Multidisciplinary Care to Treat
SEVERE ASTHMA
CASE STUDIES

Boston Children's Hospital
Severe Asthma Program

Ranked #3 in Pulmonology
by U.S. News & World Report
A 12-YEAR-OLD MALE was referred by his pulmonologist for evaluation of progressively difficult to control asthma over the past two years. He had received 10 courses of prednisone for exacerbations over the prior 12 months. He missed 18 school days and had six emergency department visits, two hospitalizations and an ICU admission over the past year. His symptomatology was primarily cough, wheeze and labored breathing. These symptoms awakened him from sleep most nights. He responded very well to albuterol and prednisone when prescribed. His triggers were cold air, exercise, hot-humid climate, viral URIs and cat exposure. His medications were high dose fluticasone/salmeterol, montelukast, fluticasone nasal spray and cetirizine. He kept an EpiPen on hand in case of sudden severe dyspnea. Pharmacy refill audit agreed with patient report of excellent medication adherence. There were no environmental triggers identified.

At his initial Boston Children’s Severe Asthma Program consultation, spirometry found an FEV₁ of 22 percent predicted with a 27 percent improvement in FEV₁ following bronchodilator administration (Fig. 1). Examination was concerning for sinusitis which was confirmed by imaging. Laboratory evaluation demonstrated an IgE of 694 with specific sensitization to dog and cat, and absolute eosinophil count of 1090 cells/µl. Dehydroepiandrosterone (DHEAS), a screen for adrenal function, was normal. He was treated for sinusitis with improvement in his acute symptoms and lung function returned to recent baseline FEV₁ of 55–60 percent predicted.

The patient was started on mepolizumab, a monoclonal antibody that binds interleukin 5 (IL-5), due to the very elevated peripheral eosinophilia. Over the subsequent 12 months, he has not required any systemic steroid courses; he has not missed any school days and is playing on the school basketball team. His FEV₁ has improved to 74 percent predicted (Fig. 2).
CASE STUDY 2
Tackling mental health and medication adherence issues

A 5-YEAR-OLD FEMALE PATIENT presented with asthma symptoms that began at nine months of age and progressively worsened, especially over the past three years. Symptoms were characterized as episodes of wheezing, coughing and shortness of breath without seasonal clustering. She had frequent nighttime awakenings and days with asthma symptoms with rarely more than a few contiguous symptom-free days. In the prior year, the patient was prescribed >10 courses of prednisone for exacerbations, had multiple ED and hospital admissions and one ICU stay without intubation.

Prior allergy testing had indicated sensitivity to cat, dog and horsehair. Triggers were cold air, humid climate, exercise and respiratory infections. She had a history of eczema and congenital sinus malformation. She was taking daily high dose mometasone/formoterol, montelukast, omeprazole, mometasone nasal spray, cetirizine and rescue albuterol by nebulizer at least four times/week.

The family occasionally had difficulty getting the pharmacy to provide the medications. She had previously been on cromolyn, and four other formulations of ICS; each offered partial symptomatic benefit.

THE HOME ENVIRONMENT had no pets, pests or smokers, however, cigarette smoke occasionally wafted in from other apartments in the building.

HER INITIAL ENCOUNTER at Boston Children’s Severe Asthma Program included pulmonologist and allergist interview and examination, review of all prior documentation and radiology imaging, pharmacy refill audit (which suggested good ICS adherence, but limited montelukast refills), medication delivery evaluation, spirometry with inspiratory flow-volume loops and bronchodilator responsiveness testing, aeroallergen skin prick testing and laboratory evaluation for immune deficiency as her history suggested frequent and severe triggers by URIs leading to lower respiratory tract illness. Our otolaryngologist evaluated her sinus issues.

FROM THE INITIAL EVALUATION, we confirmed the asthma diagnosis by demonstrating mild airflow obstruction with an 18 percent bronchodilator response and uncovered several potential comorbid issues. First, anxiety served as both precipitating factor and result of her asthma exacerbations. Her mother described that the acute worsening in her symptoms corresponded to enrolling in preschool, which also brought significant separation anxiety to light. The child expressed anger, nervousness, and sadness regarding her father’s absence from their home. Additionally, when we demonstrated wheeze and stridor, she identified both as sounds she makes when ill, suggesting possible vocal cord dysfunction. Second, despite good reported adherence with inhalers, her MDI-Spacer technique was poor. Third, laboratory evaluation noted her to have mild hypogammaglobulinemia, low IgA and an elevated IgE.

OUR INITIAL INTERVENTIONS included education about asthma and disease management, including goals of therapy to improve control. Our nurse educator worked with the patient and her family to train them on appropriate spacer technique, an intervention that is repeated at every clinic visit. We engaged a local community asthma initiative in their home state to perform a home visit for environmental assessment and education. We arranged a consultation with speech-language pathology to address suspected paradoxical vocal fold movement (PVFM) and began a trial
of ipratropium for rescue therapy. Finally, based on the hypogammaglobulinemia and low IgA in the context with difficulty clearing infections, we started her on a prophylactic antibiotic for the winter months.

**HER RESPONSE** to these interventions was notable. In the first six months while attending the Severe Asthma Program, she had only three courses of oral steroids and one hospitalization; in the subsequent six months, she had no courses of oral steroids and a single ED visit that was felt to be dyspnea with anxiety. She began attending school willingly.

**OVER SEVERAL MORE VISITS** to the Severe Asthma Program, it became clear that with recurrence of anxiety, her asthma symptoms and exacerbation rate worsened. She was referred to a child mental health program and ultimately started on anxiolytic medications. To address school-related anxiety and some concern about medication adherence, we partnered with the school nurse to do a morning check-in where she offered reassurance and delivered daily controller medications.

Each of these interventions met with success in improving asthma symptom control and reducing severe exacerbations. We continue to closely follow this patient to ensure that each of these pieces of support continues to address her asthma.