NON-CYSTIC FIBROSIS BRONCHIECTASIS

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Bronchiectasis (BE) is characterized by irreversible dilation of the airways associated with frequent bacterial infections and inflammatory destruction of the bronchial and peribronchial tissue. BE has become an uncommon entity and has thus been named an “orphan” disease. Although morbidity and mortality caused by BE seem to be declining in Western countries, the condition is still one of the most common reasons for morbidity in developing countries. Improvement in vaccination programmes, tuberculosis control programs, prevention of diseases like measles and pertussis and treatment of lower respiratory tract infections with appropriate antibiotics contributed to the decreased incidence of BE in developed countries. In a study done in 1963, the prevalence of BE was found to be 1/10000 in Scotland. In Finland, the incidence has been estimated to be 3.9/100.000. Estimates of the incidence of this entity in Western type populations are increasing progressively as ever more sensitive methods are introduced into routine use, although many of these “new” cases will tend to be found at the milder end of the disease spectrum. Eastham et al. reported a prevalence of 1/5800 in North East of England and suggested HRCT defined non-CF BE is not an uncommon problem in developed countries. In recent years, the rates of bronchiectasis for Indigenous children from remote Australian communities are unacceptably high, with a study showing 14.7/1000 Aboriginal children. Twiss et al. described the results of a national survey of pediatricians from New Zealand which suggests that the incidence of non-CF BE in this diverse population is in the region of 3.7 per 100.000 with a prevalence of 1 in 3000. They reported a much higher incidence of BE in at-risk groups such as Maoris and Pacific Island children resident in New Zealand in whom a rate of up to 19.4 per 100.000 has been estimated.

Eastham et al. suggested that the nomenclature of this group of disorders in children should be improved. They proposed that chronic suppurative lung disease of childhood may be viewed as a disease spectrum comprising three interrelated components: pre-bronchiectasis, HRCT BE, and established BE. In pre-bronchiectasis; chronic or recurrent bacterial endobronchial infection which may be associated with non-specific changes such as bronchial wall thickening on the HRCT scan. This condition may persist, resolve or progress to “HRCT BE”. In HRCT BE; the clinical features are associated with HRCT evidence of bronchial dilation. This entity may persist, progress to established BE, return to a pre-bronchiectatic state, or
resolve entirely. In established BE; the HRCT findings have not resolved after a significant period, two years are suggested. This condition should be regarded as irreversible. Children with pre-bronchiectasis are presumably suffering from a form of chronic bronchitis. Persistent endobronchial infection in the developing child appears to be associated with the subsequent development of BE, whereas this does not appear to be the case for adult patients. Long term epidemiological studies will be required to establish details of the interrelationships and prognoses for three diseases entities. The pathogenesis of BE is incompletely understood. The most commonly proposed pathophysiological mechanism is the “vicious cycle theory” whereby an initial insult damages the respiratory tract resulting in impaired mucociliary clearance. This leads to chronic bacterial infection associated with a persistent inflammatory response producing fibrotic changes. The initial trigger is often infective although other factors must also be considered, particularly those predispose to bronchial and pulmonary infection including immunodeficiency and anatomical abnormalities of the airways. Bronchiectasis should be suspected in any child with recurrent lower respiratory tract infection, prolonged moist-sounding cough, exertional dyspnoea, symptoms of reactive airways disease, growth failure, hyperinflation of lungs, chest deformity or digital clubbing. The clinical case definition of bronchiectasis is imprecise and its severity and extent is highly variable, ranging from mild respiratory morbidity to death. The principal aims of investigations in children with suspected bronchiectasis are to confirm the diagnosis, to define the distribution and severity of airway involvement, and to identify familial and treatable causes of bronchiectasis. The basic diagnostic algorithm includes obtaining specimens of airway secretions for bacterial culture, radiological investigations, sweat test, and immune function tests. Other investigations may clearly be required according to the clinical picture. Most young children will not expectorate sputum and so cough swab or nasopharyngeal aspirate are frequently required. Interpretation of the significance of these findings can sometimes be difficult as the most common pathogens isolated are *H. influenzae* and *S. pneumococcus* which may also be upper airway commensals. Bronchoscopy is a useful tool which may reveal evidence of previously unrecognised endobronchial infection and also helps to differentiate between upper airway colonisation and true endobronchial infection. Radiological changes have long been reported in BE, initially using plain chest radiography and bronchography, followed by HRCT. The plain chest radiograph is of very limited use, as it lacks sensitivity and may be totally normal even in children with significant bronchiectatic changes on HRCT. HRCT is now accepted as the “gold” standard for making the diagnosis.
Chest HRCT should identify congenital lesions and determine the extent and severity of disease. Typical HRCT findings of bronchiectasis include "signet-ring" appearance (dilated bronchus compared with adjacent pulmonary artery), loss of bronchial tapering, and end-expiratory scans showing increased translucency in areas of air trapping from small-airways disease. Lung function tests are non-specific, but in older children provide a measure of functional impairment and small-airways involvement.

All children with BE should be investigated for an underlying cause. Previous studies have reported that an underlying cause for BE can be determined in about 46-82% of patients. With improving diagnostic techniques the proportion of idiopathic patients may change, especially with recognition of more subtle immunological abnormalities and improving facilities for the assessment of primary ciliary dyskinesia (PCD). Evaluation of immunodeficiency, cystic fibrosis, chronic aspirations and other predisposing factors must be considered according to the clinical picture. Recurrent respiratory infections, immune deficiency, retained foreign bodies, asthma, tuberculosis and primary ciliary dyskinesia are some of the more common risk factors.

The importance of lung damage occurring after pneumonia, pertussis, measles or tuberculosis as a cause of BE is difficult to estimate, but is still the most common cause in developing countries. Postinfectious BE in the normal host is becoming distinctly uncommon, and in developed countries, most patients with the disorder have an underlying systemic illness. In the series of patients from developed countries, the most commonly reported initial insult appears to be a previous pneumonic illness which accounted for 30% of the cases. This is in contrast to 66-69% of cases in developing countries where conditions such as measles, pertussis and tuberculosis are more prevalent. Studies on the effect of pneumonic illness on the development of BE are complicated by the fact that there is often a considerable delay between the acute illness and the recognition chronic lung disease. Mantoux test is required if a child have risk factors for tuberculosis.

Where immunodeficiency is suspected, immunoglobulin G and its subclasses, immunoglobulins A,M and E should be measured. Measurements of IgG subclass levels should be performed even if total IgG levels are found to be normal. Identification of immunodeficiency in these patients is important since they may benefit from replacement therapy. Functional antibodies should also be measured to common childhood immunisations such as the pneumococcal, diphtheria and pertussis vaccines. Cellular immunity should be assessed by quantifying T and B-cell subsets.
PCD is a rare but important cause of BE because early diagnosis and treatment appears to improve the prognosis. A history of sinusitis, draining ears and suppurative cough would warrant investigations to exclude PCD. Screening tests for PCD include nasal nitric oxide and in vivo tests of ciliary motility such as the saccharin test. Specific diagnosis requires examination of cilia by light and electron microscopy, with epithelial culture in doubtful cases.

Prolonged presence of a foreign body within the airway can result in the development of bronchiectasis. In a long-term follow-up of foreign body aspiration, BE was found in 25% of the patients who were diagnosed after more than 30 days of aspiration.

Diagnosing the underlying etiology of BE is so important as it may enable many advantages in the management of the disease. In a study from UK, it has been shown that knowing the etiology may lead a change in management of non-CF BE. In this study, immunodeficiency, aspiration and primary ciliary dyskinesia accounted for 67% of the cases and in 56% of the children, the identification of a cause led to a specific change in management. In another study by Chang et al. the majority of the patients did not have a treatable underlying cause, investigations had significant impact on management in only 12.5% of BE patients.

In conclusion, BE remains a disease of concern to pediatricians, particularly in developing countries. Infections remain as important causes of BE in developing countries. Over the last decade there has been a significant improvement in our ability to recognise non-CF BE in children. It is unlikely that many of the underlying causes of this problem will be eradicated in the near future, and so it must be expected that with increasing awareness and ever improving technology this diagnosis will be made with increasing frequency. Especially in childhood, a causative approach enables an effective treatment and a change in the natural course of the disease. As BE is associated with ongoing inflammation, follow-up of patients using inflammatory markers may improve patient care as well.

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