Disclosures

- None
Objectives

1. Discuss the evaluation and management of asthma in a pediatric patient
2. Accurately assess asthma severity and level of control and develop a comprehensive asthma action plan
3. Identify common barriers to good asthma control and minimize ER visits

Asthma Overview

Definition: A chronic inflammatory, obstructive lung disease-recurrent episodes of wheezing, chest tightness, breathlessness, coughing (particularly at night or early morning)

Leading cause of ER visits, hospitalizations, and missed school days

Affects more than 6 million children

Most common chronic disease of childhood

Can occur at any age

Number of deaths: 3,615, Deaths per 100,000 population: 1.1
• Rule out other underlying cause for wheezing
  
  • Careful history: symptoms, patterns, precipitating factors, and risks
  
  • Physical exam
  
  • Diagnostic studies

Diagnosis: “All that wheezes is not all asthma”

• Children 0-4 yrs old often underdiagnosed
  
  • 50–80% of children who have asthma develop symptoms before their fifth birthdays

• DDx:
  
  Gastroesophageal Reflux
cystic fibrosis
aspiration syndrome
congenital heart disease
bronchopulmonary dysplasia

• Recurrent episodes of cough and wheezing are due most often to asthma in both children and adults
Diagnosis

01 Episodic symptoms of airflow obstruction are present
  • Airflow obstruction is at least partially reversible

02 Based on “impairment” and “risk”

03 Spirometry for children >5 yo, with FEV1 % for age and height

Impairment

daytime and nighttime symptoms
albuterol use
degree of limitation with activity
Pulmonary function
### Risks

<table>
<thead>
<tr>
<th>Frequency of exacerbations</th>
<th>Use of oral corticosteroids</th>
</tr>
</thead>
</table>

**RISK FACTORS**

- Parental history
- Atopic disease: the strongest identifiable predisposing factor for developing asthma.
- Viral Respiratory infections: most important causes of asthma exacerbation and may also contribute to the development of asthma (RSV infection will result in about 40% of children with continue wheezing)
- Triggers: airborne allergens, airway irritants (tobacco smoke, pollution), indoor allergens (dust mite, cockroach, animal dander, molds)
Asthma pathway

Asthma or Reactive airway disease (RAD)?

- Reactive airway disease, a vague term used in young patients on asthma medications
- RAD was used as a term to described hyperactivity of airways
- Not been recognized by the American Academy of Pediatrics, the American Thoracic Society, or the National Heart Lung and Blood Institute to date
- RAD ICD10 code=J45.909, ICD 9 code=493.90
- Asthma IC10 code=J45.909, ICD 9 code=493.90
Determine severity at time of diagnosis before treatment

Classifications

- Intermittent
- Mild Persistent
- Moderate Persistent
- Severe Persistent

### Classifying Asthma Severity in Children 0–4 Years of Age

Classifying severity in children who are not currently taking long-term control medication.

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity (Children 0–4 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>0</td>
</tr>
<tr>
<td>Short-acting bronchodilators for symptom control (not prevention of EEI)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td>Exacerbations</td>
<td>0–1/year</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td></td>
</tr>
</tbody>
</table>

Consider severity and interval since last exacerbation.
Frequency and severity may fluctuate over time.

Descriptions of any severity may occur in patients in any severity category.
**CLASSIFYING ASTHMA SEVERITY IN CHILDREN 5–11 YEARS OF AGE**

Classifying severity in children who are not currently taking long-term control medication.

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity (Children 5–11 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>≥2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≥2/month</td>
</tr>
<tr>
<td>Short-acting beta-agonist use for symptom control (see prevention of EIB)</td>
<td>≥2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Lung Function</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations requiring oral corticosteroids</td>
</tr>
</tbody>
</table>

**CLASSIFYING ASTHMA SEVERITY IN YOUTHS ≥12 YEARS OF AGE AND ADULTS**

Classifying severity for patients who are not currently taking long-term control medications.

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity (Youths ≥12 years of age and adults)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>≥2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≥2/month</td>
</tr>
<tr>
<td>Short-acting beta-agonist use for symptom control (see prevention of EIB)</td>
<td>≥2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Lung Function</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations requiring oral corticosteroids</td>
</tr>
</tbody>
</table>
Treatment

• Goal=reduce Impairment and reduce risk

• Reduce Impairment:
  • Prevent chronic symptoms.
  • Require infrequent use of short-acting beta2-agonist (SABA), maintain (near) normal lung function and normal activity levels.

• Reduce Risk
  • Prevent exacerbations.
  • Minimize need for emergency care, hospitalization.
  • Prevent loss of lung function (or, for children, prevent reduced lung growth
  • Minimize adverse effects of therapy.

Treatment

1. Quick relief

1. Long-term control medications “Prevention”
   • Started on all children with Persistent Asthma
Quick Relief Medications

1. Short Acting Beta Agonist: Albuterol, Levalbuterol

2. Anticholinergic: Ipratropium

3. Systemic corticosteroid-adjunct to SABA for Moderate-severe asthma to speed recovery
   • Daily use or >2 “bursts”/yr is a sign of poorly controlled asthma, associated with mild adrenal suppression

Long Term Control Medications

1. Corticosteroid (inhaled, or short burst oral systemic)
   Most effective long-term treatment for patient with persistent asthma
   Potential risks (linear growth) of ICSs are well balanced by their benefits
   Poorly controlled asthma may delay growth in children

2. Cromolyn

3. Leukotriene modifiers: Montelukast, Zafirlukast, Zileuton

4. Long Acting Beta Agonist: Salmeterol, Formoterol
   • Not to be used as monotherapy
   • Risks for exacerbations
   • Adjuvant therapy with ICS for >12yrs old
### Table 5. Stepwise Approach for Managing Asthma: Preferred Therapy by Age Group

<table>
<thead>
<tr>
<th>Age</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Step 5</th>
<th>Step 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4 yr</td>
<td>SABA PRN</td>
<td>Low-dose ICS</td>
<td>Medium-dose ICS</td>
<td>Medium-dose ICS + either LABA or montelukast</td>
<td>High-dose ICS + either LABA or montelukast</td>
<td>High-dose ICS + ICS + either LABA or montelukast</td>
</tr>
<tr>
<td>5 to 11 yr</td>
<td>SABA PRN</td>
<td>Low-dose ICS</td>
<td>Medium-dose ICS + either LABA, ITRA, or theophylline</td>
<td>High-dose ICS + LABA</td>
<td>High-dose ICS + LABA</td>
<td>High-dose ICS + LABA + OCS</td>
</tr>
<tr>
<td>12 yr to adult</td>
<td>SABA PRN</td>
<td>Low-dose ICS</td>
<td>Medium-dose ICS</td>
<td>Medium-dose ICS + LABA</td>
<td>High-dose ICS + LABA*</td>
<td>High-dose ICS + LABA + OCS*</td>
</tr>
</tbody>
</table>

*Approved for once/day dosing

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### Table 4. Estimated Comparative Daily Dosages for Inhaled Corticosteroids

<table>
<thead>
<tr>
<th>Inhaled Steroid</th>
<th>Low Dose</th>
<th>Medium Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 4 yr</td>
<td>5 to 11 yr</td>
<td>12 yr to adult</td>
</tr>
<tr>
<td>Beclomethasone HFA (DuoNeb™)</td>
<td>NA</td>
<td>80 mg/actuator</td>
<td>160 mg/actuator</td>
</tr>
<tr>
<td></td>
<td>40 or 80 mcg/actuator</td>
<td>80 mg/actuator</td>
<td>160 mg/actuator</td>
</tr>
<tr>
<td>Fluticasone (Inhalar™)</td>
<td>176 mcg</td>
<td>88 mcg/actuator</td>
<td>176 mcg</td>
</tr>
<tr>
<td></td>
<td>200 mcg</td>
<td>100 mcg/actuator</td>
<td>200 mcg</td>
</tr>
<tr>
<td>Flunisolide (Aerolizer™)</td>
<td>0.5 mg</td>
<td>0.5 mg</td>
<td>1 mg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>160 mcg</td>
<td>220 mcg</td>
</tr>
</tbody>
</table>

*DEP=Depot powder inhaler, ICS=Inhaled corticosteroids, MDI=Metered-dose inhaler, N/A=not available, not approved, no data available, or safety/efficacy not established for this age group.
Treatment

• Current treatment:
  • effective in controlling symptoms
  • reducing airflow limitations
  • preventing exacerbations
  • **does not** appear to prevent the underlying severity of asthma

• Asthma self management

• Physician-Family Partnership

Asthma Self Management

• **Written Asthma Action Plan:**
  • recommended for patients who have moderate or severe persistent asthma, a history of severe exacerbations, or poorly controlled asthma

• Improves lung function
• Reduces missed school days
• Reduces ER visits
Asthma Self-management:

**FIGURE 3-10b: SAMPLE ASTHMA ACTION PLAN**

**Child Asthma Action Plan**

- **Child's Name:** [Blank]
- **Medical Record #:** [Blank]
- **Health Care Provider's Name:** [Blank]
- **Health Care Provider's Phone #:** [Blank]
- **Date:** [Blank]
- **When Was Action Taken:** [Blank]
- **How Often:** [Blank]
- **Other Instructions:** [Blank]

**Child is well:**

- **PREVENT:**
  - Avoid triggers that make the child asthmatic:
  - Use prescribed medications:
  - Avoid smoke, pollen, cold air, etc.
- **CAUTION:**
  - Teen: [Blank]

**Child is not well:**

- **PREVENT:**
  - Use prescribed medications:
  - Avoid smoke, pollen, cold air, etc.
- **CAUTION:**
  - Teen: [Blank]
  - Child: [Blank]

**Child feels awful:**

- **MEDICAL ALERT?** Get help:
  - Kid: [Blank]
  - Teen: [Blank]

**FIGURE 3-10a: SAMPLE ASTHMA ACTION PLAN**

**My Asthma Action Plan**

- **Patient's Name:** [Blank]
- **Medical Record #:** [Blank]
- **Physician's Name:** [Blank]
- **Physician's Phone #:** [Blank]
- **Date:** [Blank]
- **When Was Action Taken:** [Blank]
- **How Often:** [Blank]
- **Other Instructions:** [Blank]

**Special instructions when I feel good:**

- **PREVENT:**
  - Avoid triggers that make the child asthmatic:
  - Use prescribed medications:
  - Avoid smoke, pollen, cold air, etc.

**Special instructions when I do not feel good:**

- **PREVENT:**
  - Use prescribed medications:
  - Avoid smoke, pollen, cold air, etc.

**Special instructions when I feel awful:**

- **MEDICAL ALERT?** Get help:
  - Kid: [Blank]
  - Teen: [Blank]
What about those with only occasional symptoms?

“Rule of Two”

DO YOU...

1. Take your “quick-relief inhaler” more than TWO TIMES A WEEK?

2. Awaken at night with asthma more than TWO TIMES A MONTH?

3. Refill your “quick-relief inhaler” more than TWO TIMES A YEAR?

Follow up

• Initial diagnosis 1-3 weeks, then 1-6 months interval

• patient’s adherence to the regimen, inhaler technique, and side effects of medications

• History of exacerbation

• Monitor quality of life
Complementary treatment

• Osteopathic manipulation therapy:
  • rib raising, muscle energy for ribs, and myofascial release
  • Guiney, DO study showed significant improvement in peak expiratory flow

Complementary treatment

• Breathing exercises

• Natural health products

• Acupuncture (not recommended)

• Diet, vitamins, supplements
  Antioxidants (Mg), Omega-3 fatty acids, Vit D
Balancing cytokines

Numerous factors, including alterations in the number or type of infections early in life, the widespread use of antibiotics, adoption of the Western lifestyle, and repeated exposure to allergens, may affect the balance between Th1-type and Th2-type cytokine responses and increase the likelihood that the immune response will be dominated by Th2 cells and thus will ultimately lead to the expression of allergic diseases such as asthma.

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Taken from National Heart, Blood, and Lung Institute Expert Panel Report 3 (EPR 3): Guidelines for the Diagnosis and Management of Asthma. NIH Publication no. 08-4051, 2007
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“Hygiene Hypothesis”

- URECA study (Urban Environment and Childhood Asthma)

- New research associating increased bacterial diversity and abundance with lower risk appears

- Increase in the prevalence of allergies and asthma in modern, westernized countries might be an unintended consequence of children being exposed to fewer bacteria in cleaner indoor environment

“Hygiene Hypothesis”

- Evidence indicates that the incidence of asthma is reduced in association with
  - certain infections (M. tuberculosis, measles, or hepatitis A)
  - exposure to other children (e.g., presence of older siblings and early enrollment in childcare)
  - less frequent use of antibiotics

- Exposure to infections early in life influences the development of a child’s immune system along a “nonallergic” pathway, leading to a reduced risk of asthma and other allergic diseases
  - observed associations between large family size, later birth order, daycare attendance, and a reduced risk of asthma
Prevention

• Reduce prenatal smoking exposure, maternal stress and depression during and during infancy

• higher indoor levels of pet or pest allergens in infancy were associated with lower risk of asthma

• Avoid, dust mites, cockroaches and rodents, environmental allergens, high humidity level

Natural History of Asthma

“Will my child outgrow this?”
Depends....

If symptoms occur before 3 yrs of age, more likely to have persistent asthma symptoms risk factors?
four or more episodes of wheezing during the previous year:
Plus.....
either (1) one of the following:
1. parental history of asthma,
2. a physician diagnosis of atopic dermatitis
3. evidence of sensitization to aeroallergens, or
4. (2) two of the following: evidence of sensitization to foods, ≥ 4 percent peripheral blood eosinophilia, or wheezing apart from colds
Barriers to compliance

- Misuse of medication due to lack of education, understanding of its use
  - Roles of medication
- Lack understanding about the severity of their disease
- Daily medication as preventive is a burden
- Costs of medication for non-insurers
- Lack of environmental exposures control
- Provider education

References

5. Peter A. Guiney, DO; Rick Chou, DO; Andrea Vianna, MD; Jay Lovenheim, DO; Effects of Osteopathic Manipulative Treatment on Pediatric Patients With Asthma: A Randomized Controlled Trial, JAOA Vol 105 No 1 January 2005