STUDY OF CLINICAL, MICROBIOLOGICAL AND RADIOLOGICAL PROFILE OF PATIENTS PRESENTING WITH ACUTE EXACERBATION OF BRONCHIECTASIS IN A TERTIARY CARE HOSPITAL

Pulmonary Medicine

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ABSTRACT

BACKGROUND: Bronchiectasis is one of major causes of morbidity and mortality in developing countries. Patients with bronchiectasis colonize many aerobic bacteria and fungi and lead to an increase in exacerbations and decrease in quality of life. Determining clinical, microbiological and radiological profile of bronchiectasis with acute exacerbation helps in adoption of optimized diagnosis and therapeutic approach.

AIM: To study the clinical, microbiological and radiological profile of patients presenting with acute exacerbation of bronchiectasis

RESULTS: In the present study, majority were males (80%). H/O ANTI-TUBERCULAR THERAPY was present in 54% patients. Cough with sputum is the commonest symptom. 24% patients presented with hemoptysis. 76% patients had shortness of breath with significant exercise limitations. 62% patients had fever. About 85% patients variable combination of coarse crepitations and wheeze on affected side. Features of cor pulmonale were seen in about 10% patients. Cultures (sputum and bronchial washings) were positive in 66% cases. The most common organism isolated was *Pseudomonas aeruginosa* (40%). On Chest x-ray majority (54%) had bilateral disease as evident by bilaterally fibrosed, shrunken and bronchiectatic lung. On HRCT thorax, the predominant type of bronchiectasis was Cystic in 58% cases. More than one type of bronchiectasis was observed in 28% subjects.

CONCLUSION: The frequent cause of bronchiectasis is post tuberculosis. Acute exacerbation manifests with copious purulent sputum. *Pseudomonas aeruginosa* is the most frequently isolated bacteria. HRCT of thorax is a non-invasive diagnostic technique which has high sensitivity and specificity. The most frequent concomitant disease in bronchiectasis is COPD.

KEYWORDS

Bronchiectasis, *Pseudomonas*, Tuberculosis, HRCT Chest.

INTRODUCTION

Bronchiectasis continues to be one of the major causes of morbidity and mortality in developing countries, with a probably underestimated higher prevalence than in developed countries. Although the prevalence once declined over the past years in societies with high socioeconomic status, probably due to the development of preventive medicine, especially childhood immunizations, and improvement of the living conditions and widespread use of antibiotics, nowadays bronchiectasis has been recognized more, mainly due to use of high resolution computerized tomography (HRCT).

Bronchiectasis is defined as "abnormal and permanent dilatation of one or more bronchi due to weakening or destruction of the muscular and elastic components of the bronchial walls". Bronchiectasis may be congenital or acquired. Congenital bronchiectasis occurs due to developmental defects of the bronchial tree and are less common. Bronchiectasis can present either focally or diffusely involving multiple lobes. Bilateral bronchiectasis occurs more often as a result of congenital abnormality or in association with a systemic disease¹.

Most cases of bronchiectasis present clinically with chronic persistent or intermittent cough with sputum production. The sputum may be mucoid, mucopurulent or purulent. Hemoptysis occurs in some patients. Shortness of breath occurs in a vast majority of patients. Systemic symptoms include fever, chest pain, loss of appetite.

Patients with mild bronchiectasis may not have any physical signs between exacerbations whereas patients with moderate to severe bronchiectasis have physical signs on examination such as digital clubbing, coarse crackles on auscultation and occasionally evidence of respiratory failure. Ultimately the patients with moderate to severe form of the bronchiectasis will progress to chronic respiratory failure and cor pulmonale².

Acute exacerbations are characterized by deterioration of respiratory symptoms which includes increased volume and purulence of sputum and increased breathlessness with or without fever. The sputum may have offensive odour if anaerobic infections are associated.

In a study by O'Donnell, et al.³, an acute exacerbation of bronchiectasis was defined when four or more of the following symptoms were

present. The symptoms are change in sputum production, increased dyspnoea, increased cough, fever, increased wheezing, constitutional symptoms such as malaise, fatigue, lethargy, reduced pulmonary function, radiographic changes consistent with a new pulmonary process and change in chest sounds.

There are three distinct pathogenic events that contribute to the disease namely infection, inflammation and release of inflammatory mediators. Reid's classified Bronchiectasis into four types⁴ -

Cylindrical bronchiectasis which is characterized by uniform dilatation of bronchi without any tapering.

Varicose bronchiectasis characterized by beaded appearance due to alternating dilatation and constriction of bronchi.

Cystic or saccular bronchiectasis is the most severe form characterized by peripheral bronchial dilatation to form large cysts with air fluid levels.

Follicular bronchiectasis is characterized by extensive lymphoid follicles within the bronchial walls and this type usually occurs following childhood infections.

Bronchography once considered as gold standard for diagnosis of bronchiectasis is no longer possible as production of the dye for the technique was discontinued about 20 years back. Now, HRCT has become the gold standard to diagnose bronchiectasis⁵.

Patients with bronchiectasis are frequently colonized by pathogenic micro organisms. Infections such as tuberculosis and allergic bronchopulmonary aspergillosis are being increasingly recognized as a cause of bronchiectasis. Most of the patients have impaired mucociliary clearance which contribute to the increased incidence of underlying infections. Gram negative bacteria like *Pseudomonas aeruginosa* are frequently isolated and pose a therapeutic challenge. Systemic diseases such as Rheumatoid arthritis are also associated with bronchiectasis. In bronchiectasis, antibiotics and chest physiotherapy are main components of management.

Determining the clinical, microbiological and radiological profile of

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cases with bronchiectasis with acute exacerbation helps in adoption of regionally optimized diagnosis and therapeutic approach.

PATIENTS AND METHODS

This prospective study was done in Department of Pulmonary Medicine, Alluri Sitaramaraju Academy of Medical Sciences, Eluru from January 2016 to June 2017, including 50 patients with bronchiectasis of 18 years and above of either sex, with acute exacerbation.

EXCLUSION CRITERIA:

- Age less than 18 years.
- Not requiring hospital admission.
- Not willing to give consent.
- Patient with concomitant cardiac disease, psychiatric illness, HIV infection, diabetes mellitus, active tuberculosis, cystic fibrosis, allergic bronchopulmonary aspergillosis.

Appropriate clinical history in terms of symptoms, previous hospitalizations, h/o tuberculosis and any childhood infections, reproductive history, smoking status and antibiotic courses in previous years were collected. General information including gender, age, BMI were collected.

All cases were subjected to detailed clinical examination, arterial blood gas analysis, urine and blood examination, blood chemistry, blood cultures, sputum examination (smears and cultures for bacteria and mycobacteria). Valid sputum samples were collected from all patients and samples were sent as soon as possible. Anaerobic cultures were not possible for want of facilities. Patients were considered to have mild expectoration if they produced less than 10ml in 24 hours, moderate expectoration if they produced 10 to 100 ml and copious expectoration if they produced more than 100 ml in 24 hours.

Flexible bronchoscopy was done in 15 patients, who couldn't produce adequate sputum, whose serial sputum testing did not yield results and who were worsening, to localize the site of bleeding in patients with hemoptysis and in localized bronchiectasis. Bronchoscopic specimens like bronchial washings and brushings were examined by smear and culture for bacteria and mycobacteria.

Chest x-ray and HRCT thorax were also done for all patients.

In addition, spirometry (n:29) and trans thoracic 2D echocardiogram (n:34), alpha-1 antitrypsin levels, x-ray of paranasal sinuses were done in selected patients. Immunoglobulin profile done included serum total IgE measurement in patients (n:8) with history of asthma. Since electron microscopy facility is not available in our hospital, we used saccharin test for ciliary motility assessment in cases who doesn't give history of tuberculosis.

Four cases who had allergic bronchopulmonary aspergillosis were excluded. Measurement of other immunoglobulins like IgM, IgG was not possible due to lack of facilities. Two cases were excluded as their sputum smears were positive for acid fast bacilli.

RESULTS

During the study period of two years, 72 patients with bronchiectasis got admitted, out of which 50 patients were eligible for participation in the study.

In the present study, majorities were males(80%). Mean age of the population was 46.8years.

History of smoking was present in 58%patients including all cases of COPD. Majority were current smokers.

31 cases (62%) had bronchiectasis of more than 5 years duration and 19 cases (38%) had bronchiectasis of less than 5 years duration.

H/O ANTI-TUBERCULAR THERAPY was present in 54% patients suggesting post tubercular bronchiectasis as a major cause in the study.

SYMPTOMS AND SIGNS

Cough with sputum is the commonest symptom and is present in almost all cases. Clinical features of cor-pulmonale were seen in about 10% of the patients. Evidence of malnutrition and gross weight loss was seen in almost 50% of the patients.

TABLE -1 SYMPTOMS AND SIGNS OF BRONCHIECTASIS:

SYMPTOMS	No of Patients (n=50)	SIGNS	No of Patients (n=50)
Cough	48(96%)	Clubbing	30(60%)
Sputum	44(88%)	Cyanosis	4(8%)
Shortness of breath	38(76%)	Pedal edema	14(28%)
Fever	31(62%)	Crackles	43(86%)
Hemoptysis	12(24%)	Rhonchi	28(56%)
Wheeze	19(38%)	Bronchial breathing	9(18%)
Chestpain	3(6%)		

CULTURE REPORTS OF SPUTUM AND BRONCHIAL WASHINGS:

Cultures (sputum and bronchial washings) were positive in 33 cases (66%). The most common organism isolated was pseudomonas aeruginosa(40%). Those who underwent flexible bronchoscopy, bronchial aspirates had growth of bacteria on culture in 12 including 9 in whom sputum cultures were sterile.

TABLE-2 CULTURE REPORTSO F SPUTUM AND BRONCHIAL WASHINGS

Organism	(n=50)
Pseudomonas aeruginosa	44%
Klebsiella pneumonia	12%
Moraxellacatarrhalis	6%
Streptococcus pneumonia	16%
Staphylococcus aureus	4%
Acinetobacter	6%
No growth	32%

CHEST X-RAY FINDINGS:

Chest x-ray was found abnormal in 43(86%) patients. Majority (54%) of the patients had bilaterally fibrosed, shrunken and bronchiectatic lung. Chest x-ray was normal in 7(14%) patients.

X-ray of paranasal sinuses was normal in all cases of post tubercular bronchiectasis (n:30) and 6 cases had bilateral bronchiectasis including 4 cases of Kartagener's syndrome. The abnormalities in sinus x-ray included maxillary sinusitis in 2 cases and pansinusitis in other 4 cases.

TABLE-3 CHEST X-RAY FINDINGS

SL. NO.	FINDINGS	NO.OF PATIENTS
01	Normal	7(14%)
02	Fibrotic lesion with volume loss	7(14%)
03	Fibrotic lesion with calcified foci with volume loss	12(24%)
04	Cystic lucencies	8(16%)
05	Hyperinflated lung fields with bronchiectatic changes	11(22%)
06	Hyperinflated lung fields with consolidation	2(4%)
07	Consolidation	6(12%)
08	Bronchiectatic changes	7(14%)
09	Dextrocardia	4(8%)

HRCT Thorax:

HRCT the most frequent finding was bilateral multiple cysts in 58% cases. It was often distributed to both the upper lobes.

TABLE 4 TYPE OF BRONCHIECTASIS ON HRCT THORAX:

TYPE OF BRONCHIECTASIS	NO OF CASES
Cystic / Saccular	29(58%)
Varicose	3(6%)
Tubular / Cylindrical	18(36%)
Mixed	14(28%)

TABLE -5 DISTRIBUTION OF BRONCHIECTASIS IN HRCT THORAX

Sl.No.	Findings	No.of patients
01	Bilateral disease	29(58%)
02	Unilateral disease	21(42%)
	Right side	08

	Left side	13
03	Only Upper Lobes	28(56%)
	B/L Upper Lobes	18
	Right upper Lobe	06
	Left upper Lobe	04
04	Only Lower Lobes	12(24%)
	B/L Lower Lobes	07
	Right lower Lobe	04
	Left lower Lobe	01
05	Right Upper Lobe with Middle Lobe	03
06	Left Upper Lobe with Lingula	02
07	Involvement of more than two lobes	35(70%)
08	Associated with Emphysema	14(28%)

Spirometry was done in 29 patients with h/o smoking and suspected cases of COPD. Majority of them showed obstructive pattern with poor bronchodilator reversibility.

2D echo was done in 34 patients. PAH was detected in 15 patients. Features of cor pulmonale were seen in 10% of cases.

DISCUSSION

The classical presentation of bronchiectasis is copious purulent sputum which was common in the pre-antibiotic era⁷ and this has changed in recent years with childhood immunization and availability of newer broad range antibiotics⁷.

AGE AND SEX PRESENTATION:

In the present study, the mean age of distribution was 46.8 years with male preponderance (49 years mean age). Clinical studies reflect increased prevalence of the disease in older population. The age at the presentation of bronchiectasis averages 10 to 20 years after the causative incident.

SYMPTOMS:

In our study most of the patients had persistent cough, increasing sputum production and hemoptysis. Further evaluation of foul smelling sputum was not possible due to lack of anaerobic culture facility.

TABLE 6 STUDY COMPARISON OF SYMPTOMS

Symptoms	Present study	Habesoglu MA et. al ⁹	P. T. King et al ¹²
Cough	96%	83.6%	96%
Sputum	88%	83.6%	87%
Hemoptysis	24%	33.9%	26%
Breathlessness	76%	72%	60%
Chestpain	6%	10%	19%

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TABLE 7 STUDY COMPARISON OF SYMPTOMS

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Cough	96%	83.6%	96%
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Hemoptysis	24%	33.9%	26%
Breathlessness	76%	72%	60%
Chestpain	6%	10%	19%

MICROBIOLOGY:

The number of pathogens in individual patients was widely variable, with 44% single pathogen and 22% two pathogens isolated on culture.

The bacterial culture was sterile in 16 cases due to use of antibiotics before admission and viral exacerbations which could not be detected.

TABLE 8 STUDY COMPARISON OF ORGANISM ISOLATED:

Organism	Present Study	Nicotra et al ¹⁷	Pasteur et al ¹⁸	King PT et al ¹²
	44%	31%	31%	12%
Pseudomonas				
Aeruginosa				
Hemophilus	0	30%	35%	47%
Influenza				

Klebsiella	12%	0	0	0
Pneumonia				
Moraxella	6%	2.4%	20%	8%
Catarrhalis				
Streptococcus	16%	10.6%	13%	7%
Pneumonia				
Staphylococcus	4%	7.3%	14%	4%
Aureus				
Acinetobacter	6%	0	0	0
No growth	32%	Not specified	23%	21%

CHEST X-RAY:

The most common finding on chest-x-ray was nonspecific chronic fibrotic changes. It was normal in 7 cases and as per literature Barker AF et al, chest x-ray can be normal in 10% cases of bronchiectasis. Bronchiectatic changes include increased pulmonary markings, honeycombing, atelectasis. Increased pulmonary marking was the most common radiologic finding. The findings are consistent with study by Haseboglul et al¹, where fibrotic changes was the most common radiologic finding (71.1%), honeycombing (34.9%), loss of lung volume (30.6%) were the other CXR findings.

A temporary bronchial dilatation and thickening of the bronchial wall named as "pseudo-bronchiectasis" may arise secondary to infection or inflammation at the acute phase. But it becomes permanent when destruction of muscle and elastic tissue in bronchi develops with scarring. Accordingly, it is recommended that HRCT be ordered at least 4 months after an acute infection for diagnosing post-infectious bronchiectasis.

HRCT THORAX:

HRCT of thorax is currently the gold standard for diagnosis of bronchiectasis⁷ and a non-invasive diagnostic technique and has high sensitivity and specificity for bronchiectasis.

TABLE: 9 STUDY COMPARISON OF TYPE OF BRONCHIECTASIS ON HRCT THORAX:

Type of Bronchiectasis	Present Study	Hassan et al ¹⁰	Frank et al	Lynch et al ¹¹
Cystic	58	55	45	62
Cylindrical	36	45	47	32
Varicose	6		9.9	
Mixed	28		24.4	

The radiologic findings of bronchiectasis determined by HRCT were quite extensive as shown in [Table 5].

In bronchiectasis, 50% of cases may have concomitant COPD¹³. In the present study, arterial blood gases were abnormal in 60% cases and all cases of bronchiectasis with COPD(28%). HRCT thorax showed features of emphysema along with bronchiectatic lesions in 28% of cases. None of the cases had alpha 1 antitrypsin deficiency and all COPD cases had history of significant smoking.

Chronic exposure to tobacco, as well as indoor air pollution from biomass smoke impairs the lung defense mechanism by its effect on mucociliary function of tracheobronchial mucosa, impairs the function of pulmonary alveolar macrophages, and impairs the intracellular killing of microorganism by decreasing production of TNF alpha.

In our country bronchiectasis as sequelae of treated cases of tuberculosis is frequent. Post tubercular bronchiectasis occurs when post primary pulmonary tuberculosis, after specific therapy, leaves behind distorted and dilated bronchi in the affected lobes which lead to continuation of respiratory symptoms, especially hemoptysis. Sometimes healed tuberculosis due to traction on major airways from surrounding lung parenchyma, disrupts their architecture can cause this entity.

In present study post-tuberculous bronchiectasis(54%) was the most frequent form of bronchiectasis in middle aged patients(41-65), with past history of tuberculosis, who present with moderate hemoptysis along with productive cough and shortness of breath. In developed countries where tuberculosis is less prevalent, idiopathic bronchiectasis continues to be the most common form^{6,14}.

The study conducted by Rajasekharan et al¹⁵ in Thanjavur showed

post-tuberculous bronchiectasis is commonest cause of bronchiectasis. In another study¹⁶ done in Nepal, post-tuberculous bronchiectasis was the most commonest cause of bronchiectasis.

This shows that in spite of effective tuberculosis control programmes, pulmonary tuberculosis and its sequelae are still important causes of chronic respiratory diseases in the developing countries.

In the present study, 95% cases of bronchiectasis had acquired aetiology. With regard to detection of ciliary abnormalities, electron microscopy is not available in our institute and we relied on saccharin test in cases of non tuberculous bronchiectasis (n:20).

The diagnosis of kartagener's syndrome (n:4) was made earlier. Increased availability of CT facilities in the recent years lead to detection of more number cases of bronchiectasis.

The limitations of the study include non- availability of electron microscopy to view the ultrastructure of cilia and cultures of anaerobic and viruses.

CONCLUSION

The most frequent cause of bronchiectasis in our study is post-tuberculosis. Acute exacerbation of bronchiectasis manifests with copious purulent sputum in 38.6% cases and foul smelling sputum in 32% of cases. *Pseudomonas aeruginosa* is the most frequently isolated bacteria in bronchiectasis. HRCT of thorax is a non-invasive diagnostic technique which has high sensitivity and specificity for bronchiectasis. The most frequent concomitant disease in bronchiectasis is COPD.

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