DISSERTATION ON

THE ETIOLOGICAL, EPIDEMIOLOGICAL AND CLINICAL PROFILE IN CASES OF BRONCHIECTASIS AMONG CHILDREN LESS THAN TWELVE YEARS OF AGE AS SEEN IN AN URBAN REFERRAL CENTRE

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CERTIFICATE

Certified that this dissertation titled **"The etiological, epidemiological and clinical profile in cases of bronchiectasis among children less than twelve years of age as seen in an urban referral centre"** is a bonafide work done by **Dr.Srinivas K.G, M.D.,** Post graduate, Institute of Child Health and Hospital for Children, Madras Medical College, Chennai ,during the academic year 2006-2009.

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CONTENTS

INTRODUCTION

Bronchiectasis was often called as an 'orphan disease' for the last two decades as its incidence decreased markedly and became an uncommon clinical entity among adults and children in developed countries[1]. But in developing countries like India its frequency is still higher where measles, pneumonia, tuberculosis, and HIV infection are all on the rise and are associated with bronchiectasis[1].

Bronchiectasis is defined as a permanent abnormal dilatation of one or more segmental bronchi, which typically involves the second to sixth order of segmental bronchi [2] (diameter greater than 2 mm).

It was first described by **René Laennec** (inventor of the stethoscope) in 1819 based on examination of postmortem specimens and observing patients with tuberculosis and the sequelae of pneumonia in the pre-antibiotic era.[3] The term Bronchiectasis is derived from the Greek *bronchion*, meaning windpipe, and *ektasis*, meaning stretched. Bronchiectasis is characterized by the permanent dilatation of bronchi with destruction of elastic and muscular components of their walls. Bronchiectasis can be focal or diffuse. It is usually due to acute or chronic infection, anatomic airway obstruction, or underlying congenital disease that predisposes to chronic infection[5].

Since the first report of Bronchiectasis by Laennec in 1819, an extensive literature has accumulated describing the natural history of the disease based on both clinical and experimental observations. There has been a dramatic change during the antibiotic era in the pathogenesis, clinical manifestation, treatment and prognosis of Bronchiectasis.[4] The natural history of Bronchiectasis is strikingly different as compared to the pre-antibiotic era.[4, 23] But even then there are many patients in the developing countries who have had measles, pneumonia, tuberculosis and pertusis and have not been treated early or adequately to prevent the development of Bronchiectasis.[4]

In India, bronchiectasis is the third commonest non-tubercular respiratory disease in adults and its incidence in general population is still on higher side[4]. The problem of bronchiectasis gets complicated due to the interaction of various factors like infection, growth and malnutrition in children. The exact incidence, clinical profile and the radiological abnormalities in children have not been reported in the Indian literature[4].

Like any other chronic disease, prevention is the only way to effectively reduce the incidence as there is no effective therapy, once the disease is established and permanent damage occurred. Henceforth it is important to know the etiological and epidemiological factors of

bronchiectasis which will be helpful in preventing this permanent damage.[6]

The present study pertains to bronchiectasis as is seen in hospital practice in south India. An attempt has been made to review the broad spectrum of clinical manifestation and to elicit the association of etiological and epidemiological factors of Bronchiectasis in children.

Types of Bronchiectasis[7]

Morphologically bronchiectasis is classified as follows:

A. Cylindrical or fusiform – This type of bronchiectasis occurs in early stages when the bronchial cartilages are intact. This is of reversible type.

B. Varicose type – Alternate constriction and dilatation, intertents between cylindrical and saccular types.

C. Cystic or sacclar – In this type airway cartilage is destroyed and the bronchi are dilated to form rounded blind sacs, which usually do not communicate with parenchyma. This is of irreversible type.

Common sites of Bronchiectasis[4]

In cystic fibrosis there will be diffuse and bilateral bronchiectasis.

In other causes bronchiectasis follows a segmental distribution.

Commonly involved segments:

A. Left lower lobe segments

B. Right lower lobe

C. Right middle lobe

D. Lingular segments of left lobe

Etiology [6]

A. **Infections** Tuberculosis

Severe pneumonia

Measles

Pertussis

Adenovirus

Allergic bronchopulmonary aspergillosis

Mycoplasma

HIV

B. **Obstruction** Foreign body (retained)

Extrinsic compression (Adenopathy or any mass)

C. **Congenital anomalies** Abnormal tracheo bronchial development

Mounier-Kuhn syndrome (Tracheo bronchomegaly)

Williams-Campbell syndrome, (congenital absence of bronchial Cartilage or Rings)

Tracheo broncho malacia

Mac Leod syndrome (Unilateral congenital emphysema)

D. **Inherited causes** Cystic fibrosis

Alfa1 anti trypsin deficiency,

Collagen vascular disease (Ehler Danlos syndrome, Marfans syndrome)

Congenital immunodeficiency (Immunoglobulin A (IgA), IgG deficiencies and IgG subclass deficiencies, especially IgG2 deficiency, Bruton -agammaglobulinemia)

Yellow nail syndrome

Young syndrome

		Primary ciliary dyskinesia (kartageners syndrome and Immotile cilia syndrome)
E.	**Chronic aspiration**	Gastroesophageal reflux
		Tracheoesophageal fistula/ Aspiration
F.	**Others**	Persistent atelectasis
		Fibrosing lung diseases associated with sarcoidosis
		Idiopathic pulmonary fibrosis
		Connective tissue disorders (rheumatoid arthritis and systemic lupus erythematosus)

Pathology / Pathogenesis

Various theories have been put forth which are as below:

A. Atelectasis theory – Negative intrapleural pressure and positive intramural pressure will distend the alveoli.

B. Infection theory – It is largely the infection, inflammatory response to the infection which results in damage to the supporting bronchial walls and subsequent bronchiectasis.

C. Secretion theory – The thick secretions destructs and mechanically distends the airways and the dilatation persists even after removal of the obstruction.

D. Traction theory – Peribronchial inflammation causes fibrosis which produces traction of the wall.

Obstruction can occur because of tumor, foreign body, impacted mucus caused by poor mucociliary clearance, external compression, bronchial webs, and atresia[8].

Infections due to Bordetella pertussis, measles, rubella, togavirus, respiratory syncytial virus, and Mycobacterium tuberculosis induce chronic inflammation, progressive bronchial wall damage, and dilatation[8].

Chronic inflammation similarly contributes to the mechanism by which obstruction leads to bronchiectasis. The mechanism by which bronchiectasis occurs in congenital forms is likely related to abnormal cartilage formation. The common thread in the pathogenesis of bronchiectasis is difficulty clearing secretions and recurrent infections with a "vicious cycle" of infection and inflammation resulting in airway injury and remodeling[8]. The damage may result from chronic infection that leads to recruitment of neutrophils, T lymphocytes, and monocyte-

derived cytokines. The release of inflammatory mediators, elastases, and collagenases leads to inflammation and destruction of elastic and muscular components of bronchial walls. In addition, the outward elastic recoil forces of surrounding lung parenchyma exert traction, which causes expansion of airway diameter.

CLINICAL APPROACH

History:

1. Age of onset:

Onset of symptoms should be enquired. onset soon after birth increases the possibility of presence of hereditary/congenital disorder.

2. Cough:

- Bronchiectasis in children presents with a wide spectrum of disease severity. Some children have intermittent symptoms of cough and occasional lower respiratory tract infections. Others experience daily cough and produce purulent fetid sputum, requiring frequent hospitalizations for respiratory exacerbations.

- The diagnosis should be considered in children with a daily productive cough for longer than 6 weeks.

- One should ask about the onset, duration and diurinal variation, aggravating and relieving factors and postural variation.

- Cough is an almost universal symptom and is frequently described as productive in older children or loose in toddlers and infants. Because small children rarely expectorate, the clinician may observe the child with a loose-sounding cough who swallows after coughing.

3. Recurrent lower respiratory tract infection

It is very important to ask about the history which is suggestive of recurrent respiratory infection which can give clue to the diagnosis. And how often the child is admitted to treat this problem .one should also enquire about the duration of hospital stay during each episode.

4. Hemoptysis

If the child presents with Hemoptysis one should enquire the following:

- Frequency
- Duration
- Fresh or altered blood
- Seen alone or associated with purulent sputum

5. The following should also be enquired:

- Whether the child had wheezing or noisy breathing
- Loss of weight/loss of appetite
- Breathlessness
- Prolonged fever / exanthematous illness / diarrheal illness / dermatological problems
- Halitosis
- History suggestive of chronic sinusitis Choking / aspiration / persistent vomiting
- Contact with tuberculosis

- Any previous treatment including anti-tubercular treatment
- Family history of asthma
- History of atopic / allergic lesions
- Low birth weight / birth asphyxia / meconium aspiration/any other problems during neonatal period.
- Immunization should be enquired including BCG and pneumococcal vaccines.

Examination:

On examination one should look for general condition of the child and tachypnea, chest retractions or subcostal retractions.

General findings like pallor, clubbing, lymphadenopathy, cyanosis and nutritional status, should be noted.

To look for BCG scar and external markers of TB like phlecten, erythema nodosum, carie spine which will give additional clue to the diagnosis.

Upper respiratory system should be looked thoroughly including sinuses and nasopharynx and to look for nasal polyps if any. Lower respiratory examination should be done in detail which may reveal coarse

crepitation over the affected area on auscaltation. Other systems also to be examined which will be helpful to make the diagnosis.

Lab Investigation:

Laboratory investigation should include the following tests:

- CBC count
- Peripheral smear
- ESR
- Parenteral screening for tuberculosis
- Tuberculin skin test
- Sputum for AFB
- Sputum C/S for Mycobacterium tuberculosis
- BAL for AFB
- Sweat chloride test
- Serum IgG, immunoglobulin M (IgM), and IgA
- IgG and its subclasses
- HIV Tests

- Sputum culture or deep oropharyngeal swab in younger children
- Antinuclear antibody and rheumatoid factor

Imaging Studies

Because bronchiectasis is defined as an abnormal dilatation of airways, the diagnosis depends on radiographically or anatomically visualizing the typical changes.

- Chest radiography: Obtain a routine posteroanterior and lateral chest radiograph. However, normal radiograph findings do not rule out bronchiectasis[22].
- Computed tomography[7]
    - The diagnosis is usually established using high-resolution CT (HRCT) scanning, which has a sensitivity and specificity of more than 90%[7].
    - The key feature on HRCT scanning is an enlarged internal bronchial diameter with bronchi that appear larger than the accompanying artery, called the signet sign. Other HRCT scan findings include the failure of the larger airways to taper while progressing to the lung periphery, air fluid

levels in the dilated airways, and the identification of airways in the extreme lung periphery.

Investigation for Gastroesophageal reflux disease [5]

- Evaluate patients suspected of having bronchiectasis for GERD, especially infants and young children.
- Studies may include barium esophagraphy, gastric scintiscanning, and intraesophageal pH monitoring.
- Suspicion of poor oromotor coordination should lead to a swallow study.

Flexible fiber optic bronchoscopy; is very useful modality especially to rule out congenital airway anomalies like Tracheomalacia, Bronchomalacia. It is also very useful in visualizing missed foreign bodies, which can be the causative factor for Bronchiectasis[6].

Treatment [8]

The initial therapy for patients with bronchiectasis is medical and aims at decreasing airway obstruction and controlling infection. Chest physiotherapy (postural drainage), antibiotics, and bronchodilators are essential. 2 to 4 wk of parenteral antibiotics are often necessary to manage acute exacerbations adequately. Antibiotic choice is dictated by

the identification and sensitivity of organisms found on deep throat, sputum (induced or spontaneous), or bronchoalveolar lavage fluid cultures. Chronic prophylactic oral (macrolide) or nebulized antibiotics may be beneficial. Any underlying disorder (immunodeficiency, aspiration) that may be contributing must be addressed. When localized bronchiectasis becomes more severe or resistant to medical management, segmental or lobar resection may be warranted. Lung transplantation can also be performed in patients with bronchiectasis.

Prognosis[8]Overall, the prognosis for patients with bronchiectasis has improved considerably in the past few decades. Earlier recognition or prevention of predisposing conditions, more powerful and wide-spectrum antibiotics, and improved surgical outcomes are likely reasons.

REVIEW OF LITERATURE

Hanaa Hasan Banjar, et al[9] studied a group of 151 cases to know the etiological factors and diseases associated with pediatric noncystic fibrosis bronchiectasis in a tertiary care center in Saudi Arabia. It was a retrospective review of all patients with confirmed noncystic fibrosis (Non-CF) bronchiectasis by chest X-ray and/or CT chest in a pulmonary clinic during the period 1993-2005 at a tertiary care center in Riyadh.

A total of 151 cases were diagnosed as Non-CF bronchiectasis. Seventy-five (49.7%) were male, 76 (50.3%) were female; 148 (98%) are alive and 3 (2%) died. The south western regions constituted 72 (50%) of the cases. There was a period of [5 ± 3.2] years between the start of symptoms and diagnosis of bronchiectasis. More than two-thirds of the patients had cough, tachypnea, wheezing, sputum production and failure to thrive. Ninety-one (60%) had associated diseases: Pulmonary diseases in 48 (32%), immunodeficiency in 27 (18%), central nervous system anomalies in 10 (7%), cardiac in 10 (7%) and asthma in 103 (68%) of the patients. Left lower lobe was commonly involved in 114 (76%) patients. Sixty-eight (67%) were found to have sinusitis. More than two-thirds of patients had two or more associated diseases. Forty-nine (32%) developed gastroesophageal reflux. Hemophilus influenza was cultured in

56 (37%), strept pneumoniae in 25 (17%) and pseudomonas aeruginosa in 24 (16%) of the patients. Eighty percent of the patients who had pulmonary function test had abnormal changes. Disease progression was related to development of symptoms before 5 years of age, persistent atelectasis and right lower lobe involvement ($P < 0.05$).

Twiss J, et al[10] studied 65 cases to know the etiological factors in bronchiectasis at Starship Children's Hospital, Auckland District Health Board, Auckland, New Zealand during 2001 and 2002. Cases were followed up by postal questionnaire one year after diagnosis. Demographic, aetiological, and severity data were collected. Ninety nine notifications were received. Sixty five cases were confirmed. An overall incidence of 3.7 per 100,000 under 15 year old children per year was estimated. Incidence was highest in Pacific children at 17.8 compared with 4.8 in Maori, 1.5 in NZ European, and 2.4 other per 100,000 per year. Incidence varied significantly by region. The median age at diagnosis was 5.2 years; the majority had symptoms for more than two years. Eighty three per cent had bilateral disease, with a median of three lobes affected, mean FEV1 of 77% predicted, and modified Bhalla HRCT score of 18.

K. K. Khanna, et al[4] from the Department of Paediatrics, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, studied 30 cases of bronchiectasis in childhood. 46.7% of the cases were in the age range of five to eight years and 36.6% in the age range of nine to twelve years. Male: female ratio was found to be 2.8:1. Predisposing factors were not found in 50 per cent of the cases. Foreign body aspiration as the cause of bronchiectasis was not seen at all. Cough with expectoration was the commonest symptom which was present in 64.4% of cases followed by haemoptysis which was present in 38% of cases Clubbing was found in 56.7% of the cases. Unilateral bronchiectasis was more common than bilateral. Lingular involvement alone was not demonstrated. The posterior basal segment of the left lower lobe was the segment affected most often saccular bronchiectasis was the commonest morphological variety followed by mixed and tubular bronchiectasis.

C. Elaine Field, et al[11] from the Hospital for Sick Children, Great Ormond Street, and the University College Hospital, London, studied 160 cases of irreversible bronchiectasis in childhood. From the history given by the parents, it was found that the age at onset of symptoms lay in the first year of life in approximately one fifth of the cases, the number thereafter declining with advancing age (except for a slight and possibly

insignificant rise at age 5). In 55.6% of cases the parental history associated the onset of symptoms with an attack of pneumonia or pertussis.

The characteristic features of the disease included a constant cough with or without sputum (this is often swallowed by children). Haemoptysis was rare, but in 33.1% of cases there were associated asthmatic symptoms. More children were underweight than overweight for age and many had abnormal chest deformities. Clubbing occurred in 43.7% and when present was diagnostic of irreversible bronchiectasis in this series. Physical signs in the chest were variable, but the most useful diagnostic finding was localized rales on deep inspiration over the suspected area of lung.

In comparison with children having nonpulmonary causes and normal children, there was a marked increased incidence of pneumonia at all ages. There was, however, no suggestion that bronchiectasis increased or decreased susceptibility to tuberculosis. Sinusitis is frequently associated with bronchiectasis. Tubular dilatation was the commonest type of bronchiectasis.

In 85.6% of cases the disease was situated in the left lower lobe, and in 65.6%, in the lingula lobe, but in no case was the lingular affected

as the only lobe. The disease has shown a predilection for lobes whose bronchi are directed upwards against gravity towards the main bronchus and those which have an anatomic peculiarity impeding drainage. Massive collapse of the lung was associated with bronchiectasis in 74 (46.3%) cases. It is important to recognize in children that bronchial dilatation may be reversible. In the diagnosis of irreversibility, duration of the dilatation and its contour are helpful. Bronchoscopy was not helpful in diagnosis or localization of bronchiectasis. The sedimentation rate was frequently raised, but was of little help in assessing activity of the disease. Alterations in the blood count were few and usually only of significance in severe active cases of the disease. Complications were infrequent, the commonest being pneumonia which occurred in 16.3% of cases.

Valeray PC, et al[12] studied 61 cases of bronchiectasis at Queensland Institute of Medical Research, Population Studies and Human Genetics, Brisbane, Australia. A medical record-based case-control study of bronchiectasis in Indigenous children was conducted. Controls (183), matched to cases (61) by gender, age and year of diagnosis, were Indigenous children hospitalized with other conditions. There was a strong association between a history of hospitalized pneumonia and bronchiectasis [odds ratio (OR), 15.2; 95% confidence interval (95% CI) 4.4-52.7]. This was particularly evident in recurrent

hospitalized pneumonia (P for trend < 0.01), severe pneumonia episodes with longer hospital stay (P for trend < 0.01), presence of atelectasis (OR 11.9; 95% CI 3.1-45.9) and requirement for oxygen (P for trend < 0.01). The overall number of pneumonia episodes, rather than its site, was associated with bronchiectasis. Although the total number of pneumonia episodes in the first year of life did not increase the risk of bronchiectasis, more severe episodes early in life did. Malnutrition, premature birth and being small for gestational age were more common findings among cases. Breast-feeding appeared to be a protective factor (OR 0.2; 95% CI 0.1-0.7).

Berman DM, et al[13] studied risk factors for the development of bronchiectasis in HIV-1 infected children at the University of Miami School of Medicine, Jackson Memorial Medical Center, Miami, Florida. This study was a retrospective, case controlled study based upon medical record review of HIV-1 infected children receiving primary care at a single large, urban medical center in Miami, Florida. Cases (HIV-1 infected children who developed bronchiectasis while being cared for between January 1982 and September 2000) were matched 1:3 (birth +/- 24 months) with controls (HIV-1 infected children without bronchiectasis). Variables analyzed including number of episodes of pneumonia (including Pneumocystis jiroveci pneumonitis [PCP],

lymphoid interstitial pneumonitis (LIP), and CDC category of immunosuppression) were noted in both cases and controls until the age at which the cases developed bronchiectasis. Of the 749 patients whose charts were reviewed, 43 met the case definition for bronchiectasis and 19 met the eligibility criteria for this study. Fifty-seven controls were randomly selected from the patients without bronchiectasis. Cases were more likely to have experienced recurrent pneumonia than the controls; 17 (89.5%) versus 5 children (8.8%) respectively (P-value <or=0.001) as well as a greater mean number of episodes of pneumonia 8.2 (range, 4-13) versus 1.45 (range, 0-9) respectively (CI = (5.58, 7.82); P-value <or=0.001). Cases were more likely to have progressed to CDC immunological category 3 than the controls; 19 (100%) versus 32 (56%) children respectively (P-value <0.001). LIP occurred more frequently in the cases than in the controls; 14/19 (73.6%) versus 19/57 (33.3%), respectively (P-value = 0.005). HIV-1 infected children with a history of recurrent pneumonia, profound immuno-suppression (CDC immunologic category 3), and LIP appear to have a higher risk of developing bronchiectasis.

David A. Spencer, et al[14] studied 93 children at Dept of Pulmonology, Keimyung University School of Medicine, Taegu, Korea In his study the following observations were made male to female ratio

was 2:1. Median age at symptom onset was 1,1 years (0 – 16) and of diagnosis was 7,2 years (1,6 – 18,8). The referral diagnosis of asthma was refuted in 39 of 45 cases. Associations were previous pneumonic illness (30 perc.), immunocompromise (21 perc.), obliterative bronchiolitis (9 perc.), congenital lung abnormality (5 perc.), chronic aspiration (3 perc.), eosinophilic oesophagitis (2 perc.), familial syndrome (2 perc.), primary ciliary dyskinesia (1 perc.) and right middle lobe syndrome (1 perc.). Chest radiograph and high resolution computer tomography scan agreed for diagnosis and lobe affected in only 5 perc. cases.

KM Eastham, et al[15] studied 93 children at pediatric respiratory unit in Newcastle. The HRCT diagnosis was based on one or more of the following four findings: cross sectional diameter of at least one bronchus greater than that of the accompanying pulmonary artery, mucoid impaction within a dilated bronchus, bronchi non-tapering in longitudinal cuts, and bronchi visible adjacent to non-mediastinal pleura. The 93 children were aged up to 16 years (median 1.1 years) at the onset of symptoms and two thirds were boys. The age at HRCT diagnosis was 1.6–18.8 years (median 7.2 years) and the time from symptom onset to diagnosis was 0.2–14.8 years (median 3.0 years). Most bronchiectasis was post pneumonic (28 cases, 30%); 19 cases (21%) were associated with immunodeficiency or immunosuppression, and 17 (18%) were idiopathic.

Among the immunoincompetent group four children had chronic grandomatous disease and one agammaglobulinaemia; five had had heart transplants and one had been treated for leukaemia. Deficiencies of IgA, IgG_2, IgG_3, or specific antibodies were demonstrated in a number of children. Other conditions associated with bronchiectasis included bronchiolitis obliterans (8 cases), congenital lung abnormality (4), and chronic aspiration (3). Almost half of the children (45) had a referral diagnosis of asthma, erroneous in 39 cases. The organisms most commonly isolated from the 93 children were *Haemophilus influenzae*, *Streptococcus pneumoniae*, and *Moraxella catharalis*. Eighty-one children had had a chest X-ray in the 12 months before the HRCT diagnosis but only five reports accurately predicted the HRCT findings. Repeat HRCT scanning was done for 18 children 18 months to 5 years after the diagnostic scan; in six cases there had been complete resolution of the bronchiectasis, six had remained the same, five had progressed, and in one case there had been improvement but not complete resolution.

Tsao PC, et al[16] studied 21 children at Department of Pediatrics, Taipei Veterans General Hospital the diagnosis was based on the history of recurrent cough with fetid sputum, hemoptysis, or recurrent lobar pneumonia for months at least and radiological findings of lobar infiltration, tram-track like patterns, bronchiolar dilatation or honeycomb

patterns. The diagnostic examinations included chest plain radiography, bronchography and chest computed tomography (CT) scans. Respiratory tract infections were the commonest cause predisposing to bronchiectasis in our study. Tuberculosis is not rare in this study. In recent years, immunodeficiency disorders have been recognized. Most patients suffered from recurrent cough and fetid sputum for years before diagnosis was established. Hemoptysis was the second common symptom in our study. The plain chest radiograph of bronchiectasis revealed dilatation of bronchial trees with honeycomb pattern or infiltration only. In recent years, chest CT became the most accurate and being noninvasive diagnostic tool. The initial treatment was primarily medical conservative therapy. Only five patients in our cases underwent pulmonary resection due to persistent hemoptysis, recurrent bacterial pneumonia or pulmonary parenchyma destruction. Most patients still suffered from recurrent pneumonia or occasional exacerbation in the long-term follow-up.

Karadag B, et al[17] studied 111 children with bronchiectasis at Division of Pediatric Pulmonology, Marmara University, Istanbul, Turkey. General characteristics and underlying causes were recorded from the medical records. Clinical outcomes were evaluated in terms of lung function tests, annual exacerbation rates and patient/parent perception of health status. RESULTS: Mean age of the patients was

7.4 +/- 3.7 years at presentation, and patients had been followed 4.7 +/- 2.7 years on average. In 62.2% of the patients, an underlying etiology was identified, whereas post infectious bronchiectasis was the most common (29.7%). In spite of intensive medical treatment, 23.4% of the patients required surgery. The annual lower respiratory infection rate has decreased from a mean of 6.6 +/- 4.0 to 2.9 +/- 2.9 during follow-up ($p < 0.0001$). Lung function tests were also found to be improved (mean FEV1% 63.3 +/- 21.0 vs. 73.9 +/- 27.9; $p = 0.01$; mean FVC% 68.1 +/- 22.2 vs. 74.0 +/- 24.8; $p = 0.04$). There was clinical improvement in both the surgical (73%) and medical (70.1%) groups ($p > 0.05$).

Lai SH, et al[18] studied 29 cases of bronchiectasis at Division of Pulmonology, Department of Pediatrics, Chang Gung Children's Hospital, Taipei, Taiwan Using a retrospective chart review, 29 cases of bronchiectasis were diagnosed from 1991 through 2001. For each case, the diagnosis was confirmed using high-resolution computed tomography. Medical records were analyzed for demographic data, clinical presentation, spirometric data, and microbial isolation. Radiographic findings were reviewed, and possible causes of bronchiectasis were also identified. RESULTS: There were 17 girls and 12 boys enrolled. Persistent cough, daily sputum production, and hemoptysis were common presenting symptoms. Crackles and wheezing

were the most frequent findings during the physical examination. Previous lower airway infection, asthma, and primary immunodeficiency were the most common, but 31.0% of the cases had unknown causes. Dependent lobes were involved more frequently. Simultaneous sinusitis was noted in 70.6% of the cases. Spirometry showed mild airway obstruction in most of the cases. Most specimens (52.2%) from lower airway secretions yielded bacterial pathogens, most commonly Pseudomonas aeruginosa, Haemophilus influenzae and Streptococcus pneumoniae.

Li AM, **Sonnappa S, et al**[19] studied 136 cases of bronchiectasis in children at Dept. of Pediatric Respiratory Medicine, Royal Brompton Hospital, London, UK. A total of 136 patients were identified; there were 65 young males and the group median (range) age was 12.1 yrs (3.1-18.1). Immunodeficiency, aspiration and primary ciliary dyskinesia accounted for 67% of the cases. In 77 (56%) children, the identification of a cause led to a specific change in management. There was no association between aetiology and the distribution of CT abnormalities.

JUSTIFICATION FOR THE STUDY

- Bronchiectasis contributes to a significant proportion of morbidity and mortality due to chronic lower respiratory tract infections.

- Very few studies have been done in this field world wide and most of them were done in western countries.

- The etiological and epidemiological profile in Indian children is expected to be different.

- The outcome of the study is expected to throw new light on this perplexing problem and can be helpful in the preventive aspect of this chronic lung disease, which causes permanent sequelae in the lower respiratory tract.

AIM OF THE STUDY

To know the etiological, epidemiological and clinical profile of bronchiectasis in children below 12 years of age as seen in an urban referral centre.

METHODOLOGY

STUDY POPULATION

All children below 12 years of age, admitted in our institute with clinical and radiological evidence of bronchiectasis.

STUDY PLACE

Institute of Child Health and Hospital for Children, Egmore, Chennai

STUDY PERIOD

1st December 2006 to 30th November 2008

STUDY DESIGN

Descriptive study

STUDY MANOEUVRE

Inclusion criteria

- All children less than 12 years of age admitted at ICH and HC.
- All children who were clinically diagnosed as bronchiectasis.
- Children with radiological diagnosis like chest X-ray / CT / HRCT.

All children included in this study were subjected to a detailed history regarding time of onset of symptoms and their nature and severity. History suggestive of recurrent respiratory tract infections and prolonged fever, number of hospitalizations were sought. History of contact with an open case of tuberculosis and treatment so far obtained including Antitubercular drugs was scrutinized. History regarding aspiration, choking, halitosis, exanthematous fever, diarrheal illness, dermatological problem was specifically sought. A thorough clinical observation was performed in all these patients with specific regards to anthropometry and signs suggesting chronicity of the disease process. Upper airways and lower respiratory system were thoroughly examined, as were the other systems.

All of these children were subjected to the following investigations:

- Complete blood count
- Peripheral smear
- ESR
- Mantoux
- RGJ for AFB staining and culture
- Sputum for AFB staining and culture
- Chest X-Ray / X-Ray sinuses
- High resolution computed tomography
- Bronchoalveolar lavage for
- Cytology
- Lipid laden macrophages
- Bacterial culture including Mycobacteria
- Fungal staining and culture
- Fiber optic bronchoscopy

- HIV screening and test
- Parental screening for TB

Additional investigations listed below were performed in selected cases as guided by the clinical suspicion:

- Immunoglobulins assay
- Sweat Chloride Test
- Upper GI scopy
- Barium Swallow
- PCR for Tuberculosis
- ECHO

All the children were followed up clinically and radiologically at periodic intervals. The details of these children were collected through a structured proforma and statistical analysis was done.

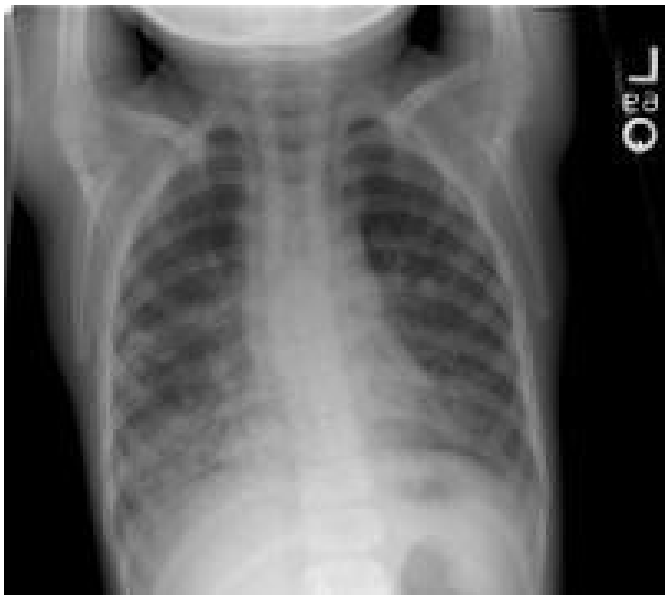


Figure 1 : Posteroanterior chest radiograph of a child with bronchiectasis

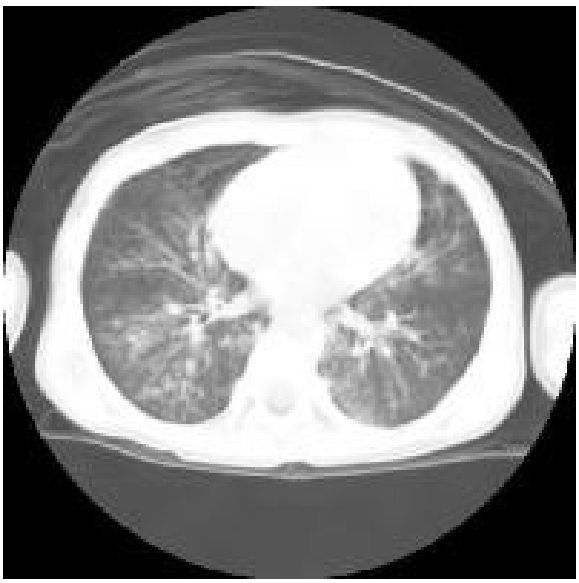


Figure 2: CT scan of the chest of a child with bronchiectasis

OBSERVATIONS

Total Number of cases studied : 96

Total Number of Male Patients : 49

Total Number of Female Patients : 47
Total Number of Cases in which etiological diagnosis identified : 86

Total Number of Cases in which etiological diagnosis not identified : 10

Statistics of lower respiratory disorders in ICH & HC in the last 5 yrs is given below:

Table 1 : STATISTICS OF LOWER RESPIRATORY DISORDERS AT ICH & HC

		Lower Respiratory disorder	
Years	**Total no of cases**	**Acute cases**	**Chronic cases**
2003	2933	895	2038
2004	2541	630	1911
2005	2360	658	1702
2006	2631	632	1999
2007	2582	569	2013

Statistics of bronchiectasis in ICH & HC in the last 5 yrs is given below:

Table 2 : CASE DISTRIBUTION OF BRONCHIECTASIS IN ICH FOR THE PAST 5 YRS

Years	Total	Male	Female	Death
2003	87	47	40	3
2004	44	24	20	2
2005	41	24	17	2
2006	48	31	17	2
2007	53	27	26	2
2008 till November 30	48	24	24	1

A total of 96 cases were recruited in the study.

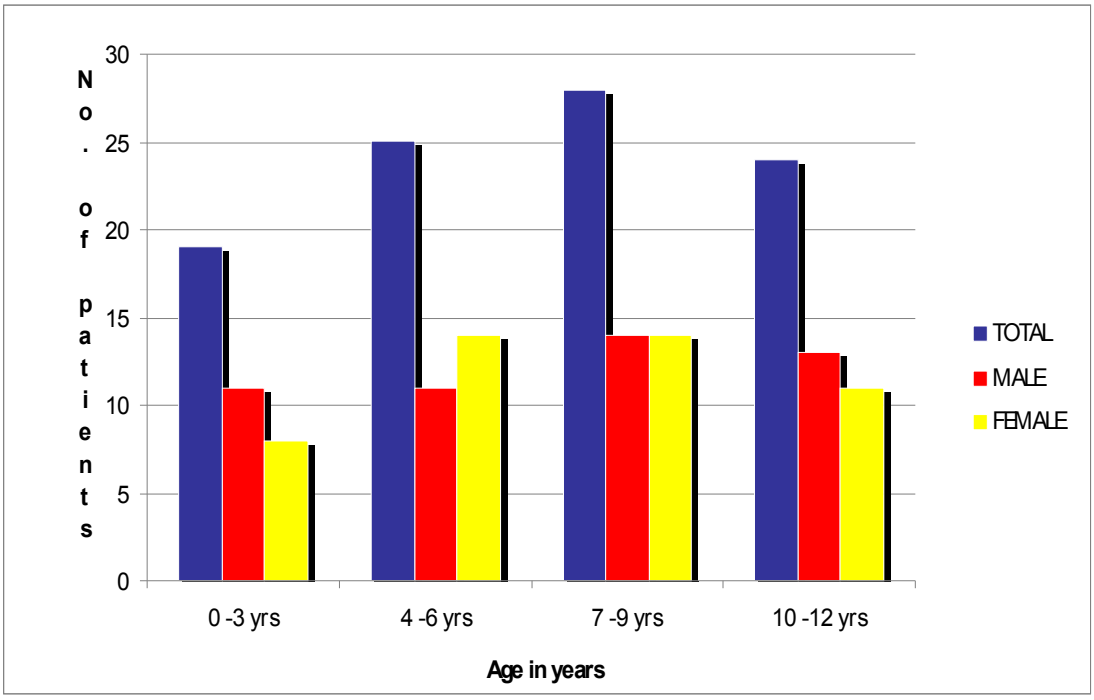
Males outnumbered females. Forty-nine (51.1 %) of the total number of children were males and forty seven (48.9%) were females.

In our study population 45.8% of all the patients were below 6 yrs of age and 54.2% of all the children were between the age group of 6 and 12 yrs. Females outnumbered males in the age group of 4 to 6 yrs (Table 3).

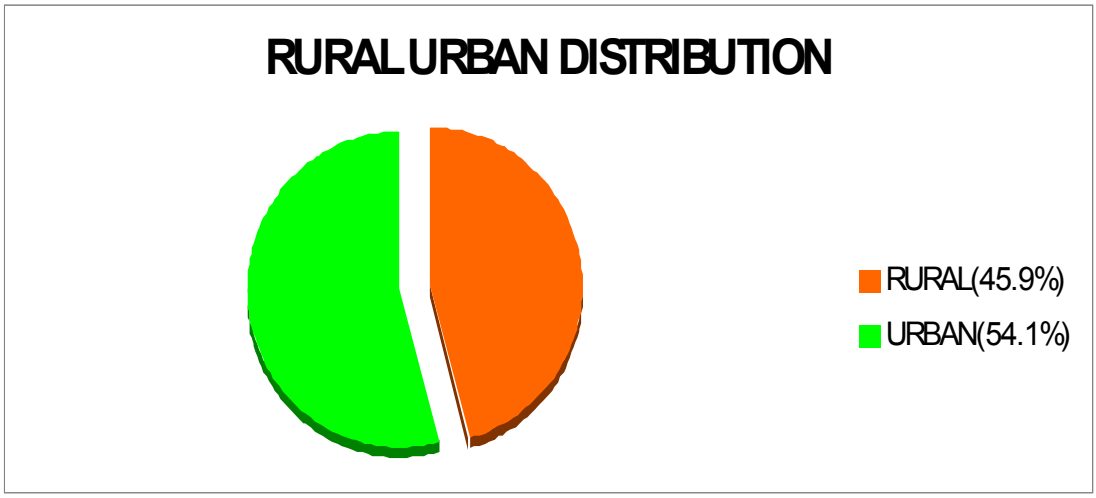
Table 3 : AGE AND SEX DISTRIBUTION

AGE (in years)	TOTAL (96)	MALE	FEMALE
0 – 3 yrs	19 (19.8%)	11 (57.9%)	8 (42.1%)
4 – 6 yrs	25 (26%)	11 (44%)	14 (56%)
7 – 9 yrs	28 (29.2%)	14 (50%)	14 (50%)
10 – 12 yrs	24 (25%)	13 (54.2%)	11 (45.8%)

The age and sex distribution in our study population is shown in the bar diagram below:



In our study population urban children outnumbered rural children constituting about 54.1% of all the children and 45.9% were from rural population.



In our study population majority of the children were belonged to class IV socio economic class (according to modified Kuppuswamy scale) constituting about 55.2% of the total study population and 38.5% of the total belonged to class III socio economic class. None of the children belonged to class I socioeconomic class (Table 4).

Table 4 : SOCIAL ECONOMIC STATUS – MODIFIED KUPPUSWAMY SCALE

	TOTAL (96)	RURAL	URBAN
CLASS I	-	-	-
CLASS II	6 (6.3%)	2 (33.3%)	4 (66.7%)
CLASS III	37 (38.5%)	14 (37.8%)	23 (62.2%)
CLASS IV	53 (55.2%)	28 (52.8%)	25 (47.2%)

The duration between onset of symptoms and presentation was noted. Overall, the duration was between one to two years in 50% of the children. Among the age group of 0 to 3 years it was less than one year in 47.3% and between one to two years in 52.6%. The duration for more than 3 yrs was commonly observed in the age group of 10 to 12 yrs, which was 54.2%. The median age at presentation was 4.5 years.

Cough was the universal complaint, but cough with expectoration was mainly seen in the age group of 7 to 12 yrs (75% -79.2%). Breathlessness was one of the major complaints (52.1%). Hemoptysis was seen mainly in the age group of 7 to 12 yrs (46.4% -54.1%). Loss of weight was mainly seen in the group of 10 to 12 yrs (70.8%). Chest pain and wheeze were in lesser proportion of the patients.

Clubbing was noticed in 38.5% of the total study population, which was mainly seen in the age group of 10 to 12 yrs (58.3%). Pallor was noticed in 39.6% and lymphadenopathy was seen in 26.0% (Table 5).

Table 5: SYMPTOMS AND SIGNS IN CASES OF BRONCHIECTASIS

SYMPTOMS		**TOTAL 96**	**0 -3 yrs 19(19.8%)**	**4-6 yrs 25(26%)**	**7 -9 yrs 28(29.2%)**	**10 -12 yrs 24(25%)**
Duration between onset and presentation	**< 1 yr**	17(17.7%)	9(47.3%)	3(12%)	3(10.7%)	2(8.3%)
	1-2 yr	48(50%)	10(52.6%)	14(56%)	15(53.5%)	9(37.5%)
	3-5 yr	31(32.2%)	-	8((32%)	10(35.8%)	13(54.2%)
Cough		96 (100%)	19 (100%)	25 (100%)	28 (100%)	24 (100%)
Cough& expectoration		54 (56.3%)	-	14(56.0%)	21(75.0%)	19(79.2%)
Breathlessness		50 (52.1%)	8(42.1%)	11(40.0%)	16(57.1%)	15(62.5%)
Chest pain		12 (12.5%)	-	2(8.0%)	4(14.2%)	6(25.0%)
Wheeze		20 (20.8%)	-	3(12.0%)	10(35.7%)	7(29.1%)
Loss of wt		35 (36.4%)	-	4(16%)	14(50.0%)	17(70.8%)
Hemoptysis		29 (30.2%)	-	3(12.0%)	13(46.4%)	13(54.1%)
Persistent vomiting		8 (8.3%)	4(21.05%)	3(12.0%)	-	1(4.1%)
Clubbing		37 (38.5%)	-	7(28%)	16(57.1%)	14(58.3%)
Pallor		38 (39.6%)	4(21.05%)	12(48%)	14(50.0%)	8(33.3%)
Lymphadenopathy		25 (26.0%)	3(15.7%)	8(32%)	6(21.4%)	8(33.3%)

Protein energy malnutrition was found to be a common accompaniment with Bronchiectasis. Only 7(19.4%) of the total 36 in the

age group of 0 to 5 yrs, had normal nutritional status with regard to their weight for age according to Indian Academy of Pediatrics classification of Protein energy malnutrition. While 3(8.3%) had Grade 1 PEM, 13(36.1%) had Grade 2 PEM, 10(27.7%) had Grade 3 PEM and 3 (8.3%) had Grade 4 PEM.

In the age group of 6 to 12 yrs, 34 (56.6%) were undernourished and remaining 26 (43.4%) were normally nourished according to WHO charts (Table 6 and Table 7).

Table 6 : NUTRITIONAL STATUS IN CHILDREN WITH BRONCHIECTASIS OF AGE 0 -5 YRS (ACCORDING TO IAP CLASSIFICATION) (n = 36)

Wt for age	**Total (36)**	**< 1 yr (9)**	**1.1- 3 yrs (10)**	**3.1 – 5 yrs (17)**
Normal	7 (19.4%)	1 (11.1%)	3 (30%)	3 (17.6%)
Grade I PEM	3 (8.3%)	1 (11.1%)	-	2 (11.7%)
Grade II PEM	13 (36.1%)	5 (55.5%)	3 (30%)	5 (29.4%)
Grade III PEM	10 (27.7%)	2 (22.2%)	2 (20%)	6 (35.2%)
Grade IV PEM	3 (8.3%)	-	2 (20%)	1 (5.9%)

Table 7 : NUTRITIONAL STATUS IN CHILDREN WITH BRONCHIECTASIS

	Total (60)	**5.1-9 yrs (36)**	**9.1 -12 yrs (24)**
Undernourished	34 (56.6%)	19 (52.7%)	15 (62.5%)
Normally nourished	26 (43.4%)	17 (47.3%)	9 (37.5%)

After detailed etiological work up, tuberculosis was found be one of the major etiological factors in bronchiectasis contributing for 22.9% of the total cases and majority were in the age group of 7 to 12 yrs (21.4 % - 45.8%). Persistent or recurrent pneumonia was the other major etiological factor contributing nearly 16%, in which measles contributed for about 3.1% of the total cases. Aspiration was equally contributing for about 14 % of the cases in which majority of the cases was in the age group of 0 to 3 yrs.

Bronchial asthma contributed for 10.4% and congenital airway anomaly accounted for 9.4% in which all the cases were below 6 yrs of age. Immunodeficiency including HIV contributed for 7.3% and foreign body aspiration accounted for 7.3% of all the cases. Muco –ciliary disorder accounted for 3% of the cases.

The underlying etiology remained elusive in 10% of the cases, in spite of detailed work up (Table 8).

Table 8 : ETIOLOGICAL PROFILE IN BRONCHIECTASIS

ETIOLOGICAL FACTORS		**AGE in years**				
		TOTAL (96)	**0 – 3 (19)**	**4 – 6 (25)**	**7 – 9 (28)**	**10 – 12 (24)**
TUBER CULOSIS	**TB /EBTB**	22 (22.9%)	1 (5.3%)	4 (16%)	6 (21.4%)	11(45.8%)
PNEUMONIA	**Persistent/Recurrent Pneumonia**	12 (12.5%)	1 (5.3%)	4 (16%)	5 (17.9%)	2 (8.3%)
	Measles	3 (3.1%)	3 (15.8%)	-	-	-
ASPIRATION SYNDROME	**Tracheo-esophageal fistula/ Aspiration**	8 (8.3%)	5 (26.3%)	3 (12%)	-	-
	Gastro esophageal reflux / Aspiration	5 (5.2%)	2 (10.5%)	2 (8%)	-	1 (4.2%)
BRONCHIAL ASTHMA	**Asthma/Allergic disorders**	10 (10.4%)	-	-	7 (25%)	3(12.5%)
AIRWAY ANOMALY	**Tracheo-Broncho malacia**	9 (9.4%)	2 (10.5%)	7 (28%)	-	-
IMMUNO-DEFICIENCY	**HIV Infection**	7 (7.3%)	-	1 (4%)	4 (14.3%)	2 (8.3%)
FOREIGN BODY	**Foreign Body aspiration**	7 (7.3%)	4 (21.1%)	2 (8%)	-	1 (4.2%)
MUCO -CILIARY DISORDERS	**Cystic Fibrosis**	2 (2.1%)	1 (5.3%)	-	1 (3.6%)	-
	Kartageners syndrome	1 (1%)	-	-	1(3.6%)	-
UNKNOWN	**Cause undetected**	10 (9.6%)	-	2(8%)	4(14.3%)	4(16.6%)

In our study population 86 cases had specific etiology. Contact history was present mainly in TB group constituting 14 (63.6%) of 22

cases of tuberculosis, although 3(20%) of 15 cases in pneumonia group and 3(42.8%) of 7 cases in immunodeficiency group had history of contact with tuberculosis.

History of recurrent respiratory infection was commonly seen in all the etiological groups but it was seen in 100% of cases in persistent pneumonia group. 15 (68.2%) in the tuberculosis group, 12(80%) in pneumonia group and 5(71.4%) in the immunodeficiency group had more than three hospitalizations per year. Aspiration history was mainly seen in aspiration group (60%) and persistent pneumonia group (26.6%). Exanthematous illness was seen mainly in persistent pneumonia group (26.6%).

Family history of asthma and allergic history is present mainly in bronchial asthma group constituting 60% and 50% of cases respectively. Chronic sinusitis was mainly seen in asthma group (70%). History suggestive of immunodeficiency was mainly seen in Immunodeficiency group and persistent pneumonia group.

5 (22.7%) cases in tuberculosis group, 3 (20%) cases in pneumonia group and 2 (28.5%) cases in immunodeficiency group were not immunized with BCG, DPT and measles vaccination.

BCG scar was absent mainly in tuberculosis group accounting for 8 (36.3%) cases. It was also absent in 3 (20%) of cases in persistent pneumonia group and 3 (42.8%) of cases in Immunodeficiency group.

Mantoux positivity was seen in 50% of tuberculosis group and 13.3% of pneumonia group. But none of the other group had Mantoux positivity (Table 9).

Table 9 : PROFILE OF PATIENTS WITH SPECIFIC ETIOLOGY (n=86)

	22(22.9%) T B	**15(15.6%) Persistent/Recurrent Pneumonia**	**13(13.5%) Aspiration**	**7(7.3%) Foreign body**	**10(10.4%) Bronchial asthma**	**12(12.5%) Airway anomalies Congenital**	**7(7.2%) Deficiency Immuno-**
Contact with TB Cases	14 (63.6%)	3 (20%)	2(15.3%)	-	1 (10%)	-	3 (42.8%)
Recurrent Respiratory infection	16 (72.7%)	15(100%)	8(61.5%)	-	6 (60%)	7 (58.3%)	7 (100%)
Recurrent hospitalization (>3/yr)	15 (68.2%)	12(80%)	6(46.1%)	-	5 (50%)	5 (41.6%)	5 (71.4%)
Choking or aspiration history	-	4 (26.6%)	7(53.8%)	3(43%)	1 (10%)	3 (25%)	-
Exanthematous illness	2 (9%)	4 (26.6%)	-	-	1 (10%)	-	-
Family history of Asthma	2 (9%)	3 (20%)	1 (7.6%)	-	6 (60%)	1 (8%)	-
Allergic /atopic lesion	-	2 (13.3%)	-	-	5 (50%)	1 (8%)	2 (28.5%)
Chronic sinusitis	2(9%)	2(13.3%)	-	-	7(70%)		
Immuno-deficiency	2 (9%)	4 (26.6%)	-	-	-	-	5 (71.4%)
Not immunized with BCG,DPT and Measles	5 (22.7%)	3 (20%)	-	-	-	-	2(28.5%)
Mantoux Positivity	11(50%)	2 (13.3%)	-	-	-	-	-
BCG scar absence	8 (36.3%)	3 (20%)	2 (15.3%)	-	1 (10%)	3 (25%)	3 (42.8%)

Analysis of chest x-ray of all the patients revealed that left lung was mainly involved in the age group of 10 to 12 yrs, where tuberculosis etiology was commonly present. Right lung was mainly involved in the age group of 0 to 6 yrs, where aspiration, foreign body and congenital airway anomaly were the major etiological factors. Middle lobe on right side or lingula on left side were not involved as an isolated lesion.

But over all right lung was commonly involved, affecting 42 (43.8%) cases and left lung was involved in 30(30.3%) cases. 24 (24.9%) the cases had bilateral involvement (Table 10).

Table 10 : SITE OF BRONCHIECTASIS

	Right Side 42 (43.8%)				**Left Side 30 (31.3%)**				**Bilateral / Both Lower Lobe 24 (24.9%)**
	Upper Lobe	**Middle Lobe**	**Lower Lobe**	**Middle Lobe and Lower Lobe**	**Upper Lobe**	**Lingula**	**Lower Lobe**	**Lingula and Lower Lobe**	
TOTAL	5 (11.9%)	-	26 (61.9%)	11 (26.2%)	1 (3.3%)	-	19 (63.3%)	10 (33.3%)	24
0 -3 yrs	-	-	12 (46.1%)	3 (27.2%)	-	-	4 (21.1%)	-	3 (12.5%)

4 -6 yrs	1 (20%)	-	8 (30.7%)	3 (27.2%)	1 (100%)	-	5 (26.3%)	2 (20%)	10 (41.6%)
7 -9 yrs	2 (40%)	-	13 (50%)	5 (45.4%)	-	-	7 (36.8%)	3 (30%)	5 (20.8%)
10 -12 yrs	2 (40%)	-	4 (15.3%)	-	-	-	13 (68.4%)	5 (50%)	6 (25%)

Among tuberculosis group cough was present in 100% of the cases. Fever was present in 72.7% of the cases. Hemoptysis was present in 45.5% of cases mainly in the age group of 7 to 12 yrs.

Contact history was present in 63.6% of cases, while parental screening was positive in 40.9% of cases. Mantoux positivity was seen in 50% of cases.

BCG scar was absent in 8 (36.4%) cases while 5 (22.7%) cases were not immunized with BCG vaccination. Smear for acid fast bacilli was positive in 10 (36%) cases. Among these ten cases, resting gastric juice smear for acid-fast bacilli was positive in 4 (18.2%) cases, while sputum smear for acid-fast bacilli was positive in 2 (9.1%) cases. BAL fluid smear for acid-fast bacilli was positive in 2 (9.1%). Sputum cultures for mycobacterium was positive in 2(9.1%).

Chest X-ray revealed that right side 9(40.9%) bronchiectasis is more common than left side 7(31.8%). Bilateral involvement is seen in 6 (27.2%) cases.

Endobronchial tuberculosis as evidenced by Fiber Optic Bronchoscopy was seen in 9 (40.9%) cases (Table 11).

Table 11 : TUBERCULOSIS AS AN ETIOLOGICAL FACTOR IN CHILDREN WITH BRONCHIECTASIS (n = 22)

		Total	0-3 yrs	4-6 yrs	7-9 yrs	10-12 yrs
Cough		22 (100%)	1	4	6	11
Fever		16 (72.7%)	1	4	4	7
Hemoptysis		10 (45.5%)	-	-	4	6
Contact History		14 (63.6%)	1	2	4	7
Parental screening		9 (40.9%)	1	1	2	5
Mantoux test +VE		11 (50%)	-	3	2	6
BCG Scar absence		8 (36.4%)	-	1	2	5
BCG not immunized		5 (22.7%)	-	-	3	2
AFB positivity	**RGJ for AFB**	4 (18.2%)	-	-	-	4
	Sputum for AFB	2 (9.1%)	-	-	-	2
	BAL for AFB	2 (9.1%)	-	-	-	2
Sputum culture for TB		2(9.1%)	-	-	-	2

Chest X-ray	**Right side**	9(40.9%)	-	2	3	4
	Left side	7(31.8%)	1	-	2	4
	Bilateral	6(27.2%)	-	2	1	3
Endo bronchial TB (FFBS finding)*		9 (40.9%)	-	3	2	4

***** *Among 9 cases of EBTB six were having granulomatous lesion, one case had ulcerative lesion and one case had caseation and one case had stenotic lesion.*

In the pneumonia group, all the cases were having recurrent respiratory tract infection and repeated hospitalization (more than 3 per year).

7 (46.6%) cases had bad child rearing practices of which 75% of the cases were below 3 years of age. Measles was present in 3 (20%) of the cases. Diarrheal illness and Allergic history was commonly present in the age group of 0 to 6 years.

Aspiration history was present in 4 (26.6%) of cases of which 3 (25%) had gastro esophageal reflux disease as evidenced by barium meal study. 2(13.3%) cases had congenital heart disease both had ventricular

septal defect as confirmed by Echocardiography. One case had a history of meconium aspiration syndrome. 3 (20%) of cases had history of contact and Mantoux was positive in 2 (13.3%) cases. 2 (13.3%) cases had history of low birth weight.

Immunological assay was done for 9 cases among which all of them had normal immunoglobulin levels (Table 12).

Table 12 : PNEUMONIA AS A PRESUMPTIVE ETIOLOGY IN CHILDREN WITH BRONCHIECTASIS (n=15)

	Total 15	**0-3 yrs 4 (26.6 %)**	**4-6 yrs 4 (26.6%)**	**7-9 yrs 5 (33.3 %)**	**10-12 yrs 2 (13.3 %)**
Recurrent respiratory infection	15 (100%)	4 (100%)	4 (100%)	5 (100%)	2 (100%)
Bad child Rearing practices	7 (46.6 %)	3 (75%)	2 (50%)	2 (40%)	-

Exanthematous illness		3 (20%)	3 (75%)	-	-	-
Recurrent hospitalization (>3/yr)		15 (100%)	4 (100%)	4 (100%)	5 (100%)	2 (100%)
H/o suggestive of CHD*		2(13.3%)	-	2(50%)	-	-
Contact History with TB case		3 (20%)	-	1 (25%)	2 (40%)	-
Diarrheal illness		4 (26.6%)	2 (50%)	2 (50%)	-	-
Allergic and Atopic lesions		2 (13.3%)	-	2 (50%)	-	-
Aspiration		4 (26.6%)	-	2 (50%)	2 (40%)	-
H/O MAS in neonatal period**		1 (6%)	1 (25%)	-	-	-
H/O Low Birth Weight		2 (13.3%)	2 (50%)			
Immunological profile***	**Normal**	9(59.9%)	2(50%)	1(25%)	4(80%)	2(100%)
	abnormal					

** CHD-congenital heart disease*
*** Meconium aspiration syndrome*
****Immunological assay done for 9 patients in pneumonia group of cases*

Aspiration as an etiological factor for bronchiectasis contributed for 13 cases of which tracheoesophageal fistula/Aspiration accounted for 8 (61.5%) cases. All these children have undergone surgery soon after birth. This study emphasizes that all children who underwent surgery for tracheoesophageal fistula are to be properly followed up in order to anticipate aspiration or its complication like bronchiectasis. Gastro esophageal reflux/aspiration as evidenced by clinical history and barium meal study contributed for 5 (38.5%). Lipid laden macrophages seen in BAL analysis was present in 4 (30.7%) of the total 13 cases (Table 13).

Table 13 : ASPIRATION AS AN ETIOLOGICAL FACTOR IN BRONCHIECTASIS (n=13)

		TOTAL (13)	**0 – 3 yrs**	**4 – 6 yrs**	**7 – 9 yrs**	**10 – 12 yrs**
Tracheo- esophageal fistula/ Aspiration		8 (61.5%)	5	3	-	-
Gastro esophageal reflux / Aspiration	**Barium meal suggesting GER**	5 (38.5%)	2	2	-	1
Lipid laden macrophages in BAL analysis		4(30.7%)	2	2	-	-

Among 10 cases of Bronchial asthma, 5(50%) had allergic history and family history was present in 6(60%) of cases while chronic sinusitis was present in 7(70%) of the cases and 1(10%) had

trachea/bronchomalacia and 1(10%) had history of contact with tuberculosis.

Spirometry was done for all the 10 cases which was revealing obstructive pattern (FEV1 decreased and FEV1/FVC RATIO decreased) in 6(60%) of cases and the remaining 4(40%) of cases had mixed pattern (both obstructive and restrictive) (Table 14).

Table 14 : BRONCHIAL ASTHMA AS AN ETIOLOGICAL FACTOR IN BRONCHIECTASIS (n=10)

		Total (10)	**0- 3 yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
History of Atopy		5(50%)	-	-	4	1
History of nebulization		10(100%)	-	-	7	3
On Inhaler therapy		8(80%)	-	-	5	3
Poor compliance		9(90%)	-	-	6	3
Family history of Asthma		6(60%)	-		4	2
Bronchial asthma with Chronic sinusitis		7(70%)	-	-	4	3
Bronchial asthma with Tracheo/ Bronchomalacia		1 (10%)	-	-	1	-
PFT*/Spirometry	**Obstructive type**	6(60%)	-	-	4	2
	Mixed type	4(40%)	-	-	2	2

**PFT-Pulmonary function test-Spirometry.*

Among 7 HIV cases, 6 (85.7%) cases had tuberculosis and majority of them were in the age group of 6 to 12 yrs (Table 15).

Table 15 : HIV AS AN ETIOLOGICAL FACTOR IN BRONCHIECTASIS (n=7)

	Total (7)	**0-3 yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
HIV with Tuberculosis	6 (85.7%)	-	1	3	2
HIV without tuberculosis	1 (14.3%)	-	-	1	-

Radiological investigation was done for all the cases of bronchiectasis. Chest X –ray was done for all the cases and computed tomography was done for selective cases

Computed tomography was done for following cases

- Those children who presented with hemoptysis (29 cases)
- Those children for whom surgery was planned (6 cases)
- Those children whose chest X- ray had doubtful findings (8 cases) and also for those children whose chest X- ray showed unilateral bronchiectasis but clinically they had findings suggestive of bilateral bronchiectasis (6 cases).

In our study chest X-ray revealed that cylindrical form of bronchiectasis was more commonly seen accounting for 56 (58.3%)

cases, cystic type was next commonly seen contributing for 35(36.4%) cases and varicose type was seen in 5(5.2%) of cases (Table 16).

Table 16 : RADIOLOGICAL FINDINGS IN BRONCHIECTASIS (n = 96)

		Cylindrical type 56(58.3 %)	**Cystic/saccular Type 35(36.4%)**	**Varicose type 5(5.2 %)**
RIGHT SIDE	Upper lobe	2	2	1
	Middle lobe	-	-	-
	Lower lobe	14	10	2
	Middle and lower lobe	7	4	-
LEFT SIDE	Upper lobe	-	1	-
	Lingula	-	-	-
	Lower lobe	12	6	1
	Lingula and lower lobe	5	4	1
BOTH LOWER LOBE		16	8	-

Flexible fiber optic bronchoscopy was done in 94 cases. Dilated bronchi was the common finding which was present in 26 (27.6%) cases, 17 (18.0%) cases had purulent secretion while mucus plug was present in 16 (17.0%) cases.

Foreign body was found in 7 (7.4%) cases of which 6 (6.3%) was present on right side and 1 (1.1%) was on left side.

Tracheo/bronchomalacia (loss of semi lunar shape of tracheal lumen and forward ballooning of posterior wall as seen in FFBS) was seen in 9 (9.5%) cases.

Granulomatous lesion was present in 7 (7.4%) cases of which 6 were tuberculosis. Caseating lesion, ulcerative lesion and stenotic lesion were less common finding, while 9(9.5%) cases did not have any specific findings (Table 17).

Table 17 : FLEXIBLE FIBER OPTIC BRONCHOSCOPY IN BRONCHIECTASIS (n =94)

	Total (94)	**0-3 yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
Purulent secretions	17 (18.0%)	2	2	6	7
Mucus plug	16 (17.0%)	3	3	6	4
Dilated Bronchi	26 (27.6%)	4	7	9	6
Foreign body	7 (7.4%)	4	2	-	1
Granulomatous lesion	7 (7.4%)	-	2	-	5

Tracheomalacia	9 (9.5%)	2	7	-	-
Bronchial stenosis	1 (1.1%)	-	-	1	-
Caseating	1 (1.1%)	-	-	1	
Ulcerative	1 (1.1%)	-	1	-	-
No specific findings	9 (9.5%)	4	1	4	-

Sweat chloride test was done in 28 cases on clinical suspicion of whom only 2(7.2%) had positive sweat chloride test (Sweat chloride > 60 mmol/L). The remaining 26(92.8%) had normal sweat chloride level (20 - 60 mmol/L).

Table 18 : SWEAT CHLORIDE TEST IN BRONCHIECTASIS (n=28)

	Total (28)	**0-3yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
Normal	26 (92.8%)	1	8	9	8
Elevated	2 (7.2%)	1	-	1	-

Among the total of 96 cases 51 children were subjected for sputum culture analysis of which 6 (11.7%) cases had Klebsiella growth in their sputum. Mycobacterium growth was seen in 2 (3.9%) cases and streptococci growth was seen in 2 (3.9%) cases. While one (1.9%) had pseudomonas growth.34 (66.7%) had no pathogenic growth in their sputum (Table 19).

Table 19 : SPUTUM CULTURE IN BRONCHIECTASIS (n=51)

Growth	Total	0-3 yrs	4-6 yrs	7-9 yrs	10-12 yrs
Klebsiella	6(11.7%)	-	1	3	3
Streptococci	2(3.9%)	-	-	1	-
Mycobacterium	2(3.9%)	-	-	-	2
Pseudomonas	1(1.9%)	-	1	-	-
No growth	34(66.7%)	-	3	14	17

Among the total of 96 cases, 31 children were subjected for BAL Fluid analysis, 4(12.9%) cases had lipid laden macrophages suggestive of chronic aspiration. 2(6.4%) cases had shown Mycobacterium culture positivity while 4(12.9%) cases had shown Klebsiella growth who were also having sputum culture positive for klebsiella growth and 2(6.4%) had shown E.coli growth. Remaining 19(61.3%) cases did not show any growth of organism (Table 20).

Table 20 : ANALYSIS OF BAL FLUID (n=31)

		Total	**0-3 yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
AFB staining		-	-	-	-	-
Lipid laden macrophage		4(12.9%)	2	1	-	1
Culture for Mycobacteria		2(6.4%)	-	-	-	2
Bacterial culture	Klebsiella	4(12.9%)	-	1	1	-
	E.coli	2(6.4%)	-	-	-	-
No Growth		19(61.3%)	1	4	6	8

In our study population 6 cases underwent surgery. Lobectomy was done for 6 children of whom two underwent lobectomy on the right side and remaining four on the left side (Table 21).

Table 21 : LOBECTOMY IN BRONCHIECTASIS (n =6)

	Total	**0-3 yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
Right lower lobe	2	-	-	1	1
Left lower lobe	4	-	-	3	1

Immunological assay was performed in thirteen cases as per clinical suspicion of immunodeficiency state other than HIV cases; all thirteen had immunoglobulin levels within normal limits.

Pulmonary function tests (Spirometry) was done in twenty six cases on clinical suspicion, of whom ten (10.4%) cases had obstructive pattern nine (9.3%) cases were showing restrictive pattern. The remaining seven (7.2%) were showing mixed pattern.

Echocardiography was done in six cases on clinical suspicion of whom two had ventricular septal defect .The later cases also had persistent pneumonia.

Out of the 96 cases recruited in our study, the underlying etiology was identified in 86(89.6%) of cases. Of the 10(10.4%) cases in whom specific cause could not be identified, two (20%) expired during the stay, five (50%) cases are on follow up and three (30%) are not reported for follow up (Table 22).

Table 22 : OUTCOME OF CHILDREN IN WHOM AN UNDERLYING ETIOLOGY COULD NOT BE DETECTED
(n = 10)

	Total (10)	**0-3 yrs**	**4-6 yrs**	**7-9 yrs**	**10-12 yrs**
On Follow up	5(50 %)	-	1	3	1
Not reported for follow up	3(30 %)	-	1	1	1
Expired	2(20 %)	-	-	-	2

Among 86 cases (89.6%) where specific cause was identified, sixty two children (72%) are on regular chest physiotherapy. Among them, sixteen (18.6%) had marked improvement. These were the children who had foreign body aspiration and mucus plug which was aspirated by bronchoscopy. Rest of the forty six children had partial improvement. six (6.9%) had undergone lobectomy. The remaining eighteen (20.9%) are not on regular follow up (Table 23).

Table 23 : FOLLOW UP OF CHILDREN IN WHOM SPECIFIC ETIOLOGY WAS IDENTIFIED (n=86)

		Total	0-3 yrs (19)	4-6 yrs	7-9 yrs	10-12 yrs
On regular Chest Physiotherapy	Markedly improved	16(18.6%)	4	6	2	4
	Partially improved	46(53.4%)	9	12	13	12
Not on regular follow up		18(20.9%)	6	5	5	2
Lobectomy		6(6.9%)	-	-	4	2

DISCUSSION

Bronchiectasis is a chronic lung disease characterized by abnormal permanent dilatation of one or more segmental bronchi, which typically involves second to sixth order of segmental bronchi with accumulation of exudative material resulting in chronic cough and foul smelling sputum. It is an important cause for chronic cough in children.

The incidence is declining following availability of vaccines like Measles, Pertussis, Hemophilus influenza, Pneumococcal vaccines and effective control of respiratory infection. This is more so in the developed countries, but in developing countries like India, post infection bronchiectasis still remains as an important problem.

Like any other chronic disease, prevention is the only way to effectively reduce the incidence as there is no effective therapy, once the disease is established and permanent damage occurred. Henceforth it is important to know the etiological and epidemiological factors of bronchiectasis which will be helpful in preventing this permanent damage.

In our study population, 96 cases of bronchiectasis were included of which, 45.8% of all the patients were below 6 yrs of age and 54.2% of all the children were between the age group of 6 and 12 yrs. Males outnumbered females. Forty-nine (51.1 %) of the total number of children were males and forty-seven (48.9%) were females.

In their study**, Hanaa Hasan Banjar, et al**[9] Studied 151 cases of bronchiectasis, report similar sex distribution.49.7% were males and 50.3% were females.

In another study by **K. K. Khanna, et al**[4] from the Department of Paediatrics, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, studied 30 cases of bronchiectasis in childhood. 46.7% of the cases were in the age range of five to eight years and 36.6% in the age range of nine to twelve years.

In our study, Urban population (54.1%) outnumbered the rural population (45.9%).This observation could be due to the reason that ours being tertiary centre and majority of the cases are referred cases.Majority of the children belonged to class lV socio economic class (according to modified Kuppuswamy scale) constituting about 55.2% of the total study population and 38.5% of the total belonged to class lll socio economic class. None of the children belonged to class I socioeconomic class.

Since most of the studies were from western countries they have not stressed upon the socio economic status, but in country like India it is one of the important factor which has got impact on overall morbidity and mortality and also overcrowding is one of the risk factors for communicable diseases.

In our study, cough was the universal complaint, but cough with expectoration was mainly seen in the age group of 7 to 12 yrs (75% -79.2%). Breathlessness was one of the major complaints (52.1%). Hemoptysis was seen mainly in the age group of 7 to 12 yrs (46.4% -54.1%). Loss of weight was mainly seen in the group of 10 to 12 yrs (70.8%).

Clubbing was noticed in 38.5% of the total study population, which was mainly seen in the age group of 10 to 12 yrs (58.3%). Pallor was noticed in 39.6% and Lymphadenopathy was seen in 26.0%.

In their study, Hanaa Hasan Banjar et al[9] where they have studied 151 cases of bronchiectasis had similar findings.More than two-thirds of the patients had cough, tachypnea, wheezing, sputum production and failure to thrive.

In a study by k k khanna, et al [4] similar findings were present. Cough with expectoration was the commonest symptom which was seen in 64.4% of cases followed by haemoptysis present in 38% of cases .Clubbing was found in 56.7% of the cases

In our study, Protein energy malnutrition was found to be a common accompaniment with Bronchiectasis. 3(8.3%) had Grade 1 PEM, 13(36.1%) had Grade 2 PEM, 10(27.7%) had Grade 3 PEM and 3 (8.3%) had Grade 4 PEM. In the age group of 6 to 12 yrs, 34 (56.6%) were undernourished and remaining 26 (43.4%) were normally nourished. There were very few reports regarding nutritional status in cases of bronchiectasis since most of the literatures were from western countries.

The etiological work up in our study revealed that tuberculosis as an etiological factor in bronchiectasis contributed for 22.9% of the total cases and majority were in the age group of 7 to 12 yrs (21.4 % - 45.8%).

Persistent or recurrent pneumonia was the other major etiological factor contributing in nearly 16% of the cases, in which measles contributed for about 3.1% of the total cases. 46.6% cases in the pneumonia group had bad child rearing practices of which 75% of the cases were below 3 years of age. Aspiration history was present in 4 (26.6%) cases of whom 3 (25%) had gastro esophageal reflux disease as evidenced by barium meal study. 2(13.3%) cases had congenital heart disease both had ventricular septal defect as confirmed by echocardiography.

Aspiration was equally contributing for about 14 % of the cases in which majority of the cases were in the age group of 0 to 3 yrs. Tracheoesophageal fistula/Aspiration accounted for 8 (61.5%) cases. Gastro esophageal reflux / Aspiration as evidenced by clinical history and Barium Meal Study contributed for 5 (38.5%).

Foreign body aspiration accounted for seven (7.3%) of the total cases of which six (94%) were below six years of age.

Bronchial asthma contributed for 10.4% sinusitis was present in 7(70%) cases, 1(10%) had trachea/bronchomalacia and congenital airway anomaly accounted for 9.4% in which all the cases were below 6 yrs of age. All of them had tracheo-bronchomalacia as evidenced by fiber optic bronchoscopy. Immunodeficiency including HIV contributed for 7.3% of all the cases.

Muco-ciliary disorder accounted for 3% of the cases of which two cases were having cystic fibrosis as per clinical history and examination and elevated sweat chloride test and one case had Kartageners syndrome. The underlying etiology remained elusive in 10% of the cases, in spite of detailed work up.

In a study by David A. Spencer, et al [14] the referral diagnosis of asthma was refuted in 39 of 45 cases. Associations were previous pneumonic illness (30 %.), immunocompromise (21 %.), obliterative bronchiolitis (9%), congenital air way abnormality (5 %.), chronic aspiration (3%.), eosinophilic oesophagitis (2 %.), familial syndrome (2 %.), primary ciliary dyskinesia (1 %.) and right middle lobe syndrome (1%.)

In another study by KM Eastham, et al[15] studied 93 children Most bronchiectasis was post pneumonic accounting for 28 cases (30%); 19 cases (21%) were associated with immunodeficiency or

immunosuppression, and 17 (18%) were idiopathic bronchiolitis obliterans 8 cases (8.3%), congenital airway abnormality 4 cases (4.3%), and chronic aspiration 3 cases (3.2%). Among the immunoincompetent group 4 children had chronic granulomatous disease and one agammaglobulinaemia; 5 had heart transplants and one had been treated for leukaemia.

In both the above studies post pneumonic bronchiectasis was common as similar to our study but tuberculosis was not seen in their study since prevalence of tuberculosis is very less in their population. In their study immunodeficiency was more commonly seen than in our study.

In the study by Hanaa Hasan Banjar, et al[9] the etiological profile for bronchiectasis was similar to our study. They have reported that pulmonary diseases contributed for 48 (32%) of the cases, immunodeficiency in 27 (18%) of the cases, aspiration syndrome in 10 (7%) of the cases, cardiac in 10 (7%) and asthma in 103 (68%) of the patients. Among asthma cases 68 (67%) were found to have chronic sinusitis. In our study 70% of the cases had chronic sinusitis in asthma group.

In a study of K K Khanna, et al[4] foreign body aspiration, as the cause of bronchiectasis was not seen at all. But in our study foreign body aspiration was accounted for 7.3% of all the cases.

In our study, analysis of chest x-ray of all the patients revealed that left lung was mainly involved in the age group of 10 to 12 yrs, where tuberculous etiology was commonly present. Right lung was mainly involved in the age group of 0 to 6 yrs, where aspiration, foreign body and congenital airway anomaly were the major etiological factors. But over all right lung was commonly involved, affecting 42 (43.8%) of cases and left lung was involved in 30(30.3%) of cases. 24 (24.9%) of the cases had bilateral involvement

In a study by KK Khanna, unilateral bronchiectasis was more common than bilateral. Lingular involvement alone was not demonstrated. The posterior basal segment of the left lower lobe was the segment affected in majority of the cases but in our study overall it was right side which was commonly affected. This is similar to our study where unilateral involvement was more common than bilateral involvement and either middle lobe on right side or lingula on left side was not involved as an isolated lesion.

In a study by C. Elaine Field, et al[11] studied 160 cases of irreversible bronchiectasis in childhood. In 85.6% of cases the disease was situated in the left lower lobe, and in 65.6%, in the lingula lobe, but in no case was the lingula affected as the only lobe. Massive collapse of the lung was associated with bronchiectasis in 74 (46.3%) cases. Bronchoscopy was not helpful in diagnosis or localization of bronchiectasis.

But in our study flexible fiber optic bronchoscopy was done in 94 cases. Dilated bronchi was the common finding which was present in 26(27.6%) of cases, 17 (18.0%) of cases had purulent secretion while mucus plug was present in 16(17.0%) of cases. Foreign body was found in 7 (7.4%) of cases of which 6(6.3%) was present on right side and 1(1.1%) was on left side. Tracheo / bronchomalacia was seen in 9 (9.5%) of cases. Granulomatous lesion was present in 7 (7.4%) of cases. These findings had radiological correlation as well; hence bronchoscopy was very useful in knowing the causes as well localizing the bronchiectasis in our study.

In our study sputum culture was done for 51 cases of which 6(11.7%) cases had kliebsiella growth in their sputum. Mycobacterium growth was seen in 2 (3.9%) of cases and streptococci growth was seen in

2 (3.9%) of cases. While one (1.9%) had pseudomonas growth. 34 (66.7%) had no pathogenic growth in their sputum.

In the study by Hanaa Hasan Banjar, et al[9] Hemophilus influenza was cultured in 56 (37%), strept pneumoniae in 25 (17%) and pseudomonas aeruginosa in 24 (16%) of the patients In our study Kliebsiella growth was more commonly seen than the other bacterial culture this disparity could be due to variability in the prevalence of the pathogenic organisms at different places.

Cystic fibrosis has traditionally been thought to be rare entity in this part of the world. But studies from North India have proved that this disease after all might not be that uncommon[20].

In our study Sweat chloride test was done in 28 cases as per clinical suspicion of which only 2(7.2%) had positive sweat chloride test (Sweat chloride >60 mmol/L). The remaining 26(92.8%) had normal sweat chloride level (20 -60 mmol/L).

In our study Immunological assay was performed in thirteen cases as per clinical suspicion of immunodeficiency state other than HIV cases; all thirteen had immunoglobulin levels within normal limits.

In a study by KM Eastham, et al[15] one agammaglobulinaemia was reported. But in our study none of them had congenital immuno-deficieny.

SUMMARY

- Bronchiectasis occurs uniformly in all the age groups below twelve years of age with the median age at presentation was 4.5 yrs and the majority had symptoms for more than one year (82.2%) and nearly 35% of the total population had symptoms for more than 3 yrs. Male children (51.1%) being slightly more affected than their female counterparts (48.9%).

- Bronchiectasis occurs predominantly in lower socio economic population (93%) than the upper socio economic population (7%) and urban population (55%) being more affected than the rural population (45%).

- The common symptoms in these children are cough (100%), fever (65%) and breathlessness (53%). Cough with expectoration (56.3%) and hemoptysis (30.2%) was predominant in above six years of age.

- Majority of the children were malnourished (70%).

- Tuberculosis (22.9%) and persistent pneumonia (15.3%) were found to be the major etiological factors. Chronic or recurrent aspiration due to various causes was the underlying abnormality in

13.5% of the cases. Bronchial asthma accounted for 10.4% of the cases. Congenital anomalies accounted for 12.5%. HIV was the underlying cause in 7.3%. The underlying etiology remained elusive in nearly 10% of the cases.

- Contact history (63.6%), Mantoux positivity (50%) and parental screening (40.9%) remained significant in children with tuberculous bronchiectasis. Endo bronchial tuberculosis (40.9%) was the common underlying abnormality in the tuberculous group.

- Bad child rearing practices are a major contributing factor in children with persistent pneumonia. This was significant in children below three years of age (75%). All the children with persistent pneumonia had recurrent respiratory infection and recurrent hospitalization (more than three per year). Chronic aspiration (26.6%) was majorly seen in these children.

- Majority of the children with chronic aspiration had tracheo-esophageal fistula (61.5%), who were operated in neonatal life. Gastro esophageal reflux(38.5%) was the other important abnormality in chronic aspiration

- Personal history of atopy (50%), family history of asthma (60%) and poor compliance regarding asthma treatment were significant in children with bronchial asthma. Chronic sinusitis (70%) was commonly seen in these children.

- Flexible fiber-optic bronchoscopy was useful in detecting the underlying abnormality like children who were having EBTB (10.6%), foreign body (7.4%) and tracheobronchomalacia (9.5%). It had therapeutic role in children who were having mucus plug and purulent secretions.

- Quantiication of lipid-laden macrophages in bronchio-alveolar lavage fluid is a good marker of chronic aspiration in children.

CONCLUSION

- The common etiological factors in Bronchiectasis were Tuberculosis, persistent pneumonia, chronic aspiration, foreign body, congenital airway anomalies, bronchial asthma and HIV.

- Preventable factors like missed foreign body aspiration and Endo Bronchial Tuberculosis to be identified early.

- Tracheo esophageal fistula operated children should be followed up properly in order to prevent chronic aspiration and bronchiectasis.

- The association of HIV in 7% of children gives idea that children has to be screened for HIV in the children who present with bronchiectasis.

- Bad child rearing practices is significant in younger children who present with bronchiectasis.

+ANNEXURE – I

DATA ENTRY FORM

1. NAME :
2. AGE (IN YEARS) :
3. SEX :
4. I.P.NO. :
5. ADDRESS :
6. AREA (URBAN/RURAL) :
7. STATE :
8. PHONE NO. :
9. FATHER'S NAME
   & EDUCATION :
10. MOTHER'S NAME
    & EDUCATION :
11. FATHER'S OCCUPATION :

12. PER CAPITA INCOME :

13.

14. SOCIO ECONOMIC

STATUS :

15. HISTORY

1. Cough

a) Duration

b) Type

c) Aggravating & Relieving Factors

d) Productive / Non productive

If Productive (Sputum) Quantity

Color

Odour

Consistency

More at morning or night

2. Fever

a) Duration

b) Continous / Intermittent

c) Associated Features

3.

4. Breathlessness

5. Hempptysis

6. Halitosis / Bad Breath

7. H/O Sinopulmonary / ChronicSinusitis

8. Loss of Appetite

9. Loss of Weight

10. Past H/O of Pronged Fever and cold

11. H/O Hospitalization

12. H/O Suggestive of Pneumonia

13. H/O Foreign Body Aspiration

14. H/O Bad CRP (Nose Blowing / Oil Massage etc.)

15. H/O Exanthematous Fever

16. H/O Diarrheal illness

17. H/O Skin Disease

18. H/O TB in the past (Site and Age of occurrence)

19. H/O TB treatment

20.

21. H/O contact with TB (Father / Mother / Grandmother / Grandfather / sibling schools / neighbors)

22. Neonatal History (MAS and others)

23. Immunization history including BCG, DPT, Pneumococcal Vaccine

16. GENERAL IEXAMINATION:

1. Pallor
2. Cyanosis
3. Lymphadenopathy
4. Clubbing and its description
5. BCC Scar
6. MANTOUX positive / negative
7. Examination of Nose / Throat / Sinuses

8. Vitals:

HR

RR

BP

9. TEMP

SaO_2

10. Anthropometry

Wt

Ht

MAC

Wt/Ht

Wt/Age

Ht/Age

17. SYSTEMIC EXAMINATION:

1. Respiratory system

Inspection : Chest Wall symmetry

Position of trachea

Apical impulse

Work of breathing

Palpation: Confirmation of inspectory findings

Chest expansion

Position of apical impulse

Tactile fremitus

Percussion: Normal / woody dullness (or) stony dullness/

2. resonant

Auscultation: Type of breath ounds

Airway entry

Added sounds

Vocal fremitus

3. Cardiovascular System

4. Abdomen Findings

5. CNS

18. INVESTIGATIONS:

1. Total count

2. Differential count

3. ESR

4. HB
5. Parental Screening
6. Tuberculin skin test
7. Sputum positive for AFB
8. Sputum C/S
9.
10. Chest X-Ray / Sinuses X-Ray
11. BAL for AFB
12. HRCT
13. Fiber Optic Bronchoscope Findings
14. Immunoglobulin and its Profiles
15. Sweat Chloride Test
16. NOTES and others if any

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