Interventional and surgical treatments

Interventional and surgical treatments have been proposed for patients with COPD to reduce dyspnea, cough, and mucus production. Such interventions target airway and lung parenchymal structural changes that are seen in COPD.[2] Examples include, among others, giant bullectomy, lung volume reduction surgery, and endobronchial valve placement. Pursuit of these types of treatments depends on a variety of factors, including the patient's severity of symptoms following use of other therapies, types of structural abnormalities, comorbidities, physiologic assessment, and risk versus benefit.[2]

EXACERBATIONS

COPD exacerbations, typically caused by infection, environmental factors such as pollution, or another issue impacting the lungs, usually involve increased airway inflammation, increased mucus production, and discernible gas trappings. Together, these issues lead to increased dyspnea and/or cough and sputum occurring over a period of less than 14 days.[2,23] Other symptoms of exacerbation include increased sputum purulence, sputum volume, coughing, and wheezing.[2]

Early detection of an exacerbation is key, as the condition can negatively impact patient health, increase hospitalization, increase readmission rates, and ultimately lead to disease progression. Additionally, it is important to consider comorbidities that may mimic or aggravate COPD exacerbation such as decompensated heart failure, pneumonia, and pulmonary embolism. In the primary care setting, presence of exacerbation can be determined by using a visual analogue scale measuring dyspnea intensity and by measuring respiratory rate, heart rate, and oxygen saturation level. In a setting in which lab and advanced testing are available, then evaluation of arterial blood gases and C-reactive protein is recommended. The 2024 GOLD Report includes a discussion of diagnosis, assessment, appropriate treatment settings including

when to consider hospitalization, and management of exacerbations. Discussion of these topics is outside of the scope of this article; providers should refer to the document.

COMORBIDITIES

COPD often occurs in parallel with other conditions that have overlapping symptoms. Comorbidities can significantly impact disease course. Providers should assess for comorbidities and treat them based on guideline recommendations; their management should not change the course of treatment for COPD.[2] Cardiovascular diseases are common comorbidities in patients with COPD and often include hypertension, heart failure, ischemic heart disease, arrhythmias, and peripheral vascular disease. Lung cancer is another condition that is frequently seen in patients with COPD due to the higher incidence of tobacco use among this population. Though frequently underdiagnosed, obstructive sleep apnea, osteoporosis, depression, anxiety, and gastroesophageal reflux disease are frequent comorbidities that are associated with poorer health status and prognosis.

COPD AND COVID-19

The COVID-19 pandemic introduced new challenges for the management and diagnosis of COPD. For individuals with preexisting COPD, COVID-19 testing is recommended whenever symptoms such as fever arise, even if the symptoms are mild.[2,24,25] During periods of high levels of community transmission of COVID-19, spirometry and bronchoscopy may be limited to essential cases due to the increased risk of transmission.[2,26,27] Difficulty in differentiating between symptoms of COPD and symptoms of COVID-19 may lead to a lack of COVID-19 detection during the milder prodromal phase. The GOLD Report recommends maintaining a high level of suspicion of infection, particularly among patients experiencing symptoms of exacerbation and patients reporting fever or alterations in sense of taste or smell.[2] For patients with COPD and COVID-19, the presence of COPD does not change the standard of care for treatment of COVID-19.[2] Despite the overlap between symptoms of COVID-19 and symptoms of COPD, multivariate analysis indicates that preexisting COPD does not increase the risk of long-term symptoms after a patient has acute COVID-19.[28,29]

Tele-rehabilitation has been considered in the management of COPD, particularly in view of the COVID-19 pandemic. However, concrete recommendations cannot be made at this time due to limited evidence-based data supporting tele-rehabilitation models as opposed to pandemic-adapted models.[2]

CONCLUSION

COPD is a serious condition that is highly prevalent throughout the world. In all patients, early identification is key to preventing poor health outcomes, morbidity, and mortality. Using spirometry in high-risk patients can be useful for early diagnosis and treatment. Patient presentation and ability are important factors that can help determine appropriate selection of inhaler device, pharmacotherapy, and nonpharmacologic therapy for COPD treatment. Comorbidities and COVID-19 can worsen COPD outcomes, and thus, it is important to identify and address parallel diagnoses early. Finally, vaccination against infectious diseases is critical for prevention of illness-related exacerbations. NP

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