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 $38.5^\circ$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 in patients with CF, CHD, and Other diagnoses; and 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.

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.

RESULTS

A total of 228 patients divided into three main categories of primary diagnosis (CF, congenital heart disease [CHD], and Other) were identified during the 10-year study period (Table 1). The racial composition was African-Americans, 21%; Asians, 2%; Caucasians, 18%; and Hispanics, 19. The age, sex, and length of stay for the three categories are shown in Table 2. Patient distr-
The distribution 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 1. Etiology of Hemoptysis

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

### TABLE 2. Demographics

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

Values are mean ± SD.
* P < .0001 vs congenital heart disease and other, using analysis of variance.
† P < .005 vs other, using analysis of variance.

### TABLE 3. Hemoptysis and Clinical Variables

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>CF*</th>
<th>CHD†</th>
<th>Other</th>
<th>Age Group (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of hemoptysis</td>
<td></td>
<td></td>
<td></td>
<td>0–5</td>
</tr>
<tr>
<td>Mild (&lt;150 mL/day)</td>
<td>102</td>
<td>19</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Large (150 to 400 mL/day)</td>
<td>48</td>
<td>8</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Massive (&gt;400 mL/day)</td>
<td>17</td>
<td>10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Blood products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>23</td>
<td>13</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>No</td>
<td>144</td>
<td>24</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Fever (≥38.5°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>23</td>
<td>6</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>No</td>
<td>144</td>
<td>31</td>
<td>31</td>
<td>23</td>
</tr>
</tbody>
</table>

Numbers represent episodes of hemoptysis.
* Cystic fibrosis.
† Congenital heart disease.
identified with tuberculosis, a disease once consid-
ernoteworthy that only two patients in this study were
all the patients in the Other group (Table 1). It is
cheobronchitis representing 48% of the infections of
such as pneumonia, sepsis, tuberculosis, and tra-
The present study are very similar, with infections
increases, according to several studies in children6,12
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 consid-
ered 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 patho-
physiology 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 mortal-
ity rate of 10%) and by Corey et al30 in a report of
59 adult patients (a mortality rate of 9% in those
patients with <1000 mL/day of bleeding). The mortal-
ity rate is higher when the amount of hemoptysis
increases, according to several studies in children6,12
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 mor-
tality 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 inflam-
matory 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 men-
tioned that massive hemoptysis occurred in young
people, but the analysis did not show age as a sig-
ificant 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 mas-
sive hemoptysis between survivors (28 patients;
mean age, 17 years) and nonsurvivors (10 patients;
mean age, 16 years). Another report, by Holsclaw et
al6 that included 19 CF patients with massive he-
moptysis 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 pa-
tients with hemoptysis, transfusion of blood prod-
ucts 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, hemop-
tysis 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 pre-
dictive of mortality for all groups.

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