

Diagnosis and Initial Assessment of COPD

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Introduction

- Chronic Obstructive Pulmonary Disease
- Affects 5% of the population
- 3rd leading cause of death in the United States
- High resource utilization, frequent clinic visits, frequent hospitalizations and need for chronic therapies

Definition

- Characterized by airflow limitation
- Usually caused by significant exposure to noxious particles or gases
- Most common symptoms include dyspnea, cough and/or sputum production
- Main risk factor is tobacco smoking
 - Biomass fuel and air pollution may also contribute
- Chronic inflammation leads to structural changes, small airways narrowing, and destruction of lung parenchyma
 - Leads to mucociliary dysfunction

Diagnosis

- Consider COPD in any patient that has dyspnea, chronic cough or sputum production, and/or a history of exposures to risk factors

Key Indicators for Considering a diagnosis of COPD	
Dyspnea that is:	<ul style="list-style-type: none"> Progressive over time Characteristically worse with exercise Persistent
Chronic cough:	<ul style="list-style-type: none"> May be intermittent May be nonproductive Recurrent wheeze
Chronic sputum production:	Any pattern of chronic sputum production
Recurrent lower respiratory tract infections	
History of risk factors:	<ul style="list-style-type: none"> Host factors (genetic factors, congenital/developmental abnormalities) Tobacco smoke Smoke from home cooking and heating fuels Occupational dusts, vapors, fumes, gases and other chemicals
Family history of COPD and/or childhood factors:	Birthweight, childhood respiratory infections

Symptoms

- Shortness of breath
 - Chronic cough
 - Sputum

Risk Factors

- Host factors
 - Tobacco
 - Occupation
- Indoor/ outdoor pollution

Spirometry:
Required to
establish
diagnosis

Spirometry

- Required to make the diagnosis
- Post-bronchodilator FEV1/FVC <0.70
 - Confirms the presence of persistent airflow limitation

Symptoms

Dyspnea

- Chronic and progressive
- May vary from day to day
- Major cause of disability and anxiety
- Described as:
 - A sense of increased effort to breathe
 - Chest heaviness
 - Air hunger
 - gasping

Cough

- Often the first symptom and often attributed to a consequence of smoking or environmental exposure
- May be intermittent at first, progressing to throughout the day
- May be productive or nonproductive


Sputum Production

- Difficult to evaluate as it is not always expectorated
- Can be intermittent with periods of flare-up
- If patients produce large volumes of sputum, they may have underlying bronchiectasis
- Purulent sputum indicates an increase in inflammatory mediators
 - May or may not indicate bacterial infection

Wheezing and Chest Tightness

- Symptoms vary between days, as well as over the course of the day
- Wheezing can be inspiratory or expiratory
- Chest tightness follows exertion
 - Poorly localized
 - Muscular in character
 - May arise from contraction of intercostal muscles
- These symptoms do not confirm or exclude the diagnosis of COPD

Additional Features of Severe Disease

- Fatigue
- Weight loss
- Anorexia
- Ankle swelling  cor pulmonale
- Depression and anxiety

Clinical Exam

Medical History

- Exposures
 - Smoking and occupational or environmental exposures
- PMH
 - Asthma, allergy, sinusitis, nasal polyps, history of respiratory infections as a child, other respiratory diseases
- Family history of chronic respiratory disease
- Pattern of symptom development
 - Adult onset
 - Increased breathlessness
 - “Winter colds”
 - Social restriction for many years

Medical History

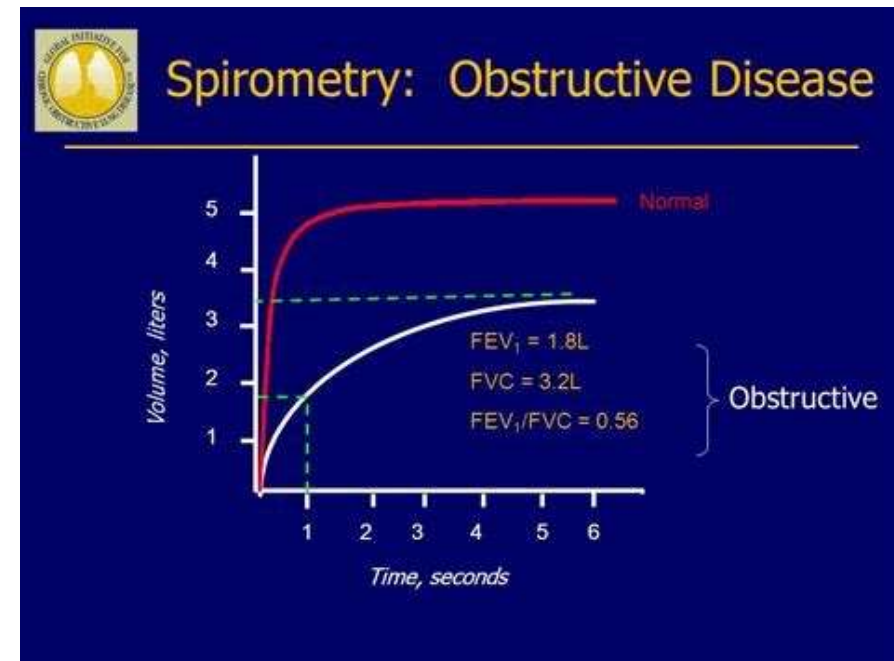
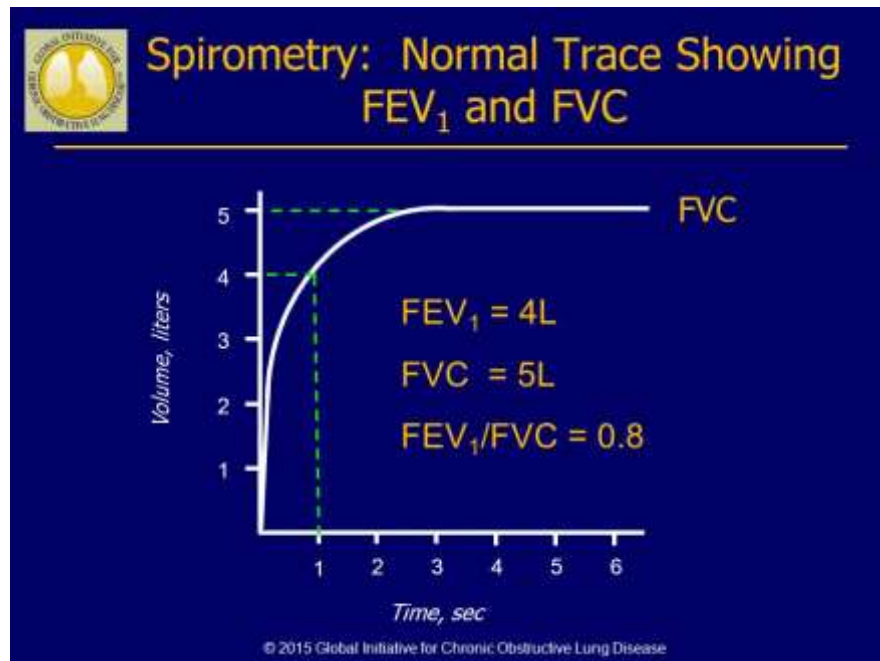
- History of exacerbations or previous hospitalizations for respiratory disorders
 - May notice periodic worsening of symptoms
- Presence of comorbidities
 - Heart disease, osteoporosis, musculoskeletal disorders, malignancies may also restrict activity
- Impact of disease on patient's life
 - Limitation of activity
 - Missed work
 - Effect on family routines
 - Feelings of depression and anxiety
 - Well-being and sexual activity
- Social and family support available to patient
- Possibilities for reducing risk factors

Physical Exam

- Rarely diagnostic
- Signs of airflow obstruction are usually not present until significant impairment of lung function has occurred
- Low sensitivity and specificity
- Absence of physical signs does not exclude diagnosis

Spirometry

- Most reproducible and objective measurement of airflow limitation
- Noninvasive and readily available
- Peak expiratory flow is sensitive but not specific



Spirometry

- Post-bronchodilator fixed ratio of FEV1/FVC <0.70
 - This may result in more frequent diagnosis of COPD in the elderly
 - Less frequent diagnosis in adults <45 years old
 - Compared to LLN (lower limit of normal)
- Risk of misdiagnosis and over-treatment of individual patients is low
 - Spirometry is only one parameter for establishing diagnosis
- FEV1 and FVC predict all-cause mortality independent of tobacco smoking
- Abnormal lung function identifies a subgroup of smokers at increased risk for lung cancer

Assessment

Goals

- Determine the level of airflow limitation
- Determine the impact on the patient's health status
- Determine risk of future events
 - Exacerbations, hospital admissions or death
- To guide therapy

Aspects of Disease

- The presence and severity of spirometric abnormality
- Current nature and magnitude of the patient's symptoms
- Exacerbation history and future risk
- Presence of comorbidities



Classification of Severity of Airflow Limitation in COPD*

In patients with $FEV_1/FVC < 0.70$:

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

**Based on Post-Bronchodilator FEV_1*

Assessment of Symptoms

- Previously measured breathlessness using Modified British Research Council (mMRC) Questionnaire
- Now recognized that it impacts more than just dyspnea
- More comprehensive assessment is recommended
 - Chronic Respiratory Questionnaire (CRQ)
 - St. George's Respiratory Questionnaire (SGRQ)
 - These are too complex for routine use
- Shorter comprehensive measures have been developed
 - COPD Assessment Test (CAT)
 - The COPD Control Questionnaire (The CCQ)

Modified Medical Research Council (mMRC) Dyspnea Scale

Grade	Description
0	Not troubled with breathlessness except with strenuous exercise
1	Troubled by shortness of breath when hurrying on the level or walking up a slight hill
2	Walks slower than people of the same age on the level because of breathlessness or has to stop for breath when walking at own pace on the level
3	Stops for breath after walking about 100 yards or after a few minutes on the level
4	Too breathless to leave the house or breathless when dressing or undressing

COPD Assessment Test (CAT)

- Patients answer each question
- Given a score from 0-40

Your name: Today's date:

How is your COPD? Take the COPD Assessment Test (CAT)

This questionnaire will help you and your healthcare professional measure the impact COPD (Chronic Obstructive Pulmonary Disease) is having on your wellbeing and daily life. Your answers, and test score, can be used by you and your healthcare professional to help improve the management of your COPD and get the greatest benefit from treatment.

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	<input type="text"/>
I have no phlegm (mucus) in my chest at all	(0) (1) (2) (3) (4) (5)	My chest is completely full of phlegm (mucus)	<input type="text"/>
My chest does not feel tight at all	(0) (1) (2) (3) (4) (5)	My chest feels very tight	<input type="text"/>
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	<input type="text"/>
I am not limited doing any activities at home	(0) (1) (2) (3) (4) (5)	I am very limited doing activities at home	<input type="text"/>
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	<input type="text"/>
I sleep soundly	(0) (1) (2) (3) (4) (5)	I don't sleep soundly because of my lung condition	<input type="text"/>
I have lots of energy	(0) (1) (2) (3) (4) (5)	I have no energy at all	<input type="text"/>
			TOTAL SCORE <input type="text"/>

Assessment of Exacerbation Risk

- Exacerbation- acute worsening of respiratory symptoms that results in additional therapy
 - Mild- treated with short acting bronchodilators (SABD)
 - Moderate- treated with SABD plus antibiotics and/or oral corticosteroids
 - Severe- requires hospitalization or visits to the ED
- Rates of exacerbations vary greatly among patients
- Best predictor of frequent exacerbations (2 or more a year) is a history of frequent exacerbations
- As airflow limitation deteriorates, patients have increased exacerbations, risk of hospitalization and death

Assessment of Exacerbation Risk

- Blood eosinophil count
- Post-hoc analysis of two clinical trials in COPD patients with an exacerbation history showed higher blood eosinophil counts may predict increased exacerbation rates in patients treated with long acting beta-agonists (LABA)
- Findings suggest eosinophils are:
 - Biomarker of exacerbation risk in patients with a history of exacerbations
 - Can predict the effects of ICS on exacerbation prevention
 - Apparently increased effect of ICS in COPD patients with higher blood eosinophil counts

Comorbidities

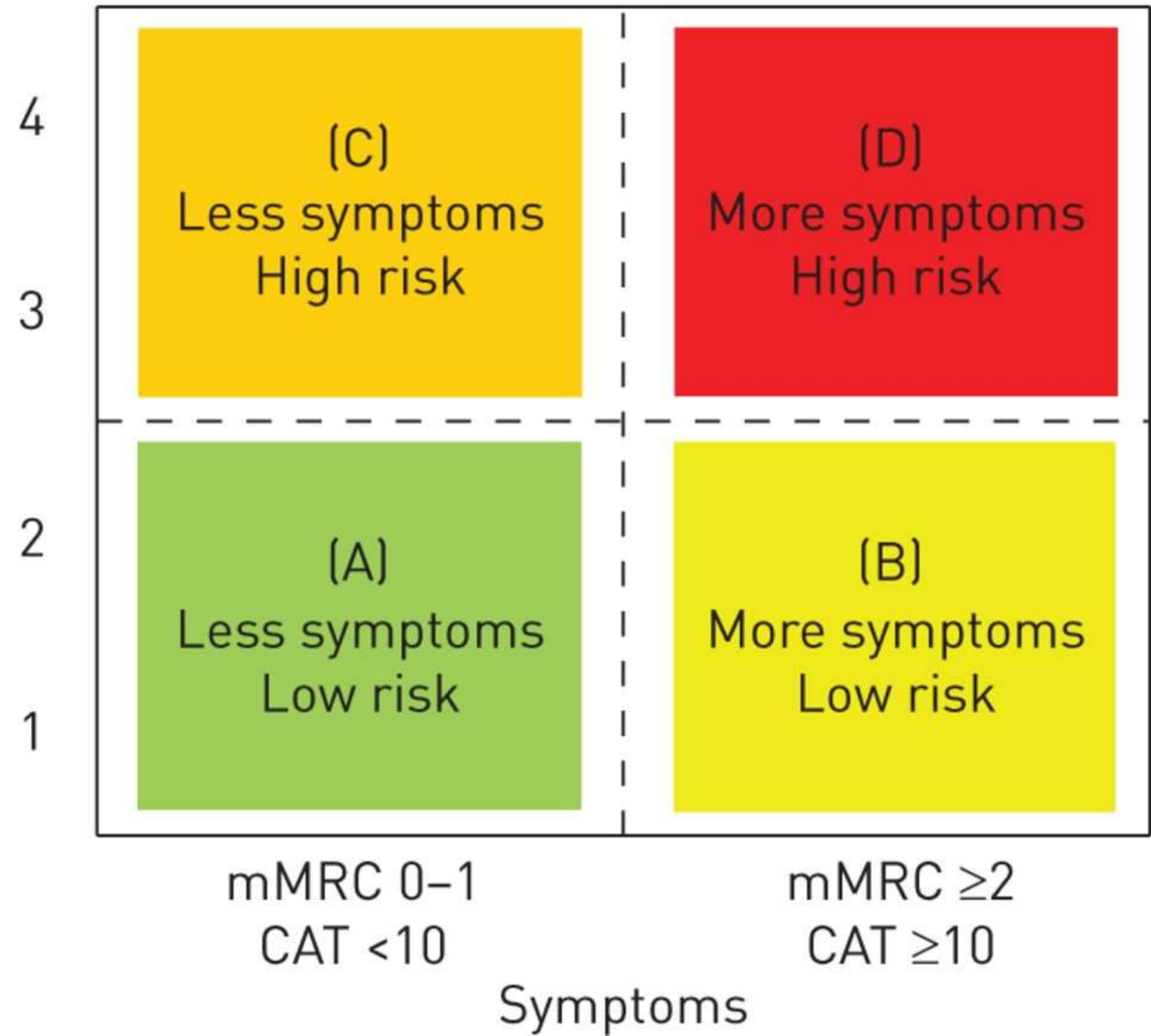
- Can occur in patients with any severity of disease
- Influence mortality and hospitalizations independently
- Existence of COPD may actually increase risk for other diseases
- COPD also has significant extrapulmonary effects
 - Weight loss, nutritional abnormalities, skeletal muscle dysfunction

Revised Combined COPD Assessment

ABCD Assessment

- Previous assessment consisted of GOLD staging
- “ABCD” assessment tool incorporates patient-reported outcomes and highlighted the importance of exacerbation prevention in the management of COPD
- Limitations
 - This assessment performed no better than spirometry grades for mortality prediction or other important health outcomes
 - Group “D” outcomes were modified by spirometry and/or exacerbation history and caused confusion

Risk
(GOLD classification of airflow limitation)



≥2
1
0
Risk
Exacerbation history

Revised Assessment

- Separates spirometry from “ABCD” groups
- Both are used in conjunction to provide diagnosis

Spirometrically confirmed diagnosis



Assessment of airflow limitation



Assessment of symptoms/risk of exacerbations

Post-bronchodilator $FEV_1/FVC < 0.7$

FEV ₁ (% predicted)	
GOLD 1	≥ 80
GOLD 2	50–79
GOLD 3	30–49
GOLD 4	< 30

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
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Symptoms

Refined Assessment

- Number provides information regarding severity of airflow limitation
 - FEV1 is an important in the prediction of clinical outcomes such as mortality and hospitalization
 - Can prompt consideration of non-pharmacological therapies
- Letter provides information regarding symptom burden and risk of exacerbation
 - Can be used to guide therapy

Additional Investigations

Alpha-1-Antitrypsin Deficiency

- World Health Organization recommends all patients with a diagnosis be screened once

Imaging

- Chest x-ray not useful in establishing a diagnosis
 - Is useful in excluding alternative diagnoses and establishing significant comorbidities
- Radiological changes include hyperinflation, hyperlucency, rapid tapering of vascular markings
- CT not routinely recommended except for detection of bronchiectasis or lung cancer screening
- May be helpful in diagnosing comorbidities, evaluating for possible surgery

Lung Volumes and Diffusion Capacity

- Gas trapping seen even in early stages of disease
- As disease worsens, hyperinflation increases
- Diffusion capacity provides information on the functional impact of emphysema in COPD
 - May be helpful in patients with breathlessness that seems out of proportion to the degree of airflow limitation

Oximetry and ABG

- Determine need for supplemental oxygen
- Pulse oximetry in all patient with clinical signs suggestive of respiratory failure or right heart failure
- If peripheral arterial oxygen saturation is $<92\%$ blood gases should be assessed

Exercise Testing and Assessment of Physical Activity

- Exercise impairment, measured by reduction in 6 minute walk test distance
 - Indicator of health status impairment and predictor of prognosis
 - Used to assess disability and risk of mortality
 - Assess the effectiveness of pulmonary rehabilitation
- Testing using cycle or treadmill ergometry can assist in identifying co-existing or alternative conditions (eg., cardiac disease)

Composite Scores

- BODE (Body mass index, Obstruction, Dyspnea, and Exercise) composite score is a better predictor of subsequent survival than any single component

Conclusion

- Patients with symptoms and exposure to risk factors should undergo spirometry testing for COPD staging
- Airflow limitation alone is not enough to completely assess patients with COPD
- Refined ABCD method uses airflow limitation as well as symptomatic assessment to classify patients
- This classification can then be used to guide treatment

Resources

- Global Initiative for Chronic Obstructive Lung Disease 2017 Report
 - <http://goldcopd.org/wp-content/uploads/2016/12/wms-GOLD-2017-Pocket-Guide.pdf>
- Chronic obstructive pulmonary disease: Definition, clinical manifestations, diagnosis, and staging. Uptodate.com
- Mahler D et al. Chest 1988; 93: 580.