Pediatric Allergy

Susanne Diesner
Jan 20, 2011

Lecture - Overview

1. Risk factors for sensitization in children
   • Genetic factors
   • Hygiene hypothesis
2. Atopic march
3. Atopic eczema/dermatitis
4. Food allergy
5. Asthma
6. Allergic rhinoconjunctivitis
Allergies and Pediatrics

Most common **chronic disease** among children

Susceptibility in early life because neonates have a more pronounced **Th2**, pro-allergic cytokine response

Th2 suppression during first year of life in non-atopic children, whereas atopic children have a Th2 response and **defective IFN-γ production**

Sensitization

**When does sensitization/priming towards allergens occur?**

**Transplacentar/prenatal?**
- Allergen reactive T-cells found in cord blood
- Transplacental transport of IgG/allergen complexes
- But allergen avoidance during pregnancy protective?

**Postnatal/early life?**
- Active priming early in life – Risk for seasonal allergy higher when born in spring
- Not all children who have allergen reactive T-cells develop allergies

---

*Isabella Pali: Pregnancy and allergy Jan 27, 2011*

*Rowe et al. JACI. 2007*
Risk factors for sensitization in children

<table>
<thead>
<tr>
<th>Factor</th>
<th>Influence on risk of sensitization in the child</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Diet of mother during pregnancy | 6/6 PUFAs-based, oily and citrus fruits | Higher risk of eczema in the child during first 2 years of life 37, 38  
| Nutritional intake | Vegetable oil, raw sweet pepper, citrus fruits | Higher risk of food sensitization 39  
| Nutritional intake | Daily consumption of milk and milk products | Higher risk of sensitization against inhalant antigens 37  
| Nutritional intake | Overall high energy and lipid intake | Higher risk of wheezing, dyspnea, asthma, and rhinitis 39  
| Nutritional intake | Protein intake (e.g., Lactobacillus rhamnosus GG) | No effect on the outcome of atopic dermatitis at 2 years of age, increased risk of recurrent wheezing episodes 40, 41  
| Smoke exposure of mother during pregnancy | Higher total and specific IgE levels, eosinophilia, asthma, and wheezing episodes 42-45  
| Antibiotic treatment of child | Altered IgE levels | Increased wheezing treated with inhaled corticosteroids, skin test reactivity, and development of specific IgE 46, 47  
| Insufficient exposure to environmental bacteria | Inadequate intake of bacteria during pregnancy, infancy, early life, and persists with infections in first 9 months of child's life, increased respiratory volume, increased bronchial hyperresponsiveness, and decreased lung function in adolescent age 48, 49  
| Infantile dimer, low birth weight | Exposure route to an allergen: environmental contact through skin | Development of allergy: disease more likely, asthma, hay fever, and contact dermatitis 50, 51  
| Exposure route to an allergen: environmental contact through skin | Birth by cesarean section | Increased risk of allergic rhinitis and asthma, higher number of wheezing episodes and specific IgE levels 52, 53  

Pali-Schöll et al. JACI. 2009

Genetic risk-factors

- Alleles promoting Th2 are more frequent in tropical areas → fight against helminths → but improved hygienic conditions → no survival advantage → predispose to allergic diseases
- Single nucleotide polymorphism (C-159T) of CD14 associated with development of asthma and food allergy
- Mutations in FLG (filaggrin) affect AD
- HLA-DRB1, HLA-DQB1, HLA-DPB1 polymorphisms increase frequency of food allergy
- Low FOXP3 expression levels cause severe food allergy
- STAT6 polymorphism (G2964A) increased in nut allergics
- SNPs of IL10 gene (A-1082G and C-627A) higher risk for FA
- IL13 polymorphism (C-1055T) increases risk for FA

Wong et Chow. Pediatric Pulmonology. 2008  
Hong et al. Curr Opin Pediatr. 2009
Hygiene hypothesis

1989, Strachan et al:

„infection in early childhood transmitted by unhygienic contact with older siblings... have protective effect on the subsequent development of asthma and allergy“


Hygiene hypothesis

• Metaanalysis: reduced risk for allergy in children raised on farms

• Livestock exposure and allergic risk: (8 studies)
  – 42% reduction of allergic manifestation

• Pet ownership and allergic risk: (27 studies)
  – Pet ownership during childhood leads to 14% decrease in allergic risk
  – Dog ownership more protective than cats

Hygiene hypothesis

- **Unpasteurized milk consumption**: (7 studies)
  - 32% reduction in allergic manifestation

- **Home endotoxin exposure**: (13 studies)
  - 10% reduction by high endotoxin levels at home


Metanalysis of hygiene hypothesis studies

Hygiene hypothesis

• Infections
  – More than 3 episodes of gastroenteritis increase risk for later development of asthma at age 6
    Thomson et al. Pediatric Allergy and Immunology 2010
  
  – Measles infection protect against allergic disease in children
    Rosenlund et al. PARSIFAL Study group. Pediatrics 2009
  
  – Helminth infections: reduce risk for allergy by upregulation of IL10, cross-reactive blocking IgG4

• Immunisations/Vaccinations
  – Hypothesis: Children with higher vaccination coverage seemed to be better protected against development of allergy during early life
  
  – However, no significant effect of BCG, smallpox, pertussis or influenza virus on the development of allergies found
    Rottem and Shoenfeld. Curr Opin Otolaryngol. 2004
  
  – Combined diphteria and tetanus immunisation in first year increases risk for asthma
    Thomson et al. Pediatric Allergy and Immunology 2010. Vol 21, Issue 7
Atopic march

**Atopy**: genetic determined, familial cumulative disposition for hypersensitivity of skin and mucosa against allergens, including elevated IgE, alterations in cellular immune system

- **Atopic triad**
  - Atopic dermatitis
  - Asthma
  - Allergic rhinitis

---

**Sensitization model of atopic march**

- Langerhans cells have FcεRI
- Capture of allergens before processing in APC and presentation to T-cells
- Migration to lymph nodes
- Stimulate naive T-cells
- Expansion of Th2-cells

- AD patients: elevated Th2 cells and L13
- Memory Th2 cells migrate through circulation to nasal and lung mucosa and bone marrow
- Inhalation of aeroallergens → presentation by DC to T-cells in environmental rich Th2 cytokines
- Promoting allergic response
- Activation of eosinophils, induction of IgE, mast cells, mucus hypersecretion, smooth muscle cell proliferation

---

Wahn. WAO 2007

Spergel and Paller. JACI 2003
Atopic eczema/Atopic dermatitis

- **Onset**: in 45% of AD children within first 6 months of life; in 85% within first 5 years
- **Prevalence**: 15% in EU and USA
- **Prognosis**: 40-60% complete clearance of AD at puberty
- Very early onset of eczema associated with mutations of FLG (skin barrier protein filaggrin) → predisposes for early onset of acute severe asthma exacerbations
- Gestational diabetes increases risk for AD
- **Triggers**: irritants (soap, detergents), food allergens, skin infections

### Clinical criteria of AD

**Diagnosis** based on:
1) essential
2) important
3) associated clinical features

- Atopy patch test: Already in infants valuable additional diagnostic tool
- Pos. reaction to aeroallergens: specific for sensitized AD patients

**Clinical features**:
- Chronicity of the disorder, pruritus and age specific morphology and distribution of lesions
- Mild-limited: eg. Flexural area involvement
- Generalized-severe AD
- Risk for Staph.aureus superinfections

Spergel and Paller. *JACI* 2003
Krakowski et al. *Pediatrics* 2008
3 phases of AD

Infantile Phase

Onset: AD manifestation from birth to 2 years of age

Characteristics:
Papules and vesicles on cheeks, forehead or scalp
Intensely pruric
Exudative lesions
Significant oedema of affected areas
No lesions in diaper area

Spergel and Paller. JACI 2003

3 phases of AD

Childhood phase

Onset: 2 years of age to puberty

Characteristics:
Lichenified papules and plaques representing chronic disease
Areas: hands, feet, wrists, ankles, antecubital and popliteal regions
Facial involvement periorbital and perioral
Severe pruritus
Lymphadenopathy

Spergel and Paller. JACI 2003
3 phases of AD

**Adult phase**

**Onset:** Puberty to adulthood  
**Characteristics:**  
Areas: flexural folds, face, neck, upper arms and back, dorsa of the hands, feet, fingers and toes  
Dry scaling erythematous papules and plaques

![Do you Suffer from Eczema?](http://volacecream.com/wp-content/uploads/eczema-areas.png)

Spergel and Paller. *JACI* 2003

---

**Management of AD in children**

**Therapy/Management**  
Personalized treatment strategies: tailored to individual child’s age and needs, extent and localization of AD and overall disease course

**Breastfeeding??**  
**Probiotics??**  
**Timing of solid-food introduction** at 4-6 months of age

**Pharmaceutical therapy**  
**Emollients**, moisturizing agents (inhibiting water loss) recommended in all AD patients  
Emollients reduce use of topical corticosteroids  
**Topical corticosteroids** reduce inflammation and pruritus  
**Topical calcineurin inhibitors** NOT recommended as first line therapy  
But as alternative in children above 2 years who fail to respond to corticosteroids

Food Allergy

- **Prevalence:**
  - 3.9% of children affected, 18% increase in childhood from 1997-2007 (Sicherer. JACI. 2010)
  - Highest in infants and toddlers (6-8%)
  - Leading cause of anaphylaxis
  - Children with atopic dermatitis have higher prevalence (10-30%)
- **Children resolve food allergy:**
  - 11% resolved egg allergy by age 4
  - 19% resolved milk allergy by age 4
  - 80% resolved these allergies by age 16 years
  - 20% resolved peanut allergy by school age

Cianferoni and Spergel. Allergol Int. 2009

Food Allergens

Common food allergens in pediatric food allergy:
Cow’s milk, egg, peanuts, tree nuts, soy, wheat, fish, shellfish

<table>
<thead>
<tr>
<th>Prevalence</th>
<th>Infant/child</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>2.5%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Egg</td>
<td>1.5%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Peanut</td>
<td>1%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Tree nuts</td>
<td>0.5%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Fish</td>
<td>0.1%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Shelled</td>
<td>0.1%</td>
<td>2%</td>
</tr>
<tr>
<td>Wheat, soy</td>
<td>0.4%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Soy</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Overall</td>
<td>5%</td>
<td>3% to 4%</td>
</tr>
</tbody>
</table>

Sicherer and Sampson. JACI. 2010
Pathophysiology of food allergy

Brandtzaeg, Nature Reviews Gastroenterology & Hepatology. 2010

Pathogenetic features of pediatric food allergy

Gastrointestinal mucosal barrier important for food allergy prevention:
- **Physiological barrier**: tight junctions, mucus layer, trefoil factors strengthen mucosal barrier, enzymes, bile salts, extremes of pH
- **Immunological components**: innate (neutrophils, macrophages, NK cells, epithelial cells, TLR) and adaptive (IEL, lamina propria lymphocytes, Peyers patches, slgA and cytokines

**Infants and young children**: immaturity of various components of barrier:
- Various **enzymes** suboptimal in newborn period
- slgA system is not fully mature until 4 years of age
- Altered physiological barrier leads to increased IgE sensitization
- Altered intestinal **permeability** in infants and early exposure to allergens have been proposed as sensitization cause in some studies
Potential factors contributing to food allergy

Allen et al. J Clin Gastroenterol. 2010

Vitamin D and food allergy

Medical history

Allergen specific IgE

Skin prick test

Double blind placebo controlled food challenges under hospital settings
IgE vs. Non-IgE mediated food allergy

<table>
<thead>
<tr>
<th>Acute Allergic Reactions IgE</th>
<th>Intermediate</th>
<th>Delayed Allergic Reactions Non-IgE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to onset of reaction</td>
<td>&lt; 1 h</td>
<td>1–24 h</td>
</tr>
<tr>
<td>Volume required for reaction</td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Urticaria</td>
<td>Vomiting, diarrhea</td>
</tr>
<tr>
<td></td>
<td>Angioedema</td>
<td>Diarrhea</td>
</tr>
<tr>
<td></td>
<td>Anaphylaxis</td>
<td>Eczema, Failure to thrive</td>
</tr>
<tr>
<td></td>
<td>Oral allergy syndrome</td>
<td>Gastroesophageal reflux</td>
</tr>
<tr>
<td></td>
<td>Eczema</td>
<td>Severe irritability</td>
</tr>
<tr>
<td></td>
<td>Immediate</td>
<td>Food ingestion</td>
</tr>
<tr>
<td>Immediate profile</td>
<td>Mixed IgE</td>
<td>Mixed IgE mediated and non-IgE</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Skin prick test elevated levels of food-specific serum IgE antibodies</td>
<td>Modified from Allen RJ, Heese R, Hii DJ. M &amp; E. 2006;15:394-400</td>
</tr>
</tbody>
</table>

Allen et al. J Clin Gastroenterol. 2010
Non IgE mediated food allergy

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Age</th>
<th>Symptoms</th>
<th>Casual Foods</th>
<th>Investigations</th>
<th>Treatment</th>
<th>Differential Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food protein-induced early infancy</td>
<td>Early infancy</td>
<td>Persistent diarrhea, vomiting, abdominal distension, failure to thrive, eczema</td>
<td>Cow’s milk, soy, egg, wheat, fish, chicken, fish</td>
<td>Endoscopy (Biopsy): normal villi, no hyperplasia or crypt hyperplasia resulting in malabsorption, positive patch test, specific IgG (high), delayed reaction (oral food challenge)</td>
<td>Elimination diet during infancy</td>
<td>Chronic malabsorption due to intestinal villous damage</td>
</tr>
<tr>
<td>Food protein-induced cow’s milk</td>
<td>First weeks to months of life</td>
<td>Persistent feeding refusal, vomiting, eczema</td>
<td>Cow’s milk, casein, fish, crustaceans, eggs</td>
<td>Histamine-mediator tests: positive for cow’s milk, casein, eggs, fish</td>
<td>Elimination diet during infancy</td>
<td>Appears in first 3 months</td>
</tr>
<tr>
<td>Food protein-induced cow’s milk</td>
<td>Young infants</td>
<td>Persistent diarrhea, vomiting, abdominal distension, failure to thrive</td>
<td>Cow’s milk</td>
<td>Endoscopy (Biopsy): normal villi, no hyperplasia or crypt hyperplasia resulting in malabsorption, positive patch test, specific IgG (high), delayed reaction (oral food challenge)</td>
<td>Elimination diet during infancy</td>
<td>Chronic malabsorption due to intestinal villous damage</td>
</tr>
<tr>
<td>Enteropathic eosinophils</td>
<td>Any age (early infancy most detectable)</td>
<td>Chronic watery diarrhea, abdominal pain, failure to thrive</td>
<td>Cow’s milk, casein, eggs, gluten, foods</td>
<td>Endoscopy (Biopsy): normal villi, no hyperplasia or crypt hyperplasia resulting in malabsorption, positive patch test, specific IgG (high), delayed reaction (oral food challenge)</td>
<td>Elimination diet during infancy</td>
<td>Chronic malabsorption due to intestinal villous damage</td>
</tr>
</tbody>
</table>

Symptoms limited to gut

Allen et al. J Clin Gastroenterol. 2010

Anaphylaxis

Box 1: Definition of anaphylaxis (adapted from Sampson HA et al. [2])

Anaphylaxis is highly likely when any of the following three criteria are fulfilled:
1. An acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (e.g. generalized hives, pruritus or flushing, swollen lips, tongue, stridor, hypotension) and at least one of the following:
   a. Respiratory compromise (e.g. dyspnea, bronchoconstriction, stridor, hypoxia)
   b. Cardiovascular compromise (e.g. hypotension, collapse)
2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):
   a. Involvement of the skin or mucosal tissue (e.g. generalized hives, itch, flushing, swelling)
   b. Respiratory compromise (e.g. dyspnea, bronchoconstriction, stridor, hypoxia)
   c. Cardiovascular compromise (e.g. hypotension, collapse)
   d. Persistent gastrointestinal symptoms (e.g. crampy abdominal pain, vomiting)
3. Hypotension after exposure to known allergen for that patient (minutes to several hours)

Hypotension for children is defined as systolic blood pressure <50 mm Hg (2.5 SD below age) from 1 to 10 years and <30 mm Hg from 11 to 17 years.

Prevalence: 10.5 episodes in 100,000 children years

Most common triggers: latex (27%), food (25%), drugs (16%), venoms (15%)

Food allergens: Peanuts (19%), nuts (19%), milk (13%), fish, sesame, egg, tomato (all 2%)

Treatment:

Acute phase: Adrenaline (auto-injectors, EpiPen; 10 µg/kg KG i.m.), Antihistamines, Corticosteroids, oxygen, volume (crystalloid solutions), Monitoring for 6-8 hours or 24 hours after collapse

Long term risk reduction: Risk assessment (diagnosis) and personalised risk reduction strategies

**Asthma - Pathophysiology**

Sensitized patients: cross-linking of allergen specific IgE by inhalative allergens → secretion of inflammatory mediators → increase of vascular permeability, contraction of smooth muscle cells, increase of mucus production and migration of inflammatory cells (eos, Th2 cells)

Activated mast cells and Th2 cells secrete cytokines → eosinophils activated and degranulate → tissue damage → migration of inflammatory cells → chronic inflammation with irreversible tissue damage


**Asthma Prevalence**

- Childhood asthma is most prevalent chronic respiratory disease in Western world
- Prevalence increased up to 10% in children
- Higher in Western Europe than in Eastern Europe
- Highest in English speaking countries
- Onset in preschool age (90% before age 5)
Risk factors Asthma

- **Risk factors:**
  - Persistent and late-onset wheeze at school age associated with atopy
  - Transient wheeze associated with maternal smoking
  - Association of severity of symptoms in childhood and persistence of asthma into adult life (50% of severe asthmatic 10 year old have persistent asthma at 42 years)
  - Eczema, hay fever, allergic sensitization in childhood increases risk for severe asthma later in life
  - Risk factors for onset of asthma in adolescent: female sex and parental asthma, 2/3 of them had wheezing at preschool age
- **Genetics:** FLG, ORMDL3 and DENND1B genes
- **Viruses:** associated with acute disease worsening
  - Rhinovirus during wheezing in first year predicts asthma
  - Respiratory syncytial virus increases risk for asthma
- **Bacteria:**
  - Unfavourable composition of commensal bacteria can lead to asthma, eczema and allergy
- **Tobacco exposure:**
  - Pre/postnatal smoke exposure linked to asthma and wheezing
- **Multiple early sensitizaitons**


Phases of asthma

Initiation/Inception phase
- Gene
- Environment
  - Allergen
  - Virus

Maintenance/progression phase
- Environment
  - Allergen
  - Virus
  - Bacteria
  - Air Quality

Genes:
- Mast cell chymase 1 gene (CMA1)
- IL13, IL4 receptor gene, IL18
- SPINK5
- FLG
- MS4A2
- NAT2
- CTLA4

Importance of Environment-Gene interaction

Persistence/remission of asthma

- **Persistence** associated with female sex, smoking and atopy and earlier age of onset related with greater risk of relapse

- **Remission** associated with: lack of sensitization and allergen exposure, milder symptoms, older age, higher FEV1 and less bronchial hyperresponsiveness
  3 of 4 asthmatics will outgrow asthma at mid-adulthood

Models of asthma progression

- **A**: normal Lung function (FEV1), remains normal
- **B**: begins normal, severe obstruction over time
- **C**: begins normal, rapid decline early on resulting in severe obstruction
- **D**: begins with low levels, and continues with low lung functions

Differences - adult and childhood asthma

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease onset</td>
<td>Preschool children &gt;&gt; older children/adults</td>
</tr>
<tr>
<td>Increased incidence</td>
<td>Children &gt;&gt; adults</td>
</tr>
<tr>
<td>Pulmonary function tests (availability/use)</td>
<td>Adults/adolescents &gt; older children &gt;&gt; infants</td>
</tr>
<tr>
<td>Pathologic information</td>
<td>Adults &gt;&gt; adolescents &gt; children &gt; infants</td>
</tr>
</tbody>
</table>

Problems in assessing airway responsiveness in young patients:
- lack of standardized methods
- absence of established normal values
- difficulty in performing lung function in preschool aged children

Larsen. JACI 2000
### Differences - adult and childhood asthma

<table>
<thead>
<tr>
<th>Children vs Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>More likely to be male</td>
</tr>
<tr>
<td>More sensitive to suppressive glucocorticoids</td>
</tr>
<tr>
<td>Less impaired lung function</td>
</tr>
<tr>
<td>Higher mean FEV1 values (FEV1 measures are inadequate as indicators for disease severity in children)</td>
</tr>
<tr>
<td>Greater annual decline of FEV1 than adults</td>
</tr>
<tr>
<td>More likely to be episodic</td>
</tr>
<tr>
<td>Children tend to hyperinflate, increase total lung capacity. (FEV25-75 better for diagnostics)</td>
</tr>
</tbody>
</table>

### Differences – early life vs childhood asthma

<table>
<thead>
<tr>
<th>Early life vs childhood asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characterized by parental asthma</td>
</tr>
<tr>
<td>More often a history of eczema and early allergic sensitization</td>
</tr>
<tr>
<td>Infants less responsive to inhaled glucocorticoids</td>
</tr>
<tr>
<td>Inflammatory response more neutrophilic than eosinophilic</td>
</tr>
<tr>
<td>Reduced lung function in early infancy or even prenatally is risk factor for asthma in childhood</td>
</tr>
</tbody>
</table>
### Classification of Asthma Severity (0–4 years of age)

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Intermittent</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2 days/week</td>
<td>&gt;2 days/week</td>
<td>Daily</td>
<td>Throughout the day</td>
<td></td>
</tr>
<tr>
<td>Nighttime awakening</td>
<td>0</td>
<td>1-2/night</td>
<td>3+ months</td>
<td>&gt;1/month</td>
</tr>
<tr>
<td>Short-acting bronchodilator use for symptom control (not prevention of IBR)</td>
<td>&lt;2 days/week</td>
<td>&gt;2 days/week</td>
<td>Daily</td>
<td>Several times per day</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>Minor limitation</td>
<td>Same limitation</td>
<td>Extremely limited</td>
</tr>
</tbody>
</table>

### Risk Factors

- **Exacerbations with significant clinical symptoms**
- **Hospitalization**
- **Daily use of short-acting bronchodilator**
- **Emergency department visits**
- **Mother's and child's work with high levels of allergens**
- **Seasonal variation**
- **Respiratory infections**
- **Other illnesses**

### Recommended Step for Initiating Therapy

**Step 1:** Once diagnosis is confirmed, consider oral corticosteroids.

**Step 2:** If no improvement is observed in 3-4 weeks, consider adjusting therapy.

**Step 3:** If no improvement is observed in 4-6 weeks, consider alternative diagnosis.

---

**Key:** EIB, exercise-induced bronchoconstriction


---

**Lecture 514.094 of the Medical University Vienna**

**Chapter 11: Pediatric Allergy**

**Susanne Diesner**

Dept. of Pathophysiology and Allergy Research
**Asthma management of children (0-4 years)**

ICS: Inhaled Corticosteroids, Montelukast: Leukotriene receptor antagonist
LABA: inhaled long acting beta2 agonist
SABA: inhaled short acting beta2 agonist

**Schatz, Allergy Asthma Proc. 2007**

---

**Allergic rhinoconjunctivitis**

**Prevalence:** in 1990s 40% of US children

**Triggers:** Aeroallergens (pollen, mites, cat allergens)

**Mucosal sites:** conjunctiva, upper airways and lower airways

**Treatment:** Intranasal corticosteroids, Immunotherapy

**Diagnosis of allergic rhinitis**

- Careful History/Physical Examination
  - Differentiation
    - Allergic
      - Detection of signs/symptoms of allergen sensitivity:
        - Sneezing
        - Red, itchy, watery eyes, Rhinitis
        - Congestion, Oedema, Nasal secretions
      - Diagnostic testing:
        - IgE antibody (skin prick, serum IgE antibody immunoassay)
        - Blood eosinophils
    - Non-allergic

**Stewart, Clin Exp Allergy 2008**
**Pathophysiology of Allergic rhinitis**

**Allergen induced inflammation:**
- Inhaled allergens are taken up by DCs
- Presentation to T-cells
- Proliferation of basophils
- Production of IgE
- Proliferation of eosinophils and mastcells
- Histamine mediates symptoms

Broide. Allergy Asthma Proc. 2007

**Conclusion**

**Gene – environment interaction crucial for allergy**

**Developing countries**
- Large family size
- Rural homes, livestock
- Intestinal microflora-variable, transient
- Low antibiotic use
- High hemorrhagic burden
- Poor sanitation, high microbial burden

**Westernized countries**
- Small family size
- Affluent, urban homes
- Intestinal microflora-stable
- High antibiotic use
- Low or absent hemorrhagic burden
- Good sanitation, low microbial burden

Thank you for your attention!