Role of CT scan chest and fiber optic bronchoscopy in evaluating patients with hemoptysis and normal chest radiograph

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Abstract

Introduction: To study the role of CT scan chest and fiber optic bronchoscopy in evaluating patients with hemoptysis and normal chest radiograph.

Materials and Method: 50 patients over the age of 15 years having hemoptysis with normal chest X ray in a government teaching hospital in Andhra Pradesh were taken as study subjects. They were evaluated using FOB and CT thorax. Other investigations were done when necessary.

Results: The mean age of the study population was 44.5 ± 13.5 years with age ranging from 20yrs to 80yrs. Of them 28(56%) were males and 22 (44%) females. Out of 50 such patients, a definitive diagnosis could be established in 33 patients (66%) with commonest being tuberculosis (12/50, 24%), followed by acute bronchitis (11/50, 22%), bronchiectasis (7/50, 14%), aspergilloma (2/50, 4%), malignancy (1/50,2%). CT scan is more efficacious in establishing a diagnosis of bronchiectasis than bronchoscopy ($P < 0.05$) while bronchoscopy is more sensitive in making a diagnosis of bronchitis than CT scan ($P < 0.05$). There was no statistically significant difference between CT scan and bronchoscopy ($P > 0.05$) in diagnosing PTB in patients with hemoptysis and normal CXR. CT scan solely diagnosed 30% cases with bronchoscopic findings being normal. While FOB solely diagnosed 28% cases with CT features being normal. In 8% cases both modalities established the diagnosis.

Conclusions: Overall, there was no statistically significant difference ($P > 0.05$) between CT scan and bronchoscopy in diagnosing the underlying cause of hemoptysis. Therefore, CT scan and bronchoscopy are equally important and complementary to each other in establishing diagnosis in a patient with hemoptysis and normal chest radiograph.

Keywords: Fiber Optic Bronchoscopy; CT-chest; Expectoration; Hemoptysis

Introduction

Hemoptysis is defined as the expectoration of blood from the lower respiratory tract, a spectrum that varies from blood-streaking of sputum to coughing up large amounts of pure blood [1]. Expectoration of even relatively small amount of blood is an alarming symptom.

On the other hand, massive hemoptysis can represent an acutely life-threatening problem.

Therefore, hemoptysis of any degree needs thorough evaluation. The aim of evaluation is to find treatable cause and at times, to reassure the patient. The aim of this study was to evaluate the role of CT scan chest and fiber optic bronchoscopy (FOB) in patients presenting with hemoptysis and normal chest radiograph.

Materials and Methods

A prospective study was conducted on 50 patients with hemoptysis and normal Chest radiographs at Government hospital for chest and communicable diseases, affiliated to Andhra Medical College, Visakhapatnam over a period of 2 years. The inclusion and exclusion criteria used for this study were:

Inclusion Criteria

- Hemoptysis with normal chest x ray
- Age above 15 years

Exclusion Criteria

- A definite localizing abnormality on chest X- ray
- History of bleeding diathesis
- Patients on anticoagulation (or) antiplatelet therapy
- Liver and cardiac diseases
- Bleeding lesion in the upper respiratory tract (or) oral cavity
- A previous history of lung cancer
- Patients with past history of pulmonary tuberculosis
- Pregnancy

All the 50 patients were subjected to a detailed history and physical examination including ear, nose, throat (ENT). Chest radiographs and CT scans of all the patients were reported by consultant radiologist. CT scans of the chest were performed using the General Electronics, USA Scanner. The standard CT procedure in our hospital during the study period was non contrast contiguous 5mm sections from lung apices to the liver and adrenal glands. Presence of fever and cough for more than 2 weeks duration with small cavities and centrilobular nodules demonstrating 'tree-in-bud' appearance on CT were considered suggestive of TB.

The technique of FOB has been described for all patients and done with Olympus video fiber optic BF type TE 2 bronchoscope. All the patients were fasting overnight. With the patients in supine position, the bronchoscope was passed transnasally after adequate topical anaesthesia of the nasal passages and pharynx. Thereafter, a thorough examination of the upper airway and tracheobronchial tree was performed. Patients who

required supplemental oxygen via nasal catheter was administered when indicated. Routine bronchial washings were obtained and processed with Ziehl–Neelsen stain, H&E stain and Gram's stain were sent for cytology.

Biopsies were taken as and when indicated. Bronchoscopic evidence of granular, ulcerated mucosa with demonstration of Mycobacterium tuberculosis in bronchial washings were considered suggestive of endobronchial tuberculosis (TB).

Patients with fever, purulent expectoration, hemoptysis for less than 5 days duration with bronchoscopic appearance of hypervascular mucosa and presence of poly-morphorphonuclear (PMN) leucocytes in bronchial washing cytology were taken suggestive of acute bronchitis. All the patients in our study were hemodynamically stable and were subjected to CT scan and then were taken up for bronchoscopy.

Results

The data was analyzed using standard statistical methods. The age and sex distribution, severity of hemoptysis were expressed in percentage. P Value <0.01 was considered statistically extremely significant. P-value 0.05 was considered significant.

Mean age of the study population was 44±13.5 years with age ranging from 20 to 80 years. Majority of them were in the age group of 30-49 yrs(22/50,44%). There were 28 males (56%) and 22 females (44%).

Cough was the most common associated symptom present in 42 (84%) cases. Hoarseness of voice was present in 1 patient (2%) who was eventually diagnosed of bronchogenic carcinoma. These details are shown in Table 1.

Table 1: Demographic and clinical profile of the study population (n=50)

	n (%)
Mean age	44.5±13.5 yrs
15-29 yrs	09(18)
30-49 yrs	22(44)
50-69 yrs	16(32)
>70 yrs	03(6)
Sex	
Males	28(56)
Females	22(44)
Associated symptoms	
Cough	42(84)
Fever	27(54)
Purulent sputum	17(34)
Weight loss	13(26)
Pallor	13(26)
Clubbing	08(16)
Hoarseness of voice	01 (2)

Table 2: Results of the study

Result	No. of Patients (%)
Diagnosed Cases	33 (66)
Undiagnosed Cases	17 (34)
Total Cases	50(100)

Total diagnosed cases using both modalities were 33(66%) and undiagnosed were 17(34%).

Table 3: Etiologies of hemoptysis in the study population

Diseases	No. of Patients (%)
Idiopathic	17 (34)
Tuberculosis	12(24)
Acute bronchitis	11(22)
Bronchiectasis	07(14)
Aspergilloma	02(4)
Malignancy	01(2)

In our study, Tuberculosis (24%) was the most common cause for hemoptysis with normal chest X ray followed by acute bronchitis (22%).

Table 4: Diseases diagnosed by CT scan

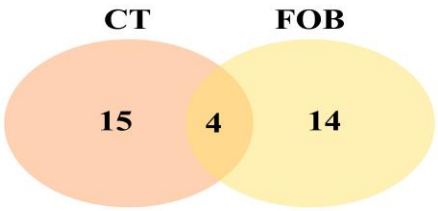
Diagnosis	No. of Patients (%)	
PTB	09	(18)
Bronchiectasis	07	(14)
Aspergilloma	02	(4)
Malignancy	01	(2)
Undiagnosed	31	(62)
Total	50(100)	

19 cases were diagnosed by CT scan in study population. Maximum cases diagnosed were pulmonary TB followed by bronchiectasis. CT scan is more efficacious than FOB in diagnosing bronchiectasis (P < 0.05).

Table 5: Diseases diagnosed by FOB

Diagnosis	No. of patients (%)	
Acute bronchitis	11	(22)
PTB	06	(12)
Malignancy	01	(2)
Undiagnosed	32	(64)
Total	50(100)	

18 cases were diagnosed by FOB in the study population. Maximum cases diagnosed by bronchoscopy were acute bronchitis followed by PTB. Bronchoscopy is more sensitive than CT scan in making a diagnosis of bronchitis(P<0.05).



Cases diagnosed by CT scan alone were 15 (30%) and cases diagnosed by FOB alone were 14 (28%). However, 3(6%) cases of PTB and 1 (2%) case of bronchogenic carcinoma were diagnosed by both the modalities. Overall a definitive diagnosis was established in 33 cases (66%).

Table 6: Profile of PTB Diagnosed by CT Scan And FOB

Investigations	No. of PTB Cases (%)
CT Scan S/O PTB FOB Normal	06(12)
BW* Positive for AFB CT Scan Normal	03(6)
BW* Positive for AFB CT Scan S/O PTB	03(6)
Total	12(24)

*B W- Bronchial washings

This table shows that no statistical significant difference exist between CT scan and FOB in diagnosing PTB with hemoptysis and normal CXR. (P value > 0.05)

6 (12%) cases were diagnosed by CT scan alone, endobronchial TB was diagnosed in 3 (6%) cases and in remaining 3 (6%) cases both CT scan and FOB were suggestive of PTB.

Discussion

Hemoptysis is an important symptom of pulmonary disease reported in 7-15% of patients [2]. Therefore, it is necessary to use diagnostic tools such as CT scan chest and bronchoscopy to get an accurate diagnosis in a patient presenting with hemoptysis and normal chest radiograph.

In 30% of patients presenting with hemoptysis, the underlying cause remains undetermined despite extensive investigations [2]. The major causes of hemoptysis with normal Chest X-ray include TB, bronchiectasis, and lung cancer [2]. In the present study, 66 % of cases were diagnosed by both the modalities, which is on par with the study results of Naidich et al. [3] where 62.7% of cases were diagnosed. Similar results were reported by an Indian study conducted by Magu et al. [4], while a UK based study led by Thirumaran et al. [5] reported a diagnostic yield of 94%.

The diagnostic yield from bronchoscopy in our study was 36%, out of these, 22% had bronchoscopic evidence of acute bronchitis, while bronchial washings were positive for AFB in 12% and in remaining 2 % of cases malignant cytology was positive for squamous cell carcinoma.

Naidich et al. reported a diagnostic yield as high as 62.7% from bronchoscopy, whereas Heaton et al. reported 19.5% yield [3,6].

In the present study CT scan of the chest had diagnosed the cause in 38 % of cases. Among these, PTB was diagnosed in 18%, bronchiectasis in 14%, aspergilloma in 4% and bronchogenic carcinoma in remaining 2%. These results were consistent with those reported by Tak S et al. [7] where HRCT established a definite diagnosis in 30%.

In the present study pulmonary tuberculosis was diagnosed in 24% of cases, out of these CT scan had shown the features of PTB in 12% with bronchoscopic findings being normal. In 6% of cases there was an appearance of granular and ulcerated mucosa with demonstration of Mycobacterium tuberculosis in bronchial washings, however these patients had normal CT scan findings. In remaining 6% of cases both FOB and CT had findings was suggestive of PTB. Our results were comparable with those reported by Magu et al. [4] where PTB was diagnosed in 20% of cases. However, another US based similar study conducted by Mc Guinness et al. [8], had identified PTB in 16% of cases.

Zavala et al. [9] had reported malignancy in 16.3% of cases, another UK based similar study conducted by Thirumaran et al. [5], had reported malignancy in 9.6% however, in our study only one patient (1/50, 2%) was diagnosed as bronchogenic carcinoma by CT and bronchoscopy, which is consistent with the incidence reported by Suri et al. [10] (3.7%) and Jindal et al. [11] (4.5%). In the present study, there was a statistically significant difference (P <0.05) in detecting bronchiectasis, CT being remarkably more efficacious than FOB in detecting 7 cases, all of which had normal bronchoscopic findings.

On the contrary, FOB is superior to CT in making a diagnosis of bronchitis. There was a statistically significant difference (P < 0.05), with FOB diagnosing eleven cases all of which had normal CT findings.

Mc Guinness et al. [8] had also concluded that CT was of particular value in diagnosing bronchiectasis, aspergilloma while bronchoscopy is helpful in diagnosing bronchitis and mucosal lesions.

There was no statistically significant difference (P > 0.05) between the two modalities in diagnosing tuberculosis. Hence both modalities have equal role in establishing diagnosis in PTB.

Both CT and FOB had an important role in evaluating patients with hemoptysis and normal chest

radiograph. In our study, many patients with abnormal CT findings had normal bronchoscopic findings and vice-versa. Bronchoscopy allowed direct visualization and collection of samples from proximal endobronchial tree, but it is not useful in detecting small peripheral tumor.

However, CT scan is not only non-invasive but also detects parenchymal abnormalities and sometimes endobronchial abnormalities, but it does not allow for histologic and bacteriologic examination of abnormal findings. CT scan is especially useful in detecting bronchiectasis and some cases of early pulmonary TB.

Overall, there was no statistically significant difference ($P > 0.05$) between CT scan and bronchoscopy in diagnosing the underlying cause of hemoptysis. Therefore CT and bronchoscopy are equally important and complementary to each other in establishing a diagnosis in normal chest radiograph. As the incidence of malignancy in our study group is low and tuberculosis being the important cause of hemoptysis in India, it is suggested that CT scan should precede fiber optic bronchoscopy in patients with hemoptysis and normal chest radiograph.

Conclusions

To conclude, CT scan and fiber optic bronchoscopy are the two important modalities to diagnose the cause for hemoptysis especially when the initial investigations like chest radiographs, sputum analysis etc. are normal. In our study, CT scan and bronchoscopy together led to a diagnosis in 66% patients. Bronchoscopy is superior to CT scan in evaluating mucosal lesions including bronchitis, endobronchial tuberculosis, malignancy and also aids in histopathological and microbiological confirmation. However, CT scan is the investigation of choice in evaluating distal airway and parenchymal abnormalities like bronchiectasis, aspergilloma. As there was no statistically significant difference ($P >0.05$) between CT scan and FOB in diagnosing the underlying cause of hemoptysis, they are complementary to each other in establishing diagnosis in these patients. However, large scale studies are needed to further define the role of these modalities in patients with hemoptysis and normal chest radiographs.

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