Disclosures

None
Case

45 year old man presents to the clinic complaining of 6 months of increased shortness of breath mainly with exertion and occasional cough. He denies any chest pain, weight loss or fever.

PMH: HTN controlled on HCTZ

All: None

SoHx: Smokes 1 PPD since he was 15; Drinks alcohol 2 six-packs of beer per week; no drug use. Works as a car salesman

On examination, he is in no distress. Vitals are within normal limits. Lung examination reveals bilateral wheezing; no crackles. Cardiac exam shows regular rate and rhythm with no added sounds
Case

<table>
<thead>
<tr>
<th>Test</th>
<th>Predicted</th>
<th>Before Bronchodilator</th>
<th>After Bronchodilator</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>3.5</td>
<td>2.5</td>
<td>2.95</td>
<td></td>
</tr>
<tr>
<td>FVC%</td>
<td>79%</td>
<td>93%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV1</td>
<td>2.3</td>
<td>1.15</td>
<td>1.55</td>
<td>+34%, 300ml</td>
</tr>
<tr>
<td>FEV1%</td>
<td>54%</td>
<td>73%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>50%</td>
<td>67.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEFR</td>
<td>476</td>
<td>280</td>
<td>320</td>
<td></td>
</tr>
</tbody>
</table>
What is this patient’s diagnosis?

A. Asthma
B. Emphysema
C. COPD
D. Asthma and COPD Overlap syndrome
E. Chronic bronchitis
## COPD vs. ASTHMA

<table>
<thead>
<tr>
<th>COPD</th>
<th>Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-life onset</td>
<td>Early onset</td>
</tr>
<tr>
<td>Progressive symptoms</td>
<td>Varying symptoms</td>
</tr>
<tr>
<td>Irreversible or poorly reversible airflow limitation</td>
<td>Largely reversible airflow limitation</td>
</tr>
<tr>
<td>Smoking history</td>
<td>May have accompanying history of allergic rhinitis and eczema</td>
</tr>
<tr>
<td>Macrophages and neutrophils</td>
<td>Eosinophils and mast cells</td>
</tr>
<tr>
<td>CD8 T cells</td>
<td>CD4 T cells</td>
</tr>
<tr>
<td>LTB4</td>
<td>LTD4</td>
</tr>
<tr>
<td>Cytokines</td>
<td>Cytokines</td>
</tr>
<tr>
<td>IL 8; TNF</td>
<td>IL 4; IL 5; IL 13</td>
</tr>
</tbody>
</table>
Histopathologic Differences Between Asthma, Chronic Bronchitis and Emphysema
COPD
COPD: A Multi-component Disease

- Mucus hypersecretion
- Reduced mucociliary transport
- Mucosal damage

- Increased numbers of inflammatory cells/activation:
  - CD8+ T-lymphocytes
  - Monocytes/macrophages
  - Neutrophils
  - Mast cells
  - Elevated inflammatory mediators: IL-8, TNF-α, LTB-4, and oxidants
  - Protease/anti-protease imbalance

- Mucociliary dysfunction
- Airflow limitation
- Airway inflammation
- Structural changes

- Goblet cell hyperplasia/metaplasia
- Mucous gland hypertrophy
- Increased smooth muscle mass
- Airway fibrosis
- Alveolar destruction

- Systemic component
  - Poor nutritional status
  - Reduced BMI
  - Impaired skeletal muscle
    - Weakness
    - Wasting

- Loss of alveolar attachments
- Loss of elastic recoil
- Increased smooth muscle contraction
- Mucous gland hypertrophy
- Alveolar destruction
- Reduced BMI
- Impaired skeletal muscle
  - Weakness
  - Wasting

- Poor nutritional status
- Reduced BMI
- Impaired skeletal muscle
  - Weakness
  - Wasting

- Mucous gland hypertrophy
- Alveolar destruction
- Reduced BMI
- Impaired skeletal muscle
  - Weakness
  - Wasting
A Normal Lung

- Distal airway
- Alveolar attachments

Maximal Expiratory Flow Rate (liters/sec)

- Forced Vital Capacity
- Residual Volume

% of Predicted Total Lung Capacity

Lung Volume (% of predicted total lung capacity)

End-expiratory lung volume at rest

Rest Increasing Exercise Intensity

B COPD

- Distal airway
- Alveolar attachments

Maximal Expiratory Flow Rate (liters/sec)

- Forced Vital Capacity
- Residual Volume

% of Predicted Total Lung Capacity

Lung Volume (% of predicted total lung capacity)

End-expiratory lung volume at rest

Rest Increasing Exercise Intensity
Assess symptoms
Assessment of COPD: Symptoms

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of Breathlessness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I only get breathless with strenuous exercise</td>
</tr>
<tr>
<td>1</td>
<td>I get short of breath when hurrying on level ground or walking up a slight hill</td>
</tr>
<tr>
<td>2</td>
<td>On level ground, I walk slower than people of the same age because of breathlessness, or have to stop for breath when walking at my own pace</td>
</tr>
<tr>
<td>3</td>
<td>I stop for breath after walking about 100 yards or after a few minutes on level ground</td>
</tr>
<tr>
<td>4</td>
<td>I am too breathless to leave the house or I am breathless when dressing</td>
</tr>
</tbody>
</table>

Global Strategy for Diagnosis, Management and Prevention of COPD: Assessment of COPD

Assess symptoms

Assess degree of airflow limitation using spirometry
Assessment of Airflow Limitation: Spirometry

- Spirometry should be performed AFTER the administration of a short-acting inhaled bronchodilator

- A post-bronchodilator $\text{FEV}_1/\text{FVC} < 0.70$ confirms the presence of airflow limitation *

- Where possible, values should be compared to age-related normal values to avoid overdiagnosis of COPD in the elderly.
Assessment of Airflow limitation

**Severity of Obstruction**

- **I: Mild**
  - FEV\(_1\) ≥ 80%

- **II: Moderate**
  - FEV\(_1\) 50% to 79%

- **III: Severe**
  - FEV\(_1\) 30% to 49%

- **IV: Very Severe**
  - FEV\(_1\) < 30%

**Post-bronchodilator**

FeV\(_1\)/FVC < 70%

---

**Assessment of Airflow limitation**

**Table 1. Stage and Severity of COPD According to Postbronchodilator Spirometry.**

<table>
<thead>
<tr>
<th>Stage and Severity of COPD</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1 — mild</td>
<td>FEV(_1):FVC &lt; 0.70, FEV(_1) ≥ 80% of predicted value</td>
</tr>
<tr>
<td>Stage 2 — moderate</td>
<td>FEV(_1):FVC &lt; 0.70, FEV(_1) 50 to 79% of predicted value</td>
</tr>
<tr>
<td>Stage 3 — severe</td>
<td>FEV(_1):FVC &lt; 0.70, FEV(_1) 30 to 49% of predicted value</td>
</tr>
<tr>
<td>Stage 4 — very severe</td>
<td>FEV(_1):FVC &lt; 0.70, FEV(_1) &lt; 30% of predicted value or FEV(_1) &lt; 50% of predicted value plus chronic respiratory failure</td>
</tr>
</tbody>
</table>

Adapted from the Global Initiative for Chronic Obstructive Lung Disease. COPD denotes chronic obstructive pulmonary disease, FEV\(_1\) forced expiratory volume in 1 second, and FVC forced vital capacity.
Global Strategy for Diagnosis, Management and Prevention of COPD: Assessment of COPD

Assess symptoms

Assess degree of airflow limitation using spirometry

Assess risk of exacerbations

High risk

Two exacerbations or more within the last year

FEV$_1$ < 50% of predicted value
Assessment of COPD


Severity of Obstruction

I: Mild
FEV₁ ≥80%

II: Moderate
FEV₁ 50% to 79%

III: Severe
FEV₁ 30% to 49%

IV: Very Severe
FEV₁ <30%

Symptoms

A
Mild-Mod Obstruction
Minimal Symptoms
Few Exacerbations

B
Mild-Mod Obstruction
Severe Symptoms
Few Exacerbations

C
Severe Obstruction
Minimal Symptoms
++ Exacerbations

D
Severe Obstruction
Severe Symptoms
++ Exacerbations

Exacerbations

None

1 per year

≥ 2 or more per year

Modified Medical Research Council Dyspnea Score

0 1 2 3 4

High Risk

Post-bronchodilator

FEV₁/FVC <70%

Worse obstruction

High Risk

More Severe

Frequent exacerbations
Goals for the Treatment of COPD

- Relieve symptoms
- Improve exercise tolerance
- Improve health status
- Prevent disease progression
- Prevent and treat exacerbations
- Reduce mortality

REDUCE SYMPTOMS

REDUCE RISK

Management of COPD: *Non-pharmacologic Approaches*

- Smoking cessation
  - Avoidance of indoor and outdoor occupational exposures
- Vaccinations
  - Influenza
  - Pneumococcal – no documented evidence
- Optimizing nutrition
- Oxygen
- Pulmonary rehabilitation
- Surgical interventions (LVRS, transplantation)
Management: Non-pharmacological Overview

A
Stage: Mild-Moderate
Minimal Symptoms
Exacerbations (0-1/yr)
Active reduction of risk factors
Administer vaccinations (influenza/pneumococcal)
Increase physical activity
Add pulmonary rehabilitation

B
Stage: Mild-Moderate
Severe symptoms
Exacerbations (0-1/yr)

C
Stage: Severe-Very Severe
Minimal Symptoms
Exacerbations (≥2/yr)
Consider evaluation for need for supplemental oxygen

D
Stage: Severe-Very Severe
Severe Symptoms
Exacerbations (≥2/yr)
Consider surgical eval

Criteria for Long-term Oxygen Therapy

• PaO2 < 55 mm Hg or SaO2 < 88%
• PaO2 < 59 mm Hg and evidence of at least one of the following:
  ◦ Pulmonary Hypertension (P wave > 3 mm in LII, LIII, or aVF)
  ◦ Cor pulmonale (dependent edema)
  ◦ Erythrocytosis (Hct > 56%)

(Certificate of Medical Necessity, HCFA-484)
Pulmonary Rehabilitation

<table>
<thead>
<tr>
<th>Common indications</th>
<th>Essential components</th>
</tr>
</thead>
<tbody>
<tr>
<td>◦ Anxiety with activity</td>
<td>◦ Education</td>
</tr>
<tr>
<td>◦ Breathlessness</td>
<td>◦ Exercise training</td>
</tr>
<tr>
<td>◦ Limitations with activity</td>
<td>◦ upper-extremity</td>
</tr>
<tr>
<td>◦ Loss of independence</td>
<td>◦ lower-extremity</td>
</tr>
<tr>
<td></td>
<td>◦ strength</td>
</tr>
<tr>
<td></td>
<td>◦ respiratory-muscle</td>
</tr>
<tr>
<td></td>
<td>◦ Psychosocial/behavioral</td>
</tr>
</tbody>
</table>
Pharmacotherapy

Most patients will experience improvement in their symptoms with the use of bronchodilator therapy.

There are several classes of bronchodilators available for the treatment of obstructive airway diseases (both acute and chronic)

◦ Anticholinergics
◦ Beta-2 agonists
◦ Methyl-xanthines
**Management: Pharmacological Overview**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Exacerbations (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild-Moderate</td>
<td>Minimal Symptoms</td>
<td>0-1/yr</td>
</tr>
<tr>
<td>Severe</td>
<td>Severe symptoms</td>
<td>≥2/yr</td>
</tr>
</tbody>
</table>

**A. Stage: Mild-Moderate**
- Minimal Symptoms
- Exacerbations (0-1/yr)
- Add short-acting bronchodilator (as needed)
- Add one or more long-acting bronchodilator(s): scheduled
- Add pulmonary rehabilitation

**B. Stage: Severe**
- Severe symptoms
- Exacerbations (≥2/yr)
- Consider adding inhaled corticosteroid***

**C. Stage: Severe-Very Severe**
- Minimal Symptoms
- Exacerbations (≥2/yr)
- Consider PDE4-inhibitor

---

***Never use an inhaled corticosteroid as a single agent in patients with COPD (inhaled corticosteroids are not approved by the FDA as a single agent for COPD and they should always be prescribed with a long-acting bronchodilator)***

---

<table>
<thead>
<tr>
<th>Drug</th>
<th>Formulation</th>
<th>Delivery Device</th>
<th>Inhalations/Unit</th>
<th>Usual Adult Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-Acting Beta₂-Agonists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol generic</td>
<td>90 mcg/inhalation</td>
<td>MDI</td>
<td>200</td>
<td>2 inhalations q4-6h PRN</td>
</tr>
<tr>
<td>Albuterol sulfate generic</td>
<td>2.5 mg base/3 mL</td>
<td>Nebulizer</td>
<td>—</td>
<td>2.5 mg q6-8h PRN</td>
</tr>
<tr>
<td></td>
<td>2.5 mg base/0.5 mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AccuNeb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>single-dose vials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>multi-dose vials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProAir HFA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ventolin HFA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>single-dose vials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levalbuterol hydrochloride</td>
<td>0.31, 0.63, 1.26 mg/mL</td>
<td>Nebulizer</td>
<td>—</td>
<td>0.63-1.25 mg tid q6-8h</td>
</tr>
<tr>
<td>generic</td>
<td>Xopenex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levalbuterol tartrate</td>
<td>45 mcg/inhalation</td>
<td>MDI</td>
<td>200</td>
<td>2 inhalations q4-6h PRN</td>
</tr>
<tr>
<td>generic</td>
<td>Xopenex HFA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pributerol</td>
<td>200 mcg/inhalation</td>
<td>MDI</td>
<td>80, 400</td>
<td>2 inhalations q4-6h PRN</td>
</tr>
<tr>
<td><strong>Short-Acting Anticholinergic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ipratropium generic</td>
<td>250 mcg/mL</td>
<td>Nebulizer</td>
<td>—</td>
<td>500 mcg qid PRN</td>
</tr>
<tr>
<td>generic</td>
<td>Atrovent HFA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 mcg/inhalation</td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td><strong>Short-Acting Beta₂-Agonist/Short-Acting Anticholinergic Combination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol sulfate/ipratropium</td>
<td>90 mcg albuterol base/18 mcg</td>
<td>MDI</td>
<td>200</td>
<td>2 inhalations qid PRN</td>
</tr>
<tr>
<td>Combivent</td>
<td>ipratropium/inhalation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DuoNeb</td>
<td>2.5 mg albuterol base/0.5 mg</td>
<td>Nebulizer</td>
<td>—</td>
<td>2.5 mg/0.5 mg qid PRN</td>
</tr>
<tr>
<td></td>
<td>ipratropium/3 mL</td>
<td></td>
<td></td>
<td>(max 6 doses/d)</td>
</tr>
</tbody>
</table>

HFA = Hydrofluorocarbon, MDI = Metered-dose inhaler

1. Not FDA-approved for use in COPD.
### Long Acting Bronchodilators

#### Table 3. Some Inhaled Long-Acting Bronchodilators

<table>
<thead>
<tr>
<th>Drug</th>
<th>Formulation</th>
<th>Delivery Device</th>
<th>Inhalations/Unit</th>
<th>Usual Adult Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long-Acting Beta&lt;sub&gt;2&lt;/sub&gt;-Agonists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmeterol – Seretide Diskus</td>
<td>50 mcg/blist</td>
<td>DPI</td>
<td>60</td>
<td>50 mcg bid</td>
</tr>
<tr>
<td>Formoterol – Foradil Aerolizer</td>
<td>12 mcg/capsule</td>
<td>DPI</td>
<td>60</td>
<td>12 mcg bid</td>
</tr>
<tr>
<td>Perforomist</td>
<td>20 mcg/2 mL</td>
<td>Nebulizer</td>
<td>—</td>
<td>20 mcg bid</td>
</tr>
<tr>
<td>Arformoterol – Brovana</td>
<td>15 mcg/2 mL</td>
<td>Nebulizer</td>
<td>—</td>
<td>15 mcg bid</td>
</tr>
<tr>
<td><strong>Long-Acting Anticholinergic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tiotropium – Spiriva HandiHaler</td>
<td>18 mcg/capsule</td>
<td>DPI</td>
<td>30</td>
<td>18 mcg once/d</td>
</tr>
<tr>
<td><strong>Corticosteroid/Long-Acting Beta&lt;sub&gt;2&lt;/sub&gt;-Agonist Combinations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluticasone/salmeterol – Advair Diskus&lt;sup&gt;1&lt;/sup&gt;</td>
<td>100, 250, 500 mcg/50 mcg blister</td>
<td>DPI</td>
<td>60</td>
<td>1 Inhalation bid</td>
</tr>
<tr>
<td>Advair HFA&lt;sup&gt;2&lt;/sup&gt;</td>
<td>45, 115, 230 mcg/21 mcg/Inhalation</td>
<td>MDI</td>
<td>120</td>
<td>2 Inhalations bid</td>
</tr>
<tr>
<td>Budesonide/formoterol – Symbicort&lt;sup&gt;3&lt;/sup&gt;</td>
<td>80, 160 mcg/4.5 mcg/Inhalation</td>
<td>MDI</td>
<td>120</td>
<td>2 Inhalations bid</td>
</tr>
<tr>
<td>Mometasone/formoterol – Dulera&lt;sup&gt;2&lt;/sup&gt;</td>
<td>100, 200 mcg/5 mcg/Inhalation</td>
<td>MDI</td>
<td>120</td>
<td>2 Inhalations bid</td>
</tr>
</tbody>
</table>

DPI = Dry powder inhaler, HFA = Hydrofluoroalkane, MDI = Metered-dose inhaler  
1. Only the 250/50 mcg dose is FDA-approved for use in COPD.  
2. Only FDA-approved for treatment of asthma.  
3. Only the 160/4.5 mcg dose is FDA-approved for use in COPD.
Newer Medications - LABA

Arformoterol (Brovana)
- Long acting beta agonist
- Twice daily 15mcg
- Approved for COPD maintenance

Vilanterol
- Selective long acting B2 adrenergic agonist
- Once daily
- Available combined with inhaled steroid fluticasone (Breo Ellipta) or combined with Umeclidinium (Anoro Ellipta)
- Approved for COPD and asthma patients >18 years
Newer Medications-LABA

Indacaterol (Arcapta)
• Ultra-long acting beta agonist
• Once daily
• Approved for COPD maintenance

• Olodaterol
  • Selective long acting B2 adrenergic agonist
  • Once daily 2.5mcg two inhalations
  • Only for maintenance therapy for COPD
  • Available as Steriverdi
Newer Medications- LAMA

Umeclidinium
○ Long acting anti-cholinergic medication
○ Indicated for COPD maintenance therapy
○ Approved for adults
○ Available as Incruse Ellipta

Aclidinium
○ Long acting anticholinergic
○ Indicated for COPD maintenance therapy
○ Available as Tudorza Pressair
Surgical Therapies for COPD

Bullectomy
- For patients with bulla >1/3 of hemithorax

Lung volume reduction surgery
- LVRS offers a mortality and symptomatic benefit in selected patients with emphysema (upper lobe predominant and low post rehab. exercise capacity)

Lung transplantation
- Currently COPD is leading indication for transplant
Novel treatment options

Still under investigation

- Non-surgical bronchoscopic lung volume reduction
COPD exacerbation

Treatment:
- Aggressive bronchodilators
- Antibiotics
- Systemic corticosteroids
- Oxygen if needed
- Non-invasive mechanical ventilation
- Mechanical ventilation
Asthma
Definition of Asthma

- Greek word for panting or breathlessness
- A chronic inflammatory disorder of the airways
- Associated with increase in airway hyper-responsiveness
- Recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning
- Widespread but variable airflow obstruction often reversible spontaneously or with treatment
Major Symptoms of Asthma

Wheezing
- Wheezing during a cold or other illness
- When laughing or crying
- In response to allergens or irritants

Breathlessness

Chest tightness

Cough
- Frequent coughing, particularly at night
- May be the only sign in children
- Especially during cold weather
Initial Assessment and Diagnosis of Asthma

Is airflow obstruction at least partially reversible?

Use spirometry to establish airflow obstruction:
  • $\text{FEV}_1 < 80\%$ predicted;
  • $\text{FEV}_1/\text{FVC} < 70\%$

Use spirometry to establish reversibility:
  • $\text{FEV}_1$ or FVC increases $\geq 12\%$ and at least 200 mL after using a short-acting inhaled beta$_2$-agonist
Additional Tests

• Diurnal Variations in Peak Flow
• Bronchoprovocation Testing
• Chest x-ray
• GERD assessment
Management

Goals

• Reduce impairment
• Reduce risk
Main Components of Asthma Management

I. Initial Assessment and Continuous Monitoring
   • Monitor symptoms, exacerbations, quality of life
   • Periodic pulmonary function tests
# Assessment and Monitoring

<table>
<thead>
<tr>
<th>Severity</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>— Intrinsic intensity of disease during patient’s initial presentation</td>
<td>— Degree to which manifestations of asthma are minimized and goals of long-term control therapy are met</td>
</tr>
<tr>
<td>— <strong>Application:</strong> Used for initiating the appropriate medication</td>
<td>— <strong>Application:</strong> Guides decisions to maintain or adjust therapy</td>
</tr>
</tbody>
</table>

Classifying Severity in Patients >12 Years Not Currently Taking Long-Term Controllers

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Intermittent</th>
<th>Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild</td>
<td>Moderate</td>
</tr>
<tr>
<td>Symptoms</td>
<td>&lt;2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>&lt;2x/month</td>
<td>3-4x/month</td>
</tr>
<tr>
<td>Short-acting β2-agonist use for symptom control</td>
<td>&lt;2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>Minor limitation</td>
</tr>
</tbody>
</table>
| Lung function          | ● Normal FEV₁ between exacerbations 
● FEV₁ >80% predicted 
● FEV₁/FVC normal | ● FEV₁ >80% predicted 
● FEV₁/FVC normal | ● FEV₁ >60% but <80% Predicted 
● FEV₁/FVC reduced 5% | ● FEV₁ <60% predicted 
● FEV₁/FVC reduced >5% |
| Risk                   | 0-2/year (consider frequency and severity) | >2/year (frequency and severity may fluctuate over time) | Relative annual risk of exacerbations may be related to FEV₁ |
### Assessing Asthma Control in Patients ≥12 Years

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Control (Youths &gt;12 years of age &amp; adults)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well-Controlled</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2/month</td>
</tr>
<tr>
<td>Short-acting (\beta_2)-agonist use for symptom control</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>FEV(_1) or peak flow</td>
<td>&gt;80% pred/personal best</td>
</tr>
<tr>
<td>Validated questionnaires</td>
<td>ATAQ</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>≤20</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations</td>
</tr>
<tr>
<td>Reduction in lung growth</td>
<td>Evaluation requires long-term follow-up care.</td>
</tr>
<tr>
<td>Treatment-related adverse effects</td>
<td>Medication side effects vary in intensity from none to very troublesome. Level of intensity does not correlate to specific levels of control but should be considered in overall assessment of risk.</td>
</tr>
</tbody>
</table>
Asthma Control Test™ (ACT)

1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home? 

2. During the past 4 weeks, how often have you had shortness of breath?

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night, or earlier than usual in the morning?

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

5. How would you rate your asthma control during the past 4 weeks?

Assess control at every visit
- Intermittent or mild persistent asthma: every 6 months
- Uncontrolled and/or severe persistent asthma: more often

Patient Total Score
Main Components of Asthma Management

II. Control of triggers
   • Provide Specific Guidance on Environmental Controls
Main Components of Asthma Management

III. Pharmacotherapy
# Pharmacotherapy - Overview of Asthma Medications

<table>
<thead>
<tr>
<th><strong>Long-Term Control</strong></th>
<th><strong>Quick Relief</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhaled Corticosteroids</td>
<td>Short-acting inhaled beta&lt;sub&gt;2&lt;/sub&gt;-agonists</td>
</tr>
<tr>
<td>Cromolyn/nedocromil</td>
<td>Anticholinergics</td>
</tr>
<tr>
<td>Leukotriene modifiers</td>
<td>Systemic corticosteroids</td>
</tr>
<tr>
<td><strong>Long-acting beta&lt;sub&gt;2&lt;/sub&gt;-agonists</strong></td>
<td></td>
</tr>
</tbody>
</table>
Asthma Pharmacotherapy

All persistent Asthmatics should be on a Controller Medication

- Inhaled corticosteroids (ICSs) are the most potent and consistently effective long-term control medication for asthma (Evidence A)
- Leukotriene agents are alternatives to steroids in children
  - leukotrienes can be an alternative medication in mild persistent asthma, mild patient or used as add-on therapy
Inhaled corticosteroids-Controller

<table>
<thead>
<tr>
<th>Inhaled corticosteroid</th>
<th>Low dose</th>
<th>High dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclometasone propionate (HFA)</td>
<td>100–200</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Budesonide</td>
<td>200–400</td>
<td>&gt;800</td>
</tr>
<tr>
<td>Ciclesonide</td>
<td>80–160</td>
<td>&gt;320</td>
</tr>
<tr>
<td>Fluticasone furoate</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Fluticasone propionate (HFA or DPI)</td>
<td>100–250</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Mometasone furoate</td>
<td>110–220</td>
<td>&gt;440</td>
</tr>
<tr>
<td>Triamcinolone acetonide</td>
<td>400–1000</td>
<td>&gt;2000</td>
</tr>
</tbody>
</table>
Combined inhaled steroids and long-acting beta agonists

**Advair**
- Fluticasone/Salmeterol combination

**Symbicort**
- Budesonide/Formoterol combination
Newer Medications

Dulera

- Combination inhaled steroids mometasone and long acting beta agonist formoterol
- Indicated for asthma maintenance >12 year
Box 2. Stepwise asthma management

PREPARED CONTROLLER CHOICE

STEP 1
Low dose ICS

Consider low dose ICS
Leukotriene receptor antagonists (LTRA)
Low dose theophylline

STEP 2
Low dose ICS/LABA**

Consider low dose ICS
Leukotriene receptor antagonists (LTRA)
Low dose theophylline

STEP 3
Med/high dose ICS/LABA

Med/high dose ICS
Low dose ICS + LTRA (or + theophyl)

STEP 4
Refer for add-on treatment e.g. tiotropium, omalizumab, mepolizumab

STEP 5
Add tiotropium**
High dose ICS + LTRA (or + theophyl)
Add low dose OCS

RELEVER

As-needed short-acting beta₂-agonist (SABA)
As-needed SABA or low dose ICS/formoterol®

Consider stepping up if: uncontrolled symptoms, exacerbations or risks, but first check diagnosis, inhaler technique and adherence
Consider stepping down if: symptoms controlled for 3+ months and low risk for exacerbation. Ceasing ICS is not advised for adults

ABBREVIATIONS
DPI: dry powder inhaler
FEV₁: forced expiratory volume in 1 second
FVC: forced vital capacity
HFA: hydrofluoroalkane propellant
ICS: inhaled corticosteroid
LABA: long-acting beta₂-agonist
LTRA: leukotriene receptor antagonist
OCS: oral corticosteroids
PEF: peak expiratory flow
SABA: short-acting beta₂-agonist
Theoph: theophylline

*Not for children <12 years
**For children 6–11 years, preferred Step 3 treatment is medium dose ICS.

#Low dose ICS/formoterol is reliever for ICS/formoterol maintenance and reliever therapy (see p.7).
†Tiotropium by mist inhaler is an add-on option for patients ≥12 years with a history of exacerbations
Education and Asthma Action Plan

- Daily RX
- How to recognize worsening asthma
- Lays out specific steps that patients can take under changing clinical conditions
- Provides guidelines for when to seek urgent or emergency medical care
- Constructed in collaboration with patient and family to be incorporated into daily activities and consistent with patient goals
- Presented in a way that is convenient and easy to visualize
Asthma Action Plan

The colors of a traffic light will help you use your asthma medicines.

- Green means Go! Take your preventive medicines.
- Yellow means Caution! Add quick-relief medicines.
- Red means Danger! Call help from a doctor or go to the nearest Emergency Room.

Use these daily preventive anti-inflammatory medicines:

<table>
<thead>
<tr>
<th>MEDICINE</th>
<th>HOW MUCH</th>
<th>HOW OFTEN/WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continue with green zone medicine and add:

<table>
<thead>
<tr>
<th>MEDICINE</th>
<th>HOW MUCH</th>
<th>HOW OFTEN/WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

CALL YOUR PRIMARY CARE PROVIDER.

Take these medicines and call your doctor now.

<table>
<thead>
<tr>
<th>MEDICINE</th>
<th>HOW MUCH</th>
<th>HOW OFTEN/WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</table>

GET HELP FROM A DOCTOR RIGHT! Do not be afraid of causing a fuss. Your doctor will want to see you right away. It’s important you cannot contact your doctor, go directly to the nearest Emergency Room. DO NOT WAIT. Make an appointment with your primary care provider within two days of an FL attack or hospital visit.

Plan de Acción para el Asma

Los colores de un semáforo le ayudarán a usar sus medicamentos para el asma.

Verde representa la Zona de Precaución.

Medicina preventiva.

Necesita 3 clases de medicamentos preventivos.

PROCEDER

Usa estas medicinas anti-inflamatorias preventivas diariamente.

<table>
<thead>
<tr>
<th>MEDICINA</th>
<th>CANTIDAD</th>
<th>MEDICIONES NECESITADAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

Para el asma cuando necesite ayuda.

CONTINUAR CON SU MEDICINA DE ZONA VERDE, Y ADIÉNTALE:

<table>
<thead>
<tr>
<th>MEDICINA</th>
<th>CANTIDAD</th>
<th>MEDICIONES NECESITADAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LLAME A SU PROVEEDOR DE ATENCIÓN PRIMARIA.

TOME ESTAS MEDICINAS Y LLAME A SU MÉDICO INMEDIATAMENTE.

<table>
<thead>
<tr>
<th>MEDICINA</th>
<th>CANTIDAD</th>
<th>MEDICIONES NECESITADAS</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Conclusions

- There are many similarities and differences between asthma and COPD
- Assessment of symptoms and classifying severity is an important first step in managing both these disorders
- Non-pharmacological measures are equally important in both disorders
- Stepwise approach based on severity of illness is indicated
- Long acting beta agonists are contraindicated as single therapy in asthma. Should only be used combined with inhaled steroids
Thank you