REVIEW ARTICLE

Managing Pediatric Asthma in Primary Care

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KEYWORDS

Pediatric asthma

Primary care

Preventative medicine

Asthma education

ABSTRACT

Asthma is the most common chronic lung disease of childhood, affecting approximately 6 million children in the United States. Its pathophysiology involves airway hyperresponsiveness and inflammation, which can lead to intermittent or persistent respiratory symptoms such as coughing, wheezing, shortness of breath, and chest tightness. The severity of disease ranges from mild intermittent symptoms to life-threatening airway compromise. Highlighting the complexity and individuality of asthma, this review will summarize the management of pediatric asthma within a primary care setting. By reviewing the etiology and recent nomenclature for the various subtypes of pediatric asthma, it aims to clarify the diagnostic process and the appropriate treatment algorithms. In addition, this review seeks to demonstrate the role of primary care in managing pediatric asthma to prevent exacerbations and improve children's overall health.

INTRODUCTION

Asthma is the most common chronic pediatric respiratory disease.[1] It is a complex multifactorial disorder characterized by bronchial hyperresponsiveness, intermittent airflow obstruction, and airway inflammation, affecting 14% of children worldwide, with an etiology attributed to interactions between genetics and a variety of host factors.[2-4] Prevalence and outcomes vary by age, sex, race, and socioeconomic status, with a higher disease burden observed among males during childhood, African Americans, and those living below the poverty line.[2,5] Low income has not only been associated with asthma prevalence but also with higher rates of exacerbations, hospitalizations, and critical care requirements.[5] Additional risk factors include personal or family history of atopy, secondhand smoke exposure, prematurity, low birth weight, obesity, and diverse environmental triggers.[3] These environmental factors include air pollution, tree pollen, wood pollen, influenza, and human rhinovirus.[6]

In addition to genetic, environmental, and comorbid factors, it is also important to consider the socioeconomic factors that impact asthma diagnosis and treatment. Low income has been linked to increased asthma prevalence, exacerbations, hospitalizations, and critical care admissions.[5] This relationship is likely multifactorial, as low income affects other social determinants of health, such as education, exposure to pests and pollution, and access to food and healthcare, which are all risk factors for asthma morbidity.[5] Lower educational attainment can reduce health literacy, directly influencing health outcomes.[5] Lack of insurance and access to care are important components, as fewer referrals are then made to asthma specialists, resulting in higher emergency room utilization for asthma, increased work and school absences, decreased consistency of providers, uncontrolled asthma, and overall worse asthma care.[5]

Despite all of these factors, the exact etiology of the development of asthma is unknown, and continued investigation into asthma pathophysiology, education, diagnosis, improved access, and treatment is necessary to prevent exacerbations.[7] Because pediatric asthma is frequently managed by primary care physicians or nonrespiratory specialists, implementing current asthma guidelines in nonspecialized care settings remains challenging due to their length and complex guidelines.[8] Improving asthma management in these settings requires primary care providers to recognize risk factors, establish an accurate diagnosis, initiate appropriate therapy, and support medication adherence.[8]

Presentation

The presentation of asthma varies depending on the individual and the severity of symptoms. Typical manifestations include wheezing, shortness of breath, and cough.[3] Obtaining a detailed history is essential and

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 Print ISSN: 1877-573X doi: 10.33181/18202

The authors have no relevant financial relationships or conflicts of interest to disclose.

should focus on the pattern of symptoms, precipitating factors, and risk factors.[2] Asthma should be considered when evaluating a child with a cough, particularly if it occurs predominantly at night or is triggered by a specific stimulus.2 Common triggers for asthma exacerbations include respiratory infections, exercise, weather changes, pollutants (domestic and environmental), secondhand smoke exposure, strong odors, strong emotions or anxiety, and certain medications.[3]

Wheezing is also a common symptom of asthma and results from inflammation and narrowing of the small airways.[3] It is important to note that many children experience wheezing in the first few years of life, but not all of them ultimately develop asthma.[3] Patients may also report chest tightness and shortness of breath. If the child is asymptomatic at the time of evaluation, the physical examination may be normal.[2] Children with asthma may also exhibit findings consistent with atopy including inflamed nasal mucosa, nasal discharge, sinus tenderness, eczema, atopic dermatitis, nasal polyps, and periorbital darkening.[2] Some children may present with asthma as part of the natural progression of the atopic march, which involves development of atopic dermatitis in infancy followed by allergic rhinitis and asthma during childhood.[9] In addition, excessive daytime fatigue and poor school performance may also indicate disrupted sleep due to nocturnal symptoms.[2]

During an acute exacerbation, symptoms become more pronounced and may include tachypnea, hypoxia, wheezing, and the use of accessory muscles. The child may also exhibit nasal flaring, tripod positioning, grunting, or inability to speak in complete sentences. Children presenting with these severe symptoms may be at risk for impending respiratory failure.[2]

Diagnostic Criteria

Pediatric asthma is diagnosed based on characteristic symptom patterns and supported by objective measures, when available.[3] The National Asthma Education and Prevention Program (NAEPP) and Global Initiative for Asthma (GINA) both provide evidence-based guidelines for diagnosis and management, classifying asthma as intermittent, mild persistent, moderate persistent, or severe persistent.[1,10] Figure 1 outlines the diagnostic criteria for each classification based on NAEPP guidelines.

Pulmonary function tests, including spirometry and peak expiratory flow (PEF), are used to assess airflow obstruction and reversibility.[3] These tests are generally considered reliable only in children aged 5 years and older, at which point they can help confirm a clinical diagnosis.[3,11] Spirometry is considered the gold standard for diagnosing asthma. Patients with asthma will demonstrate an obstructive pattern of breathing, with FEV_1 <80% predicted and FEV_1/FVC ratio <0.85. After the administration of a bronchodilator, an improvement in FEV_1 of more than 12% from baseline indicates significant reversibility.[2]

FIGURE 1: Asthma severity classification.[a] Severity levels include intermittent, mild persistent, moderate persistent, and severe persistent. These are classified based on a combination of symptom frequency and interference with daily life, as well as clinical measures.

FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; SABA, short-acting beta agonist

Type	Asthma Symptoms
Intermittent	• Daytime symptoms <2 days per week • Nocturnal awakenings <2 per month • No interference with activities • Normal FEV[1] and FEV_1/FVC • Exacerbations <1 per year
Mild persistent	• Daytime symptoms >2 but <7 days per week • Nocturnal awakenings 3-4 nights per month • Minor interference with activities • Normal FEV_1 and FEV_1/FVC • Exacerbations >2 per year
Moderate persistent	• Daily symptoms • Nocturnal awakenings >1 per week but not daily • Daily use of SABA • Some activity limitation • FEV[1] 60%-80% predicted; FEV_1/FVC below normal • Exacerbations >2 per year
Severe persistent	• Symptoms throughout the day and need for SABA several times a day • Nocturnal awakenings most nights • Extreme activity limitation • FEV_1 <60% predicted and FEV_1/FVC below normal • Exacerbations >2 per year

[a]Data adapted from the National Asthma Education and Prevention Program Coordinating Committee and Expert Panel Group[1]

Because spirometry may not be widely available in primary care settings, GINA supports use of PEF as an alternative measure.[10] PEF is assessed using an inexpensive hand-held device that measures the patient's ability to exhale forcefully.[11] Exhaled fractional nitric oxide (FeNO) is a noninvasive biomarker that is becoming increasingly available. If it is suspected that a child has asthma but there is diagnostic uncertainty, a FeNO level of 35 ppb or more is considered positive for airway inflammation.[12] FeNO may also help discriminate between wheezing phenotypes and predict future asthma development in preschool children, although diagnostic value for school-aged children is limited by insufficient evidence.[13] Symptom onset often occurs before the age of 3 years, which complicates early diagnosis.[3] In such cases, patients can be diagnosed and treated based on clinical suspicion, with confirmation deferred until they reach an age at which reliable testing is feasible.[3]

Despite established guidelines, patients are often diagnosed with asthma based on clinical presentation,

particularly when clinical symptoms, family history, environmental exposures, or atopic features strongly suggest asthma, and prompt treatment is necessary. However, GINA guidelines emphasize the importance of confirming an asthma diagnosis with objective testing to avoid unnecessary treatment, overtreatment, and overlooking of other significant conditions.[10]

Treatment

Current treatment strategies follow NAEPP guidelines and are stratified based on age and asthma severity (Figure 2).[1] Disease control should be assessed regularly using symptom-based measures, as poor control increases the risk of future exacerbations (Figure 3). For patients with worsening or uncontrolled symptoms, clinicians should evaluate adherence to the prescribed medication regimen, inhaler technique, environmental exposures, and comorbid conditions. If indicated, treatment should be stepped up to the next level, with control reassessed within 2-6 weeks.[1] When asthma has been well controlled for at least 3 consecutive months, stepping down therapy may be considered.[1] Consultation with an asthma specialist is recommended for children aged 0-4 years who reach step three or higher, and for children 5 years and older who reach step four or higher.[1]

Although evidence supporting OMT in pediatric asthma is limited, its use is grounded in osteopathic principles. Techniques such as rib raising and suboccipital release may help modulate sympathetic and parasympathetic tone and reduce viscerosomatic reflex activity.[14] Rib raising can alleviate restrictions by articulating the rib heads and increasing rib mobility, thereby facilitating more effective respiratory effort.[14] This technique can also influence diaphragm biomechanics, as the inferior ribs have direct diaphragmatic attachments, further improving respiratory function.[14] Given these physiologic mechanisms, OMT may serve as a helpful adjunct to standard asthma care, although further research is needed to clarify its clinical impact.[14,15]

Prevention

Prevention of asthma exacerbations and symptoms is essential to minimizing the inflammation to which children's lungs are exposed. Patient education is a critical component of disease management, including self-monitoring to assess asthma control and recognizing early signs of worsening symptoms, which can be achieved through symptom tracking or peak-flow monitoring.[1] Education on proper medication administration is also important. Patients should be counseled on correct inhaler technique, appropriate use of devices, and understanding the distinction between long-term control and quick-relief medications.[1] Many modifiable risk factors and triggers contribute to asthma severity, with obesity being a notable factor that can exacerbate pediatric asthma.[16] Consequently, promoting healthy lifestyle choices, such as weight control, exercise, and diet, is an important counseling point in management. Primary care physicians will play a pivotal role in reducing asthma morbidity through prompt and accurate diagnosis, adherence to treatment guidelines, and patient education to support effective self-management.

CONCLUSION

Primary care physicians are tasked with diagnosing and treating asthma within their pediatric patient population. Because asthma is a highly individualized chronic disease, clinicians must understand all aspects of care for children

FIGURE 2: Stepwise approach for management of asthma based on age and severity.[a] Guidelines are based on the 2020 Focused Updates to the Asthma Management Guidelines: A Report from the National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group. These are the preferred treatments, but there are alternatives that can be used based on the individual's needs.

	INTERMITTENT ASTHMA	MANAGEMENT OF PERSISTENT ASTHMA				
Age	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
0-4 yrs	PRN SABA and At the start of RTI: add short course daily	Daily low-dose ICS and PRN SABA	Daily medium dose ICS and PRN SABA	Daily medium dose ICS-LABA and PRN SABA	Daily high-dose ICS-LABA and PRN SABA	Daily high-dose ICS-LABA + oral systemic corticosteroid and PRN SABA
5-11 yrs	PRN SABA	Daily low-dose ICS and PRN SABA	Daily and PRN combination low-dose ICS-	Daily and PRN combination medium-dose ICS-formoterol	Daily high-dose ICS-LABA and PRN SABA	Daily high-dose ICS-LABA + oral systemic corticosteroid and PRN SABA
>12 yrs	PRN SABA	Daily low-dose ICS and PRN SABA	Daily and PRN combination low-dose ICS-formoterol	Daily and PRN combination medium-dose ICS-formoterol	Daily medium-high dose ICS-LABA + LAMA and PRN SABA	Daily high-dose ICS-LABA + oral systemic corticosteroids + PRN SABA

[a]Table is adapted from the National Asthma Education and Prevention Program Coordinating Committee and Expert Panel Group[1]

ICS, inhaled corticosteroid; LABA, long-acting beta agonist; LAMA, long-acting muscarinic agonist; PRN, as needed; RTI, respiratory tract infection; SABA, short-acting beta agonist

FIGURE 3: Assessing control of asthma based on symptoms and medication use

COMPONENTS OF CONTROL	WELL CONTROLLED			NOT WELL CONTROLLED			VERY POORLY CONTROLLED		
	Ages 0-4	Ages 5-11 years	Ages ≥12 years	Ages 0-4	Ages 5-11 years	Ages ≥12 years	Ages 0-4	Ages 5-11 years	Ages ≥12 years
Symptoms	≤2 days/week	≤2 days/week but not more than once each day	≤2 days/week	>2 days/week	>2 days/week or multiple times on ≤2 days/weeks	>2 days/week	Throughout the day		
Nighttime Awakenings	≤1x/month		≤2x/month	>1x/month	≥2x/month	1-3x/week	>1x/week	≥2x/week	≥4x/week
Interference with normal activity	None			Some limitation			Extremely limited		
SABA Use for symptom control	≤2 days/week			>2 days/week			Several times per day		
Lung Function →FEV_1 (% predicted) or peak flow (% personal best →FEV_1/FVC	Not applicable	>80% >80%	>80% Not applicable	Not applicable	60-80% 75-80%	60-80% Not applicable	Not applicable	<60% <75%	<60% Not applicable
Validated Questionnaires → ATAQ* → ACQ* → ACT*	Not applicable	Not applicable	0 ≤0.75 ≥20	Not applicable	Not applicable	1-2 ≥1.75 16-19	Not applicable	Not applicable	3-4 Not applicable ≤15
Asthma exacerbations requirin oral systemic corticosteroids	0-1/year			2-3/year	≥2 year		3/year	≥2/Year	
	Consider severity and interval since last asthma exacerbation.								
Reduction in lung growth/Progressive loss of function	Not applicable	Evaluation requires long-term follow-up care.		Not applicable	Evaluation requires long-term follow-up care.		Not applicable	Evaluation requires long-term follow-up 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.*								

Figure from the National Asthma Education and Prevention Program Coordinating Committee and Expert Panel Group[1]
ATAQ: Asthma therapy assessment questionnaire; ACQ: Asthma control questionnaire; ACT: Asthma control test

with asthma. Patient and family education should be a priority to prevent future exacerbations, and awareness of the obstacles each patient faces is essential for providing personalized care. Primary care providers should remain current with pediatric asthma classification, diagnosis, and treatment guidelines to provide the best care for their patients.

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