Rhinosisinusitis in Children

Jennifer Ker MD MS
Assistant Professor
Pediatric Allergy and Immunology
Rhinosinusitis

• Define types of rhinitis
• Pathophysiology of Allergic Rhinitis
• Management of Allergic Rhinitis
• Nonallergic Rhinitis
• Infectious Rhinitis
• Immunodeficiency associated with CRS
Definition of Rhinitis

• Rhinitis is characterized by 1 or more of the following symptoms:
  – Nasal congestion
  – Rhinorrhea (anterior and/or posterior)
  – Sneezing
  – Itching

Classification of Rhinitis

- Differentiation between allergic rhinitis and nonallergic rhinitis
  - Skin Prick Testing
  - Immunocap RAST testing
  - Defines approach to treatment
  - Also differentiate from other conditions that mimic the symptoms of rhinitis

## Types of Rhinitis

<table>
<thead>
<tr>
<th>Allergic Rhinitis</th>
<th>Nonallergic Rhinitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal Allergic Rhinitis</td>
<td>Vasomotor Rhinitis</td>
</tr>
<tr>
<td>Perennial Allergic Rhinitis</td>
<td>Infectious Rhinitis</td>
</tr>
<tr>
<td></td>
<td>NARES</td>
</tr>
<tr>
<td></td>
<td>Gustatory Rhinitis</td>
</tr>
<tr>
<td></td>
<td>Hormonal Rhinitis</td>
</tr>
</tbody>
</table>

Allergic Rhinitis

• 10-30% of adults
• 40% of children
• Risk factors:
  – Family history of atopy
  – Serum IgE > 100 IU/ml before age 6 years
  – Higher socioeconomic class
  – Presence of positive allergy skin prick tests

Allergic Rhinitis

• Pathophysiology
  – Initial sensitization - activation of allergen specific T cells that then coordinate the production of allergen specific IgE
  – Allergen specific IgE binds to high affinity receptors on mast cells and basophils
  – Reexposure exposure to allergen – leads to crosslinking of IgE molecules on the cell surface and mast cell and basophil activation

Allergic Rhinitis

- Degranulation of mast cells
  - Release of preformed mediators (5 minutes)
    - Histamine, proteases, cytokines
- Synthesis of other mediators (15 minutes)
  - Important in the recruitment of other cells and start of late phase response

Allergic Rhinitis

- Influx of eosinophils, basophils, monocytes, macrophages and lymphocytes
- Congestion predominates
- The inflammatory milieu that is created primes the tissue to respond to many triggers – allergic and nonallergic

Management of Allergic Rhinitis

• Environmental control measures
  – Pollen
  – Fungi/Mold
  – Dust mite
  – Furry animals (cat, dog, horse, rabbit, hamster)
  – Cockroach

Management of Allergic Rhinitis

• Medications
  – Oral second generation antihistamines
  – Intranasal antihistamines
  – Oral and topical decongestants
  – Intranasal corticosteroids
  – Oral corticosteroids
  – Intranasal anticholinergics
  – Oral anti-leukotriene agents

Management of Allergic Rhinitis

• Omalizumab
  – Humanized IgG1 monoclonal antibody that binds to free human IgE in the blood and interstitial fluid and to membrane-bound IgE on the surface of B lymphocytes
  – Demonstrated efficacy in AR
  – FDA approval for allergic asthma

Management of Allergic Rhinitis

• Nasal Saline
  – Effective in the treatment of chronic rhinorrhea and rhinosinusitis when used as the sole modality or for adjunctive treatment

Management of Allergic Rhinitis

- **Allergen Immunotherapy**
  - The repeated administration of specific allergens to patients with IgE mediated conditions for the purpose of providing protection against the allergic symptoms and inflammatory reactions associated with the natural exposure to these allergens.
Allergen Immunotherapy

• Very effective
• Use depends on the degree of improvement with avoidance/medications, amount of medication required for control, and adverse effects of medications
• May prevent the development of new allergen sensitization
• Reduces risk for development of asthma
### Allergen Immunotherapy

#### Build up Phase:
Injections 1-3 times per week

#### Maintenance:
Weekly -> Biweekly -> Monthly

<table>
<thead>
<tr>
<th>Dilution</th>
<th>Volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:10,000</td>
<td>0.05, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5</td>
</tr>
<tr>
<td>1:1000</td>
<td>0.05, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5</td>
</tr>
<tr>
<td>1:10</td>
<td>0.05, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5</td>
</tr>
<tr>
<td>1:1</td>
<td>0.05, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5</td>
</tr>
</tbody>
</table>

Dilution Volume (mL) | 1:10,000 | 1:1000 | 1:10 | 1:1 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Nonallergic Rhinitis

- Vasomotor Rhinitis
- Infectious Rhinitis

Vasomotor Rhinitis

- Episodic or perennial
- Pathophysiology never been established
- ‘idiopathic rhinitis’
- Heightened sensitivity to stimuli
  - Temperature change
  - Airborne irritants
  - Cold dry air
  - Exercise

Vasomotor Rhinitis

• Predominant nasal congestion
  – Intranasal antihistamines and/or intranasal corticosteroids most effective

• Rhinitis predominant
  – Ipratropium nasal spray most effective

Infectious Rhinitis

• **Acute Bacterial Rhinosinusitis**
  – Acute viral URIs are the most common predisposing factor for bacterial sinusitis
    • 90-98% of all episodes of acute bacterial sinusitis
  – AR is also an important predisposing factor to the development of acute bacterial sinusitis

  – Diagnosis made on the basis of history
    • Symptoms persisting beyond 7-10 days
    • Imaging is generally not needed

Infectious Rhinitis

• Acute Bacterial Rhinosinusitis
  – *Haemophilus influenzae* has become more common than *Streptococcus pneumoniae*
  – Studies regarding the use of antimicrobial agents have conflicting results, but generally favor treatment
  – First line treatment in children is Amoxicillin-clavulanate
  – Adjunctive treatment – nasal saline

Infectious Rhinitis

- **Recurrent sinusitis**
  - Acute bacterial sinusitis 3 or more times per year
  - Patients should be evaluated for comorbid conditions
    - Allergy
    - Anatomic abnormality
    - Underlying inflammation
    - Immunodeficiency, in particular if symptoms persist after surgical intervention or is associated with bronchiectasis or pneumonia
Infectious Rhinitis

• **Chronic rhinosinusitis:**
  – An inflammatory condition involving the paranasal sinuses and linings of the nasal passages which persists 12 weeks or longer

  – Four cardinal symptoms (≥2 must be present):
    • Anterior and/or posterior mucopurulent drainage
    • Nasal obstruction
    • Facial pain, pressure, and/or fullness
    • Decreased sense of smell
Infectious Rhinitis

• **Chronic Rhinosinusitis**
  – Medical Management
    • Oral prednisone 1-2mg/kg/day x 5 days, 0.5-1mg/kg/day x 5 days
    • 20-30 days of oral antibiotics
      – may be extended up to 6 weeks or for 7 days after symptoms have cleared
    • Intranasal saline irrigations or nasal saline spray
    • Topical glucocorticosteroid sprays or nasal instillations
Infectious Rhinitis

• Immune evaluation:
  – Typically performed for refractory sinusitis, sinusitis associated with pneumonia or bronchiectasis
  – CBC with differential
  – Quantitative immunoglobulins
  – Response to vaccination
    • Protein versus polysaccharide vaccine response
  – Lymphocyte enumeration
  – Sweat chloride
Infectious Rhinitis

• Immunodeficiency associated with CRS
  – Common Variable Immunodeficiency
    • B cell phenotyping
      – Switched memory B cells
  – Specific Antibody Deficiency
    • Deficiency in polysaccharide response
    • Normal immunoglobulin levels
  – Selective IgA deficiency
Infectious Rhinitis

• Treatment of Immunodeficiency
  – Immunoglobulin replacement
    • IV monthly versus subcutaneous weekly
    • Treatment for SVID and SAD, not IgA deficiency
  – Immunization with conjugate vaccine
  – Prophylactic antibiotics
    • Amoxicillin 20mg/kg/day
    • Trimethoprim-sulfamethoxazole 5mg/kg/day
    • Clarithromycin 7.5mg/kg/day
  – Prolonged courses of antibiotics