Bronchial asthma

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Objectives

- By the end of this lecture the student will be able to
- Define asthma
- Identify the risk factor
- Classify asthma
- Plan a management for a child with asthma
Definition

- It is a syndrome characterized by chronic AIRFLOW OBSTRUCTION that varies markedly, both spontaneously and with treatment.
- Narrowing of the airways is usually reversible, but in some patients with chronic asthma there may be an element of irreversible airflow obstruction
Asthma: Pathological changes
It is characterized

- **pathologically** by bronchial inflammation with prominent eosinophil infiltration
- **physiologically** by bronchial hype-reactivity, and
- **clinically** by variable cough, chest tightness and wheeze
Epidemiology

- It affects approximately 10-15% of children and 5-10% of adults
- Prevalence is greater in industrialized countries
- Prevalence is increasing world-wide
Pathology of asthma

- Infiltration with inflammatory cells (esp. eosinophils and T-lymphocytes)
- Patchy epithelial shedding
- Airway smooth muscle thickening
- Subepithelial fibrosis
- Mucus gland and goblet cell hyperplasia
- Widespread mucus plugging in fatal asthma
Current Understanding of Asthma

- A chronic inflammatory disorder of the airway
- Infiltration of mast cells, eosinophils and lymphocytes
- Airway hyperresponsiveness
- Recurrent episodes of wheezing, coughing and shortness of breath
- Widespread, variable and often reversible airflow limitation
The Underlying Mechanism

Risk Factors (for development of asthma)

INFLAMMATION

Airway Hyperresponsiveness

Airflow Limitation

Risk Factors (for exacerbations)

Symptoms - (shortness of breath, cough, wheeze)
Cell-Derived Mediators

Mast cells

T lymphocytes

many other cells

Eosinophils

Histamine
Leukotrienes
Prostaglandins
Platelet activating factor
Enzymes
Cytokines
Mechanisms of asthma

- Inflammation underlies airway hyperresponsiveness
- The inflammation is of characteristic pattern and it involves interaction between many inflammatory cells
- This results in the release of multiple inflammatory mediators
- Inflammatory mediators result in bronchoconstriction, mucus secretion, exudation of plasma and airway hyperresponsiveness
Neural mechanism may amplify the asthmatic inflammation.

Structural changes may occur with subepithelial fibrosis, airway smooth muscle hyperplasia and new vessel formation. These changes may underlie irreversible airflow obstruction.
Types of asthma

- Allergic (extrinsic) asthma
- Non-allergic (intrinsic) asthma
- Occupational asthma
- Aspirin induced asthma
- Asthma of infancy(<2 yr of age)
Aspirin induced asthma

- Special type of intrinsic asthma
- It is a metabolic, pharmacological disorder
- Acute asthma attacks on first and subsequent exposure to aspirin and NSAID
Asthma of infancy

- Recurrent bouts of significant airflow limitation in small airways from viral infections
- Often remits as child gets older
- Not associated with atopy
- Sometimes called wheezy bronchitis
## Risk Factors that Lead to Asthma Development

### Predisposing Factors
- Atopy

### Causal Factors
- Indoor Allergens
  - Domestic mites
  - Animal Allergens
  - Cockroach Allergens
  - Fungi
- Outdoor Allergens
  - Pollens
  - Fungi
- Occupational Sensitizers

### Contributing Factors
- Respiratory infections
- Small size at birth
- Diet
- Air pollution
  - Outdoor pollutants
  - Indoor pollutants
- Smoking
  - Passive Smoking
  - Active Smoking
Triggers And Irritants

- Allergens
- Emotional Responses
- Physical Changes
- Irritants
DIAGNOSIS OF ASTHMA

- History and patterns of symptoms
- Physical examination
- Measurements of lung function
PATIENT HISTORY

- Has the patient had an attack or recurrent episodes of wheezing?
- Does the patient have a troublesome cough, worse particularly at night, or on awakening?
- Does the patient cough after physical activity (eg. Playing)?
- Does the patient have breathing problems during a particular season (or change of season)?
- Do the patient’s colds ‘go to the chest’ or take more than 10 days to resolve?
- Does the patient use any medication (e.g. bronchodilator) when symptoms occur? Is there a response?

*If the patient answers “YES” to any of the above questions, suspect asthma.*
Physical Examination

- Wheeze - Usually heard without a stethoscope
- Dyspnoea - Rhonchi heard with a stethoscope
  Use of accessory muscles

- Remember - Absence of symptoms at the time of examination does not exclude the diagnosis of asthma
Diagnostic testing

Diagnosis of asthma can be confirmed by demonstrating the presence of reversible airway obstruction using Peak flow meter.
Typical Spirometric (FEV$_1$) Tracings

Note: Each FEV$_1$ curve represents the highest of three repeat measurements.
Spirometry
Spirometry

- Spiro - from the Greek for ‘breathing’
- Metry - measurement
- SPIROMETRY - the measurement of breathing.
### Classification of Asthma Severity

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Nighttime Symptoms</th>
<th>PEF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 4</strong> Severe Persistent</td>
<td>Continuous Limited physical activity</td>
<td>Frequent</td>
</tr>
<tr>
<td><strong>Step 3</strong> Moderate Persistent</td>
<td>Daily Use β₂-agonist daily Attacks affect activity</td>
<td>&gt;1 time week</td>
</tr>
<tr>
<td><strong>Step 2</strong> Mild Persistent</td>
<td>&gt;1 time a week but &lt;1 time a day</td>
<td>&gt;2 times a month</td>
</tr>
<tr>
<td><strong>Step 1</strong> Intermittent</td>
<td>&lt; 1 time a week Asymptomatic and normal PEF between attacks</td>
<td>≤2 times a month</td>
</tr>
</tbody>
</table>

The presence of one of the features of severity is sufficient to place a patient in that category. Global Initiative for Asthma (GINA) WHO/NHLBI, 2002
# Stepwise approach (adult)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Mild Intermittent</th>
<th>Mild Persistent</th>
<th>Moderate Persistent</th>
<th>Severe Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor symptoms</td>
<td>&lt; 2 /week</td>
<td>2-3 /week</td>
<td>4-5 /week</td>
<td>Continuous</td>
</tr>
<tr>
<td>PEF between attacks</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>60-80%</td>
<td>&lt; 60%</td>
</tr>
</tbody>
</table>

- **Step 1**
- **Step 2**
- **Step 3**
- **Step 4**
Goals to Be Achieved in Asthma Control

- Achieve and maintain control of symptoms
- Prevent asthma episodes or attacks
- Minimal use of reliever medication
- No emergency visits to doctors or hospitals
- Maintain normal activity levels, including exercise
- Maintain pulmonary function as close to normal as possible
- Minimal (or no) adverse effects from medicine
Tool Kit for Achieving Management Goals

- Relievers
- Preventers
- Peak Flow meter
- Patient education
What Are Relievers?

- Rescue medications
- Quick relief of symptoms
- Used during acute attacks
- Action lasts 4-6 hrs
RELIEVERS

- Short acting $\beta_2$ agonists
  - Salbutamol
  - Levosalbutamol
- Anti-cholinergics
  - Ipratropium bromide
- Xanthines
  - Theophylline
- Adrenaline injections
What are Preventers?

- Prevent future attacks
- Long term control of asthma
- Prevent airway remodelling
## PREVENTERS

<table>
<thead>
<tr>
<th>Corticosteroids</th>
<th>Anti-leukotrienes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prednisolone, Betamethasone</td>
<td>Montelukast, Zafirlukast</td>
</tr>
<tr>
<td>Beclomethasone, Budesonide</td>
<td>Xanthines</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>Theophylline SR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Long acting $\beta_2$ agonists</th>
<th>Mast cell stabilisers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bambuterol, Salmeterol</td>
<td>Sodium cromoglycate</td>
</tr>
<tr>
<td>Formoterol</td>
<td></td>
</tr>
</tbody>
</table>

## COMBINATIONS

- Salmeterol/Fluticasone
- Formoterol/Budesonide
- Salbutamol/Beclomethasone
Medications
Reliever

Reliever (also known as rescue medication)

- Bronchodilator (beta$_2$ agonist)
- Quickly relieves symptoms (within 2-3 minutes)
- **Not for regular use**
Rescue Medication

SALBUTAMOL INHALER
100 mcg:
1 or 2 puffs as necessary

LEVOSALBUTAMOL INHALER
50 mcg:
1 or 2 puffs as necessary
Preventer

- Anti-inflammatory
- Takes time to act (1-3 hours)
- Long-term effect (12-24 hours)
- Only for regular use
  (whether well or not well)
ICS + LABA

Which LABA?

**Formoterol**: Immediate relief (as fast as salbutamol)

12 hours effect

Can be combined with budesonide
Ideal combination

- Formoterol (fast relief and sustained relief) +
- Budesonide (twice or even once daily use)

Dose: 1-4 puffs (OD/BD)

Another combination

Salmeterol + Fluticasone
All Asthma Drugs Should Ideally Be Taken Through The Inhaled Route.
<table>
<thead>
<tr>
<th>Oral</th>
<th>Inhaled route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow onset of action</td>
<td>Rapid onset of action</td>
</tr>
<tr>
<td>Large dosage used</td>
<td>Less amount of drug used</td>
</tr>
<tr>
<td>Greater side effects</td>
<td>Better tolerated</td>
</tr>
<tr>
<td>Not useful in acute symptoms</td>
<td>Treatment of choice in acute symptoms</td>
</tr>
</tbody>
</table>
Aerosol delivery systems currently available

- Metered dose inhalers
- Dry powder inhalers (Rotahaler)
- Spacers / Holding chambers
Inhalation devices you can use

- Dry Powder Inhaler
- Metered Dose inhaler
- Spacer
Advantages of Spacer

- No co-ordination required
- No cold - freon effect
- Reduced oropharyngeal deposition
- Increased drug deposition in the lungs
The Zerostat advantage

- Non-static spacer made up of polyamide material
- Increased respirable fraction → Increased deposition of drug in the airways
- Increased aerosol half-life → Plenty of time for the patient to inhale after actuation of the drug
- No valve → No dead space → Less wastage of the drug
- Small, portable, easy to carry → Child friendly
Rotahaler - The dry powder advantage

- Overcomes hand-lung coordination problems that are encountered with MDIs.
- Can be easily used by children, elderly and arthritic patients.
- Can take multiple inhalations if the entire drug has not been inhaled in one inhalation.
Age-wise selection of inhaler devices

- < 3 years – MDI + Spacer + Mask or nebulisers
- 3 – 5 years – MDI + Spacer ± Mask or Rotahaler
- 5 – 8 years – Rotahaler or MDI + Spacer
- > 8 years – Rotahaler or MDI ± Spacer
Patient Education in the Clinic

- Explain nature of the disease (i.e. inflammation)
- Explain action of prescribed drugs
- Stress need for regular, long-term therapy
- Allay fears and concerns
- Peak flow reading
- Treatment diary / booklet
Key Messages

- Asthma is a common disorder
- It can happen to anybody
- It is not caused by supernatural forces
- Asthma is not contagious
- It produces recurrent attacks of cough with or without wheeze
- Between attacks people with asthma lead normal lives as anyone else
- In most cases there is some history of allergy in the family.
Key Messages

- Asthma can be effectively controlled, although it cannot be cured.

- Effective asthma management programs include education, objective measures of lung function, environmental control, and pharmacologic therapy.

- A stepwise approach to pharmacologic therapy is recommended. The aim is to accomplish the goals of therapy with the least possible medication.