Pulmonary Tuberculosis: A Predominant Cause of Childhood Bronchiectasis in India


Abstract

Objective: This study was conducted to evaluate the clinicodemographic and etiological profile of pediatric patients with bronchiectasis in a tertiary care center in New Delhi, India.

Methods: A retrospective study of patients diagnosed with bronchiectasis was conducted at the Department of Pediatrics of a tertiary care teaching hospital in Northern India. A total of 31 cases of bronchiectasis were reviewed, those were diagnosed at our center between July 2011 and December 2013. The diagnosis was confirmed using high-resolution computed tomography. Medical records were analyzed for demographic data, clinical presentation, pulmonary function testing, and microbial isolation. All patients underwent a comprehensive examination to identify etiologic factors.

Results: A total of 31 cases were diagnosed with bronchiectasis of which 15 (48.38%) were male and 16 (51.61%) were female. The median age at the time of the diagnosis of bronchiectasis was 12 years (IQR = 4, range = 4 months - 17 years). Persistent wet cough was the most common symptom. The underlying etiologies could be identified in 19 patients (58.06%). Pulmonary tuberculosis was identified as the most common etiology (10/19 i.e. 52.63%). Other causes that could be identified were bronchial asthma (2/19), gastroesophageal reflux disease (2/19), cystic fibrosis (2/19), X-linked hyper-IgM syndrome (1/19), primary ciliary dyskinesia (1/19), and spinal muscular atrophy (1/19).

Conclusion: Tuberculosis is a major cause of childhood bronchiectasis in India. Early diagnosis and treatment directed towards the underlying cause is vital to prevent further progression of the disease.

Keywords: Bronchiectasis, Children, Indian, Tuberculosis.

Introduction

Bronchiectasis is defined as permanent and abnormal dilation of the bronchi caused by destruction of the elastic and muscular components of the bronchial wall. Cystic fibrosis (CF) is the most common cause of bronchiectasis in western countries, and other etiologies include various respiratory infections such as pneumonia, pertussis, measles, and tuberculosis. Recurrent pneumonia is considered the major preceding factor leading to bronchial damage. The pathogenesis and therapy of bronchiectasis has often been neglected and has even been called the "orphan disease". High-resolution computed tomography is the most reliable non invasive method for assessing the degree of bronchial wall dilatation, and thus bronchiectasis can be accurately diagnosed by using HRCT. Due to introduction of routine vaccination and the widespread use of antibiotics, the incidence and prevalence of post infectious bronchiectasis is considered to be declining. To the best of our knowledge, no comprehensive review of the clinical features of bronchiectasis among Indian children has been published in the last two decades.

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We retrospectively analyzed 31 cases of bronchiectasis in a tertiary care children's hospital of Northern India for clinical, etiological, radiographic, and spirometric features.

**Materials and Methods**

This study was carried out at a tertiary care teaching hospital of Northern India. Retrospective analyses of medical records were done for all patients who had attended the pediatric pulmonology clinic during the period January 2011 to December 2013. Subjects under 18 years of age, diagnosed with bronchiectasis were included in this study. Bronchiectasis was confirmed using findings of the high-resolution computed tomography (HRCT) scans. The diagnosis of bronchiectasis was based on bronchial dilatation with abnormal bronchial tapering, bronchial wall thickening, or mucus plugging in small peripheral airways observed in HRCT.

We evaluated the age, gender, initial symptoms, and underlying etiology including microbiological analysis. The anatomical distribution of bronchiectasis was also identified radiologically. Investigations were performed to determine the underlying etiology of bronchiectasis depending on clinical discretion, which included bacterial and fungal culture of sputum, Gastric aspiration (GA) for Acid Fast Bacilli (AFB), Mantoux test, Gastroesophageal scan, barium swallow study, bronchoalveolar lavage (BAL), sweat chloride test, serum immunoglobulin profile and nitroblue tetrazolium test. Spirometry was performed in 16 patients. Three acceptable maneuvers were performed, and the best value of forced expiratory volume in the first second (FEV1), its corresponding forced vital capacity (FVC), and FEV1/FVC ratio were recorded. Bronchiectasis was defined as idiopathic if extensive investigations failed to identify an underlying cause.

The data was analyzed using standard statistical software SPSS 17, Chicago, IL, USA. The demographic data and pulmonary function parameters were expressed as median and interquartile range; and 95% confidence interval was considered.

**Results**

Thirty one patients (15 males and 16 females) participated (fig. 1). The median age of the patients was 12 years (IQR = 4, range = 4 months - 18 years). At the time of diagnosis, the main symptoms were chronic wet cough (100%), repeated respiratory infections (19.35%), dyspnea (38.70%), wheezing (38.7%), fever (64.51%), chest pain (6.45%), weight loss (16.13%), and hemoptysis (9.68%) (table 1).

![Figure 1.Age distribution of the 31 children with bronchiectasis](image-url)
Symptoms | Number of Cases (%)  
--- | ---  
Chronic wet cough | 31 (100)  
Recurrent respiratory infections | 6 (19.35)  
Fever | 20 (64.51)  
Chest pain | 2 (6.45)  
Dyspnea | 12 (38.70)  
Hemoptysis | 3 (9.68)  
Weight loss | 5 (16.12)  
Crepitations | 17 (54.83)  
Wheeze | 12 (38.70)  
Clubbing | 7 (22.58)  

Table 1. Clinical presentation at the time of diagnosis

Pulmonary tuberculosis was identified as the most common etiology (10/19 i.e. 52.63%). 7 out of 10 patients of Tubercular bronchiectasis had family history of tuberculosis. One patient of pulmonary tuberculosis was found to be HIV Elisa positive. Two children had persistent asthma and bronchiectasis developed in these patients about 4 years after the diagnosis of asthma. Specific IgE for Aspergillus was negative in these two patients. GERD was diagnosed as the underlying etiology in two children on the basis of abnormal gastroesophageal reflux (GER) scan. Two children were diagnosed as cystic fibrosis on the basis of abnormal sweat chloride test. One patient (3.22%) was diagnosed with X-Linked Hyper IgM syndrome. Primary ciliary dyskinesia was clinically diagnosed in a 16 years old girl who had bilateral maxillary sinusitis, situs inversus and bronchiectasis. A 13 years old boy, diagnosed with spinal muscular atrophy type 2 (SMA type 2), developed bronchiectasis 7 years after the diagnosis. The remaining 12 subjects were classified as idiopathic bronchiectasis (table 2).

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary tuberculosis</td>
<td>10 (32.25)</td>
</tr>
<tr>
<td>Bronchial asthma</td>
<td>2 (6.45)</td>
</tr>
<tr>
<td>Aspiration syndrome</td>
<td>2 (6.45)</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>2 (6.45)</td>
</tr>
<tr>
<td>X-Linked Hyper IgM syndrome</td>
<td>1 (3.22)</td>
</tr>
<tr>
<td>Primary ciliary dyskinesia</td>
<td>1 (3.22)</td>
</tr>
<tr>
<td>Spinal muscular atrophy type 2 with scoliosis</td>
<td>1 (3.22)</td>
</tr>
<tr>
<td>Unknown causes</td>
<td>12 (38.70)</td>
</tr>
</tbody>
</table>

Table 2. Etiological Profile of Bronchiectasis

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Number performed</th>
<th>Number abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchoscopy with alveolar lavage</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Immunological work up</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Mantoux test</td>
<td>28</td>
<td>10</td>
</tr>
<tr>
<td>Sputum microscopy for AFB</td>
<td>27</td>
<td>7</td>
</tr>
<tr>
<td>Sweat chloride test</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Gastroesophageal (GER) scan</td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3. Investigation profile

Spirometry was performed in 16 patients. Forced vital capacity (Mean: 67.38± 3.84, Median: 69 IQR: 18, 95% CI: 59.17-75.58) and Forced expiratory volume in one second (65.44-3.51, Median: 68.50 IQR: 18, 95% CI: 57.95-72.92) and FEV1/FVC (Mean: 97.72± 3.84, Median: 96.80 IQR: 10.71, 95% CI: 93.92-101.51) were found to be universally low.

Left lower lobe (LLL) was commonly involved in 14 (45.16%), right middle lobe (RML) in 13 (41.93%), and right lower lobe (RLL) in 12 (38.70%) of the patients; lingula in 6 (19.35%),
right upper lobe (RUL) in 11 (35.48%) and left upper lobe (LUL) in 11 (35.48%) of the patients. We did not observe any specific anatomical distribution of the disease.

Bronchoscopy along with BAL was performed in 25 of the 31 patients. A total of 22 patients had sinus X-ray, and 4 patients had CT scan. Sinusitis was detected in 5 (16.12%) of the 22 patients.

Respiratory cultures (sputum, induced sputum and bronchoalveolar lavage) were done according to the patient’s ability to perform. Mycobacterium tuberculosis culture was positive in 6 patients. 6 patients were positive for AFB staining in GA. 7 patients of pulmonary TB were positive for TB specific Polymerase Chain Reaction (PCR) in GA. 8 patients of pulmonary TB were AFB positive in sputum. Klebsiella pneumoniae was isolated in induced sputum of two patients. BAL was positive for Klebsiella pneumoniae and Pseudomonas aeruginosa in one patient each.

Discussion

Bronchiectasis is a relatively frequent complication of lower respiratory tract infections and remains a persistent problem in children from developing countries.3 7

Predisposing factors such as immunodeficiency, Cystic fibrosis, and chronic aspiration should be considered according to clinical features. Post infectious etiology including Tuberculosis is still the most common cause of bronchiectasis in developing nations.3 7

In our study, bronchiectasis occurred before 5 years of age in 6 patients (14.28%). As bronchiectasis presents no pathognomonic symptoms, identifying the etiologic factors based only on clinical symptoms, may have been difficult. We found that the majority of children suffering from bronchiectasis were > 9 years of age. For patients below 9 years of age, few pediatricians considered bronchiectasis and HRCT was not regularly performed.

This study revealed chronic wet cough as the most common symptom (table 1); this finding is comparable to the other studies.11 14 Twelve patients (38.70%) in our study group had recurrent wheezing as the main symptom. A previous study reported wheezing as the main symptom in 20% of children with bronchiectasis.8 Hemoptysis is a relatively rare phenomena in pediatric bronchiectasis.13 In our study, hemoptysis was noted in three patients (9.68%). Clubbing of the fingers was present in seven patients (22.58%). Previous studies reported clubbing of the fingers in 3-51% of cases.12 13 14

In this study, bronchiectatic lesions were identified most commonly in the left lower lobe, followed by the right middle lobe and right lower lobe. Idiopathic bronchiectasis occurs predominantly in the lower lobe, bronchiectasis due to primary ciliary dyskinesia in the middle lobe, and bronchiectasis due to hypogammaglobulinemia in the lower/ middle lobe and lingual segment.12 13 16 Bronchiectatic lesions were most commonly found in the lower lobes, which could probably be explained by decreased mucociliary clearance from lower lobes.8 13 However, whether the distribution of bronchiectasis be sufficiently characteristic for a specific diagnosis, is still controversial.17 18

In this study, post tubercular bronchiectasis was identified in 10 patients (32.25%). Lodha et al. identified post- tubercular etiology in 31.6% cases of bronchiectasis.19 No predisposing factors were found in 12 (38.70%) patients with the exclusion of asthma (n = 2), immunodeficiency (n = 1), chronic aspiration syndrome (n = 2), cystic fibrosis (n = 2), PCD (n = 1), and SMA type 2 (n = 1).

The incidence of idiopathic bronchiectasis in this study was lower than that of previous studies. Other studies reported 14- 48% cases of idiopathic bronchiectasis.20 21 These results suggest that further diagnostic investigations are necessary to identify the etiologic factors.

To prevent bronchiectasis progression, accurate identification and proper treatment of the underlying disease is important. However, the effect of different treatment modalities on the natural course of childhood bronchiectasis has not been studied.22

Most studies have agreed that aggressive drug therapy should be conducted before surgical treatment, and some reports of effective surgical treatment have been published.23 24

However, no significant difference in clinical improvement between medical and surgical treatment was observed.25 In our study group, no patient was treated with surgery.

Being a retrospective study, we could not track the progression of the radiological abnormalities and course of the disease. Our data is limited to children evaluated in our specialty clinic. All
children were not subjected to a uniform set of investigations.

Tuberculosis remains an important etiology of pediatric bronchiectasis. Prompt identification and appropriate management of childhood tuberculosis may be an effective strategy in the prevention of bronchiectasis.

References