Module 2			
11.	Clinical syndromes and symptoms of respiratory system affection (obstructive syndrome) .	2	5.12.16
12.	Clinical syndromes and symptoms of respiratory system affection (lungs consolidation syndrome).	2	12.12.16
13.	Clinical syndromes and symptoms of respiratory system affection (pulmonary insufficiency syndrome, dry and exudative pleuritis.)	2	19.12.16
14.	Clinical symptoms of blood system affection: anemia and erithrocitosis. Leukopenias and leukocytosis. Methods of clinical, laboratory and instrumental examination.	2	26.12.16
15.	Clinical syndroms and symptoms of gastrointestinal tract diseases (syndromes of esophagus motility disorders and stomach diseases).	2	2.01.17
16.	Clinical syndroms and symptoms of gastrointestinal tract diseases (syndromes of large and small intestine motility disorders, syndromes of malgidestion and malabsorption).	2	9.01.17
17.	Clinical syndroms and symptoms of hepato-biliary system diseases (syndroms of gallbladder motility disorders, syndrome of jaundice).	2	16.01.17

Obstructive Syndrome

SIGNS AND SYMPTOMS OF RESPIRATORY SYSTEM DISEASES

LECTURE IN INTERNAL MEDICINE PROPAEDEUTICS

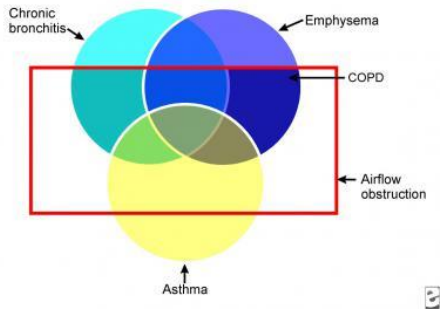
M. Yabluchansky, L. Bogun, L.Martymianova, O. Bychkova, N. Lysenko, N. Makienko
V.N. Karazin National University Medical School' Internal Medicine Dept.

Preamble:
the importance of the respiratory system

- Since our childhood we all are aware that food, water and oxygen are the basic necessities of life and we cannot survive without them
- An average person can live without food for 3-4 weeks
- We cannot survive without water for more that 3-5 days
- Oxygen is crucial to sustain life, and 3 minutes is the maximum time where person can stay alive without breathing

http://www.justforhearts.org/2013/08/for-how-long-a-person-can-survive-without-oxygen-water-food/
http://assets-s3.mensjournal.com/img/article/you-re-breathing-all-wrong/298_298_you-re-breathing-all-wrong.jpg

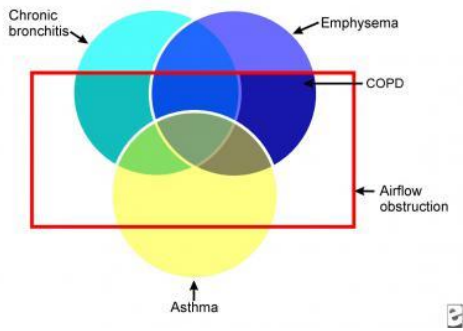
Obstructive lung syndrome: definition, diseases 1



- Obstructive syndrome is characterized by airway obstruction
- Many obstructive diseases of the lung result from narrowing of the smaller bronchi and larger bronchioles, often because of excessive contraction of the smooth muscle itself

https://en.wikipedia.org/wiki/Obstructive_lung_disease http://img.medscapestatic.com/pi/meds/ckb/74/38574tn.jpg

Obstructive lung syndrome: definition, diseases 2



- Obstructive syndrome is generally characterized by inflamed and easily collapsible airways, obstruction to airflow, problems with exhaling and frequent medical clinic visits and hospitalizations
- Obstructive syndrome lays in basis of asthma, bronchiectasis, bronchitis, chronic obstructive pulmonary disease (COPD), cystic fibrosis , etc.

https://en.wikipedia.org/wiki/Obstructive_lung_disease http://img.medscapestatic.com/pi/meds/ckb/74/38574tn.jpg

Obstructive lung syndrome: accent on causes 1

- Smoking including passive smoking (Chronic Obstructive Pulmonary Disease (COPD))
- Frequent chest infections, particularly in winter
- Serious asthma symptoms with frequent exacerbations for a long time, which have not been improving with treatment
- Long-term exposure to lung irritants (air pollution (industrial dust , chemical fumes, etc.)

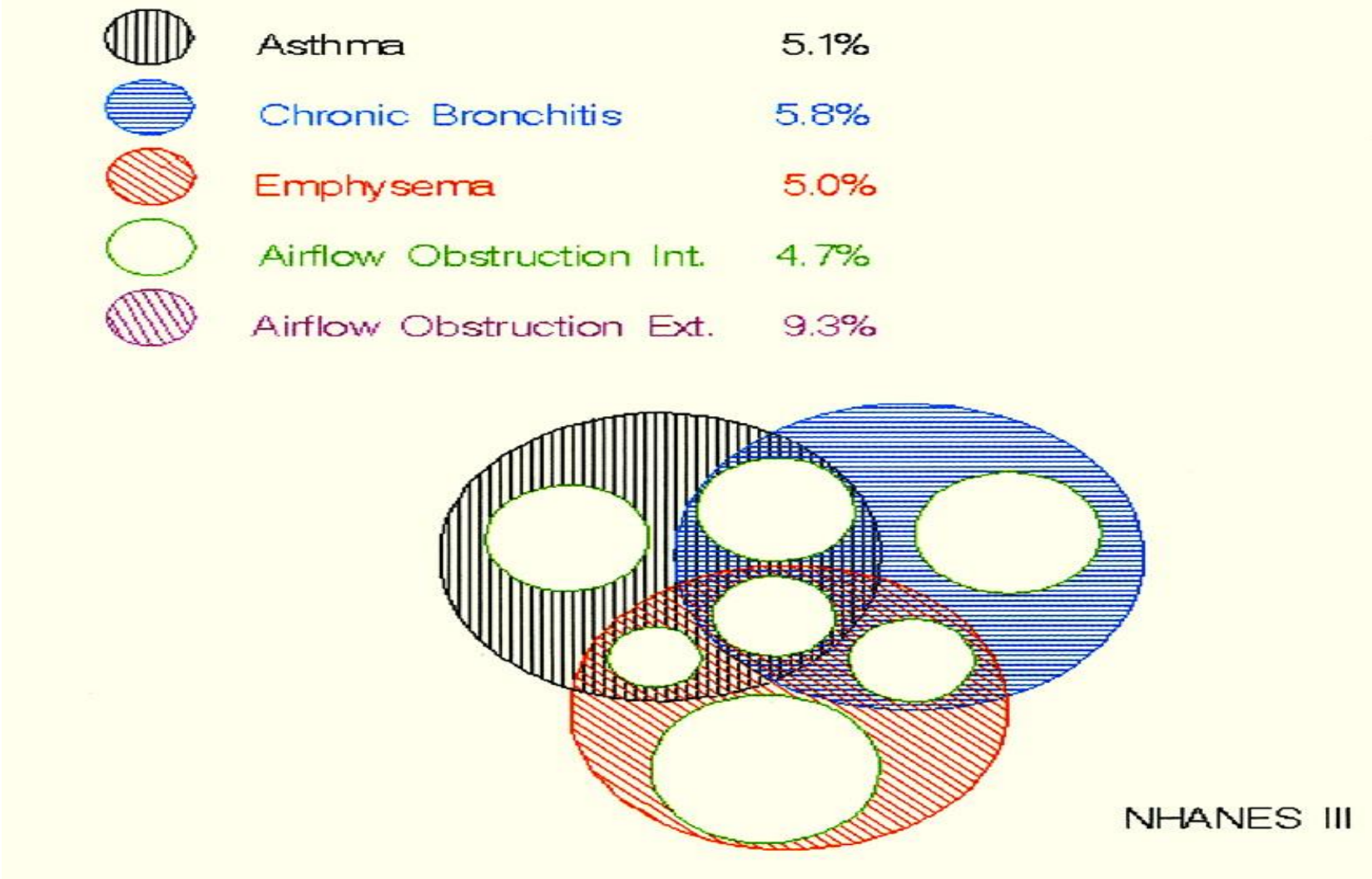
http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2 http://i3.ytimg.com/vi/ln6oTPZ7YWU/0.jpg

Obstructive lung syndrome: accent on causes 2

- Preterm birth that leads to lung damage (neonatal chronic lung disease).
- A family history of emphysema
- Inherited factors (genes), including alpha-1 antitrypsin deficiency

http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2 http://i3.ytimg.com/vi/ln6oTPZ7YWU/0.jpg

Obstructive lung syndrome: the United States III surveys from 1988 to 1994



http://journal.publications.chestnet.org/data/Journals/CHEST/21997/cb0635683005.jpeg

Obstructive lung syndrome: symptoms 1

- Shortness of breath (in early stages occurs only with exertion)
- Tightness in chest
- Cough (dry or productive of white or colored sputum)
- A flare-up (an exacerbation), often worse in winter with wheezing
- Depression and anxiety

http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2 http://www.nhs.uk/Conditions/chronic-obstructive-pulmonary-disease/Pages/symptoms.aspx
http://www.efpia.eu/uploads/COPD1_CLR.jpg

Obstructive lung syndrome: symptoms 2

- Weight loss
- Tiredness and fatigue
- Swollen ankles
- Limitations in activity and lifestyle

http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2 http://www.nhs.uk/Conditions/chronic-obstructive-pulmonary-disease/Pages/symptoms.aspx
http://www.efpia.eu/uploads/COPD1_CLR.jpg

Obstructive lung syndrome: History 1

- Most patients seek medical attention late in the course of their disease
- Patients often ignore the symptoms because they start gradually and progress over the course of years
- Patients often modify their lifestyle to minimize dyspnea and ignore cough and sputum production
- With retroactive questioning, a multiyear history can be elicited
- Patients typically present with a combination of signs and symptoms of chronic bronchitis, emphysema, and reactive airway disease
- Systemic manifestations (decreased fat-free mass, impaired systemic muscle function, osteoporosis, anemia, depression, pulmonary hypertension, cor pulmonale, left-sided heart failure)

http://emedicine.medscape.com/article/297664-clinical

Obstructive lung syndrome: History 2

- A productive cough or an acute chest illness is common
- The cough usually is worse in the mornings and produces a small amount of colorless sputum
- Breathlessness is the most significant symptom, but it usually does not occur until the sixth decade of life (although it may occur much earlier)
- By the time the FEV_1 has fallen to 50% of predicted, the patient is usually breathless upon minimal exertion
- Wheezing may occur in some patients, particularly during exertion and exacerbations
- A history of more than 40 pack-years of smoking was the best single predictor of airflow obstruction

http://emedicine.medscape.com/article/297664-clinical

Obstructive lung syndrome: History 3

- With disease progression, intervals between acute exacerbations become shorter, and each exacerbation may be more severe
- In addition, obstructive lung syndrome appears to increase the risk for mild cognitive impairment
- Some important clinical and historical differences may help distinguish between the types of obstructive lung syndrome
- Classic findings for patients with chronic bronchitis include productive cough with gradual progression to intermittent dyspnea; frequent and recurrent pulmonary infections; and progressive cardiac/respiratory failure with edema and weight gain
- Classic findings for patients with emphysema include a long history of progressive dyspnea with late onset of nonproductive cough; occasional mucopurulent relapses; and eventual cachexia and respiratory failure.

http://emedicine.medscape.com/article/297664-clinical

Obstructive lung syndrome: Physical Examination 1

- The sensitivity of a physical examination is relatively poor; however, physical signs are quite specific and sensitive for severe disease
- Patients with severe disease experience tachypnea and respiratory distress with simple activities
- Use of accessory respiratory muscles and paradoxical indrawing of lower intercostal spaces is evident (known as the Hoover sign)
- In advanced disease, cyanosis, elevated jugular venous pulse, and peripheral edema can be observed

http://emedicine.medscape.com/article/297664-clinical#b3

Obstructive lung syndrome: Physical Examination 2

Thoracic examination reveals the following:

- Hyperinflation (barrel chest)
- Wheezing – Frequently heard on forced and unforced expiration
- Diffusely decreased breath sounds
- Hyperresonance on percussion
- Prolonged expiration
- In addition, coarse crackles beginning with inspiration may be heard

http://emedicine.medscape.com/article/297664-clinical#b3

Obstructive lung syndrome: Physical Examination 3

- Patients may have signs of right heart failure (cor pulmonale), such as edema and cyanosis
- Patients may be very thin with a barrel chest
- Patients typically have little or no cough or expectoration
- Breathing may be assisted by pursed lips and use of accessory respiratory muscles
- The chest may be hyperresonant, and wheezing may be heard
- Heart sounds are very distant.

http://emedicine.medscape.com/article/297664-clinical#b3

Obstructive lung syndrome: conditions and nature

Condition	Main site	Major changes	Causes	Symptoms
Chronic bronchitis	Bronchus	Hyperplasia and hypersecretion of mucus glands	Tobacco smoking and air pollutants	Productive cough
Bronchiectasis	Bronchus	Dilation and scarring of airways	Persistent severe infections	Cough, purulent sputum and fever
Asthma	Bronchus	Smooth muscle hyperplasia, excessive mucus, inflammation, constriction	Immunologic or idiopathic	Episodic wheezing, cough and dyspnea
Bronchiolitis (subgroup of chronic bronchitis)	Bronchiole	Inflammatory scarring and bronchiole obliteration	Tobacco smoking and air pollutants	Cough, dyspnea

https://en.wikipedia.org/wiki/Obstructive_lung_disease

Obstructive lung syndrome: spot the difference 1

- In asthma the bronchial tubes (airways) are hyperresponsive and usually triggered by breathing in things in the air such as dust, pollen, etc. with recurring episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning
- Bronchiectasis refers to the abnormal, irreversible dilatation of the bronchi caused by destructive and inflammatory changes in the airway walls

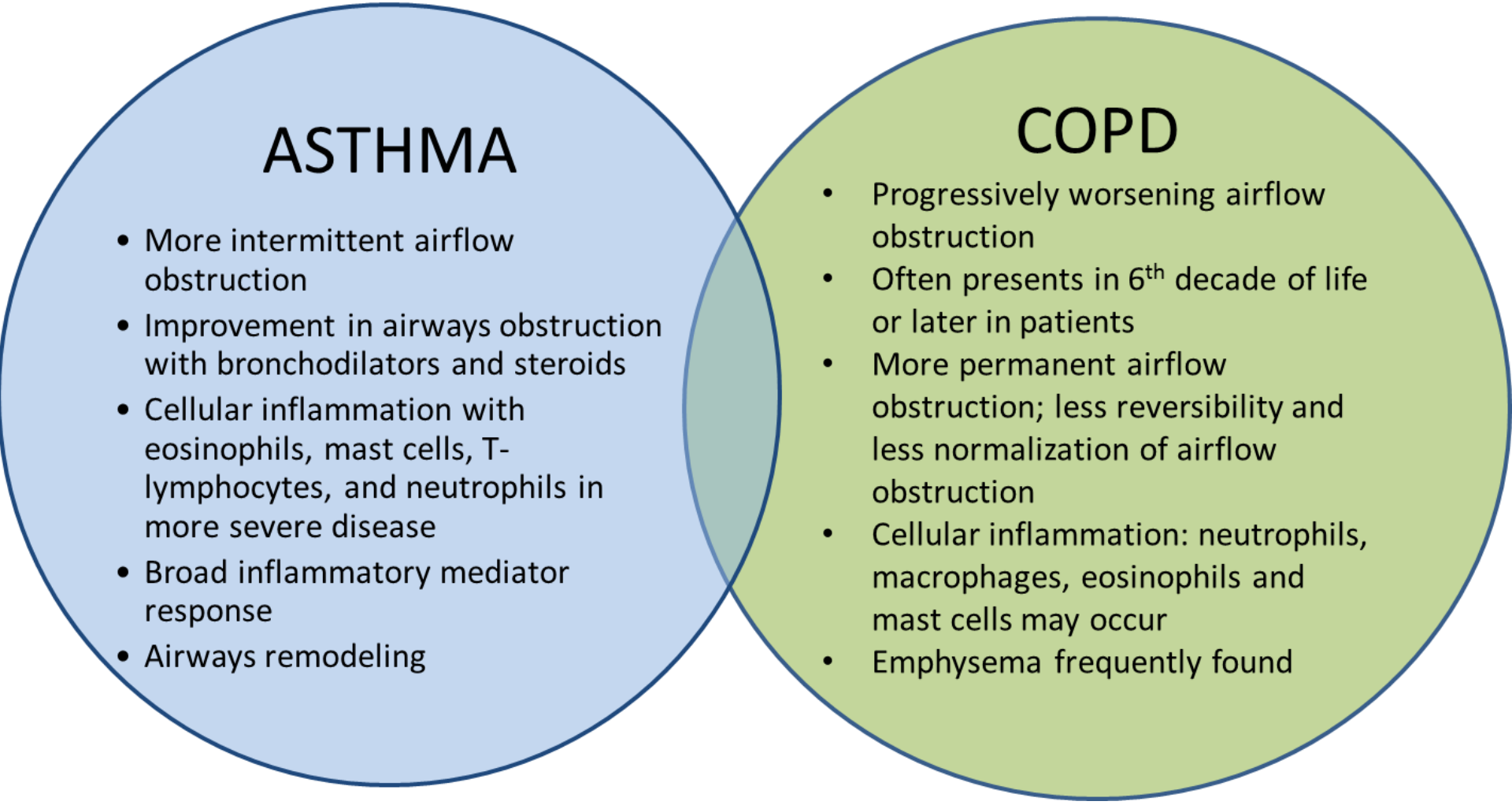
http://www.meddean.luc.edu/lumen/MedEd/elective/pulmonary/bronchiectasis/bronchi_f.htm https://en.wikipedia.org/wiki/Obstructive_lung_disease

Obstructive lung syndrome: spot the difference 2

- Chronic obstructive pulmonary disease (COPD) is characterized by airflow limitation that is not fully reversible.

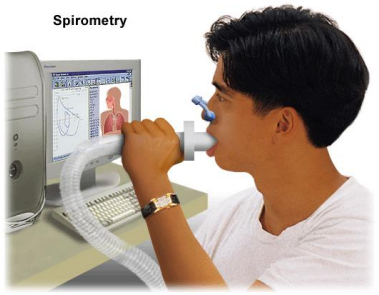
http://www.meddean.luc.edu/lumen/MedEd/elective/pulmonary/bronchiectasis/bronchi_f.htm https://en.wikipedia.org/wiki/Obstructive_lung_disease

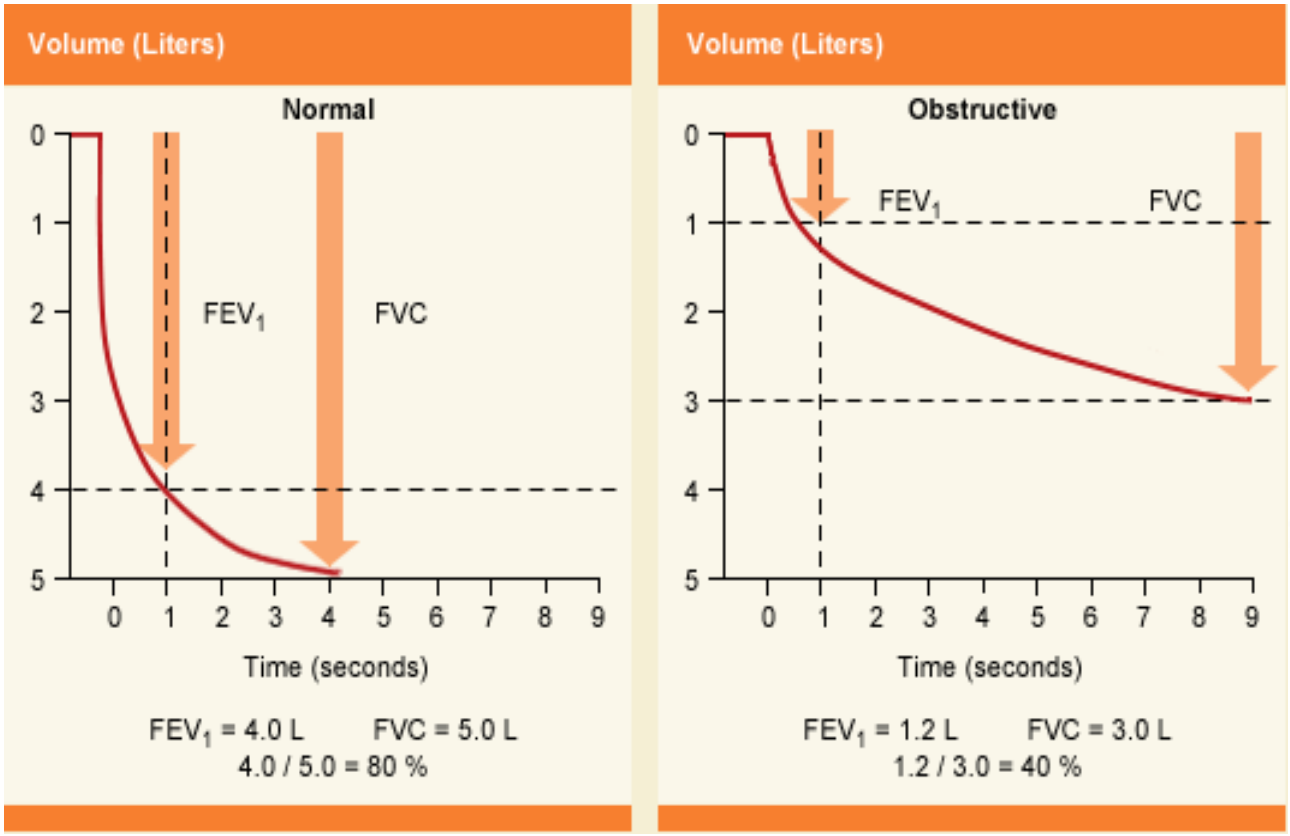
Obstructive lung syndrome: spot the difference

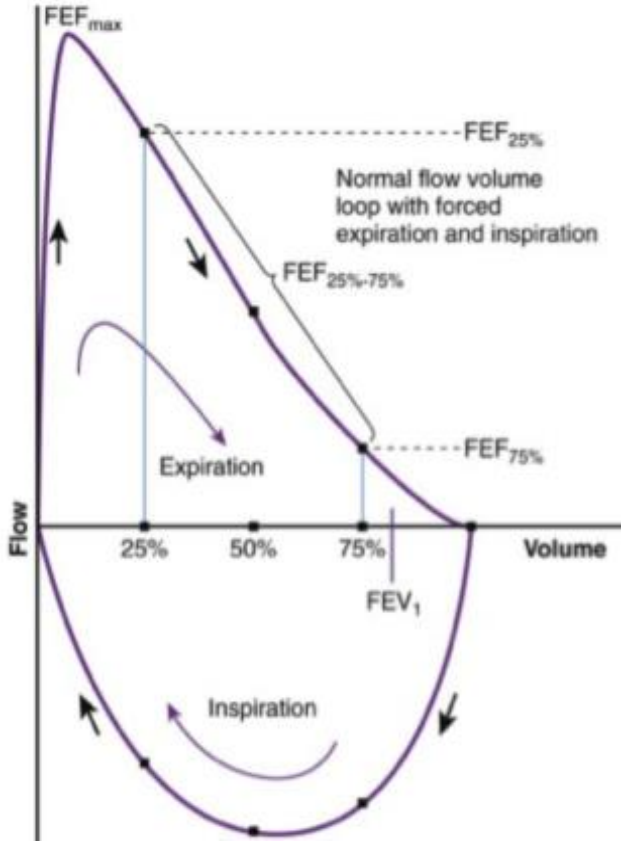


http://vaticancities.com/image/551e2d0f7f9ef.jpg

Obstructive lung syndrome: lung function tests







FVC = forced vital capacity, FEV_1 = forced expiratory volume in the first second of expiration

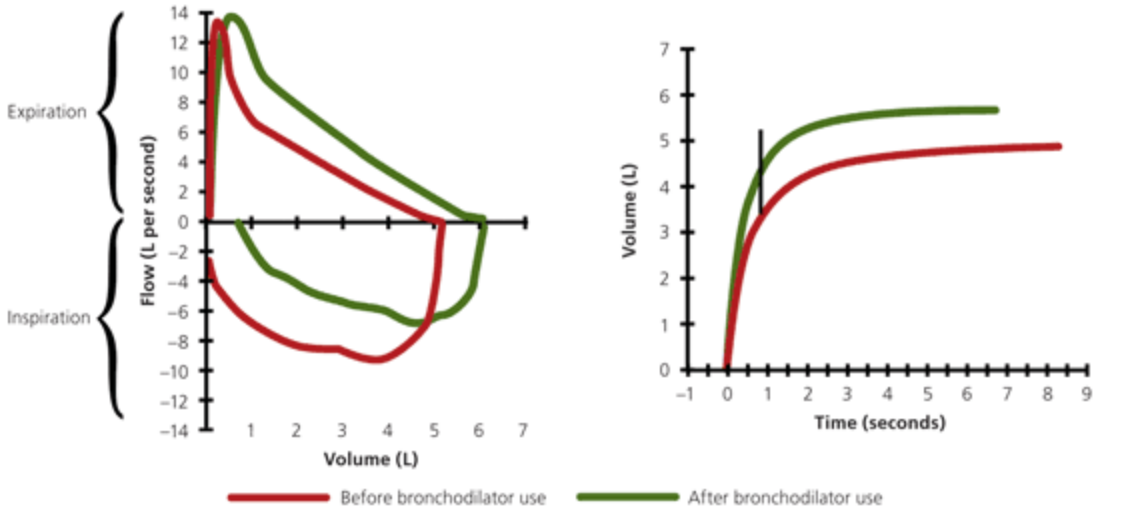
http://drmhanna.com/wp-content/uploads/20lightbox-investigation_and_workup-copd-classification_by_impairment.png
http://www.cmaj.ca/content/183/1/77/F6.large.jpg

Obstructive lung syndrome: lung function tests 1

The obstructive defect is reversible because at least one of the two measurements (FVC or FEV_1) increased by at least 0.2 L and by at least 12%

Age: 26 years **Height:** 5 ft, 8 in **Weight:** 197 lb **Sex:** Male **Race:** Hispanic

	Prebronchodilators				*Postbronchodilators*		
Spirometry	*Predicted*	*LLN*	*Actual*	*% of predicted*	*Actual*	*% of predicted*	*% change*
FVC (L)	5.20	4.34	5.18[A]	99[D]	6.06[F]	116	+16[I]
FEV_1 (L)	4.37	3.64	3.55[B]	81[E]	4.64[G]	106	+30[J]
FEV_1/FVC (%)	84	75	68[C]	81	77[H]	91	+11
$FEF_{25\%-75\%}$ (L per second)	4.74	3.11	2.41	50	3.84	80	+59



A = FVC (before bronchodilators), this is > LLN and thus does not show a restrictive pattern
B = FEV_1 (before bronchodilators)
C = FEV_1/FVC ratio (before bronchodilators), this is < LLN and thus shows an obstructive defect
D = FVC percentage of predicted (before bronchodilators)
E = FEV_1 percentage of predicted (before bronchodilators)
F = FVC (after bronchodilators)
G = FEV_1 (after bronchodilators)
H = FEV_1/FVC ratio (after bronchodilators)
I = A 0.88-L increase in FVC is a 16% increase
J = A 1.09-L increase in FEV_1 is a 30% increase

The above indicates reversibility because at least one of the two (FVC or FEV_1) increased by at least 0.2 L and by at least 12%

http://www.aafp.org/afp/2014/0301/afp20140301p359-f4.gif

Obstructive lung syndrome: lung function tests 2

($FEF_{25\%–75\%}$ = forced expiratory flow at 25% to 75% of FVC; FEV_1 = forced expiratory volume in one second; FVC = forced vital capacity; LLN = lower limit of normal)

Age: 26 years **Height:** 5 ft, 8 in **Weight:** 197 lb **Sex:** Male **Race:** Hispanic

	Prebronchodilators				*Postbronchodilators*		
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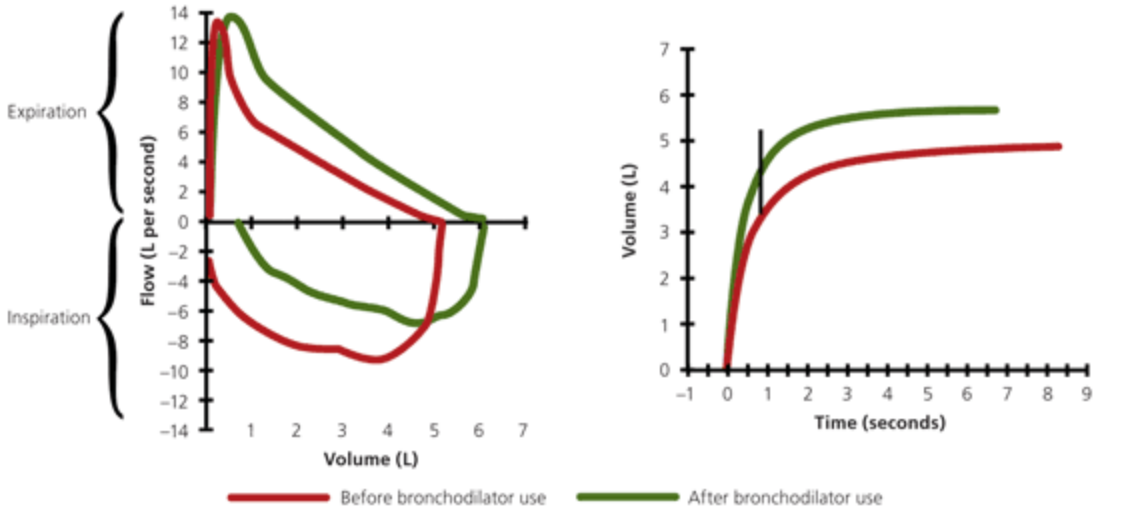

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http://www.aafp.org/afp/2014/0301/afp20140301p359-f4.gif

Obstructive lung syndrome: lung function tests

Classification of COPD by impairment of lung function

	COPD stage	Spirometry (postbronchodilator)
GOLD 1	Mild	$FEV_1 \geq 80\%$ predicted $FEV_1/FVC < 0.7$
GOLD 2	Moderate	$50\% \leq FEV_1 < 80\%$ predicted $FEV_1/FVC < 0.7$
GOLD 3	Severe	$30\% \leq FEV_1 < 50\%$ predicted $FEV_1/FVC < 0.7$
GOLD 4	Very severe	$FEV_1 < 30\%$ predicted $FEV_1/FVC < 0.7$

FEV_1: Forced expiratory volume in 1 second; **FVC:** Forced vital capacity; **GOLD:** Global Initiative for Chronic Obstructive Lung Disease

Classification of COPD severity should be undertaken with care in patients with comorbid diseases or other possible contributors to shortness of breath

Postbronchodilator forced expiratory volume in 1 s (FEV1) to forced vital capacity (FVC) ratio less than 0.7 is required for the diagnosis of COPD to be established

Reference: *Modified from GOLD Global strategies for the diagnosis, management, and prevention of chronic obstructive pulmonary disease updated 2014*

13/06/pft.jpg http://www.hopkinsmedicine.org/healthlibrary/GetImage.aspx?ImageId=125819 http://www.educatehealth.ca/media/443895/5-l

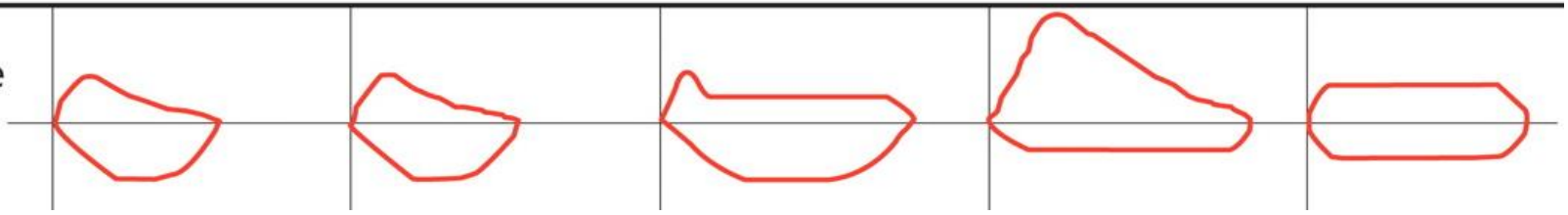
Obstructive lung syndrome: spirometric measures in asthma, COPD and ACOS

Spirometric variable	Asthma	COPD	ACOS
Normal FEV_1/FVC pre- or post BD	Compatible with diagnosis	Not compatible with diagnosis	Not compatible unless other evidence of chronic airflow limitation
Post-BD FEV_1/FVC <0.7	Indicates airflow limitation but may improve spontaneously or on treatment	Required for diagnosis (GOLD)	Usually present
FEV_1 ≥80% predicted	Compatible with diagnosis (good asthma control or interval between symptoms)	Compatible with GOLD classification of mild airflow limitation (categories A or B) if post- BD FEV_1/FVC <0.7	Compatible with diagnosis of mild ACOS
FEV_1 <80% predicted	Compatible with diagnosis. Risk factor for asthma exacerbations	An indicator of severity of airflow limitation and risk of future events (e.g. mortality and COPD exacerbations)	An indicator of severity of airflow limitation and risk of future events (e.g. mortality and exacerbations)
Post-BD increase in FEV_1 >12% and 200 ml from baseline (reversible airflow limitation)	Usual at some time in course of asthma, but may not be present when well-controlled or on controllers	Common and more likely when FEV_1 is low, but ACOS should also be considered	Common and more likely when FEV_1 is low, but ACOS should also be considered
Post-BD increase in FEV_1 >12% and 400ml from baseline (marked reversibility)	High probability of asthma	Unusual in COPD. Consider ACOS	Compatible with diagnosis of ACOS

ACOS: asthma-COPD overlap syndrome; BD: bronchodilator; FEV1: forced expiratory volume in 1 second; FVC: forced vital capacity; GOLD: Global Initiative for Obstructive Lung Disease.

http://www.goldcopd.org/uploads/users/files/AsthmaCOPDOverlap.pdf

Obstructive lung syndrome: lung function tests

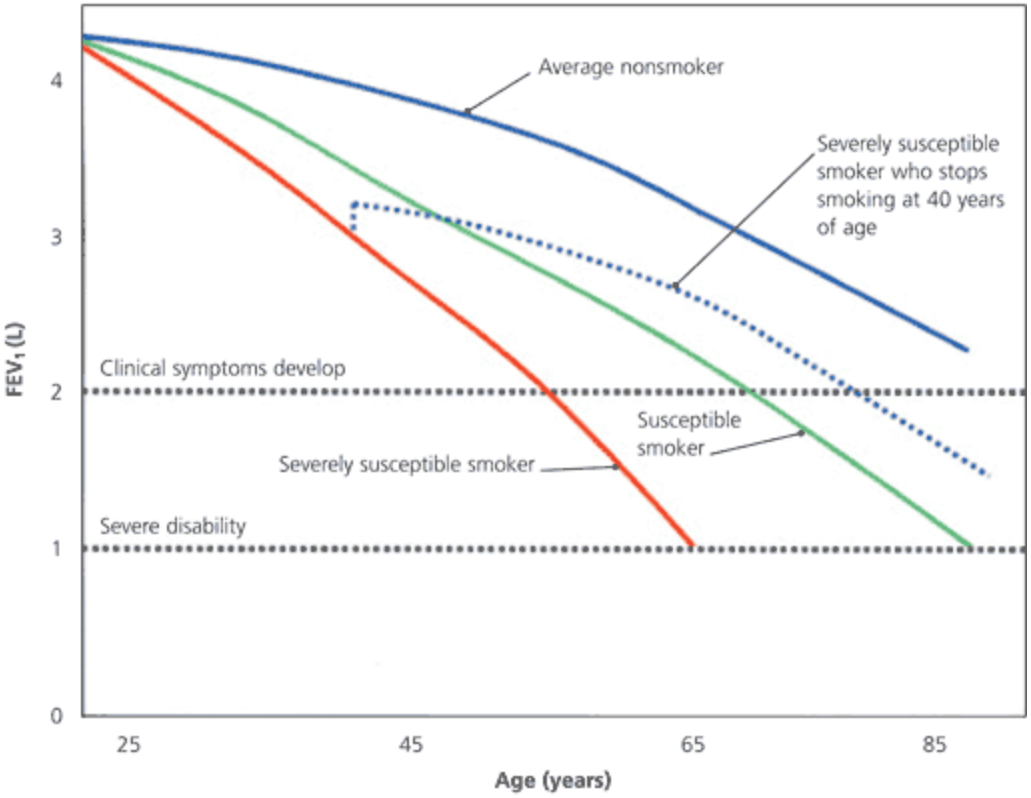
	Small airway obstruction		Upper airway obstruction		
	COPD	Asthma attack	Variable intrathoracic	Variable extrathoracic	Fixed
FVC	N to ↓	↓	N	N	N
FEV_1	↓	↓	↓	N	↓
FEV_1/FVC	↓	N to ↓	↓	N	↓
Flow–volume loop					

Typical findings in patients with lower airway and upper airway obstruction. COPD = chronic obstructive pulmonary disease, FVC = forced vital capacity, FEV_1 = forced expiratory volume in the 1 second of expiration.

http://www.cmaj.ca/content/183/1/77/F6.large.jpg

Obstructive lung syndrome: lung function decline in smokers and nonsmokers 1

Smokers who are susceptible to lung injury experience an increase in the rate of age-related loss in FEV_1 compared with nonsmokers (red, green, and blue lines)

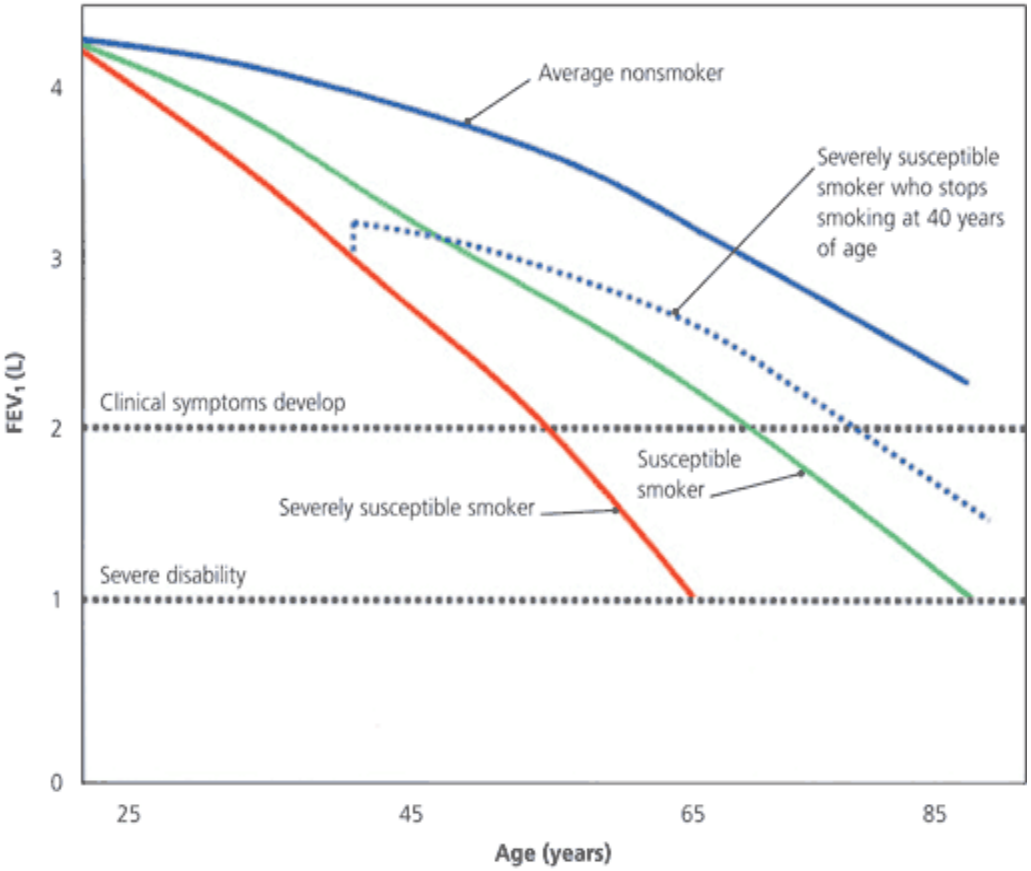


FEV_1 = forced expiratory volume in 1 second

http://www.cmaj.ca/content/183/1/77/F6.large.jpg

Obstructive lung syndrome: lung function decline in smokers and nonsmokers 2

After lung function declines to threshold levels, clinical symptoms develop (black dotted lines)
When a smoker stops smoking, the rate of FEV_1 loss again approximates to that of a nonsmoker (blue dotted line)



FEV_1 = forced expiratory volume in 1 second

http://www.cmaj.ca/content/183/1/77/F6.large.jpg

Obstructive lung syndrome: chest X-ray 1

- A chest X-ray may show signs of obstructive lung syndromes and can be used to help exclude other serious conditions (including lung cancer)

A pneumothorax on the left side. On the right side multiple large apical bullae which are also at risk of rupture.

https://emcow.files.wordpress.com/2013/10/copd-and-ptx.jpg?w=540&h=444 http://www.webmd.com/lung/copd/chest-x-rays-for-chronic-obstructive-pulmonary-disease-copd
http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2

Obstructive lung syndrome: chest X-ray 2

- The X-ray may show:
  - Flattening of the diaphragm, the large muscle that separates the lungs and heart from the abdominal cavity
  - Increased size of the chest, as measured from front to back
  - A long narrow heart
  - Abnormal air collections within the lung (focal bullae)

A pneumothorax on the left side. On the right side multiple large apical bullae which are also at risk of rupture.

https://emcow.files.wordpress.com/2013/10/copd-and-ptx.jpg?w=540&h=444 http://www.webmd.com/lung/copd/chest-x-rays-for-chronic-obstructive-pulmonary-disease-copd
http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2

Obstructive lung syndrome: chest X-ray 3

- A normal chest X-ray does not mean patient do not have COPD

A pneumothorax on the left side. On the right side multiple large apical bullae which are also at risk of rupture.

https://emcow.files.wordpress.com/2013/10/copd-and-ptx.jpg?w=540&h=444 http://www.webmd.com/lung/copd/chest-x-rays-for-chronic-obstructive-pulmonary-disease-copd
http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2

Obstructive lung syndrome: arterial blood gas test 1

pH result	Bicarbonate result	$PaCO_2$ result	Condition	Common causes
Less than 7.35	Low	Low	Metabolic acidosis	Kidney failure, shock, diabetic ketoacidosis, intoxication with methanol, salicyate, ethanol
Greater than 7.45	High	High	Metabolic alkalosis	Chronic vomiting, low blood potassium, heart failure, cirrhosis
Less than 7.35	High	High	Respiratory acidosis	Narcotics, lung diseases such as asthma, COPD, airway obstruction
Greater than 7.45	Low	Low	Respiratory alkalosis	Hyperventilation, pain, anxiety, brain trauma, pneumonia, certain drugs (salicylate, catecholamines)

- Arterial blood gas analysis is used to measure the pH and the partial pressures of oxygen and carbon dioxide in arterial blood

https://labtestsonline.org/understanding/analytes/blood-gases/tab/test/ http://www.australianprescriber.com/magazine/33/4/124/9

Obstructive lung syndrome: arterial blood gas test 2

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- Interpretation of an arterial blood gas result should not be done without considering the clinical findings

https://labtestsonline.org/understanding/analytes/blood-gases/tab/test/ http://www.australianprescriber.com/magazine/33/4/124/9

Obstructive lung syndrome: arterial blood gas test 3

pH result	Bicarbonate result	$PaCO_2$ result	Condition	Common causes
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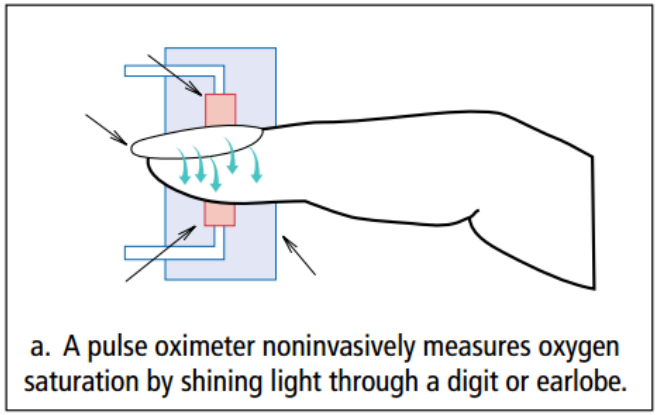
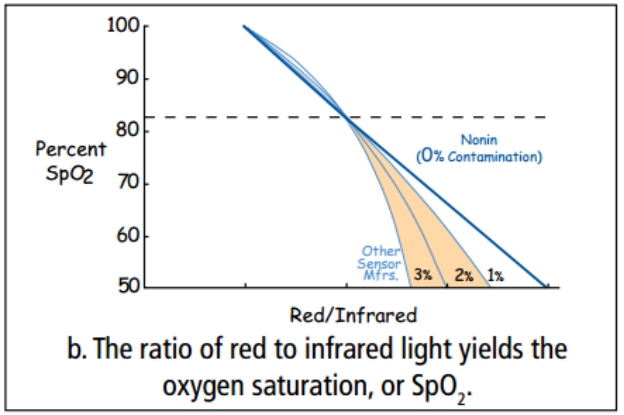
- Factors relating to sampling technique, specimen processing and environment may also influence the results

https://labtestsonline.org/understanding/analytes/blood-gases/tab/test/ http://www.australianprescriber.com/magazine/33/4/124/9

Obstructive lung syndrome: oximetry 1



a. A pulse oximeter noninvasively measures oxygen saturation by shining light through a digit or earlobe.



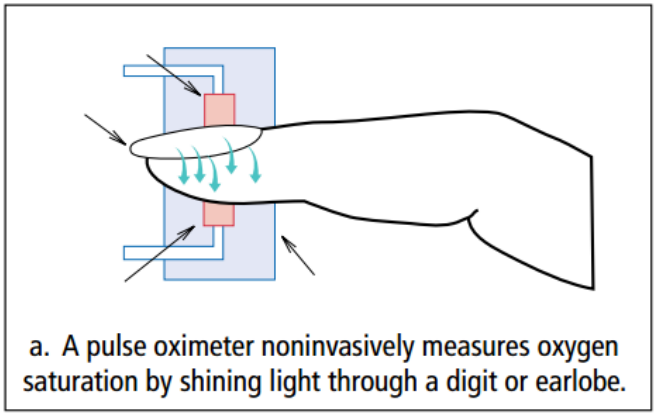
b. The ratio of red to infrared light yields the oxygen saturation, or SpO_2.

- An SpO_2 of greater than 95% is generally considered to be normal.
- An SpO_2 of 92% or less (at sea level) suggests hypoxemia.
  - In a patient with acute respiratory illness (e.g., influenza) or breathing difficulty (e.g, an asthma attack), an SpO_2 of 92% or less may indicate a need for oxygen supplementation.
  - In a patient with stable chronic disease (e.g., COPD), an SpO_2 of 92% or less should prompt referral for further investigation of the need for long-term oxygen therapy [5, 6].

- The test measures the oxygen saturation in the blood

http://www.copd-alert.com/OximetryPG.pdf http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2

Obstructive lung syndrome: oximetry 2



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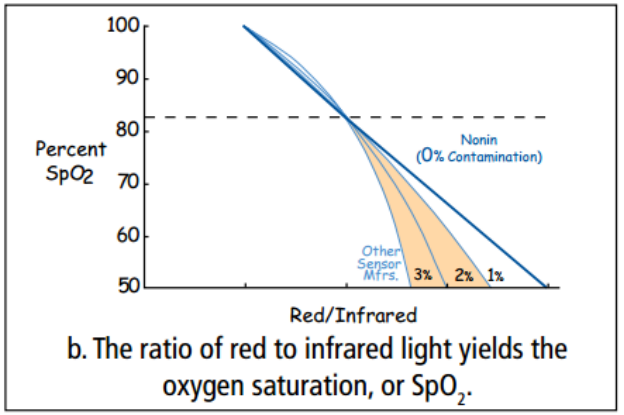

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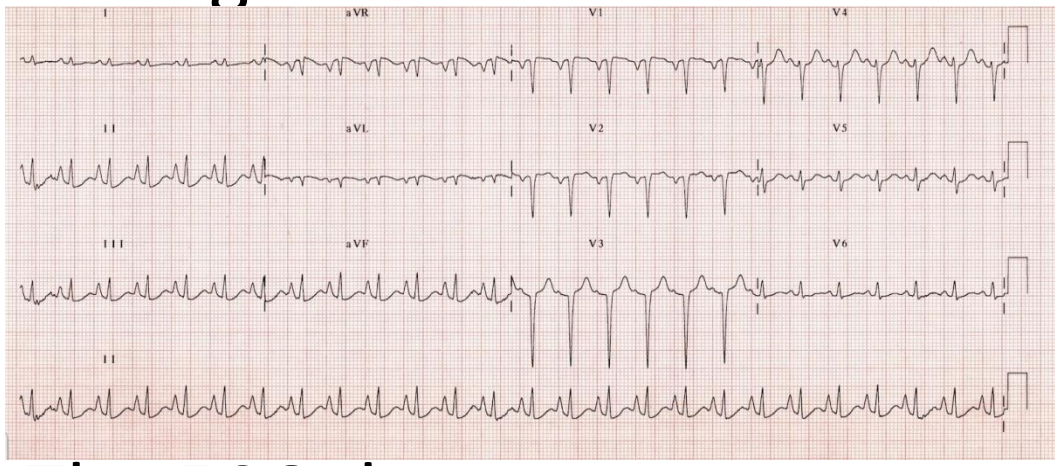
- The test can be useful in finding out whether oxygen treatment is needed, but it provides less information than the arterial blood gas test

http://www.copd-alert.com/OximetryPG.pdf http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2

Obstructive lung syndrome: electrocardiogram 1

ECG changes occur in obstructive lung syndromes due to:

- The presence of hyperexpanded emphysematous lungs within the chest

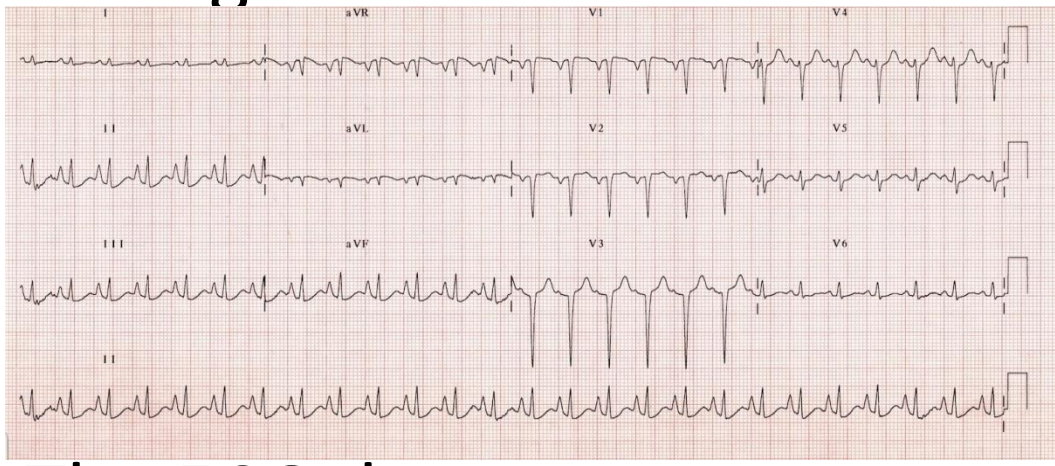


The ECG demonstrates many of the features of chronic pulmonary disease: rightward QRS axis; peaked P waves in the inferior leads; Clockwise rotation of the heart

http://lifeinthefastlane.com/ecg-library/copd/

Obstructive lung syndrome: electrocardiogram 2

- The long-term effects of hypoxic pulmonary vasoconstriction upon the right side of the heart, causing pulmonary hypertension and subsequent right atrial and right ventricular hypertrophy (i.e. cor pulmonale).



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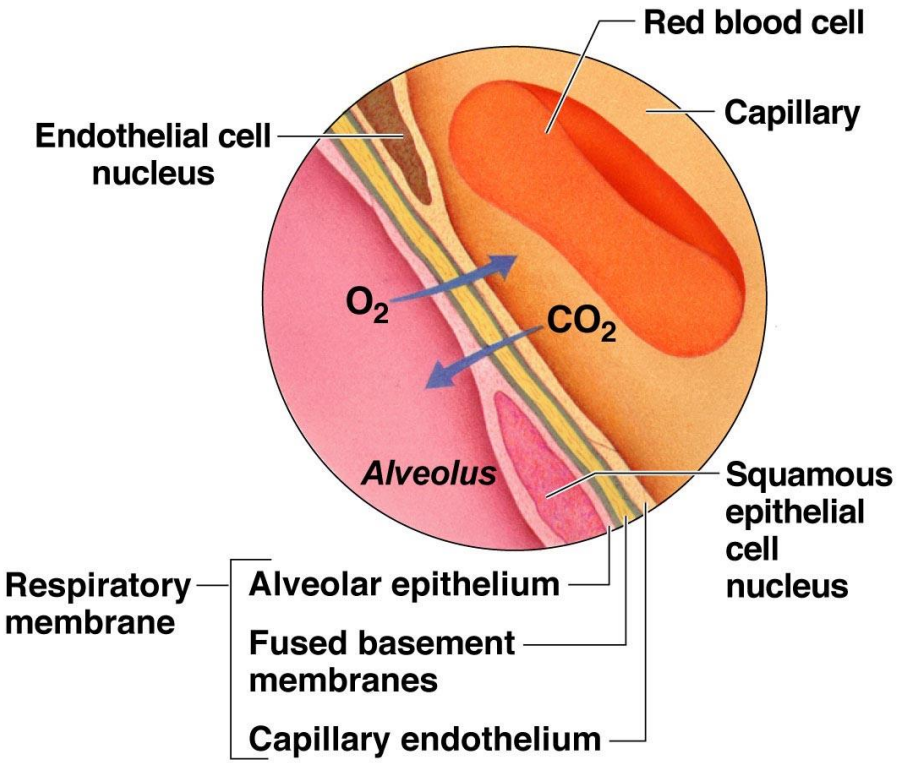
Obstructive lung syndrome: transfer factor for carbon monoxide 1

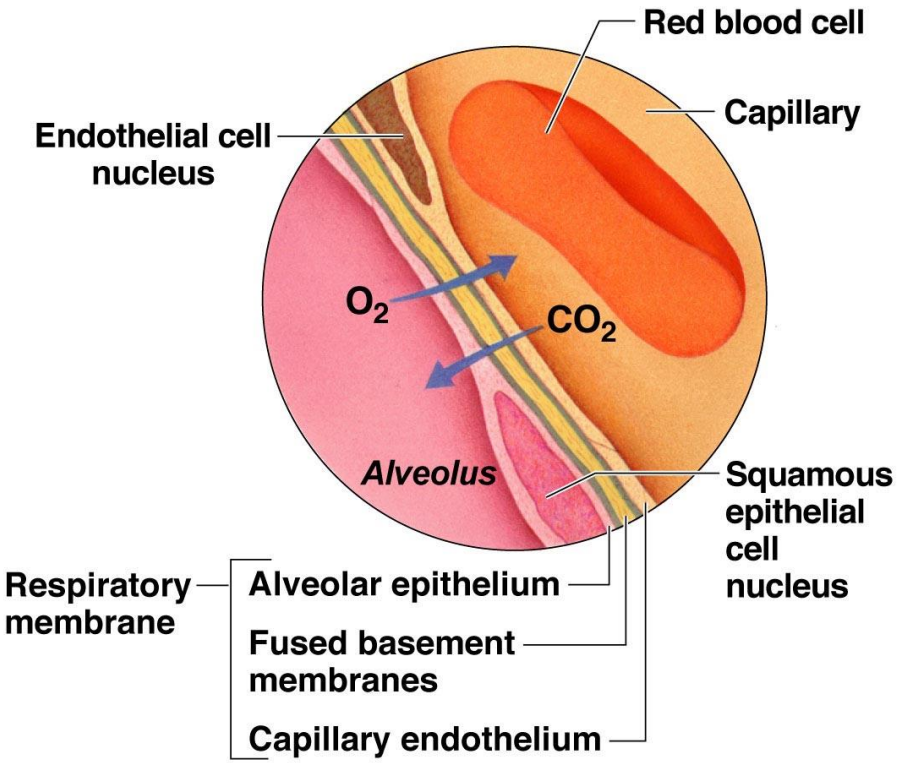
- D_{LCO} or T_{LCO} (diffusing capacity or transfer factor of the lung for carbon monoxide (CO),) is the extent to which oxygen passes from the air sacs of the lungs into the blood



ancer Research UK Cambridge Institute https://en.wikipedia.org/wiki/DLCO

Obstructive lung syndrome: transfer factor for carbon monoxide 2

- The test looks at whether lungs have been damaged and if so, how much damage there is



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Obstructive lung syndrome: tests rarely done

- Alpha-1 antitrypsin (AAT) test for recognizing emphysema
- A CT scan for detailed picture of the lungs

Computed tomography of the lung showing emphysema and bullae in the lower lung lobes of a subject with type ZZ alpha-1-antitrypsin deficiency

http://www.webmd.com/lung/obstructive-and-restrictive-lung-disease?page=2#2

Obstructive lung syndrome: specialized investigations sometimes used in distinguishing asthma and COPD

Inflammatory biomarkers

	Asthma	COPD
Test for atopy (specific IgE and/or skin prick tests)	Modestly increases probability of asthma; not essential for diagnosis	Conforms to background prevalence; does not rule out COPD
FENO	A high level (>50 ppb) in non-smokers supports a diagnosis of eosinophilic airway inflammation	Usually normal. Low in current smokers.
Blood eosinophilia	Supports asthma diagnosis	May be present during exacerbations
Sputum inflammatory cell analysis	Role in differential diagnosis is not established in large populations	

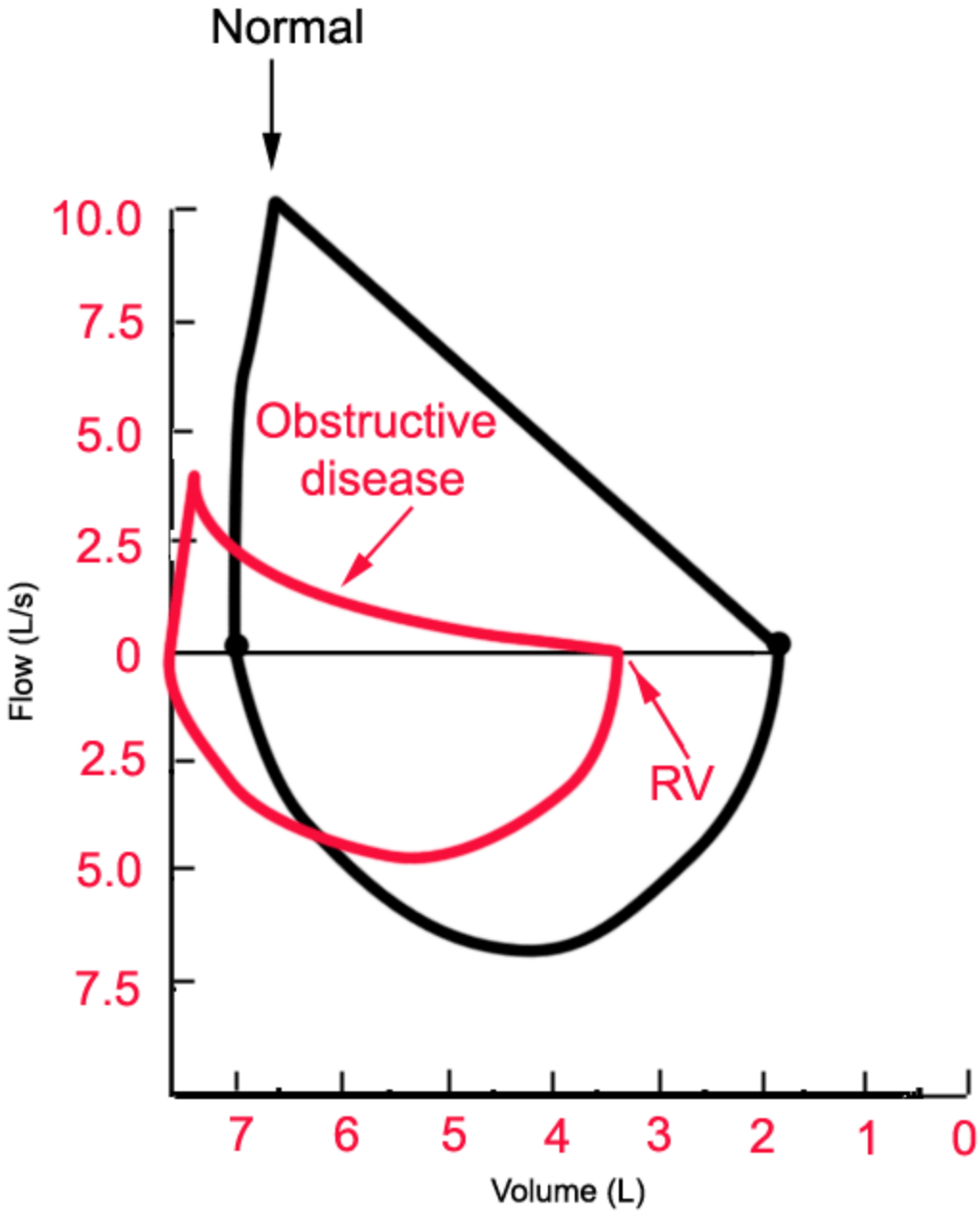
http://www.goldcopd.org/uploads/users/files/AsthmaCOPDOverlap.pdf

Obstructive lung syndrome: regular checkups

- Spirometry
- Arterial blood gas test
- X-rays or ECGs

I quit smoking 30 years ago, not soon enough, I have COPD

http://i.dailymail.co.uk/i/pix/2014/02/05/article-2552340-1B046ECC00000578-941_634x649.jpg http://www.webmd.com/lung/copd/tc/chronic-obstructive-pulmonary-disease-copd-exams-and-tests



https://www.medicine.mcgill.ca/physio/vlab/Other_exps/resp/images/loops_cond_obstructive.gif