Lots of Drugs

- Antitussives
- Decongestants
- Antihistamines
- Expectorants
- Mucolytics
- Bronchodilators
- Leukotriene antagonists
- Surfactants
- Mast Cell Stabilizers
- Antivirals

Focus on Cystic Fibrosis

Cystic fibrosis is an autosomal recessive disease affecting a gene that is responsible for a cell membrane chloride pump. There are over 1,000 known mutations to this gene that can result in cystic fibrosis. The defect alters how water and salts move across cell membranes and leads to secretions (all secretions) that are viscous. Because the pump is concentrated in the epithelium of the pancreas, lungs, GIT, sweat glands, salivary glands, and reproductive organs, these tissues are the most affected.

A sweat test is one way to screen for cystic fibrosis.

Most CF patients have:
- Salty sweat
- Fibrotic cysts in the pancreas leading to diabetes mellitus
- Opacified sinuses
- Chronic lung infections

Pseudomonas aeruginosa

P. aeruginosa is ultimately a common cause of death in cystic fibrosis patients. It may be treated using Cayston, an aerosol formulation of Aztrenam that is administered using a nebulizer.

Mucolytics & CF

Acetylcysteine (Mucomyst, Acetadote) chemically binds to mucous and changes the viscosity by breaking disulfide linkages. Mucomyst is administered using a nebulizer. The patient may observe a very disagreeable odor. There may be a large volume of liquefied secretions that may require mechanical suction.

ACETADOTE is an injectable formulation for use in Acetaminophen overdose. It acts to reduce the hepatotoxicity associated with acetaminophen.

A mucolytic such as Acetylcysteine may be used in COPD, TB, acute bronchopulmonary diseases, in the care of tracheostomies, during surgery, after chest trauma, and during bronchial diagnostic studies.
Colds, Allergies, Asthma

Antitussives

Antitussives are used to suppress cough. They are either opioids or opioid-derivatives (non-narcotic). Dextromethorphan (DXM, DM) is a common OTC non-narcotic opioid derivative. It is in hundreds of OTC products including many combination products. Hydrocodone with homatropine (Hycodan) is a commonly compounded opioid antitussive. Hydrocodone can also be compounded with APAP (Vicodin, Lortab, Lorcet Plus, Hycet), with chlorpheniramine (Tussinex), with ibuprofen (Vicoprofen), with aspirin (Lortab ASA). All are CII. Hycodan is indicated as an antitussive, the others as analgesics, but may be used as antitussives.

Non-steroidal nasal decongestants...

Oxymetazoline (Afrin) is a topical (spray) nasal decongestant. It is associated with a potent rebound reaction of increased congestion when it is discontinued. Oxymetazoline is also in many OTC products, including combination products.

Phenylephrine (Neo-Synephrine) is available PO, IV, IM, SC, PR, and topical. Like Oxymetazoline, it is a sympathomimetic alpha agonist and several formulations are available OTC and as combination cold or allergy treatment products.

Pseudoephedrine (Sudafed, Triaminic) is the 3rd sympathomimetic decongestant in this section. Pseudoephedrine is now regulated under the Combat Methamphetamine Epidemic Act of 2005. The CME Act requires products containing pseudoephedrine to be kept behind the pharmacy counter and sales are subject to strict recordkeeping and reporting requirements.

Sympathomimetics do not play nicely with COMT-I, MAOII, TCAs, SSRIs, beta blockers, digoxin, Bromocriptine or any other drug that alters the levels of, or response to, catecholamines or serotonin.
Steroid decongestants

There are a large number of synthetic corticosteroids that have been developed in recent years with an eye towards treating respiratory inflammation related to allergies and asthma. These products should not be used to treat colds as they can worsen viral infections. The products formulated to be orally inhaled increase the risk of oral candidiasis and patients should be educated to rinse out their mouths with water after using the inhaler.

**Budesonide** (*Rhinocort Aqua, Endocort-ec, Pulmicort, Symbicort*) is available as an inhalation solution and as a tablet/capsule. The oral formulations are used for Crohn’s disease, and asthma, but the inhalation products are used to treat pulmonary inflammation associated with COPD, Asthma and allergies.

**Mometasone** (*Nasonex*) is a topical steroid decongestant available as a metered inhaler. It is used for allergic rhinitis and nasal polyps.

**Flunisolide** (*AeroBid*) is a metered inhaler indicated for asthma maintenance and prophylaxis (but NOT as a rescue inhaler). It may be used for chronic allergic rhinitis.

**Fluticasone** (*Flonase, Veramyst*) is available as a topical nasal spray indicated as an antiinflammatory to treat allergic rhinitis. It requires training in order to properly apply the topical nasal sprays like Flonase and Veramyst. It is also available in combination inhalers for asthma & COPD maintenance.

None of the inhaled corticosteroids can be used as rescue asthma inhalers or to reverse status asthmaticus. These products, especially the topical nasal sprays, lead to drying of the nasal mucosa and nose bleeds. They often cause headache. All corticosteroids increase your risk of infection because they are immunosuppressant. They should not be used in active viral or fungal infections.

# Bronchodilators

## Xanthine bronchodilators

**Theophylline** (*Theo-24*) is a xanthine bronchodilator indicated to treat asthma and the bronchospasms associated with COPD. It is mainly used in COPD.

The Xanthines include caffeine and Theophylline has many side effects resembling those of coffee: tremors, tachycardia, transient diuresis....

## β2 agonist bronchodilators

The sympathomimetic bronchodilators include the short acting beta agonist **Albuterol** (*Proventil HFA, ProAir HFA*). The catecholamine **Epinephrine** (*EpiPen*) may be used to treat bronchospasms associated with anaphylaxis or status asthmaticus.

HFA refers to the hydrofluoroalkane propellant used in metered inhalers. EpiPens are available as auto-injectors.

**Isoproterenol** (*Isuprel*) is a mixed beta agonist. It is a parenteral used to prevent bronchospasm related to anesthetic agents.

## Anticholinergic bronchodilators

**Ipratropium** (*Atrovent-HFA*) is used in COPD maintenance. It has a lot of side effects.
**Leukotriene antagonists**

**Montelukast** (Singulair) and **Zafirlukast** (Accolate) are Leukotriene (LT) receptor blockers. They do not stop the synthesis of LTs so they have no effect on the production of prostaglandins.

Singulair is indicated for asthma, exercise-induced bronchoconstriction and allergic rhinitis. When used to treat asthma, it should be taken in the evening. Accolate is indicated for asthma prophylaxis.

**Zileuton** (Zyflo) is an orally active lipoxygenase (LOX) inhibitor. Zyflo may cause an increase in prostaglandin synthesis. It is indicated for asthma prophylaxis.

None of these drugs can be used for an acute asthma attack or status asthmaticus.

**Lung Surfactants**

**Beractant** (Survanta) is a natural bovine lung extract administered as an Intratracheal suspension. It is indicated to prevent and treat Respiratory Distress Syndrome (RDS) in premature infants. It needs to be warmed to room temperature prior to use and instillation requires specialized skills. It should not be shaken, but needs to be gently swirled to ensure a uniform suspension.

**Mast Cell stabilizer**

**Cromolyn** (Nasalcrom) is used to prevent asthma and exercised-induced bronchospasm. It is also used in systemic mastocytosis and in a variety of allergies. It is available in oral, intranasal or topicals (for the eye) formulations.

**Antivirals**

The antiviral drugs we are covering are all for influenza.

**Amantadine** (Symmetrel) is used to treat Parkinson’s disease, drug-induced EPS and as treatment and prophylaxis for influenza A infections. There is considerable resistance among influenza A viruses, though. Amantadine has a very narrow therapeutic margin.

**Oseltamivir** (Tamiflu) and **Zanamivir** (Relenza) are also used to prevent and treat influenza A. There is considerable resistance to these drugs as well.
Lung Smooth Muscle

Smooth muscle encircles the airways down to the level of the bronchioles. However, cartilage rings end in the bronchi. The cartilage helps keep the upper airways open. Why do we have smooth muscle in our lungs? There is no clear reason why smooth muscle is in our lungs.

It has been theorized that:

- Smooth muscle assists in coughing and sneezing, as well as mucus propulsion.
- Assists in exhalation
- Promotes lymph and venous flow
- Optimizing dead space

None of these theories hold water when closely examined. Do you have any idea?

Homework and Exercises

1. Read the “START HERE” announcement in Laulima for updates and instructions.
2. Read about Respiratory Pharmacology in Chapters 47 & 48 of Adams & Urban, PHARMACOLOGY Connections to Nursing Practice.
3. Review the Powerpoints and listen to the audio from the face-to-face lecture. You may opt to watch the appropriate videos for this lecture. Review any handouts available for this lecture in the Course Index.
4. Complete the SLO practice set for the Lungs in Tasks, Tests and Surveys.
5. Use “Chat,” “Discussions and Private Messages” or the lecture “Forum” to ask questions and find answers or to seek assistance.
6. Complete the online quiz in Laulima, Tasks, Tests and Surveys.

If you have any questions, email me at abeale@hawaii.edu