Asthma in Infancy, Childhood and Adolescence

Presented by Frederick Lloyd, MD
Palo Alto Medical Foundation
Palo Alto, California
Major Health Problem in Childhood

- Afflicts 2.7 million children in the USA less than 18 years old
- 12.9 million doctor visits
- 200,000 hospitalizations
- 2 billion dollars cost annually
- Recent reports of rising rate of fatal and near fatal asthma
Wheezing With Respiratory Illness

- Common in children younger than 2
- Peak is 2-6 months old
- Wheezing usually limited to duration of “viral” illness
Recurrence With Respiratory Viral Illness

- Rate is about 50%
- Called “airway hyper-reactivity”
- Many children outgrow this by age 3-4
History is Important

• Prognosis for recurrent wheezing leading to asthma can be better predicted with a more thorough history
  – Fetal exposure to cigarette smoke
  – Male vs. female sex
  – Neonatal history of prematurity
  – Neonatal asphyxia or respiratory illness
Conditions to be Excluded

- Cystic fibrosis
- Gastroesophageal reflux with or without microaspiration
- Congenital obstructive airways lesions
- Bronchopulmonary dysplasia
- Congenital heart disease
Recurrent wheezing should trigger complete evaluation
Remember

• Not all children who wheeze have asthma
• Must rule out other disorders associated with wheezing
Pathophysiology: Changing Concepts

- Multifactorial pathogenesis
  1. Classic allergic
     - Extrinsic
     - Intrinsic
Pathophysiology: Changing Concepts

2. Inflammatory
   - Alteration in airway constitutive cells
     • Airway epithelial cells
     • Mast cells
   - Increased numbers of infiltrating cells
     • Eosinophils
     • T lymphocytes
   - Changes in non-cell component
     • Thickening of cell wall due to chronic inflammation
     • Basement membrane alterations
Pathophysiology: Changing Concepts

3. Neural
   – Triggered by parasympathetic airway receptors

4. Smooth muscle contraction
Genetic Factors

• Hereditary disease
• Genes and abnormal gene products not yet identified
Diagnostic Evaluation
History

• Family history
  – Allergy
  – Asthma
  – Cystic fibrosis

• Birth history
  – Prematurity
  – Neonatal respiratory illness
    • Respiratory distress syndrome
    • Meconium aspiration syndrome
History

- Foreign body aspiration?
- Environmental history
  - Smoking or other inhalant history in family members
  - Home environment and pets
- Respiratory system variables
  - Episodic
  - Seasonal
  - Nocturnal
  - Exertional
History

• Atopic features
• Feeding problems
  – Food allergies
  – Symptoms of motility dysfunction
    • Heartburn or crying with feeding
    • Regurgitation
    • Cough after feeding
Physical Examination

- Otitis / sinusitis
- Shape of thorax
- Inspiratory:expiratory ratio
- Air exchange
- Adventitious breath sounds
- Cardiac murmur
- Clubbing
Laboratory / XRay

- Chest xray
- Complete blood count
- Sweat test
- Immune function
- Gastroesophageal reflux workup
  - Barium swallow
- Specialized studies
  - Provocative testing
  - RAST
Treatment Protocols
Intermittent or episodic

• Characteristics
  – Infrequent
  – Mild, without loss of sleep
  – Less than once a week

• Treatment
  – Beta 2 agonist as needed for wheezing or cough
Persistent – Mild

• Characteristics
  – Less than 3 episodes per week
  – Brief symptoms (less than an hour)
  – Nocturnal
  – No associated respiratory distress

• Treatment (see tables 1 and 2)
  – Beta 2 agonist inhaled 4 times daily and as needed
  – Leukotriene inhibitors
Persistent – Moderate

• Characteristics
  – Symptoms more than 3 times per week
  – Exacerbations last several days at a time
  – Wheeze or cough may occur daily
    • Associated with feeding difficulty
    • Activity limitation
Persistent – Moderate (continued)

• Treatment (see tables 1 and 2)
  – Burst of oral steroids 3-7 days
  – Add inhaled cromolyn sodium
  – Or add
    • Oral beta 2 agonist
    • Theophylline in babies greater than 1 year old
  – If inadequate response
    • Add cromolyn sulfate
      – Replace cromolyn with inhaled steroid
Persistent – Severe

• Characteristics
  – Daily symptoms
  – Chronic respiratory embarrassment
    • Retractions
    • Slow growth
    • Fatigue
    • Inability to carry out usual daily activities
  – Nocturnal symptoms
  – Exacerbations resulting in hospital visits
Persistent – Severe

- Treatment
  - Consider
    - Ipratopium bromide
    - With nasal symptoms
      - Add Nasalcrom or nasal steroid insufflation
  - Add oral steroid as pulse with tapering doses to minimal alleviating symptoms such as:
    - Prednisone 1 mg/kg every day for 2 days then wean by .25 mg / kg per day for 4 days
When to Hospitalize…

1. Acute exacerbation not responding to treatment
2. Inability of family to handle care during exacerbation
Acute exacerbation not responsive to treatment in emergency room

- Hypoxemia
- CO2 retention
- Pulmonary air leak
- No response to repeated bronchodilator aerosols
  - 0.15 mg/kg/dose every 20 minutes times 3
  - If patient responds
    - Continue at 0.15 – 0.30 mg/kg every 1 to 4 hours
    - Maximum dose of 10 mg
Status Asthmaticus

• Definition
  – Bronchospasm not responding to the conventional therapy
  – Evidence of respiratory failure with rising arterial or arterialized capillary CO2 greater than 42 mm Hg
Status Asthmaticus

• Management
  – Oxygen by face mask to maintain saturation above 93%
  – Intravenous hydration (100 cc/kg/day)
  – Continuous Albuterol nebulization (0.3-0.5 mg/kg/hr, maximum of 15 mg) with oxygen by face mask
  – Intravenous administration of hydrocortisone
## Medications for Children with Asthma at Home: Table 1

<table>
<thead>
<tr>
<th>DRUG</th>
<th>FORMULATION</th>
<th>ADMINISTRATION DOSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>MDI 90 mcg/puff Neb – 0.50% soln.</td>
<td>2 puffs q 6 h 0.25-0.50 cc + 2 cc N. saline</td>
</tr>
<tr>
<td>Salmeterol</td>
<td>MDI 25 mcg/puff 50 mcg/blister</td>
<td>2 puffs q 12 h 1 inhalation q 12 h</td>
</tr>
<tr>
<td>Cromolyn sodium</td>
<td>MDI 800 mcg/puff 20 mcg/2 cc soln.</td>
<td>2 puffs three or four times daily 2 cc two or three times daily</td>
</tr>
<tr>
<td>Inatropium bromide</td>
<td>MDI 18 mcg/puff Neb – 500 mcg/2.5 cc</td>
<td>2 puffs three or four times daily 1.5-2.5 cc three/four times daily</td>
</tr>
<tr>
<td>Beclomethasone</td>
<td>42 mcg/puff</td>
<td>1-2 puffs twice/four times daily</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>250 mcg/puff</td>
<td>2 puffs twice daily</td>
</tr>
<tr>
<td>Triamcinolone</td>
<td>100 mg/puff</td>
<td>1-2 puffs two/three times daily</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>44, 110, 220 mcg/puff</td>
<td>2 puffs (44 mcg) twice daily</td>
</tr>
<tr>
<td>Budesonide</td>
<td>200 mcg/inhalation</td>
<td>1-2 inhalations twice daily</td>
</tr>
</tbody>
</table>
**Use only if serum theophylline can be measured. Therapeutic concentration: 10 mcg/ml in normal patients and 15 mcg/ml in patients on long term therapy**

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<th>ADMINISTRATION DOSAGE</th>
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<tbody>
<tr>
<td>Montelukast</td>
<td>4 mg chewable</td>
<td>2-5 yrs: 1 tablet at bedtime</td>
</tr>
<tr>
<td></td>
<td>5 mg chewable</td>
<td>6-14 yrs: 1 tablet at bedtime</td>
</tr>
<tr>
<td></td>
<td>10 mg chewable</td>
<td>&gt; 14 yrs: 1 tablet at bedtime</td>
</tr>
<tr>
<td>Theophylline**</td>
<td>Liquid 80 mg/5 cc</td>
<td>Initial: 10 mg/kg (300 mg/day max)</td>
</tr>
<tr>
<td></td>
<td>Tablets 50, 75, 100, 125,</td>
<td>After 3 days: 13 mg/kg (450 mg/kg max)</td>
</tr>
<tr>
<td></td>
<td>200, 300 mg</td>
<td></td>
</tr>
</tbody>
</table>
## Assessment of Severity of Acute Childhood Asthma: Table 3

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>MILD: Manage at home</th>
<th>MODERATE: May need hospital</th>
<th>SEVERE: Admit to hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered level of consciousness</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Talks in ...</td>
<td>Sentences</td>
<td>Phrases</td>
<td>Words</td>
</tr>
<tr>
<td>Pulsus paradoxus</td>
<td>No</td>
<td>Possibly</td>
<td>Yes</td>
</tr>
<tr>
<td>Central cyanosis</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Wheeze</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Uses accessory muscles</td>
<td>Absent</td>
<td>Moderate</td>
<td>Marked</td>
</tr>
<tr>
<td>Sternal retractions</td>
<td>Absent</td>
<td>Moderate</td>
<td>Marked</td>
</tr>
<tr>
<td>Peak flow</td>
<td>&gt; 60%</td>
<td>40 – 60%</td>
<td>&lt; 40%</td>
</tr>
<tr>
<td>Initial oxygen saturation</td>
<td>&gt; 95%</td>
<td>92-95%</td>
<td>&lt; 91%</td>
</tr>
</tbody>
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