Contemporary PEDIATRICS

The September Asthma Epidemic: How To Prevent Fall Asthma Episodes

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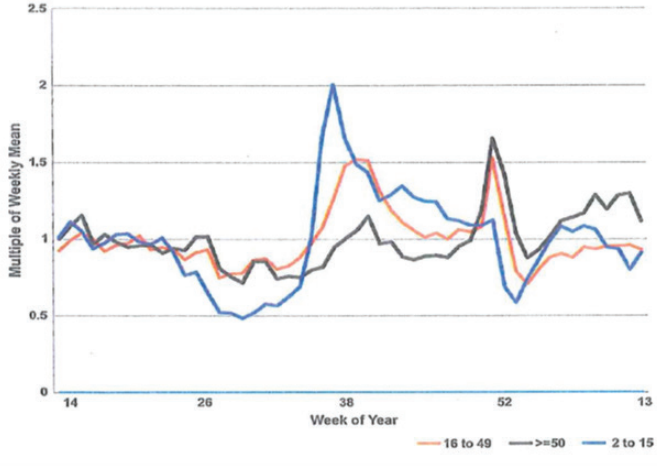
Abstract

This review addresses three important factors that contribute to asthma exacerbations during the Fall season: Fall viral infections, Fall allergy exposures and failure to adhere to medically recommended use of preventative controller medications. We stress the importance of physician involvement in preventing exacerbations by identifying patients at risk, providing influenza vaccinations, doing targeted exposure reduction with quality allergy testing, and counseling the use of daily controller medications according to National Asthma Education and Prevention Program (NAEPP) guidelines (EPR-3).

Introduction

The risk of asthma exacerbations with frequent unscheduled visits to physician offices, urgent care and even hospitalizations increases during the back-to-school season.[1] Allergic sensitization, exposure to allergic triggers and viral infections significantly increase the risk of asthma exacerbations and hospitalizations.[2,3] Asthma does not go on summer vacation, but adherence to medications in the summer tends to decrease, placing children at increased risk for moderate to severe symptoms in the Fall (Figure 1).

Figure 1.
The risk of asthma exacerbations with frequent unscheduled visits to physician offices.



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When students with asthma return to school they face the combined effects of increased exposure to cold and flu viruses, ideal conditions for spreading respiratory infections, and seasonal allergens. These, in turn, lead to asthma exacerbations and a spike in hospitalizations.

Three primary factors that contribute to the risk of asthma symptom exacerbations in the Fall:

1. Contagious viruses such as human rhinoviral infections (HRV), enteroviruses and adenoviruses[4]
2. Exposure to inhalant allergens such as to dust mites, cockroach, mold and pollen[5]
3. Lack of adherence to prescribed pharmacotherapy (i.e., inhaled corticosteroids)[5]

Increased exacerbation risk can be estimated by the use of a seasonal asthma exacerbation predictive index (saEPI). saEPI is calculated using numerous risk variables, including: age, allergic propensity (total IgE and allergen skin test positivity), percentage of blood eosinophils, exacerbation in the prior season, inhaled corticosteroids (ICS) as used in steps 2 to 4 in the EPR-3 guidelines, FEV1/forced vital capacity (FVC), and fractional exhaled nitric oxide (FeNO).[6]

In the guideline-based treatment group,[6] used in the development of the predictive index, the following were predictive of Fall exacerbations, with or without omalizumab treatment:

- Younger age
- High total IgE
- Higher blood eosinophil percentage
- Higher ICS usage, steps 2-4 as recommended by the guidelines

Pediatricians are in an ideal position to mitigate and prevent these exacerbations by identifying at-risk patients, ordering appropriate testing, and providing education and counseling to children and their families.

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The following evaluations should be considered to help identify children with asthma who may be at an increased risk of symptom exacerbations:

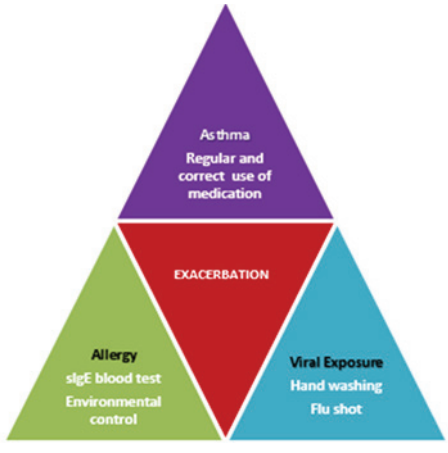
1. Perform a history and physical exam. Look for a previous seasonal history of cough, congestion, wheezing, school absences and exercise intolerance.
2. Review past medical history of eczema, rhinitis and wheezing with infections or allergy exposures. Forty-three percent of children with eczema will develop asthma by school age.[7]
3. Consider pulmonary function testing for children 5 years of age or older; spirometry with FEV1 response to bronchodilator (the American Thoracic Society criterion for diagnosing asthma is 12% improvement after bronchodilator use).[8] The use of FeNO to determine the presence of allergic airway TH2 inflammation and impulse oscillometry (IOS) to determine large vs. small airway obstruction should also be considered in children 2 years of age or older.
4. Administer the Asthma Control Test questionnaire for children as an ongoing assessment of asthma control.[9]
5. Order confirmatory allergen-specific IgE (sIgE) blood testing or skin prick testing to common aeroallergens. There is a high false-positive rate of allergy diagnosis based on patient opinion or history alone without allergy testing (in vitro diagnostic or skin test).[10] There should be a correlation between allergy history and allergy test results in order to confirm the diagnosis. Evidence of sensitization to a particular allergen is not synonymous with clinically relevant disease.

Steps To Help Prevent Fall Symptom Episodes

The following have proven effective in modifying the synergistic risk of exposure to allergic triggers and viral infections. (Figure 2):

- Utilize convenient, patient-friendly sIgE testing to identify the patient's allergic triggers,
- Provide flu shots
- Regularly monitor and ensure correct use of asthma medication(s)

Figure 2.
Modifiable Risks of Asthma Exacerbations



Viral Exposure

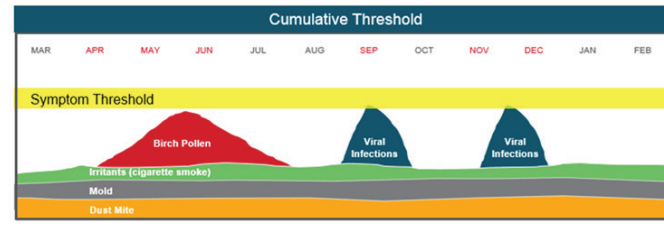
Viruses commonly circulate in late Summer and early Fall near the start of school, and are detectable in approximately 80% of children who experience acute asthma exacerbations.[2] The EPR-3 guidelines recommend that clinicians consider inactivated influenza vaccinations for patients with asthma. However, it is important to note the flu vaccine should not be given with the expectation it will reduce either the frequency or severity of asthma exacerbations during the influenza season due to the presence of other viruses. Once a child's airway is sensitized by any of these viruses, subsequent wheezing may occur with other viral exposures. The guidelines state that flu vaccine is safe for children >6 months of age.[5]

Targeted Exposure Reduction to Allergic Symptom Triggers

Environmental control of allergic and non-allergic (i.e., tobacco smoke) triggers is a significant component of symptom management. As many as 90% of children have one or more allergic triggers[11] and exposure to these triggers creates a source of chronic airway inflammation. Identification of a patient's specific symptom triggers provides the information needed to manage exposure.

Guided by sIgE in vitro or skin prick test results, the goal is to decrease the targeted allergen exposure burden below an individual's symptomatic threshold (Figure 3). For example, Morgan et al. showed reducing dust mite exposure in dust-mite sensitized children over a 2-year period significantly decreased the burden of asthma compared to no allergen avoidance. Outcomes included 3 weeks (21.3 days) per year with fewer symptoms, a month (34 days) each year with less wheezing, fewer missed school days, and unscheduled emergency department and office visits.[12]

Figure 3.
Targeted Exposure Reduction Helps Decrease the Allergen Burden Below the Symptom Threshold



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Allergic sensitization is cumulative, with clinical symptoms appearing when the allergen load exceeds the patient's symptom threshold. Targeted reduction of dust mite, mold and irritants helps maintain the patient below the symptom threshold even though challenged with seasonal pollen and viral infections.

Evidence supporting targeted exposure reduction is significant. Both the testing and implementation of targeted exposure reduction is Evidence Category A in the EPR-3 guidelines stating that "patients with persistent asthma should be evaluated for the role of allergens as possible contributing factors."[5]

Indications for allergy testing include:

1. Patients of any age with a high asthma burden (i.e., presence of chronic lower respiratory symptoms)
2. Young children with recurrent wheeze
3. Anyone meeting the Rules of Two® criteria while on daily controller or maintenance therapy:
   - >2 days per week of daytime asthma symptoms
   - >2 nights per month of nighttime asthma symptoms
   - > 2 asthma exacerbations or attacks per year resulting in a burst of oral steroids or antibiotics
   - >2 rescue albuterol inhaler fills/refills per year not just to cover different sites like home/school/day care/office
4. Patients with a history suggestive of a specific IgE-mediated allergic disease diagnosis, which most commonly includes but is not limited to: respiratory diseases (e.g., asthma, allergic rhinitis), food allergy, skin diseases (e.g., eczema, urticaria), hymenoptera venom allergy, and drug allergy.[13, 14, 15, 16]

Considerations for the Use of sIgE Testing

- Requires a single blood draw
- Is appropriate for children 3 months of age and older
- Is not affected by prescription or over-the-counter medications commonly used to treat asthma, including antihistamines of all types, sympathomimetic drugs and low doses of corticosteroids.[17]
- In patients experiencing chronic lower and/or upper respiratory symptoms, the order of a geographic-specific aeroallergen profile should be considered.
- The following regional respiratory profiles available from LabCorp have been created to efficiently assess sensitization to the most common triggers including pollens, mold, dust mites, furry animals and insect emanations (Table 1).

Table 1. Regional Respiratory Allergen Profiles Available from LabCorp

Order Code	States	Order Code	States
602627	CT, MA, ME, NH,NJNY, PA, RI, VY	602641	AZ mtns, CO, ID, mtns, MT, NM, UT mtns, WY
602628	DC, DE, MD, NC, VA	603719	Southern AZ desert area, Southern CA desert area
602629	GA, North FL, SC	602643	Southern CA coastal area
602630	FL, South of Orlando	602644	Central CA
602632	IN, KY, OH, TN, WV	602638	NV, Southern ID
602633	AL, AR, LA, MS	602645	Central & East WA, OR
602634	MI, MN, WI	602985	Northwest CA, WA, Western OR
602635	IA, IL, MO	602986	AK
602639	KS, ND, NE, SD	602987	PR
602640	OK, TX	602993	HI

Lack of Adherence to Medications

Clinical experience has shown many children are taken off their asthma controller medications and do not comply with targeted exposure reduction during the summer months, as some families mistakenly assume "asthma takes a vacation during the summer." While this may be partially true because there are fewer circulating respiratory viruses during the summer, it is clear that even in the absence of symptoms there is on-going allergic inflammation as evidenced by abnormal pulmonary function testing and elevated FeNO during asymptomatic periods.[18] Use of therapy to control asthma may be at its lowest just before school starts,[1] and parents may be waiting for the first Fall exacerbation to resume compliance. Unfortunately, this may often lead to an acute exacerbation from the synergistic effect of an acute viral infection and may result in an emergency room visit and/or hospital admission.

Allergen-specific IgE Testing in the Clinical Setting

Allergen sIgE tests can be used in an initial assessment of patients with a clinical history consistent with sensitization to food and/or inhalant allergens. Specific IgE tests should not be used as a first-line in the evaluation of patients suspected of having allergy to hymenoptera venom allergy (stinging insects) or specific drugs.[19] The presence of sIgE indicates sensitization to the allergen(s) tested but is not necessarily synonymous with clinically relevant disease. Sensitization is a prerequisite for an IgE-mediated, allergic reaction and increases the likelihood of clinical allergy. Absence of sIgE diminishes the likelihood of an allergy to the allergen(s) tested. Contemporary sIgE testing can be easily accessed and is effective in diagnosing allergy with test performance comparable to skin prick testing.[20-21] The clinical efficiency of sIgE testing is equivalent to standard skin prick testing (88.8 and 89.2, respectively[20]). The major advantage of sIgE testing is in its ability to quantify allergen-specific IgE antibody levels and the lack of interference from allergen-specific IgG antibodies.[22]

The Use of sIgE Test Results in Asthma Management

The physician plays a critical role in the interpretation of sIgE test results within the context of the patient's history and exposure to the relevant allergens.[22] The results of sIgE testing are reported quantitatively in kU/L, with the probability of symptoms increasing as sIgE levels increase.[23] The physician should rank the highest levels of sIgE and focus on reducing exposure to those antigens. Counseling and education can be used to reduce exposure to allergens to which the patient is sensitized. It has been shown that targeted exposure reduction is more effective when combined with allergy testing than with empiric management.[24]

A Case Report

An 11-year old female patient was referred to the allergy clinic in the Spring of 2018 for recurrent episodes of cough, congestion and wheezing that had occurred during the Fall of 2017. There was no family history of allergies or asthma. On physical exam, she had coarse bronchial breath sounds with partial clearing after cough. The patient's environmental exposure history indicated mold around her window seals with a moldy tree stump and mulch outside her bedroom window. The patient was diagnosed with suboptimal control of mild persistent asthma with recent exposure to mold, confirmed by elevated sIgE antibodies to Alternaria spores and recent viral infections.

Treatment Recommendations

Peak flow-guided asthma management as follows:

- Fluticasone 44, two puffs twice daily (for peak flows greater than 250 L/min)
- Albuterol sulfate quick reliever every 4 hours for acute relief (for peak flows 150-250 L/min) prednisone 20 mg for 5 days (if needed for peak flows less than 150L/min)
- Mold mitigation measures.

Follow-up later in the Summer of 2018

- Asymptomatic with peak flows in the normal range.
- Mold control completed with removal of the moldy tree stump underneath her bedroom window and installation of a HEPA air purifier in her bedroom.
- Continued current medication regimen of fluticasone (intranasal corticosteroid) throughout the Fall.

Follow-Up Test Results

- Total IgE = 164 kU/L
- Respiratory aeroallergen test results reported elevated sIgE antibodies to Alternaria mold at 30.8 kU/L. The sIgE test results to the other aeroallergens were negative.
- Forced vital capacity (FVC) = 2.39L at 73% predicted
- Forced expiratory volume (FEV1) = 2.24L at 81% predicted (mild obstruction)
- Asthma Control Test score = 27, asthma under good control
- Chest x-ray = normal

Summary

Our review cites three important factors involved in asthma exacerbations during the Fall season: viral infections, allergic airway sensitization, and lack of adherence to controller therapy. The role of the pediatrician in preventing these asthma symptom exacerbations includes moderating the viral challenge through appropriate vaccinations, sIgE testing to facilitate targeted exposure reduction of specific allergens, and summertime surveillance with education to ensure on-going adherence to asthma medication regimens.

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