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A concerning condition in childhood: Hemoptysis or pseudohemoptysis?

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MAIN POINTS

- Only half of the children who presented with oral bleeding were diagnosed with true hemoptysis.
- Lower respiratory tract infections were the most common causes of hemoptysis, while upper airway infections predominated in pseudohemoptysis.
- Bright red blood with cough and abnormal lung imaging were key indicators of true hemoptysis.
- This study highlights the importance of distinguishing hemoptysis from pseudohemoptysis based on clinical and radiological findings.

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ABSTRACT

Aim: Hemoptysis is defined as expectoration of blood from the lower respiratory tract, whereas pseudohemoptysis is defined as bleeding originating from the upper airways or gastrointestinal tract. Distinguishing between these entities in children is essential because of their differing clinical implications. This study aimed to assess the diagnostic value of clinical features in differentiating hemoptysis from pseudohemoptysis in pediatric patients and to analyze the underlying causes and diagnostic approaches.

Materials and Methods: A retrospective review was conducted on 94 pediatric patients who presented with oral bleeding between January 2018 and December 2024. We analyzed data on demographics, bleeding characteristics, clinical findings, diagnostic imaging, and etiologies.

Results: Hemoptysis was diagnosed in 51% (n = 48) and pseudohemoptysis in 49% (n = 46) of the cases. Cough, sputum production, and pink-to-bright red blood cells were significantly associated with hemoptysis ($p<0.05$). In contrast, pseudohemoptysis was more often associated with blood mixed with saliva, which came directly from the mouth. Fever and purulent sputum were more frequent in the hemoptysis group. Abnormal chest X-ray and CT findings were significantly more common in patients with hemoptysis. The leading causes of hemoptysis were parenchymal lung diseases (58.3%) and idiopathic causes (29.2%), whereas pseudohemoptysis was mainly caused by upper respiratory tract conditions, such as adenoid hypertrophy and sinusitis (24.2%), idiopathic etiologies (21.7%), and artificial bleeding (8.8%).

Conclusion: In children, only half of the cases presenting with blood in the mouth are true hemoptysis. The most important diagnostic indicators of hemoptysis are bright red to pink color, accompanying cough, and any suspicious findings on chest radiography. The most common underlying causes of hemoptysis and pseudohemoptysis are lower and upper respiratory tract infections, respectively.

Keywords: Hemoptysis, Pseudohemoptysis, Factitious hemoptysis, Child, Cough

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INTRODUCTION

Hemoptysis is defined as the expectoration of blood or blood-tinged sputum originating from the lower respiratory tract, which is below the level of the larynx. Although it is common in adults, it is a rare symptom in children, presenting a diagnostic challenge. Children tend to swallow their sputum; therefore, hemoptysis may go unnoticed unless the bleeding is significant. Consequently, it often becomes a source of considerable concern for the patient, family, and pediatrician. Hemoptysis in children is commonly classified according to the volume of bleeding: mild hemoptysis refers to expectoration of less than 5 mL of blood per day, moderate hemoptysis to 5–200 mL per day, and massive hemoptysis to more than 200 mL per day or greater than 8 mL/kg/day [1]. Pseudohemoptysis refers to bleeding from extrapulmonary sources, such as the upper airway or gastrointestinal tract, but it can be mistakenly attributed to true hemoptysis. Because diagnostic and therapeutic strategies differ significantly, identifying the source of bleeding is crucial.

Determining hemoptysis incidence in the pediatric population is a challenging task. Contributing factors include inconsistencies in case definitions, presentation to different specialties across various health care facilities, and the potential for pseudohemoptysis to be misclassified as true hemoptysis [2]. In a tertiary pediatric pulmonology center in Türkiye, hemoptysis was detected in 1.8% of patients aged >6 years

[3]. In Godfrey, hemoptysis accounted for only 0.8% of bronchoscopy indications [4]. Previous studies have identified an underlying cause in 75%–90% of pediatric hemoptysis cases, while no specific etiology could be determined in 10%–25% of cases. The most commonly reported causes include infections, bronchiectasis, parenchymal lung diseases, and previously operated congenital heart diseases [4-6]. Infections have consistently been reported as the leading etiologic factor in multiple studies [6-8]. Factitious hemoptysis, as observed in Munchausen syndrome by proxy, involves the deliberate production or simulation of symptoms by patients or caregivers. Factitious causes should be considered in the differential diagnosis in cases of hemoptysis with unclear etiology to avoid unnecessary and potentially harmful interventions [1,9-12].

This study aimed to evaluate the role of clinical and laboratory findings in differentiating hemoptysis from pseudohemoptysis in our tertiary care center and to summarize the characteristics of the diagnostic investigations performed to identify the underlying etiology.

MATERIALS AND METHODS

The data of pediatric patients who presented to our Pediatric Pulmonology outpatient clinic with complaints of oral bleeding between January 2018 and December 2024 were retrospectively obtained from the hospital's digital database and medical record archives. Ethics approval for the study was obtained from the Kartal Koşuyolu Training and Research Hospital Ethics Committee, with decision number 2024/11/842, dated June 4, 2024.

In addition to the patients' demographic data, the color and duration of bleeding, presence of accompanying symptoms, diagnostic methods, etiological causes, and final diagnoses were recorded. The results of investigations such as bronchoscopy and laryngoscopy were also documented if available. The inclusion criterion was pediatric patients who presented to the Pediatric Pulmonology outpatient clinic with oral bleeding complaints. The exclusion criteria were as follows: (1) incomplete medical records, (2) bleeding disorders, and (3) a diagnosis of vasculitis (Figure 1). Hemoptysis is categorized as mild/moderate or massive based on the daily volume of spat blood [1].

Hematemesis is the vomiting of blood originating from the stomach or upper gastrointestinal tract, typically appearing dark red or brown [4-7, 11]. Hematemesis patients were classified as having pseudohemoptysis.

Chest radiographs and thoracic computed tomography (CT) revealed suspicious pathological appearances suggestive of the etiology of hemoptysis, including ground-glass opacities, alveolar consolidation, air bronchograms, nonspecific consolidation, and cysts/cavities.

We re-evaluated and documented flexible bronchoscopy data and video recordings obtained at our center. All flexible bronchoscopy in this study were performed by our pediatric pulmonology physicians in our clinic.

The algorithm begins with history taking and physical examination, differentiating between finding suggestive of gastrointestinal/upper airway sources and those indicating lower respiratory tract origin. In cases suggestive of pseudohemoptysis or hematemesis, upper respiratory tract and gastrointestinal pathologies are evaluated. Chest radiography, thoracic CT, and further laboratory evaluation are recommended for suspected lower airway causes. The algorithm also outlines subsequent steps, including bronchoscopy, lung biopsy, and appropriate management strategies based on recurrence, specific diagnoses (e.g., tuberculosis, bronchiectasis, actinomycosis), or nonspecific findings.

Statistical analysis

An a priori power analysis was conducted in G*Power 3.1 for a chi-square test of contingency tables, assuming a medium effect size (Cohen's w = 0.40), two-sided $\alpha = 0.05$ (95% confidence), power = 0.80, and df = 5. The minimum required total sample size was 81.

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY: IBM Corp.).

Data are presented as counts and percentages for categorical variables. The Kolmogorov–Smirnov test was used to assess the normality of continuous variables. Continuous variables that did not meet the assumption of normal distribution were expressed as median (minimum–maximum) values, and the Mann–Whitney U test was used to compare the groups. Categorical variables were compared using Pearson's chi-square test (asymptotic significance or exact significance) or Fisher's exact test according to the assumptions. When the omnibus test was significant, Bonferroni-adjusted pairwise comparisons were used to determine the significantly different categories. The categories with different superscript letters were statistically different. A p-value <0.05 was considered statistically significant.

RESULTS

Between January 2018 and December 2024, 7834 patients were evaluated in our pediatric pulmonary outpatient clinic, of whom 94 (1.2%) presented with oral bleeding complaints. Hemoptysis was diagnosed in 0.61% (n = 48) of these cases, whereas pseudohemoptysis was identified in 0.58% (n = 46). The median age of the 94 patients was 159 months (range: 9–243 months), with a male-to-female ratio of 1.09.

Among the patients, 51% (n = 48) was diagnosed with hemoptysis and 49% (n = 46) with pseudohemoptysis. The male-to-female ratio was 1.3 in the hemoptysis group and 0.9 in the pseudohemoptysis group (p=0.414). The median age was 159 months (range:9-243 months) in the hemoptysis group and 140 months (range:10-227 months) in the pseudohemoptysis group (p = 0.443).

Based on the amount of bleeding, massive hemoptysis was observed in only 6.3% (n = 3) of the patients in the hemoptysis

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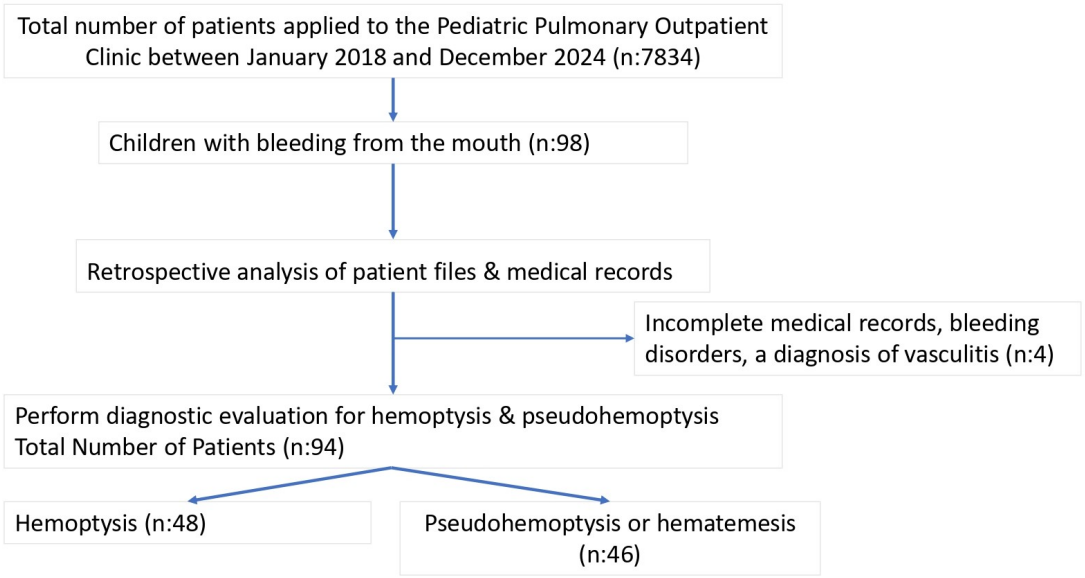

Figure 1. Flow diagram.

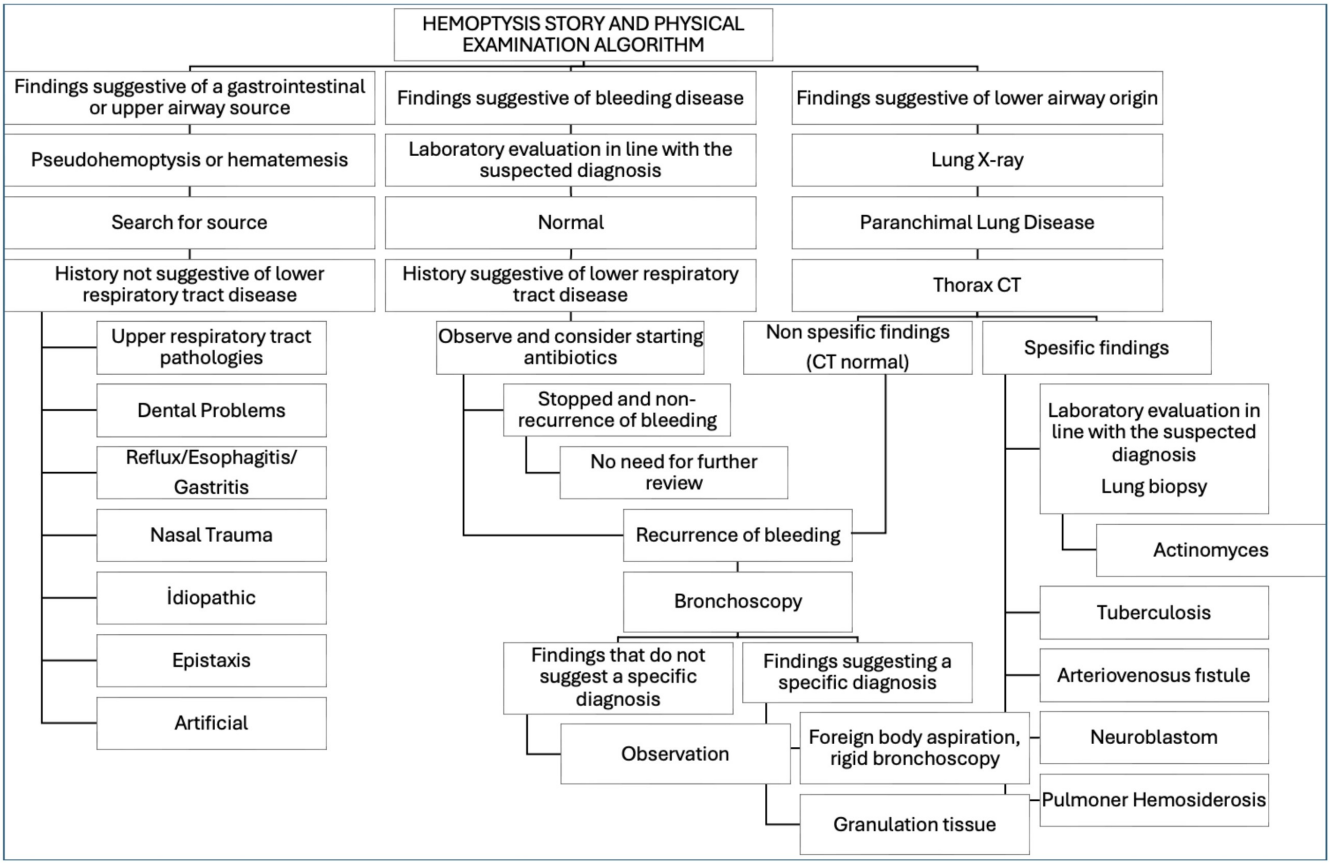

Figure 2. Algorithm for diagnosis in children with hemoptysis was adapted from the literature.

group, whereas the remainder had mild to moderate hemoptysis. All patients in the pseudohemoptysis group exhibited only mild to moderate bleeding (p = 0.082).

Based on bleeding patterns, bleeding accompanied by coughing was observed in 89.6% (n = 43/48) of patients in the hemoptysis group, compared with 30.4% (n = 14/46) in the pseudohemoptysis group, with a statistically significant difference (p<0.001).

In the pseudohemoptysis group, bleeding directly from the mouth was observed in 37% (n = 17/46) and bleeding with

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Table 1. Comparison of the demographic and clinical characteristics of patients with hemoptysis and pseudohemoptysis.

	Hemoptysis (n=48)	Pseudohemoptysis (n=46)	p
Gender Male, n (%)	27/48 (56.3)	22/46 (47.8)	0.414
Age (months) Median (min-max)	159 (9-243)	140 (10-227)	0.443
	n (%)	n (%)	
Amount of bleeding			
Massive Bleeding	3 (6.3)	0	0.242
Mild/moderate Bleeding	45 (93.8)	46 (100)	0.082
Bleeding pattern			
Cough	43 (89.6)	14 (30.4)	<0.001
Vomiting	6 (12.5)	8 (17.4)	0.506
Epistaxis	2 (4.2)	6 (13)	0.154
Saliva	2 (4.2)	15 (32.6)	<0.001
By direct mouth	5 (10.4)	17 (37)	0.002
Nausea	1 (2.1)	5 (10.9)	0.107
Sputum Examination			
Coagulated appearance	11 (22.9)	7 (15.2)	0.343
Brown	2 (4.2)	7 (14.9)	0.087
From bright red to pink	29 (60.4)	15 (33.6)	0.007
Fresh blood	12 (25)	22 (47.8)	0.008
Accompanying symptoms			
Weight loss	7 (14.6)	7 (15.2)	0.931
Night sweats	9 (18.8)	4 (8.7)	0.233
Fever	6 (12.5)	0	0.027
Purulent sputum	24 (50)	4 (8.7)	<0.001

Pearson's χ^2 test or Fisher's exact test.

Table 2. Comparison of lung X-ray and CT findings of patients with hemoptysis and pseudohemoptysis compared to Balla (1).

	Hemoptysis (n=48) n (%)	Pseudohemoptysis (n=46) n (%)	p
Lung X-ray			<0.001
Suspicious Pathological Finding	21 (56.2)	3 (6.5)	
Normal	27 (43.8)	43 (93.5)	
Thoracic CT			
Lung parenchyma			0.069
Normal	14 (45.1)	16 (76.2)	
Consolidation/Ground Glass Opacity/air broncogram	15 (48.4)	5 (23.8)	
Cavitation	2 (6.5)	0	
Tracheobronchial Tree			0.049
Normal	23 (74.2)[a]	21 (100)[b]	
Intraluminal Content/Soft Tissue	2 (6.5)	0	
Bronchiectasis	6 (19.3)	0	
Pulmonary Artery			0.506
Normal	28 (93.3)	21 (100)	
Filling Defect	2 (6.7)	0	

Pearson's χ^2 test or Fisher's exact test.

saliva in 32.6% (n = 15/46) of patients, which were significantly more frequent than in the hemoptysis group (10.4% [n = 5/48] and 4.2% [n = 2/48]), with statistically significant differences (p=0.002 and p<0.001, respectively).

In sputum examination, a color change from bright red to pink was observed in 60.4% (n = 29/48) of cases in the hemoptysis group and fresh blood was present in 25% (n = 12/48) of cases. In contrast, these rates were 33.6% (n = 15/46) and

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Table 3. Comparison of bronchoscopy findings.

	Hemoptysis (n=18)	Pseudohemoptysis (n=12)	p
Flexible bronchoscopy findings			<0.001
Normal	7 (38.9%)	12 (100.0%)	
Pathological	11 (61.1%)	0 (0.0%)	
Bleeding focus	2 (11.1)		
Purulent secretion	1 (5.6)		
Mucosal inflammation	2 (11.1)		
Tracheal abrasion	1 (5.6)		
Granulation tissue	3 (16.7)		
Increased vascularity	2 (11.1)		
Dilated mucous gland orifices	1 (5.6)		

Fisher's Exact Test (two-sided).

Table 4. List of etiological factors in patients with hemoptysis and pseudohemoptysis.

Patients (n: 94)	Etiology	n (%)
Hemoptysis (n:48)	Lung Parenchymal Disease	28 (58.3)
	Infections	23 (47.9)
	Bronchitis	10 (21)
	Pneumonia	6 (12.6)
	Bronchiectasis*	4 (8.4)
	Pulmonary Tuberculosis*	1 (2.1)
	Actinomyces	1 (2.1)
	Cist Hydatic	1 (2.1)
	Cystic Fibrosis	1 (2.1)
	Interstitial Lung Diseases	4 (8.4)
	Pulmonary Hypertension	1 (2.1)
	Pulmoner Hemosiderosis	2 (4.2)
	Arteriovenosus Fistule*	1 (2.1)
	Malignancy	1 (2.1)
	Idiopathic	14 (29.2)
	Tracheostomy	4 (8.3)
	Trauma	1 (2.1)
	Foreign Body Aspiration	1 (2.1)
Pseudohemoptysis (n:46)	Adenoid Hypertrophy, Sinusitis	11 (24)
	Idiopathic	10 (21.7)
	Dental Problem	8 (17.3)
	Esophagitis, Reflux	7 (15.2)
	Epistaxis	4 (8.7)
	Artificial	4 (8.7)
	Seasonal Allergic Rhinitis	1 (2.2)
	Trauma	1 (2.2)

*: 1 massive case.

47.8% (n = 22/46) in the pseudohemoptysis group.

The color change from bright red to pink was more frequently observed in the hemoptysis group, whereas the presence of fresh blood was more common in the pseudohemoptysis group (p = 0.007 and p = 0.008, respectively).

Clotted sputum was observed in 22.9% (n = 11/48) of the hemoptysis group and 15.2% (n = 7/46) of the pseudohemoptysis group, whereas brown sputum was noted in 4.2% (n = 2/48) and 14.9% (n = 7/46) of the patients, respectively; however, these differences were not statistically significant (p = 0.343 and p = 0.087, respectively).

Weight loss [14.5% (n = 7/48) us 15.2% (n = 7/46)] and night sweats [18.8% (n = 9/48) us 8.7% (n = 4/46)] were observed at similar rates in both groups (p>0.05). In contrast, fever was more frequently observed in the hemoptysis group (12.5%; n = 6/48), as was purulent sputum at 50% (n = 24/48); these differences were statistically significant (p=0.027 and p<0.001, respectively) (Table 1).

Imaging

Chest radiographs of all patients were obtained. Radiographs were normal in 56.2% (n = 27/48) of the hemoptysis group, compared with 93.5% (n = 43/46) of the pseudohemoptysis group. Suspicious pathological findings on chest radiographs were observed in 43.8% (n = 21/48) of the hemoptysis group, which was significantly higher than the 6.5% (n = 3/46) observed in the pseudohemoptysis group (p<0.001).

Thoracic CT was performed in 52 patients. No statistically significant difference was found in lung parenchymal findings

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between the two groups (p = 0.069). In the hemoptysis group, 45.1% (n = 14/31) of the patients had normal parenchymal appearance, whereas 76.2% (n = 16/21) in the pseudohemoptysis group. Parenchymal abnormalities, such as consolidation, ground-glass opacities, or air bronchograms, were observed in 48.4% (n = 15/31) of the hemoptysis cases and in 23.8% (n = 5/21) of the pseudohemoptysis cases. Cavitary lesions were identified exclusively in the hemoptysis group (6.5%) and were not detected in patients with pseudohemoptysis.

The tracheobronchial tree showed a statistically significant difference between the groups (p = 0.049). Normal tracheobronchial anatomy was observed in 74.2% (n = 23/31) of patients with hemoptysis and in 100% of patients with pseudohemoptysis (n = 21/21), representing the only category that remained significantly different after Bonferroni-adjusted pairwise comparisons. In the hemoptysis group, intraluminal content or soft-tissue density was detected in 6.5% (n = 2/31) of patients, and bronchiectasis was present in 19.3% (n = 6/31), whereas none of these abnormalities were identified in the pseudohemoptysis group.

Pulmonary artery evaluation revealed normal findings in 93.3% (n = 28/30) of the hemoptysis group and filling defects in 6.7% (n = 2/30). In contrast, all patients in the pseudohemoptysis group (100%, n = 21/21) had normal pulmonary arteries. This difference was not statistically significant (p = 0.506) (Table 2).

Bronchoscopy

A total of 30 patients underwent bronchoscopy. Normal bronchoscopy findings were observed in 38.8% (n = 7/18) of patients in the hemoptysis group, whereas all bronchoscopic evaluations in the pseudohemoptysis group were normal 100% (n = 12/12) (p = 0.005).

Pathological bronchoscopic findings in the hemoptysis group included granulation tissue in 16.7% (n = 3/18), bleeding focus in 11.1% (n = 2/18), mucosal inflammation in 11.1% (n = 2/18), increased vascularity in 11.1% (n = 2/18), tracheal abrasion in 5.6% (n = 1/18), and purulent secretions in 5.6% (n = 1/18). None of these findings were detected in the pseudohemoptysis group (Table 3).

Etiology of bleeding

When the etiological distribution of the cases was examined, the most common cause in the hemoptysis group (n = 48) was pulmonary parenchymal diseases, observed in 58.3% (n = 28/48) of cases. Among the parenchymal diseases, infectious etiologies accounted for 82% (n = 23/28). These infectious causes included bronchitis in 21% (n = 10/48), pneumonia in 12.6% (n = 6/48), bronchiectasis in 8.4% (n = 4/48), and pulmonary tuberculosis, actinomycosis, and hydatid cyst in 2.1% (n = 1/48).

Among non-infectious pulmonary parenchymal etiologies, cystic fibrosis, interstitial lung diseases, pulmonary hypertension, pulmonary hemosiderosis, and arteriovenous fistula were observed in 2.1% (n = 1/48), 8.4% (n = 4/48), 4.2% (n = 2/48), and 2.1% (n = 1/48), respectively. Additionally, malignancy was detected in one patient (2.1%, n = 1/48).

No identifiable cause was found in 29.2% of cases (n = 14/48), and these were classified as idiopathic. Other causes included tracheostomy in 8.3% (n = 4/48), trauma in 2.1% (n = 1/48), and foreign body aspiration in 2.1% (n = 1/48).

In the pseudohemoptysis group (n = 46), the most common etiological cause was adenoidal hypertrophy and sinusitis, observed in 24% (n = 11/46) of patients. This was followed by idiopathic causes in 21.7% (n = 10/46), dental problems in 17.3% (n = 8/46), esophagitis and gastroesophageal reflux in 15.2% (n = 7/46), epistaxis in 8.7% (n = 4/46), artificial bleeding (e.g., from oral mucosa) in 8.7% (n = 4/46), seasonal allergic rhinitis in 2.2% (n = 1/46), and trauma in 2.2% (n = 1/46). No underlying pathology could be identified in 21.7% (n = 10/46) of the patients in the pseudohemoptysis group (Table 4).

The hemoptysis evaluation algorithm presented in Figure 2 was developed to systematically guide the clinical assessment of children presenting with oral bleeding and has been integrated into the current study to support the interpretation of diagnostic findings.

DISCUSSION

This study highlights the diagnostic distinctions between hemoptysis and pseudohemoptysis by comparing the clinical, symptomatic, radiological, and etiological characteristics of patients with these conditions. Among all pediatric patients evaluated, only 1.2% presented with oral bleeding, and only 0.61% was confirmed to have true hemoptysis. Symptoms such as cough, fever, and purulent sputum, along with suspicious pathological findings on chest radiographs, were more frequently observed in the hemoptysis group. While lower respiratory tract infections emerged as the predominant cause in patients with hemoptysis, upper respiratory tract pathologies/infections and factitious hemoptysis were more commonly identified in patients with pseudohemoptysis.

Although hemoptysis is common in adults, it is a rare symptom in children and can present a diagnostic challenge [1,11]. The reported incidence has shown variability due to referrals to different clinics and variations in diagnostic facilities. In our study, the proportion of patients presenting with oral bleeding among all pediatric pulmonology outpatient visits was found to be 1.2%, with approximately half diagnosed with hemoptysis and the other half with pseudohemoptysis. A similar center with a comparable structure reported a rate of 1.8% [6].

Diagnostic and therapeutic strategies differ significantly, and anamnesis and physical examination are crucial in the differential diagnosis [1,6,7,11]. The presence of blood with coughing and the appearance of bright red, frothy blood sug-

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gest hemoptysis, whereas dark red blood mixed with food particles and associated with vomiting is more indicative of hematemesis. This approach is considered the first-line investigation in many diagnostic algorithms [1,13].

Studies on hemoptysis conducted in the pediatric population typically classify and compare patients based on age groups or the amount of bleeding (mild, moderate, or severe) [2,8]. To the best of our knowledge, no previous study has compared bleeding patterns, sputum characteristics, and accompanying symptoms to differentiate hemoptysis from pseudohemoptysis. The importance of accurately evaluating sputum characteristics and identifying the source of bleeding in the diagnosis of pediatric hemoptysis has been emphasized. In this study, hemoptysis was characterized by bright red blood typically mixed with sputum, whereas pseudohemoptysis was characterized by fresh, unmixed blood [1].

Similar results were found in our study, demonstrating that the presence of bright red or pink blood, along with symptoms such as cough, purulent sputum, and fever, may be indicative of hemoptysis.

However, it is highly likely that a portion of the bleeding initially presumed to be hemoptysis originates from the nose, infected tonsils, or adenoids.

Blood from the nasopharynx can irritate the larynx, inducing coughing and mimicking hemoptysis, a phenomenon classified as pseudohemoptysis [1,14,15]. It should also be noted that aspiration of blood from the gastrointestinal tract can trigger coughing, and swallowed pulmonary blood may be expelled through vomiting. Despite these confounding factors, the prevalence of cough was significantly higher in the hemoptysis group. These findings suggest that visual inspection of sputum and detailed assessment of accompanying symptoms are important tools for differentiating between hemoptysis and pseudohemoptysis. These simple evaluation methods may help prevent unnecessary investigations and invasive procedures in clinical practice.

In cases where a detailed physical examination and medical history of the upper and lower airways are inconclusive, chest radiography followed by thorax computed tomography (CT) scan are among the initial diagnostic tools used to support clinical evaluation [16]. In our study, the rate of chest radiograph use was 100%. Chest radiography serves as a useful objective tool, particularly given the challenges of physical examination and anamnesis in children, although this may appear high.

Although >90% of chest radiographs in the pseudohemoptysis group were normal, 43.8% of the hemoptysis group demonstrated pathological findings, most of which consisted of alveolar infiltrates, consolidations, and ground-glass opacities—radiological indicators of parenchymal bleeding.

When evaluating CT findings of the lung parenchyma, consolidation, air bronchograms, and ground-glass opacities were the most frequently observed abnormalities in patients with hemoptysis. These opacities may be associated with infectious or inflammatory processes. Suspicious pathological findings included alveolar infiltrates, consolidations, bronchiectasis, interstitial opacities, nodules, and cavitary lesions [16].

In their studies, Bhalla and Gaude emphasized that chest radiography plays a critical role in understanding the etiology of hemoptysis; however, the need for advanced imaging is not ruled out by normal radiographic findings [1,16]. Thoracic CT was performed in 52 of 94 patients. Suspicious pathological findings were identified in 55% of the patients in the hemoptysis group, whereas this rate was significantly lower in the patients in the pseudohemoptysis group (24%). Approximately half (48%) of the thoracic computed tomography scans in the hemoptysis group revealed alveolar consolidation or ground-glass opacities, whereas cavitary lesions were observed less frequently. Nonspecific air bronchograms or consolidation were detected in 23% of the thoracic CT scans in the pseudohemoptysis group.

Angiographic thoracic CT is also recommended to rule out pulmonary vascular pathologies [16]. Angiographic thoracic CT was performed in a small subset of patients. Interventional treatment with plug placement was administered to three patients who presented with massive hemoptysis.

The detection of bleeding focus, granulation tissue, and mucosal inflammation in patients with hemoptysis underscores the importance of bronchoscopy as a crucial diagnostic tool [6,11]. The diagnostic yield of bronchoscopy has been reported to range from 40% to 100%, with particularly high sensitivity in cases of bleeding due to bronchiectasis, foreign body aspiration, and pulmonary infections [1,16]. Bronchoscopy was performed in 30 out of 94 patients in our study. In the tracheobronchial tree evaluation, findings such as granulation tissue, intraluminal contents, soft tissue masses, and bleeding foci were more frequently identified bronchoscopically in the hemoptysis group. In contrast, all patients in the pseudohemoptysis group had a normal tracheobronchial system. The predominantly normal bronchoscopic findings in the pseudohemoptysis group support the notion that the source of bleeding in these patients was not pulmonary, but rather originated from the upper respiratory or gastrointestinal tract. Consistent with literature recommendations, our findings underscore the importance of systematically evaluating the lung parenchyma, tracheobronchial tree, and pulmonary arteries when assessing hemoptysis.

Childhood hemoptysis is mild to moderate in volume and tends to be self-limiting in most cases [7]. In both groups, mild to moderate bleeding was more common. However, three of our cases involving massive bleeding episodes were in the hemoptysis group. In one of these cases, endobronchial tuberculosis was diagnosed. The patient was managed solely with anti-TB therapy, and no additional treatment was required despite the presence of massive hemoptysis. A bronchial arteriovenous fistula was identified in the

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left bronchial artery in the second patient, and bronchial embolization was performed. The third patient, who had previously undergone surgery for Kartagener syndrome and transposition of the great arteries, developed massive hemoptysis and was treated with bronchial artery embolization.

Although the disease groups causing hemoptysis may vary depending on the characteristics of the center and the availability of diagnostic tools, infections are the most commonly reported cause of hemoptysis. In our study, the most frequent causes of hemoptysis were PLDs, with infections being the leading etiology (50%), followed by idiopathic causes (30%) and interstitial lung diseases (8.4%). Similarly, another study conducted in a pediatric pulmonology clinic identified infections as the most common cause (47.4%), followed by neoplasms (22.6%) and autoimmune/immune dysregulation syndromes (19.1%) [12]. In a pediatric pulmonology clinic in our country, respiratory tract infections were identified as the most common cause of hemoptysis in 69 patients (18.8%). The causes of pseudohemoptysis in our study were similar to those reported in the literature and included epistaxis, gingivostomatitis, and factitious origins [3]. In an intensive care study, infection was identified as the underlying cause in half of the 16 children diagnosed with hemoptysis based solely on pulmonary infiltrates seen on chest radiography, followed by bronchiectasis and idiopathic pulmonary hemorrhage [6]. In a study involving 19 pediatric patients, the most common causes of hemoptysis were infections (28.6%) and tracheostomy-related complications (14.3%) [11]. In a general pediatrics clinic, among 40 children with hemoptysis who had no history of trauma, bleeding diathesis, or malignancy, infections (25%) and congenital heart diseases (17.5%) were the most common causes [8]. The mechanism by which infections lead to hemoptysis is associated with inflammation of the bronchial mucosa and disruption of vascular integrity, resulting in bleeding from the bronchial arteries [16,17]. Similarly, bronchitis, pneumonia, and bronchiectasis were identified as the most common infectious causes of hemoptysis in our study. Other types of infections contributing to the etiology of hemoptysis in our cohort included tuberculosis, actinomycosis, and hydatid cyst.

Upper respiratory tract-related causes, such as adenoid hypertrophy, sinusitis, and dental problems, as well as factitious hemoptysis, were found to be more common in patients with pseudohemoptysis [18]. Factitious hemoptysis has been shown to be an important differential diagnosis in cases of unexplained hemoptysis, particularly those with prolonged symptoms and no identifiable underlying cause. This possibility should be considered before proceeding with unnecessary invasive procedures [8]. Cases of factitious hemoptysis associated with Munchausen syndrome may go unnoticed for extended periods in the absence of clinical suspicion and may be linked to child abuse [19]. In our study, factitious causes were found to mimic hemoptysis in four patients, once again emphasizing the critical role of detailed patient history and physical examination. In the first case, a 14-year-old girl was found to have induced pseudohemoptysis by biting the oral mucosa. The second case involved an 8-year-old girl who presented to the outpatient clinic with photos taken solely by her mother, showing what was claimed to be blood. A review of the patient's prior medical history revealed multiple hospital admissions for nasal and rectal bleeding, and the pediatric hematology department had previously diagnosed her with Munchausen by proxy (MBP). In the third case, a 13-year-old girl was hospitalized for hemoptysis. She had drawn blood through a venipuncture site and collected it in a container, presenting it as hemoptysis material.

The fourth case was an 8-year-old boy diagnosed with hypersensitivity pneumonitis and followed up for chronic cough. The mother repeatedly brought the patient to our outpatient clinic, claiming to have seen blood on his pillow at night and presenting photos of the alleged blood. However, no active bleeding was observed during any of the hospitalizations. The mother appeared to derive secondary gain from the situation, and the case was reported to social services.

Despite all laboratory, radiologic, and bronchoscopic evaluations, no source of bleeding could be identified in 14 patients (29.2%), highlighting the diagnostic challenges in the follow-up of pediatric hemoptysis. In our study, idiopathic causes were identified in 29.2% of cases, which is consistent with the previously reported rates of 11%–25% in pediatric cohorts [1-3,5,7,8,11,12].

All patients presenting with complaints of oral bleeding should be evaluated according to a hemoptysis assessment algorithm [1]. This algorithm includes steps designed to identify the source of bleeding and underlying pathology. An algorithmic approach enhances patient safety by preventing unnecessary interventions. The algorithm begins with history taking and physical examination, differentiating between finding suggestive of gastrointestinal/upper airway sources and those indicating lower respiratory tract origin. In cases suggestive of pseudohemoptysis or hematemesis, upper respiratory tract and gastrointestinal pathologies are evaluated. Chest radiography, thoracic CT, and further laboratory evaluation are recommended for suspected lower airway causes. The algorithm also outlines subsequent steps, including bronchoscopy, lung biopsy, and appropriate management strategies based on recurrence, specific diagnoses (e.g., tuberculosis, bronchiectasis, actinomycosis), or nonspecific findings.

CONCLUSION

Approximately half of children with oral bleeding have true hemoptysis. Massive hemoptysis was uncommon in our cohort, absent in pseudohemoptysis, and controlled medically or with bronchial artery embolization. Lower respiratory infections predominated in patients with hemoptysis and upper airway conditions in patients with pseudohemoptysis. Bedside cues (cough/purulent sputum with pink-to-bright-red

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sputum) and abnormal chest imaging favored a lower-airway source, whereas saliva/epistaxis suggested pseudohemoptysis; bronchoscopy was normal in all pseudohemoptysis cases and abnormal mainly in hemoptysis, supporting the selective use of invasive testing. A pragmatic diagnostic algorithm is also proposed to guide triage and reduce unnecessary procedures.

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Informed Consent: The study involved a retrospective review of anonymized data and did not include any identifiable patient information; therefore, written informed consent was not required.

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