

**Pulmonary Medicine:
2012 Review**
Oregon Society of Physician Assistants

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OHSU – Pulmonary and Critical
Care Medicine

To be covered...

- Obstructive lung diseases
 - Asthma
 - COPD
- Restrictive lung disease
 - Interstitial lung disease
- Potpourri

Asthma and COPD

- Diagnosis
- Assessing control and severity
- Management
 - Chronic
 - Acute
- Differential diagnosis

Asthma: Diagnosis

Symptoms

Cough, wheezing,
dyspnea, phlegm
Triggers? Allergies?
Nocturnal? Seasonal?
Exercise-induced?
NSAIDs?

Exam

Wheezing-
Expiratory>Inspiratory
Signs of allergy
Normal

Key Diagnostic Test: Pulmonary
Function Testing

Spirometry

Measured forced expiratory volumes after maximal
inhalation

FVC- Forced Vital Capacity

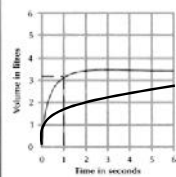
Total Volume
exhaled after
minimum 6 seconds

FEV₁- Forced Expiratory Volume during 1st second of exhalation

Obstruction: FEV₁/FVC < 0.70
Normal FEV₁/FVC: ~0.70-0.80

Asthma: Spirometry

Forced Expiratory Volume in 1 second = FEV₁.
The FEV₁ is the volume of air that can be forcibly
expelled from maximum inspiration in the first second.



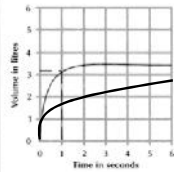
Normal

Female, 33 yrs, 163cm
FEV₁ = 3.20 litres

Predicted FEV₁ = 3.03 litres
%predicted = 105%

Asthma: Spirometry

Forced Expiratory Volume in 1 second = FEV₁.
The FEV₁ is the volume of air that can be forcibly expelled from maximum inspiration in the first second.



Obstruction

FEV1 = 1.5

FVC = 2.75

Ratio: 0.55

Asthma Diagnosis

Post Bronchodilator Response

After inhaler, >12% improvement in FVC and FEV1

"Reversibility"

Normalization

Asthma with Normal Spirometry?

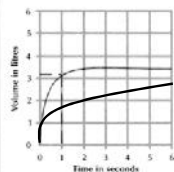
Methacholine Testing

Increasing doses of bronchoconstrictor

Drop in FEV1 by 20% of baseline

Asthma: Spirometry

Forced Expiratory Volume in 1 second = FEV₁.
The FEV₁ is the volume of air that can be forcibly expelled from maximum inspiration in the first second.



Obstruction

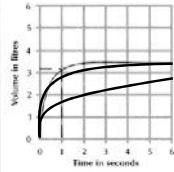
FEV1 = 1.5

FVC = 2.75

Ratio: 0.55

Asthma: Spirometry

Forced Expiratory Volume in 1 second = FEV₁.
The FEV₁ is the volume of air that can be forcibly expelled from maximum inspiration in the first second.



Post BD

FEV₁ = 2.80

FVC = 3.30

Ratio: 0.85

Asthma Severity and Control

Asthma Severity

Impairment

- Frequency of symptoms; emphasis on nocturnal
- Interference with normal activity
- Rescue inhaler use
- Spirometry (FEV₁/FVC, FEV₁ % predicted)

Risk

Asthma Control

Impairment

- Frequency of symptoms; emphasis on nocturnal
- FEV₁ or PEF variability
- Rescue inhaler use
- Questionnaires- ACT (Asthma Control Test)

Risk

PEF-meter: Portable monitoring



- Exhale forcibly into chamber
- Measures expiratory flow rates
- Zones
 - Green: > 80% personal best
 - Yellow: 50-80%
 - Red: < 50%
- **ACTION PLAN**

Asthma Risk



Exacerbations requiring oral steroids

- 0-1 per year: Mild, intermittent
- > 2 per year: Persistent

Spirometry

FEV1 % predicted

RF for death: intubations, ICU admissions, > 2 SABA canisters/month, low socioeconomic status, drug use, psychiatric illness, other medical problems

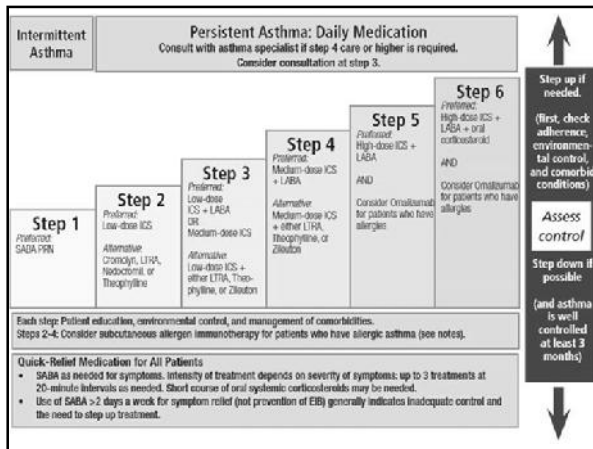
Meds for chronic asthma control: Anti-inflammatories take the lead

- **INHALED CORTICOSTEROIDS (ICS)**
- Long-acting B-agonists (LABA)
 - Bronchodilator
 - Salmeterol (Serevent)*
- **ICS + LABA**
- Methylxanthines
- Leukotriene modifiers
 - LTRA (e.g. montelukast)
 - Zileuton
- Cromolyn (kids)
- Rescue inhaler (Short acting B-agonist = SABA)
 - Albuterol

*Black box warning with solo therapy with LABA


Components of Severity		Classification of Asthma Severity (Youths ≥12 years of age and adults)			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment Normal FEV ₁ /FVC: 0-19 yr 85% 20-59 yr 80% 60-80 yr 75% 80-80 yr 70%	Symptoms	<2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	<2/month	3-4/month	>1x/week but not nightly	Often 7x/week
	Short-acting beta ₂ -agonist use for symptom control (not prevention of EAs)	<2 days/week	>2 days/week but not >1 daily	Daily	Several times per day
	Interference with normal activity	None	Mild limitation	Some limitation	Extremely limited
Lung function	• Normal FEV ₁ between exacerbations				
	• FEV ₁ ≥80% predicted • FEV ₁ /FVC normal	• FEV ₁ ≥80% predicted • FEV ₁ /FVC normal	• FEV ₁ >60% predicted • FEV ₁ /FVC normal	• FEV ₁ >60% predicted • FEV ₁ /FVC reduced 5%	• FEV ₁ <60% predicted • FEV ₁ /FVC reduced >5%
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year		
		Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to FEV ₁ .			

Components of Control		Classification of Asthma Control (≥12 years of age)		
		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	<2 days/week	>2 days/week	Three or more times per day
	Nighttime awakenings	<2/month	1-2/week	>4/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting beta ₂ agonist use for symptom control (not prevention of EIB)	<2 days/week	>2 days/week	Several times per day
	FEV ₁ or peak flow	>80% predicted/personal best	60-80% predicted/personal best	<60% predicted/personal best
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year	
	Progressive loss of lung function	Evaluation requires long-term follow-up care		
Recommended Action for Treatment		<ul style="list-style-type: none"> Medication side effects can vary in intensity from none to very troublesome and sometimes. The level of severity does not correlate to specific levels of control but should be considered in the overall assessment of risk. 		



“Steps” of Asthma Care

- Severity of asthma – 4 levels
 - Mild Intermittent (step 1)
 - Mild Persistent (step 2)
 - Moderate Persistent (step 3)
 - Severe Persistent (steps 4-6)
- 6 steps of care: Step up/Step down
 - Gain control as quickly as possible
 - Review treatment in 2-6 weeks
 - Phone, PEF, office visit, ACT, spirometry



Step 1: Intermittent Asthma

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> •Daytime symptoms: <2x/week •Nighttime symptoms: <2x/month •PEF or FEV1: >80% predicted 	<p>B-agonist as needed*</p> <p>Avoid Risk Factors*</p> <ul style="list-style-type: none"> -Smoking, pollution, occupational exposures, allergens <p>Vaccinations*</p> <ul style="list-style-type: none"> -Influenza
*Apply to all asthmatics	

Step 2

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> •Daytime symptoms: 2-6x/week •Nighttime symptoms: 3-4x/month •PEF or FEV1: >80% predicted • 2 exacerbations per year 	<p>Low-dose Inhaled Corticosteroid (ICS)</p> <p>Alternatives:</p> <ul style="list-style-type: none"> -Leukotriene receptor antagonist (LTRA), theophylline, Cromolyn or Nedocromil

Step 3

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> •Daytime symptoms: Daily •B-agonist use: Daily •Nighttime symptoms: > 1x/week •PEF or FEV1: 60-80% predicted 	<p>Low dose Inhaled Corticosteroid (ICS) + LABA OR Med dose ICS</p> <p>Alternatives:</p> <ul style="list-style-type: none"> -Low-dose ICS + either LTRA, Theo or Zileuton
Referral to asthma specialist should be considered	

Step 4

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> •Continual symptoms •Frequent nighttime symptoms and exacerbations •Activity very limited •PEF or FEV1: $\leq 60\%$ predicted 	<p>Med dose Inhaled Corticosteroid (ICS) + LABA</p> <p>Alternatives:</p> <ul style="list-style-type: none"> -Med dose ICS + either LTRA, Theo, or Zileuton
<p>All patients at Step 4 and beyond should be referred to a specialist</p>	

Steps 5 and 6

<p>Step 5- High dose ICS + LABA</p> <p>Step 6- High dose ICS + LABA + oral corticosteroid</p> <p>Consider omalizumab for patients who have allergies</p>
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Asthma Exacerbation	Symptoms and Signs	Initial PEF (or FEV1)	Clinical Course
Mild	Dyspnea with only activity	70% predicted or personal best	<ul style="list-style-type: none"> •Home •SABA relief quickly with minimal use •Possible prednisone
Moderate	Dyspnea interferes or limits usual activity	40-69% predicted or personal best	<ul style="list-style-type: none"> •Office or ED •SABA- decent relief with frequent use •Prednisone •Sxms last 1-2 days after tx has begun
Severe	Dyspnea at rest; interferes with conversation	< 40% predicted or personal best	<ul style="list-style-type: none"> •ED; likely hospital •SABA- partial relief from frequent use •Prednisone •Sxms last > 3 after tx has begun
Life threatening	Too dyspneic to speak; sweating	< 25% predicted or personal best	<ul style="list-style-type: none"> •ED/hospital; possible ICU •SABA- minimal relief with frequent use •IV steroids

Management of Acute Asthma Exacerbation: Bronchodilators

Short-acting B-agonist:
high-dose MDI or nebulizer

Albuterol

Neb: 2.5-5 mg every 20 minutes for 3 doses, then 2.5-10 mg q 1-4 h prn, or 10-15 mg/hr cont;
MDI: 4-8 puffs q 20 min

Short-acting anticholinergic:
high dose MDI or nebulizer

Ipratropium

Neb: 0.5 mg q 30 minutes for 3 doses, then q 2-4 h prn

BA/AC combo: MDI (Combivent) or Neb (Duoneb)

There is no evidence nebulizers deliver medicine better than properly used MDI

Management of Acute Asthma Exacerbation: Steroids

Mild symptoms: Increase SABA +/- Prednisone

Moderate symptoms:
Prednisone

Mild-mod exacerbations often treated at home

Severe symptoms:
Prednisone; ED visit for monitoring, aggressive tx

Prednisone: ~5-10 day burst (no taper!) 40-60 mg/day (qD or divided)

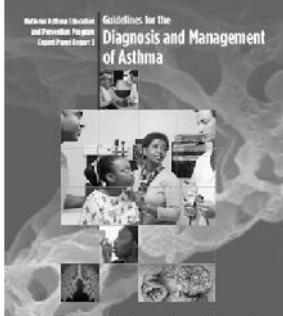
Hospitalized patient: IV or oral: 40-80 mg/day until PEF reaches ~70% personal best

Antibiotics: Generally NOT needed for asthma exacerbation (viruses, allergies, smoke)

Asthma: Final points

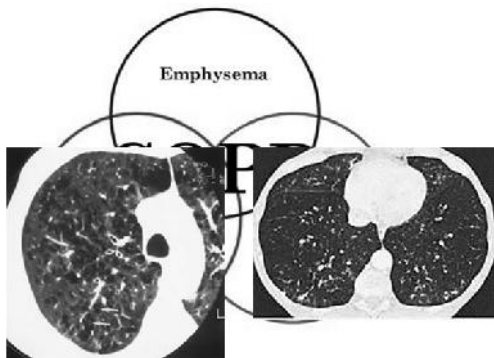
- Asthma
 - Most do well
 - #1 chronic disease causing missed school days
 - Good outpatient management can prevent morbidity/mortality
 - Inhaled corticosteroids; Action Plan –sxms; PEF
 - Exacerbations: viruses, non-compliance, allergies, sinus disease, GERD
 - Lung function can be stabilized
 - Cost to society in billions of dollars: hospitalization, medications, missed work days

2007 Guidelines for the Diagnosis and Management of Asthma



www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm





COPD: Causes

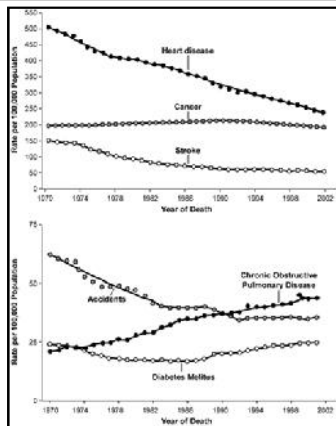
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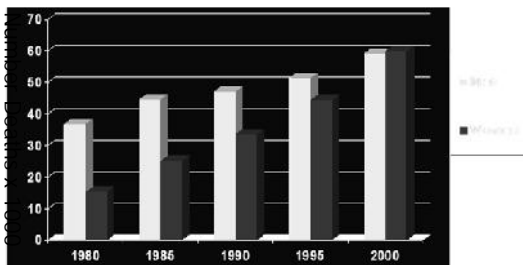
Occupational dusts and chemicals – intense and prolonged exposures

- Indoor air pollution-cooking in poorly ventilated areas
- Outdoor air pollution
- Passive smoke exposure (2nd hand)

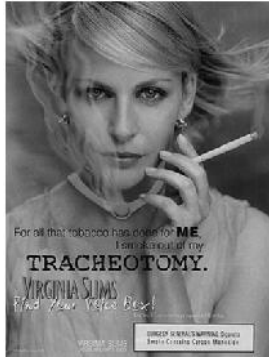
Of the six leading causes of death in the United States, only COPD has been increasing steadily since 1970



Trends in US COPD deaths by gender



You've Come a Long Way, Baby...





Diagnosis of COPD

SYMPTOMS

cough
sputum
dyspnea

EXPOSURE TO RISK FACTORS

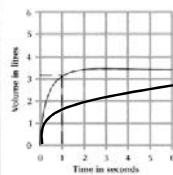
tobacco
occupation
indoor/outdoor pollution



SPIROMETRY

COPD: Spirometry

Forced Expiratory Volume in 1 second = FEV₁.
The FEV₁ is the volume of air that can be forcibly expelled from maximum inspiration in the first second.



Normal

Obstruction

FEV₁ = 1.5

FVC = 2.75

Ratio: 0.55

Sometimes "reversible" (>12% change); **damage is irreversible**

Unless very early in disease, **NEVER** normalizes

COPD: Chronic Management

- General points
 - QUIT SMOKING!!!
 - Ask, Advise, Assess, Assist, Arrange
 - Symptom driven
 - Medications increased in a step-wise fashion
 - Unclear if any medication will slow/reverse the decline in lung function
 - Non-pharmacologic interventions

Management of COPD Stage I: Mild COPD

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> • FEV₁/FVC < 70 % • FEV₁ ≥ 80 % predicted • With or without chronic symptoms 	<ul style="list-style-type: none"> • Short-acting bronchodilator as needed • Albuterol • Ipratropium • Combivent®
<small>Avoid risk factors* - Smoking, pollution, occupational exposures</small> <small>Vaccination* - Influenza, pneumococcal</small>	

Management of COPD Stage II: Moderate COPD

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> • FEV₁/FVC < 70% • 50% ≤ FEV₁ < 80% predicted • With or without chronic symptoms 	<ul style="list-style-type: none"> • Short-acting bronchodilator as needed • Regular treatment with one or more <u>long-acting bronchodilators*</u> • Rehabilitation
<small>*LABA: Salmeterol, Formoterol</small> <small>-ULABA: Indacaterol</small> <small>*LAAC: Tiotropium</small>	

Management of COPD Stage III: Severe COPD

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> • FEV₁/FVC < 70% • 30% ≤ FEV₁ < 50% predicted • With or without chronic symptoms 	<ul style="list-style-type: none"> • Short-acting bronchodilator as needed • Regular treatment with one or more long-acting bronchodilators • <u>Inhaled glucocorticosteroids</u>* if repeated exacerbations • Roflumilast? Azithromycin? • Rehabilitation • Pulmonary consultation?
<p>*Many ICS preps ICS/LABA combo: Multiple available</p>	

Management of COPD Stage IV: Very Severe COPD

Characteristics	Recommended Treatment
<ul style="list-style-type: none"> • FEV₁/FVC < 70% • FEV₁ < 30% predicted or FEV₁ < 50% predicted <i>plus</i> chronic respiratory failure 	<ul style="list-style-type: none"> • Short-acting bronchodilator as needed • Regular treatment with one or more long-acting bronchodilators • Inhaled glucocorticosteroids if repeated exacerbations • Treat complications • Rehabilitation • Long-term oxygen therapy* if respiratory failure • Consider <u>surgical options</u> <ul style="list-style-type: none"> • TXP or LVRS
<p>*O₂ sat \geq 88%** with rest or activity **Oxygen improves mortality</p>	

Therapy at Each Stage of COPD			
I: Mild	II: Moderate	III: Severe	IV: Very Severe
<ul style="list-style-type: none"> • FEV₁/FVC > 70% • FEV₁ ≥ 80% predicted 	<ul style="list-style-type: none"> • FEV₁/FVC < 70% • 50% ≤ FEV₁ < 80% predicted 	<ul style="list-style-type: none"> • FEV₁/FVC < 70% • 30% ≤ FEV₁ < 50% predicted 	<ul style="list-style-type: none"> • FEV₁/FVC < 70% • FEV₁ < 30% predicted or FEV₁ < 50% predicted plus chronic respiratory failure
Active reduction of risk factor(s); influenza vaccination			
Add short-acting bronchodilator (when needed)			
Add regular treatment with one or more long-acting bronchodilators (when needed); Add rehabilitation		Add inhaled glucocorticosteroids if repeated exacerbations	
Roflumilast is an option for stage III and IV with chronic bronchitis and repeated exacerbations		Add long term oxygen if chronic respiratory failure. Consider surgical treatments	
Azithromycin is an option for stage III and IV with repeated exacerbations			

Managing Acute COPD exacerbations

Causes

Infection: viral > bacterial

-Acute-on-chronic bronchitis >>> pneumonia

Air pollution

Co-morbidities

Exacerbation Severity

Symptoms: Degree of breathlessness

Signs: General appearance, WOB, other disease (heart failure)

Tests: Spirometry, CXR

Managing Acute COPD exacerbations

BD/steroid Treatment

Short-acting BD:
Albuterol, Ipratropium

?Theophylline

Steroids

-Systemic (po vs. IV)

Bipap > Intubation

Antibiotics?

Signs of airway infection?

-Increased sputum

-Change in color

Fever

Abx may benefit*

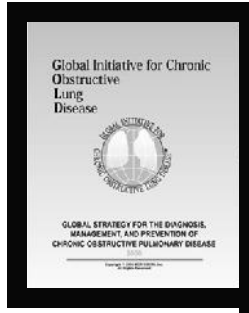
*Usually can use narrow spectrum (doxycycline, bactrim) unless colonized with more resistant bugs

COPD exacerbations

- COPD summary
 - Progressive decline in lung function
 - Older and more co-morbidities than asthma patients
 - Much higher mortality
 - Similar initial assessment as asthmatics
 - History/Physical, assess severity, ABC's, IV access, oxygen (more controlled), monitoring; assess response to therapy

Guidelines on Management of COPD

www.goldcopd.com



Latest Update in
2011

Differential Diagnosis

- Chronic cough (> 6 weeks)
 - Asthma, GERD, sinusitis, post-infection = 95%!!!
 - Bronchiectasis-dilation/destruction of large airways
 - Chronic productive cough; copious sputum
 - Pseudomonas aeruginosa and staph aureus respiratory infections
 - Cystic fibrosis (younger)
 - Chronic infections: Tb
 - Medications: ACE Inhibitors

Cystic Fibrosis

- Most common fatal genetic disease of Caucasians
- Autosomal recessive
- Chronic cough; clubbed fingers
- Bronchiectasis
- Respiratory Failure
- Regular Airway Clearance
- Antibiotics for exacerbations



CF Bronchiectasis



Clubbing



Chronic SOB

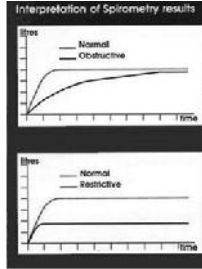


–Chronic SOB

- Lung disease:
 - Parenchymal lung disease- ILD (IPF, sarcoidosis). Parenchymal damage.
 - Pulmonary vascular disease: PE (usually acute), pulmonary HTN. Clear CXR!
- Heart disease: CHF, ischemic heart disease
- Neuromuscular disease

Restrictive lung disease

- Spirometry
 - Low FVC, *normal/elevated* FEV1/FVC
- **Reduced lung volumes**
- DDx
 - Interstitial lung disease
 - Neuromuscular disease
 - Pleural disease



Interstitial lung disease

- Generally, a slow decline in lung function due to increasing inflammation and scarring (fibrosis)
 - Several months - years
- Causes
 - Idiopathic
 - IPF- Scarring, very progressive
 - Sarcoidosis- Nodules; indolent generally
 - Exposures – especially occupations ("Pneumoconioses")
 - Asbestos, beryllium, Silica

Interstitial lung disease

- Diagnosis
 - Early, may not have any findings
 - History
 - Exposures?
 - Physical
 - Clubbing (IPF)
 - "dry velcro crackles" (IPF)
 - PFT's- **Restriction**
 - Low DLCO
 - Imaging. CT > CXR



Management

Remove exposure

Steroids/Immunosuppression?

Transplant?

Test time!



1. Which of the following is NOT routinely used in the outpatient assessment of asthma control?

- A. Spirometry
- B. Peak Expiratory Flow
- C. Chest x-ray
- D. Asthma control test
- E. Frequency of albuterol use
- F. Frequency of nighttime symptoms

2. Which of the following agents should NOT be used alone as the sole controlling therapy in asthma?

- A. Fluticasone/Salmeterol (Advair)
- B. Salmeterol
- C. Budesonide
- D. Budesonide/Formoterol (Symbicort)
- E. Montelukast (Singulair)

3. Which of the following is NOT an obstructive lung disease?

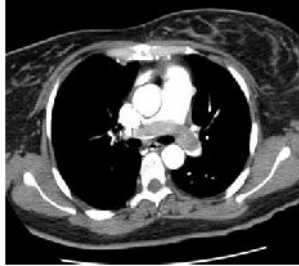
- A. Idiopathic Pulmonary Fibrosis
- B. Asthma
- C. COPD
- D. Cystic Fibrosis

4. In COPD, inhaled corticosteroids are best used in patients with:

- A. Frequent exacerbations
- B. Emphysema
- C. COPD (all patients should be on)
- D. Hypoxia
- E. Pulmonary Hypertension

5. Name that lung disease!

- A. COPD
- B. Pneumothorax
- C. Pleural Effusion
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb



Pulmonary Embolism


- Clots in pulmonary artery circulation
 - Origin: DVT – lower ext > upper
 - Risk factors: Cancer, surgery, age, immobilization, hypercoagulability
 - Treatment- Early and adequate anticoagulation (heparin)
 - Transition to coumadin for 6 months to lifetime
 - DVT prophylaxis! Prevent it!!!!
 - LMWH; unfractionated heparin



6. Name that lung disease!



- A. COPD
- B. Pneumothorax
- C. Pleural Effusion
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb





Tb!


- 1 in 3 in the world are infected!!!
 - Latent infection
 - Early treatment reduced risk of reactivation (10% overall risk decreased by ½)
 - Active infection
 - Up to 4 drugs needed for 6 months!
 - Can become resistant
 - Very infectious
 - Public Health issue
 - DOT

IGRA?


7. Name that lung disease!

- A. COPD
- B. Pneumothorax
- C. Pleural Effusion
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb



Pleural Effusion

- Sample it if no clear diagnosis
 - Transudate – Treat underlying issue
 - Low protein, low LDH
 - CHF, cirrhosis; nephrotic syndrome
 - Exudate
 - High protein, high LDH
 - Infection (bacterial, Tb); cancer; trauma
 - If infected fluid, DRAIN ASAP!!!
 - Call for assistance.



Chest tube drains blood from the lungs

8. Name that lung disease!

- A. COPD
- B. Pneumothorax
- C. Strep pneumonia
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb



8. Name that lung disease!


- A. COPD
- B. Pneumothorax
- C. Strep Pneumonia
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb




8. Name that lung disease!

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Lung Cancer




- Leading cause of cancer death in the country
 - More deaths than breast, colon and prostate cancer COMBINED! (yes)
 - Early stage potentially curable - Surgery
 - Late stage – chemo +/- XRT
 - Overall 5 year survival ~ 15%
 - Role for screening? Latest study concluded it may happen (CT for high-risk smokers)

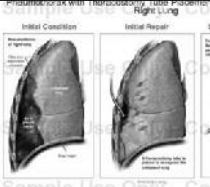


9. Name that lung disease!

- A. COPD
- B. Pneumothorax
- C. Strep Pneumonia
- D. Pulmonary Fibrosis
- E. Pulmonary Embolism
- F. Lung Cancer
- G. Tb



Pneumothorax



- Types
 - Primary- Normal lungs
 - Usually won't get unless trauma
 - Secondary- Underlying lung disease that predisposed to Pneumothorax (e.g. COPD)
 - Spontaneous
 - Usually underlying lung disease
 - Traumatic
 - Tension- one-way valve effect. Air pressure builds in chest
- Treatment – Evacuate air (chest tube)

Good Luck!

Alladag@ohsu.edu