EVALUATION OF 30 CASES OF BRONCHIECTASIS USING HRCT

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ABSTRACT

BACKGROUND

The objective of this study is to identify the most common aetiology of bronchiectasis in patients undergoing HRCT chest at Navi Mumbai. Further, to understand the demographical profile and anatomical distribution of bronchiectasis in these patients.

MATERIALS AND METHODS

This study included 30 patients within the age group of 10 - 75 years who had all undergone an HRCT chest for a variety of chest symptoms such as breathlessness, cough, haemoptysis and fever with/without chills. These patients were scanned using a 64 slice Toshiba Aquilion CT machine. The scans were done in the supine position. For inspiratory scans, 1 mm thick sections were taken at 5 mm intervals from the lung apices to below the CP angles with 50 mAs, 120 kVp. Same parameters were used for the expiratory scans except in this the interval taken was 20 mm.

RESULTS

In this study, the male: female ratio was found to be 3: 2. The cause of bronchiectasis in most patients in this study was found to be post-infectious, Koch's being the commonest (66.67%) followed by Staphylococcus infection (13.33%), UIP (10%), fungal infection (6.67%) and COP (3.33%). The left lung was more commonly involved (56.67%) followed by the right lung (26.67%) and then bilateral involvement (16.67%). The upper lobes were most commonly involved (43.33%) followed by the lower lobes (36.6%). Middle lobe involvement was 20%. Other associated findings included tree in bud appearance in 10 cases, air space consolidation in 6 cases, mucous plugs in 3 cases, pleural effusion and cavity in 2 cases each.

CONCLUSION

It is important to perform HRCT in symptomatic cases of suspected bronchiectasis. HRCT is a very sensitive modality for showing bronchiectasis which is characterised by the lack of bronchial tapering, bronchi visible in the peripheral 1 cm of the lungs and an increased broncho-arterial ratio producing the 'signet-ring sign.' Bronchiectasis is caused by a complex cycle of repeated inflammation and a defective immune response to suppress it. Haemoptysis is common and is usually a sequelae of tuberculosis. Commonly bronchiectasis results from necrotising bacterial infections, but in this study Koch's infection evolved as the most common cause of bronchiectasis.

KEYWORDS

HRCT, Bronchiectasis, Tuberculosis, Koch's, Infection.

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BACKGROUND

Bronchiectasis is the irreversible, abnormal dilatation of the bronchi.

Involved bronchi are dilated, inflamed and easily collapsible, resulting in airflow obstruction and impaired clearance of secretions.

Aims and Objectives

1. To identify the most common aetiology of bronchiectasis in patients undergoing HRCT chest at Navi Mumbai.
2. To understand the demographical profile and anatomical distribution of bronchiectasis in these patients.

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Causes

- Post infectious (most common).
- Congenital.
- Bronchial obstruction.
- Others.

High resolution CT is a scanning protocol, in which thin sections (usually 0.625 to 1.25 mm) are acquired and reconstructed using a sharp algorithm (e.g. bone algorithm).

It has been used for

- Lung imaging.
- Temporal bone imaging.

MATERIALS AND METHODS

This study included 30 patients within the age group of 10 - 75 years, who had all undergone an HRCT chest.

They all had a Variety of Chest Symptoms

- Breathlessness.
- Cough with variable amount expectoration (scanty to copious).
- Haemoptysis.

- Fever with/without chills.

Equipment and Protocol

- These patients were scanned using a 64 slice Toshiba Aquilion CT machine.
- The scans were done in the supine position.
- For inspiratory scans, 1 mm thick sections were taken at 5 mm intervals from the lung apices to below the CP angles with 50 mAs, 120 kVp.
- Same parameters were used for the expiratory scans, except in this the interval taken was 20 mm.

RESULTS

HRCT Findings	No. of Cases	Percentage of Cases
Bronchiectasis	30	100%
Consolidation	6	20%
Tree in Bud	10	33%
Pleural Effusion	2	6.7%
Cavity	2	6.7%
Secretions	3	10%

Table 1. Summary of HRCT Findings

Disease	Total No. of Cases	No. of Male Patients	No. of Female Patients
Tuberculosis	20	13	7
UIP	3	2	1
Staph. Infection	4	2	2
Fungal Infection	2	1	1
COP	1	0	1

Table 2. Demographical Distribution based on Aetiology

Distribution of Lesions in Bronchiectasis	No. of Cases
Right Lung	8
Left Lung	17
Both Lungs	5
Upper Lobes	13
Lower Lobes	11
Middle Lobe	6

Table 3. Distribution of Lesions

DISCUSSION

High resolution CT is a scanning protocol in which thin sections (usually 0.625 to 1.25 mm) are acquired and reconstructed using a sharp algorithm (e.g. bone algorithm). It has been used for:

- Lung imaging.
- Temporal bone imaging.

Lung Imaging

Two techniques have been used.

- Spaced axial (Non-helical).
- Volumetric HRCT.

Spaced Axial

Thin sections are acquired with an interval of 1 - 2 cms between the two sets of images. It has been considered sufficient to detect abnormalities in diffuse lung diseases.¹ This technique is most useful when single detector CT is being used. The patient dose is less as compared to volumetric imaging.

Volumetric HRCT

Thin sections are acquired continuously using multidetector row CT scanners and in a single breath-hold. It allows detection of all the abnormalities and has been considered easier and better for interpretation by providing the ability for coronal and sagittal reformations. The patient dose though is higher as compared to axial imaging.

Fundamental Technical Protocols

Slice Thickness - 0.625 - 1.25 mm

Scan Time - 0.5 - 1 second

kV - 120

mAs - 100 - 200

Collimation - 1.5 - 3 mm

Matrix Size - 768 x 768 or the largest available

FOV - 35 cm

Reconstruction Algorithm - High spatial frequency

Window - Lung window

Patient Position - Supine (Routinely) or prone (If suspected ILD)

Level of Inspiration

Full inspiration (Routinely recommended) expiratory HRCT scans at three or more levels in patients with obstructive lung diseases.

Bronchiectasis

Bronchiectasis refers to abnormal dilatation of the bronchial tree and is seen in a variety of clinical settings. CT is the most accurate modality for diagnosis. It is largely considered irreversible.²

As there are many causes of bronchiectasis, which may occur at essentially any age no single demographic is particularly involved. Two groups make up the majority of cases: post-infectious and cystic fibrosis.

Bronchiectasis typically presents with recurrent chest infections, production of copious amounts of sputum and haemoptysis. The latter is often the only symptom and is encountered in up to 50% of cases.

As is true for most lung pathology, bronchiectasis is the common response of bronchi to many different insults. Causes include -

Post-Infective (Most Common)

- Necrotising bacterial pneumonia, e.g. Staph. aureus, Klebsiella, B. pertussis.
- Granulomatous disease, e.g. tuberculosis, MAIC, histoplasmosis.
- Allergic Bronchopulmonary Aspergillosis (ABPA).
- Measles.

Congenital

- Congenital cystic bronchiectasis.
- Cystic Fibrosis (CF).
- Ciliary dysfunction syndromes, e.g. Kartagener syndrome.
- Bronchial cartilage deficiency, e.g. Williams-Campbell syndrome.
- Abnormal lung, e.g. pulmonary sequestration.
- Abnormal physiology, e.g. alpha-1-antitrypsin deficiency.
- Mounier-Kuhn syndrome.

Bronchial Obstruction

- Malignancy, e.g. bronchogenic carcinoma.
- Inhaled foreign bodies.
- Chronic aspiration lung changes.

Loss of Surrounding Lung Volume

- Traction bronchiectasis.

Others

- Rheumatoid arthritis 6.
- Systemic Lupus Erythematosus (SLE) 7.
- Post-radiotherapy.
- Post-transplantation.

Subtypes

According to macroscopic morphology, three types have been described, which also represent a spectrum of severity.

Cylindrical Bronchiectasis

Bronchi have a uniform calibre, do not taper and have parallel walls (Tram track sign and signet ring sign). It is the commonest form.

Varicose Bronchiectasis

Relatively uncommon, beaded appearances where dilated bronchi have interspersed sites of relative narrowing.

Cystic Bronchiectasis

Severe form with cyst-like bronchi that extend to the pleural surface air-fluid levels are commonly present.

Additionally, bronchiectasis can result from the traction of fibrotic lung surrounding an airway.³ This is known as traction bronchiectasis. There is dilation of bronchi and bronchioles due to elastic tissue and smooth muscle destruction.

CT and HRCT, especially excels at demonstrating the airways and is able to a greater or lesser degree to distinguish some of the various underlying causes.

Several Features are Helpful in Diagnosing Bronchiectasis^{4,5}**Bronchus Visualised within 1 cm of Pleural Surface -**

- Especially true of lung adjacent to costal pleura.
- Most helpful sign for early cylindrical change.

Lack of Tapering**Increased Bronchoarterial Ratio**

- Diameter of a bronchus should measure approximately 0.65 - 1.0 times that of the adjacent pulmonary artery branch.
- Between 1 and 1.5 may be seen in normal individuals, especially those living at high altitude.
- Greater than 1.5 indicates bronchiectasis.

Several Ancillary Findings are also Recognised

- Bronchial wall thickening: normally wall of bronchus should be less than half the width of the accompanying pulmonary artery branch.
- Mucoid impaction.
- Air-trapping and mosaic perfusion.

Signs Described on CT include

- Tram-track sign.

- Signet ring sign.
- String of pearls sign.
- Cluster of grapes sign.

In general treatment of bronchiectasis is medical and involves promoting sputum clearance using positional physiotherapy and early and aggressive treatment of pulmonary infections.^{6,7} In some cases, chronic prophylactic administration of antibiotics may be required.

In cases where bronchiectasis is severe and significant morbidity is present, surgical resection of the affected lobe may be of benefit provided adequate respiratory reserve exists.

In cases where both lungs are extensively involved (e.g. cystic fibrosis) lung transplantation can be considered.

Conditions that may mimic cystic bronchiectasis include:

- Langerhans Cell Histiocytosis (LCH).
- Lymphangiomyomatosis (LAM).
- Lymphocytic Interstitial Pneumonitis (LIP).
- Pulmonary manifestations of AIDS.
- Pneumocystis pneumonia (PCP).
- Emphysema.
- Cystic pulmonary metastases.

Case Findings Examples

Figure 1. Cystic Bronchiectatic Cavities noted in ML and Post Seg OG LUL

Figure 2. Tree in Bud Nodules, Patchy ASC noted in Post Seg of b/l UL (L > R)

Figure 3. Cystic and Varicose Bronchiectasis in Post Seg of LUL

Figure 4. Cystic Bronchiectasis with Signet Ring Sign seen in Medial Seg of ML and Inferior Seg of Lingular Lobe

CONCLUSION

It is important to perform HRCT in symptomatic cases of suspected bronchiectasis.

High resolution CT is a very sensitive modality for showing bronchiectasis.

It is characterised by the lack of bronchial tapering, bronchi visible in the peripheral 1 cm of the lungs, and an increased broncho-arterial ratio producing the 'signet-ring sign.'

According to appearance, bronchiectasis can be classified as cylindrical, varicose or cystic.

Bronchiectasis is caused by a complex cycle of repeated inflammation and a defective immune response to suppress it.

Haemoptysis is common and may occur in as many as 50% of patients. Episodic haemoptysis with little to no sputum production (dry bronchiectasis) is usually a sequelae of tuberculosis.

Commonly bronchiectasis results from necrotising bacterial infections, such as caused by the *Staphylococcus* or *Klebsiella* species.

However, in our study, Koch's infection evolved as the most common cause of bronchiectasis. In this study, the male: female ratio was found to be 3: 2.

The cause of bronchiectasis in most patients in this study was found to be post-infectious, Koch's being the commonest (66.67%) followed by *Staphylococcus* infection (13.33%), UIP (10%), fungal infection (6.67%) and COP (3.33%).

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