Journal of Paediatric Respirology and Critical Care

A girl with persistent bacterial bronchitis

Vivien Chung-Wai MAK 麥中慧

Department of Paediatrics and Adolescent Medicine, Prince of Wales Hospital, Hong Kong

Introduction

Chronic cough is a common complaint in children and it is commonly caused by asthma, allergic rhinitis or post-viral airway hyperresponsiveness. An emerging cause of chronic cough is persistent bacterial bronchitis (PBB). Persistent bacterial bronchitis is the persistent bacterial infection of the conducting airways. The diagnostic criteria includes the presence of isolated chronic (>4 weeks) moist cough, positive bronchoalveolar lavage culture and response to antibiotic treatment with resolution of the cough.

The study from a tertiary centre in Brisbane, Australia showed that up to 40% of the children who presented with chronic moist cough were diagnosed to have persistent bacterial bronchitis.[1] A case of persistent bacterial bronchitis was presented here and the management of PBB was discussed.

Case

The 6-year-old girl, with good past health except allergic rhinitis, was referred to our paediatric out-patient clinic for chronic cough. When she attended our clinic, she already presented with a four-week history of chronic moist cough, which did not respond to symptomatic treatment and one course (7 days) of oral amoxicillin/clavulanic acid. The cough was persistent throughout the day and there was no exacerbation of symptoms at night time. The cough was not exaggerated by exercise. Mild shortness of breath was noticed, which was associated with the coughing bout. Her parents recalled a short period of fever at the beginning of the illness. Otherwise there was no systemic symptom.

Physical examination showed that the patient had good general condition. The growth parameters were within the normal range. She was pink with no respiratory distress nor finger clubbing. There was bilateral diffuse crepitation with occasional rhonchi over the chest. There was neither contact history nor travel history of note.

Email: mcw608@ha.org.hk

However, the chest radiograph showed clear lung fields with no consolidation nor dilated bronchi.

In view of her persistent productive cough, bronchoscopy was performed in this girl, which showed mildly inflamed tracheobronchial mucosa with copious purulent thick secretion seen lining the trachea and right bronchi (Figure 1).

Bronchoalveolar lavage showed a few pus cells. Gram stain showed a few gram negative coccobacilli and a few gram positive cocci. Culture from the bronchoalveolar lavage showed >10,000 CFU/ml *Moraxella catarrhalis* and 1,000 to 10,000 *Streptococcus pneumoniae*. PBB was diagnosed and she was given 2 weeks of oral amoxicillin/clavulanic acid initially (with a total dose of amoxicillin ~80 mg/kg/day) and was given a follow up appointment in 2 weeks. During the follow up, she was found to have partial resolution of cough with incomplete compliance with the antibiotics treatment. The antibiotics were continued for a total of 6 weeks. After completion of antibiotics, she had complete resolution of the troubling moist cough.

Other investigations had been performed to look for any other underlying disease or abnormality associated with chronic cough. The result of nasal brushing for electronic microscopy to look for primary ciliary dyskinesia was essentially normal with some non-specific change. The complete blood picture showed borderline elevated eosinophil level. Skin prick test demonstrated she was allergic to house dust mite. The immunologlobulin pattern was unremarkable. Spirometry was attempted but failed to obtain interpretable results because of poor technique due to her young age.

Discussion

Chronic cough is a common complaint in paediatric practice. There are a number of different differential diagnoses which can present as chronic cough. The differential diagnoses include asthma, persistent bacterial bronchitis, chronic suppurative lung disease and bronchiectasis, congenital airway abnormalities, foreign body aspiration, chronic or less common

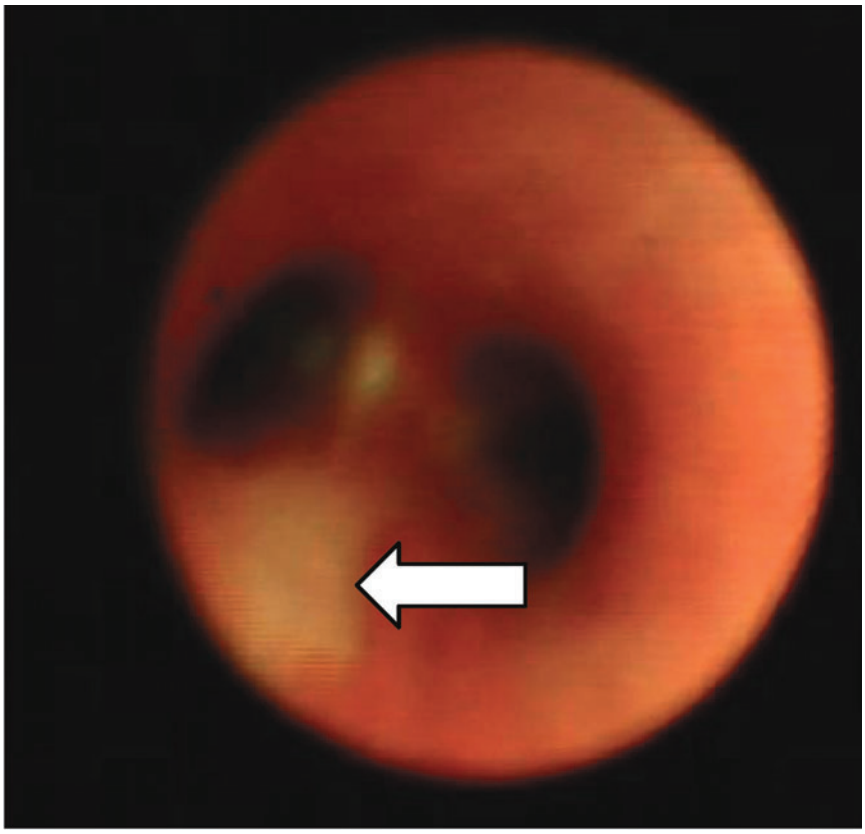

Figure 1. Bronchoscopy showed inflamed tracheobronchial mucosa with copious whitish thick secretion (arrow) seen lining the trachea and right bronchi.

infections, interstitial lung disease or extrapulmonary causes, e.g. cardiac abnormalities, ear conditions, gastroesophageal reflux, and etc.

Children with chronic cough warrant detailed evaluation, including lung function assessment (difficult in those aged less than 3 to 6-year-old), atopy workup like skin prick test, eosinophil count, thorax CT scan, flexible bronchoscopy with BAL for fat-laden macrophage and quantitative bacterial culture, 24 hours esophageal pH study and swallowing study.

It was postulated that untreated persistent bacterial bronchitis is the precursor of chronic suppurative lung disease and bronchiectasis.[2,3] Correct diagnosis and early appropriate treatment may enable the recovery of endobronchial infection and inflammation, reverse the endobronchial damage, thus may prevent the patient from progressing to chronic suppurative lung disease and bronchiectasis.

The diagnostic approach to chronic cough should begin with careful history taking. A few key elements should be included in the history. Age and circumstances of symptoms onset and duration of symptoms are important. Children with persistent bacterial bronchitis typically have a prolonged productive cough which lasted for at least 4 weeks. Patient with foreign body aspiration can also present with chronic productive cough and the cough that begins suddenly while playing or eating, especially in the toddlers, should raise the suspicion of an aspirated foreign body in the airway.

The nature of cough is also important. In patient with persistent bacterial bronchitis, the cough is usually described as chronic, wet cough. The patient may or may not have purulent sputum as young child may not be able to cough out the sputum. Occasionally, parents may notice some rattling sound when the child coughs, which represent the excessive secretion in

the larger airways. In contrast to PBB, in children with frequent viral infections, there is resolution of coughs for at least a few days to weeks between episodes. The chronic cough in asthma patient is typically described as non-productive, which occurs following exposure of characteristic asthma triggers, and typically worsens during sleep. The wheeze in asthma patient is usually musical, compared with the rattling sound in patient with persistent bacterial bronchitis. In patient with allergic rhinitis, the cough often associated with change of body position, while cough due to bronchiectasis typically is worst and most productive early in the day.

The symptom of a chronic wet cough, with or without production of purulent sputum, is always pathologic and warrants investigations for a persistent bacterial bronchitis or chronic suppurative lung disease, retained airway foreign body, or immunodeficiency.

Chest radiograph must be taken in patient who presented with chronic productive cough. The chest radiograph in patient with PBB may be clear. Bilateral peribronchial accentuation ("cuffing") may be present, which suggests diffuse airway inflammation or infection.[1,4]

As there are some overlapping symptoms for asthma and PBB, lung function test may help to differentiate between the two. Spirometry results which show obstructive lung disease or airway reversibility may point to the diagnosis of asthma, but we should bear in mind that the two conditions may co-exist. Allergy test, including skin prick test or radioallergosorbent test (RAST) should be considered in patient with chronic cough, to confirm atopy that may support diagnosis of allergic rhinitis and/or asthma.

Bronchoscopy is a useful diagnostic tool in patient with PBB. Bronchoscopy may reveal inflamed endobronchial mucosa and secretion in the airway in patient with PBB. Microscopy and culture of bronchoalveolar lavage may reveal organisms that commonly cause PBB. It is also an important diagnostic and therapeutic tool in children with chronic wet cough who is suspected to have foreign body aspiration. Bronchial brushing can also be taken for patients with suspected primary ciliary dyskinesia, although nasal brushing also can be used in diagnosing primary ciliary dyskinesia.

Gastroesophageal pH monitoring is indicated in patient who is suspected to have gastroesophageal reflux disease, especially in patients with symptoms of frequent vomiting or heart burn, cough in the first hour after meals, or which is worse while supine.

Tuberculin skin testing should be considered in patient with chronic productive cough especially if there are systemic symptoms suggestive of tuberculosis, or if the child has history of household contact of adults with pulmonary tuberculosis.

Persistent bacterial bronchitis as an important differential diagnosis in children with chronic cough

Persistent bacterial bronchitis is defined as: (1) presence of isolated chronic (>4 weeks) wet/moist cough, (2) resolution of cough with antibiotic treatment, and (3) absence of pointers suggestive of alternative specific cause of cough.[1,4] Persistent bacterial bronchitis (PBB) is increasingly recognised as a cause of chronic wet cough in children. Children who have persistent bacterial bronchitis are typically young (<5 years of age, median age: 3 years) and do not have any other systemic symptoms. Some parents may report rattling noise from the airway, which actually represents the secretion from the airway. The most common pathogens causing PBB are *Haemophilus influenzae*, *Streptococcus pneumoniae* and *Moraxella catarrhalis*.[1,4]

It was believed that children with PBB have impaired mucocillary clearance, due to immature immune dysfunction or immature adaptive immunity. The "Vicious Cycle Hypothesis" is used to explain the pathogenesis of PBB. The impaired mucocillary clearance will lead to colonisation of bacteria, which causes endobronchial infection, which will in turn stimulate the mucus production and cause collateral damage, which will further impair the mucocillary clearance.[5-7]

The approach to treatment was high-dose antibiotic treatment capable of treating *Haemophilus influenzae* and *Streptococcus pneumoniae* for 2 weeks and then to review the response to treatment. If the cough cleared, the antibiotic was continued for a further 4-6 weeks, to allow eradication of infection and then to keep the airways clear of infection while the repair process takes places.

References

1. Marchant JM, Masters IB, Taylor SM, Cox NC, Seymour GJ, Chang AB. Evaluation and outcome of young children with chronic cough. Chest 2006;129(5):1132-41.
2. Stockley RA. Lung infections. 1. Role of bacteria in the pathogenesis and progression of acute and chronic lung infection. Thorax 1998;53(1):58-62.
3. Chang AB, Redding GJ, Everard ML. State of the art - Chronic wet cough: protracted bronchitis, chronic suppurative lung disease and bronchiectasis. Pediatr Pulmonol 2008;43(6):519-31.
4. Donnelly D, Critchlow A, Everard ML. Outcomes in children treated for persistent bacterial bronchitis. Thorax 2007;62(1):80-4.
5. Darelid J, Lofgren S, Malmvall BE. Erythromycin treatment is beneficial for longstanding Moraxella catarrhalis associated cough in children. Scand J Infect Dis 1993;25(3):323-9.
6. Gottfarb P, Brauner A. Children with persistent cough-outcome with treatment and role of Moraxella catarrhalis? Scand J Infect Dis 1994;26(5):545-51.
7. Marchant JM, Morris P, Gaffney J, Chang AB. Antibiotics for prolonged moist cough in children. Cochrane Database Syst Rev 2005;(4):CD004822.