



COPD, Lung Cancer, OSA, Sarcoidosis

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Learning Objectives

1. Explain the common approach(es) to diagnosis and treatment of COPD.
2. Summarize risk stratification and treatment in patients with a COPD exacerbation.
3. State the USPSTF recommendation on screening for lung cancer.
4. Describe the diagnosis and treatment of obstructive sleep apnea (OSA).
5. Summarize the risks associated with untreated OSA.
6. Discuss the clinical manifestations, evaluation and treatment of Sarcoidosis.

1. Which one of the following is true regarding COPD and mortality in the U.S?

- A. It is the 1st leading cause of death
- B. It is the 2nd leading cause of death
- C. It is the 3rd leading cause of death
- D. It is the 4th leading cause of death

1. Which one of the following is true regarding COPD and mortality in the U.S?

- 2% A. It is the 1st leading cause of death
- 22% B. It is the 2nd leading cause of death
- 68% ✓ C. It is the 3rd leading cause of death
- 7% D. It is the 4th leading cause of death

COPD...What Is It?

- Key elements of COPD
 - 3rd leading cause of death in the US
 - Toxin exposure (primarily tobacco)
 - Airway inflammation
 - Airflow obstruction (not fully reversible)
 - A subset of 2-3% is caused by alpha-1 antitrypsin deficiency

Amer Lung Assoc Fact Sheet

COPD

- Prevalence
 - Estimated at 10.1%
 - 24 million people have COPD
- Costs
 - Economic costs approx \$49.9 billion, \$29.5 billion direct medical costs
- 715,000 hospital discharges each year

2. Which of the following is the most common symptom in COPD?

- A. Cough
- B. Dyspnea on exertion
- C. Increased sputum
- D. Wheezing

2. Which of the following is the most common symptom in COPD?

- 50% ✓ A. Cough
- 38% B. Dyspnea on exertion
- 10% C. Increased sputum
- 2% D. Wheezing

COPD Common Symptoms

<i>Hallmark Symptoms</i>	<i>Less Commonly Reported Symptoms</i>
Cough (85%)	Fatigue
Increased sputum production (45%)	Edema
Dyspnea, exertional (70%)	Chest tightness
Wheezing (40%)	Weight loss
Exercise intolerance	Increased nocturnal awakenings
	Decreased quality of life

COPD Symptoms and Airflow

- Relationship between airflow obstruction and patient perception of symptoms is highly variable
- Only 60% of patients with moderately severe COPD with reduced FEV1 (50-85% of predicted) complained of any symptoms

3. What proportion of active smokers are likely to develop COPD?

- A. 10%
- B. 25%
- C. 50%
- D. 75%

3. What proportion of active smokers are likely to develop COPD?

- 1% A. 10%
- 32% ✓ B. 25%
- 51% C. 50%
- 17% D. 75%

COPD Risk Factors

Other Risk Factors

Advancing age

Secondhand smoke exposure

Family h/o COPD

Chronic exposure to home, environmental or occupational pollutants

Alpha-1 antitrypsin deficiency

Childhood history of recurrent respiratory infections

Primary Risk Factor

Smoking

- 80% of lung cancer deaths are directly attributable to smoking
- Smokers 12-13 times more likely to die from COPD than non-smokers
- Absolute risk of COPD among active continuous smokers is at least 25%

COPD Findings

- “Normal” in many patients
- Possible CXR findings:
 - Lung hyperinflation
 - Widened AP diameter
 - Narrow heart width
- Hyper resonance on percussion
- Diminished breath sounds



COPD Physical Findings

- Abnormal findings
 - Increased work of breathing
 - Use of accessory respiratory muscles
 - Paradoxical abdominal movement
 - Increased expiratory time
 - Pursed lip breathing
 - Wheezing (variable)
 - Cachexia
 - Cyanosis

COPD Diagnosis

- Single best variable for identifying adults is a history of > 40 pack yrs of smoking
- Combination of all 3 of the following almost ensures the presence of obstruction
 - > 55 pack yr hx
 - Wheezing on auscultation
 - Patient self-reporting of wheezing
- Absence of all 3 essentially rules it out

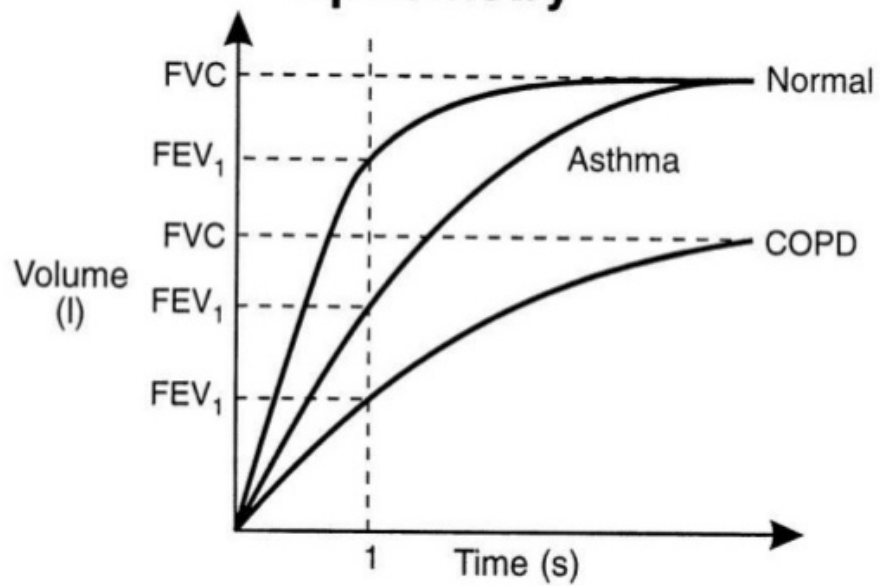
COPD Differential Diagnoses

- Asthma
- CHF
- Bronchiectasis
- Lung cancer
- Interstitial lung disease/pulmonary fibrosis
- Sarcoidosis
- Tuberculosis
- Bronchopulmonary dysplasia

COPD Diagnosis

- Spirometry is the **key** test
 - Recommended for all symptomatic adults
 - USPSTF recommends against screening asymptomatic adults for COPD using spirometry (Grade D)
 - Key features
 - FEV1
 - Volume of air expired in one second after a full inspiration
 - FVC
 - Maximum volume of air exhaled after a full inspiration
 - Not recommended to track disease progression or modify Rx after it has been initiated

Spirometry



COPD Workup

- If abnormal spirometry:
- CXR to evaluate for
 - Lung nodules
 - Masses
 - Fibrotic changes

COPD Workup

- ECG or echocardiography
 - In patients with signs of cor pulmonale
- Pulse oximetry at rest, with exertion, and possibly during sleep
 - Evaluate the need for supplemental oxygen
- Alpha-1 Antitrypsin Deficiency Screening: Perform when COPD develops in patients of Caucasian descent under 45 years, or with a strong family history of COPD

Strategy for Assessing COPD

- **Assess symptoms**
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations
- Assess comorbidities

Medical Research Council (MRC) Dyspnea Index

Grade	Level of Dyspnea
1	Not bothered by dyspnea, except during strenuous activity
2	Shortness of breath when walking up a short hill
3	Walks more slowly than others because of breathlessness; stops to catch breath when walking at own pace
4	Stops to catch breath after walking 100 m (328 ft) on level ground
5	Too short of breath to leave the house; breathless with activities of daily living, such as dressing and undressing

Stephens, et al. Diagnosis of Chronic Obstructive Pulmonary Disease, *Am Fam Physician*. 2008;78(1):87-92.

CAT Questionnaire

- Patient-completed questionnaire assessing globally the impact of COPD (cough, sputum, dyspnea, chest tightness, limitation on activities, confident leaving home and going out, sleep, energy level) on health status
- 8 questions on a 1-5 scale, max 40 points
- **10 or more** considered significant COPD symptoms
- <http://www.catestonline.org/index.htm>

Strategy for Assessing COPD

- Assess symptoms
- **Assess degree of airflow limitation using spirometry**
- Assess risk of exacerbations
- Assess comorbidities

4. A 59 y.o. woman presents with progressive cough, increased cough and sputum production over the past 5-10 years, worsening lately. She has smoked 1.5 ppd for nearly 40 years, and often feels too fatigued to play catch with the grandkids. Which of the following results would indicate severe COPD?

- A. FEV1/FVC > 0.7, FEV1 50-79% predicted
- B. FEV1/FVC > 0.7, FEV1 30-49% predicted
- C. FEV1/FVC < 0.7, FEV1 30-49% predicted
- D. FEV1/FVC < 0.7, FEV1 < 30% predicted

4. A 59 y.o. woman presents with progressive cough, increased cough and sputum production over the past 5-10 years, worsening lately. She has smoked 1.5 ppd for nearly 40 years, and often feels too fatigued to play catch with the grandkids. Which of the following results would indicate severe COPD?

- 0% A. FEV1/FVC > 0.7, FEV1 50-79% predicted
- 7% B. FEV1/FVC > 0.7, FEV1 30-49% predicted
- 87% ✓ C. FEV1/FVC < 0.7, FEV1 30-49% predicted
- 6% D. FEV1/FVC < 0.7, FEV1 < 30% predicted

COPD Staging*

Gold Stage	Spirometry
1: Mild	FEV1 > 80% predicted
2: Moderate	FEV1 <80% predicted
3: Severe	FEV1 <50% predicted
4: Very severe (or “end-stage”)	FEV1 <30% predicted

*Based on post-bronchodilator FEV1/FVC <0.7

Strategy for Assessing COPD

- Assess symptoms
- Assess degree of airflow limitation using spirometry
- **Assess risk of exacerbations**
- Assess comorbidities

Assess History of Exacerbations

- Two or more exacerbations within the last year
- One or more hospitalizations for COPD exacerbation

Strategy for Assessing COPD

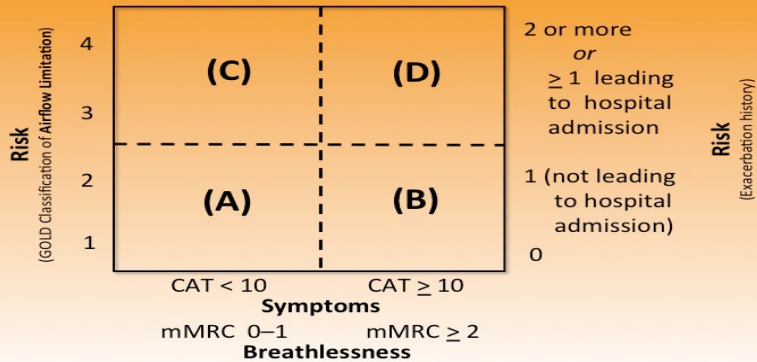
- Assess symptoms
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations
- **Assess comorbidities**

Assess COPD Comorbidities

- CVD
- Osteoporosis
- Respiratory infections
- Anxiety, depression
- Diabetes
- Lung cancer
- Bronchiectasis

COPD – Putting it All Together

- **Assess symptoms**
- **Assess degree of airflow limitation using spirometry**
- **Assess risk of exacerbations**
- Strategy for Combined Assessment – GOLD



Global Strategy for Diagnosis, Management and Prevention of COPD

Combined Assessment of COPD

When assessing risk, choose the **highest** risk according to GOLD grade or exacerbation history. One or more hospitalizations for COPD exacerbations should be considered high risk.)

Patient	Characteristic	Spirometric Classification	Exacerbations per year	CAT	mMRC
A	Low Risk Less Symptoms	GOLD 1-2	≤ 1	< 10	0-1
B	Low Risk More Symptoms	GOLD 1-2	≤ 1	≥ 10	≥ 2
C	High Risk Less Symptoms	GOLD 3-4	≥ 2	< 10	0-1
D	High Risk More Symptoms	GOLD 3-4	≥ 2	≥ 10	≥ 2

Goals of COPD Management

- Relieve disabling dyspnea
- Improve exercise tolerance
- To reduce long-term function decline
- Prevent and treat exacerbations
- Reduce hospitalizations and mortality
- Improve health-related quality of life

5. Which of the following statements is true concerning nicotine replacement therapy (NRT) for smoking cessation?
- A. Nicotine gum is the most effective form of NRT
 - B. NRT should be used for at least 4 months
 - C. NRT must be tapered off
 - D. NRT will double the chance of quitting

5. Which of the following statements is true concerning nicotine replacement therapy (NRT) for smoking cessation?

- 4% A. Nicotine gum is the most effective form of NRT
- 21% B. NRT should be used for at least 4 months
- 30% C. NRT must be tapered off
- 44% ✓ D. NRT will double the chance of quitting

COPD Management – First Things First

Stop smoking!

- **ASK** about tobacco use at every visit
- **ADVISE** all users to stop
- **ASSESS** users' willingness to attempt to quit
- **ASSIST** users' efforts to quit
- **ARRANGE** follow-up

Tobacco cessation and O₂ therapy are the only interventions proven to prolong survival of patients with COPD!

Tobacco Cessation

- Nicotine may be as addictive as heroin
 - Proven interventions (may double chance of quitting!)
 - Counselling*
 - Nicotine replacement therapy (NRT)
 - Patch, gum, lozenge, inhaler, nasal spray all equally effective
 - Nicotine vapor (“vaping”) not proven to help
 - Varenicline (Chantix) – nicotine blockade
 - Bupropion SR (Zyban)
- *Counselling and meds more effective together than either one alone*

COPD Management

- Assess (spirometry, exacerbations and symptoms)
- Assess need for Rx
- Education plan based on patient's specific needs
- Encourage regular exercise
- Immunization status monitoring:
 - Pneumococcal
 - Influenza (yearly)
 - others

6. A 65-year-old male with COPD is complaining of increased breathing difficulty for 2 months, and using his short-acting bronchodilator 4 times a day. The next best step in therapy for him would be:

- A. Prednisone 20 mg a day
- B. Tiotropium inhalation daily
- C. Azithromycin daily for 5 days
- D. Fluticasone inhalation daily

6. A 65-year-old male with COPD is complaining of increased breathing difficulty for 2 months, and using his short-acting bronchodilator 4 times a day. The next best step in therapy for him would be:

- 3% A. Prednisone 20 mg a day
- 67% ✓ B. Tiotropium inhalation daily
- 0% C. Azithromycin daily for 5 days
- 30% D. Fluticasone inhalation daily

COPD Management

- Beta-agonists
- Anti-cholinergics (LAMA: long-acting muscarinic antagonists)
- Combination Beta and anticholinergic
- Inhaled Corticosteroids
- Combination long-acting beta-agonists+corticosteroids
- Theophylline
- Systemic corticosteroids
- Phosphodiesterase-4 inhibitors

Bronchodilators

- Step #1 – **Short-acting bronchodilators**, prn or regularly according to symptoms
- Step #2 – **Anticholinergics (LAMA)**, such as tiotropium or aclidinium, or combination therapy as needed to control symptoms and reduce exacerbations
- Step #3 – **Combination therapy** (LAMA or LABA with ICS) improves efficacy and decrease the risk of side effects.
- The choice of treatment depends on patient's individual response in terms of symptom relief and side effects.

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Corticosteroids

- Regular treatment with inhaled corticosteroids improves symptoms, lung function and quality of life and reduces frequency of exacerbations for COPD patients with an FEV₁ < 60% predicted
- Inhaled corticosteroid therapy is associated with an increased risk of pneumonia. Cochrane review 2014 – balance with fewer exacerbations and higher quality of life, no change in overall mortality
- Combined ICS and bronchodilator is more effective than the individual components in moderate to very severe COPD
- Long-term systemic steroids should be avoided

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Phosphodiesterase Inhibitors

Roflumilast (Daliresp) – Selective PD-4 Inhibitor in patients with severe and very severe COPD (GOLD 3 and 4). Dose 500 mcg once a day; Contraindicated in moderate to severe liver impairment. Caution due to weight loss and suicidality

Theophylline – Oral, twice a day, 200-400 mg bid; has a modest bronchodilator effect and some symptomatic benefit but is less effective and less well tolerated than LABAs and is not recommended except as an alternate choice

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Global Strategy for Diagnosis, Management and Prevention of COPD
Manage Stable COPD: Pharmacologic Therapy

(Medications in each box are mentioned in alphabetical order, and therefore not necessarily in order of preference.)

Patient	RecommendedFirst choice	Alternative choice	Other Possible Treatments
A	SAMA prn or SABA prn	LAMA or LABA or SABA and SAMA	Theophylline
B	LAMA or LABA	LAMA and LABA	SABA and/or SAMA Theophylline
C	ICS + LABA or LAMA	LAMA and LABA or LAMA and PDE4-inh. or LABA and PDE4-inh.	SABA and/or SAMA Theophylline
D	ICS + LABA and/or LAMA	ICS + LABA and LAMA or ICS+LABA and PDE4-inh. or LAMA and LABA or LAMA and PDE4-inh.	Carbocysteine SABA and/or SAMA Theophylline

COPD Management

- Severe disease (FEV1 30-49%)
 - Oxygen
 - Pulmonary rehab
 - All previously mentioned meds
 - Lung volume reduction surgery
 - Transplant

Goals of COPD Management

- Relieve disabling dyspnea
- Improve exercise tolerance
- To reduce long-term function decline
- **Prevent and treat exacerbations**
- Reduce hospitalizations and mortality
- Improve health-related quality of life

Classification of COPD Exacerbations

<i>Severity</i>	<i>Description</i>
Mild	Can be controlled with an increase in dosage of regular medications
Moderate	Requires treatment with systemic corticosteroids or antibiotics
Severe	Requires hospitalization or evaluation in the emergency department

Adapted from: Evensen AE. Management of COPD Exacerbations. Am Fam Physician. 2010;81(5):607-613.

Acute COPD Exacerbations

- Indications for admission:
 - Marked increased symptoms
 - pH < 7.32
 - O₂ sats < 80%
 - Failed outpatient
 - Older age
 - Serious comorbidities
 - Insufficient home support

7. You see a 57-year-old female with moderate COPD who has done well up until this week when she experienced increased cough productive of yellow sputum, mild dyspnea and wheezing. PE significant for RR of 20, pulse ox of 90% on room air, and scattered wheezes and rhonchi on lung auscultation. Which one of the following would be most appropriate for you to prescribe at this time?

- A. Oxygen
- B. Theophylline
- C. Chest physiotherapy
- D. Antibiotics

7. You see a 57-year-old female with moderate COPD who has done well up until this week when she experienced increased cough productive of yellow sputum, mild dyspnea and wheezing. PE significant for RR of 20, pulse ox of 90% on room air, and scattered wheezes and rhonchi on lung auscultation. Which one of the following would be most appropriate for you to prescribe at this time?

- 19% A. Oxygen
- 1% B. Theophylline
- 10% C. Chest physiotherapy
- 70% ✓ D. Antibiotics

Global Strategy for Diagnosis, Management and Prevention of COPD

Acute COPD Exacerbations: Treatment Options

Oxygen: titrate to target O₂ saturation of 88-92%.

Bronchodilators: Short-acting inhaled beta₂-agonists with or without short-acting anticholinergics are preferred.

Systemic Corticosteroids: 40 mg prednisone per day for 5 days is recommended.

Nebulized magnesium – No (Ann Thoracic Med 2014).

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Acute COPD Exacerbations

Antibiotics should be given in exacerbation of COPD with all three symptoms: (SOR B)

- Increased **dyspnea**
- Increased **sputum volume**
- Increased **purulence** or
- If hospitalized for COPD and mechanical ventilation (invasive or non-invasive) is required

Acute COPD Exacerbations

- Antibiotics
 - Which bacteria to cover?
 - *S. pneumoniae*, *H. influenzae*, *M. catarrhalis*,
M. pneumoniae
 - Which agent to use?
 - *Optimal choice has not been determined*: amoxicillin, macrolides, cephalosporins, quinolones all have been used successfully

Acute COPD Exacerbations

- No longer routinely recommended:
 - Theophylline
 - Mucolytics
 - Nitric oxide
 - Chest physiotherapy
 - Antitussives
 - Morphine

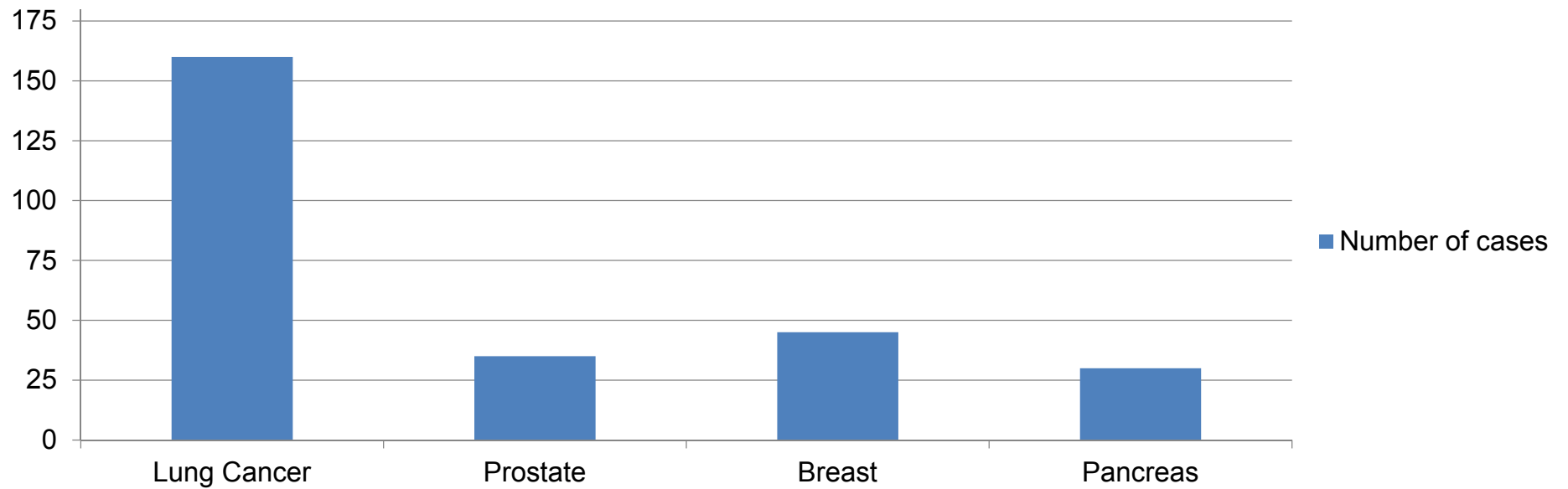
Lung Cancer

- #1 cancer in men and women
- 158,000 people, 27% of cancer deaths; 374,000 people in the US are living with cancer
- 81% are over 60 years of age
- The 5-year survival rate (16.3%) is lower than many other cancers: colon (65.2%), breast (90.0%), prostate (99.9%).

Amer. Lung Assoc. Facts 2015

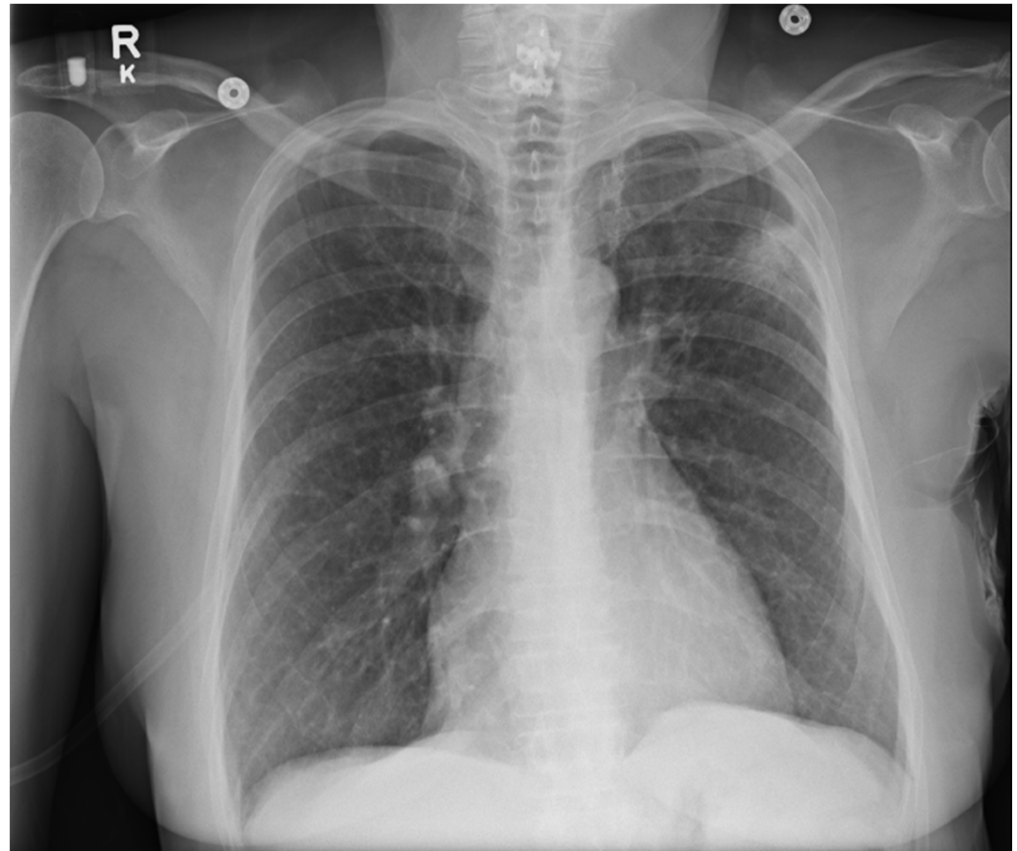
Lung Cancer

Number of cases



Lung Cancer Causes

- 90% due to smoking
- Radon and asbestos 5-10%
- Air pollution 1-2% (higher in developing countries)



Lung Cancer

- The five-year survival rate for lung cancer is 54% for cases detected when the disease is still localized within the lungs
- Only 15% of lung cancer cases are diagnosed at an early stage. Later stage 5-year survival rate is only 4%
- Over half of people with lung cancer die within one year of being diagnosed

Lung Cancer Pathology

- Small Cell – 20%
 - Central/mediastinal location
 - Aggressive
 - Early mets
 - Poor prognosis
 - Primary Tx: chemo
- Non-small Cell
 - Adenocarcinoma – 40%
 - Peripheral location
 - Often occur with underlying lung disease
 - Squamous Cell – 25%
 - Large Cell – 10%
 - Primary Tx: resection

8. Which one of the following is currently recommended regarding screening for lung cancer in smokers age 55-80?

- A. Chest x-ray one time only at diagnosis
- B. Low-dose lung CT one time only at diagnosis
- C. Annual low-dose lung CT
- D. No screening is indicated

8. Which one of the following is currently recommended regarding screening for lung cancer in smokers age 55-80?

- 1% A. Chest x-ray one time only at diagnosis
- 25% B. Low-dose lung CT one time only at diagnosis
- 53% ✓ C. Annual low-dose lung CT
- 21% D. No screening is indicated

Lung Cancer Screening

- **USPSTF recommendation (B):** annual low-dose lung CT ages 55-80; accompanied by stop-smoking advice
- If 30 pack-year history of smoking or more
- Can stop screening if patient has quit smoking for 15 years
- Need ability to follow up and investigate nodules if found
- Best done at experienced centers
- Based on results of the National Lung Screening Trial 2012

Obstructive Sleep Apnea (OSA)

- OSA is caused by a blockage of the airway, soft tissue in the rear of the throat collapses during sleep, leading to snoring, poor sleep, poor oxygenation, and apneic periods.
- It affects 10-15% of the population
- *Everyone with OSA snores, but not everyone who snores has OSA!*
- Risk factors include **O**besity (most important risk!), **S**ex (male), and **A**ge over 40, but sleep apnea can strike anyone at any age.

OSA Consequences

- High blood pressure
- CVD
- Sleep disturbance
- Memory problems
- Weight gain, impotence, headaches
- May lead to daytime sleepiness, job impairment, and motor vehicle crashes

OSA Symptoms

- Nocturnal
 - ***Snoring****
 - Apneas
 - Choking
 - Nocturia
 - Disrupted sleep
 - Daytime
 - Nonrestorative sleep
 - Morning headache
 - Excessive ***Sleepiness****
 - Cognitive deficits
 - ***Significant other**** complaints
- *3 S's of OSA: cardinal symptoms**

OSA Diagnosis

- Epworth Sleepiness Scale, 0-3 for each factor
- Sitting, in a car, watching TV, etc.
- Scoring:
 - 0-10: Normal
 - 10-12: Borderline
 - 13-24: Abnormal

OSA Diagnosis

- **Sleep study** (polysomnography), whole night or a “split-night” study. If OSA is found, the patient is awakened and fitted with a PAP device and re-tested.
- The **apnea-hypopnea index**, or AHI. An **apnea** is not breathing for > 10 seconds. **Hypopnea** is a constricted breath that lasts > 10 seconds. The AHI is the number of apneas and hypopneas per hour.
- An AHI of 5 to 15 is mild; 15 to 30 is moderate; > 30 is severe OSA

OSA Treatment

- Weight loss (a factor in 70% of cases)
- Nasal decongestant
- Positional therapy (tennis ball behind the head)
- Surgery—multiple options, individual; uvulopalatopharyngoplasty, or UPPP
- Mandibular advancement device (sleeping appliance)
- Positive airway pressure device

OSA Treatment

- CPAP or BiPAP
 - Indicated for Mod OSA (AHI >15) or Mild OSA (AHI 5-15) with comorbidities
- PAP is the most effective treatment, per AHRQ 2011 national report
- Reduces AHI
- Reduces blood pressure
- Improves daytime alertness

Sarcoidosis

- An inflammatory auto-immune disease condition that most commonly (90%) impacts the lungs, but may involve other organs
- Cause unknown
- Course often waxes and wanes
- More common in African Americans (10-20 X), sl. more common in women, usually starts age 20-40

Sarcoidosis Symptoms

- Shortness of breath, cough
- Reddish bumps or patches on the skin
- Enlarged lymph nodes in the chest, neck, axillae
- Fever, weight loss, fatigue, night sweats, general feeling of ill health
- Lofgren's syndrome – acute form of sarcoid – erythema nodosum, fever, arthritis, self-limited

Sarcoidosis Initial Evaluation

History (occupational and environmental exposure, symptoms)

Physical examination

AP chest radiograph

Pulmonary function test

Complete blood count, Serum chemistries

Urinalysis

EKG

Routine ophthalmologic examination

Tuberculin skin test

Adapted from the American Thoracic Society Guidelines for Sarcoidosis

Sarcoidosis Diagnosis

- Granulomas in lung tissue biopsy
- Typical signs and symptoms of sarcoidosis like picture
- Abnormal CXR or lung CT



Extra Pulmonary Manifestations

- 90% confined to lung, but may involve:
 - Eye – acute anterior uveitis
 - Skin – cutaneous involvement, erythema nodosum
 - Neurosarcoidosis – may have intracranial lesions or peripheral neuropathy
 - Cardiac granulomas – cardiomyopathy
- Symptoms may resolve in 2-3 years, or may persist indefinitely

Sarcoidosis Treatment

- No specific treatment or cure; Focus is on management of symptoms, anti-inflammatory meds, reduced lung exposure to toxins, and nutrition
- Follow patients every 3 months in the first two years, then less often depending on severity per ATS guidelines
- Follow angiotensin-converting enzyme (ACE) levels in the blood to follow disease activity
- **Corticosteroids** are mainstay of treatment (start 20-40 mg a day, 5-10 mg a day maintenance)
- Also used: methotrexate, azathioprine, chloroquine, etanercept (Enbrel), infliximab (Remicaide) – consult Pulmonary

Wegener's Granulomatosis

- Necrotizing granulomatous vasculitis affecting upper and lower respiratory tract with focal segmental glomerulonephritis
- Unknown cause; more common in young or middle age (esp males)
- Early diagnosis can lead to full recovery; without treatment, Wegener's can be fatal
- Sx: cough, chest pain, dyspnea, malaise, blood in the urine
- Incr. sed rate; anti-neutrophil cytoplasmic bodies (**ANCA**); CBC, U/A
- **Corticosteroids** are mainstay of treatment, also azathioprine, methotrexate; Rituximab approved by FDA
- Consult Pulmonary, Nephrology

Resources and References

- American Thoracic Society website:
<http://www.thoracic.org/clinical/copd-guidelines/>
- American Lung Association website: <http://www.lung.org/lung-disease/lung-cancer/resources/facts-figures/lung-cancer-fact-sheet.html>
- Sarcoidosis, and x-rays used:
<http://www.aafp.org/afp/2004/0715/p312.html>
- GOLD 2015 guidelines and therapy slides:
- With permission, from the *Global Strategy for the Diagnosis, Management and Prevention of COPD*, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2015. Available from:
<http://www.goldcopd.org/>.

Answers

1. C
2. A
3. B
4. C
5. D
6. B
7. D
8. C

Thank you!