

Preliminary Discussion About Cough and Expectoration

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ABSTRACT

This article introduces cough and expectoration related diseases. Cough is not only a protective reflex action, but also one of the most common symptoms of respiratory diseases. Expectoration refers to the action of expelling secretions in the respiratory tract from the mouth by means of ciliary movement of bronchial mucosal epithelial cells, contraction of bronchial muscles and the impulse of cough [66]. It is difficult and important to use cough, expectoration and related symptoms to quickly and accurately identify the cause of disease. According to the teacher's explanation and comments on the actual cases in the undergraduate clinical practice class, and the author's reading of the literature after the class, this article was finally formed, hoping to have a better understanding of the future study of respiratory medicine related diseases, especially those with cough and expectoration related symptoms.

KEYWORDS

Cough; expectoration; etiology; symptom relief; diagnosis; initial treatment; treatment strategy

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INTRODUCTION

Cough is a protective reflex action, secretions in the respiratory tract and foreign bodies inhaled from the outside can be discharged through the cough reflex, however, if frequent and irritating coughs affect rest and sleep, when inflammation occurs in the pharynx, larynx, trachea, bronchus or lung, the mucous membrane will be congested and edematous, the secretion of mucus increases, the permeability of capillary wall increases, and serous exudes, the exudate is mixed with mucus to form sputum [3].

Cough is a protective reflex action, the secretion in the respiratory tract or the foreign matter entering the airway can be effectively cleared through reflection, but if the patient coughs frequently for a long time, which affects work and rest, it is a pathological phenomenon [70]. Expectoration is a pathological phenomenon in which the pathological secretion in the respiratory tract is discharged out of the mouth by the action of coughing [70]. Therefore, severe cough or weak cough and sputum retention can bring a series of problems to the patient. Therefore, encouraging and helping the patient to cough and discharge sputum is an important part of clinical nursing [70].

Cough is a protective reflex action, which can effectively eliminate secretions or foreign bodies in the respiratory tract, however, under pathological conditions, symptoms such as persistent and frequent cough and poor expectoration will affect the functions of respiratory and circulatory systems [88]. Therefore, effective prevention and nursing can prevent the occurrence of complications, keep the respiratory tract unobstructed and protect the health of the body [88].

Cough is a sudden, explosive exhalation to clear airway secretions. Sputum expectoration refers to the action of expelling respiratory secretions from the oral cavity by means of ciliary movement of bronchial mucosa epithelium, contraction of bronchial smooth muscle and cough reflex [6].

Coughing can invisibly defeat the enemy, expel some uninvited guests (foreign bodies entering the body through the respiratory tract) and alien molecules (pathological secretions produced in the respiratory tract) from the body, thus reducing the risk of human disease [8].

Cough is a protective reflex action of the body, it can remove respiratory secretions and foreign bodies, it is one of the common symptoms of the respiratory system. Common causes of cough and expectoration include: ① infection factors, such as pneumonia, tuberculosis, bronchitis, pleuritis, etc.; ② Physical and chemical factors, such as foreign matters, dust, smoking, irritant gases, and supercooled and overheated air; ③ Allergic factors, contact or inhalation of allergens, such as pollen, paint, etc. [67].

COUGH AND EXPECTORATION

The effect of "Tanreqing" (Chinese Medicine) injection on children with fever, cough and expectoration is good, which can shorten the time for relieving clinical symptoms, reduce the level of inflammatory factors in the body, and improve the symptoms of fever and cough [4].

Thyroidectomy is a common operation in general surgery. Because the operation site is adjacent to the trachea and thyroid blood circulation is rich, it is a high-risk and potentially dangerous operation. Life-threatening complications can occur 24 to 48 hours after surgery [5]. Most patients can cough and expectorate to varying degrees after surgery, which can be alleviated by themselves if it is mild [5]. Severe cough and expectorate can cause local inflammation and edema to intensify if it lasts for a long time, affecting wound healing, what's more, severe neck tremor may also increase the risk of serious complications such as bleeding and asphyxia, the incidence of cough and expectorate after neck surgery is relatively high, therefore, it is very important for the prevention and nursing of postoperative cough and expectoration [5]. Thyroid surgery adopts general anesthesia with tracheal intubation, because of the stimulation of intubation, it is easy to cough and sputum, sticky and difficult to cough up, and throat pain. Because of the special anatomical position of the thyroid gland, coughing aggravates the pain of the surgical incision, severe coughing and expectoration can also cause bleeding of the incision, and even cause breathing difficulties and endanger life in severe cases, therefore, effective sputum excretion after thyroid surgery can not only improve the comfort of patients, but also reduce complications, which is conducive to the rehabilitation of patients [35].

Cough and expectoration of patients with cardio pulmonary diseases are related to cardiac dysfunction and pulmonary stasis [17]. Many babies now have cough and expectoration, although it is common, it is also harmful [23]. Parents need to pay enough attention to it, otitis media, pneumonia and other complications are easily caused by phlegm accumulation. The tissue of infant's eustachian tube is underdeveloped and its function is far lower than that of adults [23]. Nasopharyngeal secretions can easily enter the middle ear cavity through the eustachian tube, causing middle ear effusion, even acute otitis media is not sensational. In addition, sputum may flow back to the trachea and bronchioles, and even cause pneumonia [23].

The comprehensive characteristics of patients with cough and expectoration after pulmonary tuberculosis is cured but caused by lung structural damage are similar clinical manifestations and imaging manifestations that are difficult to identify [27]. Therefore, patients with cough and expectoration after pulmonary tuberculosis is cured but caused by lung structural damage cannot blindly establish the diagnosis of tuberculosis because they have similar clinical symptoms and imaging manifestations to tuberculosis, let alone because they have a history of tuberculosis, we should strive to obtain pathogenic or pathological evidence for diagnosis and differential diagnosis [27].

Some patients with gastroesophageal reflux disease have only cough and expectoration, which are easily misdiagnosed as respiratory diseases and chronic left heart failure [28]. The term "cough and expectoration ≥ 2 W" in the definition of suspicious symptoms of pulmonary tuberculosis can be appropriately shortened to make use of the timely detection and early treatment of pulmonary tuberculosis cases [30].

In clinical practice, some respiratory diseases can cause the cilia of mucosal epithelial cells to fall off or even cells to degenerate and necrosis, thus reducing the resistance and clearance function of the respiratory tract, often causing a large number of sputum discharge obstacles after severe cough, which troubles patients and family members with panic and confusion, if the treatment is improper, the thick sputum blocks the airway, and the inability to cough leads to asphyxia, even endangering life [33].

There is a certain correlation between the positive grade of acid-fast staining test of sputum smear of pulmonary tuberculosis patients and the length of cough, the number of pulmonary fields involved and whether there is cavity in the focus, and the correlation degree is from weak to strong [36]

Diabetes is a common disease in modern times, and its complication with diabetes ketoacidosis (DKA) is the most common emergency of diabetes [37]. The mortality of DKA is 1% ~ 15%, therefore, once diagnosed, it should be actively treated, the clinical manifestations of DKA are characterized by acute onset, severe illness, rapid change, and often complicated with serious complications [37]. The treatment needs to be timely rescued, fluid replacement, low-dose insulin, correction of electrolyte and acid-base disorders, and elimination of inducements, treatment complications and other aspects are treated at the same time [37]. Patients with no previous history of diabetes are treated with cough and expectoration accompanied by nausea and vomiting, after being admitted into the respiratory department with "acute bronchitis and chronic gastritis", they are diagnosed as "diabetes and diabetes ketoacidosis" through systematic examination, and then transferred to the internal secretion department for treatment [37].

The disease started with "fever, cough, expectoration with shortness of breath", in the middle of the course of the disease, there was blood in sputum; the imaging manifestation was bilateral lung diffuse disease; the disease progressed rapidly; respiratory failure occurred 10 days later; the effect of broad-spectrum antibiotic treatment was not good [42]. After antifungal treatment, the respiratory failure was significantly improved, after the vital signs were stable, bronchoscopy was performed; pathogenic examination and pathological examination of the secretion showed that it was *Aspergillus* infection. In the diagnosis of invasive pulmonary aspergillosis, for patients with normal immunity and no underlying diseases, the collection of special medical history within the first half month of the onset is particularly important, which can help clinicians to early judge and take early treatment, so as to improve the success rate of treatment; for severe pneumonia with such pathogens spreading along the airways, if the condition permits, it is recommended to conduct bronchoscopy at an early stage, which is conducive to early identification of the etiology diagnosis and further guidance for clinical treatment [42].

Cough and expectoration with blood in sputum, and anti-infection treatment is ineffective; two weeks later, left axillary and left supraclavicular mass was found, and left supraclavicular lymph node biopsy was performed; it was considered as invasive or metastatic poorly differentiated adenocarcinoma [43].

Cough and expectoration 5 years after operation for colon cancer and 2 years after operation for rectal cancer. Blood in sputum for half a month. "Patients had a case discussion; the patient had a radical resection of colon cancer five years ago, and had a radical resection of rectal cancer two years ago [44]. At present, multiple lung metastases were found; through multidisciplinary discussion, Opinion 1 believed that although the case had multiple lung metastases, it could still be completely removed, suggesting surgical treatment: Opinion 2 believed that the patient might have potential metastases in other parts except the lung, suggesting conservative treatment and chemotherapy with the FORFIRI regimen, the patient finally underwent surgical resection of the lung. Focus shifting, FOLFIRI scheme was used as adjuvant chemotherapy after operation [44].

Neutrophils, eosinophils and their chemokines Eotaxin, RANTES and other airway inflammatory markers are involved in the cough and sputum response of COPD patients, the levels of eosinophil chemokines Eotaxin and RANTES in sputum are related to the degree of airway inflammation [45].

Esophageal carcinoma is a malignant tumor originating from the esophagus, most of which is squamous cell carcinoma [54]. In clinical practice, progressive dysphagia is the most typical symptom, early symptoms are mostly atypical and easy to be ignored [54]. The main symptoms are poststernal discomfort, burning sensation, acupuncture like or traction like pain, and slight choking sensation, the symptoms in the middle and late stages include progressive dysphagia, food reflux, pharyngeal pain and other symptoms (such as hoarseness caused by compression of the recurrent laryngeal nerve, esophageal bronchial fistula and aspiration pneumonia may occur when the tumor invades adjacent organs with perforation) [54].

Respiratory, circulatory system diseases and other diseases can cause cough and expectoration, based on the clinical manifestations of cough and expectoration, laboratory examination of sputum, and comprehensive analysis of other clinical data, the basic diseases causing cough and expectoration can be diagnosed [64]. Both natural sputum expectoration and induced sputum expectoration can be used for sputum cytological analysis, the two methods have no significant impact on the evaluation of sputum eosinophil ratio, but have an impact on the proportion of neutrophils and macrophages [83].

Primary Sjogren's syndrome is a chronic inflammatory autoimmune disease that mainly involves exocrine glands, its clinical manifestations are mainly impairment of salivary glands and lacrimal glands, resulting in functional decline and dry mouth and eyes, as well as multiple system damage due to involvement of other organs, the patients included in this study were admitted to the hospital because of chronic cough and expectoration, and the treatment effect was not obvious [92]. The results of the antinuclear antibody spectrum were abnormal, after further examination, they were finally diagnosed as primary Sjogren's syndrome [92]. Therefore, patients with respiratory symptoms must be tested for autoantibodies in time to screen for autoimmune diseases and improve the treatment effect [92]

A case of "persistent cough and expectoration", bilateral lung diffuse disease, and pathological change of "bronchiolar mucus hyperplasia" is reported, which is difficult to be diagnosed [95]. The diagnostic problems of this case are raised to improve the diagnosis and differential diagnosis of clinical difficult diseases, and enhance the follow-up awareness of difficult cases, (1) Although histopathology is often used as the "gold standard" for diagnosing diffuse lung diseases, sometimes it cannot answer all clinical questions; (2) The diagnosis and treatment of bronchial mucus hypersecretion disease should be paid enough attention to by clinicians; (3) Close follow-up is an important method for diagnosis of difficult diseases. Clinicians must pay attention to and earnestly practice [95].

Operation mode, guidance method, pain and malnutrition are the main reasons for ineffective cough and expectoration after operation, thoroughly quit smoking before operation, correctly guide cough, expectoration and respiratory exercise, improve cardiopulmonary reserve function, strengthen respiratory management after operation, effectively relieve pain, inhale oxygen, decompress stomach and intestines, and effectively drain chest tubes, all of which are conducive to effective cough and expectoration of patients, prevent pulmonary complications, and promote rehabilitation [96].

The analysis showed that although the positive rate of acid fast bacilli smear was significantly higher in suspected pulmonary tuberculosis patients with cough and expectoration ≥ 3 weeks than in suspected pulmonary tuberculosis patients with cough and expectoration < 3 weeks, however, a considerable number of smear positive pulmonary tuberculosis cases can still be found among those suspected of pulmonary tuberculosis who cough and expectorate for less than 3 weeks [100].

DISCUSSIONS

Feilike capsule is more effective than ambroxol hydrochloride oral solution in improving cough and expectoration symptoms of COVID-19 patients, especially in shortening the course of disease and improving the prognosis of early COVID-19 patients [7].

"Tanreqing" injection can effectively reduce the level of inflammatory factors in patients with fever, cough and expectoration, and improve the symptoms of fever, cough and expectoration, it has a good effect [9]. Posting exercise can improve the spleen and kidney functions, increase "yang qi" in the body, and has significant effects. The value of treating cough and expectoration is worth promoting [11].

The best oxygen flow rate for patients with cough and expectoration in respiratory medicine is 2-4 L/min, which has good effects on cough, inhalation effect and comfort [12].

Traditional Chinese medicine application combined with ear point burying beans can effectively improve patients' cough and expectoration symptoms and improve nursing satisfaction, which is worthy of further promotion in clinical practice [13].

The combination of traditional Chinese and western medicine can have an important impact on the improvement of symptoms of cough and expectoration patients after thyroidectomy, and the patient's satisfaction with nursing is high, so it is recommended to promote the application [14]. Nursing intervention with integrated traditional Chinese and western medicine for patients with cough and expectoration after thyroidectomy can significantly improve the efficacy and quality of life of patients [15].

Through breathing training, it can effectively maintain and increase the activity of the chest, enhance the elasticity of the respiratory muscles, improve the strength of the respiratory muscles and auxiliary muscles, make patients cough and expectorate more smoothly, and reduce the risk of lung infection caused by cough effort and difficulty in discharging airway secretions [16].

Acupoint stimulation has a significant therapeutic effect on cough and expectoration after thyroidectomy, combined with systematic nursing intervention, it further improves the quality of life of patients and promotes the rehabilitation process of patients [18].

The effective rate of ambroxol aerosol inhalation in relieving cough and expectoration is 93%, which is significant, namely, it can rapidly relieve cough symptoms, promote the discharge of sputum, avoid wound bleeding and other complications caused by severe cough, and also reduce the patient's throat pain symptoms, increase the patient's comfort, and help the patient eat [19].

During the treatment of chronic obstructive pulmonary cough and expectoration with traditional Chinese medicine sticking and auricular point seed embedding, the targeted nursing was assisted, which was helpful for symptom recovery and improved nursing satisfaction [20].

Through nursing intervention on the elderly patients with pancreatic disease complicated with pulmonary infection and weak expectoration, the expectoration ability of the patients was significantly restored, and the remission of the disease was improved, the effect was significant [24].

For patients with ineffective cough due to poor cough after esophageal cancer surgery, two methods, namely, finger pressing the trachea above the sternal notch and sputum suction tube stimulating the trachea, should be taken in a timely and correct manner to stimulate patients to cough, thus effectively eliminating sputum to clear the respiratory tract and promote lung recruitment [25].

Massaging Fenglong and Feishu acupoints can help patients with pulmonary distension discharge sputum, reduce the risk of hypostatic pneumonia in hospitalized patients, and improve the quality of life of patients [26].

Massaging Fenglong point can help patients with pulmonary distension to expel sputum, reduce the risk of hypostatic pneumonia in hospitalized patients, and improve their quality of life [99].

Compound methoxyphenamine (Asme) is a compound preparation composed of methoxyphenamine hydrochloride, nacodine, aminophylline and chlorpheniramine, it has cough relieving, expectorant, antiasthmatic, anti-inflammatory and anti-allergic effects, it has been used clinically for more than 20 years, and its efficacy and safety for respiratory diseases are widely recognized by many clinicians and patients [32].

Jiawei Wendan Decoction combined with aerosol inhalation has a significant effect on cough and expectoration symptoms after thyroid surgery, which is worthy of clinical promotion [38].

Acupoint application technology is to make drugs into a certain dosage form and apply them to human acupoints, stimulate acupoints, stimulate meridian qi, and play a therapeutic role, lung cancer is mainly characterized by cough and expectoration, we use traditional Chinese medicine point application to treat lung cancer cough and expectoration [40].

Compound dextromethorphan hydrobromide syrup can treat cough, improve the nature of sputum, and cough easily; the compliance of children is good [61].

Expectoration machine is applied to COPD patients with cough weakness after mechanical ventilation withdrawal and extubation in the Department of respiratory critical illness medicine, which can improve the effect of cough and sputum discharge, improve oxygenation, reduce carbon dioxide retention, reduce the rate of reintubation, shorten the time of non-invasive ventilation and the hospital days after extubation, and improve the efficacy [63].

Asarone has significant effect on cough and expectoration [65].

“Tanreqing” injection is effective and safe in the treatment of cough and expectoration caused by pulmonary tuberculosis combined with infection [69].

The clinical study of Mongolian medicine atomization inhalation therapy to assist in the treatment of chronic cough and expectoration caused by chronic bronchitis, various pneumonia, cor pulmonale with pneumonia, etc. Mongolian medicine belongs to pure plant ingredients, with little local irritation, no side effects, and definite curative effect, which is worthy of clinical application [72].

The application of oxygen driven atomized inhalation of ambroxol hydrochloride in the treatment of children's pneumonia can significantly improve the related symptoms of children [73]. The overall treatment efficiency of pneumonia is higher, and the time to stop coughing, reduce fever, eliminate lung rales, and eliminate cough and sputum is significantly shorter, which can promote the recovery of children's health, and has high clinical promotion value [73].

Through respiratory training for patients with cervical spinal cord injury, it can effectively improve the patient's pulmonary function indicators and the patient's cough and sputum weakness, correct the patient's respiratory function, and promote the patient's subsequent physical recovery, it has high clinical value and is worth widely using and promoting [79].

The combined effect of compound pholcodine syrup and procaine is better than that of procaine, which can be popularized [81].

Salmeterol and fluticasone powder inhalation can effectively improve the clinical symptoms of stable COPD patients, improve the treatment effect, improve the pulmonary function of patients, and effectively reduce airway inflammation, relieve cough, expectoration and other symptoms [91].

Qianhu Ketan Decoction is a prescription created under the guidance of TCM theory to treat cough caused by exogenous wind heat. It takes dispelling external evils as the principle of treatment, clearing heat and expelling lung, relieving cough and resolving phlegm as the treatment method, and uses drugs such as Qianhu, Huangqin, Platycodon grandiflorum, almond, tangerine peel, Pinellia ternate, Poria cocos, licorice to clear heat and regulate lung qi, strengthen spleen and expel phlegm, it can dissipate wind and heat outside, and expel dampness and phlegm inside [98]. In clinical application, it can be flexibly tailored according to the Chinese medicine dialectics; through preliminary experiments, it can be seen that Qianhu expectorant decoction has strong expectorant, antitussive, antiasthmatic effect, the antitussive effect is similar to that of codeine although the expectorant effect is not as good as that of ammonium chloride, it also significantly increases the excretion of phenol red in mice, indicating that it also has an obvious expectorant effect [98]. The anti-asthmatic effect of Qianhu Ketan Decoction is equivalent to that of aminophylline. In addition, Qianhu Ketan Decoction can also significantly reduce the lung index, reduce the pulmonary inflammatory reaction caused by influenza virus, and protect the lungs of mice infected by the virus [98]. The maximum tolerance dose experiment shows that the formula is safe and reliable, and the maximum tolerance dose of mice per day is 167 times of the clinical dose. IgA is the main effect factor of mucosal immunity, it has both immune defense function and can reduce tissue damage caused by inflammation. ICAM-1 is an important inflammatory factor, which can attract white blood cells to swim out, stay at the inflammatory site, activate effector cells, enhance their ability to clear antigen, and aggravate inflammatory reaction.

Mucosal immune experiment proved that Qianhu Ketan Decoction can significantly increase the expression of IgA in the mucosa and inhibit the expression of ICAM-1. This is one of the mechanisms of Qianhu Ketan Decoction to enhance the defense function of the body and inhibit inflammatory response [98].

CONCLUSION

Cough and expectoration are not independent diseases, but one of the symptoms of a certain lung disease, the nature of cough and expectoration can be used to determine the subtle changes of a certain primary lung disease [46]. In particular, if effective measures are not taken to solve the cough and expectoration symptoms of patients with chronic lung diseases in a timely manner, the development and evolution of the primary disease can be aggravated, and the final life is in danger [46].

Coughing and expectoration are the most common symptoms of respiratory diseases. Coughing is a protective reflex action, which helps to clear airway secretions, cough up inhaled foreign bodies, and keep the airway smooth. Sputum expectoration refers to the action of expelling secretions from the respiratory tract out of the mouth by means of ciliary movement of bronchial mucosal epithelial cells, contraction of bronchial smooth muscle and airflow impulse during cough [68]. Sputum expectoration is an important protective physiological function of the body, there are many causes of cough and sputum expectoration, such as bronchial and pulmonary diseases, including pleural and diaphragm diseases, the cough and expectoration of patients with pulmonary tuberculosis are closely related to their condition [68]. Early mild pulmonary tuberculosis may have no cough or only a slight cough or a small amount of white sticky sputum; when the lesions are active, cavities are formed, and endobronchial tuberculosis or bronchiectasis is complicated, the cough is severe and accompanied by a large amount of white mucus sputum, sometimes blood sputum; when secondary infection occurs, there is purulent sputum [68].

① Coughing and expectoration are the first symptoms and main causes of most newly diagnosed patients with suspected pulmonary tuberculosis; the clinical manifestations of 8 diseases such as pneumonia, bronchitis and pleurisy are similar to or similar to that of tuberculosis, and they are the internal diseases that must be identified in the tuberculosis prevention and treatment outpatient department; ② Cough and expectoration ≥ 2 weeks are highly scientific and operable as the recommended/referral indicators for the initial diagnosis of suspected pulmonary tuberculosis; ③ The development of occupational disease diagnosis/identification and experimental antibiotic treatment has improved the accuracy of pulmonary tuberculosis diagnosis, reduced and avoided misdiagnosis, over diagnosis and over treatment [62].

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