How to Handle Chronic Cough in Kids: A Practical Approach to the Workup

December 31, 2006
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The patient is a 4-year-old boy who has been coughing persistently for the past 2 months. The mother reports that about the time the coughing began, the child had a “cold” with nasal congestion and fever. These symptoms resolved, but a cough ensued. The mother tried using over-the-counter medications, including cough suppressants, but the cough has not abated. It occurs during the day and at night. It is disrupting the child’s sleep, and the teachers at his day-care center are concerned that he may be infecting other children.

This scenario is all too familiar to primary care clinicians who are faced with a child with chronic cough—and his or her tired and frustrated parents. A child with a persistent cough is a source of both concern and potential disruption for the parents, other family members, and playmates and classmates. Parents want to know why their child is coughing and want the coughing to cease. How will you approach the child with a chronic cough? How do you efficiently mine the history for key diagnostic clues? What diagnostic tests are most appropriate? The answers to these questions are the focus of this review. We present an algorithm that offers a practical approach to the diagnostic workup. WHAT IS CHRONIC COUGH?

A cough that persists for at least 3 weeks (and usually 6 weeks or longer) is considered chronic.1 Every day in our pediatric clinic, we see children with cough that lingers after a viral upper respiratory tract infection (URI). The challenge is to determine whether the persistent cough is just a resolving symptom of the URI—or whether it is a manifestation of a serious condition that requires more aggressive therapy. In children without a preceding URI or obvious lower respiratory tract infection, other causes must be considered. Key diagnostic possibilities include asthma, sinusitis, and gastroesophageal reflux, which are the most commonly reported causes of persistent cough. Allergic rhinitis often goes hand in hand with asthma and sinusitis and contributes to exacerbations of both these conditions. WHAT CAUSE?

Many studies detail the causes of chronic cough in childhood.2-6 Bacterial lung infections usually produce acute respiratory symptoms that readily point to the diagnosis. However, some infectious agents can invade the pulmonary system and produce insidious or prolonged symptoms: these agents include respiratory syncytial virus, cytomegalovirus, Mycoplasma, Bordetella pertussis, Ureaplasma urealyticum, Chlamydia trachomatis, and Mycobacterium tuberculosis. The usual causes. Holinger and Sanders4 determined that the most common causes of chronic cough among patients in their otolaryngology clinic between 2 months and 15 years of age were (in descending order of occurrence):

- Cough variant asthma.
- Sinusitis.
- Gastroesophageal reflux.

Gastroesophageal reflux and vascular anomalies were the most common causes of chronic cough in children 18 months and younger.4 Asthma was a close third, followed by tracheomalacia, sinusitis, and subglottic stenosis. Other diagnoses included “viral” infection, bronchogenic cyst, cystic fibrosis, and foreign-body aspiration. Sinusitis was the most common cause of chronic cough among those aged 18 months to 6 years, followed by asthma, subglottic stenosis, and gastroesophageal reflux. The most common causes of chronic cough among children 6 to 16 years old were (in descending
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Published on Diagnostic Imaging (http://www.diagnosticimaging.com)

Swallow especially for the child who has a chronic cough during the first few years of life. This test results may prompt further evaluation with CT or MRI of the chest. Consider ordering a barium swallow.

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Pulmonary function tests. In children who are able to cooperate, spirometry aids in the diagnosis of persistent cough. At the lead author's institution, a sinus x-ray film can be obtained and reviewed within a few hours; a sinus CT scan, however, must be scheduled for a later time--especially if sedation is required for the procedure.

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Infected sinuses should be considered in all children with chronic cough. Whether to order a sinus x-ray film or a sinus CT scan to confirm this diagnosis is controversial, however. The American Academy of Pediatrics (AAP) recommends against imaging of the sinuses in children aged 6 years or younger as an aid in the diagnosis of acute bacterial sinusitis. The AAP recommends CT scanning for patients who are possible candidates for surgery. High-quality sinus x-ray films can be nearly impossible to obtain in a young child, and interpretation can be quite challenging and subjective. We have not found sinus x-ray films to be helpful in the very young child with chronic cough, although these films have occasionally helped us diagnose sinus disease in older children. Although studies refer to CT as the "gold standard," it is not always practical to obtain such a scan immediately, and a child may need to be sedated for the procedure. Nevertheless, a CT scan can provide valuable information and should be considered for a child who is coughing persistently. At the lead author's institution, a sinus x-ray film can be obtained and reviewed within a few hours; a sinus CT scan, however, must be scheduled for a later time--especially if sedation is required for the procedure.

Diagnostic tests

Pulmonary function tests. In children who are able to cooperate, spirometry aids in the diagnosis of asthma. It is possible to obtain consistent pulmonary function test results in children aged 5 years or younger, but this is not always feasible. In these young children, the diagnosis of asthma is based on a history of recurrent cough and wheezing that responds to bronchodilators, such as albuterol.

Barium swallow. This test can provide additional information about the child's anatomy; abnormal results may prompt further evaluation with CT or MRI of the chest. Consider ordering a barium swallow especially for the child who has a chronic cough during the first few years of life. This test
may suggest the presence of a vascular anomaly (such as an aberrant innominate artery), a major cause of chronic cough among young children.\textsuperscript{3} \textbf{pH Probe.} If the chest film, sinus film, sinus CT scan, and/or barium swallow fail to elucidate the cause of chronic cough, a pH probe study is recommended to determine whether gastroesophageal reflux is the underlying problem. Referral to a pediatric gastroenterologist for this procedure may be warranted. \textbf{Miscellaneous tests.} Consider testing for tuberculosis with a purified protein derivative test, performing a sweat chloride test, and ordering an evaluation for immunodeficiency disorders. Because laboratory confirmation of many uncommon infectious agents can be difficult, an infectious disease specialist should be consulted. The anatomy must be examined via endoscopy from the nares to the lungs and the mouth to the stomach. Endoscopy is particularly helpful in the young infant,\textsuperscript{4} but can be helpful in persons of all ages. An allergist/immunologist can aid in the evaluation for underlying allergies or immunodeficiency. \textbf{TREAT THE UNDERLYING CAUSE}

Here we offer treatment suggestions for the most common causes of chronic cough. A discussion of treatment of various infections is beyond the scope of this article; the Red Book serves as an excellent source for up-to-date recommendations.\textsuperscript{12} The consensus panel report by Irwin and colleagues\textsuperscript{11} summarizes the American College of Chest Physicians' recommendations for managing cough; most of these recommendations can be applied to pediatric patients as well. At any point during the workup for chronic cough (see Algorithm), you may want to consider empiric therapy for asthma or sinusitis—especially when optimal testing may not be available because of the patient's age. The safety and cost-effectiveness of this approach have not been established for pediatric patients (as they have for adults\textsuperscript{14,15}), but a trial may be desirable in some children (for example, in an infant with a persistent cough following an uncomplicated URI). \textbf{Asthma.} This disease must be treated aggressively so that the child is symptom-free. Anti-inflammatory medications, such as inhaled corticosteroids—at the lowest effective dosages—are recommended for the treatment of all "persistent" grades of asthma, with the possible addition of leukotriene modifiers. Inhaled longacting $\beta_2$-agonists are also recommended when a child experiences severe persistent asthma (ie, symptoms that occur daily and frequently at night).\textsuperscript{16} Inhaled short-acting $\beta_2$-agonists are also used for symptom relief. The clinician's time is well-spent in educating the family about asthma and its treatment—and in reinforcing that education. \textbf{Sinusitis.} The AAP recommends antibiotic therapy for pediatric patients with acute bacterial sinusitis but acknowledges that the optimal duration of therapy has not been determined. Chronic inflammation of the sinuses accompanied by symptoms that persist for at least 90 days may be caused by disorders such as gastroesophageal reflux, underlying allergies, pollution exposure, and cystic fibrosis.\textsuperscript{9} As with chronic cough, the precise cause of the chronic sinus disease needs to be determined and treated. Certainly, many children suffer from asthma, allergies, and sinusitis simultaneously—and all need to be aggressively controlled. \textbf{Gastroesophageal reflux.} The many available treatment modalities—such as upright positioning, thickened feeding formula for very young children, H$_2$ blockers, proton pump inhibitors, motility agents, and surgery—have been studied to varying degrees in children. The severity of the child's symptoms dictates the extent of therapy. \textbf{Psychogenic cough.} This phenomenon can sometimes be alleviated by wrapping a bedsheet tightly around the patient's chest and convincing him that the bedsheet will aid the chest muscles in eliminating the cough.\textsuperscript{17} Bye\textsuperscript{18} reported that a peak flow meter provided positive feedback to an asthmatic child suffering from a psychogenic cough and helped eliminate that cough. Perhaps offering a non-asthmatic child concrete evidence of a normal peak flow may bring relief from psychogenic cough. In some cases, a behavioral medicine consultation may be required to stifle the psychogenic cough. \textbf{CONGENITAL ANOMALIES, FOREIGN BODIES}

Congenital anomalies and other less common causes of chronic cough often require the expertise of a pediatric specialist (such as a pulmonologist, cardiologist, or surgeon) for definitive treatment. Whether they are needed to correct an anatomic abnormality, remove a foreign body, or offer further treatment options, the pediatric specialist needs to be involved. Patients with certain illnesses, such as cystic fibrosis, require a multidisciplinary approach.

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