

## Coughing in Childhood

Hyman Shrand, MD  
Cambridge, Massachusetts



Coughing in childhood is a common complaint involving a wide spectrum of underlying causes which require a thorough and rational approach by the physician. Most children who cough have relatively simple self-limiting viral infections, but some may have serious disease. A dry environment, allergic factors, cystic fibrosis, and other major illnesses must always be excluded. A simple clinical approach, and the sensible use of appropriate investigations, is most likely to succeed in finding the cause, which can allow precise management.

The cough reflex as part of the defense mechanism of the respiratory tract is initiated by mucosal changes, secretions or foreign material in the pharynx, larynx, tracheobronchial tree, pleura, or ear. Acting as the "watchdog of the lungs," the "good" cough prevents harmful agents from entering the respiratory tract; it also helps bring up irritant material from the airway. The "bad" cough, on the other hand, serves no useful purpose and, if persistent, causes fatigue, keeps the child (and parents) awake, interferes with feeding, and induces vomiting. It is best suppressed. Coughs and colds constitute almost three quarters of all illness in young children. The purpose of this article is to outline a rational approach to this common problem which will allow effective therapy based on specific diagnosis.

By far the majority of children with cough as their presenting symptom have an acute self-limiting viral upper respiratory tract infection. Sometimes — although rarely — the cough may be an indicator of serious disease. The cough may be caused by congenital malformations, inherited deficiencies, infections, allergies, neoplasms, trauma, or irritant substances in the air (Table 1).

Table 1. Persistent Cough — Causes in Childhood\*

Common	Uncommon	Rare
<b>Environmental</b>		
Overheating with low humidity Allergens Pollution Tobacco smoke		
<b>Upper Respiratory Tract</b>		
Recurrent viral URI Rhinitis, Pharyngitis Allergic rhinitis Prolonged use of nose drops Sinusitis	Pertussis Echo 12 Nasal polyp Wax in ear	Laryngeal stridor Vocal cord palsy Vascular ring
<b>Lower Respiratory Tract</b>		
Asthma Viral pneumonia Mycoplasma Aspiration	Cystic fibrosis Tuberculosis Atypical mycobacteria Foreign body Bronchiectasis Lung abscess	Rt. middle lobe syndrome Diaphragm hernia T. E. fistula Sequestration of lung Congenital cyst Mediastinal mass Hemosiderosis Histoplasmosis Fungal infection Pleural involvement Parasites Pneumocystis carinii Visceral larva migrans
<b>Cardiovascular Disease</b>		
	Congestive failure a.) Congenital heart disease b.) Rheumatic fever	
<b>Psychogenic</b>		
	Cough tic	
<b>Newborn</b>		
	Fistula Vascular ring	
*Coughing lasting more than a few weeks Uncommon causes in Boston may be common in other parts of the world.		

From the Division of Pediatrics and Adolescent Medicine, Mount Auburn Hospital, Cambridge, Massachusetts. Requests for reprints should be addressed to Dr. Hyman Shrand, Division of Pediatrics and Adolescent Medicine, Mount Auburn Hospital, 330 Mount Auburn St, Cambridge, Mass 02138.

The family physician must recognize those children suffering from the simple common causes while remaining alert for the small minority who might have a serious problem. Experience will dictate which children need further investigations, antibiotics, or surgery, and which are best managed by simple symptomatic relief and a "wait and see" policy. The more common causes are easily recognized in the office; uncommon causes may need the skills of a specialist in respiratory disease.

## History

A good history can provide valuable clues (Table 2). All too frequently the coughing child has been given a poly-pharmaceutical cough syrup containing obsolete medications which may delay the identification of serious disease. Other children have been subjected to

unnecessary investigations and operative procedures when a carefully-taken history could have suggested the diagnosis. A family history of cystic fibrosis, tuberculosis, allergic problems, or immunoglobulin deficiencies has obvious implications.

Although caused by a wide variety of viruses, the common upper respiratory tract infection (URI) is readily recognized by the usual coryza, febrile malaise, and cough which is usually worse at night and no doubt prevents a postnasal drip from entering the larynx. A family history or seasonal "epidemic" is often found. A child who has had a "cold" and cries a great deal has probably developed an acute otitis media. A feverish child with grunting painful cough, rapid breathing, and active alae nasae is most likely to suffer from bacterial pneumonia, although nowadays this is seen infrequently. Viral infections (respiratory

syncytial or parainfluenza) account for most of the lower respiratory tract infections in infants and children seen in urban pediatric practice.<sup>1</sup> Starting usually as a viral URI, they present either as cases of "pneumonia" or bronchiolitis. These children are not likely to benefit from antibiotics.

Coughing in the newborn is so uncommon that its presence, particularly during feeding, is highly suggestive of tracheoesophageal fistula. If the cough is worse at night it could be caused by a postnasal drip induced by the coryza of a URI, bedroom allergy, sinusitis, or dried out air in an overheated room. A child who snores at night, sleeps with an opened mouth, and has had repeated ear infections may be suffering from adenoid enlargement or allergic rhinitis. Children put to bed with a bottle of milk are prone to both cough and middle ear infections. If a child appears reasonably well but is constantly coughing, perhaps with wheezing and sneezing, the cause may be asthma. Asthma should also be suspected wherever there is a history of eczema. If the child looks sickly, fails to thrive, and has foul loose stools, the most likely diagnosis is cystic fibrosis. A persistent cough after an exanthem or viral URI may be due to a complicating viral pneumonitis (rarely mycoplasma) or may reflect segmental collapse and bronchiectasis. Any previous history of gagging is highly suspicious of an aspirated foreign body. A history of recurrent lung infections should bring to mind asthma, cystic fibrosis, atrial septal defect, collapsed segment of lung, or an immunoglobulin deficiency. A URI with much coughing is usually viral. A streptococcal pharyngitis starts with a fever and a sore throat which is worse on swallowing; it may have a frequent short cough. In the infant, streptococcal rhinitis is not uncommon and often causes excoriation beneath the nares.

Enormously enlarged tonsils and adenoids can obstruct the airway and cause progressive hypoxia, reactive pulmonary hypertension, and chronic cor pulmonale.<sup>2</sup> Children with this condition snore noisily at night, have chronic respiratory problems, and develop congestive failure with or without cyanotic spells and coma. Emergency treatment requires the provision of an adequate airway and

Table 2. Suggestive Clues in History

Clue	Probable Cause
1. Newborn period	T. E. fistula (especially if associated with feeding) Cystic fibrosis Vascular ring
2. Onset with febrile coryza	Viral URI Viral pneumonitis Mycoplasma
3. Postoperative	Atelectasis Lung abscess
4. Story of gagging	Foreign body
5. Seasonal a.) Winter	Mould allergy Recurrent URI Pollen and grass allergy
b. Summer	
6. More at night with mouth breathing	Postnasal drip Low humidity Allergens in bedroom (feathers, dust, stuffed toys) Adenoid enlargement
7. Eczema	Asthma
8. Wheezing	Asthma Foreign body (especially if localized) Cystic fibrosis
9. Bad breath	Rhinitis Adenoiditis Nasal foreign body Sinusitis
10. Sputum	Bronchiectasis
11. Foul stools and underweight	Cystic fibrosis
12. Shortness of breath	Asthma Congestive heart failure Diffuse lung disease
13. Worms in stool	Ascariasis
14. Puppy in the house and pica	Visceral larva migrans
15. Fever and sweating	Lung infection
16. Pain in chest	Pleural involvement
17. Child in kindergarten	Recurrent viral infections
18. Wiping nose upwards (Allergic Salute)	Allergy
19. Wiping nose beneath nares	Streptococcal rhinitis
20. Visit to a cave (bats)	Histoplasmosis

management of the congestive failure. Subsequent removal of tonsils and adenoids gives dramatic relief.

Children whose mothers smoke have a higher incidence of bronchitis and pneumonia.<sup>3</sup> Many adolescents already have a smoker's cough.

A child coughing after anesthesia may well have aspirated material into the lungs producing an area of collapse, with or without abscess.

Some coughs have diagnostic features:

1. A repetitive series of coughs with loss of breath followed by a whooping inspiration, sometimes with vomiting, is suggestive of pertussis, advanced cystic fibrosis, or foreign body aspiration. More recently, Echo Virus 12 infection has been reported with a pertussis-like syndrome. With immunization, pertussis is rare but not all children are adequately immunized.

2. A brassy cough may occur as a result of extrinsic pressure on trachea or bronchus from enlarged mediastinal lymph glands.

3. A hacking, repetitive cough which (with bronchospasm) becomes high-pitched and is associated with wheezing usually indicates asthma.

4. The child who, literally, coughs almost every minute of the day could have a psychogenic cough tic.<sup>4</sup> These are children or adolescents with a constant crowing or barking cough extremely annoying to the rest of the family. They never cough during sleep and there are no abnormal physical findings. Such children need tranquilizers and psychotherapy.

5. The croupy cough is usually of viral origin in the infant but may, in the older child, be caused by an influenzal epiglottitis which becomes an acute emergency. A constant source of anxiety to the family physician is whether to send such a child to the hospital. If one can recognize the swollen cherry-like epiglottitis, or if the child is unduly restless or pale or blue, admit immediately. If the child does not have a swollen epiglottitis, is not too distressed, and the family can provide steam and constant observation at home, waiting is acceptable. But when in doubt, always admit. A child with croup can quickly develop anoxia.

6. Children do not expectorate. They swallow their sputum. This may be recognized by examining gastric aspirate for bacteria or presence of

mucopus after emesis. Thus, we cannot speak of productive ("wet") or nonproductive ("dry") coughs. However, the older child with a loose, rattling cough and purulent sputum may well have bronchiectasis with or without underlying cystic fibrosis.

Hemoptysis is a most alarming symptom which has many serious causes (Table 3). A child bleeding from the nose may appear to cough up blood.

**Table 3. Hemoptysis**

<p><b>A. Pulmonary disorders:</b></p> <p>Tuberculosis</p> <p>Pneumonia — viral — bacterial</p> <p>Pertussis</p> <p>Bronchiectasis</p> <p>Lung abscess</p> <p>Foreign body in airway</p> <p>Bronchialadenoma, papilloma, hemangioma</p> <p>Idiopathic pulmonary hemosiderosis</p> <p>Pulmonary hypertension, associated congenital heart disease or mitral stenosis</p> <p>Mycotic infection of bronchus</p>	
<p><b>B. Systemic bleeding disorder</b></p>	

Recently, a number of drugs have been found to induce pulmonary disease. The clinician should suspect any drug taken prior to the onset of symptoms.<sup>5</sup>

### Physical Examination

If a child has failed to thrive, cystic fibrosis must always be excluded. Look for cyanosis (severe lung disease or congenital cardiac anomaly) and enlarged cervical lymph nodes which may be a part of a generalized lymphadenopathy. If the child has eczema, the chronic cough is probably due to asthma. Clubbing of the fingers, now very rare, suggests chronic lung disease or bronchiectasis, but is more likely cyanotic heart disease. Erythema nodosum is often found with tuberculosis or Boeck's sarcoid.

The pinched nose of adenoidal obstruction is easily recognized. The creased nose produced by the constant upward rubbing of the tip of the itching nose (the allergic salute) suggests hayfever. The pale boggy mucosa of allergy is easily distinguished from

the red engorged mucosa of infection. Nasal polyps are often found in children with cystic fibrosis. A purulent, blood-stained nasal discharge indicates presence of a foreign body. Sinusitis is a common complication of URI and may be the cause of recurrent ear and lung infection.

Inspection of the chest may reveal the pigeon chest of chronic asthma or a differential in the movement of the chest wall during respiration suggesting a collapsed lung or pneumothorax. Palpation may reveal any shift of the mediastinum, and percussion may detect any abnormal dullness or hyperresonance.

Ever since Laennec invented the stethoscope there has been much confusion concerning the words "rales" and "rhonchi." This author prefers the terms "crackles" and "wheezes." "Crackles" (which resemble the sound produced when the hairs near the ears are rubbed between the fingers) are found when there is fluid in the alveoli — pus, exudate, transudate, blood, or chyle. A "wheeze" (high-pitched musical sound of varying intensity) is found in cases of airway obstruction. The obstruction may be located in the lumen in the wall or caused by pressure from without.

When evaluating the significance of a crackle, one considers the history and other symptoms and signs. Localized crackles in a feverish child indicate lung infection. If minimal, interstitial viral pneumonia is more likely; if associated with bronchial breathing, this may indicate a bacterial segmental pneumonia or collapse. Diffuse crackles in a child with shortness of breath mean that congestive failure must be considered.

Wheezing is not always an indication of asthma. A diffuse wheeze is a sign of diffuse airway obstruction found in asthma and bronchiolitis, but localized wheeze indicates a local airway obstruction. About 20 percent of all children have at least one wheezing attack. In infancy, acute laryngo-tracheo-bronchitis or bronchiolitis is a common cause of acute diffuse wheezing. In one series of 126 "wheezers," 63 percent had only one attack; only eight percent had more than three. Almost 95 percent had outgrown their wheezy attacks by the time they left school.<sup>6</sup> Thus, the great majority of children with an occasional wheeze are not asthmatic. Recurrent diffuse



wheezing, especially with a family history of allergy or a personal history of eczema, is probably asthma. Noises generated in the blocked and stuffy nose are often transmitted to the chest and misdiagnosed by the mother as "congestion" and by the doctor as "bronchitis." But if the child breathes through the mouth, the chest noises disappear. These are the children who are so often given expectorants when a nose drop is really needed.

### Further Studies

At the conclusion of the history and physical examination, the experienced clinician will have correctly diagnosed, and be able to manage without further investigations, the majority of children presenting with cough. Further specific investigations used with clinical common sense may help elucidate the less common causes.

An obvious pleocytosis of the white blood count with shift to the left is likely to indicate a bacterial infection of the lungs, whereas a low blood count with lymphocytosis is more commonly found with viral infections. In the presence of a paroxysmal cough, a lymphocyte count of over 20,000 is almost diagnostic of pertussis. Miliary tuberculosis can induce a leukemoid blood picture. Eosinophilia suggests allergy (asthma) and ascariasis but is most pronounced with visceral larva migrans. Anemia and thrombocytopenia are found with leukemia and anemia alone with hemosiderosis.

Infants and children usually swallow sputum which may be vomited. A gastric aspirate from the infant may reveal staphylococci swallowed from a staphylococcal pneumonia. In the older child, sputum can be expectorated or a specimen may be produced by postural percussion and handled in the usual manner. A cough plate or postnasal swabs are useful in identifying *H. pertussis*.

An increased number of eosinophils in the nasal discharge suggests an allergic factor. Every child with undiagnosed chronic cough should have a sweat test. If it is normal, cystic fibrosis is excluded. Other useful laboratory studies include immunoglobulin levels and examination of bone marrow for fungus, tuberculosis, and leukemia.

Tuberculosis, although very uncommon, still exists and must be con-

sidered in any chronic cough especially if there is a history of contact with tuberculosis.<sup>7</sup> In 1970-1971 only 0.2 percent of the five- and six-year-olds entering school gave positive tests. This indicated an average annual infection rate of less than three new infections per 10,000 children each year, probably the irreducible minimum for positive skin tests since in some parts of the country positive reactions are caused by atypical mycobacteria. In suspicious cases, tuberculin testing is very worthwhile as over 95 percent of new cases treated with isoniazid will become noninfectious, recover, and remain well.

X-ray examinations are frequently rewarding including routine views, fluoroscopy, tomograms, bronchograms, radiopaque swallow, and lung scans as indicated. Although most children seen in the office with cough as a presenting symptom will not have any radiological changes in the chest, every child with a persistent cough must have a chest x-ray to exclude the less common causes.

Bronchial washings, needle aspiration of lung, and lung biopsy may be necessary to confirm the presence of rarer causes of persistent cough. Pulmonary function testing has become quite elaborate. The author has, for years, used the Wright Peak Flow meter to assess presence of diffuse airway obstruction. This is simple to use and as much fun as blowing a bugle. It is most useful when following the effects of bronchodilator therapy in asthma.

### Management

The wide variety of causes makes it clear that proper management can only occur after proper diagnosis. For the majority of children with self-limiting viral infections, and for others awaiting diagnosis, symptomatic relief can be welcome. Although most coughs in childhood are probably useful, all are irritating to the mother who wants them stopped unless she can be convinced of their benefit.

The use of expectorant cough mixtures is based primarily on tradition and the widespread impression that they are effective.<sup>8</sup> There is little place for them in pediatric practice. In children with cystic fibrosis or a collapsed segment of lung, postural percussion by physiotherapist or mother, with or without bronchodilators, can

be most useful in dislodging and bringing up sputum. Recently, bronchodilators followed by postural percussion have been used successfully to dislodge foreign bodies from the lower airways. Inhalations of steam (in a bathroom at home, or in a cold mist tent in the hospital) seem to be soothing, although their mucolytic effects are still to be confirmed. If the cough is irritating the child and serving no apparent useful purpose, a useful medication is Dextromethorphan Syrup in these dosages: children over four years old, 7.5 to 15 mg, one to four times a day; children one to four years old, 3.75 to 7.5 mg, one to four times a day.

Children with common colds have a blocked nose, postnasal drip, and cough. Demulcent candy cough drops or lemon tea and honey are soothing and provide some relief. Properly applied phenylephrine nose drops give instant relief and their effect lasts as long as oral decongestants.<sup>8</sup> For fever, use acetaminophen. Care should be taken because overdose can cause serious liver damage.<sup>9</sup> Many "cough and cold remedies" contain various combinations of so-called expectorants, antihistamines, analgesics, and cough suppressants. They do not seem rational and the amounts of each are often homeopathic. There are some combinations of dextromethorphan with an oral decongestant that could be useful as a "cough and cold remedy." Each physician should learn the ingredients of one or two of these mixtures and ascertain their efficacy. For the common URI the author prefers to prescribe nose drops, dextromethorphan, and acetaminophen separately, and when needed.

### References

1. Zollar LM et al: Microbiological studies on young infants with lower respiratory tract disease. *Am J Dis Child* 126:56-60, 1973
2. Talbot AR, Robertson LW: Cardiac failure with tonsil and adenoid hypertrophy. *Arch Otolaryngol* 98:277-281, 1973
3. Harlap S, Davies AM: Infant admissions to hospital and maternal smoking. *Lancet* 1:529, 1974
4. Kravitz H et al: Psychogenic cough. *Clin Pediatr* 8:850, 1969
5. Rosenow EC: Drug induced pulmonary disease. *Drug Therapy*, October, 1974, p 34
6. Fry J: *The Catarrhal Child*. London, Butterworths, 1961
7. Tuberculosis in the United States Today (editorial). *Clin Pediatr* 12:257, 1973
8. American Medical Association Drug Evaluations. Chicago, AMA, 1971
9. Clark R et al: Hepatic damage and death from overdose of paracetamol (acetaminophen). *Lancet* 1:66, 1973