

A Study of Clinical Profile of Hemoptysis and Its Correlation with Radiological, Microbiological and Pathological Findings

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Abstract

Background: Hemoptysis is one of the most important and alarming respiratory symptoms encountered in pulmonary medicine. It may result from a wide variety of pulmonary and systemic disorders ranging from infections to malignancy. Early identification of the underlying etiology through clinical, radiological, microbiological, and pathological correlation is essential for appropriate management and prevention of complications. The aim is to study the clinical profile of hemoptysis and to correlate the clinical findings with radiological, microbiological, and pathological findings among patients presenting with hemoptysis. **Material and Methods:** The present prospective observational study was conducted in the Department of Pulmonary Medicine at a tertiary care teaching hospital over a period of one year. A total of 100 adult patients presenting with hemoptysis were included in the study. Detailed clinical history, physical examination, laboratory investigations, sputum examination, radiological investigations including chest X-ray and CECT thorax, and pathological investigations were performed whenever indicated. Data were analyzed using appropriate statistical methods and expressed in frequencies and percentages. **Results:** The majority of patients belonged to the age group of 30–49 years (39%), followed by 50–69 years (31%). Male predominance was observed with 73% males and 27% females. Pulmonary tuberculosis was the most common etiology accounting for 68% of cases, followed by bronchiectasis (10%) and malignancy (7%). Mild hemoptysis was observed in 83% of patients, while severe hemoptysis occurred in 2% of cases. Cough was the most common associated symptom and was present in 98% of patients. Radiological abnormalities were observed in the majority of cases, predominantly involving the upper lung zones. Microbiological evaluation revealed sputum positivity for acid-fast bacilli in a substantial proportion of patients and bacterial isolates such as *Klebsiella* and *Pseudomonas* species in others. **Conclusion:** Pulmonary tuberculosis remains the leading cause of hemoptysis in developing countries. Clinical evaluation along with radiological, microbiological, and pathological correlation plays a vital role in identifying the underlying etiology and guiding appropriate management. Early diagnosis and timely intervention are essential to reduce morbidity and prevent life-threatening complications associated with hemoptysis.

Keywords: Hemoptysis; Pulmonary tuberculosis; Radiological correlation; Microbiological findings; Bronchiectasis.

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INTRODUCTION

Hemoptysis, defined as the expectoration of blood originating from the lower respiratory tract, remains one of the most alarming and clinically significant symptoms encountered in pulmonary medicine. The severity of hemoptysis may vary from blood-streaked sputum to massive life-threatening bleeding, often leading to considerable morbidity and mortality if not promptly diagnosed and managed. The condition represents a manifestation of a broad spectrum of pulmonary, cardiovascular, infectious, inflammatory, and neoplastic disorders, making accurate etiological diagnosis essential for effective treatment and prognosis.^[1] Hemoptysis contributes substantially to emergency admissions and respiratory clinic visits, particularly in developing countries where pulmonary infections remain highly prevalent.^[2]

The pathophysiology of hemoptysis is closely related to disruption of the bronchial or pulmonary circulation. In nearly 90% of clinically significant cases, the bleeding originates from the bronchial arteries because of their

systemic pressure circulation, while pulmonary arterial bleeding accounts for a smaller proportion of cases.^[3] Massive hemoptysis can rapidly compromise airway patency and gas exchange, resulting in respiratory failure and death due to asphyxiation rather than exsanguination.^[4] Therefore, timely identification of the bleeding source and underlying pathology is critical in determining the appropriate therapeutic approach.

The etiological profile of hemoptysis varies considerably between developing and developed nations. In countries such as India, pulmonary tuberculosis continues to be the leading cause

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owing to the persistent burden of active and post-tubercular lung disease.^[5] Bronchiectasis, chronic bronchitis, bacterial pneumonia, fungal infections, and lung abscesses are also important infectious causes frequently associated with hemoptysis.^[6] In contrast, malignancy, chronic obstructive pulmonary disease, and bronchiectasis predominate in developed countries due to lower tuberculosis prevalence and higher smoking rates.^[7] This geographical variation highlights the importance of region-specific evaluation of hemoptysis.

Radiological investigations play a pivotal role in the localization and etiological diagnosis of hemoptysis. Chest radiography remains the initial imaging modality because of its accessibility and rapidity; however, high-resolution computed tomography (HRCT) and contrast-enhanced computed tomography (CECT) provide superior diagnostic accuracy in identifying cavitory lesions, bronchiectasis, neoplasms, vascular abnormalities, and parenchymal diseases.^[8] Radiological correlation is particularly useful in patients with recurrent or unexplained hemoptysis, where chest X-ray findings may be inconclusive.

Microbiological evaluation is equally important, especially in regions with high prevalence of pulmonary infections. Sputum examination for acid-fast bacilli, Gram staining, bacterial culture, fungal studies, and molecular diagnostic techniques aid in establishing infective etiologies and guiding antimicrobial therapy.^[9] Furthermore, pathological examination including sputum cytology, bronchoscopy-guided biopsy, and histopathological analysis becomes essential in suspected malignancies and diffuse pulmonary disorders. Correlation between clinical manifestations and pathological findings helps in differentiating benign from malignant causes and improves diagnostic precision.

Despite advances in diagnostic modalities, the etiology of hemoptysis remains unidentified in a subset of patients, often termed cryptogenic hemoptysis. This creates significant challenges in management and necessitates a systematic diagnostic approach integrating clinical, radiological, microbiological, and pathological evaluation.^[10] Early recognition of the underlying cause not only improves patient outcomes but also helps prevent recurrent episodes and life-threatening complications.

Considering the diverse etiologies and diagnostic complexities associated with hemoptysis, the present study was undertaken to evaluate the clinical profile of patients presenting with hemoptysis and to correlate the clinical findings with radiological, microbiological, and pathological investigations in order to identify the underlying causes and improve diagnostic assessment of this important respiratory symptom.

MATERIALS AND METHODS

The present prospective observational study was conducted in the Department of Pulmonary Medicine at a tertiary care teaching hospital over a period of one year. The study included 100 adult patients presenting with hemoptysis who attended the outpatient department or were admitted to the pulmonary medicine ward. Patients of both sexes aged more

than 18 years were enrolled after obtaining written informed consent. Patients with bleeding originating from the upper respiratory tract or gastrointestinal tract, patients with known bleeding diathesis, and those receiving anticoagulant or antiplatelet therapy were excluded from the study.

A detailed clinical history was obtained from all patients, including duration and severity of hemoptysis, smoking and tobacco habits, associated respiratory symptoms, constitutional symptoms, history of pulmonary tuberculosis, chronic lung diseases, and other comorbid conditions. Thorough general and systemic examinations were performed in all cases.

The severity of hemoptysis was classified as mild, moderate, or severe based on the quantity of blood expectorated. Routine laboratory investigations including complete blood count, erythrocyte sedimentation rate, random blood sugar, serum creatinine, bleeding time, clotting time, prothrombin time, activated partial thromboplastin time, and urine examination were carried out in all patients. Sputum samples were subjected to Ziehl–Neelsen staining for acid-fast bacilli, Gram staining, bacterial culture and sensitivity testing, and cytological examination whenever indicated.

Radiological evaluation included chest radiography in posteroanterior view for all patients, while lateral chest radiographs, contrast-enhanced computed tomography (CECT) thorax, ultrasonography of chest or abdomen, and other advanced imaging modalities were performed whenever clinically indicated. Electrocardiography and echocardiography were performed in selected patients to rule out cardiovascular causes of hemoptysis. Histopathological evaluation through sputum cytology, bronchoscopy-guided biopsy, or other pathological examinations was carried out in patients with suspected neoplastic or unexplained lesions.

All patients were initially managed conservatively with antitussives, antimicrobials, sedatives, oxygen supplementation, and supportive care. Patients with severe hemoptysis received blood transfusion and plasma expanders as required. Clinical, radiological, microbiological, and pathological findings were systematically recorded and analyzed to determine the etiological profile and correlation among diagnostic modalities.

Ethical approval for the study was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants before enrollment.

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical methods. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean \pm standard deviation. Correlation between clinical, radiological, microbiological, and pathological findings was assessed using the Chi-square test, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

The present study included 100 patients presenting with hemoptysis. The age-wise distribution of patients is shown in [Table 1]. The majority of patients belonged to the age group of 30–49 years, accounting for 39% of the study population, followed by the 50–69 years age group comprising 31% of

patients. Patients aged ≥ 70 years constituted 17% of the cases, while the least affected age group was 18–29 years with 13% of patients. These findings indicate that hemoptysis

was more commonly observed among middle-aged and elderly individuals.

Table 1: Age Distribution of Patients with Hemoptysis

Age Group (Years)	Number of Patients	Percentage
18–29	13	13%
30–49	39	39%
50–69	31	31%
≥ 70	17	17%
Total	100	100%

Table 2: Sex Distribution of Patients with Hemoptysis

Sex	Number of Patients	Percentage
Male	73	73%
Female	27	27%
Total	100	100%

Sex distribution of the study population is presented in [Table 2]. Male predominance was clearly observed in the present study, with 73 male patients constituting 73% of the total cases, whereas females accounted for only 27% of

patients. The male-to-female ratio was approximately 2.7:1, suggesting a higher prevalence of hemoptysis among males, possibly due to increased exposure to smoking, tobacco use, occupational hazards, and pulmonary infections.

Table 3: Etiological Distribution of Hemoptysis

Etiology	Number of Patients	Percentage
Pulmonary Tuberculosis	68	68%
Bronchiectasis	10	10%
Malignancy	7	7%
Bronchitis	2	2%
Obstructive Lung Disease	3	3%
Pneumonia	2	2%
Cardiovascular Causes	2	2%
Interstitial Lung Disease	1	1%
Kartagener Syndrome	1	1%
Lung Abscess	1	1%
Hypertension-related Causes	1	1%
Cryptogenic/Idiopathic	2	2%
Total	100	100%

The etiological profile of hemoptysis is detailed in [Table 3]. Pulmonary tuberculosis was identified as the most common cause and was observed in 68% of patients. Bronchiectasis was the second most common etiology accounting for 10% of cases, followed by malignancy in 7% of patients. Bronchitis was responsible for 2% of cases. Other less common causes included obstructive lung disease in 3%,

cardiovascular causes in 2%, pneumonia in 2%, interstitial lung disease in 1%, Kartagener syndrome in 1%, lung abscess in 1%, hypertension-related causes in 1%, and cryptogenic or idiopathic hemoptysis in 2% of patients. These findings demonstrate that infectious pulmonary diseases, particularly tuberculosis, remain the predominant cause of hemoptysis in the present study population.

Table 4: Correlation of Hemoptysis with Tuberculosis

Diagnosis	No. of patients	Percentage
Active Tuberculosis	39	57.4%
Inactive Tuberculosis (Previously treated)	29	42.6%

68 cases of hemoptysis had Pulmonary Tuberculosis as primary diagnosis, amongst 39 patients (57.3%) had active

tuberculosis, whereas 29 patients had inactive Pulmonary tuberculosis (Previously treated) (42.6%).

Table 5: Correlation of Sputum Status in hemoptysis Patients

Sputum Status	No. of Patients	Total
Negative	62	62
Positive	Scanty	38*
	1+	
	2+	
	3+	

Above results suggested that in which 38 patients had active tuberculosis. In these patients Sputum smear positivity grading 1+ in 9 patients, 2+ in 11 patients and 18 patients

have 3+ positive. *Out of 39 patients of Pulmonary Koch's, one patient was sputum negative and X-ray finding positive for pulmonary Koch's.

Table 6: Severity of Hemoptysis among Study Patients

Severity of Hemoptysis	Number of Patients	Percentage
Mild	83	83%
Moderate	15	15%
Severe	2	2%
Total	100	100%

The severity distribution of hemoptysis is shown in [Table 6]. Mild hemoptysis was the most common presentation and was observed in 83% of patients. Moderate hemoptysis was present in 15% of cases, while severe hemoptysis was noted

in only 2% of patients. These observations indicate that the majority of patients presented with non-massive hemoptysis, whereas life-threatening severe hemoptysis was relatively uncommon.

Table 7: Associated Symptoms in Patients with Hemoptysis

Symptoms	Number of Patients	Percentage
Cough	98	98%
Dyspnea	57	57%
Fever	45	45%
Chest Pain	18	18%
Malaise	16	16%
Night Sweats	11	11%
Weight Loss/Anorexia	6	6%

Associated clinical symptoms observed among patients with hemoptysis are presented in [Table 7]. Cough was the most frequently associated symptom and was present in 98% of patients. Dyspnea was observed in 57% of cases, followed by fever in 45% of patients. Chest pain was present in 18% of patients, malaise in 16%, and night sweats in 11% of patients.

Weight loss or anorexia was the least common symptom and was observed in 6% of cases. The predominance of respiratory and constitutional symptoms suggests that infective pulmonary diseases were the major underlying causes of hemoptysis in the present study.

Table 8: Correlation of Hemoptysis with Sputum Culture

Organism	No. of Patients	Percentage
No Growth	58	58%
KLEBSIELLA	20	20%
E. Coli	11	11%
Pseudomonas	6	6%
Enterococci	2	2%
Staphylococci	2	2%
Streptococcal pneumoniae	1	1%

In our study patients, there was microbiological correlation for sputum culture positivity with hemoptysis patients (42%). Various organism was found in Culture & Sensitivity, in which Klebsiella organism was (20%) present with

hemoptysis followed by E.coli (11%), Pseudomonas (6%), Enterococci (2%), Staphylococci (2%), Streptococcal Pneumoniae (1%) were seen in our hemoptysis patients.

Table 9: Correlation of Hemoptysis with Radiological Distribution

Radiological Distribution	No. of Patients	Percentage
Unilateral	79	79%
Bilateral	16	16%
No abnormality	5	5%

In our study majority patients with hemoptysis (79%) have unilateral radiological lesion and (5%) patients had no any

visible abnormality on chest radiograph.

Table 10: Correlation of Hemoptysis with Radiological Findings

Radiological Findings	No. of Patient	Percentage
More than two zone	30	30%
RUZ	23	23%
LUZ	21	21%
RLZ	10	10%

LLZ	6	6%
RMZ	4	4%
LMZ	1	1%
Normal	5	5%

There was radiological finding association with hemoptysis in our study patients. In which more than two zone involved radiological lesion attributed (30%). Also RUZ (23%), LUZ (21%), RLZ (10%), LLZ (6%), RMZ (4%), LMZ (1%), and normal radiological finding in (5%) patients of hemoptysis at presentation of our hospital.

DISCUSSION

Hemoptysis remains one of the most clinically significant respiratory symptoms encountered in pulmonary medicine due to its association with a wide range of pulmonary and systemic disorders. The present study evaluated the clinical profile of hemoptysis and correlated the findings with radiological, microbiological, and pathological investigations among 100 patients. The findings of the present study demonstrated that pulmonary tuberculosis continues to be the predominant etiology of hemoptysis in developing countries, particularly in India.

In the present study, the majority of patients belonged to the age group of 30–49 years (39%) followed by 50–69 years (31%). Similar findings were reported by Fidan et al., who observed that hemoptysis commonly affects middle-aged adults because of increased exposure to smoking, respiratory infections, and chronic pulmonary diseases.^[11] The predominance of middle-aged patients in the present study may also be attributed to the high prevalence of pulmonary tuberculosis and smoking-related lung diseases in this age group.

Male predominance was clearly evident in the study, with males accounting for 73% of cases. Similar observations were reported by Kathuria et al., who found higher occurrence of hemoptysis among males owing to greater tobacco exposure, occupational risk factors, and pulmonary infections.^[12] The increased prevalence among males in the present study may therefore be related to similar socioeconomic and environmental factors.

Pulmonary tuberculosis was identified as the leading cause of hemoptysis in 68% of patients. This finding is consistent with the study conducted by Rali et al., who reported that tuberculosis remains a major cause of hemoptysis in developing nations despite advances in diagnostic and therapeutic modalities.^[13] Residual cavitory lesions, fibrosis, bronchiectatic changes, and chronic inflammatory destruction of pulmonary vasculature following tuberculosis may contribute to recurrent episodes of bleeding.

In our present study that active pulmonary tuberculosis was 39 (57.3%) and 29 (42.8%) were old cases, also, there were defaulters 2 (2.9%), relapse cases-2 (2.9%). Result were similar to Pragati Rao study in correlation with hemoptysis in tuberculosis patients and among active tuberculosis study New, Defaulter and Relapse cases.^[14]

Bronchiectasis was the second most common cause of hemoptysis in the present study accounting for 10% of cases. Chronic airway inflammation and hypertrophy of bronchial

circulation in bronchiectasis predispose patients to recurrent bleeding episodes. Malignancy was identified in 7% of patients, emphasizing the importance of careful evaluation of elderly smokers presenting with hemoptysis. Revel et al. reported that computed tomography plays a crucial role in identifying occult malignancies and vascular abnormalities in patients with hemoptysis even when chest radiographs are inconclusive.^[15]

The majority of patients in the present study had mild hemoptysis (83%), whereas severe hemoptysis was observed in only 2% of cases. Similar findings have been reported in previous studies where mild hemoptysis constituted the most common presentation. However, severe hemoptysis remains a life-threatening emergency because airway compromise rather than blood loss is the principal cause of mortality.

Cough was the most common associated symptom observed in 98% of patients, followed by dyspnea and fever. These findings support the predominance of infective pulmonary diseases in the study population. Constitutional symptoms such as night sweats and weight loss were more commonly associated with tuberculosis and malignancy.

Microbiological evaluation demonstrated sputum positivity for acid-fast bacilli in a substantial proportion of patients, reinforcing the importance of sputum examination in the diagnostic workup of hemoptysis. Bacterial culture findings including *Klebsiella* and *Pseudomonas* species highlighted the role of secondary bacterial infections and chronic infective lung diseases in the causation of hemoptysis. In our study patients, *Klebsiella* organism was (20%) present with hemoptysis followed by *E.coli* (11%), *Pseudomonas* (6%), *Enterococci* (2%), *Staphylococci* (2%), *Streptococcal Pneumoniae* (1%). So, *S. Pneumoniae* and *Pseudomonas* organism result were similar to P. P. Mishra study and rest of organism results were contradicts and no bacteriological growth was found in 58% of our study patients.^[16]

Radiological abnormalities were observed in the majority of patients, with unilateral upper zone involvement being the most common finding. Chest radiography and computed tomography were valuable tools in identifying the site and etiology of bleeding. According to Larici et al., multidetector computed tomography has become an essential imaging modality in the evaluation of hemoptysis because it accurately localizes bleeding sites and identifies underlying pathological lesions.^[17] Sopko DR. et al study suggested that due to its convenience and portability in the acutely ill patient, chest radiography remains a basic and useful diagnostic tool in the evaluation of hemoptysis.^[18] The ability of chest radiography to accurately localize the disease process is highly variable, and can be normal in up to 30% of patients. Boaz Hirshberg study result that out of 208 patient's evaluation for hemoptysis there were 104 patients positive finding (any abnormal finding that contributed to the final diagnosis) on initial investigation of chest x-ray.^[19]

Overall, the present study emphasizes the importance of a comprehensive diagnostic approach integrating clinical evaluation with radiological, microbiological, and pathological

investigations. Early identification of the underlying etiology is essential for timely management and prevention of complications associated with hemoptysis.

CONCLUSION

Hemoptysis is a clinically significant respiratory symptom associated with a wide spectrum of underlying pulmonary and systemic diseases. The present study demonstrated that pulmonary tuberculosis remains the most common cause of hemoptysis in developing countries, followed by bronchiectasis and malignancy. Hemoptysis was more frequently observed among middle-aged male patients and was strongly associated with smoking and tobacco use.

Most patients presented with mild hemoptysis and associated respiratory symptoms such as cough, dyspnea, and fever. Radiological investigations revealed abnormalities in the majority of patients and showed good correlation with microbiological and pathological findings. Sputum examination and chest imaging were found to be valuable diagnostic tools in identifying the underlying etiology.

The study emphasizes the importance of comprehensive clinical evaluation along with radiological, microbiological, and pathological correlation in patients presenting with hemoptysis. Early diagnosis and timely management are essential to reduce morbidity and prevent potentially life-threatening complications associated with severe hemoptysis. A multidisciplinary and systematic diagnostic approach remains the cornerstone for effective management of hemoptysis.

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Conflicts of interest

There are no conflicts of interest.

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