BRONCHIAL ASTHMA
ASTHMA

Epidemiology

Pathophysiology

Diagnosis
CHILDHOOD ASTHMA

• Childhood bronchial asthma is characterized by
  – Airway obstruction – which is reversible
  
  – Airway inflammation
  
  – Airway hyper responsiveness
PREVALENCE OF BRONCHIAL ASTHMA

• Worldwide variation in prevalence
• Variation within countries
• ISAAC study – prevalence up to 25%
• More than 180,000 people die of asthma each year
• 5,000 deaths in the United States
INDUCERS
Allergens, Chemical sensitizers,
Air pollutants, Virus infections

Inflammation

Airway
Hyper responsiveness

TRIGGERS
Allergens,
Exercise
Cold Air, SO₂
Particulates

Airflow Limitation

SYMPTOMS
Cough  Wheeze
Chest tightness  Dyspnea
MODERN VIEW OF ASTHMA

- Allergen
  - Macrophage/dendritic cell
  - Mast cell
  - Th2 cell
  - Eosinophil
- Neutrophil
- Mucus plug
- Epithelial shedding
- Nerve activation
- Plasma leak
- Edema
- Vasodilatation
- New vessels
- Sub epithelial fibrosis
- Sensory nerve activation
- Sensory reflex
- Cholinergic reflex
- Bronchoconstriction
- Hypertrophy / hyperplasia

MODERN VIEW

Mucus hypersecretion
Hyperplasia
INFLAMMATION IN ASTHMA

- Acute inflammation
- Chronic inflammation
- Structural changes
**TRIGGERS**

Symptoms can occur or worsen in the presence of:

<table>
<thead>
<tr>
<th>ALLERGENS</th>
<th>OTHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Animal dander</td>
<td>● Exercise</td>
</tr>
<tr>
<td>• Dust mites</td>
<td>● Viral infection</td>
</tr>
<tr>
<td>• Pollen</td>
<td>● Smoke</td>
</tr>
<tr>
<td>• Fungi</td>
<td>● Changes in temperature</td>
</tr>
<tr>
<td></td>
<td>● Strong emotional expression</td>
</tr>
<tr>
<td></td>
<td>● Aerosol chemicals</td>
</tr>
<tr>
<td></td>
<td>● Drugs (NSAIDs, ß-blockers)</td>
</tr>
</tbody>
</table>
DIAGNOSIS

Bronchial asthma is an iceberg disease

Classical features
• Persistent cough, wheezing and dyspnea are seen in 30%

Atypical features
• Cough-variant asthma
• Nocturnal asthma
• Activity-induced asthma
• Persistent cough after an URI
• Recurrent pneumonia at different sites/ same site (middle lobe)
GUIDELINES FOR DIAGNOSIS

Diagnosis is mainly clinical

- Episodic symptoms of airflow obstruction, more than 3 episodes are present
- Airway obstruction is reversible
- Alternative diagnoses are excluded
INVESTIGATIONS

• Routine blood counts may not help
• Peripheral smear may show eosinophilia
• X–ray chest to rule out tuberculosis
• Sputum examination for eosinophils and Curschmanns spiral bodies – rarely needed
• **Pulmonary function tests** – Gold Standard
• Spirometry
• Peak Expiratory flow rate
### Differential Diagnosis of Wheezing

<table>
<thead>
<tr>
<th>Early infancy (Birth – 6 months)</th>
<th>Infancy – Early childhood (6 months – 3 years)</th>
<th>Late Childhood (&gt; 3 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration syndromes (Gastroesophageal Reflux etc.)</td>
<td>Bronchiolitis</td>
<td>Asthma</td>
</tr>
<tr>
<td>Bronchiolitis</td>
<td>Transient wheezing of childhood (TWC)</td>
<td>TWC</td>
</tr>
<tr>
<td>Foreign body inhalation (Rarely)</td>
<td>Foreign body inhalation, Congenital heart disease, Infection e.g., TB</td>
<td>Congenital heart disease</td>
</tr>
</tbody>
</table>
TREATMENT OBJECTIVES

• Freedom from
  – Acute asthma attacks
  – Symptoms including nocturnal cough
  – Emergency doctor/hospital visits

• Minimal need for quick relief (as needed) β₂-agonist

• Minimal (or no) adverse effects from medicine

• Normal
  – Physical activity including participation in sports
  – Maintain lung function as close to normal as possible

• Growth Charts
TREATMENT STRATEGY

- Identify and avoid triggers that make asthma worse
- Achieve control by selecting appropriate medication
- Treat asthma attacks promptly and effectively
- Educate patients to manage their condition
- Monitor and modify asthma care to maintain effective long-term control
## CLASSIFICATION OF ASTHMA SEVERITY

<table>
<thead>
<tr>
<th>Grade/Severity</th>
<th>Symptoms</th>
<th>Night time</th>
<th>PEFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent Grade 1</td>
<td>&lt; 3 / week</td>
<td>&lt; 3 / month</td>
<td>&gt;80%, &lt; 20% variation</td>
</tr>
<tr>
<td>Mild Persistent Grade 2</td>
<td>≥ 3 / week but &lt; once a day</td>
<td>&gt; 3-4 / month</td>
<td>&gt;80%, 20-30% variation</td>
</tr>
<tr>
<td>Moderate persistent Grade 3</td>
<td>&gt;Daily symptoms attacks affect activity</td>
<td>&gt; once a week</td>
<td>60-80%, &gt;30% variation</td>
</tr>
<tr>
<td>Severe persistent Grade 4</td>
<td>&gt; Continuous Limited physical activity</td>
<td>Frequent</td>
<td>&lt; 60%, &gt;30% variation</td>
</tr>
</tbody>
</table>
DRUGS

Relievers
• To treat bronchospasm and relieve acute attacks

Controllers
• For prevention of further attacks
Relievers

- Selective short-acting $\beta_2$-agonists
  - Salbutamol
  - Terbutaline

- Non selective $\beta$-agonist
  - Adrenaline

Controllers

- Inhaled steroids
  - Beclomethasone dipropionate
  - Budesonide
  - Fluticasone propionate

- Mast cell stabilizers
  - Sodium cromoglycate
  - Nedocromil Sodium
<table>
<thead>
<tr>
<th>Relievers</th>
<th>Controllers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Anticholinergics</strong></td>
<td>• <strong>Long acting $\beta_2$-agonist</strong></td>
</tr>
<tr>
<td>Ipratropium bromide</td>
<td>Salmeterol, Formoterol</td>
</tr>
<tr>
<td>• <strong>Oral steroids</strong></td>
<td><strong>Methyl Xanthines</strong></td>
</tr>
<tr>
<td>• <strong>Theophylline</strong></td>
<td>Sustained-release theophylline</td>
</tr>
<tr>
<td></td>
<td><strong>Oral Prednisolone</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Leukotriene antagonists</strong></td>
</tr>
<tr>
<td></td>
<td>Montelukast, Zafirlukast, Pranlukast</td>
</tr>
</tbody>
</table>
GRADE 1

Step 1: Intermittent asthma

Controller
None required

Reliever
- Inhaled $\beta_2$-agonist prn
  (not more than 3 times a week)
- Inhaled $\beta_2$-agonist or
cromone prior to exercise
  or allergen exposure

Avoid or control triggers
### Step 2: Mild persistent asthma

<table>
<thead>
<tr>
<th>Controller</th>
<th>Reliever</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Daily low dose inhaled corticosteroid (&lt;400 μg) OR</td>
<td>- Inhaled ( \beta_2 )-agonist prn (but less than 3-4 times per day)</td>
</tr>
<tr>
<td>- Inhaled sodium cromoglycate</td>
<td>▲ use may</td>
</tr>
<tr>
<td>▪ Nedocromil or leukotriene indicate need for modifier, sustained release</td>
<td></td>
</tr>
<tr>
<td>▪ Theophylline</td>
<td>- long term control</td>
</tr>
</tbody>
</table>

**Avoid or control triggers**

GRADE 2
GRADE 3

Step 3: Moderate persistent asthma

**Preventer**
- Daily low dose inhaled steroid + inhaled long-acting β₂ agonist (may provide better control of symptoms) OR
- Daily medium dose corticosteroid 400-800 μg
- LTM, SR Theophylline and long acting β agonist

**Reliever**
- Inhaled β₂-agonist prn
  ↑use may indicate need for long term control therapy

Avoid or control triggers

LTM: Leukotriene modifier
### Step 4: Severe persistent asthma

#### Controller
- Daily high dose inhaled corticosteroid > 800\(\mu\)g
- Daily long-acting bronchodilator ± theophylline
- Daily oral corticosteroid tablets or syrup
- LTM & long acting \(\beta\) agonists

#### Reliever
- Inhaled \(\beta_2\)-agonist prn (but less than 3-4 times per day)
- ↑use may indicate need for long term control therapy

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**Avoid or control triggers**
TREATMENT

Avoid or control triggers

STEP 1: INTERMITTENT
PREVENTER: None

RELIEVER
• Inhaled β₂-agonist p.r.n.

STEP 2: MILD PERSISTENT
Preventer: daily medications
• Inhaled low dose steroid
• Or possibly cromone
• LTM, Theophylline

RELIEVER
• Inhaled β₂-agonist p.r.n.

STEP 3: MODERATE PERSISTENT
PREVENTER: daily medications
• Inhaled low dose steroid and long-acting bronchodilator OR
• Inhaled medium dose steroid
• LTM, Theophylline

RELIEVER
• Inhaled β₂-agonist p.r.n.

STEP 4: SEVERE PERSISTENT
PREVENTER: daily multiple medications
• Inhaled high dose steroid
• Long-acting bronchodilator
• Oral steroid, theophylline, LTM

RELIEVER
• Inhaled β₂-agonist p.r.n.

Step up if not controlled (after check on inhaler technique and compliance)

Step down when controlled

• Patient education essential at every step
• Reduce therapy if controlled for at least 3 months
• Continue monitoring

Patient education essential at every step
• Reduce therapy if controlled for at least 3 months
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• Inhaled low dose steroid
• Or possibly cromone
• LTM, Theophylline

RELIEVER
• Inhaled β₂-agonist p.r.n.

Avoid or control triggers

RELIEVER
• Inhaled β₂-agonist p.r.n.

Avoid or control triggers

TREATMENT

Avoid or control triggers

RELIEVER
• Inhaled β₂-agonist p.r.n.
ACUTE SEVERE ATTACK

• Too breathless to feed
• Respiratory rate > 50 min
• Heart rate > 140 / min
• PEFR < 50% of the best
• Poor or only transient (<2hr) response to bronchodilator
• Worsening despite 2–3 doses of recent dose of bronchodilator at 15 minutes interval
SYMPTOMS OF LIFE THREATENING ASTHMA

• Unable to talk or cry
• Cyanosis
• Feeble chest movements
• Absent breath sounds
• Fatigue or exhausted
• Agitated
• Altered sensorium
• Oxygen saturation < 91% in pulse oximeter
Assessment of severity of an acute attack of bronchial asthma can be done by a simple scoring system called **Pulmonary Score Index (PSI)**—(PCNA December ‘99)
### PULMONARY SCORE INDEX

<table>
<thead>
<tr>
<th>Score</th>
<th>Respiratory Rate</th>
<th>Wheezing</th>
<th>Sternomastoid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt; 6 years</td>
<td>&gt; 6 years</td>
</tr>
<tr>
<td>0</td>
<td>&lt; 30</td>
<td>&lt; 20</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>31–45</td>
<td>21–35</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>46–60</td>
<td>36–50</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>&gt; 60</td>
<td>&gt; 50</td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td>0–3 Mild</td>
<td>4–6 Moderate</td>
<td>&gt; 6 Severe</td>
</tr>
</tbody>
</table>

Those children whose score is > 6 should be admitted to a pediatric ICU.
ALGORITHM FOR MANAGEMENT OF ACUTE SEVERE ASTHMA

- Establish diagnosis, consider differential diagnosis particularly if first presentation
- Assess severity

**Initial treatment**

- Oxygen to maintain saturation > 90–95%
- Nebulized salbutamol 3 doses at 20 minute intervals, < 20 kg: 0.5 ml salbutamol with 3 ml N Saline. >20 kg: 1 ml salbutamol with 3 ml N Saline
- Nebulized ipratropium: < 1 year – 0.5 ml, > 1 year – 1ml
- Steroids: Methylprednisolone 2mg/kg stat, followed by 1mg/kg x 6 hourly or Hydrocortisone– 10 mg/kg stat followed by 5 mg/kg x 6th hourly daily.
Not improved

**Reassess diagnosis**

**Inj Magnesium Sulphate 25-30 mg/kg in 50 ml N saline over 30 mins, may be repeated after 6 hrs.**

Not improved after 1st dose MgSO₄

**Terbutaline infusion Load with 5–10 μg/kg followed by 2-10 μg/kg (Increase dose every 15 minutes)**

Not improved

**Aminophylline infusion (Reduce terbutaline infusion by 50%)**

Not improved

**Mechanical ventilation**

Improved

**Nebulized Salbutamol hourly**

**Increased interval between doses as tolerated to Q-4H**

Continue steroids, ipratropium
INDICATIONS FOR INTUBATION

Absolute
• Cardiac arrest
• Comatose child
• Severe respiratory distress
• Silent chest, exhaustion

Relative
• Hypoxemia $pO_2<60$ mm Hg in 60% oxygen
• $pCo_2>65$ mm Hg & or $pCo_2$ rising by $>5$ mm Hg/hr.
• Metabolic acidosis ($BE > 8 – 10$)
TREATMENT FOR ASSOCIATED DISEASES

**Allergic Rhinitis/Sinusitis**

a. Intranasal steroid spray Budesonide 100 mcg twice a day or Fluticasone 50 mcg once a day

b. Oral antihistamines

**Gastroesophageal Reflux**

Ant reflux treatment. Oral Theophylline to be avoided.
THANK YOU