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Summary Article: **COUGH**

From *French's Index of Differential Diagnosis: An A-Z*

Healthy persons seldom cough; their scant bronchial secretions result in a thin sheet of mucus that is constantly carried up the tracheobronchial tree towards the larynx by the action of cilia. On reaching the pharynx, the secretions raised in this way are disposed of into the alimentary tract by unconscious acts of swallowing.

Coughing is an essential defence mechanism that protects the airways from the adverse effects of inhaled noxious substances, and also serves to clear them of retained secretions. Patients recognize that coughing indicates an abnormality, and this symptom is one of the most frequent reasons given for seeking medical advice.

Coughing may be produced voluntarily, but more often it results from reflex stimulation. To a lesser extent, it can be suppressed voluntarily. The involuntary initiation of a cough takes place in a reflex arc. Extrathoracic cough receptors are present in the nose, oropharynx, larynx and upper trachea. Intrathoracic irritant receptors are located in the epithelium of the lower trachea and large central bronchi, which are the air passages from which coughing effectively expels retained secretions or foreign material. Efferent pathways include the recurrent laryngeal nerves to cause closure of the glottis, and the corticospinal tract and peripheral nerves to cause contraction of the thoracic and abdominal musculature. The cough receptors may accommodate to repeated stimuli - as they often do in cigarette smokers, who may only cough after the first cigarette of the day. The cough reflex becomes less sensitive in the elderly, and is lost in anaesthesia and unconsciousness, leading to an increased danger of aspiration pneumonia.

The act of coughing occurs in three phases. The first phase is a preliminary deep inspiration, and the second is closure of the glottis, relaxation of the diaphragm and contraction of the thoracic and abdominal expiratory muscles, generating a positive pressure of 100-300 mmHg within the thorax. Because the positive pressure in the pleural space is higher than the luminal pressure in the trachea and central bronchi, a pressure difference is created that causes the posterior membranous portion of the airway walls to fold inwards and partially obliterate the lumen. When the third phase occurs - namely, sudden relaxation of the glottis - the linear velocity of airflow through the narrow channels is markedly increased, creating forces that dislodge secretions and particles from the mucosal surface. During cough, the volume rate of flow out of the lungs (litres per second) is very similar to that obtained during a forced expiratory manoeuvre - a fact that is not always appreciated. In patients with severe airflow obstruction, high rates of flow cannot be generated because the airways are already narrowed; such patients may have prolonged wheezy coughs that sometimes cause the involuntary effects of a Valsalva manoeuvre, and resultant cough syncope, which is occasionally accompanied by convulsions mimicking epilepsy.

In general, the diagnosis of the cause of cough depends not only on an analysis of the cough itself, but also on the other symptoms and physical signs and, above all, the chest radiograph. When the chest radiograph shows a significant abnormality such as lobar collapse (Figs C.26-C.28), carcinoma (Fig. C.29), bronchopneumonia (Fig. C.30) or pulmonary tuberculosis (Figs C.31 and C.32), the reason for the cough is established and the next step is to initiate appropriate treatment. Diagnostic problems arise in

those patients in whom the chest radiograph appears normal. The disorders that need to be considered are listed in Table C.3 on page 118. Some helpful diagnostic clinical clues and signs and further investigations are listed in the same table. Enquiry about the presence or absence of sputum, whether the cough is occasional or persistent, or is provoked by any activity or situation, and especially whether there is disturbed sleep, will provide helpful pointers to the diagnosis.

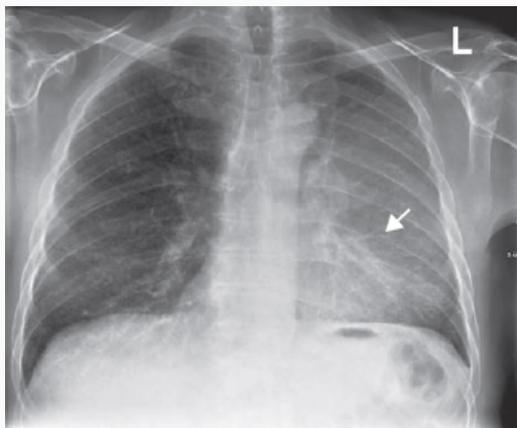


Figure C.26 Chest radiograph showing a left upper lobe collapse due to a bronchial carcinoma. A veil-like opacity is obscuring the left heart border (white arrow).

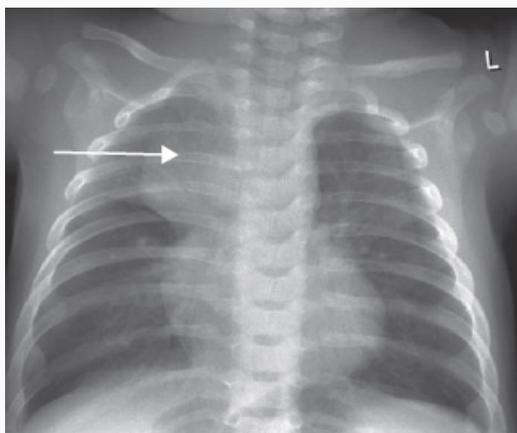


Figure C.27 Chest radiograph showing right upper lobe collapse in a child (white arrow).

When the causes of the chronic cough are analysed, asthma frequently heads the list, and indeed chronic non-productive cough - especially at night - may be the sole presenting complaint of patients subsequently proven to have bronchial asthma.

Dry cough is also a feature of lung fibrosis from any cause. Typically, the chest radiograph will be abnormal but, if equivocal, thoracic high-resolution computed tomography scanning is helpful in confirming or refuting the presence of structural lung disease. An intractable dry cough is now recognized as an important side effect of angiotensin-converting enzyme inhibitors.

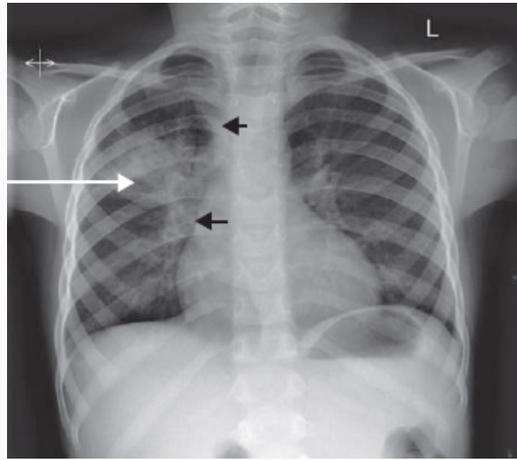


Figure C.28 Chest radiograph showing right upper lobe pneumonia due to tuberculosis (white arrow), with enlarged lymph nodes (black arrows).

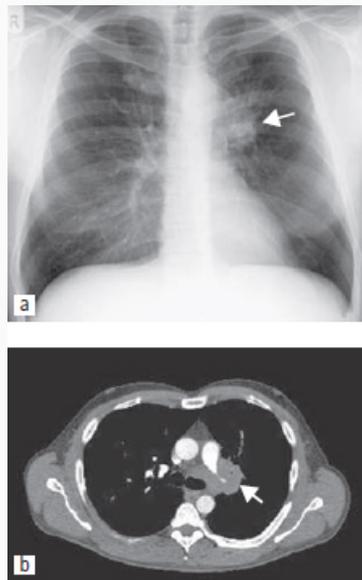


Figure C.29 Chest radiograph (a) and computed tomography scan (b) showing a lung cancer at the left hilum invading the left pulmonary artery (white arrow).

In *pertussis*, the characteristic cough is paroxysmal and occurs in bouts that may last for a minute or two and culminate in vomiting, in addition to a characteristic terminal inspiratory whoop. In severe paroxysms, the child may become cyanosed. On examination, the most striking finding in the chest is a negative one, the rhonchi characteristic of ordinary acute bronchitis being generally absent. A sublingual ulcer on the fraenum linguae due to the friction of the protruding tongue on the lower front teeth during long paroxysms of coughing is a helpful finding, as is a history of exposure to infection.



Figure C.30 Patient with bilateral basal consolidation.

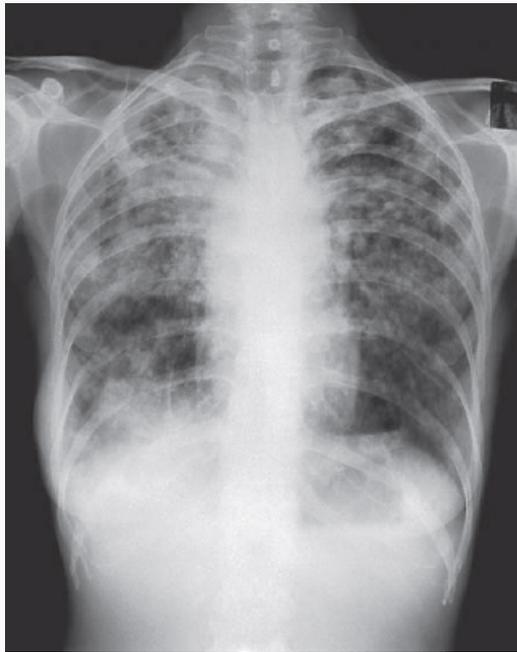


Figure C.31 Widespread pulmonary tuberculosis.



Figure C.32 Right upper lobe tuberculous infection.

A cough that an adult patient has had intermittently since childhood is more likely to be associated with bronchiectasis than one for which the onset can be dated more recently.

In children and even young adults with a persistent or recurrent cough, the possibility of cystic fibrosis must be borne in mind; the presence of associated bowel symptoms should lead to an estimate of sweat sodium levels.

A cough appearing and persisting for the first time in a young adult - especially if of Asian origin - must give rise to suspicion of pulmonary tuberculosis, and calls for complete investigation including a chest radiograph and sputum examination. Similarly, a cough appearing for the first time in middle age - especially in a man - must raise suspicion of bronchial carcinoma, which should only be dismissed after a complete investigation.

The characteristic morning cough of the cigarette smoker is due to a chronic pharyngotracheobronchitis; many cigarette smokers regard it as a normal part of their lives, and refer to it as 'clearing the throat'. It is in fact the first symptom of chronic bronchitis. The frequency with which chronic bronchitis and bronchogenic carcinoma co-exist - both being directly associated with tobacco consumption - has led to the important axiom that any change in the character or pattern of a chronic cough warrants investigation for carcinoma of the lung. Chronic nasal sinusitis may produce or contribute to this symptom, secretions that have trickled down into the trachea during sleep being expelled when the patient wakes. A cough that appears on first lying down at night or on some other changes of posture is suggestive of localized bronchiectasis or chronic pulmonary suppuration. In older people, recurrent aspiration is a not uncommon cause that is often overlooked. It may be related to oesophageal regurgitation, stricture or neurological disease affecting swallowing. Asthma and cardiac failure also commonly cause cough in the elderly, but this may be especially prominent at night. Asthmatic patients sometimes complain of cough as a predominant feature of their attacks, and wheezing and dyspnoea may be relatively trivial. In typical asthma, cough may also occur on exercise or nocturnally, waking patients from sleep. A cough with dyspnoea or orthopnoea waking the patient from sleep may also be due to pulmonary congestion or oedema due to left ventricular failure in hypertension, aortic valvular disease or disorders of the myocardium. Because such nocturnal attacks of paroxysmal dyspnoea in these conditions may be accompanied by wheeziness, they are sometimes referred to as 'cardiac asthma'. The important findings that might help to differentiate bronchial and cardiac asthma are listed in Table C.4.

Table C.3 Causes of cough to be considered when the chest radiograph does not show any gross abnormality

| Acute conditions | Helpful diagnostic clinical clues |
|--|--|
| Acute specific fever, e.g. measles, typhoid or paratyphoid <i>Pneumocystis pneumonia</i> Whooping cough (pertussis) Acute laryngitis Acute tracheobronchitis Exposure to noxious gases Inhaled foreign body | Other features, e.g. Koplik's spots and rash of measles Features of HIV disease (oral thrush, weight loss, skin disease, etc.) Characteristic cough and whoop (see text) Associated with hoarseness Painful cough with retrosternal soreness Obvious history Usually a young child, usually no history |
| Chronic or recurrent conditions | Diagnostic investigations |
| Chronic sinusitis Chronic laryngitis Laryngeal papilloma, carcinoma, tuberculosis, syphilis Cystic fibrosis Chronic bronchitis Bronchial asthma Bronchiectasis Carcinoma or adenoma or foreign body only partly obstructing the trachea or main bronchus Mediastinal lymphadenopathy or tumour pressing on a bronchus Diaphragmatic irritation due to subphrenic abscess or hepatic abscess | Sinus radiographs Laryngoscopy Chest radiograph may be characteristic Sweat test Peak expiratory flow rate or forced expiratory volume measurement Bronchoscopy, computed tomography scan of lungs Flow-volume loop may be characteristic Bronchoscopy Tomography and/or mediastinoscopy Ultrasound and fluoroscopy |

The presence or absence of expectoration and the quality of expectoration are important diagnostic features of any cough. It should be remembered that many patients find it difficult to expectorate, and habitually expel small amounts of secretion through the larynx by cough and then swallow it. This is the rule in children. A dry cough, or one producing only scant mucoid sputum, may be due to inflammation or tumour of the larynx, when there will be associated hoarseness. Laryngeal involvement in syphilis is a very unusual cause of a dry cough with hoarse voice. Another cause of cough associated with a weak voice often described as 'hoarseness' is carcinoma of the bronchus with recurrent laryngeal nerve involvement. A dry cough may be a manifestation of nervousness, but should not be accepted as such without proper investigations. A dry cough may also be due to external pressure on a bronchus by a

mediastinal mass such as benign or malignant tumour, or by enlarged mediastinal lymph nodes due to reticulosis or tuberculosis; the latter should be particularly considered in those of Asian origin. Cough due to external pressure on the trachea is usually described as 'brassy' or 'bovine'.

Table C.4 Differentiation of bronchial and cardiac asthma

| Bronchial asthma | Cardiac asthma |
|---|--|
| History of previous bronchial asthma Often young - sometimes old Expiratory wheezing No crackles | History of hypertension, valvular or ischaemic heart disease Rarely young - usually old Sometimes also expiratory wheezing Many basal crackles Gallop rhythm/cardiac failure Evidence of pre-existing cardiac disorder |
| ECG normal Chest radiograph shows hyperinflation of lungs | ECG often abnormal Chest radiograph shows enlargement of left ventricle Kerley's septal lines and other evidence of pulmonary venous congestion and/or pulmonary oedema |
| Bronchial hyperactivity (peak expiratory flow rate measurements) Methacholine or histamine Challenge | No evidence of bronchial hyperactivity |

If a cough is productive, the quality and mode of production of the sputum should be noted. Frankly purulent sputum suggests bronchiectasis, lung abscess, being primary or secondary to bronchial obstruction by new growth, foreign body or cavitating pulmonary tuberculosis. The odour of the sputum is important: a malodorous sputum almost invariably indicates infection with anaerobic organisms and suggests bronchiectasis, inhalation pneumonia, lung abscess or bronchopleural fistula with expectoration of a putrid empyema (see also SPUTUM). Cough due to a bronchopleural fistula is characteristically dependent on position; the cough is worse when the patient lies on their good side, and is relieved by lying on the side of the lesion.

Coughing seems to provoke more coughing. Paroxysms of coughing as in pertussis may terminate in vomiting, which seems to break the cycle. Paroxysmal attacks may also terminate in syncope. At times, severe coughing attacks have continued to the point of utter exhaustion. The muscular force developed during coughing may be sufficient to cause occasional fractures of the ribs (cough fractures) and even compression fractures of the vertebral bodies. In some cases, no physical cause for the cough may be detected, and in some of these patients psychogenic factors are important.

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