Diagnosis, Assessment, Monitoring and Pharmacological Treatment of Asthma
Magnitude of Asthma - India

Delhi

Childhood asthma: 10.9%
Chhabra SK et al Ann Allergy Asthma Immunol Nov 1999
Chhabra SK et al J Asthma May 1998

Adults: 8%
Chhabra SK et al Arch Environ Health Jan 2001

Other Cities

3 to 18%
Global Epidemiology

- Developed countries have consistently reported a higher prevalence
- 10 – 28%
- Highest prevalence in NZ and Australia
- Studies in Developing countries have usually reported less than 5% prevalence
- Children have a higher prevalence
Methodological Issues

- Definition of asthma – lack of consensus (cold-associated, exercise induced, cough variant)

Tools used to determine prevalence

- Questionnaire
- Spirometry
- Airway hyperresponsiveness
Global Epidemiology

Increasing morbidity and mortality inspite of development of highly effective drugs and devices

Cause not known

- New allergens
- Increased dietary sodium
- “Western” way of life
- Air pollution
- Hygiene hypothesis
Risk Factors

- Family history of atopy
- Passive smoking (ETS exposure)
- Lack of breast feeding
- Obesity
Four Components of Asthma Management

- Measures of Assessment and Monitoring
- Control of Factors Contributing to Asthma Severity
- Pharmacologic Therapy
- Patient Education for a Partnership in Asthma Care
Component 1: Measures of Assessment and Monitoring

- Two aspects:
  - Initial assessment and diagnosis of asthma
  - Periodic assessment and monitoring
Initial Assessment and Diagnosis of Asthma

- **Determine that:**
  - Patient has history or presence of episodic symptoms of airflow obstruction
  - Airflow obstruction is at least partially reversible
  - Alternative diagnoses are excluded
Initial Assessment and Diagnosis of Asthma (continued)

- Tools for establishing diagnosis:
  - Detailed medical history
    - (Wheeze, shortness of breath, chest tightness, or cough, rhinitis, dermatitis/eczema)
  - Physical exam
  - Spirometry to demonstrate reversibility
Initial Assessment and Diagnosis of Asthma (continued)

History

✓ Asthma symptoms vary throughout the day and over time (Variability and intermittency)

✓ Absence of symptoms at the time of the examination does not exclude the diagnosis of asthma

✓ Other suggestive features:

  Triggers causing exacerbations

  Diurnal variation
Initial Assessment and Diagnosis of Asthma (continued)

Is airflow obstruction at least partially reversible?

- Use spirometry to establish airflow obstruction:
  - $\text{FEV}_1 < 80\%$ predicted;
  - $\text{FEV}_1/\text{FVC} < 70\%$ or below the lower limit of normal

- Use spirometry to establish reversibility:
  - $\text{FEV}_1$ increases $\geq 12\%$ and at least 200 mL after using a short-acting inhaled beta$_2$-agonist
  - If necessary, Oral Steroids for 1-2 weeks
Initial Assessment and Diagnosis of Asthma (continued)

Are alternative diagnoses excluded?

- Vocal cord dysfunction, vascular rings, foreign bodies, other pulmonary diseases
Additional Tests

Reasons for Additional Tests

- Patient has symptoms but spirometry is normal or near normal.
- Suspect infection, large airway lesions, heart disease, or obstruction by foreign object

The Tests

- Assess diurnal variation of peak flow over 1 to 2 weeks.
- Refer to a specialist for bronchoprovocation with methacholine, histamine, or exercise; negative test may help rule out asthma.
- Chest x-ray
# Additional Tests

## Reasons for Additional Tests

| Suspect coexisting chronic obstructive pulmonary disease, restrictive defect, or central airway obstruction |

## The Tests

| – Additional pulmonary function studies |
| – Diffusing capacity test |
| – Allergy tests—skin or in vitro |
| – Nasal examination |
| _ Gastroesophageal reflux assessment |
## Classification of Asthma Severity: Clinical Features Before Treatment

<table>
<thead>
<tr>
<th>Step</th>
<th>Days With Symptoms</th>
<th>Nights With Symptoms</th>
<th>PEF or FEV&lt;sub&gt;1&lt;/sub&gt; Variability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 4</strong>&lt;br&gt;Severe Persistent</td>
<td>Continuous</td>
<td>Frequent</td>
<td>≤60%</td>
</tr>
<tr>
<td><strong>Step 3</strong>&lt;br&gt;Moderate Persistent</td>
<td>Daily</td>
<td>≥5/month</td>
<td>&gt;60%-%&lt;80%</td>
</tr>
<tr>
<td><strong>Step 2</strong>&lt;br&gt;Mild Persistent</td>
<td>3-6/week</td>
<td>3-4/month</td>
<td>≥80%</td>
</tr>
<tr>
<td><strong>Step 1</strong>&lt;br&gt;Mild Intermittent</td>
<td>≤2/week</td>
<td>≤2/month</td>
<td>≥80%</td>
</tr>
</tbody>
</table>

Footnote: The patient’s step is determined by the most severe feature.
Goals of Asthma Therapy

- Prevent chronic and troublesome symptoms
- Maintain (near-) “normal” pulmonary function
- Maintain normal activity levels (including exercise and other physical activity)
Goals of Asthma Therapy

(continued)

- Prevent recurrent exacerbations and minimize the need for emergency department visits or hospitalizations
- Provide optimal pharmacotherapy with minimal or no adverse effects
- Meet patients’ and families’ expectations of, and satisfaction with, asthma care
Component 3: Pharmacologic Therapy

- Asthma is a chronic inflammatory disorder of the airways.
- A key principle of therapy is regulation of chronic airway inflammation.
Pharmacologic Therapy

Asthma is a chronic inflammatory disorder of the airways.

A key principle of therapy is regulation of chronic airway inflammation.
Inhaled Medication
Delivery Devices

- Metered-dose inhaler (MDI)
- Dry powder inhaler (DPI) (Rotacaps, Accuhaler, Diskhalers)
- Spacer/holding chamber
- Spacer/holding chamber and face mask
- Nebulizer
Transition to Non-CFC Inhalers

- Most currently available MDIs use chlorofluorocarbons (CFCs) as propellants.
- CFCs are being phased out globally to protect the earth’s ozone layer.
- CFC MDIs have a temporary medical exemption to the phaseout.
- Over the next several years, CFC MDIs will be gradually replaced by non-CFC alternatives.
- Non-CFC alternatives will include HFA MDIs, DPIs, and other new devices.
Overview of Asthma Medications

- **Daily: Long-Term Control**
  - Corticosteroids (inhaled and systemic)
  - Cromolyn/nedocromil
  - Long-acting beta$_2$-agonists
  - Methylxanthines
  - Leukotriene modifiers
Overview of Asthma Medications (continued)

- **As-needed: Quick Relief**
  - Short-acting beta$_2$-agonists
  - Anticholinergics
  - Systemic corticosteroids
Inhaled Corticosteroids

- Most effective long-term-control therapy for persistent asthma
- Small risk for adverse events at recommended dosage
- Reduce potential for adverse events by:
  - Using spacer and rinsing mouth
  - Using lowest dose possible
  - Using in combination with long-acting beta$_2$-agonists
  - Monitoring growth in children
Inhaled Corticosteroids
(continued)

- **Benefit of daily use:**
  - Fewer symptoms
  - Fewer severe exacerbations
  - Reduced use of quick-relief medicine
  - Improved lung function
  - Reduced airway inflammation
Inhaled Corticosteroids and Linear Growth in Children

- Potential risks are well balanced by benefits.
- Growth rates in children are highly variable. Short-term evaluations may not be predictive of attaining final adult height.
- Poorly controlled asthma may delay growth.
- Children with asthma tend to have longer periods of reduced growth rates prior to puberty (males > females).
**Inhaled Corticosteroids and Possible Effect on Linear Growth**

- Most studies show no effect with low-to-medium doses, but some short-term studies show growth delay.
- Potential risk appears to be dose dependent:
  - Medium doses may be associated with possible, but not predictable, effect on linear growth. The clinical significance has not yet been determined.
  - High doses have greater potential for growth delay or suppression.
- For severe persistent asthma, high doses of inhaled corticosteroids have less risk than oral corticosteroids.
Inhaled Corticosteroids and Possible Effect on Linear Growth (continued)

- Some caution is suggested while studies continue:
  - Monitor growth
  - Use the lowest dose necessary to maintain control (step down therapy when possible)
  - Administer with spacers/holding chambers
  - Advise patients to “rinse and spit” following inhalation
  - Consider adding a long-acting inhaled beta$_2$-agonist to a low-to-medium dose of inhaled corticosteroids (vs. using a higher dose of the corticosteroid)
Estimated Comparative Dosages of Inhaled Corticosteroids

- Preparations are not equivalent per puff or per microgram.
- Comparative doses are estimated.
  - Few data directly compare preparations.
- Most important determinant of dosing is clinician judgment.
  - Monitor patient’s clinical response to therapy.
  - Adjust dose accordingly.
## Estimated Comparative Daily Dosages of Inhaled Corticosteroids for Adults

<table>
<thead>
<tr>
<th>Drug</th>
<th>Low Dose</th>
<th>Medium Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone</td>
<td>168 - 504 mcg</td>
<td>504 - 840 mcg</td>
<td>&gt; 840 mcg</td>
</tr>
<tr>
<td>Budesonide DPI</td>
<td>200 - 400 mcg</td>
<td>400 - 600 mcg</td>
<td>&gt; 600 mcg</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>500 - 1,000 mcg</td>
<td>1,000 - 2,000 mcg</td>
<td>&gt;2,000 mcg</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>88 - 264 mcg</td>
<td>264 - 660 mcg</td>
<td>&gt; 660 mcg</td>
</tr>
<tr>
<td>Triamcinolone</td>
<td>400 - 1,000 mcg</td>
<td>1,000 - 2,000 mcg</td>
<td>&gt;2,000 mcg</td>
</tr>
</tbody>
</table>
Estimated Comparative Daily Dosages of Inhaled Corticosteroids for Children ≤12 Years

<table>
<thead>
<tr>
<th>Drug</th>
<th>Low Dose</th>
<th>Medium Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone</td>
<td>84 - 336 mcg</td>
<td>336 - 672 mcg</td>
<td>&gt; 672 mcg</td>
</tr>
<tr>
<td>Budesonide DPI</td>
<td>100 - 200 mcg</td>
<td>200 - 400 mcg</td>
<td>&gt; 400 mcg</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>500 - 750 mcg</td>
<td>1,000 - 1,250 mcg</td>
<td>&gt;1,250 mcg</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>88 - 176 mcg</td>
<td>176 - 440 mcg</td>
<td>&gt; 440 mcg</td>
</tr>
<tr>
<td>Triamcinolone</td>
<td>400 - 800 mcg</td>
<td>800 - 1,200 mcg</td>
<td>&gt;1,200 mcg</td>
</tr>
</tbody>
</table>
Long-Acting Beta$_2$-Agonists

- Not a substitute for anti-inflammatory therapy
- Not appropriate for monotherapy
- Beneficial when added to inhaled corticosteroids
- Not for acute symptoms or exacerbations
- Drugs available: Salmeterol, Formoterol
Short-Acting Beta$_2$-Agonists

- Most effective medication for relief of acute bronchospasm
- More than one canister per month suggests inadequate asthma control
- Regularly scheduled use is not generally recommended
  - May lower effectiveness
  - May increase airway hyperresponsiveness
Leukotriene Modifiers

➤ **Mechanisms**
  - 5-LO inhibitors
  - Cysteinyl leukotriene receptor antagonists

➤ **Indications**
  - Long-term-control therapy in mild persistent asthma
    - Improve lung function
    - Prevent need for short-acting beta$_2$-agonists
    - Prevent exacerbations
  - Further experience and research needed
Stepwise Approach to Therapy: Gaining Control

1. Start high and step down.
2. Start at initial level of severity; gradually step up.

- **STEP 1**: Mild Intermittent
- **STEP 2**: Mild Persistent
- **STEP 3**: Moderate Persistent
- **STEP 4**: Severe Persistent
Stepwise Approach to Therapy for Adults and Children > Age 5: Maintaining Control

**STEP 1**
Quick-relief medication: PRN

**STEP 2**
1 Long-term-control medication: anti-inflammatory

**STEP 3**
> 1 Long-term-control medications

**STEP 4**
Multiple long-term-control medications, include oral corticosteroids

- Step down if possible
- Step up if necessary
- Patient education and environmental control at every step
- Recommend referral to specialist at Step 4; consider referral at Step 3
Indicators of Poor Asthma Control

- **Step up therapy if patient:**
  - Awakens at night with symptoms
  - Has an urgent care visit
  - Has increased need for short-acting inhaled beta$_2$-agonists
  - Uses more than one canister of short-acting beta$_2$-agonist in 1 month
Indicators of Poor Asthma Control (continued)

• **Before increasing medications, check:**
  - Inhaler technique
  - Adherence to prescribed regimen
  - Environmental changes
  - Also consider alternative diagnoses
Step 1 Treatment for Adults and Children >5: Mild Intermittent

Daily Long-Term Control
- Not needed

Quick Relief
- Short-acting inhaled beta$_2$-agonist PRN
- Increasing use, or use more than 2x/week, may indicate need for long-term control therapy
Step 2 Treatment for Adults and Children >5: Mild Persistent

**Daily Long-Term Control**

- Anti-inflammatory
  - Inhaled corticosteroid (low dose) or
  - Cromolyn or nedocromil

*Or*

- Sustained-release theophylline (to serum concentration 5-15 mcg/mL) is an alternative but not preferred
- Leukotriene modifier may be considered
Quick Relief

- Short-acting inhaled beta$_2$-agonist PRN
- Daily or increasing use indicates need for stepping up long-term control therapy
Step 3 Treatment for Adults and Children >5: Moderate Persistent

Daily Long-Term Control

- Inhaled corticosteroid (medium dose)

Or

- Inhaled corticosteroid
  (low-to-medium dose) **AND**
- Long-acting bronchodilator
  (long-acting beta$_2$-agonist
  or sustained-release theophylline)

**IF NEEDED, increase to:**

- Inhaled corticosteroid
  (medium-to-high dose) and
  long-acting bronchodilator
Step 3 Treatment for Adults and Children >5: Moderate Persistent (continued)

Quick Relief
- Short-acting inhaled beta$_2$-agonist PRN
- Daily or increasing use indicates need for stepping up long-term control therapy
Step 4 Treatment for Adults and Children >5: Severe Persistent

**Daily Long-Term Control**

- Inhaled corticosteroid (high dose) **AND**
- Long-acting bronchodilator
  - Long-acting inhaled
  - beta₂-agonist **OR**
  - Sustained-release theophylline **OR**
  - Long-acting beta₂-agonist tablets **AND**
- Oral corticosteroid, long term
Step 4 Treatment for Adults and Children >5: Severe Persistent

(continued)

**Quick Relief**

- Short-acting inhaled beta$_2$-agonist
  PRN
- Daily or increasing use indicates need for long-term control therapy
Periodic Assessment and Monitoring

- Teach all patients with asthma to recognize symptoms that indicate inadequate asthma control
- Patients should be seen by a clinician at least every 1 to 6 months
- Patients should also be asked to make a visit when they are well
Monitoring the Goals of Therapy

- Recognition of signs and symptoms
- Spirometry and peak flow
- Quality of life/functional status
- Patient self-monitoring and health care utilization
- Adherence, beta$_2$-agonist use, oral corticosteroid bursts, side effects
- Satisfaction with asthma control and quality of care
Symptom history should be based on a short (2 to 4 weeks) recall period.

Symptom history should include:

- Daytime asthma symptoms
- Nocturnal wakening as a result of asthma symptoms
- Exercise-induced symptoms
- Exacerbations
Monitoring Lung Function: Spirometry

- Spirometry is recommended:
  - At initial assessment
  - After treatment has stabilized symptoms
  - At least every 1 to 2 years
Monitoring Lung Function:
Peak Flow Monitoring

Patients with moderate-to-severe persistent asthma should:

- Have a peak flow meter and learn to monitor their peak flow
- Do daily long-term monitoring or short-term (2 to 3 weeks) monitoring
- Use peak flow monitoring during exacerbations
Monitoring Lung Function: Peak Flow Monitoring (continued)

Patients should:

- Measure peak flow on waking before taking a bronchodilator
- Use personal best
- Be aware that a peak flow <80% of personal best indicates a need for additional medication
- Use the same peak flow meter over time
Importance of Action Plan

All patients should be given a written action plan and be instructed to use it.
Monitoring History of Exacerbations

- Review patient self-monitoring records
- Ask about frequency, severity, and causes of exacerbations
- Ask about unscheduled, emergency, or hospital care
Monitoring Quality of Life/Functional Status

- Periodically assess:
  - Missed work or school due to asthma
  - Reduction in usual activities due to asthma
  - Sleep disturbances due to asthma
Monitoring Pharmacotherapy

Monitor:

- Patient adherence to regimen
- Inhaler technique
- Frequency of inhaled short-acting beta$_2$-agonist use
- Frequency of oral corticosteroid “burst” therapy
- Side effects of medications
Working Within Time
Constraints of Office Visits

- Have patients complete questionnaire in waiting room
- Schedule more frequent visits initially
- Delegate some tasks to nurses or office staff:
  - Spirometry
  - Review MDI technique
  - Review daily peak flow
General Guidelines for Referral to an Asthma Specialist (continued)

- Patient has had a life-threatening asthma exacerbation
- Patient is not meeting the goals of asthma therapy
- Signs and symptoms are atypical
- Other conditions complicate asthma
General Guidelines for Referral to an Asthma Specialist (continued)

- Additional diagnostic testing is indicated
- Patient requires additional education
- Patient is being considered for immunotherapy
- Patient has severe persistent asthma
General Guidelines for Referral to an Asthma Specialist (continued)

- Patient requires continuous oral corticosteroid therapy or high-dose inhaled corticosteroids

- Child <5 and requires step 3 or 4 care. When child is <5 and requires step 2 care, referral should be considered
Ideal Asthma Control

- Daytime symptoms - 0 to <3/wk
- Nocturnal symptoms – Nil
- Lifestyle including activity – Normal
- Exacerbations – Nil/Very mild
- Absenteeism – Nil
- $\beta_2$ agonists – 0 to <3/wk
- $\text{PEFR/FEV}_1 \geq 90\%$ of personal best
To Conclude

- Guidelines for management of asthma are not prescriptions but only guidelines.
- Treatment is highly individualized.
- If the principles underlying the guidelines are followed properly, a majority of patients can achieve most of the goals of treatment.