Sneezes, Wheezes, and Respiratory Diseases:
An update on Asthma, Allergic Rhinitis, and COPD

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Advanced Practice Education Associates

Objectives

• Evaluation of medications, evidence based guidelines used to treat Allergic Rhinitis
• Review evidence based guideline used to manage patients who have COPD and Asthma
• Review medications/classes used to manage patients who have COPD and Asthma

Speaker has no relationship to disclose.
Allergic Rhinitis

• 5th most common chronic disease in US
• Affects 1 in 6 people
• Treatment costs: $2-5 Billion annually

“Action Statements”

Strong Recommendation:
• Intranasal steroids first line
• Second generation oral antihistamines for sneezing and itching
Drug Classes with Indications to Treat AR

- Intranasal glucocorticoids (INGCs)
- Oral antihistamines
- Antihistamine sprays
- Mast cell stabilizers
- Leukotriene modifiers

Intranasal Glucocorticoids “INGCs”

- THE single most effective therapy for nasal symptoms
- Downregulate the inflammatory response
- Fewest side effects
- Best use in nasal congestion
- Superior efficacy compared to antihistamines

Why do they work?

- Inhibit allergic inflammation in nose
- Downregulate inflammatory responses by binding to the glucocorticoid receptors in the cytoplasm of the inflammatory cells
Comparisons between INGCs

- Comparative studies between INGCs have not demonstrated significant differences in efficacy

Determination of Efficacy

- First pass metabolism: decreases drug bioavailability

- Lipophilicity: ability of GC to penetrate the cell
Get the Drug *Where* it Needs to Work!

- Drug must remain in the nose (not down the back of the throat)
- If nose is crusted or contains mucus, get it out!!
- Use saline PRN

“Look at your Toes and Spray your Nose”!

- Best way to instill
- Direct away from the nasal septum
- Sniff to pull into upper parts of nose
- If it drains down the throat, sniff was too hard!

Reassurance for Long Term Use

- No increased rate of fractures, glaucoma, or cataracts
- No detrimental effects on bone density or intraocular pressure

*Ann Allergy, Asthma, Immunol 2006; 96:1.*
Quiz
When is the best time of day (or night) to use a nasal INGC?

When to Use INGCs?

- Evening/PM
- Nasal inflammation is greater at night than during the day


OTC Meds for Allergic Rhinitis
FDAs non-Rx Drugs Advisory Committee

- Triamcinolone acetonide (Nasacort Allergy 24HR) for OTC status: since Spring 2014
- Fluticasone propionate (Flonase Allergy Relief): since early 2015
Allergic Rhinitis
• Hhhhmrmrma......Insurance issues with Rx topical nasal steroids?
• $21.99-$27.99 OTC
• Generic cost to you?

“Action Statements”
Strong Recommendation:
• Intranasal steroids first line
• Second generation oral antihistamines for sneezing and itching

Anti-histamines (AH)
Why Not First Generation Anti-histamines?
1st Generation AH

- Diphenhydramine
- Chlorpheniramine
- Hydroxyzine
- Brompheniramine
- Cyproheptadine
- Others

1st Generation AH

- Cause significant sedation
- They are lipophilic and cross the blood brain barrier
- Hard to find!

1st Generation AH: Sedation

- Intellectual and motor function impairment are present even when there is no subjective awareness of sedation
Drug Trivia

What was the name of the first, once daily non-sedating anti-histamine to reach the market?
Clue: 1985 was the year

Drug Trivia:

Who remembers the name of the second one?

Seldane and Hismanal

Both removed from the market related to:
• Many drug interactions (extensive metabolism in liver, 3A4)
• QT interval prolongation
Take Home Point!

Be leery of using (or prescribing) medications that are first in their class!

2nd Generation AH
Oral Agents

- Loratadine, desloratadine, cetirizine, levocetirizine, fexofenadine (orals)
- Mostly non-sedating
- Lipophobic (so don’t cross BB barrier as the 1st gens do)
- Less impact on nasal congestion

2nd Generation AH

- Fexofenadine (metabolite of terfenadine)
- Desloratadine (isomer of loratadine)
- Levocetirizine (isomer of cetirizine)
Adverse Effects: Sedation

- Cetirizine, levocetirizine and azelastine are sedating for many patients
- Loratadine mostly non-sedating

Adverse Effects

- Fexofenadine is non-sedating even at higher than recommended doses

2nd Generations

- Less effective than topical nasal steroids for allergic rhinitis
- All oral 2nd generation agents have similar efficacies
“Options”
Clinicians may offer:
• Intranasal antihistamines seasonal, perennial, or episodic allergic rhinitis

2nd Generation AH Sprays
• Azelastine (generic) (Astelin), olopatadine (Patanase)
• Can be sedating
• Rapid onset of action! (< 15 minutes)
• Some anti inflammatory effects
• Improve nasal congestion
• PRN use
• Bitter taste

Azelastine/fluticasone (Dymista)
• Combines 2 generic meds
• Steroid plus antihistamine
• 1 spray each nostril BID

“Oral” Immunotherapy for Allergies

“Action Statements”
Recommendation:
• Clinicians should offer, or refer to a clinician who can offer, immunotherapy (sublingual or subcutaneous) for patients with AR who have inadequate response to symptoms with pharm therapy.


Grass Pollen Extracts
• Grastek: grass pollen allergen extract
• Oralair: grass pollen allergen extract
• Sublingual immunotherapy for allergic rhinitis
• > $200/month

Must have documented allergies before prescribing (Companies that will do this for primary care)
**Allergic Rhinitis**

- **Ragwitek:** ragweed pollen allergen extract
- **Sublingual immunotherapy for rhinitis**

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**Chronic Obstructive Pulmonary Disease (COPD)**

2014 Global Initiative for Chronic Obstructive Lung Disease (GOLD)

A report by NHLBI and WHO to define, diagnose, treat COPD

www.goldcopd.org/

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**Therapeutic Options: COPD Medications**

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta2-agonists</td>
<td>Short-acting beta2-agonists</td>
</tr>
<tr>
<td></td>
<td>Long-acting beta2-agonists</td>
</tr>
<tr>
<td>Anticholinergics</td>
<td>Short-acting anticholinergics</td>
</tr>
<tr>
<td></td>
<td>Long-acting anticholinergics</td>
</tr>
<tr>
<td>Combination</td>
<td>Short-acting beta2-agonists + anticholinergic in one inhaler</td>
</tr>
<tr>
<td></td>
<td>Long-acting beta2-agonists + anticholinergic in one inhaler</td>
</tr>
<tr>
<td>Methylxanthines</td>
<td></td>
</tr>
<tr>
<td>Inhaled corticosteroids</td>
<td></td>
</tr>
<tr>
<td>Combination</td>
<td>Long-acting beta2-agonists + corticosteroids in one inhaler</td>
</tr>
<tr>
<td>Systemic corticosteroids</td>
<td></td>
</tr>
<tr>
<td>Phosphodiesterase-4 inhibitors</td>
<td></td>
</tr>
</tbody>
</table>

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Chronic Obstructive Pulmonary Disease (COPD)  
Pharmacologic Management  
Bronchodilators  
1. Beta agonists (cause bronchodilation):  
   • Short acting beta agonists (SABAs)  
   • Example: albuterol  
   • Suffix is “terol”  
   • “Rescue med” (works immediately and effects last for about 4 hours)

Chronic Obstructive Pulmonary Disease (COPD)  
Pharmacologic Management  
SABAs  
Albuterol ProAir HFA, Proventil HFA, Ventolin HFA, Levalbuterol (Xopenex), ProAir RespiClick (inhalation powder)  
$42 - $56 per inhaler

Quiz  
Pharmacologic Management  
Short acting bronchodilator use is associated with greater risk of arrhythmias in new users.  
Which arrhythmia(s)?
What are the implications?

Pharmacologic Management

• Must manage cardiovascular risks aggressively!
• Get patient in good control to decrease times that SABAs are used!

<table>
<thead>
<tr>
<th>Drug</th>
<th>Brand</th>
<th>Form</th>
<th>Duration in hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>ProAir HFA</td>
<td>MDI</td>
<td>3-6</td>
</tr>
<tr>
<td></td>
<td>ProAir RespiClick</td>
<td>DPI</td>
<td></td>
</tr>
<tr>
<td>Proventil HFA</td>
<td>MDI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventolin HFA</td>
<td>MDI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levalbuterol</td>
<td>Xopenex HFA</td>
<td>MDI</td>
<td>8</td>
</tr>
</tbody>
</table>

What’s the difference between the β-2s?

<table>
<thead>
<tr>
<th>Drug</th>
<th>β-2 potency</th>
<th>Onset in minutes</th>
<th>Duration in hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>2</td>
<td>Within 5</td>
<td>3-6</td>
</tr>
<tr>
<td>Levalbuterol</td>
<td>???</td>
<td>Within 5</td>
<td>8</td>
</tr>
</tbody>
</table>
What’s the relationship between levalbuterol (Xopenex®) and albuterol?

Albuterol is a mixture of R and S isomers

R isomer ===> bronchodilation
S isomer ===> tachycardia, etc.

• Albuterol is a mixture of R and S isomers
• Levalbuterol is R-isomer of albuterol

Levalbuterol (Xopenex®)

• R-isomer of albuterol
• Albuterol is a mixture of R and S isomers
True or False

Pharmacologic Management

Levalbuterol is more effective at relieving shortness of breath than albuterol.

Levalbuterol (Xopenex®)

- Inconclusive whether there are fewer side effects for the degree of bronchodilation
- Older adults: inconclusive
- More expensive than albuterol

Levalbuterol (Xopenex®)

- Studies of children who use levalbuterol have failed to demonstrate an advantage with levalbuterol
- More expensive than albuterol
**LABAs**

*Pharmacologic Management*

*Long acting beta agonists (LABAs)*

- Salmeterol (Serevent®), formoterol (**Foradil®**: Twice Daily)
- Suffix is “terol”
- Not a rescue med (takes 10-20 mins to work) but works for 12-24 hours

***Formoterol leaving market about January, 2016***

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**LABAs**

*Pharmacologic Management*

*Long acting beta agonists (LABAs)*

- NEWER---- ONCE DAILY
  - Indacaterol (Arcapta Neohaler)
  - Olodaterol (Striverdi Respimat)

Neither has an indication for asthma!

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**Indacaterol**

*Pharmacologic Management*

*Long acting beta agonists (LABAs)*

- Stimulates beta 2 adrenergic receptors, relaxes airway smooth muscle
- Once daily, 75 mcg/ cap DPI
- Rapid onset and long duration
- US approved dose 75 mg; in Canada and Europe: 150-300 mg daily
- 3A4 substrate; P-glycoprotein transporter: ??? Is it safer in lower doses???
Pharmacologic Management

**Olodaterol**

- Long acting beta agonists (LABAs)
- Stimulates beta 2 adrenergic receptors, relaxes airway smooth muscle
- Once daily, 2 puffs; 2.5 mcg/actuation
  - MDI (soft mist inhaler)
- Rapid onset and long duration

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**How do we get the drug to the place it needs to work?**

*It has to commute from the mouth to the lungs!!!!!!*

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**Inhaler Devices:**

- MDI (multi-dose inhaler) and DPI (dry powder inhaler)
**Pharmacologic Management**

**MDI vs DPI**

- MDI
  - Solution/suspension
  - Uses a propellant to move drug into lungs
  - Small, portable
  - Hand: breath coordination (technique/coordination req’d); spacer, chamber helps
  - Less expensive (than DPI)

- DPI
  - Solid particles
  - Breath actuated (No propellants so, depends on force of inhalation)
  - Portable, quick to use
  - No spacer needed
  - Needs adequate lung volume
  - Dose counters

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**DPI Quiz**

What simple way can you use to make sure a patient has enough inspiratory effort to use a DPI inhaler?

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**Dry Powder Inhaler**

- Single dose capsules, multidose devices
- Inhalation de-aggregates the powder into smaller particles
- Can induce a cough
- Must have good inspiratory flow/effort (kids, COPD, asthma)
- Must have adequate lung volume
- Fewer irritant effects
Chronic Obstructive Pulmonary Disease (COPD)

Pharmacologic Management

<table>
<thead>
<tr>
<th>LABA</th>
<th>Dosing Frequency</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formoterol (Foradil)</td>
<td>BID</td>
<td>$221.07</td>
</tr>
<tr>
<td>Salmeterol (Serevent)</td>
<td>BID</td>
<td>$221.76</td>
</tr>
<tr>
<td>Indacaterol (DPI) (Arcapta Neohaler)</td>
<td>Daily</td>
<td>$183.37</td>
</tr>
<tr>
<td>Olodaterol (MDI) (Striverdi Respimat)</td>
<td>Daily</td>
<td>$155.70</td>
</tr>
</tbody>
</table>

Quiz

Is it considered safe practice to prescribe a LABA (as the lone daily agent) for a patient who has COPD?

1. Yes
2. No

Inhaled Anticholinergics

Pharmacologic Management

Inhaled Anticholinergic (Long-acting muscarinic agents-LAMAs)

- Works by preventing bronchoconstriction (yeah, ok it bronchodilates a little)
- Examples: Ipratropium (Atrovent), tiotropium (Spiriva), aclidinium (Tudorza Pressair), Umeclidinium (Icruse Ellipta)
- Suffix is “tropium” or “dinium”
- Combos: with SABA, LABA,
- May cause constipation, increased IOP
Quiz
Which long-acting medication class is preferred first line for a patient with COPD who complains of frequent SOB?

1. LABA?
2. LAMA?

Chronic Obstructive Pulmonary Disease (COPD)

Pharmacologic Management
Both are more likely to have CV events if used!!!

Atrial fibrillation

Atrial flutter

...back to the Quiz
Which long-acting medication class is preferred first line for a patient with COPD who complains of frequent SOB?

1. LABA?
2. LAMA?
Depends

- Data is not overwhelmingly supportive of either intervention
- Either choice is acceptable!
- Initial selection should depend on patient specific needs, comorbidities, and side effects

Chronic Obstructive Pulmonary Disease (COPD)

<table>
<thead>
<tr>
<th>Long Acting Anticholinergic (LAAC, LAMA)</th>
<th>Dosing Frequency</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aclidinium (DPI) (Turdoza Pressair)</td>
<td>BID</td>
<td>$256.05</td>
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<tr>
<td>Tiotropium Spiriva Handihaler (DPI)</td>
<td>Daily</td>
<td>$297.81</td>
</tr>
<tr>
<td>Spiriva Respimat (MDI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umeclidinium (Incruse Ellipta)</td>
<td>Daily</td>
<td>$224.76</td>
</tr>
</tbody>
</table>

Anticholinergic Medications

Anti-cholinergic Side Effects

Memory impairment, confusion, hallucinations, dry mouth, blurred vision, urinary retention, constipation, tachycardia, acute angle glaucoma
“An Ode to an Anticholinergic Med”

Oh this drug, it makes me pink,
Sometimes, I can’t think or even blink.

I can’t see,
I can’t pee,
I can’t spit,
I can’t (**it) (“defecate”).

A 60 year old patient with COPD who is on tiotropium has improvement in symptoms, but is using SABA 4-5 times daily. What next?

Incomplete resolution of symptoms:
1. Add theophylline
2. Add a LABA
3. Add a steroid
4. Punt?

Therapeutic Options: Theophylline

- Theophylline is less effective and less well tolerated than inhaled long-acting bronchodilators
- Not recommended if LABAs are available and affordable

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A 60 year old patient with COPD who is on tiotropium has improvement in symptoms, but is using SABA 4-5 times daily. What next?

**Incomplete resolution of symptoms:**
1. Add theophylline
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### Long acting Beta Agonist?

**Pharmacologic Management**

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### LAMA plus a LABA

- Umeclidinium plus vilanterol (Anoro Ellipta)
- Olodaterol/Tiotropium (Stiolto Respimat)
Are 2 better than one?

- Data from controlled trials are conflicting
- 5 trials found only slightly better QOL, small increase in post-bronchodilator FEV1 with combo (compared to LAMA alone)

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**Combo LABA and LAMA**

*Pharmacologic Management*

<table>
<thead>
<tr>
<th>Combo</th>
<th>Dosing Frequency</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olodaterol/Tiotropium</td>
<td>Daily</td>
<td>$315.68</td>
</tr>
<tr>
<td>(Stiolto Respimat)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vilaanterol/Umeclidinium</td>
<td>Daily</td>
<td>$280.95</td>
</tr>
<tr>
<td>(Anoro Ellipta)</td>
<td></td>
<td></td>
</tr>
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A 60 year old patient with COPD who is on tiotropium has improvement in symptoms, but is using SABA 4-5 times daily. What next?

*Incomplete resolution of symptoms:*

1. Add theophylline
2. Add a LABA
3. Add a steroid
4. Punt?
Chronic Obstructive Pulmonary Disease (COPD):

**Inhaled Steroids**

**Pharmacologic Management**

- Best in COPDers with FEV1 < 60% predicted
- Examples: fluticasone, mometasone, budesonide, others
- Suffix is “one” or “ide”

A 60 year old patient with COPD who is on tiotropium has improvement in symptoms, but is using SABA 4-5 times daily. What next? What is his FEV1?

**Incomplete resolution of symptoms:**

1. Add theophylline
2. Add a LABA
3. Add a steroid
4. Punt?

Therapeutic Options:

**Inhaled Corticosteroids**

- Regular treatment with inhaled corticosteroids improves symptoms, lung function and quality of life and reduces frequency of exacerbations for COPD patients who have an FEV1 < 60% predicted
Inhaled corticosteroid therapy is associated with an increased risk of pneumonia.

Therapeutic Options:

**Inhaled Corticosteroids**

- Inhaled corticosteroid therapy is associated with an increased risk of pneumonia.

Other Pharmacologic Treatments:

**Influenza and Pneumonia Immunizations**

- *Influenza vaccines* can reduce serious illness.
- Pneumococcal polysaccharide vaccine is recommended for COPD patients 65 years and older.
- Recommended for COPD patients younger than age 65 with an FEV₁ < 40% predicted.

What about oral steroids?

**Pharmacologic Management**

- CHRONIC use should be avoided!!!
- Unfavorable risk to benefit ratio.
Pharmacologic Management

Oral Steroids for Exacerbations

- Shorten recovery time
- Improve lung function (FEV₁) and arterial hypoxemia (PaO₂)
- Reduce the risk of early relapse, treatment failure, and length of hospital stay
- A dose of 40 mg prednisone per day for 5 days is recommended

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COPD

Roflumilast (Daliresp)

- New class: oral tablet phosphodiesterase 4 inhibitors
- MOA: increases cAMP in lung cells
- Reduces lung inflammation
- Reserve for severe or very severe COPD; to reduce recurrent exacerbations

PDE Receptors

- 9 different PDE receptors found in the body
- PDE5 receptors are found in male erectile tissue, platelets, vascular, skeletal, visceral tissues
- PDE3 receptors are found in coronary tissues
- PDE6 receptors are found in the retina
- PDE4 receptors are found in inflammatory and immune cells
PDE 4 Receptors

- PDE 4 is the major cAMP metabolizing enzyme found in inflammatory and immune cells
- Especially inflammatory cells in respiratory tissue
- Future use in asthma?? Allergic rhinitis??

Understanding Side Effects

- Hypotension (PDE3, PDE5)
- Abnormal vision (PDE6): color tinge to vision, increased sensitivity to light, blurred vision
- Cerebrovascular hemorrhages, SAH (PDE5)
- Diarrhea (PDE5)
- Nasal congestion (PDE5)
- Depressive mood effects (PDE4)
- Elevated PDE4 levels can produce insomnia

Therapeutic Options:

**Phosphodiesterase-4 Inhibitors**

- In patients with severe and very severe COPD (GOLD 3 and 4) and a history of exacerbations and chronic bronchitis, roflumilast, reduces exacerbations treated with oral glucocorticosteroids
COPD

Roflumilast (Daliresp)

- Maximize other inhalers first
- $255.99/month
- Watch out for 3A4 drug interactions

COPD

Roflumilast (Daliresp)

- Watch for insomnia, weight loss, depression, change in mood

Therapeutic Options:

Not Pharmacologic

- All COPD patients benefit from exercise training programs with improvements in exercise tolerance and symptoms of dyspnea and fatigue
- Although an effective pulmonary rehabilitation program is 6 weeks, the longer the program continues, the more effective the results
Mucolytics: Patients with viscous sputum may benefit from mucolytics; overall benefits are very small
Antitussives: Not recommended
Vasodilators: Nitric oxide is contraindicated in stable COPD. The use of endothelium-modulating agents for the treatment of pulmonary hypertension associated with COPD is not recommended.

Take Home Points

Pharmacologic therapy is used to reduce symptoms, reduce frequency and severity of exacerbations, and improve health status and exercise tolerance

Exacerbations

An exacerbation of COPD is:
“an acute event characterized by a worsening of the patient’s respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication.”
Exacerbations: Key Points

The most common causes:
• Viral upper respiratory tract infections
• Infection of the tracheobronchial tree

Diagnosis made on clinical presentation:
an acute change of symptoms that is beyond normal day-to-day variation

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Asthma

Asthma is a Disease of Inflammation!!!
Medications

- Bronchodilators
- Corticosteroids
- Leukotriene blockers
- Others (Feb 3: Spiriva!)

SABAs

- Every asthma patient
  MUST HAVE a short acting
  BD
- This is a safety issue!!!

Any Persistent Asthma: Mild, Moderate, or Severe

Needs an inhaled steroid
  DAILY.
  Which steroid?
### Inhaled Steroids

<table>
<thead>
<tr>
<th>Generic</th>
<th>Brand</th>
<th>Inhalation Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone</td>
<td>Qvar</td>
<td>MDI</td>
</tr>
<tr>
<td>Budesonide</td>
<td>Pulmicort</td>
<td>DPI</td>
</tr>
<tr>
<td></td>
<td>Flexhaler</td>
<td></td>
</tr>
<tr>
<td>Ciclesonide</td>
<td>Alvesco</td>
<td>MDI</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>Aerospan</td>
<td>MDI</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>Flovent Diskus</td>
<td>DPI</td>
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<td>Fluticasone HFA</td>
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<td></td>
<td>Twisthaler</td>
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<tr>
<td>Mometasone</td>
<td>Asmanex HFA</td>
<td>MDI</td>
</tr>
</tbody>
</table>

### Moderate or Severe Persistent Asthma

4. Steroid plus bronchodilators

- Combined mechanism as for steroid and bronchodilators
- Fluticasone plus salmeterol (Advair), Budesonide plus formoterol (Symbicort), Mometasone plus salmeterol (Dulera)
- Fluticasone furoate plus vilanterol (Breo)
- No generics, very expensive!!!

### Zileuton

- Zileuton (Zyflo): inhibits 5-lipoxygenase, interfering with leukotriene formation
- Inhibits LTB4, LTC4, LTD4, and LTE4
Zileuton
• Zileuton (Zyflo): Oral, QID
• Zileuton CR: 2 tabs BID
• Metabolized by 3A4, 1A2, and 2C9 enzymes
• $2000-$4000 per month

Omalizumab
• Omalizumab (Xolair)
• Inhibits IgE binding to mast cells and basophils, decreases free IgE levels, downregulates IgE receptors
• $862/vial
• 1-2 vials q 2-4 weeks

Mepolizumab
• Mepolizumab (Nucala)
• Binds to and interferes with interleukin-5 cytokine, reducing eosinophil production and survival
• Given every 4 weeks SQ
### Reslizumab

- Reslizumab (Cinqair)
- Binds to and interferes with interleukin-5 cytokine, reducing eosinophil production and survival
- Given every 4 weeks IV

### Omalizumab

- Omalizumab (Xolair)
- Inhibits IgE binding to mast cells and basophils, decreasing mediator release; binds to IgE, decreasing free levels of IgE and down-regulating IgE receptors
- Given every 2-4 weeks SQ

### Asthma is a Disease of Inflammation!!!
Asthma Exacerbations

- Asthma: nebulized bronchodilators, prednisone or prednisolone (less mineralocorticoid activity)

Last Points

- Adrenal insufficiency:
  - hydrocortisone used to help retain sodium and water
  - Give prednisone, methylprednisolone, prednisolone once daily to minimize HPA axis suppression

Thank you!

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• Dailymed.gov (drug package inserts); retrieved August, 2015