

Assessment and Management of Chronic Cough

Catherine M M Wong, MRCP, K H Lim, MRCP, C K Liam, FRCP

Department of Medicine, Faculty of Medicine, University of Malaya Medical Centre, 50603 Kuala Lumpur

Introduction

Chronic cough is an important medical as well as economic problem. In the United States, cough is the most common complaint for seeking medical attention, estimated to cost over US one billion dollars annually^{1,2}. Consultations for this complaint form 10-38% of chest physicians' workload and it is the second most common reason for a medical examination³.

Cough is arbitrarily defined as chronic if it lasts 3 to 8 weeks or more^{4,5,6,7}, being the only presenting symptom, not associated with haemoptysis, without a history of chronic lung disease to account for the cough and the current chest radiograph (CXR) is non-diagnostic.

Table I: Complications of cough

Musculoskeletal	Rectus abdominis rupture, rib fracture
Pulmonary	Pneumomediastinum, subcutaneous emphysema, pneumothorax
Cardiovascular	Heart block, superficial venous rupture
Central nervous system	Cough syncope
Others	Urinary incontinence, GERD, exhaustion, hernias

Table II: Reasons why patients seek medical help

Reasons	Frequency (%)	Most Troublesome (%)
Something wrong	98	12
Exhaustion	57	17
Self-conscious	55	10
Insomnia	45	4
Lifestyle change	44	3
Musculoskeletal pain	44	3
Hoarseness	43	2
Excess perspiration	42	1
Urinary incontinence	39	9
Dizziness	38	0
Fear of cancer	33	11

Chronic cough itself is problematic in nature with multiple associated complications (Table I) and it also raises concerns that it is an indicator of an underlying illness⁸. This is the main reason patients seek medical attention with exhaustion being cited as the most troublesome symptom and the fear of cancer as a significant concern (Table II)⁹. In South-East Asia, pulmonary tuberculosis as a cause would be a significant concern. Cough, however, also serves a variety of functions, for example, it is an important physiological defense mechanism in clearing excessive secretions and foreign materials from the airways.

This article was accepted: 13 June 2002

Corresponding Author: Catherine Wong Mee Ming, Department of Medicine, Faculty of Medicine, University of Malaya Medical Centre, 50603 Kuala Lumpur

In the last 20 years, major advances in the clinical approach to chronic cough have been made, enabling us to better understand the pathophysiology and management of this symptom. In 1977, Richard Irwin proposed an anatomical diagnostic approach and it has subsequently been shown that the causes of chronic cough could be determined in nearly 100% of cases and that cause-specific treatment was almost always successful⁸.

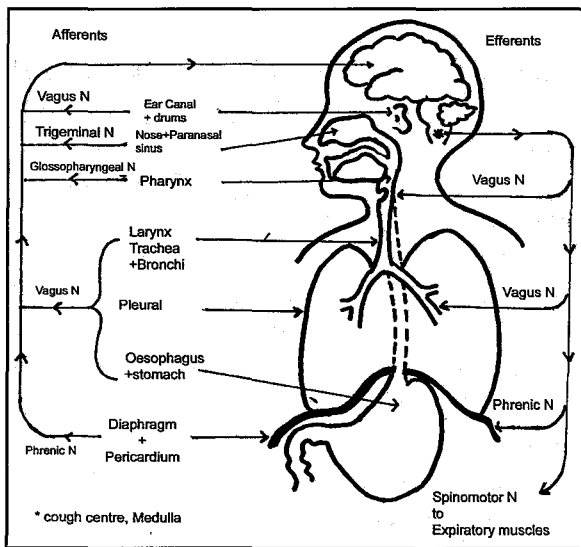


Fig. 1: Anatomy of the cough reflex

In the assessment and management of chronic cough, it is important to understand the cough reflex⁸ (Figure 1). The anatomical diagnostic protocol proposed by Richard Irwin based on this concept⁴ has proved invaluable over the last two decades to chest physicians in determining the causes of cough¹⁰.

Each cough involves a complex reflex arc that begins with the stimulation of the irritant receptors sensitive to mechanical and chemical stimuli. These receptors are distributed primarily in the respiratory tract (larynx, trachea, bronchi, nasal passages, paranasal sinuses, pharynx, auditory canals and drums) as well as extrapulmonary sites (pleural, oesophagus, stomach, pericardium, diaphragm). The afferent

Table III: Causes of chronic cough

Causes	Percentage (%)
PNDS	52
Asthma	25
GERD	24
Chronic bronchitis	8
Bronchiectasis	4
Miscellaneous	5
PNDS/Asthma/GERD	90

signals are transmitted via the ipsilateral vagus, trigeminal, glossopharyngeal and phrenic nerves to the cough centre located diffusely in the medulla. The efferent signals travel via the vagal efferents, phrenic and spinomotor nerves to the effector musculatures (larynx, bronchial smooth muscles, diaphragm, and expiratory muscles), which generate an effective expulsive force upon contraction. This approximates to an intrathoracic pressure of 300 mmHg and an expiratory flow velocity of up to 500 mph.

Cough may arise from the stimulation of the extrapulmonary cough receptors explaining why many causes of chronic cough may be due to diseases outside of the respiratory tract. Utilising this anatomical diagnostic protocol, multiple prospective descriptive studies have uncovered the spectrum of causes of chronic cough (Table III).

Causes of chronic cough

Many studies have been carried out to elucidate the causes of chronic cough^{3,11}. Chronic cough is often due to more than one condition. In nonsmokers who are not on angiotensin converting enzyme (ACE) inhibitor drugs and have normal or stable chest radiographs (CXR), postnasal drip syndrome, asthma and gastro-oesophageal reflux disease (GERD) either singularly or in combination account for nearly 100% of cause(s). Postnasal drip syndrome is the

commonest cause by far, accounting for 38-65% of all causes followed by asthma (14-36%) and gastro-eosophageal reflux disease (8-40%). Chronic cough may be the sole presenting symptom of asthma (cough variant asthma) and GERD disease. Less frequent causes of chronic cough include chronic bronchitis, pulmonary tuberculosis, bronchiectasis, bronchogenic carcinoma, ACE inhibitor drugs, chronic interstitial pulmonary disease and psychogenic cough (Table III). Multiplicity of causes make the diagnosis difficult as a single cause is found in 38-82%, two in 18-42% and up to three may exist in 3-26% of the time³⁻⁷.

Postnasal drip syndrome

Postnasal drip syndrome (PNDS) is the commonest cause of chronic cough. There are no pathognomonic criteria for this syndrome and the diagnosis requires a constellation of symptoms, signs and test results, making PNDS-induced cough difficult to diagnose. Pathogenesis of the cough is the triggering of the cough reflex from secretions emanating from the nasal and paranasal areas dripping onto the hypopharynx. Sinusitis of different origins and all types of rhinitis, including the common cold, allergic rhinitis, perennial non-allergic rhinitis, vasomotor rhinitis, enviromental induced rhinitis, pregnancy associated rhinitis and rhinitis medicamentosa, may cause PNDS.

Suggestive symptoms include a dripping or tickling sensation at the back of the throat, nasal congestion and discharge, hoarse voice, occasionally wheeze and sputum production in excess of 30 mls per day⁸. Physical findings of nasal discharge, secretions in the oropharynx and cobblestone appearance of the oropharyngeal mucosa would support the diagnosis. Allergen testing to confirm allergic rhinosinusitis may be helpful and sinus radiographs with typical features of fluid level, opacified sinuses and mucosal thickening of >6 mm would suggest the presence of chronic sinusitis. Silent PNDS is an entity⁶, and even with suggestive signs, symptoms and investigations, a definite diagnosis of PNDS-induced cough is only confirmed if the cough responds to treatment specifically directed at PNDS.

Treatment of PNDS should target the subcategory of causes (12-14) (Table IV). A first generation (older) antihistamine would be more effective for non-allergic rhinitis than the newer non-sedating antihistamines due to the anticholinergic activity it possesses. As PNDS is the sole or partial cause of chronic cough in up to 87% of cases, empirical treatment is an acceptable approach if both asthma and GERD are unlikely from the clinical assessment. This has proved effective in clinical experience and would avoid extensive investigations for other causes of chronic cough. Response to empirical treatment would be clinically apparent if the diagnosis is correct.

Table IV: Therapeutic options for causes of post nasal drip syndrome

Non allergic rhinitis	Oral older antihistamines (e.g.Chlorphenramine 4mg) and oral decongestants (e.g.Pseudoephedrine 60mg) or intranasal ipratropium+ for 3 weeks Intranasal steroids following cough resolution for 3 months.
Allergic rhinitis	Avoidance of allergen. Oral newer antihistamines (e.g.Cetirizine 10 mg) Intranasal steroid and cromoglycate helpful.
Vasomotor rhinitis	Intranasal ipratropium for at least 3 weeks, then PRN. Adding oral decongestants and oral older antihistamines may help.
Chronic bacterial Sinusitis	Antibiotics* and oral decongestants for 3 weeks plus nasal decongestants for 5 days. Intranasal steroids following cough resolution for 3 months.

+ if the oral medication not tolerated

*cover *Streptococcus pneumoniae*, *Haemophilus influenzae* & mouth anaerobes

Asthma

Asthma is the second most frequent cause of chronic cough and all asthmatics experience cough as a consequence of their disease. Cough may be the only symptom of asthma (cough variant asthma)¹⁵. This entity was reported as early as the 1970s¹⁶ and its prevalence in the adult population is undocumented. In studies of patients with chronic cough, up to 57% of the time, cough is the only symptom in those finally diagnosed to have asthma¹⁷.

Cough variant asthma is diagnosed by demonstrating airway hyper-responsiveness as often there is no variability in baseline airways obstruction at presentation. Methacoline or histamine challenge has a positive predictive value of 60-88% and a negative predictive value of nearly 100 % but is not widely available^{18,19}. A diagnosis of cough variant asthma is implausible if the methacoline or histamine challenge test is negative. Positive hyper-responsiveness may occur in post-respiratory tract infections, cystic fibrosis and bronchiectasis.

Treatment requires a combination of inhaled corticosteroids and beta-2 agonists. Response may be seen in about a week but may take up to 8 weeks for resolution. Inhaled medications, however, may make cough worse. This can be circumvented by using a spacer device or changing to different formulations. Occasionally, oral corticosteroids are necessary. Again, successful cause-specific therapy confirms the diagnosis of asthma induced cough.

Gastro-oesophageal reflux disease

This condition is extremely common and surveys suggest that up to 25% of the general population may suffer from this problem²⁰. Incidence and severity tend to increase with age and males tend to be 1.5-3 times more likely than their female counterpart to have this disease.

Until recently, there have been a divergence of opinions as to whether gastro-oesophageal (GERD) actually causes respiratory complications²¹ although this was considered even as early as 1962 by Kennedy²². Recent data showed that as many as 20% of GERD sufferers admitted to respiratory symptoms e.g. cough, wheezing, dyspnoea or sputum production²³. Utilising the anatomical diagnostic protocol, studies have shown that GERD is one of the commonest cause of chronic cough. In patients with reflux symptoms, GERD is the cause of chronic cough in 6-10% of cases^{4,10}. Even without symptoms of reflux, pH monitoring have demonstrated 'silent GERD' in as many as 40-75% of patients with chronic cough⁷.

Table V: Mechanisms for the pathogenesis of chronic cough due to GERD

Mechanism	Disease manifestation due to GERD
Macroaspiration	Aspiration pneumonia, lung abscesses, pulmonary fibrosis, bronchiectasis
Microaspiration	Laryngeal oedema, bronchitis
Vagally mediated distal oesophageal-tracheobronchial reflex	Bronchial asthma, chronic cough
Cough-reflux perpetuating cycle	Chronic cough

Various mechanisms for the pathogenesis of chronic cough due to GERD have been proposed (Table V), with the last two mechanisms being the more likely causes. It has been demonstrated that gastric refluxate in the distal oesophagus stimulates the cough reflex²⁴. The afferent arc may be blocked experimentally by local 4% lignocaine and the efferent loop may be inhibited by inhaled ipratropium bromide²⁵. This vagally mediated distal oesophageal-tracheobronchial reflex demonstrates the validity of the anatomical diagnostic protocol in diagnosing the cause of cough. The increase in transdiaphragmatic pressure

during cough itself may explain partially how cough and reflux can perpetuate each other²⁶. There is also evidence to suggest that impaired clearance of oesophageal acid may contribute to chronic cough²⁷.

Certain characteristics of GERD induced chronic cough exist. Cough is usually the sole complaint (silent GERD)²⁸ and occurs predominantly in the daytime, mostly in the upright position, as normal oesophageal function suppresses transient lower oesophageal relaxation in the supine position²⁶. The cough is usually non-productive although excessive sputum production have been documented⁵. Symptoms are usually very long standing, 13-58 months on average, and have been documented for as long as 20 years²⁹.

Although 24 hour ambulatory pH monitoring is considered the gold standard^{30,31} for diagnosing reflux (it has a positive predictive value of 89-100% and a negative predictive value of close to 100%), normal diagnostic reflux parameters may not exclude the diagnosis of GERD induced cough. A temporal relationship between cough and the reflux episode would be a critical factor in the diagnosis. Other helpful tests such as oesophagogastroduodenoscopy, oesophageal radiography or manometry may be necessary to assist diagnosis. Diagnosis of GERD induced cough is only confirmed if the cough responds to GERD specific therapy.

Empirical therapy is reasonable in non smokers with stable CXR who do not have PNDS or asthma and who are not on ACE inhibitor drugs. Conservative measures such as losing weight, raising the head of the bed, low fat diet, avoiding snacks, tomatoes, citrus fruits, soft drinks, coffee, chocolate, tea, alcohol, mint and smoking are still useful. H₂ antagonists therapy is successful in more than 70% of cases and acts via breaking the cycle of cough-reflux perpetuation. Proton pump inhibitors and prokinetic agents have a higher success rate in treating reflux and are the

treatment of choice³². Prolonged duration of treatment may be necessary and response may take 3 -6 months or more. About 3% of patients may require surgery (fundoplication, gastroplexy) if prolonged intensive medical therapy fails³³.

Other causes of chronic cough (12)

Chronic bronchitis is likely to be a very common cause of chronic cough, but many patients do not present to the medical practitioners as cough is perceived to be normal, e.g. smokers' cough. After cessation of smoking or removal of irritants, it takes four weeks for 50% of the cough to disappear. Helpful treatment for chronic bronchitis include inhaled ipratropium bromide and acetylcysteine while antibiotics and corticosteroids are useful in acute exacerbations of chronic bronchitis.

Angiotensin converting enzyme inhibitor (ACE) I drugs cause cough³⁴ in 10% of patients, 75% of whom are females and contribute up to 3% of the causes of chronic cough. Cough may appear within a few hours to 6 months of commencing the drug. The likely mechanisms involve excess bradykinins, substance P mediators and prostaglandins in the airways. This side effect is class specific. Cough may disappear or reduce after stopping the drug for 4-30 days. Inhaled ipratropium, oral nifedipine and oral non-steroidal anti-inflammatory drugs may help the resolution. Changing to angiotensin II receptor antagonist drugs is an alternative.

Pulmonary tuberculosis is an important cause of chronic cough especially in regions where the infection is prevalent. Associated symptoms of fever, night sweats, lethargy, weight loss and haemoptysis may be absent. A high index of suspicion especially in high risk groups (e.g. previous infection, contacts of tuberculosis patients, institutionalised patients, health workers, immunocompromised patient) is necessary for

the diagnosis. CXR may be normal especially if the infection is endobronchial or involves the larynx only. Sputum direct smear for acid-fast bacilli and culture for mycobacterium as well as Mantoux tuberculin skin testing would be required for initial investigation.

Bronchogenic carcinoma is the cause of chronic cough up to 2% of the time and is rare in non-smokers with normal CXR. Cough, however, occurs in 70-90% of patients with lung cancer and is a significant symptom if it appears for the first time in smokers or if it changes in character. Sputum cytology and chest radiographs would be helpful in the diagnosis. Bronchoscopy has a high yield of up to 89% if the CXR is abnormal but only has a yield of 5 % if the CXR is normal, the yield being higher in central locating tumours.

Post Infectious cough is cough that appears as a consequence of a respiratory tract infection (without pneumonia) and is seen in up to 25% of chronic cough. Resolution tends to be spontaneous, taking up to 8 weeks. Airways inflammation and transient hyper-responsiveness due to the infection may respond to inhaled corticosteroids, inhaled ipratropium bromide and oral corticosteroids (2-3 weeks). Coexisting rhinitis or postnasal drip would also require relevant treatment.

Bronchiectasis as a cause of chronic cough occurs in 4% of cases but this figure is likely to be much higher in areas where infective pneumonia such as tuberculosis is endemic. The CXR may occasionally be normal and high resolution computed tomography (HRCT) scan is now the investigation of choice. Postural drainage, chest percussion, mucolytics and systemic antibiotics for exacerbations are the main stay of treatment.

Chronic interstitial lung disease (e.g. sarcoidosis, pulmonary fibrosis) is an infrequent but recognized cause of chronic cough and the diagnosis (HRCT, lung biopsy, lung function tests)

and treatment (corticosteroids and immunosuppressive drugs) are best left to the respiratory specialist.

Psychogenic or habitual coughing is rare and should be a diagnosis of exclusion.

Evaluation and management of chronic cough

A systematic evaluation of the patient to assess the presence of the most common causes of chronic cough is recommended^{3-7, 10,11}. History, physical examination and CXR would help to focus on the most likely causes and direct investigations. The final diagnosis is determined by the resolution of cough in response to the cause specific therapy and not by the results of positive tests. The nature, timing and character of the cough is not helpful in pinpointing the cause of cough⁵.

Patients who smoke or are exposed to irritants should avoid the irritants. Likewise, patients receiving ACEI drugs should stop this medication. Symptoms should improve or resolve to confirm the causal aetiology in four weeks¹².

Patients who have normal CXR are then most likely to suffer from PNDS, asthma and GERD, either singularly or in combination^{3-5,7,28}. Depending on the most likely clinical diagnosis, the relevant tests are then performed; spirometry, bronchodilator reversibility testing or bronchial provocation challenge for asthma, ENT examination and radiology of the paranasal sinuses for PNDS, skin tests for allergy, and oesophagoscopy, oesophageal manometry and pH monitoring for GERD (Figure 2).

Empirical treatment for suspected PNDS, GERD and asthma should then be instituted. The definitive diagnosis would be established if cough responds to the cause directed treatment. Due to the existence of multiple causes in a single

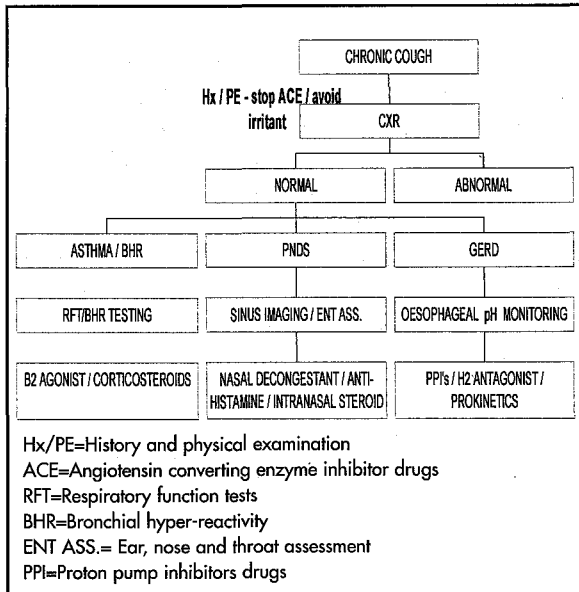


Fig. 2: Guidelines for evaluating chronic cough

patient, it is important that additional treatments should be added to the existing treatment in order to ensure that all causes are adequately treated. Following this systematic management, cause specific treatment is successful in 84-98% of cases^{3-7, 10,11}.

If, however, cough continues beyond the anticipated response time, or if the CXR is abnormal, further evaluation for uncommon causes will have to be performed (Figure 3). Sputum analysis, radiographic studies of the oesophagus, bronchoscopy, lung biopsy and cardiac studies may all be indicated, depending on the presumptive diagnosis and response to therapy.

In the diagnosis and management of chronic cough, the above scheme is applicable to immunocompetent patients. Immunocompromised patients would require CXR early, followed by arterial blood gas assessment and CD4 count to exclude opportunistic infections, before considering the usual causes of chronic cough¹².

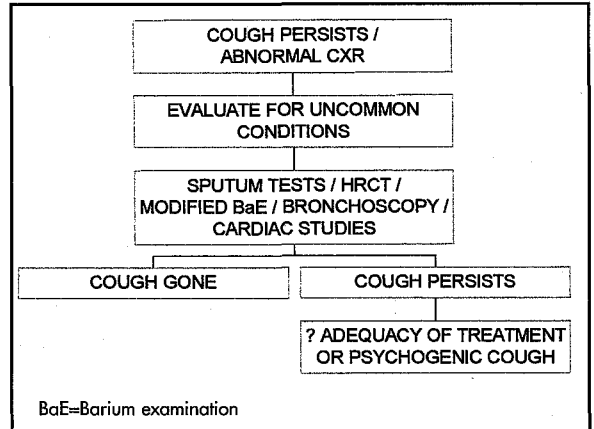


Fig. 3: Guidelines for chronic persistent cough

Pharmacological therapy of chronic cough

Pharmacological treatment should be cause-specific and non-specific antitussives have no role in the primary therapy since the cause of chronic cough can be diagnosed in 84-98% of cases⁹. Common reasons for failure of treatment include inadequate duration of treatment (e.g. 3-6 months for GERD) and substituting instead of adding treatment to existing therapy due to the coexistence of simultaneous causes of chronic cough. There is a limited role for nonspecific treatment in the event that the initial cause is not amenable to curative therapy e.g. carcinoma. All narcotics of the phenanthrene alkaloid group (e.g. codeine and morphine) are effective antitussives³⁵. Non-narcotics demonstrated to be effective antitussive agents include detromethorphan, glaucine and viminol-p-hydroxybenzoate diphenhydramine, Aerosolised ipratropium bromide exerts its antitussive effect on the efferent limb of the cough reflex and is effective in chronic bronchitis and post-infective cough.

Protussives may be indicated to assist the useful function of cough in airway clearance e.g. nebulised hypertonic saline in bronchitis, nebulised amiloride in cystic fibrosis, nebulised terbutaline in bronchiectasis^{9,12} and nebulised

CONTINUING MEDICAL EDUCATION

acetylcysteine in chronic bronchitis and cystic fibrosis³⁶.

Conclusion

Chronic cough is a common and expensive medical complaint. PNDS, asthma and GERD either singularly or in combination account for nearly 100% of causes of chronic cough in patients who have normal CXR. Using the

anatomical diagnostic protocol to assess extrapulmonary as well as pulmonary conditions, the cause(s) can be determined in the majority of patients (88-100%). In the diagnosis and management, besides careful history and physical examination, diagnostic tests are invaluable; complex investigations may be warranted in difficult cases. Cause-specific therapy is successful in the treatment of chronic cough, achieving complete response in 84-98% of patients.

References

1. Schappert SM. National ambulatory medical care survey: 199: Summary . In:Vital and Health Statistics No. 230. US Department of Health and Human Services, March 29, 1993; 1-20.
2. Couch RB. The common cold: control. *J Infect Dis* 1984; 150: 167-73.
3. Irwin RS, Curley FJ, French CL. Chronic cough: the spectrum and frequency of causes, key components of the diagnostic evaluation and outcomes of specific therapy. *Am Rev Respir Dis* 1990; 141: 640-47.
4. Irwin RS, Corrao WM, Pratter MR. Chronic persistent cough in the adult: the spectrum and frequency of causes, key components of the diagnostic evaluation and successful outcomes of specific therapy. *Am Rev Respir Dis* 1981; 123: 413-17.
5. Smyrnios NA, Irwin RS, Curley F J.C. Chronic cough with a history of excessive sputum production :the spectrum and frequency of causes, key components of the diagnostic evaluation and outcomes of specific therapy. *Chest* 1995; 108: 991-97.
6. Pratter MR, Bartter T, Akers S, et al. A algorithmic approach to chronic cough. *Ann Intern Med* 1993; 119: 977-83.
7. Mello CJ, Irwin RS, Curley FJ. The predictive values of the character, timing and complications of chronic cough in diagnosing its cause. *Arch Intern Med* 1996; 156: 997-1003.
8. Irwin RS, Rosen MJ, Braman SS. Cough: a comprehensive review. *Arch Intern Med* 1977; 137: 1186-91.
9. Irwin RS, Rosen MJ, Braman SS. The treatment of cough: a comprehensive review. *Chest* 1991; 99: 1477-84.
10. Poe RH, Harder RV, Israel RH, et al. Chronic persistent cough: experience in diagnosis and outcome using an anatomic diagnostic protocol. *Chest* 1989; 95: 723-38.
11. Poe RH, Israel RH, Utell MJ, et al. Chronic cough; bronchoscopy or pulmonary function testing? . *Am Rev Respir Dis* 1982; 126: 160-62.
12. A Concensus Panel Report of the American College of Chest Physicians. Managing cough as a defense mechanism and as a symptom. *Chest* 1998; 114: 133S-181S.
13. Berkowitz, Connell JT, Dietz AJ, et al. The effectiveness of the nonsedating antihistamine loratadine plus pseudoephedrine in the symptomatic management of the common cold. *Ann Allergy* 1989; 63: 336-39.
14. Rachelefsky GS. Pharmacologic management of allergic rhinitis. *J Allergy Clin Immunol* 1998; 10: S367-S69.

15. Corrao WM, Braman SS, Irwin RS. Chronic cough as the sole presenting manifestation of bronchial asthma. *N Engl J Med.* 1979; 300: 633-37.
16. McFadden ER Jr. Exertional dyspnea and cough as preludes to acute attacks of bronchial asthma. *N Engl J Med.* 1975; 292: 555-59.
17. Johnson D, Osborne LM. Cough variant asthma; A review of the clinical literature. *J Asthma* 1991; 28: 85-90.
18. Pratter M, Irwin RS. Usefulness and safety of Pharmacologic Bronchoprovocation challenge in evaluating patients with normal spirometric tests who are suspected of having asthma. *Chest* 1998; 93: 898-900.
19. Empey DW, Laitinen LA, Jacobs L, et al. Mechanism of bronchial hyperreactivity in normal subjects after respiratory tract infections. *Am Rev Respir Dis* 1976; 113: 131-39.
20. A Gallup survey on heartburn across America. Princeton NJ: The Gallup Organization, 1998.
21. Koufman JA. Aerodigestive manifestations of gastroesophageal reflux: what we don't yet know. *Chest* 1993; 104: 1321-22.
22. Kennedy JH. Silent gastro-oesophageal reflux: an important but little known cause of pulmonary complications. *Dis Chest* 1962; 12: 42.
23. Jauma R, Payola N, Gomez F, et al. Respiratory manifestations and gastroesophageal reflux. *Aten Primaria* 1992; 9: 375-77.
24. Irwin RS, Zawacki JK, Curley FJ, et al. Chronic cough as the sole presenting manifestation of gastroesophageal reflux. *Am Rev Respir Dis* 1989; 140: 294-300.
25. Ing AJ, Ngu MC, Breslin AB. Pathogenesis of chronic persistent cough associated with gastroesophageal reflux. *Am J Respir Crit Care Med* 1994; 149: 160-67.
26. Ing AJ, Ngu MC, Breslin AB. Chronic persistent cough and gastro-oesophageal reflux, *Chest* 1991; 46: 479-83.
27. Ing AJ, Ngu MC, Breslin AB. Chronic persistent cough and clearance of esophageal acid. *Chest* 1992; 102: 1668-71.
28. Irwin RS, French CL, Curley FJ. Chronic cough due to gastroesophageal reflux: clinical, diagnostic, and pathogenetic aspects. *Chest* 1993; 104: 1511-17.
29. Glasziou P. Evidence based case report: Twenty year cough in a non smoker. *B Med J* 1998; 316: 1660-61.
30. Johnss F, Joelsson B, Isberg PE. Ambulatory 24 hour intra-oesophageal pH monitoring in the diagnosis of gastro-oesophageal reflux disease. *Gut* 1987; 28: 1145-.
31. De Vault KR, Castell DO, for the Practice Parameters Committee of the American College of Gastroenterology. Guidelines for the diagnosis and management of gastroesophageal reflux disease. *Arch Intern Med* 1995; 155: 2165-73.
32. Harding SM, Richter JE, The role of gastroesophageal reflux in chronic cough and asthma. *Chest* 1997; 111: 1389-402.
33. Choy D, Leung R. Gastro-oesophageal reflux disease and asthma. *Respirology* 1997; 2: 163-68.
34. Israili ZH, Hall WD. Cough and angioneurotic oedema associated with angiotensin-converting enzyme inhibitor therapy; a review of the literature and pathophysiology. *Ann Intern Med* 1992; 117: 234-42.
- Irwin RS, Madison JM. Primary care: The diagnosis and treatment of chronic cough. *N. Engl J Med* 2000; 343: 1715-21.
35. Mathys H, Bleicher B, Bleicher U, Dextrometorphan and codeine: objective assessment of antitussive activity in patients with chronic cough. *J Intern Med Res* 1983; 11: 92-100.
36. Poole PJ, Black PN. Oral mucolytic drugs for exacerbations of chronic obstructive pulmonary disease: systematic review. *BMJ* 2001; 322: 1271-76.

MCQs on Assessment and Management of Chronic Cough

1. With regards to chronic cough, the following statements are true:

- a. Chronic cough is defined as the only symptom, without haemoptysis or a history of chronic lung disease, with a normal chest radiograph, lasting 3 to 8 weeks or more.
- b. It is a medical condition without much impact on health economic issues for the care provider.
- c. Patients usually seek medical care because of the perception that something is wrong with their health.
- d. The symptom of cough itself is unlikely to cause life-threatening complications.
- e. Evaluation and management may be successfully based on the systematic diagnostic protocol modeled after the anatomy of the cough reflex.

2. In considering the causes of chronic cough:

- a. Pulmonary tuberculosis can be excluded if the chest radiograph is normal.
- b. The major causes of chronic cough are postnasal drip syndrome, asthma and gastroesophageal reflux.
- c. Multiple causes may co-exist in a single patient in up to 42% of the cases.
- d. Psychogenic cough is a common cause especially if the cough is harsh, brassy and unproductive.
- e. A positive diagnostic test e.g. positive airways reversibility, would indicate the disease being investigated is the cause of the cough.

3. The following statements are applicable in the management of chronic cough:

- a. History and physical examination are unhelpful in the diagnosis of chronic cough causes.
- b. CT scan thorax and bronchoscopy should be performed as early as possible in the investigation of causes of chronic cough.
- c. Withdrawal of angiotensin converting enzyme inhibitor drugs and smoking cessation should be the initial management if there is stable, unchanging chest radiograph in a non smoking patient.
- d. Actual diagnosis is achieved only in a minority of patients due to the many causes of chronic cough.
- e. Empirical treatment for suspected postnasal drip syndrome or gastroesophageal disease may be indicated before invasive investigations are performed.

4. The following statements concerning causes of chronic cough is true:

- a. Gastro-oesophageal reflux disease triggers cough via the stimulation of the vagal distal oesophageal tracheobronchial reflex.
- b. Asthma is unlikely to be the cause if cough is the only symptom and there is no baseline airway reversibility.
- c. Postnasal drip syndrome is likely to be the cause if cobble-stoning effect is observed on the oropharyngeal mucosal.
- d. Gastro-oesophageal reflux disease and post nasal drip syndrome may be silent in patients.
- e. Rhinitis of any origin may be the source of post nasal drip syndrome.

5. In the treatment of chronic cough:

- a. Non-specific antitussives are the treatment of choice in order to eradicate this symptom.
- b. Failure of response to a cause-specific treatment would indicate the diagnosis is wrong and need to be revised.
- c. Ipratropium bromide via inhalation may be helpful in post infectious chronic cough.
- d. Second generation non-sedating antihistamines are preferred to first generation antihistamines for treatment of PNDS following acute sinusitis.
- e. GERD often respond promptly to a short course of combined proton pump inhibitor and prokinetic drugs.