

Asthma in Infancy, Childhood and Adolescence

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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

DRUG	FORMULATION	ADMINISTRATION DOSAGE
Albuterol	MDI 90 mcg/puff Neb – 0.50% soln.	2 puffs q 6 h 0.25-0.50 cc + 2 cc N. saline
Salmeterol	MDI 25 mcg/puff 50 mcg/blister	2 puffs q 12 h 1 inhalation q 12 h
Cromolyn sodium	MDI 800 mcg/puff 20 mcg/2 cc soln.	2 puffs three or four times daily 2 cc two or three times daily
Inatropium bromide	MDI 18 mcg/puff Neb – 500 mcg/2.5 cc	2 puffs three or four times daily 1.5-2.5 cc three/four times daily
Beclomethasone	42 mcg/puff	1-2 puffs twice/four times daily
Flunisolide	250 mcg/puff	2 puffs twice daily
Triamcinolone	100 mg/puff	1-2 puffs two/three times daily
Fluticasone	44, 110, 220 mcg/puff	2 puffs (44 mcg) twice daily
Budesonide	200 mcg/inhalation	1-2 inhalations twice daily

Oral Medications: Table 2

DRUG	FORMULATION	ADMINISTRATION DOSAGE
Montelukast	4 mg chewable 5 mg chewable 10 mg chewable	2-5 yrs: 1 tablet at bedtime 6-14 yrs: 1 tablet at bedtime > 14 yrs: 1 tablet at bedtime
Theophylline **	Liquid 80 mg/5 cc Tablets 50, 75, 100, 125, 200, 300 mg	Initial: 10 mg/kg (300 mg/day max) After 3 days: 13 mg/kg (450 mg/kg max)

** 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

Assessment of Severity of Acute Childhood Asthma: Table 3

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