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Aetiology, Clinical Profile, Severity and Outcomes of Haemoptysis in Children: A Seven - Year Retrospective Study from a Tertiary Care Centre in Eastern India

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Abstract

Background

Haemoptysis is an uncommon but potentially alarming symptom in children, with causes ranging from self-limiting respiratory infections to serious structural pulmonary and cardiovascular disorders. Data regarding the clinical spectrum and outcomes of paediatric haemoptysis from eastern India remain limited.

Methods

This retrospective analytical study included children aged 0–18 years presenting with haemoptysis to a tertiary care centre in eastern India between January 2018 and December 2024. Clinical characteristics, aetiology, radiological findings, bronchoscopy outcomes, intensive care requirements, and follow-up data were reviewed. Haemoptysis was classified as mild (< 10 mL/day), moderate (10–50 mL/day), or massive (> 50 mL/day or associated with clinical instability). All consecutive eligible children presenting during the study period were included in the analysis.

Results

A total of 130 children were included (median age 8.5 years [IQR 4.5–13 years]); 72 (55.4%) were male. Mild, moderate, and massive haemoptysis occurred in 62 (47.7%), 45 (34.6%), and 23 (17.7%) children, respectively. Respiratory infections were the most common cause (52/130, 40.0%), followed by structural pulmonary disease (32/130, 24.6%), tuberculosis (15/130, 11.5%), foreign body aspiration (12/130, 9.2%), cardiovascular causes (11/130, 8.5%), and other causes (8/130, 6.2%). Chest radiographs were abnormal in 115 (88.5%) children. High-resolution computed tomography was performed in 75 (57.7%) children and identified bronchiectasis in 22 cases. Bronchoscopy was performed in 46 (35.4%) children and provided diagnostic information in 34 (73.9%). Twenty children (15.4%) required intensive care admission. Among 110 children with available follow-up, recurrence occurred in 12 (10.9%), predominantly among those with structural pulmonary disease.

Conclusions

Respiratory infections remain the leading cause of paediatric haemoptysis in eastern India. Although most episodes are mild to moderate, structural pulmonary disease, particularly bronchiectasis, contributes substantially to recurrent haemoptysis. Chest radiography, HRCT, and bronchoscopy play complementary roles in identifying underlying causes and guiding management. Careful follow-up is essential for children with chronic structural lung disease because of the risk of recurrence.

INTRODUCTION

Haemoptysis, defined as expectoration of blood originating from the lower respiratory tract, is an uncommon but clinically significant symptom in children. Although most episodes are mild and self-limiting, haemoptysis may occasionally indicate serious pulmonary, cardiovascular, or systemic disease and can rarely present as a life-threatening emergency requiring prompt airway stabilisation and intensive care support [1–3]. Unlike adults, morbidity in children is often related to airway obstruction and hypoxaemia resulting from smaller airway calibre rather than exsanguination alone [2, 3].

The aetiology of paediatric haemoptysis varies considerably across geographic regions and healthcare settings. Studies from high-income countries have identified cystic fibrosis, diffuse alveolar haemorrhage syndromes, vascular malformations, and idiopathic causes as important contributors [4, 5]. In contrast, respiratory infections, post-infectious bronchiectasis, pulmonary tuberculosis, and foreign body aspiration continue to account for a substantial proportion of cases in low- and middle-income countries because of the persistent burden of infectious diseases and delayed healthcare access [3, 6].

Evaluation of paediatric haemoptysis requires a systematic diagnostic approach. Chest radiography is usually the initial imaging modality, while high-resolution computed tomography (HRCT) and bronchoscopy are useful in selected patients for identifying structural lung disease, localising the bleeding source, and establishing the underlying diagnosis [11–13]. **The diagnostic approach used in our institution is summarised in** Fig. 1.

Despite its clinical importance, published data on paediatric haemoptysis from India remain limited, particularly from eastern India. Most available studies are descriptive and provide limited information regarding disease severity, bronchoscopy findings, intensive care requirements, and recurrence during follow-up [6]. Improved understanding of the local aetiological spectrum and clinical outcomes may facilitate earlier diagnosis and more targeted management strategies.

The present study aimed to describe the aetiological spectrum, clinical profile, severity, diagnostic evaluation, and outcomes of children presenting with haemoptysis to a tertiary care centre in eastern India. Secondary objectives were to evaluate bronchoscopy findings, intensive care requirements, and recurrence during follow-up.

Materials and Methods

Study design and setting

This retrospective analytical study was conducted in the Department of Paediatrics, Institute of Child Health, Kolkata, a tertiary referral centre catering to both urban and rural populations in eastern India. Medical records of children presenting with haemoptysis between January 2018 and December 2024 were reviewed.

The Institutional Ethics Committee approved the study protocol and retrospective review of medical records (Approval No. RAC/031/2025 dated 17 February 2026). Owing to the retrospective nature of the study, the requirement for informed consent was waived.

Study Participants

Children aged 0–18 years presenting with documented haemoptysis during the study period were eligible for inclusion. Cases were identified from emergency department records, inpatient admission registers, outpatient records, and bronchoscopy databases.

Inclusion criteria

- Age 0–18 years
- Documented haemoptysis originating from the lower respiratory tract
- Availability of complete medical records

Exclusion criteria

- Epistaxis misdiagnosed as haemoptysis
- Haematemesis without evidence of pulmonary origin
- Iatrogenic post-procedural bleeding
- Incomplete documentation

A total of 130 consecutive children fulfilled eligibility criteria and were included in the final analysis. (Fig. 2)

Definitions

Haemoptysis was defined as expectoration of blood originating from the lower respiratory tract.

Severity was classified using criteria adapted from previous paediatric studies because no universally accepted paediatric definition of massive haemoptysis exists. Haemoptysis was categorized as:

- • Mild: <10 mL/day
- • Moderate: 10–50 mL/day
- • Massive: >50 mL/day or haemoptysis associated with respiratory distress, hypoxaemia, haemodynamic instability, or the need for urgent intervention.

When exact volume estimation was unavailable, severity classification was based on documentation by the treating physician and associated clinical findings.

Recurrence was defined as documentation of at least one new episode of haemoptysis following complete clinical resolution of the index episode during the follow-up period. Because the exact number and timing of recurrent episodes were inconsistently recorded in retrospective records, recurrence was analysed as a binary outcome (present/absent).

Diagnostic categorisation

Final diagnosis was established using clinical evaluation, radiological findings, microbiological investigations, bronchoscopy findings, and echocardiography where indicated.

Patients were categorized into:

1. Respiratory infections
2. Structural pulmonary disease
3. Tuberculosis
4. Foreign body aspiration
5. Cardiovascular causes
6. Other causes (coagulopathy, vasculitis, pulmonary haemosiderosis)

Structural pulmonary disease included:

- Post-infectious Bronchiectasis
- Post-tubercular bronchiectasis
- Congenital airway anomalies
- Primary ciliary dyskinesia-related bronchiectasis
- Cystic Fibrosis

Diagnostic evaluation

Laboratory investigations

The following variables were recorded:

- Haemoglobin
- Total leukocyte count
- Platelet count
- Coagulation profile

Imaging

Chest radiography was performed in all children.

HRCT thorax was performed in children with recurrent haemoptysis, abnormal radiographs, suspected structural lung disease, or unclear diagnosis. Bronchiectasis was diagnosed using standard radiological criteria [7, 12].

Bronchoscopy

Bronchoscopy (flexible or rigid as clinically indicated) was performed in children with persistent or unexplained haemoptysis, suspected foreign body aspiration, or possible endobronchial pathology. Bronchoscopic findings and therapeutic interventions were recorded.

Follow-up

Follow-up information was obtained from outpatient records and telephonic contact where available. Children were followed for a minimum of six months after the index episode.

Because detailed documentation regarding the number and timing of recurrent haemoptysis episodes was not consistently available for all patients, recurrence was recorded as a dichotomous variable (present or absent).

Study outcomes

Primary outcomes

- Massive haemoptysis
- ICU admission
- Recurrence during follow-up

Secondary outcomes

- Duration of hospital stay
- Bronchoscopy yield
- In-hospital mortality

Statistical analysis

Data were analysed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro–Wilk test and are presented as median with interquartile range (IQR) because most variables were not normally distributed. Categorical variables are expressed as frequencies and percentages.

Comparisons between groups were performed using the Chi-square test or Fisher’s exact test for categorical variables and the Mann–Whitney U test for continuous variables, as appropriate. Factors associated with recurrence of haemoptysis were explored using univariate analysis. Owing to the limited

number of recurrence events and cases of massive haemoptysis, multivariable logistic regression analysis was not performed.

A two-tailed p-value < 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics(Table 1)

A total of 130 children with haemoptysis were included during the study period. The median age was 8.5 years (IQR 4.5–13 years), and 72 (55.4%) were male. Children aged 5–10 years constituted 36.9% of the cohort, while 38.5% were older than 10 years.

The most common presenting symptoms were cough (117/130, 90.0%), fever (82/130, 63.0%), and dyspnoea (46/130, 35.4%). A history of recurrent respiratory infections was documented in 39 children (30.0%). The median duration of symptoms prior to presentation was 4 days (IQR 2–7 days).

Table 1
Baseline Characteristics of Study Participants

Variable	Value
Total patients	130
Male sex	72 (55.4%)
Median age (years)	8.5 (IQR 4.5–13)
Age < 5 years	32 (24.6%)
Age 5–10 years	48 (36.9%)
Age > 10 years	50 (38.5%)
Cough	117 (90.0%)
Fever	82 (63.0%)
Dyspnoea	46 (35.4%)
Recurrent respiratory infections	39 (30.0%)
Median symptom duration (days)	4 (IQR 2–7)

Severity of Haemoptysis

Mild haemoptysis was observed in 62 children (47.7%), moderate haemoptysis in 45 (34.6%), and massive haemoptysis in 23 (17.7%).

Among children with massive haemoptysis, respiratory distress was documented in 14 (60.9%), oxygen desaturation in 9 (39.1%), and haemodynamic instability in 5 (21.7%).

Aetiological Spectrum(Table 2)

Respiratory infections were the most common cause of haemoptysis, accounting for 52 cases (40.0%). Structural pulmonary disease was identified in 32 children (24.6%), followed by tuberculosis in 15 (11.5%), foreign body aspiration in 12 (9.2%), cardiovascular causes in 11 (8.5%), and other causes in 8 (6.2%).

Among children with structural pulmonary disease, post-infectious bronchiectasis was the commonest diagnosis (18/32, 56.3%), followed by post-tubercular bronchiectasis (5/32, 15.6%), congenital airway anomalies (4/32, 12.5%), primary ciliary dyskinesia-related bronchiectasis (3/32, 9.4%), and cystic fibrosis (2/32, 6.2%).

Foreign body aspiration occurred predominantly in younger children, whereas tuberculosis was more frequently observed among older children and adolescents.

Table 2
Aetiological Distribution of Haemoptysis

Aetiology	**n (%)**
Respiratory infections	52 (40.0)
Structural pulmonary disease	32 (24.6)
Tuberculosis	15 (11.5)
Foreign body aspiration	12 (9.2)
Cardiovascular causes	11 (8.5)
Other causes	8 (6.2)

Severity According to Aetiology(Table 3)

The severity of haemoptysis varied across different aetiological categories. Respiratory infections accounted for the largest number of mild and moderate presentations. Massive haemoptysis was observed across all major diagnostic categories and was most frequently encountered in respiratory infections and structural pulmonary disease because of their higher overall prevalence in the cohort.

Table 3
Severity of Haemoptysis According to Aetiology

Aetiology	Mild	Moderate	Massive	Total
Respiratory infections	27	16	9	52
Structural pulmonary disease	16	10	6	32
Tuberculosis	6	7	2	15
Foreign body aspiration	4	7	1	12
Cardiovascular causes	5	3	3	11
Other causes	4	2	2	8
Total	62	45	23	130

Radiological Findings

Chest radiographs were abnormal in 115 children (88.5%). The most frequently reported abnormalities included consolidation, bronchial wall thickening, and lobar collapse.

High-resolution computed tomography (HRCT) was performed in 75 children (57.7%). Bronchiectasis was identified in 22 children, while additional structural airway abnormalities were detected in a small number of cases.

Bronchoscopy Findings

Bronchoscopy was performed in 46 children (35.4%), including flexible bronchoscopy in 34 and rigid bronchoscopy in 12. Bronchoscopy provided diagnostic information in 34 children (73.9%) and therapeutic intervention in selected cases.

Common bronchoscopic findings included foreign bodies (n = 12), endobronchial inflammation (n = 10), localized bleeding sites (n = 7), and endobronchial tuberculous lesions (n = 2). Rigid bronchoscopy successfully removed foreign bodies in all children with suspected aspiration. No major procedure-related complications were recorded.

Intensive Care Admission and Hospital Stay

Twenty children (15.4%) required intensive care unit admission. ICU admission was more frequent among children presenting with massive haemoptysis and respiratory compromise.

The median duration of hospital stay was 4 days overall and increased with bleeding severity. Median hospital stay was 3 days for mild haemoptysis, 5 days for moderate haemoptysis, and 9 days for massive haemoptysis.

Recurrence During Follow-up(Table 4 and Table 5)

Follow-up data were available for 110 of the 130 children (84.6%). The median follow-up duration was 14 months (IQR 10–19 months).

Documented recurrence of haemoptysis occurred in 12 of 110 children (10.9%). Structural pulmonary disease accounted for the majority of recurrent cases (8/12, 66.7%), followed by tuberculosis (2/12, 16.7%) and respiratory infections (2/12, 16.7%). No recurrence was documented among children with cardiovascular causes, foreign body aspiration, or other aetiologies.

Children with structural pulmonary disease had a significantly higher recurrence rate than those with other causes of haemoptysis (25.0% vs 5.1%, p = 0.003). Most recurrent episodes occurred in children with bronchiectasis.

Table 4
Recurrence According to Aetiology

Aetiology	Recurrence n/N (%)
Structural pulmonary disease	8/32 (25.0)
Tuberculosis	2/15 (13.3)
Respiratory infections	2/52 (3.8)
Cardiovascular causes	0/11 (0)
Foreign body aspiration	0/12 (0)
Other causes	0/8 (0)
Total	12/110 (10.9)

Table 5
Factors Associated with Recurrence of Haemoptysis During Follow-up

Variable	Recurrence (n = 12)	No Recurrence (n = 98)	p value
Age > 10 years	7	43	0.54
Male sex	8	52	0.72
Massive haemoptysis	4	15	0.11
Structural pulmonary disease	8	24	0.003
Tuberculosis	2	13	0.39

Footnote: Data are presented as number of patients. P values were calculated using Chi-square test or Fisher's exact test as appropriate.

Mortality

All children survived to hospital discharge, and no mortality was documented during the available follow-up period.

DISCUSSION

This study describes the aetiological spectrum, clinical characteristics, diagnostic evaluation, and outcomes of children presenting with haemoptysis at a tertiary referral centre in eastern India. Respiratory infections were the most common cause, accounting for 40% of cases, while structural pulmonary disease represented approximately one-quarter of the cohort. Although most episodes were mild to moderate, nearly one-fifth of children presented with massive haemoptysis requiring urgent evaluation and management. Recurrence occurred in 10.9% of children with available follow-up and was predominantly associated with underlying structural lung disease.

The predominance of respiratory infections in our cohort is consistent with recent Indian data reported by Vijayasekaran et al. [6] and reflects the continuing burden of respiratory infections in low- and middle-income countries [3, 6]. In contrast, studies from high-income settings have reported a greater contribution from cystic fibrosis, diffuse alveolar haemorrhage syndromes, and vascular abnormalities [4, 5]. Structural pulmonary disease, predominantly bronchiectasis, was the second most common aetiological category. Chronic airway inflammation, recurrent infection, and hypertrophy of the bronchial circulation are recognised mechanisms predisposing these patients to haemoptysis [7, 8].

Tuberculosis remained an important cause of haemoptysis, particularly among older children and adolescents, reflecting the persistent burden of childhood tuberculosis in endemic regions such as India [9, 10]. Foreign body aspiration was observed predominantly in younger children and should remain an important diagnostic consideration in cases of sudden-onset haemoptysis, especially when accompanied by choking episodes or focal radiological abnormalities [11].

Nearly 18% of children experienced massive haemoptysis. Although no mortality was observed, severe haemoptysis frequently required intensive monitoring and critical care support. In paediatric patients, morbidity is often related to airway obstruction and hypoxaemia rather than exsanguination because of smaller airway calibre [2, 3]. These findings emphasise the importance of prompt airway assessment, haemodynamic stabilisation, and early referral to centres with paediatric respiratory and bronchoscopy expertise [1, 14].

Radiological evaluation and bronchoscopy played complementary roles in establishing the underlying diagnosis. Chest radiography was abnormal in most children and served as the initial imaging modality, while HRCT was particularly useful for identifying bronchiectasis and other structural abnormalities. Bronchoscopy provided diagnostic information in nearly three-quarters of procedures and was especially valuable in foreign body aspiration and localisation of endobronchial pathology [11–13].

Recurrence occurred in approximately one in ten children with available follow-up and was significantly associated with structural pulmonary disease. Most recurrent episodes occurred in children with

bronchiectasis, highlighting the need for long-term surveillance, airway clearance strategies, infection control measures, and multidisciplinary follow-up in children with chronic suppurative lung disease [7, 8, 15–19].

This study has several limitations. Its retrospective design introduces the possibility of incomplete documentation and information bias. Precise quantification of blood loss was not available in all patients, and recurrence was analysed as a binary outcome because the number and timing of recurrent episodes were inconsistently recorded. In addition, the study was conducted at a single tertiary referral centre and may not fully represent the spectrum of haemoptysis encountered in primary or secondary healthcare settings.

Despite these limitations, this study provides contemporary data on paediatric haemoptysis from eastern India and highlights the importance of structural lung disease as a major determinant of recurrence. The inclusion of severity assessment, bronchoscopy findings, intensive care requirements, and follow-up outcomes enhances its clinical relevance and provides practical information for clinicians managing children with haemoptysis.

CONCLUSION

Respiratory infections remain the leading cause of paediatric haemoptysis in eastern India, while structural pulmonary disease, particularly bronchiectasis, is the principal cause of recurrence. Although most episodes are mild to moderate, a significant proportion require intensive monitoring and specialised care. Chest radiography, HRCT, and bronchoscopy play complementary roles in diagnosis. Early recognition of structural lung disease and structured follow-up may reduce recurrent haemoptysis and improve long-term outcomes.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- • Haemoptysis in children is uncommon and is usually mild and self-limiting.
- • Respiratory infections remain a major cause of paediatric haemoptysis in low- and middle-income countries.
- • Severe haemoptysis may require urgent airway stabilisation, bronchoscopy, and intensive care support.

WHAT THIS STUDY ADDS

- • Respiratory infections accounted for 40% of paediatric haemoptysis cases in this tertiary care cohort from eastern India.
- • Structural pulmonary disease, particularly bronchiectasis, accounted for the majority of documented recurrent haemoptysis episodes.

- • Bronchoscopy demonstrated substantial diagnostic and therapeutic utility, with diagnostic findings obtained in nearly three-quarters of procedures.
- • This study provides contemporary data on the clinical profile, severity, diagnostic evaluation, and outcomes of paediatric haemoptysis from an underrepresented region of India.

Declarations

Ethical Approval:

Approved by the Institutional Ethics Committee

Funding:

None

Author Contribution

PPH conceived and finalised the study manuscript. BG and SK were responsible for data collection. PR contributed to manuscript drafting and data analysis.

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Figures

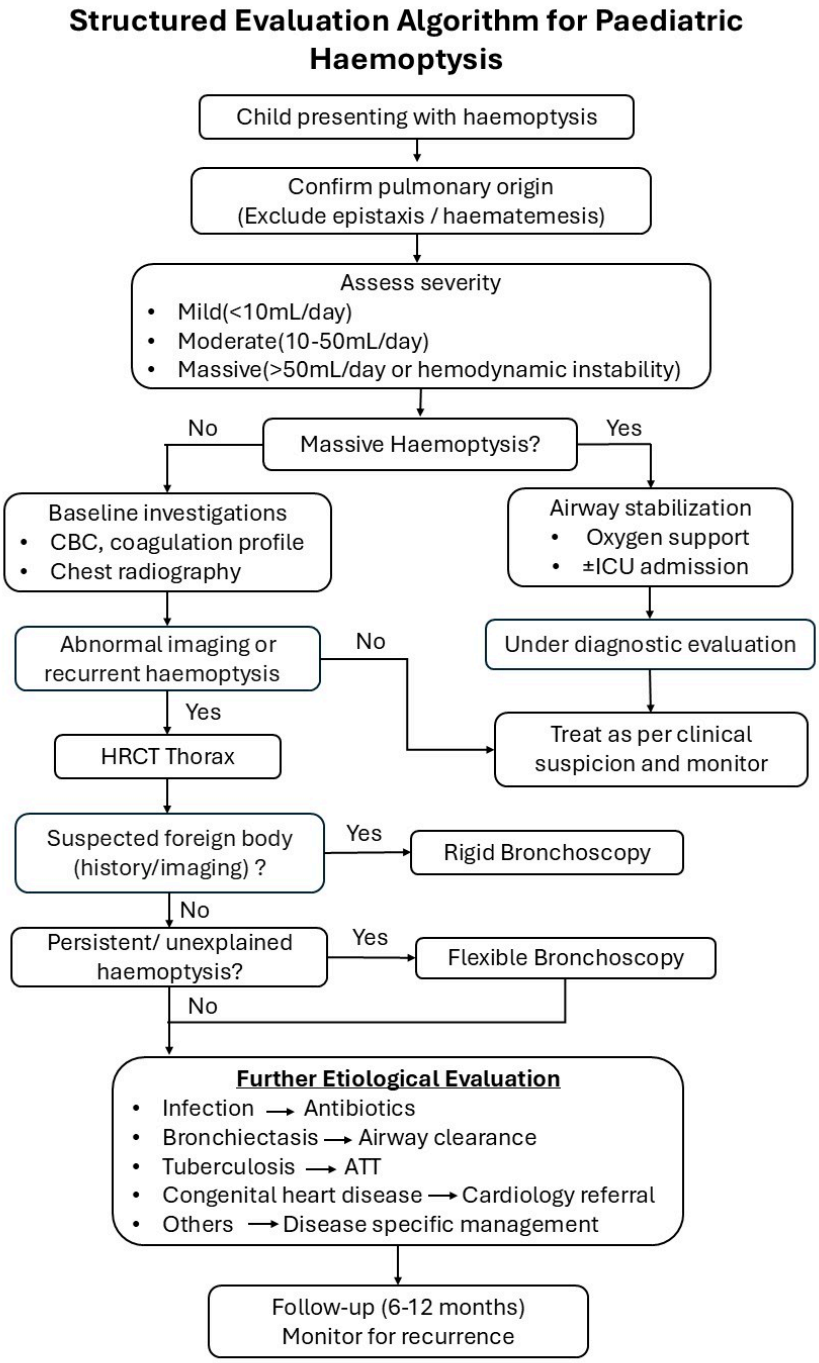


Figure 1

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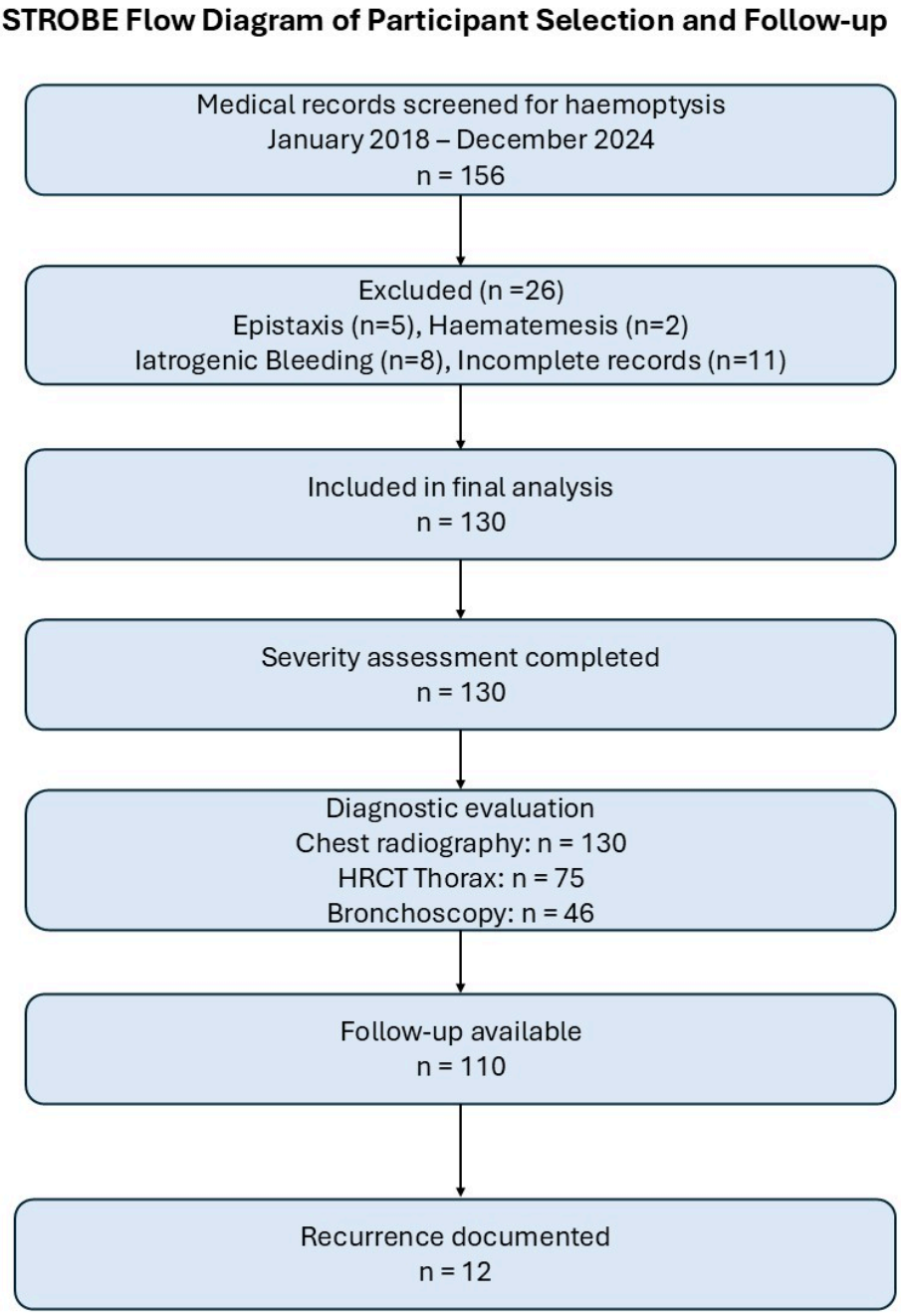


Figure 2

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