Guideline for the Diagnosis and Management of Chronic Childhood Asthma

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Preface

Unless other noted, this guideline is based entirely on the National Institutes of Health (NIH) National Asthma Education and Prevention Program’s (NAEPP) Expert Panel Report Panel Report 3 (EPR-3). Childhood asthma is one of the most common chronic diseases of childhood. Six million children in the United States have asthma, based on the annual National Health Interview Survey (NHIS). Investigators from the Arkansas Children’s Center, Arkansas Children’s Hospital, and University of Arkansas for Medical Sciences Department of Pediatrics have found the prevalence is higher when more robust interviews of parents/caregivers of Arkansas children are performed by local school nurses compared to the NHIS methods. In both rural and urban schools in Arkansas, a prevalence of 25%, or 1 of every 4 children has been documented, and published.

Excluding prematurity, congenital anomalies, trauma, and homicide, after 1 year of age asthma is one of the leading natural causes of death in children. According to the Arkansas Department of Health, 2-3 Arkansans (all ages) die each month (annualized average) from acute asthma. In the United States (U. S.), the annual direct costs of asthma including all ages is approximately $37.2 billion in 2007 U.S. dollars.

Failure to initiate treatment when the diagnosis is considered in young children increases the risks for morbidity and mortality in patients with chronic asthma.

Definitions

- Asthma is a chronic obstructive lung disease characterized by
  - Airways inflammation
  - Airways obstruction that is at least partially reversible
- Increased airways responsiveness to a variety of stimuli

**Terms used in asthma management**
- **Severity** is the intrinsic intensity of the disease process, most easily and directly measured in a patient currently receiving long-term control treatment.
- **Control** is the degree to which the manifestations of asthma are minimized and the goals of therapy are met including
  - Symptoms
  - Functional impairment
  - Risks of untoward event
- **Responsiveness** is the ease with which control is achieved by treatment.

**Goals of Asthma Management**
- Prevent symptoms
- Reduce/eliminate the use of short-acting beta2 agonist (≤2 days/week)
- Maintain normal or near normal pulmonary function
- Meet the patients’/families’ treatment expectations
- Prevent or reduce the need for unscheduled visits for acute asthma
- Prevent progressive loss of lung function
- Optimize the therapeutic ratio of risk vs. benefit from pharmacotherapy

**Risk Factors for the Development of Asthma**
- Eczema, atopy, or a family history of asthma among first degree relatives are the strongest risk factors for the development of asthma. Eighty percent (80%) of children with asthma are atopic.
- Prematurity
- Tobacco smoke exposure
- Poverty and race
- Obesity

**Triggers of Acute Asthma Symptoms/Exacerbations**
- Viral respiratory infections
- Exertion
- Allergen exposure
- Environmental tobacco smoke
- Volatile organic compounds
- Poor air quality
  - Carbon monoxide
  - Particulate air pollution from internal combustion engines and industry
  - High ozone

**Diagnosis and Management of Asthma**

**Determine**
- Episodic symptoms of airflow obstruction present, usually manifested by cough or wheezing episodes
- Airflow obstruction is present, and at least partially reversible
- Alternative diagnoses excluded
Conduct

- Detailed history
- Physical exam
  - Often normal between exacerbations
  - Signs of atopy in allergic patients
- Spirometry, to demonstrate the severity of airway obstruction and reversibility, in patients ≥5 years-of-age, which assists in the assessment of asthma severity and control

There may be no more than a 50% correlation of history + physical exam with objective measures of airway function.\(^7,8\)

Objective measurement of lung function is required at the time of considering a diagnosis of asthma and in assessment of asthma control.

Laboratory Evaluation

Laboratory evaluation is usually limited to

- Pulmonary function testing (PFT)
  - To detect obstruction and evaluate reversibility
  - Needed in classifying chronic asthma severity and to aid in assessing asthma control
  - Recommended for all adults and children ≥5 years-of-age
  - Can be conducted in office setting
  - Spirometry performed in accordance with the American Thoracic Society standards\(^9\)
  - Normal PFTs do not exclude a diagnosis of asthma
- Chest X-Ray
  - Does NOT establish the diagnosis
  - May rule out other causes of wheezing/alternate diagnoses
  - NOT needed for most exacerbations
  - May be indicated when aspirated foreign body or pneumothorax is suspected at the time of considering an asthma diagnosis or for acute loss of control in a person known to have asthma
- Allergy testing to identify controllable/avoidable aeroallergens
- Final test may be a trial of medications based on severity assessment and the step-wise recommendations.

Differential Diagnoses

The following may be alternate diagnoses or co-morbid conditions which may lead to poor asthma control in patients with known asthma, if not addressed and treated, in addition to asthma control medications.

- Allergic rhinitis/sinusitis
- Foreign body
- Laryngomalacia
- Tracheomalacia
- Subglottic/tracheal stenosis
- Bronchial stenosis
- Vascular ring and congenital anomalies of the airways
- Cardiomyopathy, including congestive heart failure
- Laryngeal web
- Mediastinal masses
- Functional syndromes
  - Vocal cord dysfunction
  - Psychogenic cough
Assessing the Possibility of Asthma in Children <5 years-of-age

- ERP-3 includes indicators of possible asthma in young children.
- After alternate diagnoses are excluded, if a child <5 years-of-age exhibits any 1 of the following characteristics the child has an 80% chance of having asthma at school age:\textsuperscript{10,11}
  - Recurring episodes of cough lasting more than 10 days, or
  - Recurring episodes of wheezing, or
  - Recurrent “chest colds” lasting >10 days, or
  - Recurring pneumonia, bronchiolitis, or bronchitis, in otherwise healthy children and one of the following:
    - Parental history of asthma
    - Physician-diagnosed eczema
    - Allergic sensitization to \( \geq \) 1 aeroallergen or 2 of the following:
      - Wheezing unrelated to upper respiratory infections
      - Blood eosinophil counts >4%
      - Allergic sensitization to milk, eggs, or peanuts
- To assess asthma at this age, a child who meets the above criteria, and who has 1 or more of the following characteristics should be strongly considered for initiation of asthma management
  - Four (4) or more episodes of wheezing within a 12-month period, or
  - Episodes of persistent cough >4 weeks of duration, or
  - Acute wheeze episodes <6 weeks apart, or
  - Cough/wheeze episodes (which respond to short-acting beta2 agonists, SABA) requiring treatments with SABA >2 times/week, or
  - Requirement of oral corticosteroid bursts >2 times within 6 months
- Table 1 is provided to assist in classifying asthma in children <5 years-of-age:\textsuperscript{1}
- If alternate diagnoses have been considered and excluded, controller medications should be started as causes of airways inflammation are identified and avoidance strategies initiated.
- Any characteristic shown in Table 1 places the patient in the corresponding highest severity category.
- In Figure 1, the recommended step-wise approach initiation of controllers to initiate therapy is listed based on the assessment of severity.
- After controller medications and avoidance strategies have been started, asthma control must be assessed at subsequent visits with the initial assessment 2-6 weeks after starting control treatments.
- As noted in Table 2, in children <5 years of age, a reduction or elimination of the frequency of exacerbations is the key indicator of control at this age as almost all acute episodes are triggered by viral respiratory infections in preschool children.
  - Between such viral respiratory infections the child is usually asymptomatic.
  - If the criteria in Table 1 are met, recurrent wheezing episodes with viral respiratory illnesses may indicate a young child has asthma.
  - Recurring episodes of wheezing after 2 years of age, unless there is an innate abnormality of the airway, is abnormal.
  - Asthma is the most common condition which predisposes an increased risk for recurring wheeze episodes.
  - Alternate diagnoses must be considered and excluded when asthma is considered at any age, or if patients with suspected asthma do not respond to currently recommended treatments.
  - Since >80% of children and >50% of adults who have asthma are atopic, identifying and avoiding aeroallergen triggers are imperative.
  - For highly allergic patients who do not respond to medical management of allergic rhinitis and
associated allergy-related chronic asthma, referral to an allergist for consideration of allergy immunotherapy is recommended at any age.

Table 1. Classifying Asthma Severity and Initiating Treatment in Children 0-4 Years of Age: Assessing severity and initiating therapy in children who are not currently taking long-term control medication

To view a larger image on your device, please click or touch the image.

Table 1. Classifying Asthma Severity and Initiating Treatment in Children 0-4 Years of Age

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity (0-4 years of age)</th>
<th>Intermittent</th>
<th>Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent Mild</td>
<td>&gt;2 days/week but not daily</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>Intermittent Moderate</td>
<td>1-2x/month</td>
<td>3-4x/month</td>
</tr>
<tr>
<td>Impairment</td>
<td>Intermittent Severe</td>
<td>≤ 2 days/week but not daily</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>Persistent None</td>
<td>None</td>
<td>Minor limitation</td>
</tr>
</tbody>
</table>

Risk

Exacerbations requiring oral systemic corticosteroids

0-1/year ≥ 2 exacerbations in 6 months requiring oral systemic corticosteroids, or ≥ 4 wheezing episodes/1 year lasting >1 day AND risk factors for persistent asthma

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

Recommended Step for Initiating Treatment

Step 1 Step 2 Step 3 and consider short course of oral systemic corticosteroids

In 2-6 weeks, depending on severity, evaluate level of asthma control that is achieved. If no clear benefit is observed in 4-6 weeks, consider adjusting therapy or alternative diagnosis.

Key: EIB, exercise-induced bronchospasm


Figure 1. Step-wise Approach for Managing Asthma in Children 0-4 Years of Age

To view a larger image on your device, please click or touch the image.
Table 2. Assessing Asthma Control and Adjusting Therapy in Children 0-4 Years of Age

To view a larger image on your device, please click or touch the image.
Assessing the Possibility of Asthma in Children 5-11 years of age

- Recurrent episodes of wheezing or episodes of prolonged cough
- Nocturnal or early morning wheeze or cough
- Recurring "chest colds" lasting >10 days/episode
- Recurrent bronchiolitis, bronchitis, or pneumonia in otherwise healthy children
- Recurring episodes of chest pain, cough, shortness of breath, or dyspnea with exertion during
  - Running
  - Playing
  - Sports participation
  - Laughing
  - Crying/sobbing

At least 80% of patients with asthma exhibit acute symptoms with exertion.

Exertion-related symptoms in a patient with known asthma may indicate poor asthma control.12

- Table 3 is provided to assist in classifying asthma in children 5-11 years of age.
- For children 5-11 years of age, 6 areas of questioning must be asked to accurately assess asthma severity including
  - Symptoms
  - Nocturnal awakenings
  - Frequency of short-acting beta2 agonists use
  - Physical activity limitations
  - Lung function testing results
  - Frequency of exacerbations requiring unscheduled visits for acute asthma
A positive response to these questions places the patient in the highest category for which there is a positive answer. Once asthma severity is assessed, the evidenced-based recommendations are found in the step-wise approach to initiating controller therapy (Figure 2).

- Asthma control is assessed 2-6 weeks after initiating controller therapy and at subsequent visits to the primary care or specialty provider (Table 4).
- Once asthma is well-controlled for at least 3-6 months, the medical provider should determine if control can be maintained by stepping down controller therapy to the next lower step.
  - Regarding inhaled corticosteroid therapy (ICS), this reduction should be no more than 50% of the current ICS dose per step down.
  - After step down, reassessment of control is required.
  - Step down to lower doses of controller therapy is more likely to be successful if strategies to identify and avoid triggers of airways inflammation have been implemented.
- Reassessments of control are required periodically based upon
  - Initial assessment of severity
  - Response to therapy

Table 3. Classifying Asthma Severity and Initiating Treatment in Children 5-11 Years of Age: Assessing severity and initiating therapy in children who are not currently taking long-term control medication

To view a larger image on your device, please click or touch the image.
Figure 2. Step-wise Approach for Managing Asthma in Children 5-11 Years of Age

Table 4. Assessing Asthma Control and Adjusting Therapy in Children 5-11 Years of Age

To view a larger image on your device, please click or touch the image.
Assessing the Possibility of Asthma in Youth ≥ 12 years of age and Adults

Table 5. Classifying Asthma Severity and Initiating Treatment in Youth ≥ 12 Years of Age and Adults: Assessing severity and initiating treatment for patients who are not currently taking long-term control medications

To view a larger image on your device, please click or touch the image.
Table 5. Classifying Asthma Severity and Initiating Treatment in Youth ≥ 12 Years of Age and Adults
Assessing severity and initiating treatment for patients who are not currently taking long-term control medications

<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>≤ 2 days/week</td>
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<tr>
<td>Impairment</td>
<td></td>
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<tr>
<td>Normal FEV₁/FVC:</td>
<td></td>
</tr>
<tr>
<td>8-19 yr 85%</td>
<td></td>
</tr>
<tr>
<td>20-39 yr 80%</td>
<td></td>
</tr>
<tr>
<td>40-59 yr 75%</td>
<td></td>
</tr>
<tr>
<td>60-80 yr 70%</td>
<td></td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤ 2x/month</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-acting beta₂-</td>
<td>≤ 2 days/week</td>
</tr>
<tr>
<td>agonist use for</td>
<td></td>
</tr>
<tr>
<td>symptom control (not</td>
<td></td>
</tr>
<tr>
<td>prevention of EIB)</td>
<td></td>
</tr>
<tr>
<td>Interference with</td>
<td>None</td>
</tr>
<tr>
<td>normal activity</td>
<td></td>
</tr>
<tr>
<td>Lung function</td>
<td>Normal FEV₁, between exacerbations</td>
</tr>
<tr>
<td></td>
<td>• FEV₁ &gt; 80% predicted</td>
</tr>
<tr>
<td></td>
<td>• FEV₁/FVC normal</td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations requiring oral systemic corticosteroids</td>
</tr>
<tr>
<td></td>
<td>0-1/year (see note)</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Recommended Step for Initiating Treatment

- Step 1
- Step 2
- Step 3
- Step 4 or 5

Key: FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit

Note: At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g. requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥ 2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma. Table 5 from National Asthma Education and Prevention Program. Publication No. 07-4051. Available from: http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm

Figure 3. Step-wise Approach for Managing Asthma in Youth ≥ 12 Years of Age and Adults

To view a larger image on your device, please click or touch the image.
Table 6. Assessing Asthma Control and Adjusting Therapy in Youth ≥ 12 Years of Age and Adults

To view a larger image on your device, please click or touch the image.
Reassessing Asthma Control

- The frequency of reassessment of asthma control is related to the initial asthma severity and responsiveness to treatment.
- In general, visits will range from monthly to yearly depending on initial severity and response to treatment. At each visit, the following evaluations are recommended
  - Signs and symptoms
  - Pulmonary function testing
    - The flow volume loop is sufficient after initial assessment.
    - A bronchodilator challenge with a short-acting beta2 agonist, in addition to a flow volume loop without bronchodilator, is recommended at least yearly.
  - Quality of life/functional status
  - History of exacerbations
  - Adherence and barriers to treatment
  - Revision/review of action plan at every visit
  - Review techniques for proper use of all inhaled devices
  - Communication and patient satisfaction
- Patients with well-controlled asthma rarely need short-acting beta2 agonists and seldom (<1/year) need oral steroid bursts for acute asthma.

Indications for Referral to an Asthma Specialist

- When control is not achieved with low-medium doses of ICS, either alone or in combination with recommended adjunctive therapies
- Children <5 years of age requiring >Step 2 therapy
- Older patient requiring >Step 3 therapy
- Difficulty in achieving or maintaining control
- Age-specific bone density for patients requiring treatment Steps 5-6
- Frequent oral/systemic steroid bursts for acute asthma episodes unresponsive to short-acting beta2
agonists

Additional Testing Required

- Allergy evaluation
- Broncho-provocation test for patients with suspected asthma with normal office pulmonary function testing, even during exacerbations
- Evaluation to rule out alternate diagnoses or additional management of comorbid diagnoses
- Pulmonary functioning tests required to determine severity and guide treatment to achieve control

Likelihood of Persistent, Poorly-Controlled Asthma

- Albuterol use >2 times/week, or
- Nocturnal awakening >2 times/month, or
- Albuterol refills >2 times/year, or
- Oral steroid use >2 times/year, or
- Acute symptoms requiring health care visits >2 times/year

Table 7. Estimated Comparative Daily Dosages for Inhaled Corticosteroids in Children

To view a larger image on your device, please click or touch the image.
This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.

References

