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Hemoptysis: A 10-Year Retrospective Study

Jorge A. Coss-Bu, MD*; Ramesh C. Sachdeva, MD*; John T. Bricker, MD‡; Gunyon M. Harrison, MD§; and Larry S. Jefferson, MD*

ABSTRACT. *Background.* Hemoptysis is uncommon in pediatric practice. We reviewed 10 years of experience with hemoptysis in a tertiary pediatric hospital to identify patient characteristics and predictors of mortality.

Methods. Patients were divided into four age groups (0 to 5, 6 to 10, 11 to 20, and >20 years). Hemoptysis was defined as mild (<150 mL/day), large (150 to 400 mL/day), or massive (>400 mL/day). Fever was defined as $\geq 38.5^{\circ}\text{C}$.

Results. A total of 228 patients (115 males and 113 females) with 246 episodes of hemoptysis were identified and grouped according to primary diagnosis. There were 149 patients in the cystic fibrosis (CF) group, 37 in the congenital heart disease (CHD) group, and 42 in the Other group. Age was significantly higher in the CF group compared with the CHD and Other groups. Length of stay was significantly prolonged in the CF group compared with the Other group. The overall mortality was 13%. After initial analysis, mortality predictors were age, amount of hemoptysis, receipt of blood products, and fever. After stratification, we found: 1) in the >20-year age group, there was a difference in mortality when comparing CF patients with CHD patients; 2) for patients who received blood products, there were differences in mortality in patients with CF, CHD, and Other diagnoses; 3) for patients who received blood, there were differences in mortality only for the 0- to 5-year age group; and 4) the amount of hemoptysis was predictive for mortality only in CHD patients.

Conclusions. Hemoptysis presented in young adult CF patients and in adolescent CHD patients. Young adult CF patients with hemoptysis had a higher risk of mortality compared with young adult CHD patients. The amount of hemoptysis predicted mortality only for CHD patients. Receiving blood products was predictive of mortality for all patients. *Pediatrics* 1997;100(3). URL: <http://www.pediatrics.org/cgi/content/full/100/3/e7>; hemoptysis, retrospective studies, pediatrics, mortality, outcome.

ABBREVIATIONS. CF, cystic fibrosis; CHD, congenital heart disease.

Hemoptysis is defined as the expectoration of blood derived from the lungs or bronchial tubes as a result of pulmonary or bronchial hemorrhage.¹ Hemoptysis is a relatively uncommon

but potentially serious problem in children.²⁻⁵ It has become increasingly frequent in cystic fibrosis (CF) patients,^{6,7} and is less commonly associated with tuberculosis, bronchiectasis, and other infections.⁸⁻¹⁰ The sudden presentation of hemoptysis requires the clinician to have adequate knowledge to make effective patient care decisions. Treatment of hemoptysis includes taking medical conservative noninvasive measures at presentation.¹¹⁻¹⁴ If these measures are not effective, then more aggressive measures are utilized, including radiological invasive maneuvers and surgical approaches.¹⁵⁻¹⁷ Mortality rates in the adult series range from 11% to 85% with medical treatment,^{9,11-13,17-21} and from 0% to 50% with surgical treatment.^{9,11,13,17-23} Mortality rates in studies of children range from 0% to 32%.^{4,6,12}

The purpose of this study was to review 10 years of experience with hemoptysis in a tertiary pediatric hospital to identify patient characteristics and predictors of mortality.

METHODS

We conducted a retrospective chart review of all patients who were admitted to Texas Children's Hospital (a referral and teaching hospital with 456 licensed beds) between 1980 and 1990 and who were discharged with a diagnosis of hemoptysis. Demographic data including sex, age, and race were collected, as well as the number of episodes, amount of hemoptysis, length of hospital stay, mortality, and clinical variables such as presence of fever and need for blood products.

We stratified patients by age: 0 to 5 years, 6 to 10 years, 11 to 20 years, and >20 years. The amount of hemoptysis was recorded from the charts and transformed to a milliliter equivalent (ie, 1 cup = 240 mL), then the episodes of hemoptysis were stratified according to the amount of blood expectorated in three groups: mild, <150 mL/day; large, between 150 and 400 mL/day; and massive, >400 mL/day. The need for blood products (packed red blood cells, fresh frozen plasma, platelets concentrate, and cryoprecipitate) was also recorded for each episode of hemoptysis.

Patients were compared based on primary diagnosis (CF, congenital heart disease [CHD], and Other), and variables (including presence of fever [axillary temperature $\geq 38.5^{\circ}\text{C}$] and need for blood products) were selected for stratified analysis. To avoid problems with multiple comparisons, we used an a priori cut-off value of $P < .0001$. Statistical analyses were performed using analysis of variance when comparing continuous variables between multiple groups and χ^2 test (and Fisher's exact test when necessary) for categorical data.

RESULTS

A total of 228 patients divided into three main categories of primary diagnosis (CF, CHD, and Other) were identified during the 10-year study period (Table 1). The racial composition was African-Americans, 21; Asians, 2; Caucasians, 186; and Hispanics, 19. The age, sex, and length of stay for the three categories are shown in Table 2. Patient distri-

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TABLE 1. Etiology of Hemoptysis

Diagnosis	Number of Patients
Cystic fibrosis	149
Congenital heart disease	
Ventricular septal defect	8
Truncus arteriosus	8
Complex cyanotic heart disease	8
Transposition of the great arteries	5
Unspecified	4
Atrioventricular canal	2
Tetralogy of fallot	2
Other	
Pneumonia	13
Neoplasm	6
Unknown	4
Sepsis	3
Tuberculosis	2
Vasculitides	2
Tracheobronchitis	2
Nasopharyngeal bleeding	2
Pulmonary hemorrhage	1
Pulmonary hypertension	1
Pulmonary hemosiderosis	1
Pulmonary embolism	1
Cardiac disease	1
Arteriovenous malformation	1
Bronchiectasis	1
Lung contusion	1
Total	228

TABLE 2. Demographics

Diagnosis	Gender (Male/Female)	Age		Length of Stay (Days)
		Years	Range	
Cystic fibrosis	73/76	21 ± 7*	(2–36)	13 ± 10†
Congenital heart disease	18/19	14 ± 11	(0.1–33)	12 ± 23
Other	24/18	9 ± 6	(0.1–19)	7 ± 10
Total	115/113	17 ± 9	(0.1–36)	12 ± 13

Values are mean ± SD.

* $P < .0001$ vs congenital heart disease and other, using analysis of variance.

† $P < .005$ vs other, using analysis of variance.

bution by age group was as follows: 0 to 5 years, 34; 6 to 10 years, 18; 11 to 20 years, 88; >20 years, 88. Table 3 contains data regarding the number of hemoptysis episodes, receipt of blood products, and fever status in relation to the diagnosis and age groups.

A total of 29 (13%) of the 228 patients died: 12 from

the CF group, 8 from the CHD group, 9 from the Other group. Predictors of mortality in the crude analysis were age ($P < .0001$), amount of hemoptysis ($P < .0001$), transfusion of blood products ($P < .0001$), and presence of fever ($P < .0005$). In the >20-year age group, mortality was significantly higher ($P = .0009$) only in the CF group, compared with the mortality of patients in the CHD group. Mortality was significantly higher in all of the groups based on diagnosis: CF group, $P = .001$; CHD group, $P = .0005$; Other group, $P < .0001$. Also, mortality was significantly higher ($P < .0001$) in the 0- to 5-year age group that received blood products. In relation to the amount of hemoptysis, this variable was a predictor of mortality only in the CHD group ($P < .0001$).

DISCUSSION

In the pediatric population, hemoptysis is an uncommon but potentially serious condition. The reported etiologic factors have varied throughout the years, and CF is currently being noted more frequently. Hemoptysis is less commonly associated with tuberculosis, bronchiectasis, and other infectious processes.

The results of this retrospective study of 228 patients indicate that the most important predictors of mortality are age, amount of hemoptysis, receiving blood products, and the presence of fever.

In this study, there was a slight male predominance. With respect to age, 78% of the episodes of hemoptysis occurred in children >10 years old, reflecting the fact that this is a clinical condition most commonly seen in older children, adolescents, and adults.

CF patients experienced 68% of the hemoptysis episodes, 93% of which occurred in patients >10 years of age. This is similar to previous reports in which CF patients had an increased life expectancy, with a consequent increase in the incidence of complications related to this disease (eg, bronchiectasis and hemoptysis).^{6,10,24} CHD patients experienced 15% of the hemoptysis episodes, 38% of which occurred in children <5 years of age and 51% of which occurred in patients >10 years of age. This bimodal presentation is a reflection of the presence of hemoptysis and pulmonary hemorrhage in the neonate and

TABLE 3. Hemoptysis and Clinical Variables

	Diagnosis			Age Group (Years)			
	CF*	CHD†	Other	0–5	6–10	11–20	>20
Amount of hemoptysis							
Mild (<150 mL/day)	102	19	32	20	12	66	55
Large (150 to 400 mL/day)	48	8	5	4	4	19	34
Massive (>400 mL/day)	17	10	5	10	4	9	9
Blood products							
Yes	23	13	12	19	4	10	15
No	144	24	30	15	16	84	83
Fever ($\geq 38.5^\circ\text{C}$)							
Yes	23	6	11	11	3	17	9
No	144	31	31	23	17	77	89

Numbers represent episodes of hemoptysis.

* Cystic fibrosis.

† Congenital heart disease.

infant^{25,26} and the development later in life of pulmonary vascular hypertension and pulmonary venous congestion with consequent hemoptysis.^{27,28} Patients in the Other group experienced 17% of the hemoptysis episodes, 40% of which occurred in children <5 years of age and 38% of which occurred in children >10 years of age. Among the several etiologies of hemoptysis in this group of patients, pneumonia was the most frequent cause accounting for 31% of the episodes. The presence of an infectious process (eg, necrotizing pneumonia, tuberculosis, lung abscess, infected bronchiectasis) leads to destruction of lung parenchyma and erosion of blood vessels, resulting in hemoptysis. Infections have been reported as the most common etiology of hemoptysis in several studies in children^{4,5} and adults.^{17-19,29} The results in the present study are very similar, with infections such as pneumonia, sepsis, tuberculosis, and tracheobronchitis representing 48% of the infections of all the patients in the Other group (Table 1). It is noteworthy that only two patients in this study were identified with tuberculosis, a disease once considered to be a major cause of hemoptysis in children³⁰ and one that may again become a significant health problem in children.^{31,32}

The present data show that the age of presentation for CF patients in this study is comparable to that in other series reported previously.^{6,12} Hemoptysis is a relatively late complication of CF, primarily affecting those patients who survive adolescence and young adulthood.³³ The age of presentation of the patients in the CHD group and Other group was significantly lower. This most likely reflects a different pathophysiology in relation to the primary cause of the hemoptysis episode. Also, the patients with CF had a significantly longer hospitalization compared with the patients in the Other group and no difference compared with the CHD group. This longer stay reflects the chronic nature of these diseases (CF and CHD) and the multitude of problems associated with CF that prolong the hospitalization course and delay the recovery process.^{34,35}

The overall mortality rate of 13% in this study is similar to that reported by Knott-Craig et al²⁹ in a study of 120 adult patients with massive hemoptysis defined as >200 mL/day (an overall hospital mortality rate of 10%) and by Corey et al⁹ in a report of 59 adult patients (a mortality rate of 9% in those patients with <1000 mL/day of bleeding). The mortality rate is higher when the amount of hemoptysis increases, according to several studies in children^{6,12} and in adults,¹⁷⁻¹⁹ with mortality rates from 23% to 36%. This correlation was significant in this study only for the patients in the CHD group. Regarding the relationship between specific diagnosis and mortality in patients with hemoptysis, the incidence of mortality among the three diagnosis groups in this study did not differ significantly. Several of the adults series reported increased mortality in patients with neoplasia compared with inflammatory lung disease. In this study, 2 of 6 patients with a neoplasia did not survive, and 3 of 15 patients with an inflammatory lung process did not survive.

In a study by Crocco et al,¹⁸ the authors reported

the results of 67 patients with massive hemoptysis (48 had tuberculosis). The series included 3 patients between 11 and 20 years of age and 10 patients between 21 and 30 years of age. The authors mentioned that massive hemoptysis occurred in young people, but the analysis did not show age as a significant factor for mortality because of the small number of patients in the pediatric age group, with death rates comparable in all ages groups. In the present study, the stratification analysis showed that age was a significant predictor of mortality in the patients >20 years of age, with increased mortality only in the CF group when compared with patients in the CHD group. In a study by Stern et al,¹² the authors reported the prognosis of 38 CF patients with massive hemoptysis. Their results showed no significant differences in age at first episode of massive hemoptysis between survivors (28 patients; mean age, 17 years) and nonsurvivors (10 patients; mean age, 16 years). Another report, by Holsclaw et al,⁶ that included 19 CF patients with massive hemoptysis also showed no differences in age at each massive episode of hemoptysis between survivors (13 patients; mean age, 18 years) and nonsurvivors (6 patients; mean age, 18 years).

Among the several specific interventions in patients with hemoptysis, transfusion of blood products is aimed to restore blood loss and to normalize the hematocrit value and coagulation factors.³ The findings in this study showed a higher mortality in recipients of blood products in all three groups of diagnosis, as well in the group of patients <5 years of age. This is similar to the results of Corey et al,⁹ which demonstrated a higher incidence of blood transfusions among nonsurvivors compared with survivors (72% vs 27%).

In conclusion, in this study of 228 patients, hemoptysis presented in young adult CF patients and in adolescent CHD patients. Young adult CF patients with hemoptysis had an increased risk of mortality compared with young adults with CHD. The amount of hemoptysis was predictive of mortality only for the CHD group. Receipt of blood products was predictive of mortality for all groups.

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