COPD: Use of Office Spirometry to Monitor Disease & Smoking Cessation Strategies

William W. Stringer, MD, FACP, FCCP
Professor and Chair
Department of Medicine
Harbor-UCLA Medical Center
Torrance, California

Disclosures:
COPD: Clinical Trials with GSK, Otsuka/Kendle

COPD – Outline
- Epidemiology and Classification of COPD
- Physiology + Pathophysiology + Diagnosis
- Smoking Cessation
- Use/Utility of Office Based Spirometry
- What’s new with COPD Therapy


Source: NHLBI/NIH/DHHS

USA Per Capita Cigarette Consumption
FYI: 1/2 PPD (10 cigarettes) x 365 days a year = 3,650 cigarettes
Radiographic Evidence Linking Smoking to Lung Cancer

COPD – Epidemiology / Costs

- COPD – Prevalence in USA
  - Ages 25-75 – NHANES Data 6-8%
- 4th leading cause of death in USA and Europe (over 2.7 million deaths) → Not counting Lung CA
- Mortality in women has doubled in past 20 years.
- 50-75% of costs associated with AECOPD

COPD – Epidemiology / Costs

- COPD Costs >> ASTHMA

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prevalence, N</th>
<th>Mortality, N</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>15 million</td>
<td>100,000/year</td>
<td>$25 billion/year</td>
</tr>
<tr>
<td>Asthma</td>
<td>10 - 12 million</td>
<td>5000-6000/year</td>
<td>$12 billion/year</td>
</tr>
</tbody>
</table>


Clinical Course of COPD

- Exacerbations
- Deconditioning
- Reduced Exercise Capacity
- Breathlessness
- Inactivity
- Poor Health-Related Quality of Life
- Disability
- Disease progression
- Death

Adapted from Decramer M. Eur Respir Rev. 2006;15:51-57.
COPD – Distinctive Types

- **Emphysema – Pink Puffer**
  - Respiration Airspace Enlargement
    - c. Paraseptal: distal part of acinus, usually close to pleura → spondyloneumothorax in young adults.

- **Chronic Bronchitis – Blue Blower**
  - a. Sputum product for 3 mos/yr for at least 2 yrs due to excessive secretion of bronchial mucus glands.
  - b. Bronchial smooth muscle hyperplasia.
  - c. Edema and chronic inflammation (PMN’s).

- **Bronchiectasis**
  - a. Thickening and dilation of the lower respiratory tract. Seen with chronic infections, foreign bodies, pre antibiotic pneumonias, etc.

Mechanisms of Airflow Limitation in COPD

Causes of Death in COPD


Calverley, P et al. TORCH NEJM 356:8 775-789, 2007
Predictors of COPD Mortality

- High BODE index
- Multiple severe exacerbations
- CVD
- Decreased FEV₁
- Dyspnea
- Hyperinflation (IC/TLC ≤ 25%)
- Pulmonary hypertension
- Impaired Exercise Performance
- Depression
- Low BMI

Survival in COPD

Risk Factors for COPD

Exposure to particles
- Tobacco smoke
- Occupational dusts, organic and inorganic
- Indoor air pollution from heating and cooking with biomass in poorly ventilated dwellings
- Outdoor air pollution

Oxidative stress
Gender
Age
Respiratory infections
Socioeconomic status
Nutrition
Co-morbidities
Genetics
Lung growth and development

Differential Diagnosis: COPD and Asthma

COPD
- Onset in mid-life
- Symptoms slowly progressive
- Long smoking history
- Dyspnea during exercise
- Largely irreversible airflow limitation with a low DLCO

ASTHMA
- Onset early in life (often childhood)
- Symptoms vary from day to day
- Symptoms at night/early morning
- Allergy, rhinitis, and/or eczema also present
- Family history of asthma
- Largely reversible airflow limitation with a normal DLCO
Relationship Between Asthma, COPD, and Emphysema


Flow Volume Loops: Normal vs. COPD

COPD / Airflow Obstruction: Grade Severity with Flow Volume Loop

Spirometry: Normal and Patients with COPD
Classification of COPD Severity by Spirometry

Stage I: Mild  
FEV₁ > 80% predicted

Stage II: Moderate  
50% ≤ FEV₁ < 80% predicted

Stage III: Severe  
30% ≤ FEV₁ < 50% predicted

Stage IV: Very Severe  
FEV₁ < 30% predicted or FEV₁ < 50% predicted plus chronic respiratory failure

Question # 1

- All of the following office history and spirometry values support the diagnosis of moderate COPD except:

A. FEV₁/FVC < 0.7
B. FEV₁ between 50 – 79% of predicted FEV₁
C. FEV₁/FVC > 0.7
D. > 20 pack years of smoking

Pathophysiological Features of COPD

- Airway Obstruction
  - Smooth muscle contraction
  - Cholinergic tone
  - Loss of elastic recoil

- Inflammation
  - Neutrophils
  - Macrophages
  - CD4+ lymphocytes
  - IL-8 and TNF-α

- Structural Changes
  - Alveolar destruction
  - Collagen deposition
  - Glandular hypertrophy
  - Airway fibrosis

100-year-old celebrates her birthday by smoking 170,000th cigarette

Objectives of COPD Management

• Prevent disease progression
• Relieve symptoms
• Improve exercise tolerance
• Improve health status
• Prevent and treat exacerbations
• Prevent and/or treat complications (e.g. Lung CA)
• Reduce mortality
• Minimize side effects from treatment

GOLD Guidelines: Management Principles in COPD

Four components:

• Assess and monitor severity
• Reduce risk factors
• Manage stable COPD
  - Education
  - Pharmacologic therapy
  - Nonpharmacologic approaches
• Treat exacerbations

COPD – Current and Future Categories of Therapy

• Smoking Cessation
• Beta-Agonists
  - SA e.g. albuterol
  - LA e.g. salmeterol
• Anticholinergics
  - SA e.g. ipratropium
  - LA e.g. tiotropium
• Methylxanthines
• Vaccines
• Antibiotics
• Mucolytics

COPD Medications / Clinical Outcomes

Table 2. Effect of commonly used medications on important clinical outcomes in chronic obstructive pulmonary disease

Barnes, P.J. Thorax 58: 803-808, 2003

Smoking Cessation:
Surgeon General Report

- 80% of smokers want to quit (> 40 M)
- Pharmacologic treatment of nicotine addiction combined with behavior support, will enable 20-25% of users to remain abstinent at 1 year post-treatment.
- Physician’s advising patient to quit can result in 5-10% cessation rates / year.
- Six first line medications FDA approved
  - Nicotine Replacement Therapy
    - gum, inhaler, nasal spray, and patch
  - Non-Nicotine Medications (bupropion and varenicline)
- Second line (non-FDA) (clonidine and nortriptyline)

[http://www.cdc.gov/tobacco](http://www.cdc.gov/tobacco) and [http://www.surgeongeneral.gov/tobacco/smokesum.htm](http://www.surgeongeneral.gov/tobacco/smokesum.htm)

COPD
Smoking Cessation

- **Patient Ready to Quit**
  - 5A’s
    - Ask—systematically identify all tobacco users at every visit
    - Advise—strongly urge all tobacco users to quit
    - Assess—determine willingness to make a quit attempt
    - Assist—aid the patient in quitting
    - Arrange—schedule follow-up contact

- **Patient Not Ready to Quit**
  - 5R’s
    - Relevance
    - Risks
    - Rewards
    - Roadblocks
    - Repetition

Newer Drugs for Smoking Cessation

- **Varenicline**
  - Nicotine Partial Agonist reduces craving and WD Sx
- **Randomized, Placebo Controlled Trial**
  - 3,920 Smokers, Ages 18-75, all smoked > 10 cigs/day, 19 sites in USA
  - All got Smoking Cessation Counseling
  - Varenicline vs Bupropion vs Placebo for 12 weeks
- **Primary Outcome:**
  - Exhaled CO checked q 4 weeks.
    - **Abstinence**:
      - Varenicline 45%
      - Bupropion 25%
      - Placebo 15%
    - **Weeks 9-12**:
      - Varenicline 22%
      - Bupropion 18%
      - Placebo 8%
  - Side Effects: Nausea (28%) with Varenicline and Nausea with Bupropion (22%)


Varenicline for Smoking Cessation

Nicotine Nasal Spray with Nicotine Patch for Smoking Cessation

- 237 smokers followed for 6 years
- Combination of a 5 month nicotine patch + nicotine nasal spray is more effective for smoking cessation than the patch alone


Varenicline: Most Common Adverse Events
From 12-week Fixed-Dose, Placebo-Controlled Studies

<table>
<thead>
<tr>
<th>Adverse Event</th>
<th>Varenicline 0.5 mg BID (n = 129)</th>
<th>Varenicline 1 mg BID (n = 821)</th>
<th>Placebo (n = 805)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>16%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Insomnia*</td>
<td>19%</td>
<td>13%</td>
<td>5%</td>
</tr>
<tr>
<td>Abnormal</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Constipation</td>
<td>2%</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>Flatulence</td>
<td>2%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>2%</td>
<td>5%</td>
<td>2%</td>
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* Includes Preferred Terms: Insomnia/initial insomnia/middle insomnia/early morning awakening

Varenicline Warning

- Psychiatric symptoms
  - Changes in behavior
  - Agitation
  - Depressed mood
  - Suicidal ideation
  - Suicidal behavior
- “Advise patients and caregivers that the patient should stop taking CHANTIX (varenicline) and contact a health care provider immediately if agitation, depressed mood, or changes in behavior that are not typical for the patient are observed, or if the patient develops suicidal ideation or suicidal behavior.”

Varenicline package insert. Available at:

Question # 2

- All of the following are true about smoking cessation except:
  A. Tobacco smoking continues to be the number one cause of preventable disease and death in the USA.
  B. More than four in five smokers say they want to quit.
  C. Combining smoking cessation interventions such as physician advice / follow-up with nicotine gum and behavior modification increases success rates.
  D. Smoking rates in males and females in the USA continue to be above 50%.
COPD THERAPY

Therapy at Each Stage of COPD

1: Mild
- FEV1/FVC < 70%
- FEV1 > 80% predicted

II: Moderate
- FEV1/FVC < 70%
- 50% < FEV1 < 80% predicted

III: Severe
- FEV1/FVC < 70%
- 30% < FEV1 < 50% predicted

IV: Very Severe
- FEV1/FVC < 70%
- FEV1 < 30% predicted or FEV1 < 50% predicted plus chronic respiratory failure

Active reduction of risk factor(s); influenza vaccination
Add long-acting bronchodilator (when needed)
Add regular treatment with one or more long-acting bronchodilators (when needed)
Add rehabilitation
Inhaled glucocorticosteroids if repeated exacerbations
Add long-term oxygen if chronic respiratory failure. Consider surgical treatments

Indications for Spirometry

Diagnostic
- To evaluate symptoms, signs or abnormal laboratory tests
- To measure the effect of disease on pulmonary function
- To screen individuals at risk of having pulmonary disease
- To assess pre-operative risk
- To assess prognosis
- To assess health status before beginning intensive physical activity programmes

Monitoring
- To assess therapeutic intervention
- To describe the course of diseases that affect lung function
- To monitor people exposed to noxious agents
- To monitor for adverse reactions to drugs with known pulmonary toxicity

Dyspnea/Impairment evaluations
- To assess patients as part of an rehabilitation programme
- To assess risk as part of an insurance evaluation
- To assess individuals for legal reasons

Public health
- Epidemiological surveys
- Detection of incidence/epidemics
- Clinical research

Spirometry
Peak Flow vs FEV₁ and FVC

Airflow Obstruction: Flow Volume Loop

Normal Pattern: N

Pulmonary Function Tests
# 1 Air Pump

Lung Volumes

Flows

Obstruction – Decreased Flow Rates

Restriction – Reduced Lung Volumes

<table>
<thead>
<tr>
<th>Obstruction</th>
<th>FEV₁</th>
<th>FVC</th>
<th>FEV₁/VC</th>
<th>TLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓ ≤ 80% predicted</td>
<td>↓ ↔ Or ↓</td>
<td>↓ ↔ Or ↑</td>
<td></td>
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<th>Restriction</th>
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<td></td>
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↓ = < 80% predicted, ↑ = > 120 % predicted, ↔ = normal
Gas Transfer: **DLCO** = Diffusing Capacity of the Lung for CO (Carbon Monoxide)

<table>
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<tr>
<th>Reduced DLCO</th>
<th>Elevated DLCO</th>
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<tbody>
<tr>
<td>&quot;Loss&quot; of Pulmonary Vascular Bed</td>
<td>&quot;Gain&quot; of Pulmonary Vascular Bed</td>
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- Anemia
- Pulmonary Embolism
- Emphysema
- Pulmonary Fibrosis
- Sarcoidosis
- PCP (PJP)

- Polycythemia
- CHF
- Asthma / Chronic Bronchitis
- Obesity
- Left to Right Shunt
- Alveolar Hemorrhage

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Office Based Spirometers

Office Based Peak Flow Meters
Office Based Spirometry

- **Indications:**
  - Diagnose Asthma and COPD
  - Stage the severity of disease (mild, moderate, severe)
  - Measure effects of therapy
  - Evaluate dyspnea
  - Pre-operative evaluation
  - Measure effects of work space exposure


Airflow Obstruction

Office Based Spirometry

- **Indications:**
  - PCPs should perform an office based spirometry test for patients ≥ 45 yo who smoke currently.
  - Rational: Safe, simple, economical.
  - Detect early, treat early, support smoking cessation efforts.
  - If undetected, can go on to significant morbidity and mortality. (? Change mortality)

Reporting “Lung Age” Increases Smoking Quit Rate

- 561 current smokers over 35
- All offered spirometry
  - Intervention “lung age” concept explained
  - If lung age was equal to or less than individual’s chronological age, subject was informed test was normal
  - If lung age was greater than chronological age, results were reported as “lung age”
  - Control group “raw figure” FEV1
  - No results given
- Confirmed smoking cessation at 1y
  - 6.4% controls
  - 13.6% intervention, P = 0.005


Office Based Spirometry

- Explain the procedure
- Demonstrate the maneuver
- Coach the patient
  - Sit up
  - Deep Breath
  - Blast it out* & hold for 6 seconds
- Obtain at least 3 good maneuvers
- Explain the results & document them in the chart.


Patient Action Plan

- Check spirometer accuracy (daily calibration check)
- Measure the patient’s height
- Wash your hands
- Ask the patient to sit for the test
- Loose restrictive clothing
- Place nose clamps in a cap
- Optionally, use noseclips

Case - #1

- 45 yo accountant. Chronic cough, especially at night for 2 years. Occasional dyspnea with walking stairs.
- Smoked 1 ppd for 22 years, “stopped last week”...
- Brother with asthma since childhood.
- PE is normal.

Case - #2

Survey Says?

A. Normal
B. Moderate COPD
C. Moderate Asthma
D. Artifact

Useful Web Sites

- Global Initiative on Obstructive Lung Disease Guidelines
  www.goldcopd.com
  www.thoracic.org/sections/copd/index.html
- COPD Foundation
  http://www.copdfoundation.org
- VA COPD Guidelines
  www.va-copd.med.va.gov
- CIRCULATE-Chronic Obstructive Pulmonary Disease Education for Specialists
  www.CIRCULATEcme.org
- National Jewish Health
  www.nationaljewish.org
Smoking Cessation Resources

• Clinical Practice Guideline: Treating Tobacco Use and Dependence
  http://www.surgeongeneral.gov/tobacco/treating_tobacco_use.pdf
• QuitNet
  http://www.quitnet.com/
• American Cancer Society
  http://www.cancer.org/docroot/PED/content/PED_10_13X_Guide_for_Qutting_Smoking.asp#How_to_Quit
• NHLBI: Quitting Smoking
  http://www.nhlbi.nih.gov/hbp/prevent/q_smoke/q_smoke.htm
• State of New York Department of Health
  http://talktoyourpatients.org/