CLINICAL ASPECTS OF PEDIATRIC ASTHMA

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Asthma Demographics

- Affects > 26 million Americans
- Affects 6 million children < 18 years old
- 1 in 13 people have asthma
- 1 in 12 children have asthma
- 3,615 people died from asthma in the U.S.
- 10 Americans die from asthma every day

AAFA.org (2018) and CDC.Gov (2018)
ASTHMA DEMOGRAPHICS

◆ Adults die 4x more frequently than children
◆ Women > men and boys > girls
◆ African-Americans: Higher risk of death
◆ 2008 to 2013: $81.9 billion dollars/year
◆ Leading chronic disease in children
◆ Top reason for missed school days

◆ AAFA.org (2018) and CDC.Gov (2018)
Doctor: “I want to know if my child has asthma”
WHAT IS ASTHMA?

◆ Asthma is an heterogeneous disease characterized by chronic airway inflammation

◆ Symptoms: wheeze, shortness of breath, chest tightness and cough that vary in time and intensity

◆ Variable expiratory airflow limitation

Global Initiative for Asthma (2015)
IMMUNOLOGICAL ASPECTS OF ASTHMA

David Weldom, M.D.  Texas A & M University, BSC
Visible sternocleidomastoid contractions

Overall hyperexpansion of the chest (increased antero-posterior diameter)

Anxious appearance

Circumoral cyanosis

Suprasternal retractions

Intercostal retractions

Substernal retractions

Sitting posture with patient slightly bent forward

Atlas of Pediatric Physical Diagnosis, 1987
VARIABLE AIRFLOW LIMITATION

https://commons.wikimedia.org/w/index.php?title=User:Evgenios_Metaxas_MD_MSc,_Pulmonologist_MD_MS
RADIOLOGICAL ASPECTS OF ASTHMA

Atlas of Pediatric Physical Diagnosis, 1987
HOW DO YOU DIAGNOSE ASTHMA?

◆ Pediatric asthma can be hard to diagnose and challenging to treat

◆ The diagnosis of asthma is clinical

◆ There is no specific test for asthma

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HISTORY OF PRESENT ILLNESS

- Cough, wheezing, chest tightness and difficulty in breathing.
- Most common: cough and wheezing
Asthma: More common cause of chronic cough in children > 3 years old

Asthma can present just with cough

Investigate the patterns of cough: nocturnal, seasonal, etc.

Asthma is frequently misdiagnosed or not suspected
80% of asthma children: symptomatic before age 5

Asthma is frequently misdiagnosed
HISTORY OF PRESENT ILLNESS - WHEEZING

- Hallmark of asthma
- Inspiratory and expiratory: polyphonic
- Central Obstruction: expiratory, monophonic: tracheomalasia
- Vocal cord dysfunction: inspiratory and monophonic (Stridor)
- Early onset: intermittent. Viruses
- Late onset: more persistent. Atopy
HX OF PRESENT ILLNESS
ASTHMA PATTERNS

◆ Intermittent exacerbations

◆ Seasonal patterns

◆ Aggravating factors: smoke, construction, irritants, URIs, GERD, rhinitis, medicines
HX OF PRESENT ILLNESS
VIRAL INFECTIONS

♦ URIs: Most important aggravating factors

♦ Rhinovirus, Influenza, and RSV.

♦ Also: Mycoplasma, Chlamydia.

♦ Chronic sinusitis

♦ AAAAI Revised 2017
HX OF PRESENT ILLNESS
VIRAL INFECTIONS

Viruses in Relation to Acute Wheezing
In Children and Adults

Percent of Patients Who Tested Positive for Virus

<table>
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<tr>
<th>Age Group</th>
<th>Wheeze</th>
<th>Control</th>
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<tbody>
<tr>
<td>&lt; 3 yrs</td>
<td>89%</td>
<td>32%</td>
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<tr>
<td>3-9 yrs</td>
<td>76%</td>
<td>0%</td>
</tr>
<tr>
<td>10-18 yrs</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>18-50 yrs</td>
<td>23%</td>
<td>6%</td>
</tr>
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</table>

# of patients

<table>
<thead>
<tr>
<th>Virus</th>
<th>2 viruses</th>
<th>&lt; 3 yrs</th>
<th>3-9 yrs</th>
<th>10-18 yrs</th>
<th>18-50 yrs</th>
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</thead>
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<tr>
<td>79</td>
<td>77</td>
<td>32%</td>
<td>16%</td>
<td></td>
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<tr>
<td>34</td>
<td>35</td>
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<tr>
<td>20</td>
<td>21</td>
<td>0%</td>
<td>5%</td>
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<td>70</td>
<td>62</td>
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</tbody>
</table>

HX OF PRESENT ILLNESS

EXERCISE

◆ Occurs in up to 90% of children with asthma
HX OF PRESENT ILLNESS
WEATHER

◆ Cold Air
◆ Hot, humid days
◆ Thunderstorms
◆ Winds
HX OF PRESENT ILLNESS
CIGARETTE SMOKE

◆ Most common environmental risk factor for the development and progression of asthma in children

◆ Smoking outdoors is better than indoors exposure
HX OF PRESENT ILLNESS

ALLERGENS

◦ House dust mites
◦ Cockroaches
◦ Rodents
◦ Pets
◦ Pollens
◦ Mold
HX OF PRESENT ILLNESS

IRRITANTS

- Nitrogen dioxide
- Perfumes
- Propellants from sprays
- Paint
- Room deodorizers
- Cleaning products
- Diesel particles
HX OF PRESENT ILLNESS

STRESS

◆ Anxiety
◆ Depression
◆ Chronic illness
ADDITIONAL ASPECTS OF THE CLINICAL HISTORY

- Atopic diseases: atopic eczema, rhinitis
- Food allergy
- Nasal polyposis
- Neonatal course
- Obesity
- Medications

- Tobacco smoke
- Wood burning
- Ventilation systems
- Animals
- Bedroom
- Water leaks
80% of children with atopic dermatitis develop asthma and or allergic rhinitis later on in life.
ATOPIC ECZEMA

% Patients with Eczema before Age 2

- Persistent wheeze before age 6
- Never wheezed by age 6


David Weldom, M.D. Texas A & M University, BSC
50% of people with AR have asthma

Most patient with asthma, have rhinitis

Risk factor for asthma

Atlas of Pediatric Physical Diagnosis, 1987
Prevalence of obesity and asthma is increasing in the world

- Early Onset: Atopic
- Late Onset: Non-atopic

Asthma is severe

- Less responsive to inhaled steroids
- Depression & sleep/apnea
MEDICATIONS

- Aadherence: < 60% in some studies
- Drug efficacy
- Drug delivery systems
- Response to treatment
PAST MEDICAL HISTORY

- Prematurity
- Developmental delay
- Failure to thrive
- Recurrent infections
- GERD
- Hospitalizations
- Emergency room visits
DISEASES THAT MIMICK ASTHMA

- Sinusitis
- Bronchiolitis
- Foreign Body
- Vocal cord dysfunction
- Vascular ring
- Laryngotracheomalacia
- Cystic fibrosis
- BPD
- Heart disease
- Bronchiectasis
- T-E Fistula
- Habitual cough
- GERD/aspiration
FAMILY HISTORY

◆ Over 100 genes associated with asthma

◆ 1 Parent: risk is 25%

◆ 2 Parents: risk is 50%

Thomsen SF. Eur Clin Respir J. 2015; 2: 10.3402/ecrj.v2.24643
ENVIRONMENT

- Wood burning
- Stoves
- Ventilation systems
- Animals, leaks & mold
- Patient’s bedroom
- Smoke exposure
Most children with asthma can have symptoms brought on by intensive activity.
PHYSICAL EXAM

- Between episodes, exam is usually normal
- Barrel chest
- Wheezing, rales, ronchi
- Decrease inspiratory phase
- Use of accessory muscles

Dr. Meyer B. Marks: Atlas of Pediatric Physical Diagnosis, 1987
PHYSICAL EXAM

- Signs of rhinitis
- Nasal Crease
- Eczema
- Clubbing
- Cyanosis
- Signs of developmental delay
- Malnutrition
- Cough
- Fever
- Lethargy
- Fatigue
- Angioedema
- Conjunctivitis
DIAGNOSIS OF ASTHMA

- History of intermittent chronic symptoms of asthma: cough and wheezing
- >10% increase of predicted FEV1 after inhalation of SABA
- Presence of other atopic diseases or family history of atopy
- Absence of other diseases
USEFUL TESTS FOR ASTHMA - SPIROMETRY

- Demonstration of reversible airflow obstruction establishes the diagnosis of asthma

- FEV1 < 80%; FEV1/FVC < 85%; FEF25-75% < 65%
USEFUL TESTS FOR ASTHMA - PEAKFLOW

- Measurements are variable
- Effort dependent
- Variability in reference values
- Variability in values from brand to brand
USEFUL TESTS FOR ASTHMA – ALLERGY TESTS

- Demonstrates the presence of atopy
- Must be supported by clinical history
- Food allergy test is not helpful unless there is GI symptoms, eczema or urticaria
USEFUL TESTS FOR ASTHMA – IMAGING

- Useful in children who do not respond to initial therapy
- Can help with other causes of wheezing: aortic arch, pneumonia, atelectasis, cystic fibrosis, etc.

Kendig’s Disorders of the Respiratory Tract in Children. Chernick 1990
USEFUL TESTS FOR ASTHMA
SWEAT CHLORIDE TEST

- When cystic fibrosis is suspected:
- Foul smelling stools
- Recurrent pneumonia
- Evidence of malabsorption
- Failure to thrive

Bruce Blaus. Blausen.com staff (2014)
ADDITIONAL TESTS FOR ASTHMA

- Sputum analysis
- Barium Swallow
- CBC with differential
- Total Immunoglobulins
- ABPA panel
- Methacholine Test.
- Nitric Oxide
DIAGNOSIS OF ASTHMA IN CHILDREN

![Graph showing the prevalence of transient early wheezers, non-atopic wheezers, and IgE-associated wheeze/asthma over different age groups.](image)

DIAGNOSIS OF ASTHMA IN CHILDREN

Asthma Predictive Index

History of greater than 4 wheezing episodes in one year (one - physician documented) PLUS

- One major criteria: OR
  - Parent with asthma
  - Atopic dermatitis
  - Aeroallergen sensitivity
    > 1 aeroallergen

- Two minor criteria:
  - Food sensitivity (milk, egg or peanuts)
  - Peripheral eosinophilia > 4%
  - Wheezing not related to viral URIs

If +, then 65% likelihood of developing asthma
If -, then 95% likelihood of NOT developing asthma


David Weldom, M.D.  Texas A & M University, BSC
CASE # 1, Maria, a 3.5 y.o. girl

History

- Maria had onset recurrent cough and labored respirations at about 7 months of age
- Typical course: rhinorrhea → cough → respiratory distress & wheezing primarily September to March
- 5 acute care visits past year for respiratory symptoms; 1 hospitalization
- Dx pneumonia 3 times
- Rx: IM & oral antibiotics repeatedly, budesonide aerosol 2 times daily, montelukast given daily, 3 four day courses of prednisolone
- Asymptomatic between episodes
Case #1, Maria, PB, 3.5 y.o. girl

Evaluation

- You are seeing Maria for the first time during the summer when she’s been well with no symptoms for the past month.
- Normal PE and oximetry.
- Review of outside chest x-rays from 3 episodes including hospitalization – peribronchial thickening, no parenchymal infiltrates.
- Allergy skin testing: no specific IgE to common inhalant allergens.
Audience Evaluation

- What’s the diagnosis?
- What treatment should be considered?
Take Home Points about Maria

- Symptoms are consistent with an asthma phenotype characterized by recurrent VRI induced lower airway inflammation (*cough, wheezing, dyspnea*) without chronicity

- Treatment with maintenance inhaled corticosteroids of little or no benefit *(McKean M, Ducharme F. Inhaled steroids for episodic viral wheeze of childhood. Cochrane Database Syst. Rev. 2000;(2):CD001107)*

- Oral corticosteroids effective for acute episodes; if given early, emergency care and hospitalizations potentially avoided

- “Pneumonia” a common misdiagnosis
CASE # 2, Lucy, 4.3 y.o. girl

History

- Lucy had atopic eczema beginning at 3 months of age
- Onset recurrent cough and labored respirations at 1.9 years of age in May
- 6 acute care visits the past year, about every 2 months
- Chronic rhinorrhea, worse seasonally with sneezing and conjunctivitis
- Episodic coughing at night
- Daily labored breathing with exertion
- Lucy wants to play sports but activity is limited by cough & dyspnea
- Improves with albuterol & prednisolone
CASE # 2, Lucy, 4.3 y.o. girl

Evaluation

- Lucy’s PE Normal except for:
  - Nasal stuffiness
  - Eczematous lesions in flexural creases and crusted areas on malar surfaces

- Oximetry 93%

- Outside x-ray reports reviewed: 10/17/06 “interstitial infiltrates”; 7/2/07 “interstitial prominence”

- Allergy skin testing: Allergen specific IgE for molds, including Alternaria, and multiple pollens
Audience Evaluation

◆ What’s the diagnosis?
◆ What treatment should be considered?
Take Home Points about Lucy

- Classic atopic triad (atopic eczema, allergic rhinitis, allergic asthma)
- Allergic asthma causing persistent symptoms
- Inhaled corticosteroid for maintenance
- Inhaled albuterol/salbutamol for acute symptom relief
- Oral corticosteroid for acute exacerbation
- Allergen identification and environmental amelioration if possible
MERRY CHRISTMAS