
VCH Community and Family Medicine Rounds

Tuesday, June 1, 2021

Update on COPD

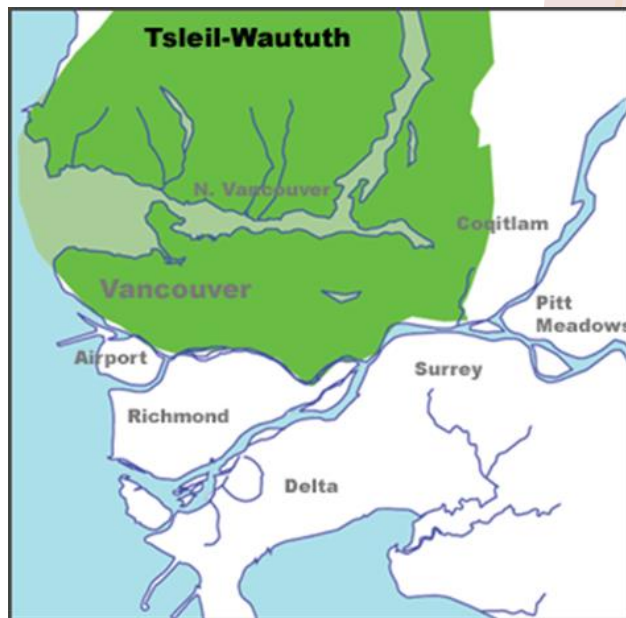
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UBC & VCH

We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.

Source: www.ihomaps.net/na/canada/bc/vancouver/firstnations/firstnations.html



Conflicts of interest

- None



Learning objectives

- Review the GOLD 2021 COPD Guidelines
 - Discuss the role of clinical phenotyping in the management of COPD
 - Define asthma-COPD overlap (ACO)
 - Explain the role of peripheral eosinophilia in the management of COPD
-

What is COPD?

- Common, preventable and treatable
 - Characterized by:
 - Persistent respiratory symptoms
 - Structural lung abnormalities – airways disease/emphysema
 - Airflow limitation
 - Usually due to exposure to noxious particles
 - Host factors including abnormal lung development
 - Significant comorbidities that affect morbidity and mortality
-

What causes COPD?

- **Tobacco smoke (2/3)**
 - Indoor air pollution
 - Occupational exposures
 - Outdoor air pollution
 - Genetic factors
 - Age and sex
 - Lung growth and development
 - Socioeconomic status
 - Asthma and airway hyperreactivity
 - Bronchitis
 - Infections
-

Epidemiology

- 3rd leading cause of death worldwide

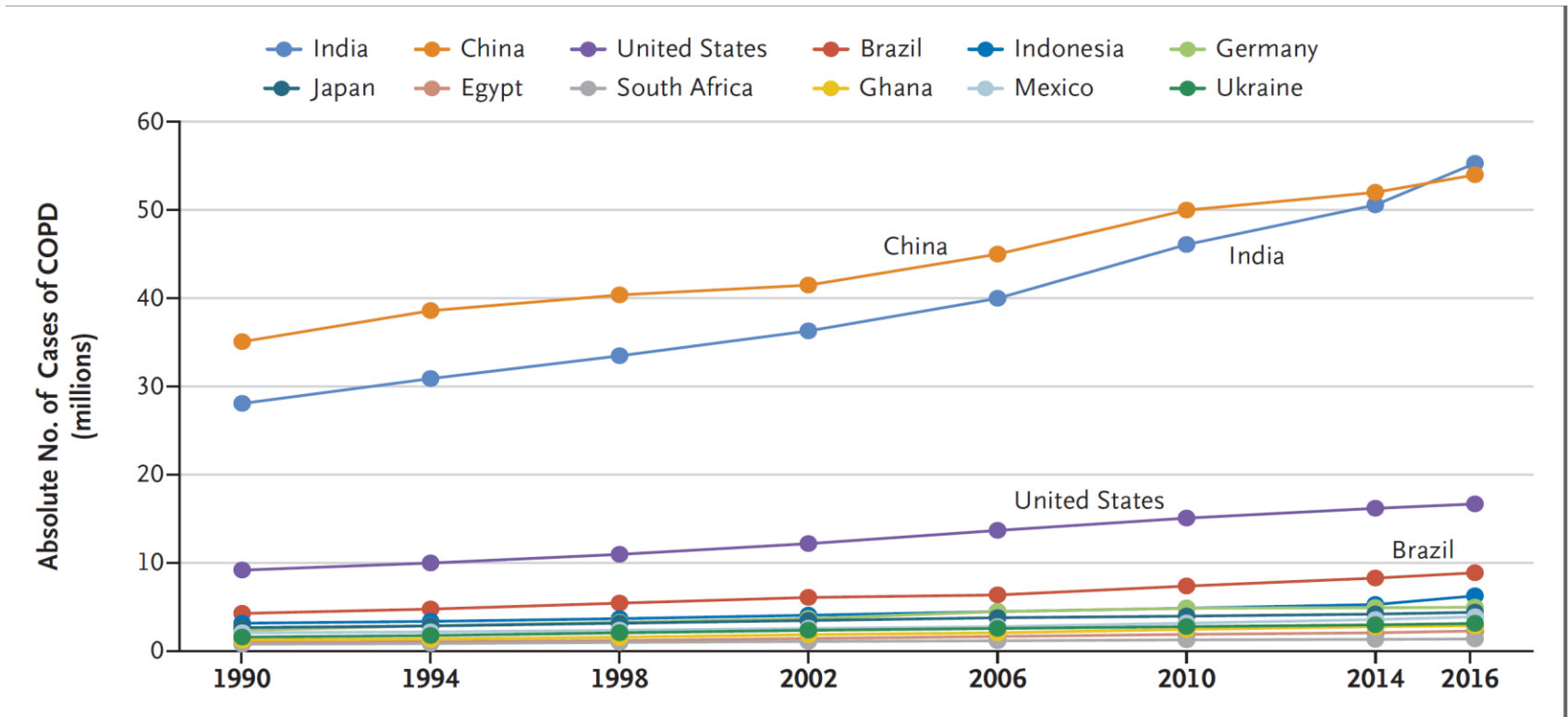


Figure 1. Prevalence of Chronic Obstructive Pulmonary Disease (COPD) in Selected Countries, 1990–2016.

COPD is currently the third leading cause of death and an important cause of complications worldwide. Although COPD is a substantial problem everywhere, China and India account for more than 50% of all cases of COPD in the world. Data are from the Global Burden of Disease (www.healthdata.org/gbd).

Comorbid conditions

- Occur a decade younger than usual in COPD
 - Ischemic heart disease
 - Atrial fibrillation
 - Heart failure
 - Osteoporosis
 - Lung cancer
 - Gastroesophageal reflux
 - Anxiety
 - Depression
-

COPD: A typical patient

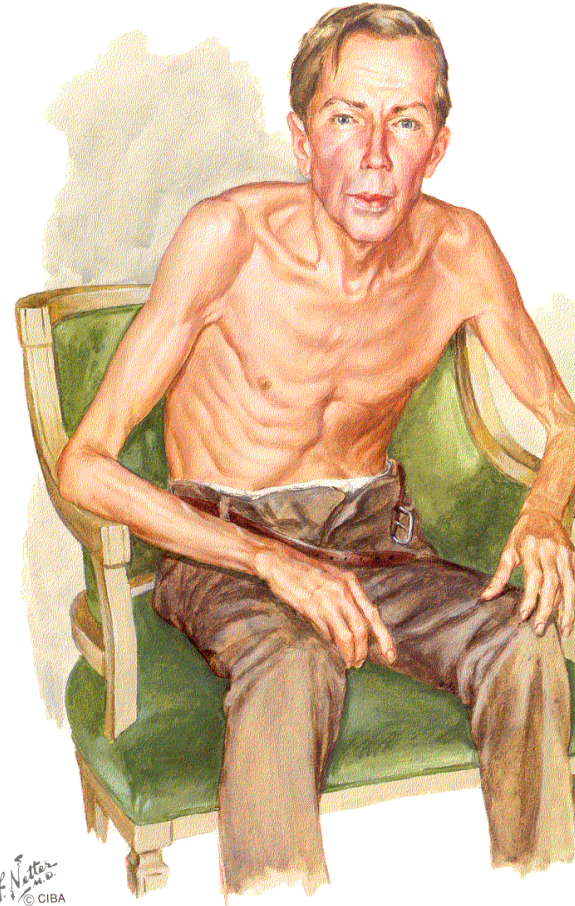
- A 60-year-old heavy cigarette smoker who has a chronic cough and wheeze, complains to his family doctor of exertional breathlessness that is slowly progressive over the past 3 years.
 - His weight has been falling by a few pounds each year, and he curtails his physical activity because of breathlessness.
 - As the disease progresses, he develops increasingly frequent exacerbations, often precipitated by viral or bacterial respiratory tract infections, that may be severe enough to warrant hospital admission.
-

Natural History: COPD

- Progressive decline in
 - Ventilatory function
 - Exercise capacity
 - Health status

- Exacerbations
 - Varying frequency
 - Increased dyspnea
 - Increased volume and purulence of sputum

The Pink Puffer



Pathophysiology



COPD

■ Pathology

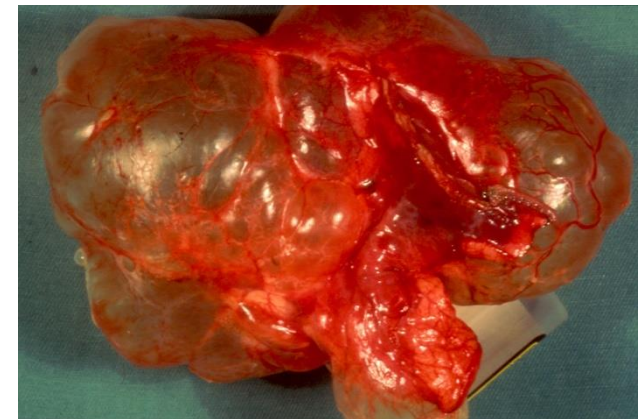
- Chronic inflammation of the airways and lung parenchyma leading to
 - Obstructive bronchitis and bronchiolitis
 - Emphysema

■ Physiology

- Progressive, partially reversible airflow limitation
- Loss of lung elastic recoil due to emphysema
- Dynamic hyperinflation during exertion
- Systemic inflammation

■ Clinical

- Persistent dyspnea and exercise limitation
- Increasing frequency and severity of exacerbations
- Systemic manifestations



Obstructive lung disease

- 2 main pathophysiological features
 - Inflammation
 - Airflow obstruction
-

Inflammation

■ Type

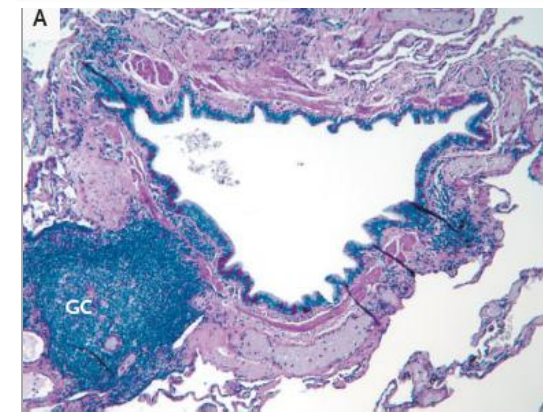
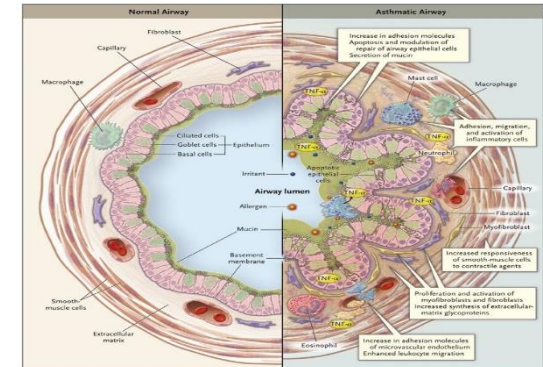
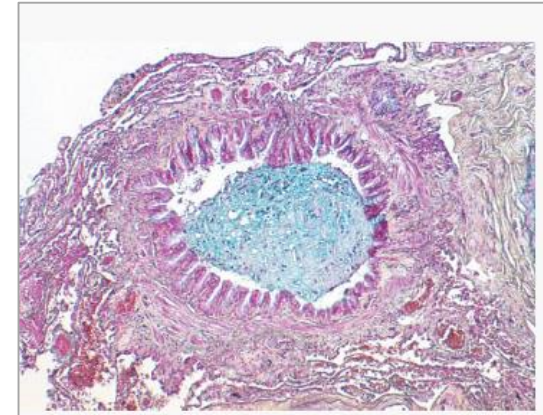
- ❑ Acute, sub acute and chronic
- ❑ Multicellular
- ❑ Redundant
- ❑ Self amplifying

■ Secondary effects

- Increased smooth muscle tone
 - Increased vascular permeability
 - Neuronal activation
 - Mucus hypersecretion
 - Epithelial injury
 - Myofibroblast proliferation
 - Collagen deposition
 - Proteolytic destruction
 - Remodelling
 - Fibrosis
-

Factors contributing to airflow obstruction

- Intra-luminal - **Exudate**
 - ❑ Inflammatory cells
 - ❑ Mucus
 - ❑ Proteinaceous exudate
- Airway wall - **Thickening**
 - ❑ Edema and inflammation
 - ❑ Smooth muscle hyperplasia
 - ❑ Lymphoid follicles
 - ❑ Bronchial hyperreactivity
 - ❑ Subepithelial fibrosis
- Extra-luminal - **Loss of Support**
 - ❑ Emphysema – loss of radial traction
 - ❑ Fibrosis
 - ❑ Dynamic hyperinflation



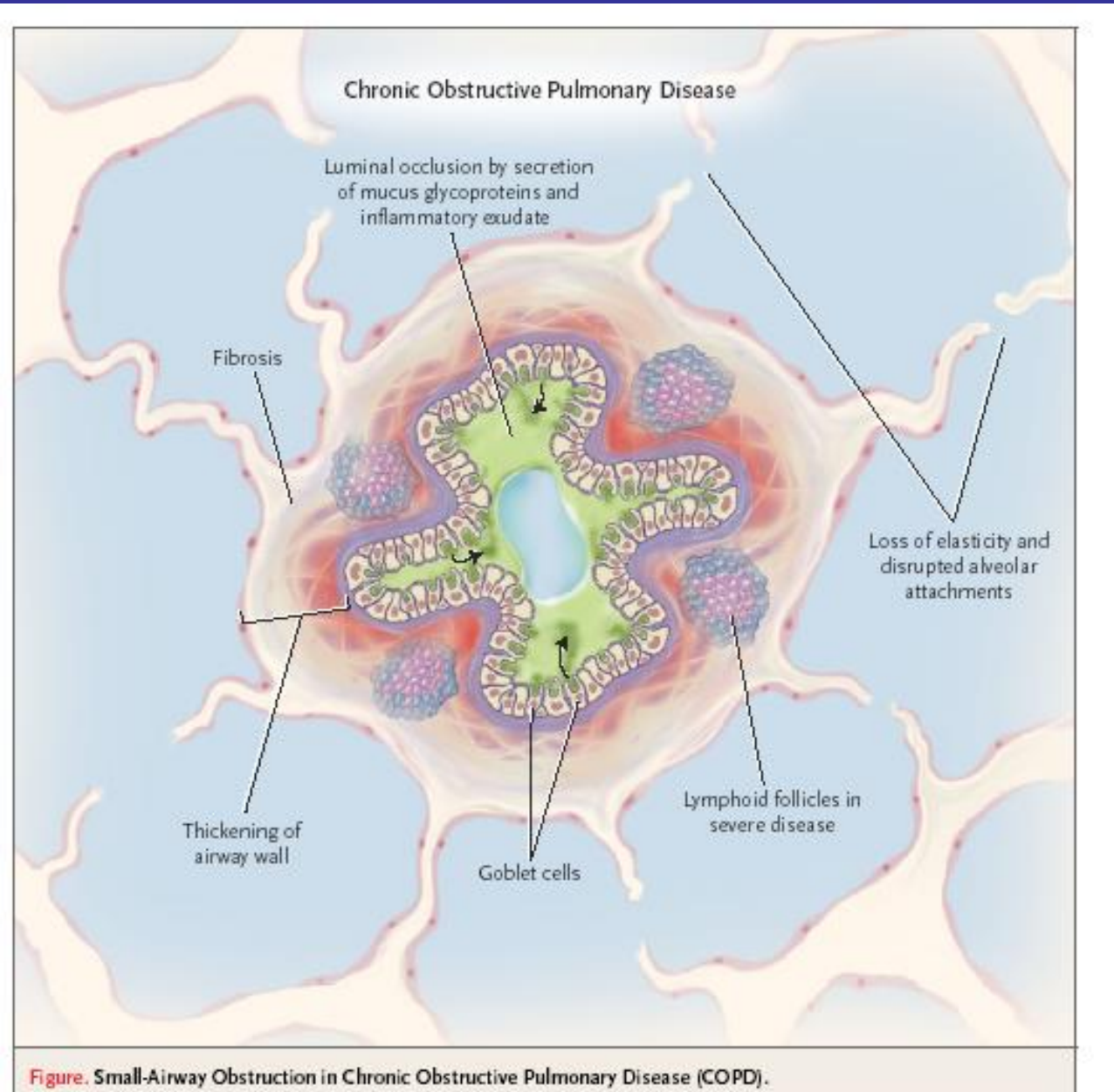
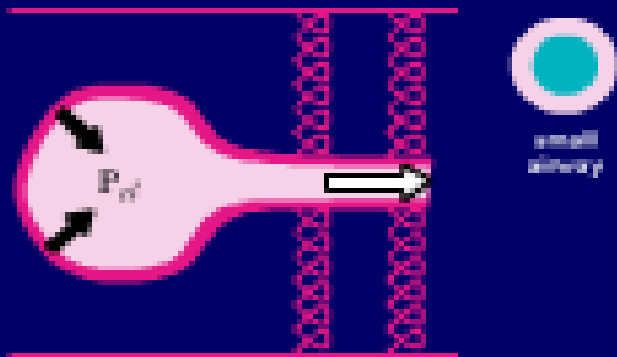


Figure. Small-Airway Obstruction in Chronic Obstructive Pulmonary Disease (COPD).

Alveolar Emptying in COPD

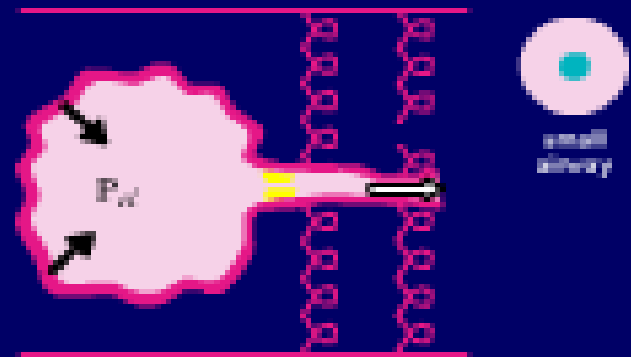
Alveolar deflation in the normal state

Cycle of deflation and inflation



Alveolar deflation in COPD

Cycle of deflation and inflation



In COPD, airflow is limited because small airways are narrowed, alveoli lose their elasticity, and supportive structures are lost.

Images courtesy of Denis O'Donnell, Queen's University, Kingston, Canada.

Diagnosis

▶ PATHWAYS TO THE DIAGNOSIS OF COPD

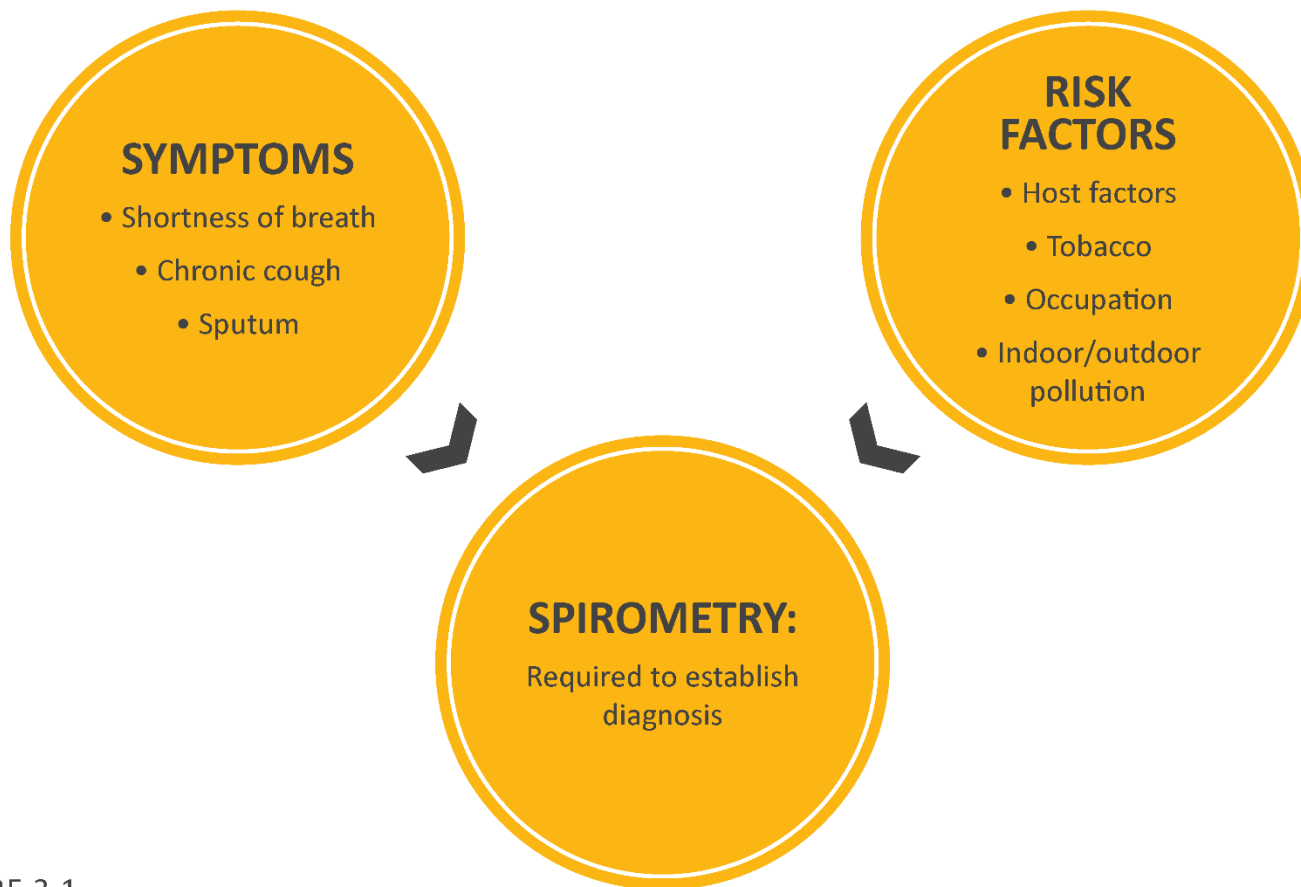


FIGURE 2.1

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. Characteristically worse with exercise. Persistent.
Chronic Cough:	May be intermittent and may be unproductive. 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.). Tobacco smoke (including popular local preparations). Smoke from home cooking and heating fuels. 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

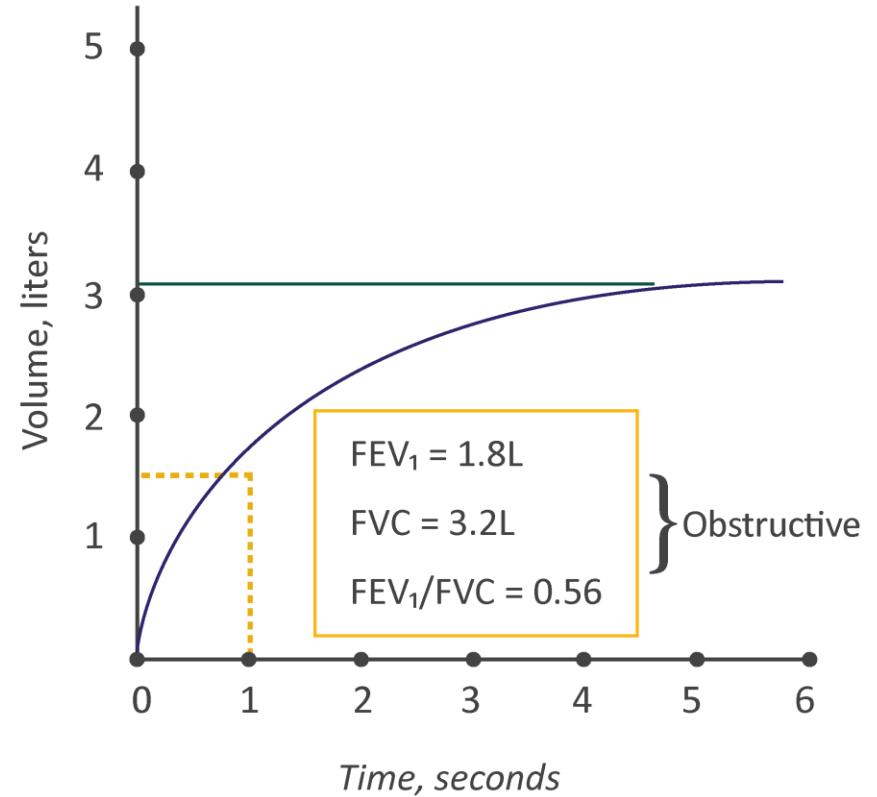
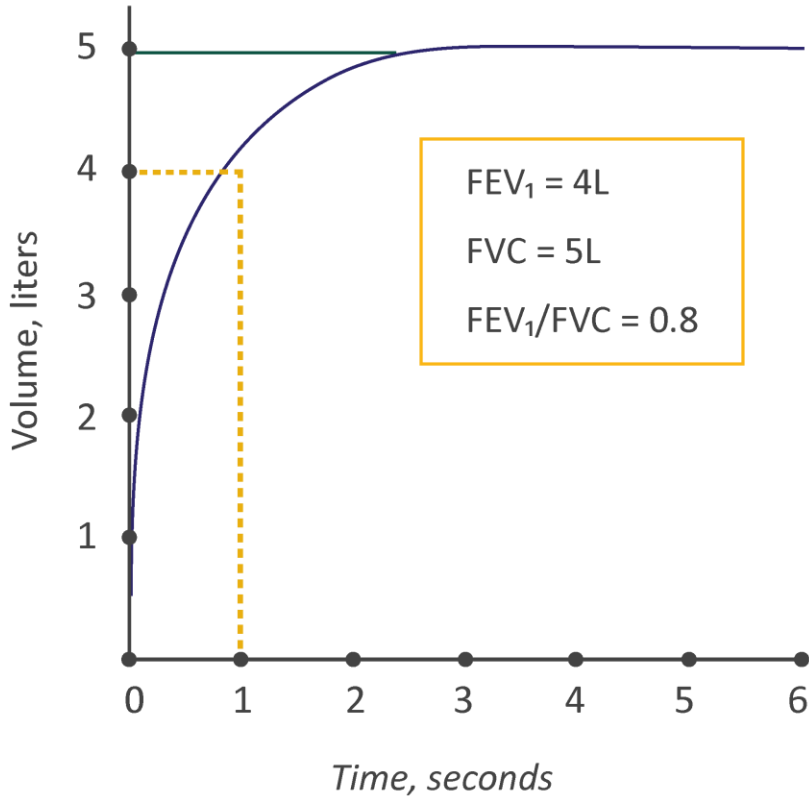
Spirometry

- Post-bronchodilator $FEV_1/FVC < 0.70$
 - Confirms the presence of persistent airflow limitation
- Reproducible
- Objective
- Non-invasive
- Readily available



SPIROMETRY - NORMAL TRACE

SPIROMETRY - OBSTRUCTIVE DISEASE



FVC = —————

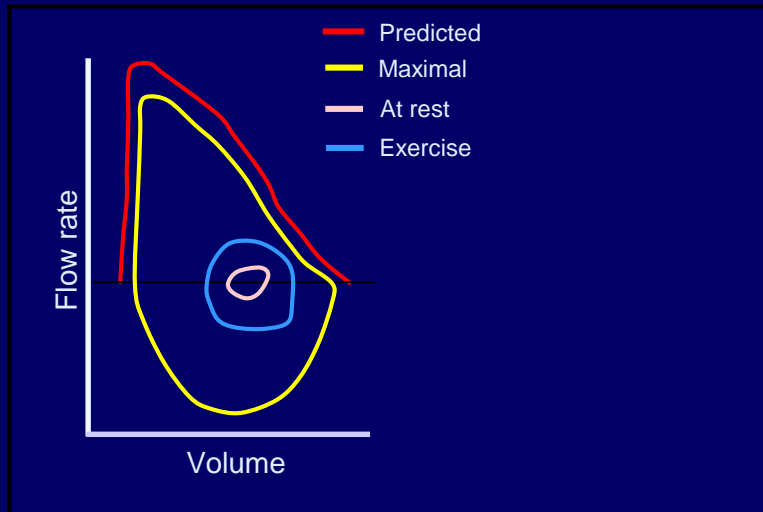
FEV_1 = - - - - -

▶ ROLE OF SPIROMETRY

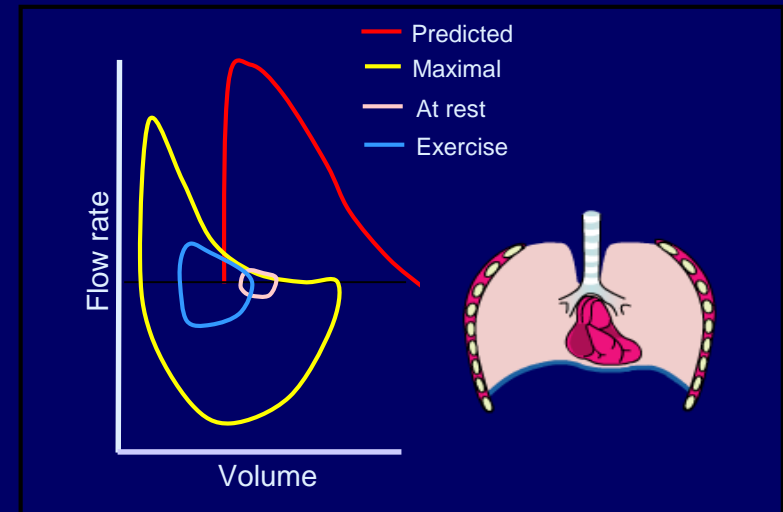
- **Diagnosis**
- **Assessment of severity of airflow obstruction (for prognosis)**
- **Follow-up assessment**
 - » Therapeutic decisions.
 - Pharmacological in selected circumstances (e.g., discrepancy between spirometry and level of symptoms).
 - Consider alternative diagnoses when symptoms are disproportionate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

Flow-Volume Loops in COPD

Breathing in the normal state
Cycle of deflation and inflation



Breathing in COPD
Cycle of deflation and inflation



Other investigations

- Imaging
 - Chest radiograph
 - Chest CT scan
 - Lung volumes and diffusing capacity
 - Oximetry and arterial blood gases
 - Exercise testing and assessment of physical activity
-

▶ DIFFERENTIAL DIAGNOSIS OF COPD

DIAGNOSIS	SUGGESTIVE FEATURES
COPD	Onset in mid-life. Symptoms slowly progressive. History of tobacco smoking or exposure to other types of smoke.
Asthma	Onset early in life (often childhood). Symptoms vary widely from day to day. Symptoms worse at night/early morning. Allergy, rhinitis, and/or eczema also present. Family history of asthma. Obesity coexistence.
Congestive Heart Failure	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. Chest X-ray/CT shows bronchial dilation, bronchial wall thickening.
Tuberculosis	Onset all ages. Chest X-ray shows lung infiltrate. Microbiological confirmation. High local prevalence of tuberculosis.
Obliterative Bronchiolitis	Onset at younger age, nonsmokers. May have history of rheumatoid arthritis or acute fume exposure. Seen after lung or bone marrow transplantation. CT on expiration shows hypodense areas.
Diffuse Panbronchiolitis	Predominantly seen in patients of Asian descent. Most patients are male and nonsmokers. Almost all have chronic sinusitis. 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.

▶ 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

Assessment

Assessment

- Presence and severity of airflow obstruction
 - Current nature and magnitude of symptoms
 - History of moderate/severe exacerbations
 - Presence of comorbidities
-

CLASSIFICATION OF AIRFLOW LIMITATION SEVERITY IN COPD (BASED ON POST-BRONCHODILATOR FEV₁)

In patients with FEV₁/FVC < 0.70:

GOLD 1:	Mild	FEV ₁ ≥ 80% predicted
GOLD 2:	Moderate	50% ≤ FEV ₁ < 80% predicted
GOLD 3:	Severe	30% ≤ FEV ₁ < 50% predicted
GOLD 4:	Very Severe	FEV ₁ < 30% predicted

▶ 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.	<input type="checkbox"/>
mMRC Grade 1.	I get short of breath when hurrying on the level or walking up a slight hill.	<input type="checkbox"/>
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.	<input type="checkbox"/>
mMRC Grade 3.	I stop for breath after walking about 100 meters or after a few minutes on the level.	<input type="checkbox"/>
mMRC Grade 4.	I am too breathless to leave the house or I am breathless when dressing or undressing.	<input type="checkbox"/>

^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	<input type="radio"/> 0 <input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	I am very sad	SCORE
I never cough	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	I cough all the time	_____
I have no phlegm (mucus) in my chest at all	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	My chest is completely full of phlegm (mucus)	_____
My chest does not feel tight at all	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	My chest feels very tight	_____
When I walk up a hill or one flight of stairs I am not breathless	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 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	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	I am very limited doing activities at home	_____
I am confident leaving my home despite my lung condition	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	I am not at all confident leaving my home because of my lung condition	_____
I sleep soundly	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	I don't sleep soundly because of my lung condition	_____
I have lots of energy	<input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	I have no energy at all	_____

Reference: Jones et al. ERJ 2009; 34 (3); 648-54.
FIGURE 2.3

TOTAL SCORE:

▶ THE REFINED ABCD ASSESSMENT TOOL

Spirometrically Confirmed Diagnosis



Assessment of airflow limitation



Assessment of symptoms/risk of exacerbations

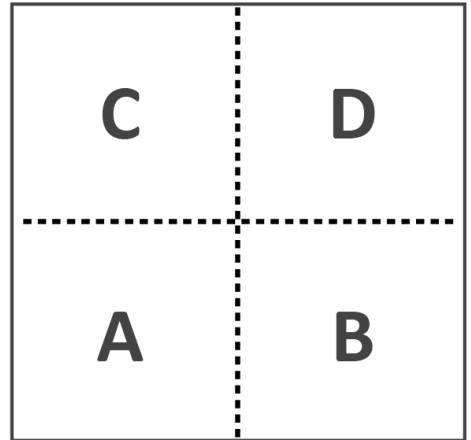
Post-bronchodilator
FEV₁/FVC < 0.7

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)



mMRC 0-1
CAT < 10

mMRC ≥ 2
CAT ≥ 10

Symptoms

Management

▶ GOALS FOR TREATMENT OF STABLE COPD

- Relieve Symptoms
- Improve Exercise Tolerance
- Improve Health Status



REDUCE SYMPTOMS

and

- Prevent Disease Progression
- Prevent and Treat Exacerbations
- Reduce Mortality



REDUCE RISK

TABLE 4.1

COPD Management

- Non-pharmacologic
 - ❑ Smoking cessation
 - ❑ Avoid occupational exposures
 - ❑ Education and self management
 - ❑ Vaccinations - influenza, pneumococcal
 - ❑ Regular exercise
 - ❑ Good nutrition
 - ❑ Pulmonary rehabilitation
 - ❑ End of life care



BRIEF STRATEGIES TO HELP THE PATIENT WILLING TO QUIT

- **ASK:**

Systematically identify all tobacco users at every visit.
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.
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.
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.
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.
Schedule follow-up contact, either in person or via telephone.

▶ VACCINATION FOR STABLE COPD

- Influenza vaccination reduces serious illness and death in COPD patients (**Evidence B**).
- 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 FEV₁ < 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**).
- The CDC recommends the Tdap (dTaP/dTPa) vaccination for adults with COPD who were not vaccinated in adolescence to protect against pertussis (whooping cough).

COPD Management

- Pharmacologic
 - Short acting bronchodilators
 - β_2 -agonists
 - Anticholinergics
 - Long acting bronchodilators
 - β_2 -agonists
 - Anticholinergics
 - Combination therapy is more effective
 - ? Methylxanthines – **theophylline**
 - Low therapeutic index
 - Need to monitor blood levels
-

COPD Management

- Pharmacologic

- Inhaled corticosteroids

- Reduce the frequency of exacerbations
 - Indicated for severe COPD

- PDE4 inhibitor

- Roflumilast – reduces frequency of exacerbations

- Oral corticosteroids

- For exacerbations only

- Antibiotics

- For infective exacerbations

- Supplemental oxygen

- Strict criteria
-

COMMONLY USED MAINTENANCE MEDICATIONS IN COPD*

DELIVERY OPTIONS					
Generic Drug Name	Inhaler Type	Nebulizer	Oral	Injection	Duration Of Action
BETA₂-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 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
Oxipropium 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 BETA₂-AGONIST PLUS ANTICHOLINERGIC IN ONE DEVICE (SABA/SAMA)					
Fenoterol/ipratropium	SMI	√			6-8 hours
Salbutamol/ipratropium	SMI, MDI	√			6-8 hours
COMBINATION LONG-ACTING BETA₂-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
METHYLYXANTHINES					
Aminophylline			solution	√	Variable, up to 24 hours
Theophylline (SR)			pill	√	Variable, up to 24 hours
COMBINATION OF LONG-ACTING BETA₂-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 propionate	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
Budesonide/formoterol/glycopyrrolate	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. Note that glycopyrrolate & glycopyrronium are the same compound.

- 31 different inhalers to choose from!
- It is impossible to remember them all
- Become familiar with a few
- Be prepared to change inhalers to suit patient preferences and abilities
- My personal preferences are based on:
 - Safety
 - Ease of use
 - Cost
 - Familiarity

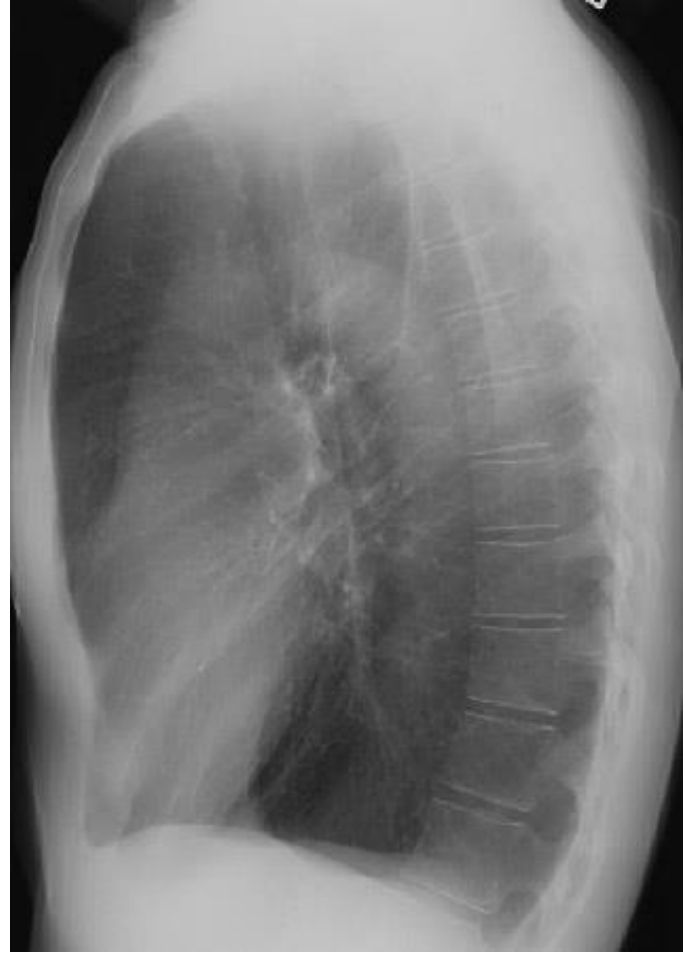
▶ THE INHALED ROUTE

- 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.

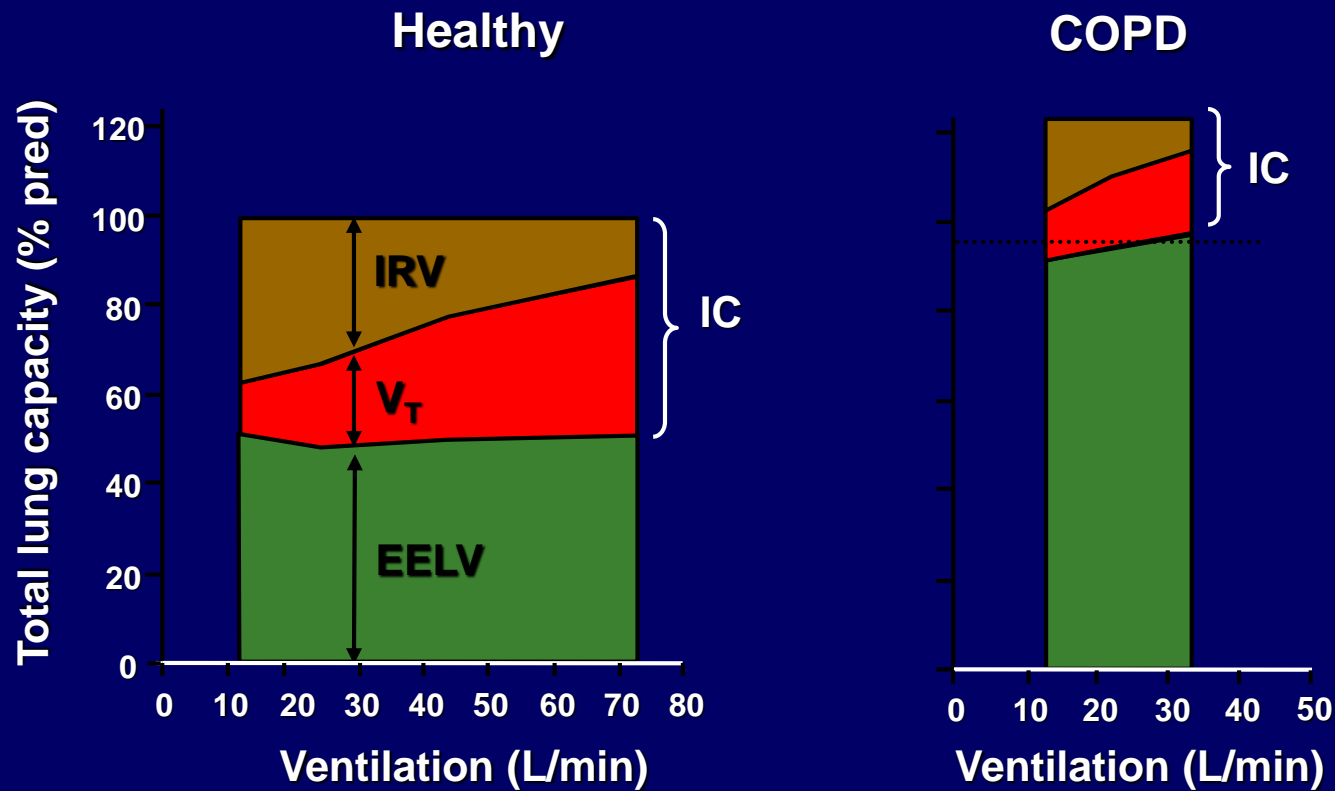
The bronchodilator paradox

- If airflow obstruction is irreversible or only partially reversible in COPD, why treat with bronchodilators?
 - Bronchodilator reversibility is a laboratory defined measurement based primarily on change in FEV_1
 - Although COPD patients do not typically demonstrate bronchodilator reversibility in the laboratory sense, they do derive benefit from bronchodilator therapy. Why?
 - In COPD, bronchodilators reduce static and dynamic hyperinflation, thereby helping to relieve dyspnea and improve exercise tolerance
-

Hyperinflation



Operating Lung Volumes During Exercise



Based on ABCD assessment tool

INITIAL PHARMACOLOGICAL TREATMENT

≥ 2 moderate exacerbations or ≥ 1 leading to hospitalization

Group C

LAMA

Group D LAMA or
LAMA + LABA* or
ICS + LABA**

*Consider if highly symptomatic (e.g. CAT > 20)
**Consider if eos ≥ 300

0 or 1 moderate exacerbations (not leading to hospital admission)

Group A

A Bronchodilator

Group B

A Long Acting Bronchodilator (LABA or LAMA)

mMRC 0-1, CAT < 10

mMRC ≥ 2, CAT ≥ 10

FIGURE 4.2

Clinical phenotyping in COPD

Clinical phenotyping (and ICS)

- Frequent exacerbations
 - ≥ 2 or 1 requiring hospitalization
 - Asthma/COPD Overlap (ACO)
 - Blood eosinophil count
 - > 300 cells / μ L
-

ACO – no clear definition

- COPD +
 - Age > 40 yr
 - History of asthma or atopy
 - Peripheral eosinophils > 300/ μ L
 - IgE > 100 IU/ml
 - Positive allergy skin tests
 - Bronchodilator reversibility > 12% and > 400ml
 - Improvement in lung function with ICS
 - Treatment
 - Short acting bronchodilator for symptom relief
 - Always include inhaled corticosteroid
 - Biologics for refractory disease
-

CLINICAL PHENOTYPE - ADULTS WITH CHRONIC RESPIRATORY SYMPTOMS (dyspnea, cough, chest tightness, wheeze)

HIGHLY LIKELY TO BE ASTHMA

if several of the following features

TREAT AS ASTHMA

HISTORY

- Symptoms vary over time and in intensity
 - Triggers may include laughter, exercise, allergens, seasonal
 - Onset before age 40 years
 - Symptoms improve spontaneously or with bronchodilators (minutes) or ICS (days to weeks)
- Current asthma diagnosis, or asthma diagnosis in childhood

LUNG FUNCTION

- Variable expiratory airflow limitation
- Persistent airflow limitation may be present

FEATURES OF BOTH ASTHMA + COPD

TREAT AS ASTHMA

HISTORY

- Symptoms intermittent or episodic
 - May have started before or after age 40
- May have a history of smoking and/or other toxic exposures, or history of low birth weight or respiratory illness such as tuberculosis
- Any of asthma features at left (e.g. common triggers; symptoms improve spontaneously or with bronchodilators or ICS; current asthma diagnosis or asthma diagnosis in childhood)

LUNG FUNCTION

- Persistent expiratory airflow limitation
- With or without bronchodilator reversibility

LIKELY TO BE COPD

if several of the following features

TREAT AS COPD

HISTORY

- Dyspnea persistent (most days)
 - Onset after age 40 years
 - Limitation of physical activity
 - May have been preceded by cough/sputum
 - Bronchodilator provides only limited relief
- History of smoking and/or other toxic exposure, or history of low birth weight or respiratory illness such as tuberculosis
- No past or current diagnosis of asthma

LUNG FUNCTION

- Persistent expiratory airflow limitation
- With or without bronchodilator reversibility

INITIAL PHARMACOLOGICAL TREATMENT (as well as treating comorbidities and risk factors. See Box 3-5A)

• **ICS-CONTAINING TREATMENT IS ESSENTIAL** to reduce risk of severe exacerbations and death. See Box 3-5A

- As-needed low dose ICS-formoterol may be used as reliever. See Box 3-5A
- **DO NOT GIVE LABA and/or LAMA without ICS**
- **Avoid maintenance OCS**

• **ICS-CONTAINING TREATMENT IS ESSENTIAL** to reduce risk of severe exacerbations and death. See Box 3-5A

- Add-on LABA and/or LAMA usually also needed
- Additional COPD treatments as per GOLD
- **DO NOT GIVE LABA and/or LAMA without ICS**
- **Avoid maintenance OCS**

• **TREAT AS COPD** (see GOLD report)

- Initially LAMA and/or LABA
- Add ICS as per GOLD for patients with hospitalizations, ≥ 2 exacerbations/year requiring OCS, or blood eosinophils $\geq 300/\mu\text{l}$
- **Avoid high dose ICS, avoid maintenance OCS**
- Reliever containing ICS is not recommended

REVIEW PATIENT AFTER 2-3 MONTHS. REFER FOR EXPERT ADVICE IF DIAGNOSTIC UNCERTAINTY OR INADEQUATE RESPONSE

Blood eosinophils in COPD

- Reducing exacerbations
 - Helps predict the effect of adding ICS to regular maintenance bronchodilator therapy
 - Continuous effect of blood eosinophil level
 - No effect if $< 100/\mu\text{L}$
 - Greatest likelihood of benefit if $> 300/\mu\text{L}$
-

▶ 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 ·
<ul style="list-style-type: none"> • History of hospitalization(s) for exacerbations of COPD[#] • ≥ 2 moderate exacerbations of COPD per year[#] • Blood eosinophils >300 cells/μL • History of, or concomitant, asthma 	<ul style="list-style-type: none"> • 1 moderate exacerbation of COPD per year[#] • Blood eosinophils 100-300 cells/μL 	<ul style="list-style-type: none"> • Repeated pneumonia events • Blood eosinophils <100 cells/μL • History of mycobacterial infection

[#]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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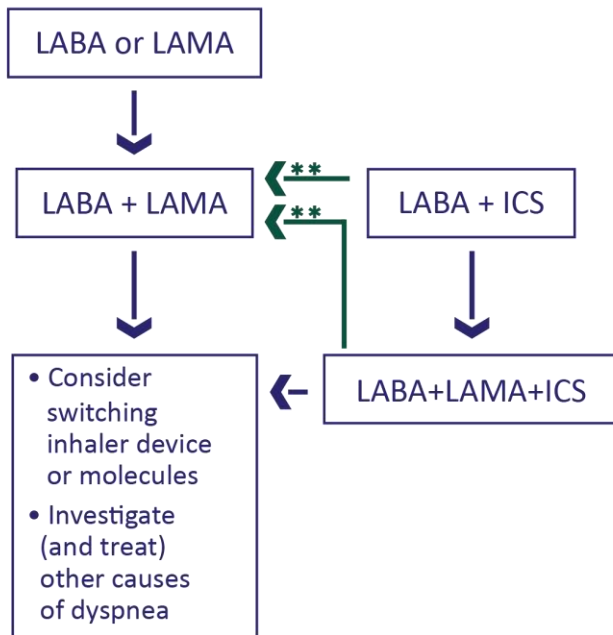
DOI: 10.1183/13993003.01219-2018 Published 13 December 2018

FOLLOW-UP PHARMACOLOGICAL TREATMENT

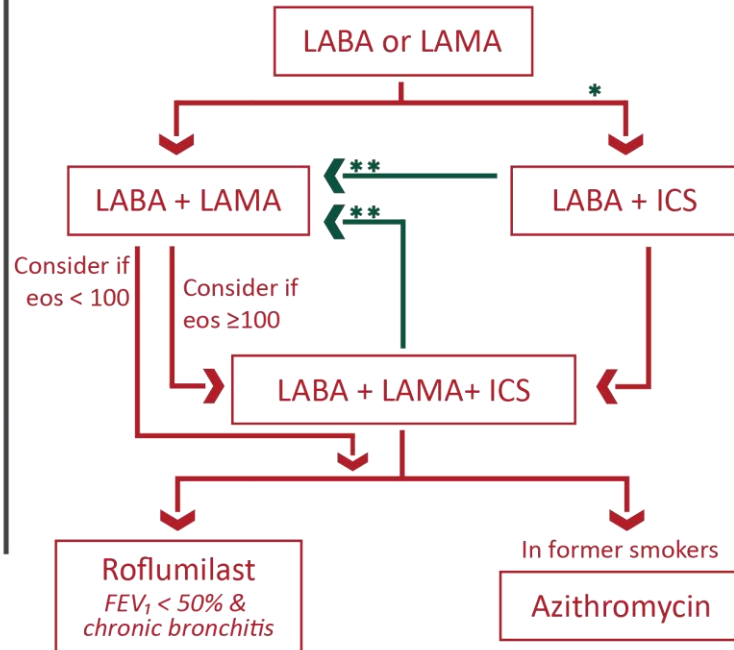
1. IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT.

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

• DYSPNEA •



• EXACERBATIONS •



eos = blood eosinophil count (cells/ μ L)

* Consider if $eos \geq 300$ or $eos \geq 100$ AND ≥ 2 moderate exacerbations / 1 hospitalization

** Consider de-escalation of ICS or switch if pneumonia, inappropriate original indication or lack of response to ICS

Summary approach to inhalers

Category	Inhaler Treatment
Minimal symptoms and airflow obstruction	A bronchodilator
Mild symptoms/obstruction	LAMA
Mild symptoms/obstruction and frequent exacerbations	LAMA
Moderate symptoms/obstruction	LAMA + LABA
Moderate symptoms/obstruction and frequent exacerbations	LAMA + LABA ICS + LABA
Features of asthma/allergy/ eosinophils > 100	ICS + LABA
Severe symptoms/airflow obstruction or persistent frequent exacerbations	LAMA + LABA + ICS

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**).
- 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**).

KEY POINTS FOR THE USE OF NON-PHARMACOLOGICAL TREATMENTS (Part I)

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**).

END OF LIFE AND PALLIATIVE CARE

(Part II)

- 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 ($P_{CO_2} > 50$ mm Hg); (2) pulmonary hypertension and/or cor pulmonale, despite oxygen therapy; or (3) $FEV_1 < 20\%$ and either $DLCO < 20\%$ or homogenous distribution of emphysema (**Evidence C**).

COPD Exacerbations

An acute worsening of respiratory symptoms that results in additional therapy

INTERVENTIONS THAT REDUCE THE FREQUENCY OF COPD EXACERBATIONS

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

▶ 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

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.

COPD and COVID

KEY POINTS FOR THE MANAGEMENT OF STABLE COPD DURING COVID-19 PANDEMIC

PROTECTIVE STRATEGIES

- Follow basic infection control measures
- Wear a face covering
- Consider shielding/sheltering-in-place

INVESTIGATIONS

- Only essential spirometry

PHARMACOTHERAPY

- Ensure adequate supplies of medications
- Continue unchanged including ICS

NON-PHARMACOLOGICAL THERAPY

- Ensure annual influenza vaccination
- Maintain physical activity

KEY POINTS FOR THE MANAGEMENT OF PATIENTS WITH COPD AND SUSPECTED OR PROVEN COVID-19

SARS-CoV-2 TESTING

- Swab/Saliva PCR if new or worsening respiratory symptoms, fever, and/or any other symptoms that could be COVID related

OTHER INVESTIGATIONS

- Avoid spirometry unless essential
- Consider CT for COVID pneumonia and to exclude other diagnoses e.g. PE
- Avoid bronchoscopy unless essential
- Assess for co-infection

COPD PHARMACOTHERAPY

- Ensure adequate supplies of medication
- Continue maintenance therapy unchanged including ICS
- Use antibiotics and oral steroids in line with recommendations for exacerbations
- Avoid nebulization when possible

COPD NON-PHARMACOLOGICAL THERAPY

- Maintain physical activity as able

PROTECTIVE STRATEGIES

- Follow basic infection control measures
- Maintain physical distancing
- Wear a face covering

COVID-19 THERAPY

- Use systemic steroids and remdesivir as recommended for patients with COVID-19
- Use HFNT or NIV for respiratory failure if possible
- Use invasive mechanical ventilation if HFNT or NIV fails
- Post COVID-19 rehabilitation
- Ensure appropriate post COVID-19 follow-up

Take home points

- COPD is common and increasing in prevalence worldwide
 - Cigarette smoking is the major cause, but other factors are responsible in 1 out of 3 patients
 - Spirometry is key to the diagnosis
 - Post bronchodilator $FEV_1/FVC < 0.70$
 - Pharmacologic management is guided by symptoms and frequency of exacerbations
 - Clinical phenotyping helps guide the use of inhaled corticosteroids
-

Questions?
