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Cough: A Distressing Symptom to a Child and a Challenge to a Physician

***ABSTRACT:** Cough is the commonest symptom for which patients seek medical advice and an annoying symptom especially in younger children. Some coughs are not serious, but a cough can be a sign of a serious problem. It is difficult to determine what causes cough but the challenge is to determine how cough can be treated.*

Cold and cough are terms often misinterpreted by parents. Physicians must ensure the correct meaning of these terms by discussing them with parents. Cold refers to symptoms such as nasal stuffiness or drainage, sore or scratchy throat, sneezing, while cough is a sudden and often repetitively occurring reflex, which helps to clear the respiratory tract from secretions, irritants, foreign particles, and microbes. Many parents believe “noisy breathing” is a symptom of a cold and cough and misguide the physician. Thus, it is essential to know how well parents understand the terms they so casually use.

Key word: cough

WHAT IS COUGH?

Coughing is a reflex action started by stimulation of sensory nerves in the lining of the respiratory passages, the tubes we use to breathe. When a person coughs, there is a short intake of breath and the larynx (voice box) closes momentarily. The abdominal and chest muscles contract, which in turn increases the pressure needed to drive air out of the lungs when the larynx re-opens.

The cough reflex is a vital part of the body's defense mechanisms. Coughing is intended to clear the airway of dust, dirt or excessive secretions. Coughing usually means that there is something in the respiratory passages that should not be there. Coughing clearly represents an airway disease and is a common symptom when the airways are "tight", as in asthma.

The pulmonary airway comprises those parts of the respiratory system through which air flows, beginning at the nose and mouth, and terminating in the alveoli. From the mouth or nose, inhaled air passes through the pharynx into the trachea, which it separates into the left and right main bronchi at the carina. The main bronchi then branch into 2-3 lobar bronchi, 20 segmental bronchi and finally into many primary bronchioles, which divide into terminal bronchioles, each associated with clusters of alveoli, the basic anatomical unit of gas exchange in the lung. Thus, the distal airways are smaller than the large airways. When the large airways are involved in disease, the intensity of the cough is higher than when it occurs in the small airways and/or lung parenchyma. Severe cough is a major symptom of larger airway pathology as occurs in asthma and bronchitis, while in acute bronchiolitis, a viral infection of the small air passages of the lung, cough is less prominent or often absent.

A bad or persistent cough is not always a symptom of acute pneumonia, although in the 4th stage, the resolving stage, a moderate cough can occur. This concept is important to consider when making a diagnosis and planning a course of treatment.

For example, a chest X-ray is a poor marker of airway disease. A child with a severe cough, as occurs in asthma, has a near normal chest X-ray. In contrast, a child with suspected pneumonia deserves a chest X-ray even in the absence of a significant cough and if the chest examination is normal. In some children, persistent high fever can be the only sign of pneumonia.

Important point: the more severe the coughing, the less likely the chest X-ray will show any abnormality, exceptions being an inhaled foreign body or endobronchial lesion.

PATTERNS OF COUGH

Type of cough. The type of cough suggests the site of disease. The origination of the cough in different sites of the respiratory system creates variations in the sounds and patterns of coughing. For example, a laryngeal stimulation

produces a choking type cough, while a dry hacking cough indicates inflammation of the pharynx or pharyngitis. Bronchitis is characterized by a productive cough with rattling in the chest.

In children, bronchitis is either due to a viral respiratory infection or allergy, while acute bacterial respiratory infection rarely causes severe cough. In fact, in pneumonia, cough is prominent only during the resolving stage while fever is a major symptom at the onset of disease.

The onset of cough. The onset of cough offers a clue to probable etiology. A cough may occur in a single episode. It may be acute and last less than 3 weeks. It may be a chronic symptom present for 3-8 weeks or longer.

A single, sudden episode of coughing may be due to exposure to an irritant in the environment or the person may have had a near choking episode with swallowing difficulty. Acute onset of cough is also seen in acute bronchitis such as asthma while subacute onset denotes possibility of infection such as pharyngitis or pertussis, also known as “whooping cough”.

Progression of cough. The progression of cough helps to diagnose probable cause. Episodic or nocturnal cough indicates asthma or post-nasal drip while a gradually worsening cough raises the possibility of pertussis. In pertussis, after one to two weeks, the coughing develops into uncontrollable fits, followed by a high-pitched “whoop” sound as the child struggles to breathe in afterwards. Adults and adolescents with pertussis rarely present with whoop but may have milder symptoms such as a prolonged cough.

Chronic or recurrent cough is a symptom of asthma and acute viral infections. It is usually easy to differentiate these disorders as asthma is typically afebrile while a viral infection starts with fever.

Associated symptoms. These symptoms help to diagnose the probable cause of cough. Other common symptoms include fever, shortness of breath, chest pain, and flu-like symptoms. Fever most commonly suggests infection, either viral or bacterial. Non-infectious fever may occur, for example postoperatively, although it is not common in routine practice.

Cough accompanied by symptoms of the common cold, or flu suggests an upper respiratory infection that by itself leads to cough due to post-nasal drip. It may also suggest involvement of both the upper and lower respiratory tract, as typically occurs in acute viral respiratory infection.

SIMPLE ALGORITHM FOR EVALUATION OF COUGH					
	Cough	Fever	Cold	Breathless	Noisy breathing
Pharyngitis	hacking	++	-	-	-
Laryngitis	barking	++	-	±	inspiratory stridor
Bronchitis	wet	+	±	-	-
Bronchiolitis	±	±	±	++	-
Pneumonia	±	++	-	+	grunting
Asthma	+++	-	±	++	wheeze
Cardiac	++	±	-	+	wheeze ±
Metabolic acidosis	-	-	-	tachypnoea	-
Respiratory muscle paralysis	-	-	-	tachypnoea	no voice

Breathlessness, that is the feeling of not being able to take in enough air, is another symptom commonly associated with cough. In fact, breathlessness can trigger cough, and *vice versa*. The symptoms of asthma can include breathlessness. So can the symptoms of pneumonia, croup and acute bronchiolitis. In addition, obstruction of the air passages may lead to breathlessness. Differential diagnosis is not difficult as asthma is afebrile and so is inhalation of foreign bodies, although breathlessness due to aspiration of foreign bodies has a sudden onset while asthma is acute but not sudden.

Breathlessness, as occurs in pneumonia, acute bronchiolitis and croup is associated with fever but again differentiating these conditions is easy. Pneumonia is associated with abnormal chest signs with grunting and intercostal retractions, acute bronchiolitis with tachypnea but without intercostal retractions, while croup presents with inspiratory stridor without any chest signs. Cough may be a minor symptom in acute bronchiolitis and is often absent, and as mentioned above, cough may appear in the resolving stage of pneumonia and so may not be present at the onset of the disease. Thus, it is important to realize that the absence of cough does not rule out airway disease, especially when it involves the smaller airways.

Cough may be a symptom of cardiac disease as occurs in congenital heart

defects with left to right shunt. Cough is also a feature of left ventricular failure due to pulmonary edema. Thus, in cardiac disease, cough is really indicative of cardio-pulmonary disease.

Breathlessness and tachypnea are not the same. While tachypnea denotes rapid breathing, which almost always occurs in breathlessness, breathlessness indicates increased work of breathing as suggested by the activity of the accessory muscles of respiration such as the alae nasi and chest retraction. Many times tachypnea is incorrectly regarded as synonymous to breathlessness. Silent breathlessness can be a feature of acute bronchiolitis; however, is also seen in metabolic acidosis and paralysis of respiratory muscles.

PRACTICAL APPROACH TO COUGH

- Assess seriousness first
- Sudden onset of a cough in a previously normal, healthy child demands ruling out inhalation of foreign bodies.
- Tachypnea should be closely monitored for any deterioration.
- Breathlessness is an emergency and must be properly evaluated. Acute onset of breathlessness needs emergency action as it could indicate acute pneumothorax (collapsed lung).
- Noisy breathing must be properly assessed for any emergency.
- Behavior of a child that depicts abnormality in gas exchange as in the case

COMMON CONDITIONS BASED ON DURATION OF COUGH		
Cough for days	Cough for > 2 weeks	Persistent/recurrent cough
<input type="checkbox"/> Pharyngitis	<input type="checkbox"/> TB	<input type="checkbox"/> Asthma
<input type="checkbox"/> Laryngitis	<input type="checkbox"/> Pertusis	<input type="checkbox"/> Hyperreactive airway
<input type="checkbox"/> Bronchiolitis	<input type="checkbox"/> Partially treated infection	<input type="checkbox"/> Cardiac disease
<input type="checkbox"/> Pneumonia	<input type="checkbox"/> Complicated bacterial infection	-
	<input type="checkbox"/> Opportunistic infections	

COMMON CONDITIONS BASED ON PHYSICAL FINDINGS IN COUGH	
Localised abnormalities (bacterial infection or foreign body)	Generalised abnormalities (viral infection or allergy)
<input type="checkbox"/> Pharyngitis (congested throat)	<input type="checkbox"/> Asthma (bilateral rhonchi)
<input type="checkbox"/> Croup (suprasternal retraction)	<input type="checkbox"/> Bronchiolitis (bilateral emphysema)
<input type="checkbox"/> Pneumonia (local chest signs)	
<input type="checkbox"/> TB (local chest signs)	
<input type="checkbox"/> Inhaled foreign body (localized emphysema)	

of hypoxia and hypercapnea must be properly assessed as such conditions need prompt action irrespective of etiology.

If seriousness is ruled out ...

Attempt anatomical, pathological, etiological and functional diagnosis.

The type of cough suggests the site of disease. The origination of the cough in different sites of the respiratory system, create variations in the sounds and patterns of coughing. The site of disease may be in the pharynx, larynx, bronchi, bronchioles, lung parenchyma, interstitium or pleura. The last two sites are not commonly affected in children presenting with cough in routine office practice.

Pathology. Pathology refers to inflammation, venous congestion or mechanical factors. Inflammation is commonly due to infection. However, it may also be due to allergy as in asthma or chemical as in aspiration syndrome. Venous congestion is typically a result of cardiac disorder. The mechanical cause of cough is classically inhalation of a foreign body. While inflammatory pathology due to infection is characterized by fever, non-infective inflammation often exists without fever as in asthma. Allergic cough is always recurrent. Thus, a positive past history of a similar cough suggests an allergy or hyper-reactive airway disease (asthma). The typical allergic cough starts acutely, settles often unexpectedly and recurs often. In contrast, a mechanical cause occurs suddenly as in inhalation of a foreign body or aspiration syndrome.

Etiology. Etiology is educated guesswork based on anatomical and patho-

logical diagnosis. While pharyngitis may be either viral or bacterial in origin, laryngitis and bronchitis are often viral or allergic. It may be impossible to distinguish between acute viral and bacterial pharyngitis although if fever persists beyond 3-4 days or shows a higher trend, acute bacterial pharyngitis is more likely as viral infections mostly settle down within 3-4 days. In addition, a child suffering from an acute bacterial infection is more toxic and continues to look ill even during the interfebrile period while a child with a viral infection is often comfortable during this period. Acute pneumonia is to be considered an acute bacterial infection until proven otherwise, even though viral pneumonia does occur. Acute bronchiolitis is always viral.

TESTS

CBC. It is non-specific. It does not help to define the etiology correctly.

Neutrophilic leukocytosis. It is observed in acute bacterial and acute viral infection.

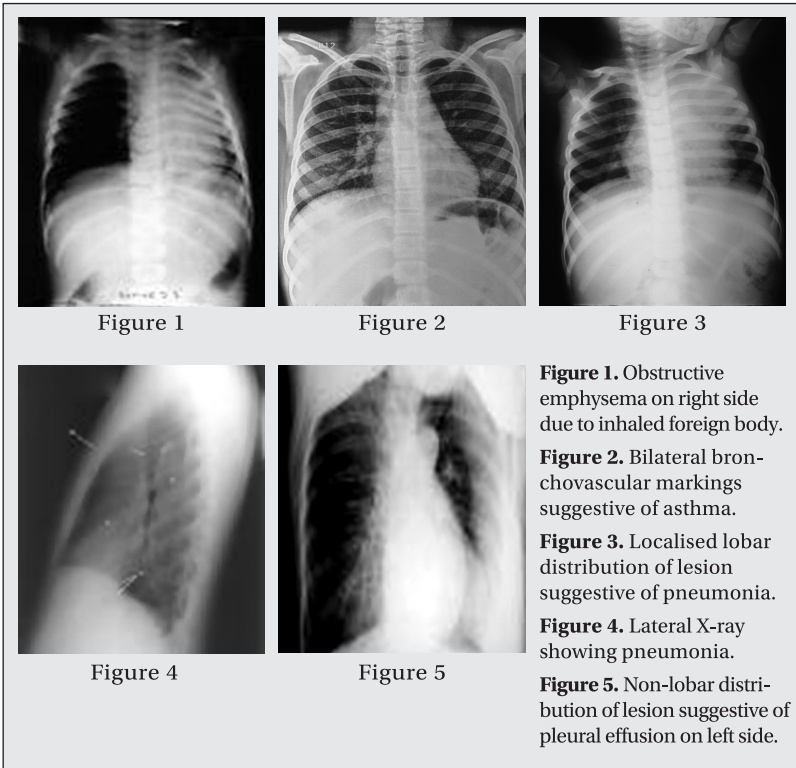
Lymphocytosis. It is present in viral infection, TB, and partially-treated bacterial infection.

Eosinophilia. It is present in allergy (not necessarily asthma). Tropical eosinophilia is rare in children.

Chest X-ray. Generally, the more severe the cough, the less useful is the chest X-ray. Except when you suspect the inhalation of a foreign body (**Figure 1**).

Chest X-ray is not useful in children with asthma. Non-specific shadows seen in a chest X-ray in asthma are due to small areas of segmental atelectasis, due to alveolar collapse or fluid consolidation, and they are observed bilaterally. These shadows are often erroneously reported as pneumonia or pneumonitis (**Figure 2**). Typically haziness in pneumonia is restricted to a lobe and is mostly unilateral and localized with other areas of the lungs appearing normal (**Figure 3**).

Chest X-ray is useful in lung parenchymal disease, pleural pathology and mediastinal mass lesion. In contrast, airway disease and interstitial lung disease are not evident on a chest X-ray. At times, if a localized shadow does not correlate with classical anatomical boundaries, a lateral chest X-ray may help (**Figure 4**). A small amount of pleural fluid is picked up better with a lateral decubitus film (**Figure 5**).



Other tests. Other tests that may be helpful in making a provisional diagnosis include the Mantoux test used to detect latent TB. Pulmonary Function Tests such as the spirometry test are not practical for children < 6 years of age and are often difficult to perform even in older children. Thus, the diagnosis of asthma remains more clinical. CT scan of the chest is rarely done in routine office practice. One needs to consider the large amount of radiation exposure during the CT scan procedure.

TREATMENT OF COUGH

Specific therapy. Antibiotic therapy is necessary only in a few children presenting with cough such as those suffering from pneumonia or pharyngitis. Most other acute infections causing cough are due to viral infection and do not justify the use of antibiotics. Anti-TB therapy should be considered

only after an attempt at rational diagnosis. Diagnosis of childhood tuberculosis is a special topic by itself and is beyond the scope of this article. So is the diagnosis and management of asthma. Suspected inhaled foreign bodies need bronchoscopic removal.

Symptomatic therapy. There is no cough remedy that can silence the cough. However, coughing episodes can be quite distressing to the child and the parents. Consequently, an attempt to relieve discomfort is essential even though the cough may not be easily controlled and probably will get better naturally. Selection of an appropriate cough mixture is an art based on scientific principles.

For bronchospastic cough, one that occurs in spasms or bouts in a child with bronchitis of any etiology, a bronchodilator such as salbutamol or terbutaline is often recommended. While the response to such a drug in an infant may be erratic, older children are often benefited. Younger children may be treated more effectively with the salbutamol inhaler.

Most children suffering from cough cannot expel airway secretions at this age. They may be prescribed a cough sedative (antitussives) on a need-basis (SOS). Generally, a cough is more distressing during sleep and so a single dose of cough sedative such as dextromethorphan or pholcodeine may be tried. First generation antihistamines either alone or in combination with a cough sedative may be helpful to put a child to sleep thereby providing relief. Thus, although no cough mixture will silence a cough, some provide temporary relief and are safe for short duration and need-basis use. This is the way a physician should offer relief without any risk of side effects by judiciously prescribing the drugs mentioned above. However it is advisable not to use these drugs for long periods. In fact every child with chronic cough needs relevant lab tests done to find the specific cause that may be treatable.

In summary, cough is a distressing symptom that demands a proper evaluation for the best outcome of treatment. Symptomatic therapy has no role except to offer temporary relief and only for a short time. Specific therapy is possible but only if a correct diagnosis is made. Thus, it is essential to attempt to make a correct diagnosis using the clinical analysis as discussed above. ■

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CME questions on
“Cough: A Distressing Symptom to a Child and
a Challenge to a Physician”

QUESTIONS

- 1 Cough is a predominant symptom except in:**
 - a) Asthma
 - b) Pharyngitis
 - c) Pneumonia
 - d) Laryngitis
 - e) All of the above
- 2 Sudden onset cough is seen in:**
 - a) Asthma
 - b) Bronchiolitis
 - c) Inhaled foreign body
 - d) Cardiac disease
 - e) None of the above
- 3 Recurrent cough is a feature of:**
 - a) Asthma
 - b) Hyperreactive airway disease
 - c) Cardiac disease
 - d) All of the above
 - e) None of the above
- 4 Generalised chest findings are common except in:**
 - a) Asthma
 - b) Bronchiolitis
 - c) Interstitial lung disease
 - d) Tuberculosis
 - e) Bronchitis
- 5 Chest X-ray is indicated in the diagnosis of all except:**
 - a) Pneumonia
 - b) Inhaled foreign body
 - c) Asthma
 - d) Pleural effusion
 - e) Cardiac disease

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Answers to CME questions on
“Cough: A Distressing Symptom to a Child and a Challenge to a Physician”

ANSWERS

- 1 The correct answer is (c).** Cough is not a predominant symptom in pneumonia. Fever is the main presenting symptom of pneumonia and cough is mild to begin with and may worsen during phase of resolution of pneumonia. Predominant cough is a feature of airway disease.
- 2 The correct answer is (c).** Sudden onset of cough is seen in inhaled foreign body. Typically child is free of cough a minute before sudden outburst of cough. On direct questioning parents may recall such a sudden onset and that helps in diagnosis of inhaled foreign body. Asthma may present with acute onset of cough but it is not sudden appearing in minutes.
- 3 The correct answer is (d).** Recurrent cough is a feature of asthma, hyperreactive airway disease and also cardiac disease. It means that there may be long periods free of cough interspersed with severe bouts of cough.
- 4 The correct answer is (d).** Tuberculosis is a localized disease at least in initial stages and even in advanced stage of the disease findings are often localized to one side. If present on both sides, chest findings are patchy with normal lung in between. While all other conditions such as asthma, bronchiolitis, bronchitis and interstitial lung disease are essentially generalized airway diseases and so will have generalized chest findings.
- 5 The correct answer is (c).** Chest X-ray is not indicated in asthma as routine chest X-ray does not reveal pathology in airway but is good for lung parenchyma, pleural pathology and cardiac disease. Non-specific radiological findings in asthma may be due to small segmental atelectasis and may be wrongly interpreted as pneumonia.

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