
GLOBAL INITIATIVE FOR CHRONIC OBSTRUCTIVE LUNG DISEASE (GOLD):

# TEACHING SLIDE SET 2020

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# DESCRIPTION OF LEVELS OF EVIDENCE

| EVIDENCE CATEGORY | SOURCES OF EVIDENCE | DEFINITION |
|---|---|---|
| A | Randomized controlled trials (RCTs)<br><br>Rich body of high quality evidence without any significant limitation or bias | Evidence is from endpoints of well-designed RCTs that provide consistent findings in the population for which the recommendation is made without any important limitations.<br><br>Requires high quality evidence from ≥ 2 clinical trials involving a substantial number of subjects, or a single high quality RCT involving substantial numbers of patient without any bias. |
| B | Randomized controlled trials (RCTs) with important limitations<br><br>Limited Body of Evidence | Evidence is from RCTs that include only a limited number of patients, post hoc or subgroup analyses of RCTs or meta analyses of RCTs.<br><br>Also pertains when few RCTs exist, or important limitations are evident (methodologic flaws, small numbers, short duration, undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent). |
| C | Non-randomized trials<br><br>Observational studies | Evidence is from outcomes of uncontrolled or non-randomized trials or from observational studies. |
| D | Panel consensus judgment | Provision of guidance is deemed valuable but clinical literature addressing the subject is insufficient.<br><br>Panel consensus is based on clinical experience or knowledge that does not meet the above stated criteria. |

TABLE A.

## ETIOLOGY, PATHOBIOLOGY AND PATHOLOGY OF COPD LEADING TO AIRFLOW LIMITATION AND CLINICAL MANIFESTATIONS

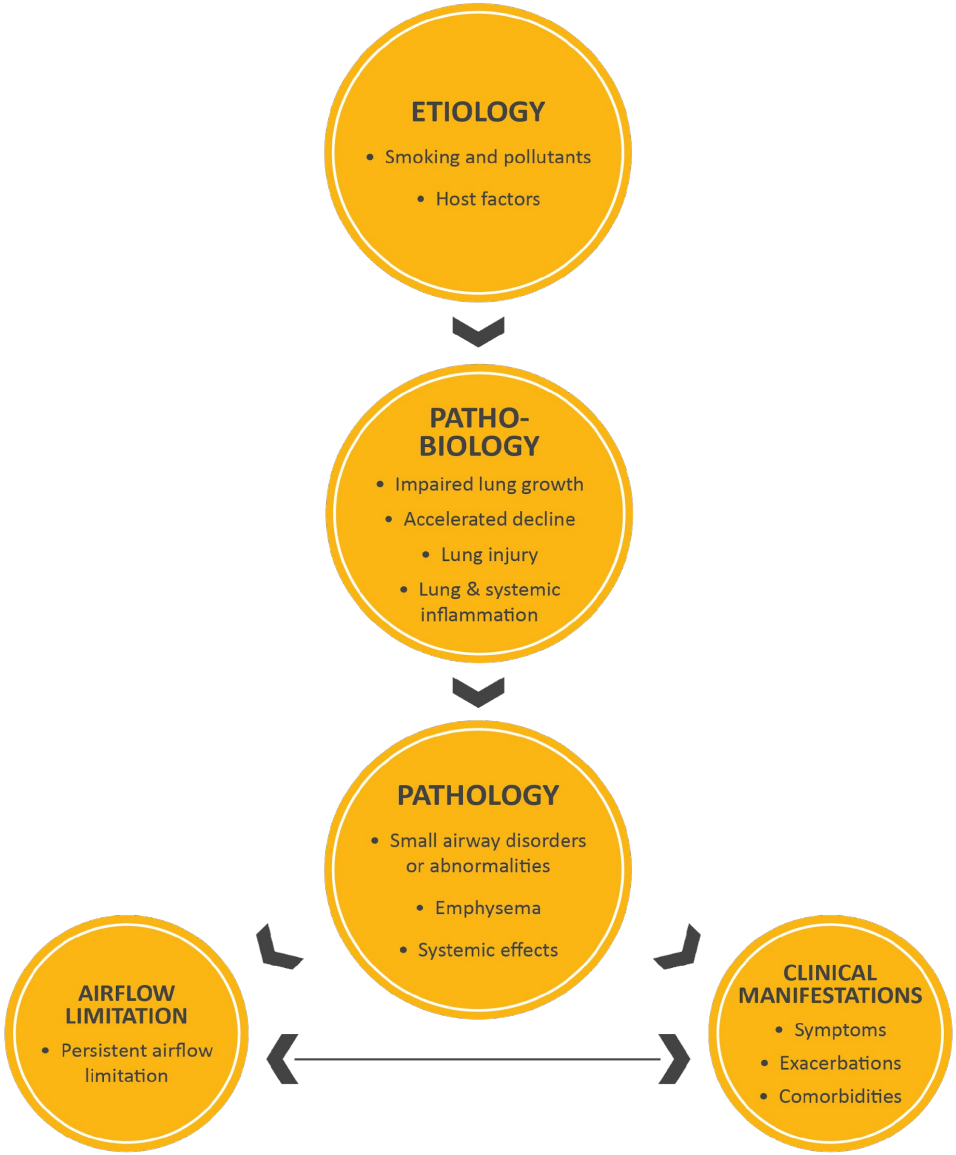


FIGURE 1.1

# $FEV_1$ PROGRESSION OVER TIME

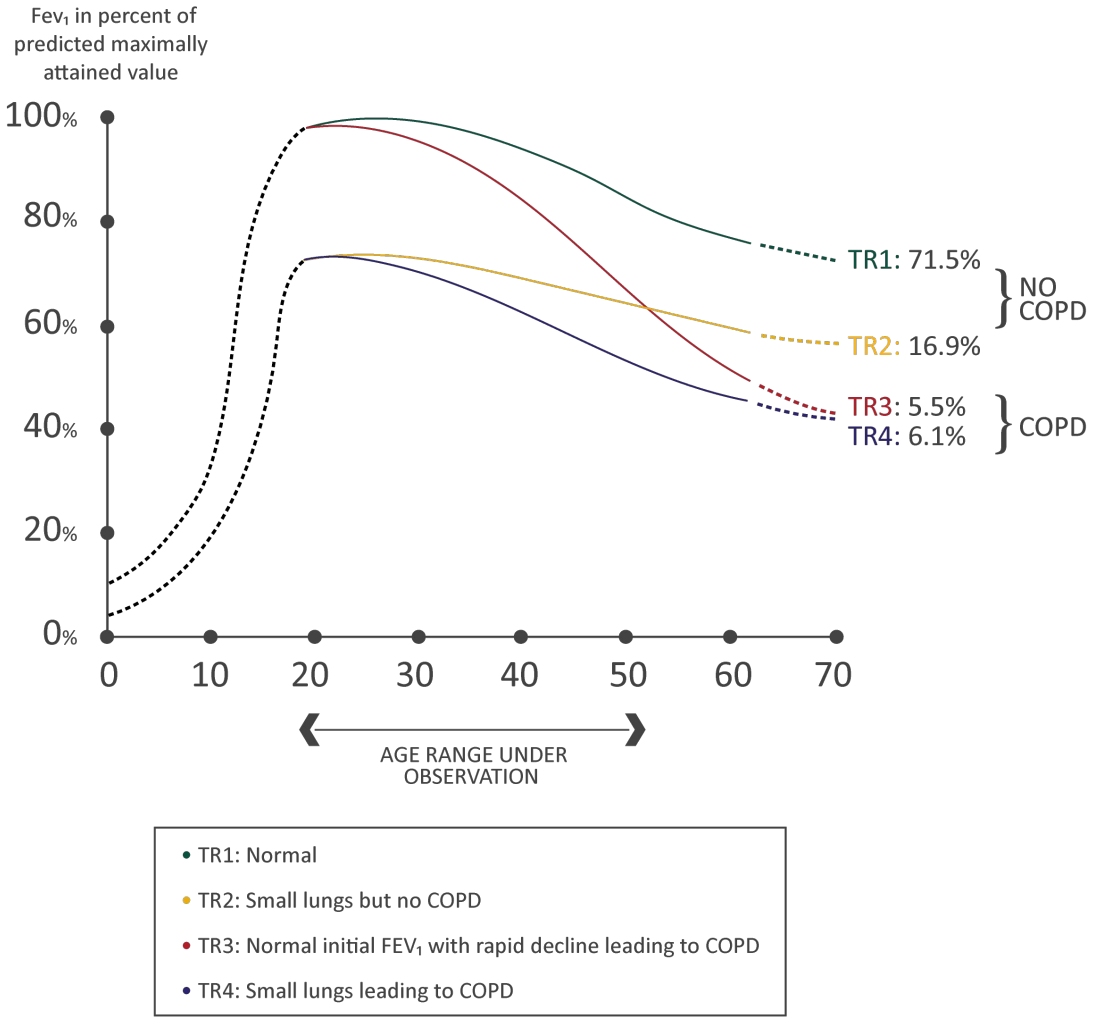


FIGURE 1.2

**Note:** This is a simplified diagram of $FEV_1$ progression over time. In reality, there is tremendous heterogeneity in the rate of decline in $FEV_1$ owing to the complex interactions of genes with environmental exposures and risk factors over an individual's lifetime [adapted from Lange et al. NEJM 2015;373:111-22].

# PATHWAYS TO THE DIAGNOSIS OF COPD

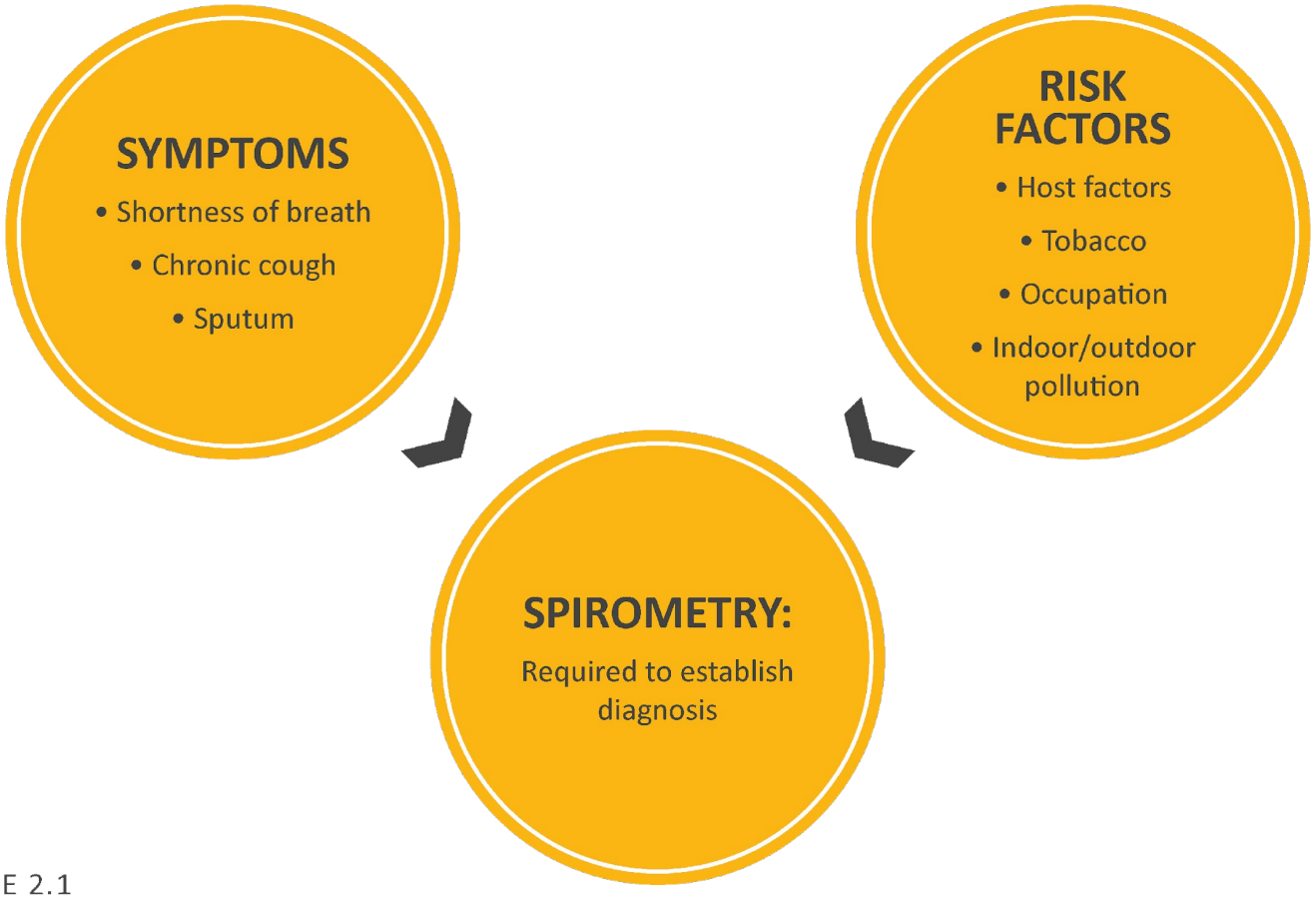


FIGURE 2.1

## KEY INDICATORS FOR CONSIDERING A DIAGNOSIS OF COPD

*Consider COPD, and perform spirometry, if any of these indicators are present in an individual over age 40. These indicators are not diagnostic themselves, but the presence of multiple key indicators increases the probability of a diagnosis of COPD. Spirometry is required to establish a diagnosis of COPD.*

| | |
|---|---|
| **Dyspnea that is:** | Progressive over time.<br>Characteristically worse with exercise.<br>Persistent. |
| **Chronic Cough:** | May be intermittent and may be unproductive.<br>Recurrent wheeze. |
| **Chronic Sputum Production:** | Any pattern of chronic sputum production may indicate COPD. |
| **Recurrent Lower Respiratory Tract Infections** | |
| **History of Risk Factors:** | Host factors (such as genetic factors, congenital/developmental abnormalities etc.).<br>Tobacco smoke (including popular local preparations).<br>Smoke from home cooking and heating fuels.<br>Occupational dusts, vapors, fumes, gases and other chemicals. |
| **Family History of COPD and/or Childhood Factors:** | For example low birthweight, childhood respiratory infections etc. |

TABLE 2.1

# OTHER CAUSES OF CHRONIC COUGH

## INTRATHORACIC

- Asthma
- Lung Cancer
- Tuberculosis
- Bronchiectasis
- Left Heart Failure
- Interstitial Lung Disease
- Cystic Fibrosis
- Idiopathic Cough

## EXTRATHORACIC

- Chronic Allergic Rhinitis
- Post Nasal Drip Syndrome (PNDS)
- Upper Airway Cough Syndrome (UACS)
- Gastroesophageal Reflux
- Medication (e.g. ACE Inhibitors)

TABLE 2.2

## SPIROMETRY - NORMAL TRACE

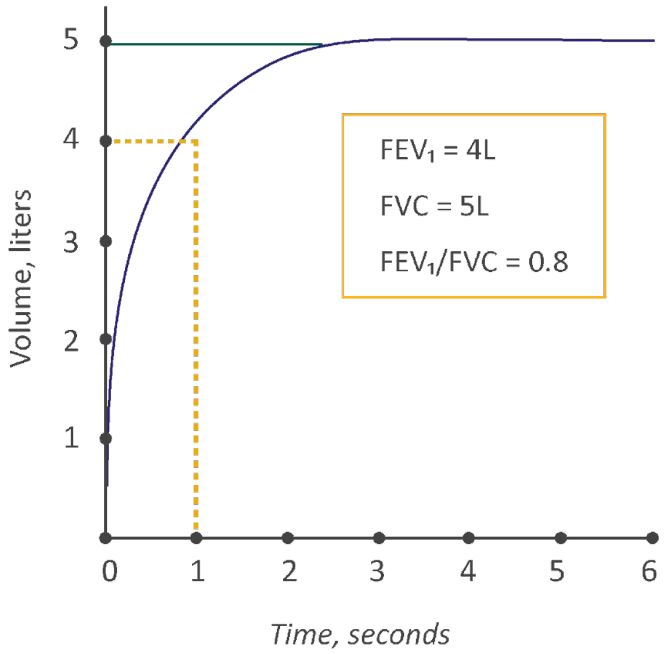


FIGURE 2.2A

## SPIROMETRY - OBSTRUCTIVE DISEASE

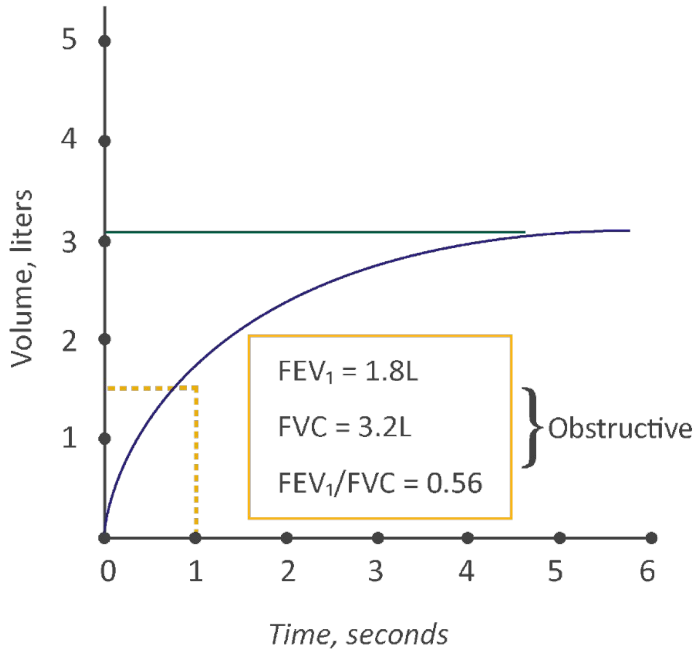


FIGURE 2.2B

FVC =

FEV$_1$ =

# CONSIDERATIONS IN PERFORMING SPIROMETRY

## PREPARATION

- Spirometers need calibration on a regular basis.
- Spirometers should produce hard copy or have a digital display of the expiratory curve to permit detection of technical errors or have an automatic prompt to identify an unsatisfactory test and the reason for it.
- The supervisor of the test needs training in optimal technique and quality performance.
- Maximal patient effort in performing the test is required to avoid underestimation of values and hence errors in diagnosis and management.

## BRONCHODILATION

- Possible dosage protocols are 400 mcg short-acting $beta_2$-agonist, 160 mcg short-acting anticholinergic, or the two combined.[a] $FEV_1$ should be measured 10-15 minutes after a short-acting $beta_2$-agonist is given, or 30-45 minutes after a short-acting anticholinergic or a combination of both classes of drugs.

## PERFORMANCE

- Spirometry should be performed using techniques that meet published standards.[b]
- The expiratory volume/time traces should be smooth and free from irregularities. The pause between inspiration and expiration should be < 1 second.
- The recording should go on long enough for a volume plateau to be reached, which may take more than 15 seconds in severe disease.
- Both FVC and $FEV_1$ should be the largest value obtained from any of three technically satisfactory curves and the FVC and $FEV_1$ values in these three curves should vary by no more than 5% or 150 ml, whichever is greater.
- The $FEV_1$/FVC ratio should be taken from the technically acceptable curve with the largest sum of FVC and $FEV_1$.

## EVALUATION

- Spirometry measurements are evaluated by comparison of the results with appropriate reference values based on age, height, sex, and race.
- The presence of a postbronchodilator $FEV_1/FVC < 0.70$ confirms the presence of airflow limitation.

a Pellegrino et al. Eur Respir J 2005; 26(5): 948-68;
b Miller et al. Eur Respir J 2005; 26(2): 319-38.

TABLE 2.3

## CLASSIFICATION OF AIRFLOW LIMITATION SEVERITY IN COPD (BASED ON POST-BRONCHODILATOR $FEV_1$)

**In patients with FEV1/FVC < 0.70:**

| | | |
|---|---|---|
| **GOLD 1:** | Mild | $FEV_1 \geq 80\%$ predicted |
| **GOLD 2:** | Moderate | $50\% \leq FEV_1 < 80\%$ predicted |
| **GOLD 3:** | Severe | $30\% \leq FEV_1 < 50\%$ predicted |
| **GOLD 4:** | Very Severe | $FEV_1 < 30\%$ predicted |

TABLE 2.4

## MODIFIED MRC DYSPNEA SCALE[a]

**PLEASE TICK IN THE BOX THAT APPLIES TO YOU | ONE BOX ONLY | Grades 0 - 4**

| | | |
|---|---|---|
| **mMRC Grade 0.** | I only get breathless with strenuous exercise. | ☐ |
| **mMRC Grade 1.** | I get short of breath when hurrying on the level or walking up a slight hill. | ☐ |
| **mMRC Grade 2.** | I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking on my own pace on the level. | ☐ |
| **mMRC Grade 3.** | I stop for breath after walking about 100 meters or after a few minutes on the level. | ☐ |
| **mMRC Grade 4.** | I am too breathless to leave the house or I am breathless when dressing or undressing. | ☐ |

[a] Fletcher CM. BMJ 1960; 2: 1662.

TABLE 2.5

# CAT™ ASSESSMENT

*For each item below, place a mark (x) in the box that best describes you currently.*
*Be sure to only select one response for each question.*

| | | | |
|---|---|---|---|
| **EXAMPLE: I am very happy** | 0 **X** 2 3 4 5 | **I am very sad** | **SCORE** |
| I never cough | 0 1 2 3 4 5 | I cough all the time | |
| I have no phlegm (mucus) in my chest at all | 0 1 2 3 4 5 | My chest is completely full of phlegm (mucus) | |
| My chest does not feel tight at all | 0 1 2 3 4 5 | My chest feels very tight | |
| When I walk up a hill or one flight of stairs I am not breathless | 0 1 2 3 4 5 | When I walk up a hill or one flight of stairs I am very breathless | |
| I am not limited doing any activities at home | 0 1 2 3 4 5 | I am very limited doing activities at home | |
| I am confident leaving my home despite my lung condition | 0 1 2 3 4 5 | I am not at all confident leaving my home because of my lung condition | |
| I sleep soundly | 0 1 2 3 4 5 | I don't sleep soundly because of my lung condition | |
| I have lots of energy | 0 1 2 3 4 5 | I have no energy at all | |

**TOTAL SCORE:** ◯

Reference: Jones et al. ERJ 2009; 34 (3); 648-54.

FIGURE 2.3

# THE REFINED ABCD ASSESSMENT TOOL

Spirometrically Confirmed Diagnosis › Assessment of airflow limitation › Assessment of symptoms/risk of exacerbations

Post-bronchodilator $FEV_1/FVC < 0.7$

| Grade | $FEV_1$ (% predicted) |
|---|---|
| GOLD 1 | ≥ 80 |
| GOLD 2 | 50-79 |
| GOLD 3 | 30-49 |
| GOLD 4 | < 30 |

**Moderate or Severe Exacerbation History**

- ≥2 or ≥ 1 leading to hospital admission
- 0 or 1 (not leading to hospital admission)

| | |
|---|---|
| C | D |
| A | B |

mMRC 0-1 CAT < 10 | mMRC ≥ 2 CAT ≥ 10

**Symptoms**

FIGURE 2.4

## ROLE OF SPIROMETRY

- **Diagnosis**
- **Assessment of severity of airflow obstruction (for prognosis)**
- **Follow-up assessment**
  - » Therapeutic decisions.
    - – Pharmacological in selected circumstances (e.g., discrepancy between spirometry and level of symptoms).
    - – Consider alternative diagnoses when symptoms are disproportionate to degree of airflow obstruction.
    - – Non-pharmacological (e.g., interventional procedures).
  - » Identification of rapid decline.

TABLE 2.6

# DIFFERENTIAL DIAGNOSIS OF COPD

| DIAGNOSIS | SUGGESTIVE FEATURES |
|---|---|
| **COPD** | Onset in mid-life.<br>Symptoms slowly progressive.<br>History of tobacco smoking or exposure to other types of smoke. |
| **Asthma** | Onset early in life (often childhood).<br>Symptoms vary widely from day to day.<br>Symptoms worse at night/early morning.<br>Allergy, rhinitis, and/or eczema also present.<br>Family history of asthma.<br>Obesity coexistence. |
| **Congestive Heart Failure** | Chest X-ray shows dilated heart, pulmonary edema.<br>Pulmonary function tests indicate volume restriction, not airflow limitation. |
| **Bronchiectasis** | Large volumes of purulent sputum.<br>Commonly associated with bacterial infection.<br>Chest X-ray/CT shows bronchial dilation, bronchial wall thickening. |
| **Tuberculosis** | Onset all ages.<br>Chest X-ray shows lung infiltrate.<br>Microbiological confirmation.<br>High local prevalence of tuberculosis. |
| **Obliterative Bronchiolitis** | Onset at younger age, nonsmokers.<br>May have history of rheumatoid arthritis or acute fume exposure.<br>Seen after lung or bone marrow transplantation.<br>CT on expiration shows hypodense areas. |
| **Diffuse Panbronchiolitis** | Predominantly seen in patients of Asian descent.<br>Most patients are male and nonsmokers.<br>Almost all have chronic sinusitis.<br>Chest X-ray & HRCT show diffuse small centrilobular nodular opacities & hyperinflation. |

*These features tend to be characteristic of the respective diseases, but are not mandatory. For example, a person who has never smoked may develop COPD (especially in the developing world where other risk factors may be more important than cigarette smoking); asthma may develop in adult and even in elderly patients.*

TABLE 2.7

## BRIEF STRATEGIES TO HELP THE PATIENT WILLING TO QUIT

| | |
|---|---|
| • **ASK:** | Systematically identify all tobacco users at every visit.<br>*Implement an office-wide system that ensures that, for EVERY patient at EVERY clinic visit, tobacco-use status is queried and documented.* |
| • **ADVISE:** | Strongly urge all tobacco users to quit.<br>*In a clear, strong, and personalized manner, urge every tobacco user to quit.* |
| • **ASSESS:** | Determine willingness and rationale of patient's desire to make a quit attempt.<br>*Ask every tobacco user if he or she is willing to make a quit attempt at this time (e.g., within the next 30 days).* |
| • **ASSIST:** | Aid the patient in quitting.<br>*Help the patient with a quit plan; provide practical counseling; provide intra-treatment social support; help the patient obtain extra-treatment social support; recommend use of approved pharmacotherapy except in special circumstances; provide supplementary materials.* |
| • **ARRANGE:** | Schedule follow-up contact.<br>*Schedule follow-up contact, either in person or via telephone.* |

TABLE 3.1

## VACCINATION FOR STABLE COPD

- Influenza vaccination reduces serious illness and death in COPD patients **(EvidenceB)**.
- The 23-valent pneumococcal polysaccharide vaccine (PPSV23) has been shown to reduce the incidence of community - acquired pneumonia in COPD patients aged < 65 years with an $FEV_1$ < 40% predicted and in those with comorbidities **(Evidence B)**.
- In the general population of adults ≥65 years the 13-valent conjugated pneumococcal vaccine (PCV13) has demonstrated significant efficacy in reducing bacteremia & serious invasive pneumococcal disease **(Evidence B)**.

TABLE 3.2

# COMMONLY USED MAINTENANCE MEDICATIONS IN COPD*

| Generic Drug Name | Inhaler Type | DELIVERY OPTIONS *Nebulizer* | *Oral* | *Injection* | Duration Of Action |
|---|---|---|---|---|---|
| **$BETA_2$-AGONISTS** | | | | | |
| ***SHORT-ACTING (SABA)*** | | | | | |
| Fenoterol | MDI | √ | pill, syrup | | 4-6 hours |
| Levalbuterol | MDI | √ | | | 6-8 hours |
| Salbutamol (albuterol) | MDI & DPI | √ | pill, syrup, extended release tablet | √ | 4-6 hours<br>12 hours (ext. release) |
| Terbutaline | DPI | | pill | √ | 4-6 hours |
| ***LONG-ACTING (LABA)*** | | | | | |
| Arformoterol | | √ | | | 12 hours |
| Formoterol | DPI | √ | | | 12 hours |
| Indacaterol | DPI | | | | 24 hours |
| Olodaterol | SMI | | | | 24 hours |
| Salmeterol | MDI & DPI | | | | 12 hours |
| **ANTICHOLINERGICS** | | | | | |
| ***SHORT-ACTING (SAMA)*** | | | | | |
| Ipratropium bromide | MDI | √ | | | 6-8 hours |
| Oxitropium bromide | MDI | | | | 7-9 hours |
| ***LONG-ACTING (LAMA)*** | | | | | |
| Aclidinium bromide | DPI, MDI | | | | 12 hours |
| Glycopyrronium bromide | DPI | | solution | √ | 12-24 hours |
| Tiotropium | DPI, SMI, MDI | | | | 24 hours |
| Umeclidinium | DPI | | | | 24 hours |
| Glycopyrrolate | | √ | | | 12 hours |
| Revefenacin | | √ | | | 24 hours |
| **COMBINATION SHORT-ACTING $BETA_2$-AGONIST PLUS ANTICHOLINERGIC IN ONE DEVICE (SABA/SAMA)** | | | | | |
| Fenoterol/ipratropium | SMI | √ | | | 6-8 hours |
| Salbutamol/ipratropium | SMI, MDI | √ | | | 6-8 hours |
| **COMBINATION LONG-ACTING $BETA_2$-AGONIST PLUS ANTICHOLINERGIC IN ONE DEVICE (LABA/LAMA)** | | | | | |
| Formoterol/aclidinium | DPI | | | | 12 hours |
| Formoterol/glycopyrronium | MDI | | | | 12 hours |
| Indacaterol/glycopyrronium | DPI | | | | 12-24 hours |
| Vilanterol/umeclidinium | DPI | | | | 24 hours |
| Olodaterol/tiotropium | SMI | | | | 24 hours |
| **METHYLXANTHINES** | | | | | |
| Aminophylline | | | solution | √ | Variable, up to 24 hours |
| Theophylline (SR) | | | pill | √ | Variable, up to 24 hours |
| **COMBINATION OF LONG-ACTING $BETA_2$-AGONIST PLUS CORTICOSTEROID IN ONE DEVICE (LABA/ICS)** | | | | | |
| Formoterol/beclometasone | MDI, DPI | | | | 12 hours |
| Formoterol/budesonide | MDI, DPI | | | | 12 hours |
| Formoterol/mometasone | MDI | | | | 12 hours |
| Salmeterol/fluticasone | MDI, DPI | | | | 12 hours |
| Vilanterol/fluticasone furoate | DPI | | | | 24 hours |
| **TRIPLE COMBINATION IN ONE DEVICE (LABA/LAMA/ICS)** | | | | | |
| Fluticasone/umeclidinium/vilanterol | DPI | | | | 24 hours |
| Beclometasone/formoterol/glycopyrronium | MDI | | | | 12 hours |
| **PHOSPHODIESTERASE-4 INHIBITORS** | | | | | |
| Roflumilast | | | pill | | 24 hours |
| **MUCOLYTIC AGENTS** | | | | | |
| Erdosteine | | | pill | | 12 hours |
| Carbocysteine† | | | pill | | |
| N-acetylcysteine† | | | pill | | |

TABLE 3.3

*Not all formulations are available in all countries. In some countries other formulations and dosages may be available. † Dosing regimens are under discussion. MDI = metered dose inhaler; DPI = dry powder inhaler; SMI = soft mist inhaler.

## BRONCHODILATORS IN STABLE COPD

- Inhaled bronchodilators in COPD are central to symptom management and commonly given on a regular basis to prevent or reduce symptoms **(Evidence A)**.
- Regular and as-needed use of SABA or SAMA improves $FEV_1$ and symptoms **(Evidence A)**.
- Combinations of SABA and SAMA are superior compared to either medication alone in improving $FEV_1$ and symptoms **(Evidence A)**.
- LABAs and LAMAs significantly improve lung function, dyspnea, health status, and reduce exacerbation rates **(Evidence A)**.
- LAMAs have a greater effect on exacerbation reduction compared with LABAs **(Evidence A)** and decrease hospitalizations **(Evidence B)**.
- Combination treatment with a LABA and LAMA increases $FEV_1$ and reduces symptoms compared to monotherapy **(Evidence A)**.
- Combination treatment with a LABA/LAMA reduces exacerbations compared to monotherapy **(Evidence B)**.
- Tiotropium improves the effectiveness of pulmonary rehabilitation in increasing exercise performance **(Evidence B)**.
- Theophylline exerts a small bronchodilator effect in stable COPD **(Evidence A)** and that is associated with modest symptomatic benefits **(Evidence B)**.

TABLE 3.4

# ANTI-INFLAMMATORY THERAPY IN STABLE COPD

## INHALED CORTICOSTEROIDS

- An ICS combined with a LABA is more effective than the individual components in improving lung function and health status and reducing exacerbations in patients with exacerbations and moderate to very severe COPD **(Evidence A)**.
- Regular treatment with ICS increases the risk of pneumonia especially in those with severe disease **(Evidence A)**.
- Triple inhaled therapy of ICS/LAMA/LABA improves lung function, symptoms and health status and reduces exacerbations compared to ICS/LABA, LABA/LAMA or LAMA monotherapy **(Evidence A)**.

## ORAL GLUCOCORTICOIDS

- Long-term use of oral glucocorticoids has numerous side effects **(Evidence A)** with no evidence of benefits **(Evidence C)**.

## PDE4 INHIBITORS

- In patients with chronic bronchitis, severe to very severe COPD and a history of exacerbations:
  - » A PDE4 inhibitor improves lung function and reduces moderate and severe exacerbations **(Evidence A)**.
  - » A PDE4 inhibitor improves lung function and decreases exacerbations in patients who are on fixed-dose LABA/ICS combinations **(Evidence A)**.

## ANTIBIOTICS

- Long-term azithromycin and erythromycin therapy reduces exacerbations over one year **(Evidence A)**.
- Treatment with azithromycin is associated with an increased incidence of bacterial resistance **(Evidence A)** and hearing test impairments **(Evidence B)**.

## MUCOREGULATORS AND ANTIOXIDANT AGENTS

- Regular treatment with mucolytics such as erdosteine, carbocysteine and NAC reduces the risk of exacerbations in select populations **(Evidence B)**.

## OTHER ANTI-INFLAMMATORY AGENTS

- Simvastatin does not prevent exacerbations in COPD patients at increased risk of exacerbations and without indications for statin therapy **(Evidence A)**. However, observational studies suggest that statins may have positive effects on some outcomes in patients with COPD who receive them for cardiovascular and metabolic indications **(Evidence C)**.
- Leukotriene modifiers have not been tested adequately in COPD patients.

TABLE 3.5

# THE INHALED ROUTE

- When a treatment is given by the inhaled route, the importance of education and training in inhaler device technique cannot be over-emphasized.
- The choice of inhaler device has to be individually tailored and will depend on access, cost, prescriber, and most importantly, patient's ability and preference.
- It is essential to provide instructions and to demonstrate the proper inhalation technique when prescribing a device, to ensure that inhaler technique is adequate and re-check at each visit that patients continue to use their inhaler correctly.
- Inhaler technique (and adherence to therapy) should be assessed before concluding that the current therapy is insufficient.

TABLE 3.6

# OTHER PHARMACOLOGICAL TREATMENTS

## ALPHA-1 ANTITRYPSIN AUGMENTATION THERAPY

- Intravenous augmentation therapy may slow down the progression of emphysema **(Evidence B)**.

## ANTITUSSIVES

- There is no conclusive evidence of a beneficial role of antitussives in patients with COPD **(Evidence C)**.

## VASODILATORS

- Vasodilators do not improve outcomes and may worsen oxygenation **(Evidence B)**.

TABLE 3.7

## PULMONARY REHABILITATION, SELF-MANAGEMENT AND INTEGRATIVE CARE IN COPD

### PULMONARY REHABILITATION

- Pulmonary rehabilitation improves dyspnea, health status and exercise tolerance in stable patients **(Evidence A)**.
- Pulmonary rehabilitation reduces hospitalization among patients who have had a recent exacerbation (≤4 weeks from prior hospitalization) **(Evidence B)**.

### EDUCATION AND SELF-MANAGEMENT

- Education alone has not been shown to be effective **(Evidence C)**.
- Self-management intervention with communication with a health care professional improves health status and decreases hospitalizations and emergency department visits **(Evidence B)**.

### INTEGRATED CARE PROGRAMS

- Integrated care and telehealth have no demonstrated benefit at this time **(Evidence B)**.

TABLE 3.8

# FACTORS TO CONSIDER WHEN INITIATING ICS TREATMENT

Factors to consider when initiating ICS treatment in combination with one or two long-acting bronchodilators (note the scenario is different when considering ICS withdrawal):

| · STRONG SUPPORT · | · CONSIDER USE · | · AGAINST USE · |
|---|---|---|
| • History of hospitalization(s) for exacerbations of COPD# | • 1 moderate exacerbation of COPD per year# | • Repeated pneumonia events |
| • ≥ 2 moderate exacerbations of COPD per year# | • Blood eosinophils 100-300 cells/µL | • Blood eosinophils <100 cells/µL |
| • Blood eosinophils >300 cells/µL | | • History of mycobacterial infection |
| • History of, or concomitant, asthma | | |

#despite appropriate long-acting bronchodilator maintenance therapy (see Table 3.4 and Figure 4.3 for recommendations);

*note that blood eosinophils should be seen as a continuum; quoted values represent approximate cut-points; eosinophil counts are likely to fluctuate.

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FIGURE 3.1

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- When a treatment is given by the inhaled route, the importance of education and training in inhaler device technique cannot be over-emphasized.
- The choice of inhaler device has to be individually tailored and will depend on access, cost, prescriber, and most importantly, patient's ability and preference.
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- Inhaler technique (and adherence to therapy) should be assessed before concluding that the current therapy is insufficient.

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- Pulmonary rehabilitation reduces hospitalization among patients who have had a recent exacerbation (≤4 weeks from prior hospitalization) **(Evidence B)**.
- Pulmonary rehabilitation leads to a reduction in symptoms of anxiety and depression **(Evidence A)**.

### EDUCATION AND SELF-MANAGEMENT

- Education alone has not been shown to be effective **(Evidence C)**.
- Self-management intervention with communication with a health care professional improves health status and decreases hospitalizations and emergency department visits **(Evidence B)**.

### INTEGRATED CARE PROGRAMS

- Integrative care and telehealth have no demonstrated benefit at this time **(Evidence B)**.

TABLE 3.8

## PALLIATIVE CARE, END OF LIFE AND HOSPICE CARE IN COPD

- Opiates, neuromuscular electrical stimulation (NMES), oxygen and fans blowing air on to the face can relieve breathlessness **(Evidence C)**.
- In malnourished patients, nutritional supplementation may improve respiratory muscle strength and overall health status **(Evidence B)**.
- Fatigue can be improved by self-management education, pulmonary rehabilitation, nutritional support and mind-body interventions **(Evidence B)**.

TABLE 3.9

## OXYGEN THERAPY AND VENTILATORY SUPPORT IN STABLE COPD

### OXYGEN THERAPY

- The long-term administration of oxygen increases survival in patients with severe chronic resting arterial hypoxemia **(Evidence A)**.
- In patients with stable COPD and moderate resting or exercise-induced arterial desaturation, prescription of long-term oxygen does not lengthen time to death or first hospitalization or provide sustained benefit in health status, lung function and 6-minute walk distance **(Evidence A)**.
- Resting oxygenation at sea level does not exclude the development of severe hypoxemia when traveling by air **(Evidence C)**.

### VENTILATORY SUPPORT

- NPPV may improve hospitalization-free survival in selected patients after recent hospitalization, particularly in those with pronounced daytime persistent hypercapnia ($PaCO_2 \geq 52$ mmHg) **(Evidence B)**.

TABLE 3.10

# INTERVENTIONAL THERAPY IN STABLE COPD

## LUNG VOLUME REDUCTION SURGERY

- Lung volume reduction surgery improves survival in severe emphysema patients with an upper–lobe emphysema and low post–rehabilitation exercise capacity **(Evidence A)**.

## BULLECTOMY

- In selected patients, bullectomy is associated with decreased dyspnea, improved lung function and exercise tolerance **(Evidence C)**.

## TRANSPLANTATION

- In appropriately selected patients with very severe COPD, lung transplantation has been shown to improve quality of life and functional capacity **(Evidence C)**.

## BRONCHOSCOPIC INTERVENTIONS

- In select patients with advanced emphysema, bronchoscopic interventions reduce end-expiratory lung volume and improve exercise tolerance, health status and lung function at 6-12 months following treatment. Endobronchial valves **(Evidence A)**; Lung coils **(Evidence B)**; Vapor ablation **(Evidence B)**.

TABLE 3.11

# MANAGEMENT OF COPD

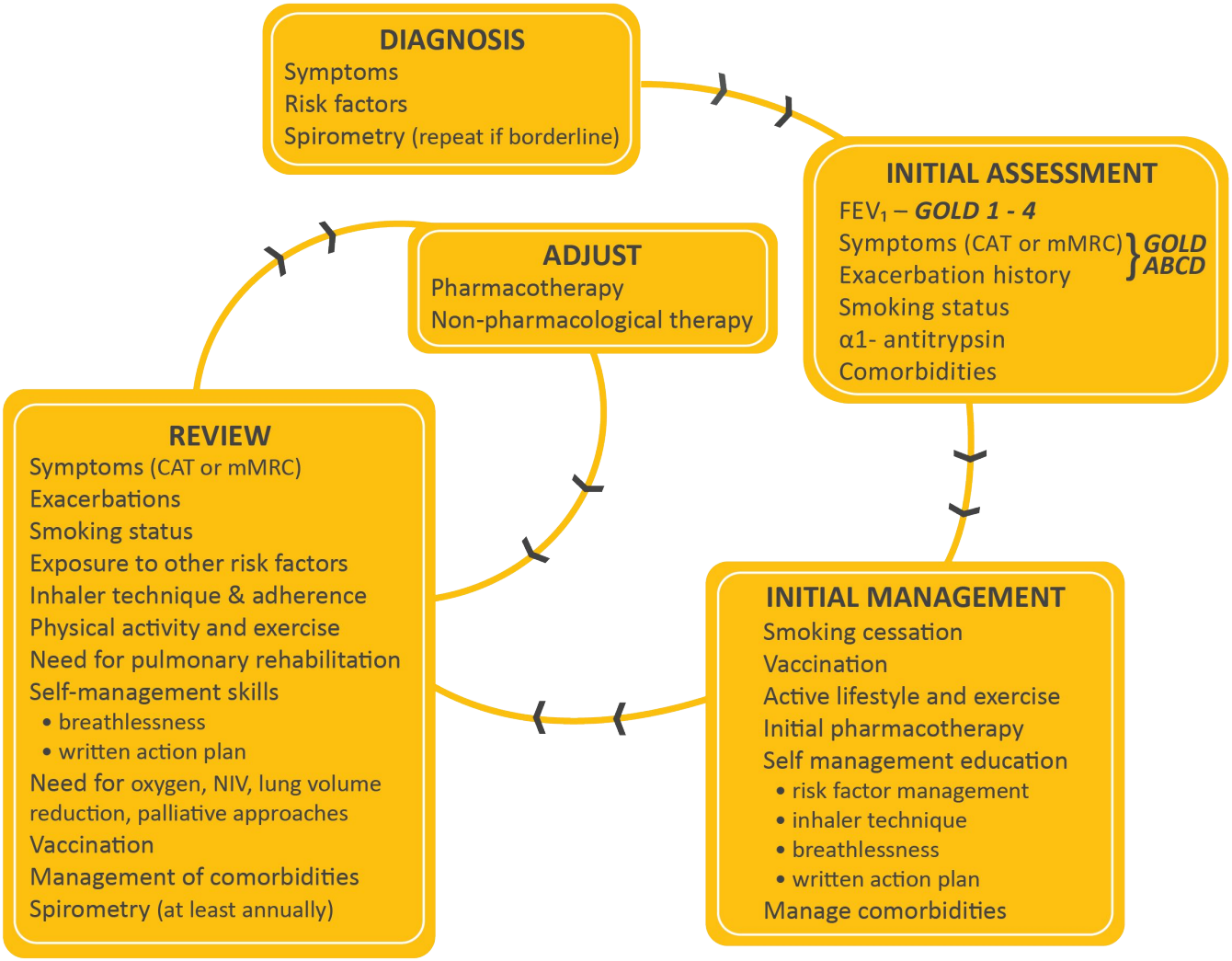



FIGURE 4.1

## GOALS FOR TREATMENT OF STABLE COPD

| | |
|---|---|
| • Relieve Symptoms<br>• Improve Exercise Tolerance<br>• Improve Health Status | REDUCE SYMPTOMS |
| *and* | |
| • Prevent Disease Progression<br>• Prevent and Treat Exacerbations<br>• Reduce Mortality | REDUCE RISK |

TABLE 4.1

## TREATING TOBACCO USE AND DEPENDENCE: A CLINICAL PRACTICE GUIDELINE — MAJOR FINDINGS & RECOMMENDATIONS

- Tobacco dependence is a chronic condition that warrants repeated treatment until long-term or permanent abstinence is achieved.
- Effective treatments for tobacco dependence exist and all tobacco users should be offered these treatments.
- Clinicians and health care delivery systems must operationalize the consistent identification, documentation, and treatment of every tobacco user at every visit.
- Brief smoking cessation counseling is effective and every tobacco user should be offered such advice at every contact with health care providers.
- There is a strong dose-response relation between the intensity of tobacco dependence counseling and its effectiveness.
- Three types of counseling have been found to be especially effective: practical counseling, social support of family and friends as part of treatment, and social support arranged outside of treatment.
- First-line pharmacotherapies for tobacco dependence — varenicline, bupropion sustained release, nicotine gum, nicotine inhaler, nicotine nasal spray, and nicotine patch—are effective and at least one of these medications should be prescribed in the absence of contraindications.
- Financial incentive programs for smoking cessation may facilitate smoking cessation.
- Tobacco dependence treatments are cost effective interventions.

TABLE 4.2

## IDENTIFY & REDUCE RISK FACTOR EXPOSURE

- Smoking cessation interventions should be actively pursued in all COPD patients **(Evidence A)**.
- Efficient ventilation, non-polluting cooking stoves and similar interventions should be recommended **(Evidence B)**.
- Clinicians should advise patients to avoid continued exposures to potential irritants, if possible **(Evidence D)**.

TABLE 4.3

## KEY POINTS FOR INHALATION OF DRUGS

- The choice of inhaler device has to be individually tailored and will depend on access, cost, prescriber, and most importantly, patient's ability and preference.
- It is essential to provide instructions and to demonstrate the proper inhalation technique when prescribing a device, to ensure that inhaler technique is adequate and re-check at each visit that patients continue to use their inhaler correctly.
- Inhaler technique (and adherence to therapy) should be assessed before concluding that the current therapy requires modification.

TABLE 4.4

## KEY POINTS FOR THE USE OF BRONCHODILATORS

- LABAs and LAMAs are preferred over short-acting agents except for patients with only occasional dyspnea **(Evidence A)**, and for immediate relief of symptoms in patients already on long-acting bronchodilators for maintenance therapy.
- Patients may be started on single long-acting bronchodilator therapy or dual long-acting bronchodilator therapy. In patients with persistent dyspnea on one bronchodilator treatment should be escalated to two **(Evidence A)**.
- Inhaled bronchodilators are recommended over oral bronchodilators **(Evidence A)**.
- Theophylline is not recommended unless other long-term treatment bronchodilators are unavailable or unaffordable **(Evidence B)**.

TABLE 4.5

## KEY POINTS FOR THE USE OF ANTI-INFLAMMATORY AGENTS

- Long-term monotherapy with ICS is not recommended **(Evidence A)**.
- Long-term treatment with ICS may be considered in association with LABAs for patients with a history of exacerbations despite appropriate treatment with long-acting bronchodilators **(Evidence A)**.
- Long-term therapy with oral corticosteroids is not recommended **(Evidence A)**.
- In patients with severe to very severe airflow limitation, chronic bronchitis and exacerbations the addition of a PDE4 inhibitor to a treatment with long acting bronchodilators with/without ICS can be considered **(Evidence B)**.
- Preferentially, but not only in former smokers with exacerbations despite appropriate therapy, macrolides, in particular azithromycin, can be considered **(Evidence B)**.
- Statin therapy is not recommended for prevention of exacerbations **(Evidence A)**.
- Antioxidant mucolytics are recommended only in selected patients **(Evidence A)**.

TABLE 4.6

## KEY POINTS FOR THE USE OF OTHER PHARMACOLOGICAL TREATMENTS

- Patients with severe hereditary alpha-1 antitrypsin deficiency and established emphysema may be candidates for alpha-1 antitrypsin augmentation therapy **(Evidence B)**.
- Antitussives cannot be recommended **(Evidence C)**.
- Drugs approved for primary pulmonary hypertension are not recommended for patients with a pulmonary hypertension secondary to COPD **(Evidence B)**.
- Low-dose long acting oral and parenteral opioids may be considered for treating dyspnea in COPD patients with severe disease **(Evidence B)**.

TABLE 4.7

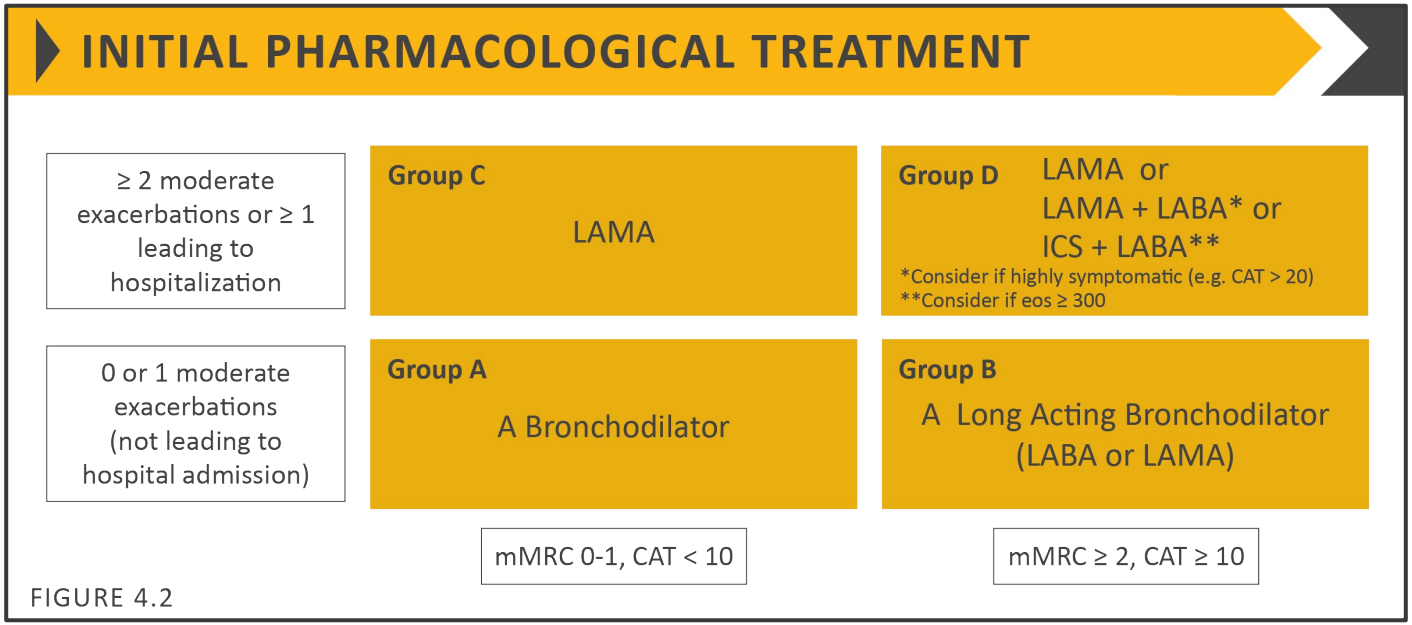



FIGURE 4.2

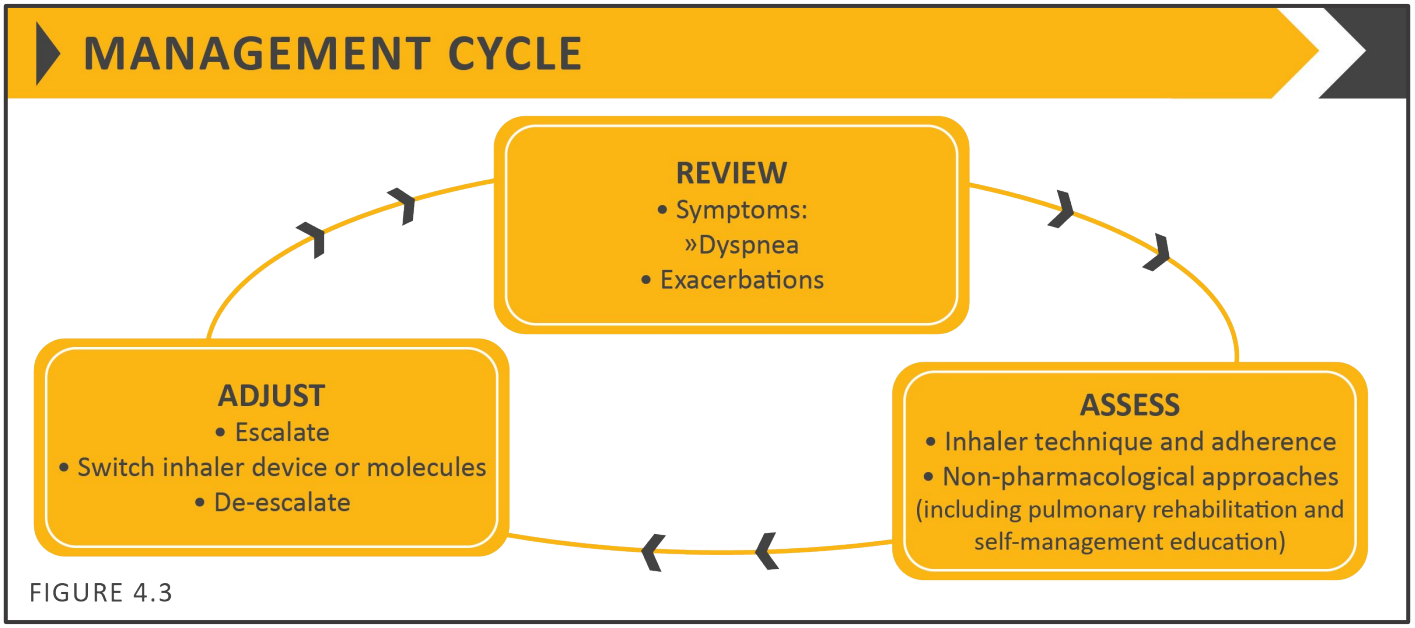
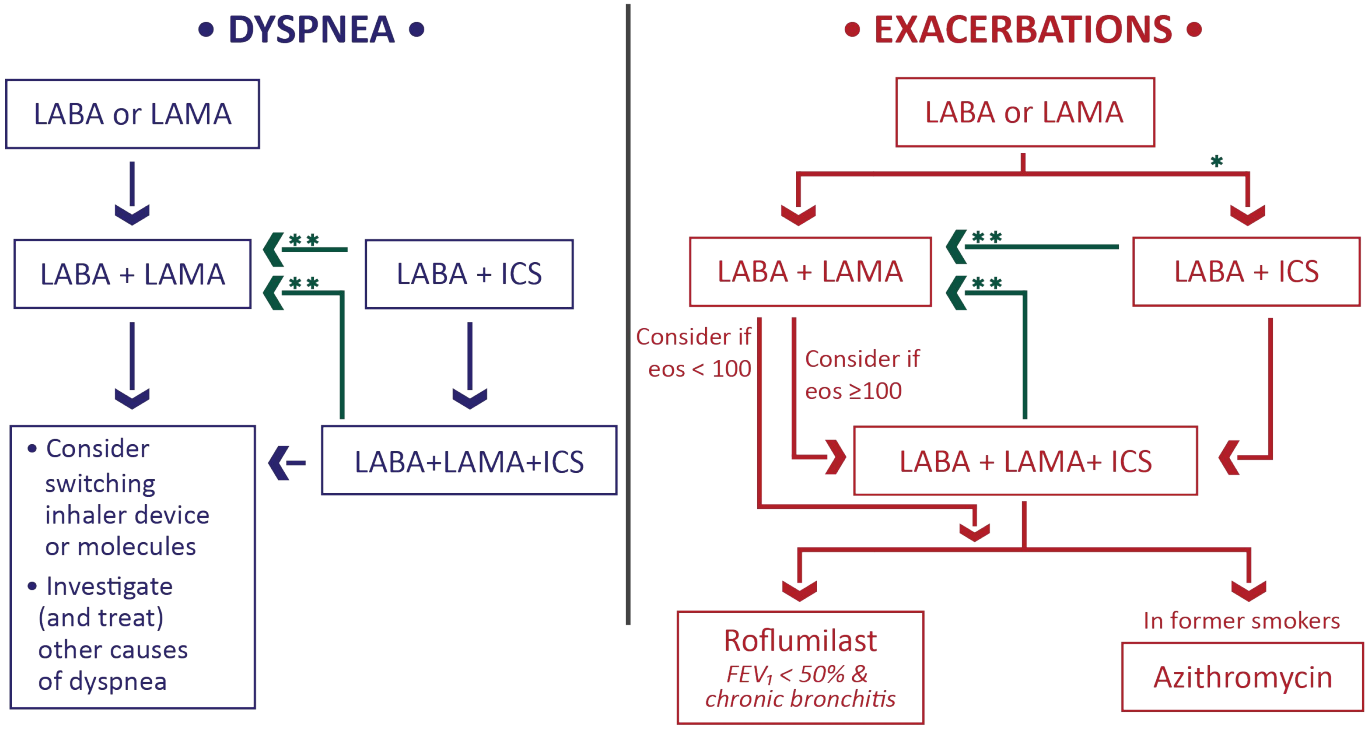



FIGURE 4.3

# FOLLOW-UP PHARMACOLOGICAL TREATMENT

1. **IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT.**
2. **IF NOT:**
   - ✓ Consider the predominant treatable trait to target (dyspnea or exacerbations)
     - Use exacerbation pathway if both exacerbations and dyspnea need to be targeted
   - ✓ Place patient in box corresponding to current treatment & follow indications
   - ✓ Assess response, adjust and review
   - ✓ These recommendations do not depend on the ABCD assessment at diagnosis




*eos = blood eosinophil count (cells/µL)*
** Consider if eos ≥ 300 or eos ≥ 100 AND ≥2 moderate exacerbations / 1 hospitalization*
*** Consider de-escalation of ICS or switch if pneumonia, inappropriate original indication or lack of response to ICS*

FIGURE 4.4

## NON-PHARMACOLOGIC MANAGEMENT OF COPD*

| PATIENT GROUP | ESSENTIAL | RECOMMENDED | DEPENDING ON LOCAL GUIDELINES |
|---|---|---|---|
| A | Smoking Cessation (can include pharmacologic treatment) | Physical Activity | Flu Vaccination<br><br>Pneumococcal Vaccination |
| B, C and D | Smoking Cessation (can include pharmacologic treatment)<br><br>Pulmonary Rehabilitation | Physical Activity | Flu Vaccination<br><br>Pneumococcal Vaccination |

*Can include pharmacologic treatment.

TABLE 4.8

# FOLLOW-UP OF NON-PHARMACOLOGICAL TREATMENT

**1. IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT AND OFFER:**

- Flu vaccination every year and other recommended vaccinations according to guidelines
- Self-management education
- Assessment of behavioral risk factors such as smoking cessation (if applicable) and environmental exposures

**Ensure**

- Maintenance of exercise program and physical activity
- Adequate sleep and a healthy diet

**2. IF NOT, CONSIDER THE PREDOMINANT TREATABLE TRAIT TO TARGET**

## • DYSPNEA •

- Self-management education (written action plan) with integrated self-management regarding:
  - Breathlessness and energy conservation techniques, and stress management strategies
- Pulmonary rehabilitation (PR) program and/or maintenance exercise program post PR

## • EXACERBATIONS •

- Self-management education (written action plan) that is personalized with respect to:
  - Avoidance of aggravating factors
  - How to monitor/manage worsening of symptoms
  - Contact information in the event of an exacerbation

**All patients with advanced COPD should be considered for end of life and palliative care support** to optimize symptom control and allow patients and their families to make informed choices about future management

TABLE 4.9

# PRESCRIPTION OF SUPPLEMENTAL OXYGEN TO COPD PATIENTS

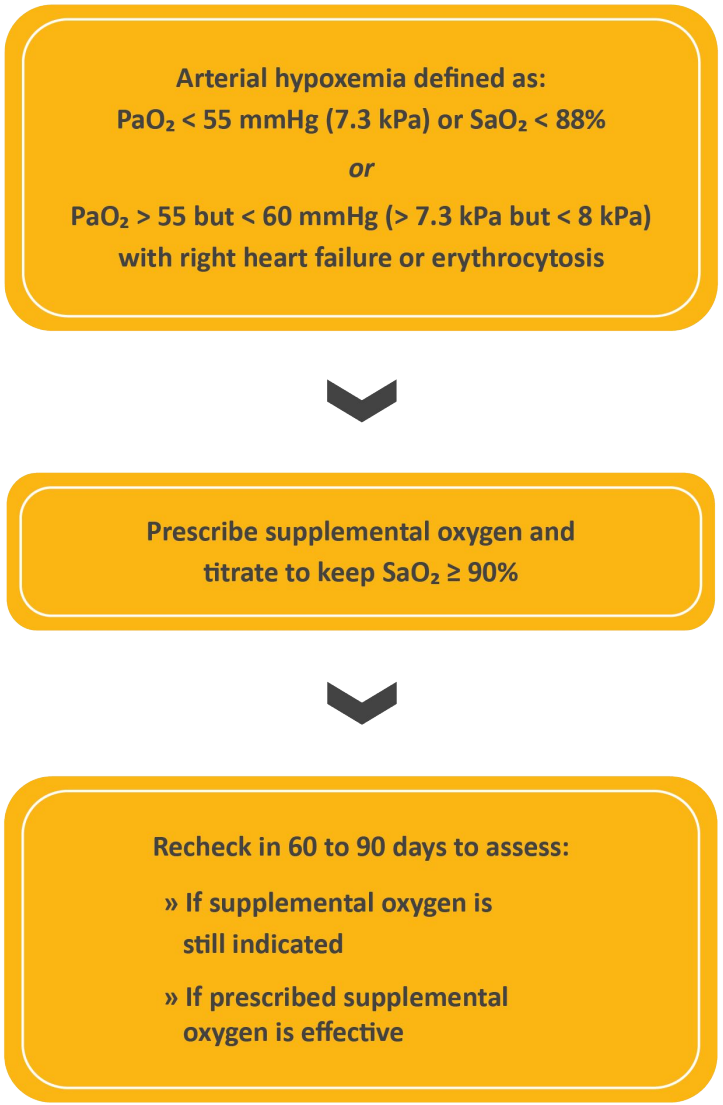
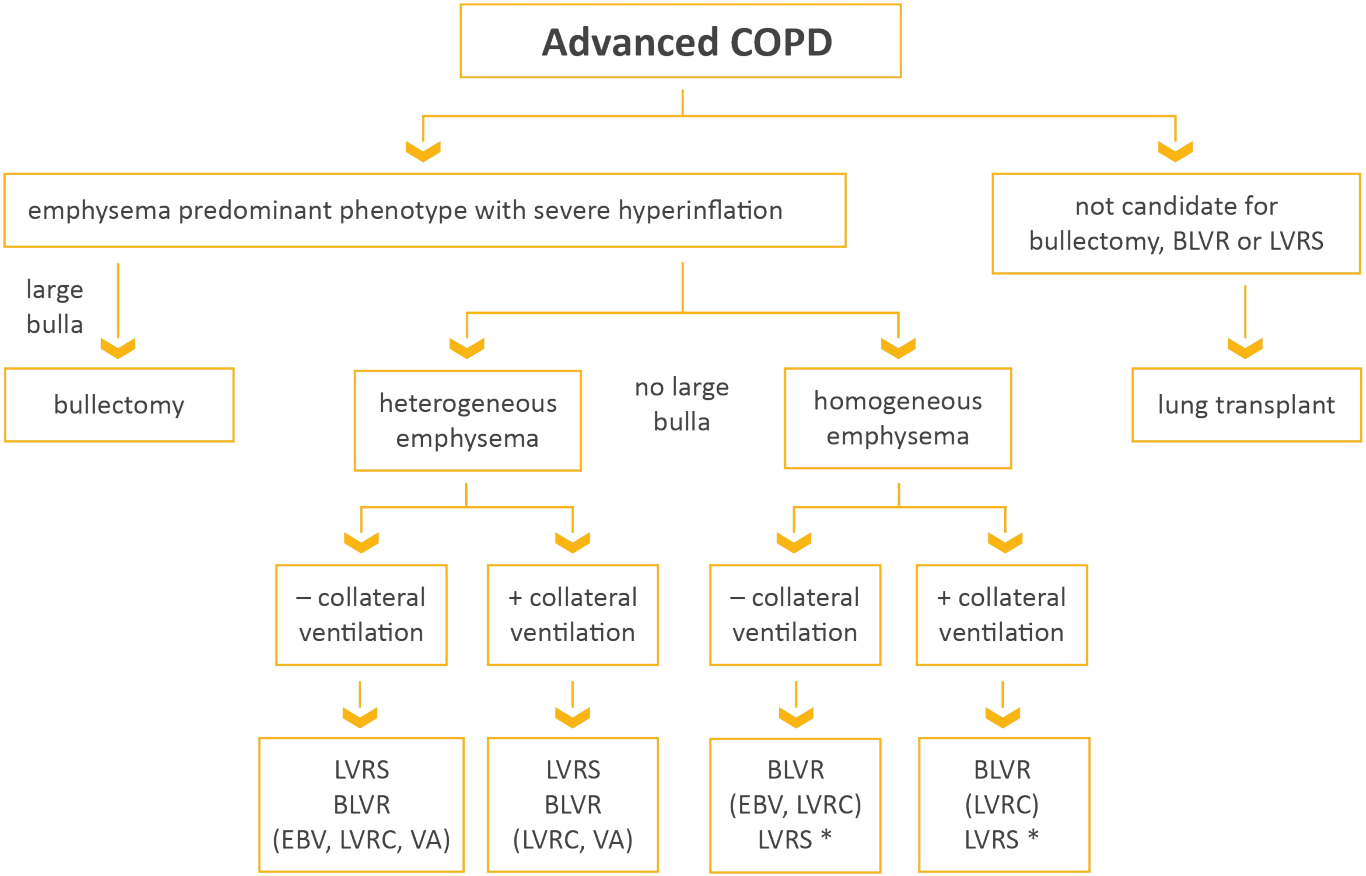



FIGURE 4.5

## INTERVENTIONAL BRONCHOSCOPIC AND SURGICAL TREATMENTS FOR COPD

Overview of various therapies used to treat patients with COPD and emphysema worldwide. Note that all therapies are not approved for clinical care in all countries. Additionally, the effects of BLVR on survival or other long term outcomes or comparison to LVRS are unknown.




Definition of Abbreviations: BLVR, Bronchoscopic Lung Volume Reduction, EBV, endobronchial Valve, LVRS, Lung volume reduction surgery, LVRC, Lung volume reduction coil, VA, Vapor ablation

*at some but not all centers

FIGURE 4.6

## KEY POINTS FOR THE USE OF NON-PHARMACOLOGICAL TREATMENTS

### EDUCATION, SELF-MANAGEMENT AND PULMONARY REHABILITATION

- Education is needed to change patient's knowledge but there is no evidence that used alone it will change patient behavior .
- Education self-management with the support of a case manager with or without the use of a written action plan is recommended for the prevention of exacerbation complications such as hospital admissions **(Evidence B)**.
- Rehabilitation is indicated in all patients with relevant symptoms and/or a high risk for exacerbation **(Evidence A)**.
- Physical activity is a strong predictor of mortality **(Evidence A)**. Patients should be encouraged to increase the level of physical activity although we still don't know how to best insure the likelihood of success.

### VACCINATION

- Influenza vaccination is recommended for all patients with COPD **(Evidence A)**.
- Pneumococcal vaccination: the PCV13 and PPSV23 are recommended for all patients> 65 years of age, and in younger patients with significant comorbid conditions including chronic heart or lung disease **(Evidence B)**.

### NUTRITION

- Nutritional supplementation should be considered in malnourished patients with COPD **(Evidence B)**.

TABLE 4.10 (Part I)

## KEY POINTS FOR THE USE OF NON-PHARMACOLOGICAL TREATMENTS

### END OF LIFE AND PALLIATIVE CARE

- All clinicians managing patients with COPD should be aware of the effectiveness of palliative approaches to symptom control and use these in their practice **(Evidence D)**.
- End of life care should include discussions with patients and their families about their views on resuscitation, advance directives and place of death preferences **(Evidence D)**.

### TREATMENT OF HYPOXEMIA

- In patients with severe resting hypoxemia long-term oxygen therapy is indicated **(Evidence A)**.
- In patients with stable COPD and resting or exercise-induced moderate desaturation, long term oxygen treatment should not be routinely prescribed. However, individual patient factors may be considered when evaluating the patient's needs for supplemental oxygen **(Evidence A)**.
- Resting oxygenation at sea level does not exclude the development of severe hypoxemia when travelling by air **(Evidence C)**.

### TREATMENT OF HYPERCAPNIA

- In patients with severe chronic hypercapnia and a history of hospitalization for acute respiratory failure, long term noninvasive ventilation may be considered **(Evidence B)**.

### INTERVENTION BRONCHOSCOPY AND SURGERY

- Lung volume reduction surgery should be considered in selected patients with upper-lobe emphysema **(Evidence A)**.
- In selected patients with a large bulla surgical bullectomy may be considered **(Evidence C)**.
- In select patients with advanced emphysema, bronchoscopic interventions reduce end-expiratory lung volume and improve exercise tolerance, quality of life and lung function at 6-12 months following treatment. Endobronchial valves **(Evidence A)**; Lung coils **(Evidence B)**; Vapor ablation **(Evidence B)**.
- In patients with very severe COPD (progressive disease, BODE score of 7 to 10, and not candidate for lung volume reduction) lung transplantation may be considered for referral with at least one of the following: (1) history of hospitalization for exacerbation associated with acute hypercapnia ($Pco_2$ >50 mm Hg); (2) pulmonary hypertension and/or cor pulmonale, despite oxyqen therapy; or (3) $FEV_1$ < 20% and either DLCO < 20% or homogenous distribution of emphysema **(Evidence C)**.

TABLE 4.10 (Part II)

# DIFFERENTIAL DIAGNOSIS OF COPD EXACERBATION

**WHEN THERE IS CLINICAL SUSPICION OF THE FOLLOWING ACUTE CONDITIONS, CONSIDER THE FOLLOWING INVESTIGATIONS:**

**PNEUMONIA**

- Chest radiograph
- Assessment of C-reactive protein (CRP) and/or procalcitonin

**PNEUMOTHORAX**

- Chest radiograph or ultrasound

**PLEURAL EFFUSION**

- Chest radiograph or ultrasound

**PULMONARY EMBOLISM**

- D-dimer and/or Doppler sonogram of lower extremities
- Chest tomography – pulmonary embolism protocol

**PULMONARY EDEMA DUE TO CARDIAC RELATED CONDITIONS**

- Electrocardiogram and cardiac ultrasound
- Cardiac enzymes

**CARDIAC ARRHYTHMIAS – ATRIAL FIBRILLATION/FLUTTER**

- Electrocardiogram

TABLE 5.1

## POTENTIAL INDICATIONS FOR HOSPITALIZATION ASSESSMENT*

- Severe symptoms such as sudden worsening of resting dyspnea, high respiratory rate, decreased oxygen saturation, confusion, drowsiness.
- Acute respiratory failure.
- Onset of new physical signs (e.g., cyanosis, peripheral edema).
- Failure of an exacerbation to respond to initial medical management.
- Presence of serious comorbidities (e.g., heart failure, newly occurring arrhythmias, etc.).
- Insufficient home support.

*Local resources need to be considered.

TABLE 5.2

## MANAGEMENT OF SEVERE BUT NOT LIFE-THREATENING EXACERBATIONS*

- Assess severity of symptoms, blood gases, chest radiograph.
- Administer supplemental oxygen therapy, obtain serial arterial blood gas, venous blood gas and pulse oximetry measurements.
- Bronchodilators:
  - » Increase doses and/or frequency of short-acting bronchodilators.
  - » Combine short-acting beta 2-agonists and anticholinergics.
  - » Consider use of long-active bronchodilators when patient becomes stable.
  - » Use spacers or air-driven nebulizers when appropriate.
- Consider oral corticosteroids.
- Consider antibiotics (oral) when signs of bacterial infection are present.
- Consider noninvasive mechanical ventilation (NIV).
- At all times:
  - » Monitor fluid balance.
  - » Consider subcutaneous heparin or low molecular weight heparin for thromboembolism prophylaxis.
  - » Identify and treat associated conditions (e.g., heart failure, arrhythmias, pulmonary embolism etc.).

*Local resources need to be considered.

TABLE 5.3

## KEY POINTS FOR THE MANAGEMENT OF EXACERBATIONS

- Short-acting inhaled beta$_2$-agonists, with or without short-acting anticholinergics, are recommended as the initial bronchodilators to treat an acute exacerbation **(Evidence C)**.
- Systemic corticosteroids can improve lung function ($FEV_1$), oxygenation and shorten recovery time and hospitalization duration. Duration of therapy should not be more than 5-7 days **(Evidence A)**.
- Antibiotics, when indicated, can shorten recovery time, reduce the risk of early relapse, treatment failure, and hospitalization duration. Duration of therapy should be 5-7 days **(Evidence B)**.
- Methylxanthines are not recommended due to increased side effect profiles **(Evidence B)**.
- Non-invasive mechanical ventilation should be the first mode of ventilation used in COPD patients with acute respiratory failure who have no absolute contraindication because it improves gas exchange, reduces work of breathing and the need for intubation, decreases hospitalization duration and improves survival **(Evidence A)**.

TABLE 5.4

## INDICATIONS FOR RESPIRATORY OR MEDICAL INTENSIVE CARE UNIT ADMISSION*

- Severe dyspnea that responds inadequately to initial emergency therapy.
- Changes in mental status (confusion, lethargy, coma).
- Persistent or worsening hypoxemia ($PaO_2$ < 5.3 kPa or 40mmHg) and/or severe/worsening respiratory acidosis (pH < 7.25) despite supplemental oxygen and noninvasive ventilation.
- Need for invasive mechanical ventilation.
- Hemodynamic instability - need for vasopressors.

*Local resources need to be considered.

TABLE 5.5

## INDICATIONS FOR NONINVASIVE MECHANICAL VENTILATION (NIV)

At least one of the following:

- Respiratory acidosis ($PaCO_2 \geq 6.0$ kPa or 45 mmHg and arterial pH ≤ 7.35).
- Severe dyspnea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing, or both, such as use of respiratory accessory muscles, paradoxical motion of the abdomen, or retraction of the intercostal spaces.
- Persistent hypoxemia despite supplemental oxygen therapy.

TABLE 5.6

## INDICATIONS FOR INVASIVE MECHANICAL VENTILATION

- Unable to tolerate NIV or NIV failure.
- Status post - respiratory or cardiac arrest.
- Diminished consciousness, psychomotor agitation inadequately controlled by sedation.
- Massive aspiration or persistent vomiting.
- Persistent inability to remove respiratory secretions.
- Severe hemodynamic instability without response to fluids and vasoactive drugs.
- Severe ventricular or supraventricular arrhythmias.
- Life-threatening hypoxemia in patients unable to tolerate NIV.

TABLE 5.7

## DISCHARGE CRITERIA AND RECOMMENDATIONS FOR FOLLOW-UP

- Full review of all clinical and laboratory data.
- Check maintenance therapy and understanding.
- Reassess inhaler technique.
- Ensure understanding of withdrawal of acute medications (steroids and/or antibiotics).
- Assess need for continuing any oxygen therapy.
- Provide management plan for comorbidities and follow-up.
- Ensure follow-up arrangements: early follow-up < 4weeks, and late follow-up < 12weeks as indicated.
- All clinical or investigational abnormalities have been identified.

### 1 – 4 WEEKS FOLLOW-UP

- Evaluate ability to cope in his/her usual environment.
- Review and understanding treatment regimen.
- Reassessment of inhaler techniques.
- Reassess need for long-term oxygen.
- Document the capacity to do physical activity and activities of daily living.
- Document symptoms: CAT or mMRC.
- Determine status of comorbidities.

### 12 – 16 WEEKS FOLLOW-UP

- Evaluate ability to cope in his/her usual environment.
- Review understanding treatment regimen.
- Reassessment of inhaler techniques.
- Reassess need for long-term oxygen.
- Document the capacity to do physical activity and activities of daily living.
- Measure spirometry: $FEV_1$.
- Document symptoms: CAT or mMRC.
- Determine status of comorbidities.

TABLE 5.8

## INTERVENTIONS THAT REDUCE THE FREQUENCY OF COPD EXACERBATIONS

| INTERVENTION CLASS | INTERVENTION |
|---|---|
| Bronchodilators | LABAs<br>LAMAs<br>LABA + LAMA |
| Corticosteroid-containing regimens | LABA + ICS<br>LABA + LAMA + ICS |
| Anti-inflammatory (non-steroid) | Roflumilast |
| Anti-infectives | Vaccines<br>Long Term Macrolides |
| Mucoregulators | N-acetylcysteine<br>Carbocysteine |
| Various others | Smoking Cessation<br>Rehabilitation<br>Lung Volume Reduction<br>Vitamin D |

TABLE 5.9