Obstructive Diseases

- **Asthma**
  - reversible airflow obstruction, different phenotypes, inflammation prominent

- **Emphysema**
  - permanent, enlargement/destruction of the respiratory bronchioles

- **Chronic Bronchitis**
  - sputum production 3 months/year for 2 years
COPD Definition

- COPD is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles and gases.
COPD is a major public health problem.
It is the fourth leading cause of death in the United States, accounting for more than 120,000 deaths annually.
COPD prevalence and impact have been increasing for several decades, following the epidemic of cigarette smoking in the 20th century, and COPD is projected to be the third leading cause of death by 2020.
Mortality may be peaking among men in the United States but, among women, mortality continues to rise and deaths from COPD among women now exceed those among men.
• The National Health and Nutrition Examination Survey (NHANES) study, in which lung function was measured in a representative portion of the population, suggests that 24 million people have impaired lung function in the United States.

• The diagnosis of COPD, however, is extremely inaccurate. It is estimated that 10 million Americans have a diagnosis of COPD. Not only does this reflect tremendous underdiagnosis, but diagnosis in the absence of spirometry is notoriously inaccurate, with more than half of patients misdiagnosed.

• This inaccuracy of diagnosis is true not only in the United States but also in other population-based studies.
Smoking is the primary risk factor for COPD. Approximately 80 to 90 percent of COPD deaths are caused by smoking. Female smokers are nearly 13 times as likely to die from COPD as women who have never smoked. Male smokers are nearly 12 times as likely to die from COPD as men who have never smoked.
Etiology of COPD

- 80-90% due to tobacco use--15% of smokers have clinically significant disease
- Occupational exposures
- $\alpha$-1 protease inhibitor deficiency--rare inherited disorder (PiMM--normal)
  - PiZZ--homozygous, 80% have emphysema
  - PiMZ--lower level (50%) of enzyme, no emphysema
Cigarette smoking

- Fletcher and colleagues suggested that a minority, perhaps 10% to 15% of smokers, would get clinically significant COPD.
- Smokers lose lung function in a dose-dependent manner. Thus, the majority of smokers are likely to have reduced lung function, particularly as they age.
- Eighty percent of individuals who have COPD and 80% who die from COPD in the United States are smokers.
DIFFERENTIAL DIAGNOSIS

• Chronic bronchitis is made on the basis of symptoms
• Emphysema is a pathological diagnosis
• Asthma is made on the basis of near-complete reversibility spontaneously or with bronchodilators and history of variability in symptoms
• Asthma frequently have night time symptoms COPD rarely has night time symptoms
• History and physical examination provide an initial database.
• Spirometry is essential, because it reveals the defining feature of COPD.
• DLCO increased in asthma and decreased in COPD
• The chest radiograph may help to exclude other pulmonary disorders.
• The single-breath diffusing capacity for carbon dioxide (DLCO) may help determine the presence of emphysema although the CT scan is more sensitive.
COPD

• History of dyspnea, and cough with exercise limitation
• PFTs help define the severity of the disease
  – Lack of bronchodilator response does not mean bronchodilators are of no use
• Lung volumes can show hyperinflation (TLC) and air trapping (RV)
• Decreased DLCO
Physical Examination

- Physical examination reveals little abnormality especially during quiet breathing.
- Prolonged expiratory time, which is best determined by listening over the larynx during a forced expiratory maneuver. Prolongation of the expiratory phase longer than the normal 4 seconds indicates significant obstruction.
- Wheezing is not a consistent finding and does not relate to the severity of obstruction.
- Clinical diagnosis of COPD is notoriously poor. Quantification of airflow by spirometry should always be performed when the diagnosis of COPD is considered. Severe COPD, patients demonstrate more apparent physical signs.
- Pink puffer and blue bloater
Spirometry

- Simple spirometry is the most important test to diagnose and stage COPD.
- The FEV1 is the most important measure. The maximal volume exhaled is the forced vital capacity (FVC).
- A reduction in FEV1/FVC ratio is diagnostic of airway obstruction.
- Because of variability in the FVC measure, the FEV1/FVC ratio can establish a diagnosis of obstruction but is not useful to monitor disease progression.
- If airflow is abnormal, postbronchodilator testing should be performed. Correction to the normal range suggests a diagnosis of asthma and could exclude COPD. Partial correction, which may vary from day to day
# Spirometry Criteria

## Definition of Obstruction and Classification of Severity by Spirometry

<table>
<thead>
<tr>
<th></th>
<th>ATS/ERS</th>
<th>GOLD</th>
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<tbody>
<tr>
<td></td>
<td>FEV₁/FVC &lt; LLN</td>
<td>FEV₁/FVC &lt; 0.70</td>
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</table>

<table>
<thead>
<tr>
<th>FEV₁ % predicted</th>
<th>Mild</th>
<th>Stage I: Mild</th>
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<tbody>
<tr>
<td>70</td>
<td></td>
<td>≥80</td>
</tr>
<tr>
<td>60–69</td>
<td>Moderate</td>
<td>Stage II: Moderate</td>
</tr>
<tr>
<td>50–59</td>
<td>Moderately severe</td>
<td>&lt;80</td>
</tr>
<tr>
<td>35–49</td>
<td>Severe</td>
<td>Stage III: Severe</td>
</tr>
<tr>
<td>&lt;35</td>
<td>Very severe</td>
<td>&lt;50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stage IV: Very severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;30</td>
</tr>
</tbody>
</table>
Severity of disease

Severity classification

- **FEV1 % predicted**
  - Normal physiologic variant: >100
  - Mild: 70–100
  - Moderate: 60–69
  - Moderately severe: 50–59
  - Severe: 35–49
  - Very severe: <35
GOLD Guidelines

• The GOLD guidelines represent a major change in the strategy of disease management. Earlier guidelines, such as the ATS Statement (1995), described symptomatic management after the patient presented to the healthcare system with specific complaints.

• Since most patients lose lung function insidiously for many years prior to diagnosis, earlier and more aggressive diagnosis is warranted.

• Treatment of previously unidentified individuals can help, not only by preventing progression through controlling risk factors but also by improving symptomatic control.

• Symptomatic improvement in “asymptomatic” individuals can be achieved if improved physiology is combined with an increased level of activity.
CXR PA & Lat chest radiograph in a 54-year-old female smoker with centriacinar emphysema. Very large lung volumes, with hyperlucency primarily seen in the upper lobes. Flattening of the diaphragms (arrows), a prominent retrosternal clear space on the lateral radiograph (double arrow), and a small-appearing heart on PA.
Treatment of COPD

• Smoking cessation--most important
• Oxygen therapy--improves mortality
  – $\text{paO}_2 \leq 55\text{mm}$, or 56-59mm with pHTN
• Drugs--may help improve symptoms
  – $\beta$-agonists, short and long acting
  – Anticholinergics
  – Theophylline--may stimulate respiratory center, improve muscle function
COPD Treatment

- None of the existing medications for COPD have been shown to modify the long-term decline in lung function that is the hallmark of this disease.
- Pharmacotherapy for COPD is used to decrease symptoms and/or complications.
- Bronchodilator medications are central to the symptomatic management of COPD.
- Regular treatment with long-acting bronchodilators is more effective and convenient than treatment with short-acting bronchodilators.
- The addition of regular treatment with inhaled glucocorticosteroids to bronchodilator treatment is appropriate for symptomatic COPD patients with an FEV1 < 50% predicted and repeated exacerbations.
- Chronic treatment with systemic glucocorticosteroids should be avoided due to an unfavorable benefit-to-risk ratio.
- Influenza vaccines can reduce serious illness.
- Pneumococcal polysaccharide vaccine is recommended for COPD patients who are 65 years and older and for those younger than 65 years with an FEV1 < 40% predicted.
- All patients benefit from exercise training programs.
- Long-term administration of oxygen (> 15 hours/day) to patients with chronic respiratory failure has been shown to improve survival.
Bronchodilators

• In the presence of bronchospasm, as occurs in asthma, bronchodilators can cause marked improvement in airflow.

• Many patients with COPD will have reduced dyspnea and improved exercise tolerance with bronchodilator therapy, even if improvement in resting spirometry is very modest.

• Unlike asthmatic patients who experience dyspnea when acute bronchospasm occurs, patients with COPD most commonly experience dyspnea due to increased respiratory demands, such as occurs with exertion.
Anticholinergics

- The short-acting inhaled anticholinergic bronchodilator drug ipratropium bromide has been used to treat chronic obstructive pulmonary disease (COPD) for more than 20 years.
- 2002 the long-acting inhaled anticholinergic medication tiotropium was introduced. Ipratropium has been shown to alleviate dyspnea and increase exercise tolerance in patients with COPD, and regular use produces a sustained increase in forced expiratory volume in 1 second (FEV1). Tiotropium improves lung function and quality of life and decreases the risk of exacerbations and hospitalizations.
- Recent studies have shown, however, that there may be increased mortality from cardiovascular events among COPD patients using inhaled anticholinergics.
Safety of anticholinergic Activity

- Singh et al. that included randomized controlled trials using ipratropium and tiotropium noted that both agents were associated with a significantly increased risk of cardiovascular death in patients with COPD.

- A 4-year trial of tiotropium in COPD published by Tashkin et al. (UPLIFT Study), which found risk for fatal cardiovascular events was decreased among COPD patients taking tiotropium.

- Celli et al. analyzed pooled safety data from 30 clinical trials of tiotropium. The study found that tiotropium was associated with a significant reduction in the risk of all-cause mortality, cardiovascular mortality, and combined cardiovascular events.

- The study by Ogale et al. included a cohort of 82,717 U.S. veterans with newly diagnosed COPD from 1999-2002. Compared with patients not exposed to anticholinergics in the past year, any exposure to anticholinergics in the past 6 months was associated with an increased risk of cardiovascular events.

- The pharmacology underlying these differences is unclear. Therapy used for a long time and they are effective bronchodilators.

- The long-acting inhaled anticholinergic tiotropium seems to be the preferred treatment based on safety, but it is associated with increased cost.
Steroids and COPD

• 10-20% of COPD patients have significant response to oral steroids
  – 2 week steroid trial with documented improvement on PFTs to justify long term use of inhaled steroids

• Effective for acute exacerbation
  – Antibiotics decrease relapse rate Chest 2000;117:1345
Long-Term Oxygen Therapy

• Long-term oxygen therapy extends life in hypoxemic COPD patients; the 24-hour regimen is more beneficial than the 12-hour regimen.

• Other benefits include reduction in hematocrit, modest neuropsychological improvement, and some improvement in pulmonary hemodynamics with reduction in the prevalence of cor pulmonale.

• Long-term oxygen therapy should be prescribed for patients who have a resting arterial Po2 of 55 mm Hg or less while breathing air.

• For those whose resting arterial Po2 is between 56 and 59 mm Hg, long-term oxygen therapy is indicated if they demonstrate erythrocytosis (hematocrit ≥ 55%) or evidence of cor pulmonale.

• Oxygen during Exercise Patients with an arterial Po2 of 60 mm Hg or higher while breathing room air may develop worsening hypoxemia with exercise.
Commercial Air Travel

- The cabins of commercial airliners flying in the stratosphere are pressurized to an altitude between 5000 and 10,000 ft. The arterial Po2 may fall below 40 mm Hg in some patients with COPD.
- Hypercapnic COPD patients should employ supplemental oxygen while flying.
- Normocapnic patients with a sea level arterial Po2 above 68 mm Hg generally have a flight arterial Po2 above 50 mm Hg and do not require supplemental oxygen.
- Several portable concentrators have been approved by the FAA for use on commercial airliners.
- Compact modern respirators can be brought into airplanes by patients, although this usually requires the purchase of an additional seat. However, only gel-cell batteries are approved for air travel. Some airlines provide inverters that convert cabin power to a usable form of electricity for respirators.
- Finally, if the patient has major bullous disease, the physician should always warn the patient that ascent to high altitude can precipitate life-threatening pneumothorax. Such a patient should probably not fly.
COPD Exacerbations

• Many exacerbations not reported
  – Major symptoms
    • Dypsnea, inc. sputum production, sputum purulence
  – Minor symptoms
    • Cough, wheeze, sore throat, cold symptoms

• Small changes in PEF
  – Larger drops may predict longer time to recovery
  – Mean time to recovery 6-7 days
    • 75% recovery at 35 days
    • 7.1% not recovered at 91 days
Systemic inflammation and COPD

- The most common cause of death among COPD patients is coronary artery disease and reduced lung function has long been recognized as an independent risk factor for cardiac disease.
- The mechanisms by which COPD increases risk for cardiac disease are not established, but systemic inflammation may play a role in the pathogenesis of atherosclerosis.
- Several studies suggest that systemic inflammation in COPD is affecting the rest of the body and that treatment of the inflammation will also treat COPD.
Statins Lung function

• The Use of Statins and Lung Function in Current and Former Smokers Jean I. Keddissi, MD, FCCP; Walid G. Younis, MD; Elie A. Chbeir, MD; Nadim N. Daher, MD; Tarek A. Dernaika, MD; and Gary T. Kinasewitz, MD, FCCP (CHEST 2007; 132:1764–1771)

  • Conclusion: In smokers and former smokers, statins are associated with a slower decline in pulmonary function, independent of the underlying lung disease.

• Statin Use Reduces Decline in Lung Function VA Normative Aging Study Stacey E. Alexeeff, Augusto A. Litonjua, David Sparrow Pantel S. Vokonas, and Joel Schwartz

  • Conclusions: Our results indicate that statin use attenuates decline in lung function in the elderly, with the size of the beneficial effect modified by smoking status.

• Influenza and COPD Mortality Protection as Pleiotropic, Dose-Dependent Effects of Statins Floyd J. Frost, PhD; Hans Petersen, MS; Kristine Tollestrup, PhD; and Betty Skipper, PhD (CHEST 2007; 131:1006–1012)

  • Conclusions: This study found a dramatically reduced risk of COPD death and a significantly reduced risks of influenza death among moderate-dose statin users
Increased Risk of Myocardial Infarction and Stroke Following Exacerbation of COPD

Gavin C. Donaldson, PhD; John R. Hurst, PhD; Christopher J. Smith, BA; Richard B. Hubbard, DM; and Jadwiga A. Wedzicha, MD CHEST 2010; 137(5):1091–1097

Studied data from 25,857 patients with COPD entered in The Health Improvement Network database over a 2-year period. Calculated risk of myocardial infarction (MI) and stroke in the postexacerbation period.

Results: We identified 524 MIs in 426 patients and 633 ischemic strokes in 482 patients. The incidence rates of MI and stroke were 1.1 and 1.4 per 100 patient-years, respectively. There was a 2.27-fold (95% CI, 1.1-4.7; $P < .03$) increased risk of MI 1 to 5 days after exacerbation (defined by prescription of both steroids and antibiotics). This relative risk diminished progressively with time and was not significantly different from the baseline MI risk at any other postexacerbation time interval. One in 2,513 exacerbations was associated with MI within 1 to 5 days. There was a 1.26-fold (95% CI, 1.0-1.6; $P < .05$) increased risk of stroke 1 to 49 days after exacerbation.

Conclusion: The results suggest that exacerbations of COPD increase the risk of MI and stroke. This may have implications for therapy in both stable and exacerbated COPD.
Beta blockers COPD

• **β-Blockers May Reduce Mortality and Risk of Exacerbations in Patients With Chronic Obstructive Pulmonary Disease**
  - Frans H. Rutten, MD, PhD; Nicolaas P. A. Zuithoff, MSc; Eelko Hak, MSc, PhD; Diederick E. Grobbee, MD, PhD; Arno W. Hoes, MD, PhD *Arch Intern Med.* 2010;170(10):880-887.
  - **Conclusion** Treatment with β-blockers may reduce the risk of exacerbations and improve survival in patients with COPD, possibly as a result of dual cardiopulmonary protective properties.

• **Cochrane Review**
  • **Cardioselective beta-blockers for chronic obstructive pulmonary disease** Salpeter SR, Ormiston TM, Salpeter EE
  • Long term treatment with beta-blocker medication reduces the risk of death in patients with hypertension, heart failure and coronary artery disease, yet patients with COPD in addition to their cardiovascular disease seldom receive these medicines because of fears that they may worsen the airways disease. This review of data from 20 randomised controlled trials on the use of cardioselective beta-blockers in patients with COPD demonstrated no adverse effect on lung function or respiratory symptoms compared to placebo. This finding was consistent whether patients had severe airways chronic airways obstruction or a reversible obstructive component. In conclusion, cardioselective beta-blockers should not be withheld from patients with COPD
Summary COPD

• COPD should be detected as soon as possible to evaluate and treat
• GOLD criteria are useful in diagnosing COPD
• Spirometry is useful in making the diagnosis of COPD
• Stopping patient smoking is a major step in treating COPD
• Oxygen therapy decrease mortality
• Consider treatment of systemic inflammation
Asthma

- Asthma: is one of the most common chronic lung diseases, affecting approximately 15 million Americans. 1.5 million ED visits a year and accounts for one third of the hospitalizations.
- Increase in prevalence and mortality. Since 1980 there has been a 60% increase in the prevalence of asthma.
- Asthma death rates increased by >50% since 1979.
  - 0.89/100,000 1977-79, 2.0/100,000 1989, 2.1/100,000 1994, 1.7/100,000 1997
Phenotypes of Asthma

- Asthma is a chronic inflammatory disorder
  - Variability in patterns of inflammation
  - Different phenotypes
    - Acute attacks PNM predominance rapid hours
    - Acute attacks eosinophils 1-2 weeks
  - Treatment of inflammation does not appear to affect disease progression
Monitoring and assessment

• Severity most easily measured in patient not on long term controller therapy
• Control degree symptoms functional impairment are minimized
• Women were more likely than men to have been told they had asthma, hay fever, sinusitis, or chronic bronchitis.

• Females were about 7% more likely than males to ever have been diagnosed with asthma.

• Females had an [asthma] hospitalization rate about 35% higher than males. Females had a 30% higher [asthma] prevalence compared to males.

• Females had an asthma death rate about 40% higher than males. Females had a 50% higher outpatient visit rate compared to males.
Predicting response to therapy

- Poor control seen in some patient groups
- Adults, older, women. Many of the groups poor control has been associated with increased incidence of GERD, rhinitis, and psychiatric illness
- Other diseases such as:
  - COPD, CHF, PE, laryngeal dysfunction, UAO, cough, VCD
- Poor control requires referral to a specialist
Defining Features Of Asthma

• Intermittent wheezing, chest tightness, cough
• Bronchial Hyperresponsiveness
• Airway inflammation
• Airway obstruction - initially reversible
• PEF variability
• Symptoms occur at any time of the day or night
Risk Factors for Fatal Asthma

- prior intubation or prior ICU admission
- history of sudden severe exacerbations
- >2 hospital admits or >3 ED visits for asthma in the last year; admit or ED visit within last month
- current oral steroid usage or recent taper
- use of >2 canisters/month of $\beta$-agonist MDI
- comorbid illness, illicit drug use, urban area
- Difficulty perceiving airflow obstruction or its severity
Diagnosis of Asthma

Does patient have history or presence of episodic symptoms of airflow obstruction?

- Wheeze, shortness of breath, chest tightness, or cough
- Asthma symptoms vary throughout the day
- Absence of symptoms at the time of the examination does not exclude the diagnosis of asthma
Spirometry

• Normal spirometry or lack of reversibility does not rule out asthma

• Further tests such as diffusion capacity are useful in a patient with severe obstructive lung disease to separate from COPD

• Long volumes only if other processes such as restrictive lung disease are suspected

• Following Peak Flows for variability and tends
Treatment of Inflammation

• Differences between COPD and asthma
• Neutrophilic vs eosinophils
• Difference in response to treatment
• Latest guidelines stress continued use of steroids
• During initial presentation severity can be used to guide therapy
• After initial visit clinical management of asthma, asthma control guides therapy
• Impairment and risk
  – Impairment QOL and functional capacity
  – Risk future adverse events exacerbations loss of lung function
Asthma Severity and Control are Different Things

• Treatment aimed at control
• Goals
  – Decreased symptoms
  – Decreased exacerbations needing steroids
  – Decreased rescue inhaler use
  – Controlling asthma so it does not interfere with daily living activities
Asthma Severity and Control are Different Things

• Treatment based on severity
• Goals
  – To prevent long term affects on the lung
  – Control the chronic inflammation
• Treatments may address both goals but modifications of therapy need to address which goal you are shooting for
Peak Flow Monitoring

Gives an objective number for assessment that the patient can perform at home. Acts as an early warning system.

Peak Flow Meters in every shape possible
Goals of Therapy

- Correct disease
- Least amount of medication for good control
- Rules of two
  - Use Rescue inhaler more than twice a week
  - Awake at night more than twice a month
  - Use more than two canisters of rescue medication a year
- Patient self-monitoring and health care utilization
Inhaled Corticosteroids

- Mainstay of treatment for all asthmatics above mild intermittent disease (symptoms more than 2 times/week)
- Blocks many of the inflammatory pathways in asthma
- Increase or decrease dose in stepwise manner--may take 3 months for plateau
- Reduce potential for adverse events by:
  - Using spacer and rinsing mouth
  - Using lowest dose possible
  - Using in combination with long-acting beta$_2$-agonists
Inhaled Corticosteroids (continued)

- Benefit of daily use:
  - Fewer symptoms
  - Fewer severe exacerbations
  - Reduced use of quick-relief medicine
  - Improved lung function
  - Reduced airway inflammation

- > 1000 ug/day consider stress doses for surgery
- IV or oral onset of actions 4-6 hours
Smoking and asthma

- Steroids are ineffective in patients with asthma who smoke.
- This applies to both maintenance therapy with inhaled steroids and systemic steroids used in an exacerbation.
- If smoking is stopped for 3 months the responsiveness to steroids returns
<table>
<thead>
<tr>
<th></th>
<th>Smokers with Asthma (n = 14)</th>
<th>Ex-smokers with Asthma (n = 10)</th>
<th>Never-smokers with Asthma (n = 26)</th>
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<tbody>
<tr>
<td>Age, yr</td>
<td>41.8 (8.3)</td>
<td>47.1 (5.2)</td>
<td>40.8 (10.3)</td>
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<tr>
<td>Sex, male/female</td>
<td>7/7</td>
<td>7/3</td>
<td>22/4</td>
</tr>
<tr>
<td>Duration of asthma, yr</td>
<td>16 (9.8)</td>
<td>23.9 (14.1)</td>
<td>25.3 (15.6)</td>
</tr>
<tr>
<td>Inhaled corticosteroid, mcg daily,</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>equivalent of beclomethasone</td>
<td>436 (645)</td>
<td>500 (356)</td>
<td>538 (520)</td>
</tr>
<tr>
<td>Pack years smoked</td>
<td>26.2 (15.6)</td>
<td>19.3 (9.7)</td>
<td>—</td>
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<tr>
<td>Serum cotinine, ng/ml, median, IQR</td>
<td>452 (253–660)*</td>
<td>2.3 (2–25.9)</td>
<td>2.35 (2.1–2.9)</td>
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<tr>
<td>Total IgE, IU/ml, median, IQR</td>
<td>153 (77–282)</td>
<td>146 (82–644)</td>
<td>185 (81–420)</td>
</tr>
<tr>
<td>Specific IgE positive, %</td>
<td>64</td>
<td>80</td>
<td>96†</td>
</tr>
<tr>
<td>FEV₁, L</td>
<td>2.23 (0.5)</td>
<td>2.21 (0.55)</td>
<td>2.57 (0.49)</td>
</tr>
<tr>
<td>FEV₁% predicted, prealbuterol</td>
<td>70.5 (5.9)</td>
<td>68.4 (14.5)</td>
<td>69 (10.7)</td>
</tr>
<tr>
<td>FEV₁% predicted, postalbuterol</td>
<td>84.2 (6.69)</td>
<td>87.7 (9.6)</td>
<td>85.5 (12.7)</td>
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<tr>
<td>FEV₁ reversibility to albuterol, %</td>
<td>17.3 (16–21)</td>
<td>22.6 (17–30)</td>
<td>18.9 (17–28)</td>
</tr>
<tr>
<td>Improvement in FEV₁, ml, after albuterol</td>
<td>422.8 (123)</td>
<td>640 (333)</td>
<td>614.8 (293)</td>
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<tr>
<td>FEV₁/FVC %, prealbuterol</td>
<td>70.0 (8.98)</td>
<td>67.7 (11.3)</td>
<td>70.2 (13.3)</td>
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<tr>
<td>FEV₁/FVC %, postalbuterol</td>
<td>66.8 (14.4)</td>
<td>71.2 (6.6)</td>
<td>72.8 (10.9)</td>
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<td>Asthma control score</td>
<td>2.64 (0.6)</td>
<td>2.06 (0.9)</td>
<td>2.03 (0.9)</td>
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<td>ATS impairment score</td>
<td>3.6 (1.3)</td>
<td>4.7 (1.8)</td>
<td>4.5 (1.4)</td>
</tr>
</tbody>
</table>

Definition of abbreviations: ATS = American Thoracic Society; IQR = interquartile range.

* p < 0.001.

† p < 0.05.
Figure 1. Mean difference (95% confidence interval) after placebo (closed circles) and after prednisolone (open circles) in smokers with asthma, ex-smokers with asthma, and never-smokers with asthma for (A) change in FEV₁ L and (B) asthma control score. A reduction in the score implies an improvement in asthma control.
Beta-2 agonists

- Acute relief of bronchoconstriction
- Inhaled is preferred route
  - **Albuterol 2 puffs prn**
  - **MDI with spacer**—just as effective as nebulized (4-6 puffs per neb) Chest 1993;106:661-665 ARRD 1991;144:347
  - intermittent neb—q 20 min., escalate dose
  - continuous neb—lactic acidosis observed

- Regularly scheduled use is not generally recommended
  - May lower effectiveness
  - May increase airway hyper responsiveness
Long-Acting Beta$_2$-Agonists

- Not a substitute for anti-inflammatory therapy
- Not appropriate for monotherapy
- Beneficial when added to inhaled corticosteroids
- Not for acute symptoms or exacerbations
Leukotriene Modifiers

- **Mechanisms**
  - 5-LO inhibitors
  - Cysteinyi leukotriene receptor antagonists

- **Indications**
  - Long-term-control therapy in mild persistent asthma
    - Improve lung function
    - Prevent need for short-acting beta$_2$-agonists
    - Prevent exacerbations
Factors Worsening Asthma

- Sinusitis/Allergic Rhinitis--post nasal drip
- Poor inhaler use
- Smoking affects steroid effectiveness
- Reflux disease--association with asthma
  - prevalence 15-40%, up to 80% abnormal GER
Inhaler Use

- The In-Check-Dial® was used to determine adequacy of inhalation techniques and teaching of two different devices Advair Diskus and Spacer.
- Retention of adequate techniques, were assessed in 234 moderate to severe asthmatics.
- Inhalation techniques were assessed at periodic follow-ups divided into less than one month return visit, between 1 and 3 months, 3 to less than 6 months, 6 months to less than 1 year.
In Check Dial
## Holding Chamber Results

<table>
<thead>
<tr>
<th>Flow Rate Holding Chamber</th>
<th>Too Low &lt; 20L/min</th>
<th>In Range 20-60 L/min</th>
<th>Too High &gt; 60L/min</th>
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</thead>
<tbody>
<tr>
<td>(n,102) Initial visit</td>
<td>0% (n, 0)</td>
<td>30% (n,31)</td>
<td>70% (n,71)</td>
</tr>
<tr>
<td>(n,107) 2 weeks-1 month</td>
<td>3% (n,3)</td>
<td>56% (n,60)</td>
<td>41% (n,44)</td>
</tr>
<tr>
<td>(n,68) 1 month- &lt; 3 months</td>
<td>0% (n, 0)</td>
<td>65% (n,44)</td>
<td>35.0% (n, 24)</td>
</tr>
<tr>
<td>(n,87) 3-&lt; 6 months</td>
<td>1% (n, 1)</td>
<td>47% (n, 41)</td>
<td>52% (n, 45)</td>
</tr>
<tr>
<td>(n, 3) &gt; 6 month-&lt; 1 year</td>
<td>0% (n, 0)</td>
<td>46% (n, 6)</td>
<td>54% (n, 7)</td>
</tr>
</tbody>
</table>
## Advair Diskus

<table>
<thead>
<tr>
<th>FLOW RATE DISKUS®</th>
<th>TOO LOW &lt;30L/min</th>
<th>IN RANGE 30-90L/min</th>
<th>TOO HIGH &gt;90 L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial visit</td>
<td>24% (n,16)</td>
<td>63% (n,42)</td>
<td>13% (n,9)</td>
</tr>
<tr>
<td>(n,67)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 weeks-1 month</td>
<td>24% (n,22)</td>
<td>71% (n,65)</td>
<td>4% (n, 4)</td>
</tr>
<tr>
<td>(n, 91)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 month-&lt;3 months</td>
<td>25% (n, 13)</td>
<td>73% (n, 38)</td>
<td>2% (n, 1)</td>
</tr>
<tr>
<td>(n, 52)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-&lt; 6 months</td>
<td>29% (n, 23)</td>
<td>61% (n, 48)</td>
<td>10% (n, 8)</td>
</tr>
<tr>
<td>(n, 79)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 6 months-&lt; 1 year</td>
<td>36% (n, 4)</td>
<td>64% (n, 7)</td>
<td>0% (n, 0)</td>
</tr>
<tr>
<td>(n, 11)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

n= number of subjects  
L/min = Liters per minute
Asthma Exacerbation

• Early treatment best action plan monitoring
• Doubling dose not recommended has not been effective some studies on quadrupling ICS dose or oral steroids Lowered doses of steroids needed for systemic steroids in an exacerbation
• 40-80 mg/day till >70% predicted ED, outpatient 40-60mg 5-10 days
• ED
  – O2, bronchodilators beta agonist + ipatropium, systemic steroids
  – ER paper IM depomedrol good response however used 180 mg IM depomedrol peak 9 hours action dose equaled their 5 day taper total dose
  – If worsening MgSO4, possibly epinephrine,
  – Normalizing of pCO2 patient is wearing out
• Follow up care 1-4 wks
Obstructive Lung Diseases

• COPD
  – Progressive loss of lung function
  – Smoking history
  – Exacerbations increased winter

• Asthma
  – Episodic with return to normal lung function
Summary

• COPD: progressive treatment symptomatic smoking cessation
• Asthma: treatment of inflammation and bronchospasm
• Treatment to control inflammation and symptoms Control based on symptoms
• Proper use of inhalers important in controlling disease
• All that wheezes is not asthma or COPD
Resources

- [www.nhlbi.gov](http://www.nhlbi.gov)  
- [www.aaaai.org/aadmc/default.htm](http://www.aaaai.org/aadmc/default.htm) AAAAI site
- [www.lungusa.org/asthma/](http://www.lungusa.org/asthma/) ALA site for asthma
- [www.nhlbi.nih.gov/health/public/lung/index.htm](http://www.nhlbi.nih.gov/health/public/lung/index.htm) site has patient handouts with action plans in English and Spanish
- [www.nhlbi.gov/guidelines/asthma/execsumm.pdf](http://www.nhlbi.gov/guidelines/asthma/execsumm.pdf) Newest 2002 summary of asthma guidelines
Asthma and Pregnancy

- Asthma may get worse, no change or better during pregnancy. The changes that occur during pregnancy do not predict what will happen in the next pregnancy.
- Goals of treating asthma are the same
- Good control lowest amount of medications needed
Demographics VCD

• General population unknown
• Up to 20% females otolaryngoscopy any reason had VCD
• 56% with VCD had coexistent asthma
• Avg age 30  70-90% female Caucasian
All that wheezes is not asthma

- Asthma
- COPD
- pulmonary embolus
- vocal cord dysfunction, laryngeal dysfunction
- Endobronchial obstruction from tumor or foreign body aspiration
- CHF
- pulmonary infiltrates with eosinophilia
Diagnosis

• Hx and Px
• Pulmonary function
  – Inspiratory loop
  – FEF50/FIF50
  – Variable
• ABG
• Laryngoscopy
  – Induction by breathing techniques, methacholine, exercise
Vocal cord dysfunction

- Differentiation between exercise induced asthma (EIA) and vocal dysfunction difficult (VCD)
- A study in military recruits 40 with symptoms 15 had vocal cord dysfunction
- Vocal dysfunction can coexist with asthma
- Methacholine test are positive in EIA and VCD
GERD Induced Changes

- Erythema and Edema of the upper airway lingular tonsils affects inhaler use and asthma control
- Treatment of GERD up to 6 months before resolution of erythema and edema
- Change in teaching of inhaler technique improves drug delivery
Upper airway GERD and VCD

- Abnormal FEF50/FIF50 ratio or loop:
  - 194 patients/692 total number of clinic patients = 28% of clinic population.
- Symptoms suggestive of poor control, symptoms of VCD or other upper airway pathology:
  - 76 patients/195 patients with abnormal spirometry = 39%
  - 76 patients/692 total number of clinic patients = 11% of clinic population
- Laryngoscopy performed on 45 patients
  - 17 patients diagnosed with VCD:
    - 2.4% of the clinic population
    - 8.8% of the patients with abnormal spirometry.
- 42 patients with edema and erythema
  - 6.0% of clinic population
  - 21.5% of patients with abnormal spirometry
Case 1

• 38 yr old female with a history of asthma since age 18
• Mainly treated with albuterol occasional prednisone burst and taper
• Recently admitted for TCA overdose with intubation overnight
• Was discharged on a prednisone burst and taper
• Since discharge seen ER again treated with prednisone
• Using albuterol 6-8 times per day not much improvement in symptoms noted
• No rhinitis
• Does have GERD
• Physical Exam
• Pulse 78 RR 20 BP 148/79 O2 sat 96%
• CV normal S1 and S2
• Pulmonary Exam Upper airway sounds
• Voice changed during exam to hoarseness
• FVC 1.92 63%
• FEV1 1.28 48%
• FEV1/FVC 67
• Severe obstruction
Patient presented with increased stridor and was placed on heliox and scheduled for surgery

CT scan no evidence of mass effect

Surgically resected area of granulomatous stricture ~ 2cm in length and reanastomosed

7mm opening seen at surgery

Since then doing well
Upper airway Obstruction

• Frequently has an insidious onset, and the early signs and symptoms may be disregarded or mistaken for a variety of other disorders.

• Shortness of breath on exertion, which may progress to dyspnea at rest, a brassy cough, recurrent pneumonitis, wheezing, stridor, and cyanosis may all be a part of the clinical presentation.

• Many of these symptoms, especially dyspnea on exertion and wheezing, can be easily attributed to other respiratory disorders such as chronic bronchitis and asthma.
**Functional mainstem bronchial obstruction**  Maximal expiratory and inspiratory flow-volume loops before (inner blue loop) and after (outer green loop) surgery in a patient with mainstem bronchial obstruction. The diameter of the orifice at the site of maximal obstruction both before and after treatment is shown in relation to the corresponding flow-volume loop. Note the relatively parallel rightward shift of the descending limb of the maximal expiratory flow-volume curve after treatment.
Upper airway obstruction

- The causes of acquired subglottic stenosis include endotracheal intubation, external trauma, infection or inflammation or thermal or caustic injuries.
- The most common cause of acquired subglottic stenosis is endotracheal intubation resulting in 90% of the cases.
- The reported incidence of subglottic stenosis in intubated patients ranges from 1-8%.
Why all the questions?

- Is it really asthma?
- Not all wheezes are asthma.
  Obstructive airway diseases will produce wheezing and many are responsive to the pharmacological agents used in asthma
- Not all asthma patients wheeze
• Coexist with asthma
  – Intensifies asthma
  – VCD may block inhalation of meds

  – PEF and FEV1 vary with both asthma and VCD
• 1. Do you have trouble breathing in?
• 2. Do you have throat tightness?
• 3. Do you have hoarseness or voice changes?
• 4. Do you make a breathing-in noise when you are having symptoms?
• 5. How soon after exercise starts do your symptoms begin and how quickly do symptoms subside?
• 6. How well does your bronchodilator work?
• GERD has been implicated in 10% to 20% of all patients with chronic cough.
• Pathologic amounts of intraesophageal acid occur in 30% to 90% of adults with asthma, although a definitive cause-and-effect relationship has not been proven.
• The pathogenesis of most cases of GERD-induced asthma appears to be stimulation of mechanosensitive (acid) afferent fibers in the esophagus triggering airway reactivity.
• Vasovagal reflexes triggered by the acid also may contribute to respiratory symptoms.
• Nearly half of asthmatics with GERD do not report any characteristic GERD symptoms.
Exacerbations

- Early treatment best action plan monitoring
- Doubling dose not recommended has not been effective some studies on quadrupling ICS dose or oral steroids Lowered doses of steroids used systemically
- 40-80 mg/day till >70% predicted ED, outpatient 40-60mg 5-10 days
- ED
  - O2, SABA + ipatropium, systemic steroids
    - ER paper IM depomedrol good response however used 180 mg IM depomedrol peak 9 hours action dose equaled their 5 day taper total dose
  - MgSO4
- Follow up care 1-4 wks
• Adjunct meds
  – Not recommended theophylline, mucolytics, CPT, antibiotics, sedation
  – IV Montelukast 10 min vs 90 min oral
  – IV Mg SO4, heliox driven albuterol may be useful
Discharge

• >70% predicted
• Watched 30-60 minutes after last dose bronchodilator
• Beclamethasone B all others C

• Theophylline safe however may make GERD worse

• Anticholinergics no data

• Leukotriene modifiers limited data available

• Cromoglycine safe
It is safer to treat asthma during pregnancy than to have asthma symptoms and exacerbations.
Asthma in New Mexico

• 90,500 persons affected
  – 35.7K under age 17
• $68 million/year in health care costs
  – $39M-direct costs, $29M indirect
• 30-40 deaths/year from asthma
  » Dept. of Health Statistics
• The appropriate use of inhaled medication is an important part in maintaining good asthma control.
• A variety of devices are used to deliver inhaled medications. These medication delivery systems often require different techniques for optimum distribution of medication into the lungs.
• Many of the subjects in our Asthma Clinic use both a dry powder device (Diskus®) and a metered dose inhaler with a holding chamber.
Two devices used were the AeroChamber® holding chamber and the Diskus®.

Medication techniques from asthmatic adults in the UNM Adult Asthma clinic were evaluated at regular clinic visits, both at initial visit and periodic follow-ups.

The periodic follow ups were broken down into less than one month return visit, greater than one month but less than 3 months, 3 month to less than 6 months, 6 months to less than 1 year
Barnes et.al 1998 Asthma Basic Mechanisms and Clinical Management
Statins in COPD: A Systematic Review

Surinder Janda, MD; Kirly Park, MD; J. Mark FitzGerald, MB, MD; Mahyar Etminan, PharmD, MSc; and John Swiston, MD, FCCP (CHEST 2009; 136:734–743)

Background: The 3-hydroxy 3-methylglutaryl coenzyme A reductase inhibitors (ie, statins) are widely used for the treatment of patients with hypercholesterolemia and cardiovascular disease. Emerging evidence suggests a beneficial effect of statins on the morbidity and mortality of patients with COPD. The objective of this study was to perform a systematic review of the literature evaluating the effect of statin therapy on outcomes in patients with COPD.

Methods: Medline, Excerpta Medica Database, PapersFirst, and the Cochrane collaboration and Cochrane Register of controlled trials were searched. Randomized controlled trials (RCTs), observational cohort studies, case-control studies, and population-based analyses were considered for inclusion.

Results: Nine studies were identified for review (four retrospective cohorts, one nested case control study of a retrospective cohort, one retrospective cohort and case series, two population-based analyses, and one RCT). All studies showed a benefit from statin therapy for various outcomes in COPD patients, including the number of COPD exacerbations (n = 3), the number of and time to COPD-related intubations (n = 1), pulmonary function (eg, FEV1 and FVC) (n = 1), exercise capacity (n = 1), mortality from COPD (n = 2), and all-cause mortality (n = 3). No studies describing a negative or neutral effect from statin therapy on outcomes in COPD patients were identified.

Conclusions: The current literature collectively suggests that statins may have a beneficial role in the treatment of COPD. However, the majority of published studies have inherent methodological limitations of retrospective studies and population-based analyses. There is a need for prospective interventional trials designed specifically to assess the impact of statins on clinically relevant outcomes in COPD.
<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age at exam (SD)</td>
<td>43.9 (13.1)</td>
</tr>
<tr>
<td>Mean age 1st sx (SD)</td>
<td>25.7 (15.1)</td>
</tr>
<tr>
<td>Male %</td>
<td>27.0</td>
</tr>
<tr>
<td>Mean FEV1 (SD)</td>
<td>2.09 (.77)</td>
</tr>
<tr>
<td>Mean (SD) FEV% pred</td>
<td>70.9 (21.7)</td>
</tr>
<tr>
<td>Mean (SD) FEV/FVC</td>
<td>0.74 (0.10)</td>
</tr>
<tr>
<td>Mean reversibility (SD, n)</td>
<td>15.2 (8.73, 15)</td>
</tr>
<tr>
<td>History of atopy (%)</td>
<td>72%</td>
</tr>
<tr>
<td>Fam Hx &gt;1 affected</td>
<td>27%</td>
</tr>
<tr>
<td>&gt;3 affected</td>
<td>6%</td>
</tr>
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</table>
Evaluation of mortality due to COPD reveals that co-morbid conditions are responsible for death in a substantial proportion of patients. Nonrespiratory causes of death may be responsible for more than 50% of cases.

The commonest causes were acute myocardial infarction, other ischemic heart disease, and lung cancer.

Symptoms of chronic bronchitis predicted the risk of coronary disease independently from the known major cardiovascular risk factors. In the Multifactor Primary Prevention Trial in Sweden, individuals who had daily cough and sputum production were 42% more likely to die from cardiovascular events than those without any respiratory symptoms adjusted for age.

Poor lung function has been shown to be as powerful a predictor of cardiac mortality as established risk factors such as total serum cholesterol.

The Lung Health Study investigators studied 5,887 smokers, aged 35 to 60 years, with mild to moderate airways obstruction. During the initial 5-year follow-up, 2.5% of the original cohort died, and 25% of those died of a cardiovascular event. For every 10% decrease in FEV1, all-cause mortality increased by 14%, cardiovascular mortality increased by 28%, and non-fatal coronary event increased by almost 20%.
A major goal of the GOLD program is to facilitate the diagnosis and staging of COPD.

The key feature necessary to establish the diagnosis of COPD is airflow limitation that is not fully reversible. For diagnosis, a ratio of the FEV1 to the FVC of less than 0.7 (FEV1/FVC < 0.7) has been used. The FEV1 can be reliably measured as the disease worsens but, because the FVC may be underestimated, the FEV1/FVC ratio is only used to establish a diagnosis.

The FEV1, expressed as the percentage of predicted, is used to stage severity.
• COPD progresses with age and COPD is more prevalent in elderly populations.
• In the United States, 15% of the total population aged 55 to 64 will have at least moderate COPD (GOLD stage 2, FEV1 < 80% predicted), and this increases to over 25% for those older than 75.
COPD Hypotheses for airway obstruction development

• “Dutch hypothesis”, Orie and associates from the Netherlands proposed that asthma and airway hyperreactivity could eventually lead to fixed airflow limitation.

• British hypothesis the concept that mucus hypersecretion leads to airway remodeling and airflow limitation

• protease-antiprotease hypothesis homozygous alpha1 protease inhibitor deficiency is associated with emphysema
  – PiZZ--homozygous, 80% have emphysema
  – PiMZ--lower level (50%) of enzyme, no emphysema

• The description of protease-induced emphysema in animal models α-1 protease inhibitor deficiency

• American hypothesis that altered repair mechanisms contribute to the development of COPD. Deficient maintenance of lung structure, particularly of alveolar capillaries, could lead to emphysema.
TREATMENT

• Therapeutic goals include
• (1) prevention of disease progression
• (2) relief of symptoms
• (3) improvement in exercise tolerance
• (4) improvement in health status
• (5) prevention and treatment of exacerbations
• (6) prevention and treatment of COPD-related complications
• (7) reduction in mortality.
• reduction of risk factors; symptomatic management of stable disease; and prevention and management of exacerbations.
Surgery

- Lung Volume Reduction Surgery
  - Dr. Otto Brantigan pioneered resectional surgery for diffuse emphysema in the late 1950s. A mortality rate of 16% soon caused the procedure to fall out of favor. Advances in technology and in surgical technique resulting from experience with lung transplantation led to a revival of surgical treatments of emphysema.
  - 1995, Cooper and colleagues presented results of 20 patients who had undergone a resection of between 20% and 30% of each lung via median sternotomy. The improvements in physical measures were remarkable as were functional and quality of life measures.
  - National Emphysema Treatment Trial (NETT), which attempted to compare surgical and medical treatment in a randomized, controlled study and to evaluate subsets of patients with distinct responses.
  - The first observation made by this study was that individuals with an FEV1 less than 20% predicted and either homogenous disease or a diffusion capacity of less than 20% predicted were at very high risk for mortality if treated surgically.
  - NETT study indentified some individuals, specifically those with localized disease and with poor exercise capacity, who experienced a substantial reduction in mortality and improvements in HRQOL and exercise capacity as a result of lung volume reduction surgery (LVRS).
  - A large number of questions related to LVRS remain. It is currently available at a limited number of centers and should be considered for patients likely to meet the selection criteria. Much of the current activity in this area centers on attempts to develop less invasive approaches to lung volume reduction, typically performed with a bronchoscopic approach.

- Surgery for Bullous Lung Disease
  - In the presence of a giant hyperlucent air space in the chest in a patient with compromised lung function, surgical excision may be considered. However, if lung function is not improved by the surgery, the morbidity and mortality of the procedure are high. It is not easy to know when to undertake surgery.
Periodic assessments

• 1-6 month intervals s/s, pulmonary function, QOL, exacerbations, Rx
• Spirometry initial, after treatment changes, exacerbations, 1-2 years
• Action plans PEF or symptom monitoring
  – PEF for moderate to severe asthma
10% deposited in lung

Mouth and Pharynx

90% swallowed (reduced by spacer mouth-washing)

GI tract

Lung

Absorption from gut

Liver

Inactivation in liver "first pass"

Systemic Circulation

Systemic Side Effects

Barnes et al. 1998 Asthma Basic Mechanisms and Clinical Management
- Smoking associated with more severe exacerbations
- Rapid decline in lung function
- Fatal attacks
Action Plans

• Lists patients best PEF
• Green, yellow and red zones
• Asthma medications they are on
• Printed each visit for the patient
• Imported into Power Chart during clinic as an Asthma Clinic Note
Spirometry

- Medical history and PE are not reliable means of excluding other diagnoses or characterizing the degree of lung impairment
- PFTs do not correlate directly with symptoms
- PFTs are recommended on a regular basis and are more reliable than PEF
- If spirometry not available PEF should be considered
Phenotype

- Two or more ED visits past year, any history of intubation or ICU admission especially last 5 years
- ICU admission untreated asthma mortality risk 25% in 6 years
- Smokers, patients attitudes to taking meds etc should all be considered in developing a treatment plan
Other considerations

• Allergens
• Formaldehyde volatile organic
• Influenza vaccine does not reduce severity or frequency of asthma exacerbations
• ABPA, obesity, OSA added
Medications

- ICS still most effective
- Higher doses flattening of the curve in response
- Addition of LABA to low to moderate dose ICS waffle a little since the studies on LABA alone
<table>
<thead>
<tr>
<th>Whistle</th>
<th>Yes</th>
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<tbody>
<tr>
<td>Initial</td>
<td>54%</td>
<td>46%</td>
</tr>
<tr>
<td>&lt; 1 mo</td>
<td>28%</td>
<td>72%</td>
</tr>
<tr>
<td>1 mo to &lt; 3 mo</td>
<td>21.5%</td>
<td>78.5%</td>
</tr>
<tr>
<td>3 mo to &lt; 6 mo</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>6 mo to 1 yr</td>
<td>76%</td>
<td>24%</td>
</tr>
</tbody>
</table>
Theophylline

- no benefit to intensive inhaled β-agonists for acute exacerbation Arch Int Med 1993;153:1784 Pediatrics 1994; 93:205
- side-effect profile significant
- many drug interactions
- not a strong role in outpatient asthma management (worsens GERD)
Sputum Examination

• In stable bronchitis, sputum is mucoid, and microscopic examination reveals a predominance of macrophages; bacteria are few.
• During an exacerbation, the sputum often becomes grossly purulent due to an influx of neutrophils. Eosinophils occur more in asthma and also make the sputum purulent.
• With an exacerbation, the number of organisms seen on Gram stain usually increases. The pathogens most often cultured from the sputum are *Streptococcus pneumoniae* and *Haemophilus influenzae*. Other oropharyngeal commensal flora such as *Moraxella catarrhalis* can be recovered.
COMPLICATIONS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

- Pneumonia
- Pneumothorax
- Osteoporosis
- Corpulmonale
- Hypercoagulability, perhaps due to systemic inflammation, may account for increased risk of deep venous thrombosis and pulmonary embolism in COPD patients.
- COPD patients may have a higher incidence of depression, which may also result, at least in part, from systemically active inflammatory mediators.
Asthma Action Plan
Name: Date: My Best Peak Flow Reading is: Doctor

GREEN Peak Flow Above
Take these medicines everyday, good days and bad days.
Breathing is good. Can work and Play. Where you should be every day
Use spacer with metered dose inhalers.

<table>
<thead>
<tr>
<th>Medicine</th>
<th>How Much to Take</th>
<th>When to take it</th>
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<tbody>
<tr>
<td>1.</td>
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<td>6.</td>
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</table>

Yellow Peak Flow Between AND
This is NOT where you should be. There may be coughing, wheezing and mild shortness of breath. Sleep and usual activities may be disturbed.
- Keep taking green zone medicines. Use spacer with metered dose inhalers.
- Add quick relief medicine: albuterol 2 to 4 puffs every four hours
  - If you improve completely after 2 to 3 treatments, continue your quick relief medicine 4 times per day for the next 24 hours.
  - Call for further advice
- If your peak flow is not back to Green Zone after using quick relief medication, Add Prednisone mg per day for four days
  - Call for further directions Karen-Lynn Fiato RN Asthma Educator pager 540-3723 8 am to 5 pm Monday-Friday. After hours call the hospital and ask for the Pulmonary Doctor on call
- If you improve completely after 2 to 3 treatments, continue your quick relief medicine 4 times per day for the next 24 hours. Call for further advice
- NOTE: Call your doctor if you keep dropping into the yellow zone. The green zone plan may need to be changed to prevent this.

RED Peak Flow Below GET HELP NOW!
Your Asthma is out of control. Quick relief medication is not working
Breathing hard and fast. Can't walk and talk well
Call your doctor now. Call for an ambulance or go to the hospital if
- You are still in the red zone after 15 minutes AND
- You have not reached your doctor
- Repeat quick relief medications every 20 minutes on your way to the hospital
• A recent study found among middle-aged smokers and former smokers, with mild or moderate chronic obstructive pulmonary disease, both breathed easier after quitting. After one year the women who quit smoking had 2 times more improvement in lung function compared with the men who quit.
History

- Cough and dyspnea are the most frequent symptoms reported by patients with COPD.
- Dyspnea is typically present only with exertion until late in the course of the disease.
- Dyspnea in COPD patients probably results from dynamic hyperinflation that worsens with increasing respiratory rate.
- Neither symptom causes the patient to seek medical care until advanced disease is present, and both symptoms should be aggressively sought in routine questioning.

- Sputum production is insidious in its onset and, in the majority of patients, it is “scanty,” defined as less than several tablespoons per day.
- Hemoptysis complicating chronic bronchitis is the most common cause of hemoptysis in the United States. Other cause of hemoptysis such lung cancer, must be kept in mind in this susceptible population.

- Exacerbations, which are characterized by increased cough, sputum, dyspnea, and fatigue, are increasingly frequent as the disease worsens. They generally resolve over a few weeks, but full recovery may take months.
COPD Exacerbation

- The most common causes of an exacerbation are tracheobronchial tree infection and air pollution, but the cause of about one-third of severe exacerbations cannot be identified.
- Inhaled bronchodilators (particularly inhaled β2-agonists with or without anticholinergics) and oral glucocorticosteroids are effective treatments for exacerbations.
- Patients experiencing an exacerbation with clinical signs of airway infection (e.g. increased sputum purulence) may benefit from antibiotic treatment.

- Rabe KF. et al. *AJRCCM* 2007; 176: 532-555
• Inflammation in COPD: a link to systemic comorbidities
• S.I. Rennard Eur Respir Rev 2007; 16: 105, 91–97

• Results from a large number of recent studies have characterised the inflammatory processes underlying COPD. Inflammatory cells, most notably CD8+ T-lymphocytes, macrophages and neutrophils, as well as a large number of chemokines, cytokines and proteinases, are believed to play a role.
• The inflammatory processes in COPD contribute to remodelling of pulmonary tissues, leading to the irreversible airflow limitation characteristic of this disease. Inflammation may also contribute to the comorbidities often observed in COPD patients. Patients with COPD often have cardiovascular disease, changes in body composition, osteoporosis and anaemia. The same inflammatory processes that characterise COPD are also risk factors for these comorbidities.

• Pharmacological actions of statins: potential utility in COPD

• ABSTRACT: Chronic obstructive pulmonary disease (COPD) is characterised by minimally reversible airflow limitation and features of systemic inflammation. Current therapies for COPD have been shown to reduce symptoms and infective exacerbations and to improve quality of life. However, these drugs have little effect on the natural history of the disease (progressive decline in lung function and exercise tolerance) and do not improve mortality. The anti-inflammatory effects of statins on both pulmonary and systemic inflammation through inhibition of guanosine triphosphatase and nuclear factor-kB mediated activation of inflammatory and matrix remodelling pathways could have substantial benefits in patients with COPD due to the following. 1) Inhibition of cytokine production (tumour necrosis factor-a, interleukin (IL)-6 and IL-8) and neutrophil infiltration into the lung; 2) inhibition of the fibrotic activity in the lung leading to small airways fibrosis and irreversible airflow limitation; 3) antioxidant and anti-inflammatory (IL-6 mediated) effects on skeletal muscle; 4) reduced inflammatory response to pulmonary infection; and 5) inhibition of the development (or reversal) of epithelial-mesenchymal transition, a precursor event to lung cancer. This review examines the pleiotropic pharmacological action of statins which inhibit key inflammatory and remodelling pathways in COPD and concludes that statins have considerable potential as adjunct therapy in COPD.
Asthma Pathophysiology

Smooth Muscle Dysfunction

- Bronchoconstriction
- Bronchial hyperreactivity
- Hyperplasia/Hypertrophy
- Inflammatory mediator release

Airway inflammation

- Inflammatory cell infiltration/activation
- Mucosal edema
- Cellular proliferation
- Epithelial damage
- Basement membrane changes

Symptoms/Exacerbations