An Update In Asthma Diagnosis and Management

Selina Gierer, DO
Division of Allergy and Immunology
April 12, 2014
Disclosures

• Speaker’s Bureau:
  – TEVA pharmaceuticals
  – Immune Deficiency Foundation
Objectives

• Diagnose asthma severity with appropriate diagnostic tools
  – Definition, Epidemiology, Clinical history, Evaluation

• Implement appropriate treatment strategies based on the severity of the asthma
  – Treatment
  – Referral guidelines

• Counsel patients on the importance of adherence and appropriate follow-up
Definition of Asthma

• No accepted formal definition
  – Lack of specificity of symptoms variety of opinions
  – Overlap with other disorders (COPD)
    • Best distinguishing feature is degree of reversibility
• “Chronic inflammatory disorder of the airways”
• “Reactive airways disease”
• “Reactive airways dysfunction syndrome”
  – Non-immunologic cause – inhaled irritant
Definition of Asthma

• “Chronic inflammatory disorder of the airways in which many cell types play a role, in particular mast cells, eosinophils, and T lymphocytes. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and cough particularly at night and/or in the early morning. These symptoms are usually associated with widespread but variable airflow limitation that is at least partly reversible either spontaneously or with treatment. The inflammation also causes an associated increase in airway responsiveness to a variety of stimuli.”
Asthma is....

an INFLAMMATORY disease...
Tip of the Iceberg

Asthma

Symptoms

Airway obstruction
Bronchial hyperresponsiveness
Airway inflammation
Asthma

• Leading cause of chronic disease in children
• 5% of children under 15 (3 million) have asthma
  – 75% diagnosed before the age of 7
  – Teens and adults may have been misdiagnosed prior
    • Characteristic history and response to medications
  – Teens often experience a remission around puberty
    • May recur later in life
• Major cause of school absenteeism and missed work
Clinical History

• Triad of symptoms:
  – Wheeze (expiratory)
  – Cough
    • Typically worse at night
    • Dry or productive (may be discolored by eosinophils)
  – Respiratory difficulty
    • Cyanosis and/or use of accessory respiratory muscles
    • Chest “tightness” (chest pain – uncommon)

• Recurrent bronchitis and/or atelectasis
• Poor growth
Clinical History

- Episodic
- Characteristic trigger
- Personal or family history of atopy
- Asthma-like problems as a child
  - Bronchitis/wheezing
Clinical History

• Less likely:
  – Lack of improvement with asthma medications
    • Bronchodilators or oral glucocorticoids
  – Onset after age 50
  – History of cigarette smoking (>20 years)
Asthma Classification

• Intermittent
• Mild Persistent
• Moderate Persistent
• Severe Persistent

– Diagnose prior to starting controller medications (this is where you come in!)
## Classifying asthma severity in children 0-4 years of age

<table>
<thead>
<tr>
<th>Components of severity</th>
<th>Classification of asthma severity (children 0-4 years of age)</th>
<th>Intermittent</th>
<th>Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
<tr>
<td>Impairment</td>
<td>Symptoms</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>0</td>
<td>1-2x/month</td>
<td>3-4x/month</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week but not daily</td>
<td>Daily</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>Minor limitation</td>
<td>Some limitation</td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0-1/year</td>
<td>≥2 exacerbations in 6 months requiring oral steroids, or ≥4 wheezing episodes/1 year lasting &gt;1 day AND risk factors for persistent asthma</td>
</tr>
</tbody>
</table>

- **Classifying severity in children who are not currently taking long-term control medication.** Level of severity is determined by both impairment and risk. Assess impairment domain by caregiver’s recall of previous 2-4 weeks. Assign severity to the most severe category in which any feature occurs. At present, there are inadequate data to correspond frequencies of exacerbations.
### Classifying asthma severity in children 0-4 years of age

<table>
<thead>
<tr>
<th>Components of severity</th>
<th>Classification of asthma severity (children 0-4 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
</tr>
<tr>
<td>Impairment</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>0</td>
</tr>
<tr>
<td>Short-acting beta_2_agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations requiring oral systemic corticosteroids</td>
</tr>
</tbody>
</table>

- Consider severity and interval since last exacerbation
- Frequency and severity may fluctuate over time
- Exacerbations of any severity may occur in patients in any severity category

### Classifying severity in children who are not currently taking long-term control medication

Level of severity is determined by both impairment and risk. Assess impairment domain by caregiver’s recall of previous 2-4 weeks. Assign severity to the most severe category in which any feature occurs. At present, there are inadequate data to correspond frequencies of exacerbations.
Classifying asthma severity in children 5-11 years of age

<table>
<thead>
<tr>
<th>Components of severity</th>
<th>Classification of asthma severity (children 5-11 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
</tr>
<tr>
<td>Impairment Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2x/month</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Lung function</td>
<td>• Normal FEV₁ between exacerbations</td>
</tr>
<tr>
<td></td>
<td>• FEV₁ &gt;80 percent predicted</td>
</tr>
</tbody>
</table>

Risk

<table>
<thead>
<tr>
<th>Exacerbations requiring oral systemic corticosteroids</th>
<th>0-1/year (see footnote)</th>
<th>≥2 in 1 year (see footnote)</th>
</tr>
</thead>
</table>

Consider severity and interval since last exacerbation

Frequency and severity may fluctuate over time for patients in any severity category

Relative annual risk of exacerbations may be related to FEV₁

**Classifying severity in children who are not currently taking long-term control medication.** Level of severity is determined by both impairment and risk. Assess impairment domain by patient’s/caregiver’s recall of the previous 2-4 weeks and spirometry. Assign severity to the most severe category in which any feature occurs. At present, there are inadequate data to correspond frequencies of exacerbations with severity.
## Classifying asthma severity and initiating treatment in youths greater than or equal to 12 years of age and adults

<table>
<thead>
<tr>
<th>Components of severity</th>
<th>Classification of asthma severity (≥12 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Normal FEV₁/FVC:</td>
<td></td>
</tr>
<tr>
<td>8-19 yr 85%</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>20-39 yr 80%</td>
<td>≤2x/month</td>
</tr>
<tr>
<td>40-59 yr 75%</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>60-80 yr 70%</td>
<td>None</td>
</tr>
<tr>
<td>Interference with</td>
<td></td>
</tr>
<tr>
<td>normal activity</td>
<td></td>
</tr>
<tr>
<td>Lung function</td>
<td></td>
</tr>
<tr>
<td>• Normal FEV₁ between</td>
<td></td>
</tr>
<tr>
<td>exacerbations</td>
<td></td>
</tr>
<tr>
<td>• FEV₁ &gt;80 percent</td>
<td></td>
</tr>
<tr>
<td>predicted</td>
<td></td>
</tr>
<tr>
<td>• FEV₁/FVC normal</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td>Exacerbations</td>
<td>0-1/year (see</td>
</tr>
<tr>
<td>requiring oral</td>
<td>footnote)</td>
</tr>
<tr>
<td>systemic corticosteroids</td>
<td></td>
</tr>
</tbody>
</table>

**Consider severity and interval since last exacerbation**

**Frequency and severity may fluctuate over time for patients in any severity category**

**Relative annual risk of exacerbations may be related to FEV₁**

**Recommended step for initiating treatment**

- **Step 1**
  - And consider short course of oral systemic corticosteroids
- **Step 2**
  - In 2-6 weeks, evaluate level of asthma control that is achieved and determine next step
- **Step 3**
  - Consider additional oral systemic corticosteroids
- **Step 4 or 5**
  - Consider inhaled corticosteroids or oral inhaled corticosteroids
Risk factors for persistent wheeze and asthma predisposition

- Frequent symptoms in the first year of life
- Eczema
- Elevated IgE levels
- Maternal history of asthma
- Maternal smoking
Natural History

• Wheezing during the first 6 years of life
  – 826 kids
    • 60% of kids with wheezing within the first 3 years had no wheeze by age 6
• 30-70% of children with asthma are markedly improved or asymptomatic by early adulthood
• Adults are less likely than children to experience a complete remission from asthma
Evaluation of the Asthmatic

- Expiratory wheezing
  - Poor predictor of the severity of airflow obstruction
  - Indicative of airway narrowing only
- Tachypnea
- Tachycardia
- Prolonged expiratory phase
- “Tripod position”
- Accessory respiratory muscle use and pulsus paradoxus in severe attacks
Think Cystic Fibrosis

- **Clubbing** should not occur in asthma
- Young people do not typically have **nasal polyposis**
- **Bronchiectasis** on CXR
  - Think CF, interstitial lung disease, immune deficiency
Evaluation of the Asthmatic

- Acute vs. Ongoing
  - Assess ABCs (agitation = hypoxia)
  - Obtain medication history
    - Steroids and antibiotics
  - Evaluate potential causes
    - Infections
    - Allergies
    - Irritants
Pulmonary Studies

• Peak expiratory flow rate (PEFR)
  – Home use
  – Record the highest of three measurements
  – Establish a “personal best” when asthma free
    • Twice daily for 2 weeks
  – Normal – 80-100% of personal best
  – Monitor response to treatment
  – Estimate the severity of a reaction
  – Shortcomings:
    • May not detect mild asthma
    • Restrictive disease/vocal cord dysfunction
    • Validity – pt dependent
Pulmonary Studies

• Pulmonary Function Studies
  – Distinguish abnormal lung function
  – **Obstructive** vs. restrictive pattern
  – Severity of abnormality
  – **Assess reversibility after bronchodilator**
  – Assess response to changes in medications
  – Exercise
  – Bronchoprovocation studies
    • Methacholine (helpful in ruling out asthma)
Pulmonary Studies

• Spirometry
  – FEV1/FVC ratio is <70% of predicted = obstruction
    • FEV1 70-99% - mild obstruction
    • FEV1 50-69% - moderate obstruction
    • FEV1 35-49% - severe obstruction
    • FEV1 <35% - very severe obstruction
  – Bronchodilator response
    • FEV1 increase >12%
      AND
    • Absolute increase in FEV1 of at least 200 ml
Pulmonary Studies

• Exhaled Nitric Oxide
  – Increased with bronchial inflammation
  – Sensitivity/specificity similar to methacholine testing
  – Simple, approved by ATS guidelines as adjunct test

• Consider a CXR – 1st time wheezer
  – Fever, sputum production, local wheezing, hemoptysis, weight loss, clubbing, inspiratory rales, hypoxemia

• Pulse oximetry

• Asthma Control Test
Childhood Asthma Control Test for children 4 to 11 years old.

Know the score.

This test will provide a score that may help your doctor determine if your child’s asthma treatment plan is working or if it might be time for a change.

**How to take the Childhood Asthma Control Test**

**Step 1** Let your child respond to the first four questions (1 to 4). If your child needs help reading or understanding the question, you may help, but let your child select the response. Complete the remaining three questions (5 to 7) on your own and without letting your child’s response influence your answers. There are no right or wrong answers.

**Step 2** Write the number of each answer in the score box provided.

**Step 3** Add up each score box for the total.

**Step 4** Take the test to the doctor to talk about your child’s total score.

**Have your child complete these questions.**

1. How is your asthma today?

   - **Very bad**
   - **Bad**
   - **Good**
   - **Very good**

2. How much of a problem is your asthma when you run, exercise or play sports?

   - **It’s a big problem, I can’t do what I want to do.**
   - **It’s a problem and I don’t like it.**
   - **It’s a little problem but it’s okay.**
   - **It’s not a problem.**

**If your child’s score is 19 or less, it may be a sign that your child’s asthma is not controlled as well as it could be. No matter what the score, bring this test to your doctor to talk about your child’s results.**
3. Do you cough because of your asthma?

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Yes, all of the time.</td>
<td>Yes, most of the time.</td>
<td>Yes, some of the time.</td>
<td>No, none of the time.</td>
</tr>
</tbody>
</table>

4. Do you wake up during the night because of your asthma?

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Yes, all of the time.</td>
<td>Yes, most of the time.</td>
<td>Yes, some of the time.</td>
<td>No, none of the time.</td>
</tr>
</tbody>
</table>

**Please complete the following questions on your own.**

5. During the last 4 weeks, on average, how many days per month did your child have any daytime asthma symptoms?

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Not at all</td>
<td>1-3 days/mo</td>
<td>4-10 days/mo</td>
<td>11-18 days/mo</td>
<td>19-24 days/mo</td>
<td>Everyday</td>
</tr>
</tbody>
</table>

6. During the last 4 weeks, on average, how many days per month did your child wheeze during the day because of asthma?

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Not at all</td>
<td>1-3 days/mo</td>
<td>4-10 days/mo</td>
<td>11-18 days/mo</td>
<td>19-24 days/mo</td>
<td>Everyday</td>
</tr>
</tbody>
</table>

7. During the last 4 weeks, on average, how many days per month did your child wake up during the night because of asthma?

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Not at all</td>
<td>1-3 days/mo</td>
<td>4-10 days/mo</td>
<td>11-18 days/mo</td>
<td>19-24 days/mo</td>
<td>Everyday</td>
</tr>
</tbody>
</table>

**Please turn this page over to see what your child’s total score means.**
Asthma Control Test™ for teens 12 years and older. Know the score.

If your teen is 12 years or older have him take the test now and discuss the results with your doctor

Step 1: Write the number of each answer in the score box provided.
Step 2: Add up each score box for the total.
Step 3: Take the test to the doctor to talk about your child’s total score.

1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?
   - All of the time: 1
   - Most of the time: 2
   - Some of the time: 3
   - A little of the time: 4
   - None of the time: 5

2. During the past 4 weeks, how often have you had shortness of breath?
   - More than once a day: 1
   - Once a day: 2
   - 3 to 6 times a week: 3
   - Once or twice a week: 4
   - Not at all: 5

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness, or pain) wake you up at night or earlier than usual in the morning?
   - 4 or more nights a week: 1
   - 2 or 3 nights a week: 2
   - Once a week: 3
   - Once or twice: 4
   - Not at all: 5

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?
   - 3 or more times per day: 1
   - 1 or 2 times per day: 2
   - 2 or 3 times per week: 3
   - Once a week or less: 4
   - Not at all: 5

5. How would you rate your asthma control during the past 4 weeks?
   - Not controlled at all: 1
   - Poorly controlled: 2
   - Somewhat controlled: 3
   - Well controlled: 4
   - Completely controlled: 5

The American Lung Association supports the Asthma Control Test and wants everyone 12 years of age and older with asthma to take it.

Copyright 2002, by QualityMetric Incorporated.
Asthma Control Test is a trademark of QualityMetric Incorporated.
Asthma Control Test

• Score of 19 or less
  – May be a sign that asthma is not well controlled.
Asthma Triggers

- Aeroallergens or Irritants
  - Pollen, mold, pollution, smoking, GERD
- Stressors
- Viral infections
- Aspirin - 20% of asthma patients
- Exercise - 90% of asthma patients
  - Symptoms develop within 5-15 minutes after exertion and resolve within 30-60 minutes
  - More intense with cold air trigger
Assessing Activity

• Exercise potential
  – Obesity
  – Sports
    • Are they keeping up with their peers?
• Albuterol use pre-treatment prior to scheduled exercise
  – Are they using it again during or after exercise
Evaluation of the Asthmatic

• Blood tests
  – CBC
    • Elevated eosinophil count may indicate allergic asthma
    • Anemia causing dyspnea
  – Alpha-1 antitrypsin level
    • Lifelong non-smoker with persistent irreversible airflow obstruction
  – IgE (not helpful unless planning to use omalizumab)

• Allergy immediate hypersensitivity testing
  – Skin testing (much cheaper than IgE testing)
  – Antigen specific IgE testing (RAST or ImmunoCap)
Goals of Treatment

• No symptoms, day or night
• Normal lung function
• No activity limitations
  – No absences from work/school
• No urgent care/ER visits or hospitalizations
• Medication compliance with few side effects
• Patient satisfaction with asthma care
Treatment

- Identify and avoid triggers
- Pharmacotherapy
  - Adequately treat inflammation
- Treatment of exacerbations
- Immunotherapy
Stepwise approach for managing asthma in children 0-4 years of age

Intermittent asthma
Consult with asthma specialist if step 3 care or higher is required.
Consider consultation at step 2.

Step 1
Preferred: Low-dose ICS
Alternative: Cromolyn or Montelukast

Step 2
Preferred: Medium-dose ICS + either LABA or Montelukast

Step 3
Preferred: Medium-dose ICS + either LABA or Montelukast

Step 4
Preferred: High-dose ICS + either LABA or Montelukast
Oral systemic corticosteroids

Step 5
Preferred: High-dose ICS + either LABA or Montelukast

Step 6
Step up if needed
(first, check adherence, inhaler technique, and environmental control)

Assess control
Step down if possible
(and asthma is well controlled at least 3 months)

Patient education and environmental control at each step

Quick-relief medication for all patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms.
- With viral respiratory infection: SABA q 4–6 hours up to 24 hours (longer with physician consult). Consider short course of oral systemic corticosteroids if exacerbation is severe or patient has history of previous severe exacerbations.
- Caution: frequent use of SABA may indicate the need to step up treatment. See text for recommendations on initiating daily long-term-control therapy.

The stepwise approach is meant to assist, not replace, the clinical decision-making required to meet individual patient needs. If alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up. If clear benefit is not observed within 4–6 weeks and patient/family medication technique is low, consider step reduction and re-education.
## Assessing asthma control in children 0-4 years of age

<table>
<thead>
<tr>
<th>Components of control</th>
<th>Classification of asthma control (children 0-4 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well-controlled</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>1x/month</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0-1/year</td>
</tr>
<tr>
<td>Treatment-related adverse effects</td>
<td>Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.</td>
</tr>
</tbody>
</table>

The level of control is based on the most severe impairment or risk category. Assess impairment domain by caregiver's recall of previous 2-4 weeks. Symptom assessment for longer periods should reflect a global estimate of frequency and severity. The severity of treatment-related adverse effects can vary from none to very troublesome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.
Stepwise approach for managing asthma in children 5-11 years of age

<table>
<thead>
<tr>
<th>Intermittent asthma</th>
<th>Persistent asthma: daily medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.</td>
<td></td>
</tr>
</tbody>
</table>

**Step 1**
- Preferred: Low-dose ICS
- Alternative: Cromolyn, LTRA, Nedocromil, or Theophylline

**Step 2**
- Preferred: EITHER: Low-dose ICS + either LABA, LTRA, or Theophylline OR Medium-dose ICS
- Alternative: High-dose ICS + either LTRA or Theophylline

**Step 3**
- Preferred: Medium-dose ICS + LABA
- Alternative: High-dose ICS + either LTRA or Theophylline

**Step 4**
- Preferred: High-dose ICS + LABA
- Alternative: High-dose ICS + either LTRA or Theophylline

**Step 5**
- Preferred: High-dose ICS + LABA + oral systemic corticosteroid
- Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

**Step 6**
- Step up if needed (first, check adherence, inhaler technique, environmental control, and comorbid conditions)

**Assess control**
- Step down if possible (and asthma is well controlled at least 3 months)

Each step: patient education, environmental control, and management of comorbidities.
Steps 2-4: consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see footnotes).

Quick-relief medication for all patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.

The stepwise approach is meant to assist, not replace, the clinical decision-making required to meet individual patient needs. If alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up. Theophylline is a less desirable alternative due to the need to monitor serum
### Assessing asthma control in children 5-11 years of age

<table>
<thead>
<tr>
<th>Components of control</th>
<th>Classification of asthma control (children 5-11 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well-controlled</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week but not more than once on each day</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤1x/month</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Short-acting beta&lt;sub&gt;2&lt;/sub&gt;-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Lung function</td>
<td></td>
</tr>
<tr>
<td>FEV&lt;sub&gt;1&lt;/sub&gt; or peak flow</td>
<td>&gt;80 percent predicted/personal best</td>
</tr>
<tr>
<td>FEV&lt;sub&gt;1&lt;/sub&gt;/FVC</td>
<td>&gt;80 percent</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0-1/year</td>
</tr>
<tr>
<td>Consider severity and interval since last exacerbation</td>
<td>Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.</td>
</tr>
</tbody>
</table>

The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient's/caregiver's recall of previous 2-4 weeks and by spirometry/or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether the patient's asthma is better or worse than usual.
**Stepwise approach for managing asthma in youths greater than or equal to 12 years of age and adults**

<table>
<thead>
<tr>
<th>Intermittent asthma</th>
<th>Persistent asthma: daily medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Preferred:</th>
<th>Low-dose ICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative:</td>
<td>Cromolyn, LTRA, Nedocromil, or Theophylline</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2</th>
<th>Preferred:</th>
<th>Medium-dose ICS + LABA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative:</td>
<td>Low-dose ICS + either LTRA, Theophylline, or Zileuton</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3</th>
<th>Preferred:</th>
<th>High-dose ICS + LABA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td></td>
<td>High-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Medium-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Low-dose ICS + LABA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 4</th>
<th>Preferred:</th>
<th>High-dose ICS + LABA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td></td>
<td>High-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Medium-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Low-dose ICS + LABA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 5</th>
<th>Preferred:</th>
<th>High-dose ICS + LABA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td></td>
<td>High-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Medium-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Low-dose ICS + LABA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 6</th>
<th>Preferred:</th>
<th>High-dose ICS + LABA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td></td>
<td>High-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Medium-dose ICS + LABA</td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>Low-dose ICS + LABA</td>
</tr>
</tbody>
</table>

| Each step: patient education, environmental control, and management of comorbidities. |
| Steps 2-4: consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see footnotes). |

<table>
<thead>
<tr>
<th>Quick-relief medication for all patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.</td>
</tr>
<tr>
<td>Use of SABA &gt;2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.</td>
</tr>
</tbody>
</table>

The stepwise approach is meant to assist, not replace, the clinical decision making required to meet individual patient needs. If alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up. Zileuton is a less desirable alternative due to limited studies as adjunctive therapy.
Assessing asthma control in youths greater than or equal to 12 years of age and adults

<table>
<thead>
<tr>
<th>Components of control</th>
<th>Classification of asthma control (youths ≥12 years of age and adults)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well-controlled</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2x/month</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Short-acting β₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/weak</td>
</tr>
<tr>
<td>FEV₁ or peak flow</td>
<td>&gt;80 percent predicted/personal best</td>
</tr>
</tbody>
</table>

Validated questionnaires

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ATAQ</td>
<td>0</td>
<td>1-2</td>
</tr>
<tr>
<td>ACQ</td>
<td>≤0.75*</td>
<td>≥1.5</td>
</tr>
<tr>
<td>ACT</td>
<td>≥20</td>
<td>16-19</td>
</tr>
</tbody>
</table>

Risk

<table>
<thead>
<tr>
<th>Exacerbations</th>
<th>0·1/year</th>
<th>≥2/year (see footnote)</th>
</tr>
</thead>
</table>

Consider severity and interval since last exacerbation

Progressive loss of lung function

Evaluation requires long-term followup care

Treatment-related adverse effects

Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.

The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient’s recall of previous 2-4 weeks and by spirometry/or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether the patient’s asthma is better or worse since the last exacerbation.
Pharmacotherapy

• Antihistamines
• Inhaled bronchodilators
• Leukotriene inhibitors
• Inhaled corticosteroids
• Cromolyn (nebulizer only)
• Systemic corticosteroids
• Allergen immunotherapy/omalizumab
• Reassess at each appointment
Antihistamines

• Cetirizine
  – Inhibits late phase reaction in skin and lung
  – Decreases influx of eosinophils and basophils
  – Available over the counter
    • Sam’s/Costco – less than $15 for 360 tabs
  – Approved for use in children >2 years old
• Fexofenadine, loratadine, levocetirizine
Inhaled Bronchodilators

• Technique for inhaler use
  – Shake
  – Remove cap
  – Exhale fully
  – Discharge while inspiring *slowly* and deeply
  – Hold breath for 10 seconds
  – Repeat
  – Use a spacer when indicated
Leukotriene Inhibitors

Monitor LFTs
Leukotriene Inhibitors

- Rapid onset of action
- Attenuates early and late phase response to allergen
- Inhibits bronchoconstriction in aspirin sensitive patients
- Reduces eosinophils and inflammation
Leukotriene Inhibitors

- Prophylaxis for exercised induced asthma
- Intermittent use for intermittent asthma
- Monotherapy for mild persistent asthma
- Add on for moderate to severe asthma
- Montelukast is indicated >1 year of age
Inhaled Corticosteroids

• Low dose
  – Can be effective for maintenance

• Medium dose
  • Pulse dose for times of infection

• High dose
  – Treatment and may be necessary for maintenance
  – May see systemic steroid side effects

• May not treat exercise induced or nocturnal symptoms
## Estimated Comparative Daily Dosage for Inhaled Corticosteroids

<table>
<thead>
<tr>
<th>Inhaled Steroid</th>
<th>Low Dose</th>
<th>Medium Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone HFA (QVAR) 40 or 80 μg/puff</td>
<td>0–4 yr</td>
<td>≥12 yr</td>
<td>0–4 yr</td>
</tr>
<tr>
<td></td>
<td>5–11 yr</td>
<td>80–160 μg</td>
<td>≥160–320 μg</td>
</tr>
<tr>
<td></td>
<td>80–240 μg</td>
<td>NA</td>
<td>&gt;240–480 μg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Budesonide DPI* (Pulmicort Flexhaler) 90 or 180 μg/puff</td>
<td>NA</td>
<td>180–400 μg</td>
<td>&gt;400–800 μg</td>
</tr>
<tr>
<td></td>
<td>180–600 μg</td>
<td>NA</td>
<td>&gt;600–1200 μg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>&gt;800 μg</td>
<td>&gt;1200 μg</td>
</tr>
<tr>
<td>Budesonide nebulizer* (Pulmicort Respules) 0.25 mg; 0.5 mg; 1 mg/respule</td>
<td>0.25–0.5 mg</td>
<td>0.5 mg</td>
<td>&gt;0.5–1mg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>1 mg</td>
<td>&gt;1 mg</td>
</tr>
<tr>
<td></td>
<td>&gt;1 mg</td>
<td>2 mg</td>
<td>NA</td>
</tr>
<tr>
<td>Flunisolide HFA (Aerospan HFA) 80 μg/puff</td>
<td>NA</td>
<td>160 μg</td>
<td>≥640 μg</td>
</tr>
<tr>
<td></td>
<td>320 μg</td>
<td>NA</td>
<td>&gt;640 μg</td>
</tr>
<tr>
<td>Fluticasone (Flovent HFA) MDIL 44, 110, 220 μg/puff</td>
<td>176 μg</td>
<td>88–176 μg</td>
<td>&gt;176–352 μg</td>
</tr>
<tr>
<td></td>
<td>88–264 μg</td>
<td>&gt;176–352 μg</td>
<td>&gt;264–440 μg</td>
</tr>
<tr>
<td></td>
<td>&gt;352 μg</td>
<td>&gt;320–640 μg</td>
<td>&gt;352 μg</td>
</tr>
<tr>
<td></td>
<td>&gt;440 μg</td>
<td>NA</td>
<td>&gt;440 μg</td>
</tr>
<tr>
<td>Fluticasone (Flovent Diskus) DPI: 50 μg/puff</td>
<td>NA</td>
<td>100–200 μg</td>
<td>≥400 μg</td>
</tr>
<tr>
<td></td>
<td>100–300 μg</td>
<td>&gt;200–400 μg</td>
<td>&gt;400 μg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>&gt;500 μg</td>
<td>NA</td>
</tr>
<tr>
<td>Mometasone DPI* (Asmanex Twisthaler) 110 or 220 μg/inhalation</td>
<td>NA</td>
<td>200 μg</td>
<td>&gt;400 μg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>400 μg</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>&gt;400 μg</td>
<td>NA</td>
<td>&gt;400 μg</td>
</tr>
<tr>
<td>Ciclesonide (Alvesco) 80 or 160 μg/inhalation</td>
<td>NA</td>
<td>160 μg</td>
<td>&gt;640 μg</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>320 μg</td>
<td>NA</td>
</tr>
</tbody>
</table>

DPI = dry powder inhaler, HFA = hydrofluoroalkanes, MDI = metered dose inhaler, NA = not available

*Approved for once/day dosing


---

**THE UNIVERSITY OF KANSAS HOSPITAL**

**ADVANCING THE POWER OF MEDICINE**

---

50
Long Acting Beta Agonists

• **Black box warning**
  – Increased risk of asthma-related death
• Use them if the patient is uncontrolled on antihistamines, leukotriene inhibitors, and inhaled corticosteroids
• **Use only in conjunction with an inhaled corticosteroid**
• Remove as part of stepping down therapy
Omalizumab (Xolair)

- Humanized IgG1 antibody to IgE (binds to free IgE)
  - Reduce amount of IgE available to bind to mast cells/basophils
  - Down-regulation of surface IgE receptors on mast cells/basophils
- Reduce asthma exacerbations
  - Moderate to severe asthma
- Black box warning
  - Anaphylaxis 0.2% incidence
Treatment

• Acute asthma is a **Medical Emergency**
  – Initial management – rapid bronchospasm reversal
  – Then maintain a bronchodilated state

• **Most asthma deaths are associated with unrecognized severity of the attack**
  – Lack of access to care
  – Under-treatment
Medication Use Assessment

• Ask repeatedly in multiple ways about medication use
  – How many times per day are you using ________ ?
  – How many times per week are you using ________ ?
  – How often do you miss your medications in a week?
  – Which medications do you use every day?
  – Are you using this every day?
Medication Use Assessment

• Spacers
  – Does the child have one at every location?
    • Dad’s, Mom’s, school, after school daycare
• Nebulizer vs MDI with spacer +/- mask
  – Is the child sitting for the neb treatments?
  – Can you transition?
Medication use assessment

• What do they think the medication is suppose to do?
• What are we treating?
• Is it a daily medication? Or as needed?
• What do the instructions say?
  – Are they in the right language?
  – Do they understand the instructions?
  – Where are the instructions?
Make sure your patients have a plan.
Difficult Case

• 17 year old male
  – High school senior, varsity basketball
  – College bound, hoping to get a sports scholarship
  – Working after school job at a nursing home
  – Single mom who works 2 jobs
  – Asthma since early childhood
Difficult Case

• You see him in your office on a Friday afternoon and he says:
  – “My asthma has been fine”
  – “My allergies are fine”
  – “I don’t even know why I am here….I am fine….and I have to get to work in 30 minutes.”
  – He has been using all his medications
Difficult Case

- Medications
  - Symbicort 160/4.5 2 puffs twice daily
  - Singulair 10 mg daily
  - Zyrtec 10 mg daily
  - Albuterol 2-4 puffs every 4-6 hours as needed and prior to scheduled exercise
  - We tried to put him on allergy shots – did not come for appointments
Difficult Case

• Meaningful use (because you are a good doctor), you ask:
  – How often do you have asthma symptoms: “That depends on what I am doing that day.”
  – Does your asthma limit your activities: “No”
  – Nocturnal awakenings: “I don’t sleep much anyway”
  – Rescue inhaler use: “If I remember it, I use it before my games...and usually a time or two during the game.”
  – Have you had any steroids: “No”
Difficult Case

• Here for routine follow up appointment
  – Missed the last 2 appointments,
  – No ER/UC/PCP visits for asthma symptoms
  – He has not been refilling his medications

• Exam
  – Mild end-expiratory wheezing in bases, clears with albuterol
Spirometry

- FEV1/FVC 62%
- FEV1: 2.07 (57%)
- FVC: 3.32 (84%)
- FEF 25-75: 1.05 (25%)
- Moderate obstructive defect
Difficult Case

- Obvious indications of non-adherence
  - Who has been filling his medications?
  - Does not show up for appointments
  - Spirometry, shows poor control
  - Use of inhaler during games after pre-treatment
Asthma related sports Deaths

- 1990-2003 38 US asthma deaths in schools
  - 47% in black children
  - 72% among teens
  - 42% were participating in exercise activity
  - 31% died while waiting for medical assistance

Difficult Case

• Subtle indications of non-adherence
  – Time constraints of a teenager
    • Basketball, work, school
  – And he is a guy!
  – On his own...practically
  – Poor perceiver of his symptoms...just does not want to discuss them today
Difficult Case

- Subtle indications of non-adherence
  - He may not want his team to know he has asthma...hiding?
    - Weaker player
    - College scouts
    - Bullying
  - He does not want his mother to worry
Difficult Case

- Risks of non-adherence
  - Exercise induced exacerbation
  - Long term complications – COPD
  - Loss of scholarship opportunities
  - Loss of future opportunities
Referral Guidelines

• Pulmonary and/or Allergy
• Additional testing needed
  – Confirm the diagnosis (atypical symptoms)
• Severe persistent asthma
• Life threatening exacerbations
• Continuous oral or high dose inhaled steroids
  – > 2 oral steroid bursts in 1 year
• Requiring daily therapy and < 3 years of age
• Goals of therapy not met (may need omalizumab)
Take home points

• NHLBI/EPR3 2007 guidelines:
  – Use symptoms and objective measures of lung function to monitor therapy
• Environmental control is essential
• Reassess patient adherence at every visit
• Therapy to reverse and prevent airway inflammation
• Patient education to foster a partnership
  – Family, clinician, and patient
We are all in this together!

Make it a team effort for your patients!

Be interested in their disease and how it affects their life!
Tobacco Smoke

• Increased hospitalization rates for lower respiratory tract illness with a smoking parent
  – Meta-analysis of 21 publications (1966-95)
    – OR 1.93 for infants and children
    – OR 1.71 < 2 years of age
    – OR 1.25 3-6 years of age

• “I only smoke outside”
  – 291 children for cotinine in hair
    • Detectable levels in all patients
    • No statistical difference between indoor and outdoor smokers
Allergen Avoidance

• Cat
  – Remains airborne in undisturbed home

• Dog
  – No allergen free dog!

• 818 homes surveyed found cat/dog dander
  – 54.9% of homes had no dog or cat

• Rodents
  – Mouse: more important in inner-city homes
  – Occupational exposures (lab workers)
Allergen Avoidance

• Cockroaches
  – Major source of indoor allergens
  – More common in inner cities (kitchens)
  – Occupational exposures: cardboard boxes

• Dust mites
  – They are there (no matter how clean your home is)!!!!

• Mold (Indoor and outdoor)
  – Association between excess indoor “dampness” and cough, wheeze, and asthma in both kids and adults
Removal of Allergen

• Pet dander – 4 months after pet leaves
  – Removal of the pet is on the only clear effective way to remove the allergen
  – Aggressive cleaning
  – Create a pet-free zone in the bedroom

• Impermeable mattress and pillow covers

• Wash bedding weekly at ≥130°F
Removal of Allergen

• Remove carpets, stuffed animals, clutter
• Vacuum weekly with HEPA filter vacuum
• Control humidity and improve ventilation
  – Avoid steam cleaning carpets
• Chemical treatments (mite)
  – Benzyl benzoate powder
  – 3% tannic acid
Removal of Allergen

• Stop inflow and removal of pests
  – Seal cracks and holes, poisons, cleaning
  – Remove sources of food and water

• Air filters
  – Electrostatic precipitators – add ozone (not good)
  – HEPA – high efficiency particulate air
    • Furnace and vacuum
  – Free standing filters - inconclusive evidence on health benefits
  – Potentially work best for cat dander and maybe dust
References


