ORIGINAL ARTICLE

Role of computed tomography and fiber-optic bronchoscopy in the evaluation of hemoptysis

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Introduction: Hemoptysis is often an alarming and worrisome symptom for the patient and the physician as well. It has been a frequent manifestation of a variety of diseases. Therefore, diagnostic approach in several cases becoming more challenging. The purpose of this study is to evaluate the causes of hemoptysis with particular reference to diagnostic strategies in patient visiting Rohilkhand Medical College and Hospital (RMCH), Bareilly. **Materials and Methods:** A cross-sectional descriptive study was done in 50 patients with complain of hemoptysis visiting in chest OPD of RMCH. After general physical examination, hematological and biochemical test was carried out. All patients were then subjected to chest X-ray (PA view), ECG and contrast-enhanced computed tomography (CECT) and fiber-optic bronchoscopy (FOB). Data analysis was done by Chi-square test and *t*-test**. Results:** CECT diagnosed CA in 33 (66%) and bronchiectasis in 13 (26%) cases and normal finding in 2 (4%) cases. FOB findings are normal in 8 (16%) cases, showed growth with obstruction in 21 (42%) and growth without obstruction in 8 (16%) cases. In 13 (26%) cases, bronchoscopy was not done. **Conclusion:** Both CECT and FOB are found to be useful diagnostic tools in evaluating the cause of hemoptysis. FOB is useful where CT is not confirmative.

KEYWORDS: Carcinoma, computed tomography, diagnostic tools, fiber-optic bronchoscopy, hemoptysis, tuberculosis

INTRODUCTION

Hemoptysis can be defined as the expectoration of blood derived from the lungs or bronchial tubes as a result of pulmonary or bronchial hemorrhage. It can be divided into two types as non-massive or massive depending on the volume of blood loss. The hemoptysis is generally caused by acute and chronic bronchitis, pneumonia, and tuberculosis (TB). Infection, cancer, and pulmonary venous hypertension are the other causes of hemoptysis. In 7–34% of patients with hemoptysis, no identifiable cause can be found after careful evaluation (Reisz *et al*., 1997; Set *et al*., 1993; Herth *et al*., 2001).[1-3] If the cause of hemoptysis is idiopathic, then we can say that the prognosis is usually good and within 6 months, the majority of the patients will show resolution. However, the previous data clearly show that the cause of hemoptysis is mainly lung cancer in individuals who are smokers and having age more than 40 years.

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Cause of Hemoptysis in Children

- Lower respiratory tract infection is found of be the most common cause of hemoptysis in children
- The other cause may include – foreign body aspiration in young age group, bronchiectasis may occur in the similar age group of individuals who are having cystic fibrosis
- Trauma and injury direct to the chest may cause hemoptysis as if may cause pulmonary contusion and hemorrhage.[4-6]

Diagnostic Approach

There are enormous global, geographical variations in the causes of hemoptysis. In the west, for example, malignancy

and non-tuberculous causes are most common, although the social mix of the population is an important variable. Human immunodeficiency virus-related TB is also on the increase. Within poorer Third World countries, however, TB is often the most likely cause (Broomhead, 2007).[7] The generally followed diagnostic approach includes history taking and clinical examination followed by investigations. A brief review of this approach is as follows:

History Taking

Important clues to the diagnosis can be gained from a carefully taken history including smoking and tobacco history, although confirmatory investigations are almost always necessary. Patient history can help identify the anatomic site of bleeding, differential between hemoptysis and pseudohemoptysis, and narrow the differentiate diagnosis. Factors such as age, nutrition status, and comorbid conditions can assist in the diagnosis and management of hemoptysis. Table 1 shows the list of diagnostic clues obtained through physical history:

Clinical Examination

Physical examination needs to be thorough and extensive. The most important immediate need is to assess whether the patient's condition is serious enough to demand emergency hospital admission for resuscitation. Cyanosis, severe dyspnea, and cardiopulmonary collapse all indicate that this is likely to be the case (Broomhead, 2007).[7] Examination of the nasal cavity and oropharynx will help to exclude "non-pulmonary causes for the bleeding (pseudohemoptysis)." Clubbing of the fingers may be present in chronic pulmonary disease or lung cancer, whereas evidence of recent weight loss or muscle wasting may be significant. Supraclavicular lymph nodes, jaundice, or hepatomegaly may also suggest an underlying malignancy. Deep vein thrombosis in a calf muscle is often difficult to exclude but is classically associated with pain, swelling, and Homans sigh (pain on flexing the foot).

Abnormal finding within the chest may include reduced air entry, rales, wheezing, and basal crepitations. Dullness on percussion may suggest consolidation or a pleural effusion, whereas the presence of a diastolic murmur may indicate mitral stenosis. An elevated jugular venous pressure, a gallop rhythm, or peripheral edema may indicate cardiac failure and pulmonary edema as the cause of the problem (Broomhead, 2007).[7]

Table 1: Diagnostic clues in hemoptysis: Physical history

The various clues in hemoptysis for diagnosis

- If hemoptysis is associated with menses cause may be catamenial
- If hemoptysis is associated with dyspnea on exertion, fatigue, orthopnea, PND, pink frothy sputum cause may be congestive heart failure
- If hemoptysis is associated with prolonged intake of NSAIDs cause may be drug induced
- If hemoptysis is associated with fever, cough, and expectoration cause may be upper/lower respiratory tract infections
- If hemoptysis in individuals (age>40 years, smoker, male) cause may be lung carcinoma
- If hemoptysis is associated with foul smelling, copious sputum cause may be bronchiectasis

PND: Paroxysmal nocturnal dyspnea

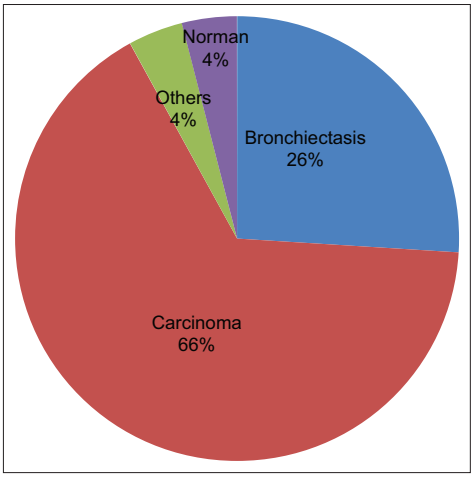


Figure 1: Contrast-enhanced computed tomographic findings

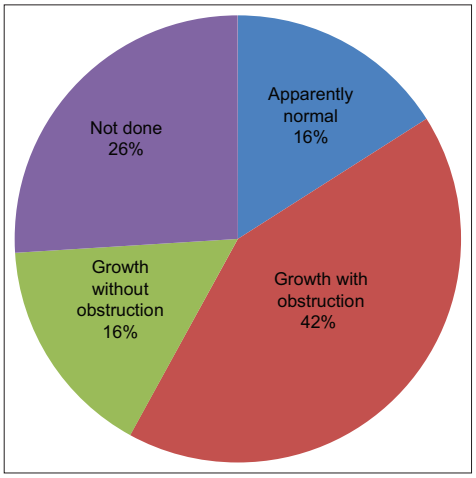


Figure 2: Fiber-optic bronchoscopic findings

Table 2: Distribution of patients according to contrast-enhanced computed tomographic findings

S. No.	Variable	No. of patients	Percentage
1	Bronchiectasis	13	26.0
2	Carcinoma	33	66.0
3	Others	2	4.0
4	Normal	2	4.0

Table 3: Distribution of patients according to fiber-optic bronchoscopy findings

S. No.	Variable	No. of patients	Percentage
1	Apparently normal	8	16.0
2	Growth with obstruction	21	42.0
3	Growth without obstruction	8	16.0
4	Not done	13	26.0

Diagnostic Evaluation

The chart presenting an algorithm for the evaluation of non-massive hemoptysis. After a careful history examination, a chest radiography should be obtained.

If the cause of hemoptysis is not diagnosed by usual examination and investigation, then further we have to move over advanced radiological imaging as CT thorax or we can perform bronchoscopy for accurate diagnosis. In view of the previous data, we can easily predict the prognosis of individual as poor (age >40 years, sex male, and smokers with 40 pack-years or more and hemoptysis for more than 1 week duration) in such patients, the fiber-optic bronchoscopy (FOB) is play an important role in diagnosing or to rule out malignancy.[8]

The advantage of FOB is not only as direct visualization of the endobronchial disease but at the same time it will also permits for BAL, brushing, or tissue biopsy for further evaluation and it will serve as preferred tool as it also provides therapy in case of massive bleeding and is useful for excluding malignancy in high-risk patients.[9,10] Its role in hemoptysis continues to evolve, and further studies are being done to evaluate its effect on patient management and outcome.

MATERIALS AND METHODS

The present study is carried out in the Department of Pulmonary Medicine, Rohilkhand Medical College and Hospital, Bareilly. It is a tertiary care teaching hospital with well-equipped state of the art infrastructure and a well-trained human resource. Study population includes all the male female, aged >20 years patients with symptoms of hemoptysis. Patients having complaints of hemoptysis following trauma, patient with blood dyscrasias, thrombocytopenia, and sputum positive for AFB have been excluded from this study.

Procedure of Study

After permission of the Institutional Ethical Committee, an informed consent is obtained from all the participants. After taking history of the patient, general physical examination followed by thorough chest examination, cardiovascular,

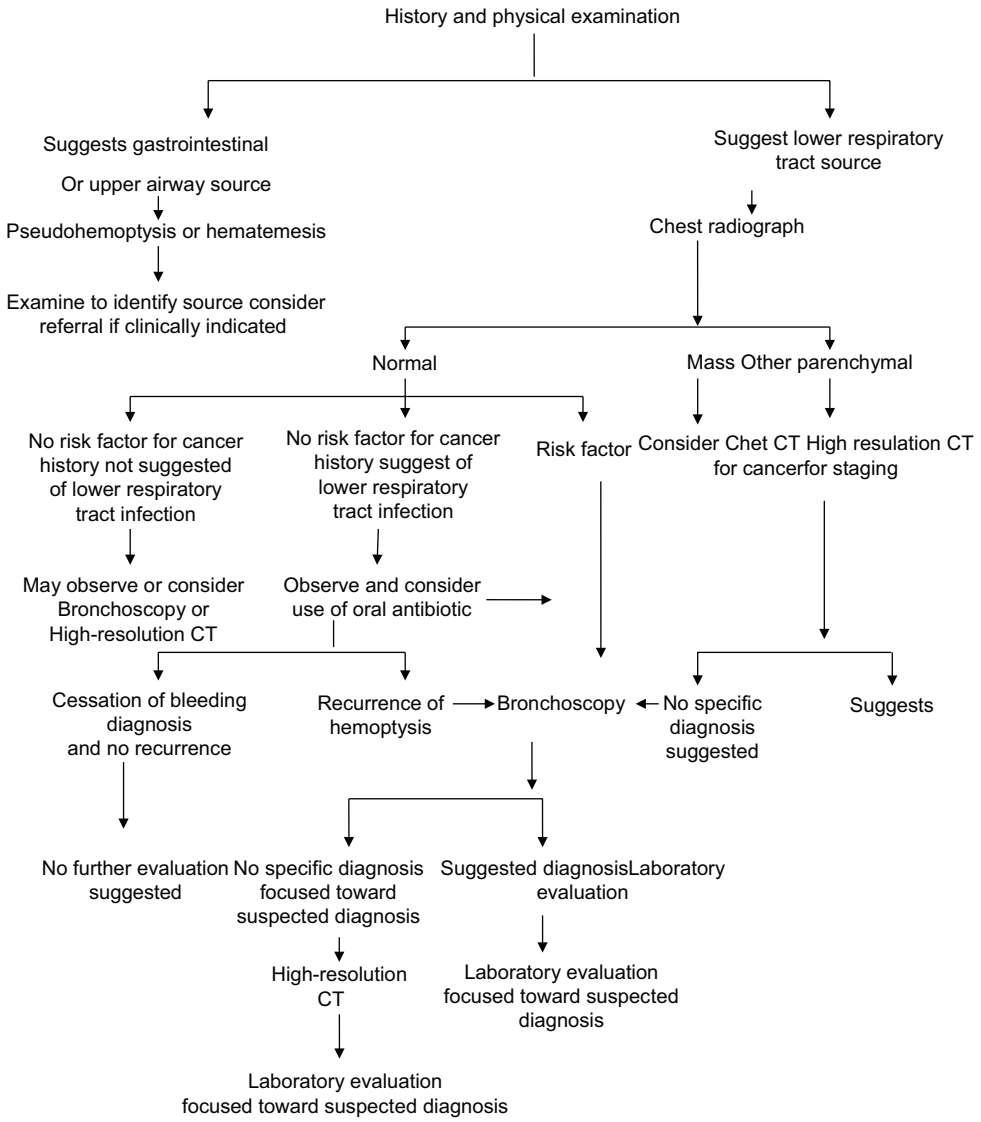
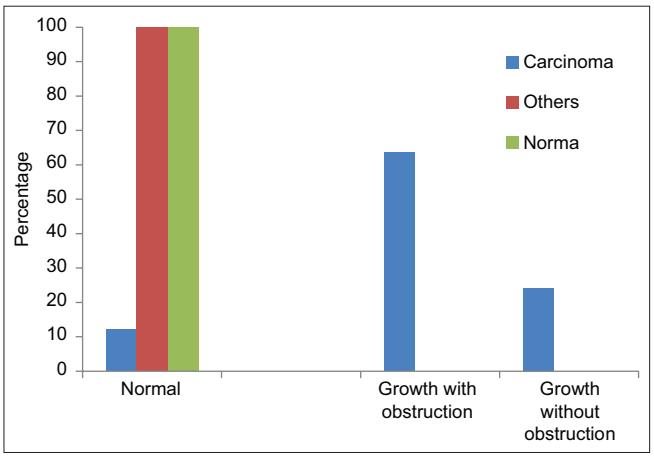


Table 4: Association between CECT finding and demographic factors

S. No.	Factors	CECT findings								Statistical significance	
		Bronchiectasis (*n*=13)		Carcinoma (*n*=33)		Other (*n*=2)		Normal (*n*=2)		x	p
		No.	%	No.	%	No.	%	No.	%		
1.	Age (year)									28.84	<0.001
	<30	4	66.7	0	0.0	0	0.0	2	33.3		
	30–50	7	33.3	14	66.7	0	0.0	0	0.0		
	>50	2	8.7	19	82.6	2	8.7	0	0.0	2.50	0.476
2.	Gender										
	Male	9	22.0	28	68.3	2	4.9	2	4.9		
	Female	4	44.4	5	55.6	0	0.0	0	0.0		
3.	Religion									6.69	0.082
	Hindu	10	34.5	17	58.6	0	0.0	2	6.9		
	Muslim	3	14.3	16	76.2	2	9.5	0	0.0		
4.	Occupation									54.30	<0.001
	Farmer	9	26.5	23	67.6	2	5.9	0	0.0		
	Housewife	4	44.4	5	55.6	0	0.0	0	0.0		
	Businessman	0	0.0	4	100.0	0	0.0	0	0.0		
	Laborer	0	0.0	1	100.0	0	0.0	0	0.0		
	Employee	0	0.0	0	0.0	0	0.0	2	100.0		

Table 5: Association between CECT finding and fiber-optic bronchoscopy finding

S. No.	Fiber-optic bronchoscopy finding	CECT finding						Statistical significance	
		Carcinoma (*n*=33)		Other (*n*=2)		Normal (*n*=2)		x^2	p
		No.	%	No.	%	No.	%		
1.	Normal	4	12.1	2	100.0	2	100.0	16.26	0.003
2.	Growth with obstruction	21	63.6	0	0.0	0	0.0		
3.	Growth without obstruction	8	24.2	0	0.0	0	0.0		



abdominal, and central nervous system is done. Hematological and biochemical test is also carried out. After that all the patients were then subjected to chest X-ray (PA view), ECG was done for the confirmatory diagnosis and contrast-enhanced computed tomography (CECT) chest was performed using a 16-slice multidetector CT scan unit. All those cases in which no confirmatory diagnosis could be made out by CT were subjected to FOB.

The data collected are analyzed using Chi-square test. Parametric evaluation is done using analysis of variance and independent sample "t" test. The confidence level of the study was kept at 95% hence "p" value is less than 0.05 which indicates statistically significant association.

OBSERVATION AND RESULTS

CECT revealed cause of hemoptysis to be carcinoma in 33 (66%) patients. A total of 13 (26%) patients had bronchiectasis, two were categorized as other causes (one with peripherally located mass and another mediastinal mass) while remaining 2 (4%) cases were found to be normal on CECT [Figure 1 and Table 2].

FOB was not done in 13 (26%) cases confirmed as bronchiectasis in CECT. It revealed normal finding in 8 (16%) patients. Growth with obstruction was observed in 21 (42%) patients and growth without obstruction was observed in remaining 8 (16%) patients [Figure 2 and Table 3].

Associations

Tables 4 and 5 show association between CECT finding with demographic, clinical, and other diagnostic findings:

On the basis of the present study, the following conclusion has been drawn.

1. CECT diagnosed carcinoma in 33 (66%) and bronchiectasis in 13 (26%) cases, and normal findings in 2 (4%) cases. In one case, each peripherally located mass and mediastinal mass was observed
2. FOB was normal in 8 (16%) cases, showed growth with obstruction in 21 (42%) and growth without obstruction in 8 (16%) cases. In 13 (26%) cases, bronchoscopy was not done
3. Histopathologically, 3 (9.1%) cases have adenocarcinoma, 22 (66.7%) have squamous cell carcinoma, and 5 (15.2%) have small cell carcinoma. There were 3 (9.1%) cases with other findings (one case each of poorly differentiated carcinoma, atypical cell, and mediastinal lymphoma, respectively). Thus, confirming the positive findings of CECT in all the cases. Prevalence of carcinoma is higher in male of older ages. Lung cancer is more common in farmer, businessmen, and laborers as compared to housewives and employees.

DISCUSSION

The diagnostic approaches for ascertaining cause of hemoptysis include both invasive (bronchoscopy, biopsy) as well as non invasive (CT and other imaging techniques). In recent years CT has emerged as a useful diagnostic modality for diagnosis of causes of thoracic abnormalities and has shown promising results in evaluation of hemoptysis.[11] In this study we have evaluated the usefulness of CT in 50 patients for diagnosis of hemoptysis and its limitations by carrying out fibroptic bronchoscopy, where CT failed to deliver a confirmative diagnosis.

In present study CECT revealed high burden of carcinoma (66%) followed by bronchiectasis (26%). Although most of the studies in past have found the high prevalence of tuberculosis, however no patient with tubercular etiology was found in our study, which might be attributed to the exclusion of sputum AFB positive cases. One of the reasons for high burden of carcinoma for present study could be the high prevalence of smoking and biomass fuel exposure. Heavy smoking is a major risk for lung cancer in both active and smokers.[12]

On histopathology of 33 cases diagnosed as carcinoma by CECT all the cases were confirmed to be carcinoma thus indicating high specificity of CECT in diagnosis of carcinoma. High utility of CECT in diagnosing of carcinoma was also reported Sharma *et al.*[13] In present study, we found that CECT provides excellent information and it should be used as a primary diagnostic tool in evaluating cases of hemoptysis as it is non invasive in nature. Fiberoptic bronchoscopy improves the results of CECT especially in cases with intraluminal growth for making histopatholgical diagnosis.

CONCLUSION

The present study corroborated the observation of the previous workers that CT is a useful diagnostic modality in cases of hemoptysis and helps in investigating the reason of unexplained hemoptysis. In the present study, we found that CECT provides excellent information and it should be used as a first diagnostic tool in evaluating the causes of hemoptysis as it is non-invasive in nature. FOB improves the results of CECT, especially in cases with intraluminal growth for making histopathological diagnosis.

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