ETIOLOGY AND TREATMENT OUTCOMES OF MASSIVE HEMOPTYSIS

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Abstract. Massive hemoptysis is a life-threatening condition and can lead to asphyxiation. This is a retrospective review of 101 patients hospitalized with massive hemoptysis at Srinagarind Hospital, Khon Kaen, Thailand, between January 1993 and December 2002. The male to female ratio was 2.1:1. The average age was 47.1 (SD 16.8) years. Half the subjects were farmers and three-fourths had an underlying disease; most notably old pulmonary tuberculosis (41.6%). The mean duration of massive hemoptysis was 3.2 (SD 3.7) days. An initial hematocrit ≤30% was found in 34.6% of patients, and a prolonged prothrombin time in 4.0%, and thrombocytopenia in 2.0%. Chest radiographs revealed unilateral, bilateral lesions and normal lungs in 57.4, 40.6, and 2.0%, respectively. A chest CT was done in 14.8% of patients. Bronchoscopy localized the bleeding and diagnosed the etiology in 19.8%. The most common causes of massive hemoptysis were bronchiectasis (33.7%), active pulmonary tuberculosis (20.8%) and malignancy (10.9%). Patients were grouped by treatment: 1) conservative (88); 2) emergency bronchial artery embolization (7); and, 3) emergency surgery (6). Of the 88 patients in group 1, the bleeding was stopped in 71 (80.7%) and recurred in 4. Of the 7 patients undergoing emergency bronchial artery embolization, the bleeding was stopped in 6 (86%) and recurred in 1. In the 6 patients who underwent emergency surgery, the bleeding was stopped in all and recurred in 1. Recurrent hemoptysis usually arose within 7 days of the first episode and was well controlled with bronchial arterial embolization. The mortality rate was 17.8%. Of the discharged patients, 36.1% had recurrent hemoptysis. Most of them occurred within one month after discharge. We conclude that, the most common cause of massive hemoptysis is benign rahter than malignant disease. Intensive care with conservative treatment should be applied vigorously. Bronchial artery embolization is an excellent, non-surgical alternative to control bleeding, and should be done before specific surgical intervention.

INTRODUCTION

Massive hemoptysis is a medical emergency associated with 30 to 50% mortality rates in non-traumatic patients (Conlan *et al*, 1983; Corey and Hla, 1987). The etiology varies among the series by age, location, and the diagnostic test(s) employed. Older series ranked tuberculosis and bronchiectasis as the most common causes of hemoptysis (Gourin and Garzon, 1974; Garzon and Gourin, 1977; Conlan *et al*, 1983), while bronchogenic carcinoma predominates in the more recent series (Johnston and Reisz, 1989; Santiago *et al*, 1991).

Management of this life-threatening disease is debated. In several studies over the last 20 years, conservative management of massive hemoptysis was associated with increased mortality (Gourin and Garzon, 1974; Garzon and Gourin, 1977; Conlan *et al*, 1983). This outcome led to the recommendation for an aggressive, early surgical approach. However, advocates of conservative management have reappeared (Bobrowitz *et al*, 1983; Corey and Hla, 1987), as have innovators of the important new technique of bronchial artery embolization (Uflacker *et al*, 1985; Swanson *et al*, 2002). The advantage of surgical management is that it prevents recurrent massive hemoptysis (Knott-Craig *et al*, 1993). This therapeutic approach should be considered for localized lung lesions if the patient is fit for operation. Obviously, emergency surgery is riskier than elective surgery.

In order to improve the treatment outcome

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of this critical issue, we conducted this study to determine: 1) the current etiology of massive hemoptysis; and, 2) the hospital course and treatment outcome of our patients.

MATERIALS AND METHODS

Patients

An extensive, retrospective chart review was performed for all patients admitted with hemoptysis to Srinagarind Hospital between January 1, 1993 and December 31, 2002. Patients 15 years or older with massive hemoptysis were included in this study. Patients who were referred to other hospitals were excluded. Massive hemoptysis was defined as expectoration of at least 200 ml of blood each time, or more than 600 ml in 24 hours.

All clinical records were reviewed including both in- and out-patient charts. Patients undergoing bronchial artery embolization in the radiology unit and who had massive hemoptysis as their indication for surgery were also reviewed. Demographic data, initial clinical symptoms and signs, laboratory findings, final diagnoses, treatments and outcomes, and recurrent hemoptysis after follow-up were collected for analysis.

Ethics

The Ethics Committee, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand, reviewed and approved the research proposal and protocols.

Statistical analysis

Descriptive statistics were used. The means and standard deviations (SD) were calculated for continuous data; the numbers and percentages for categorical data.

RESULTS

Over a ten year period, 172 patients were admitted to the Srinagarind Hospital because of hemoptysis. Of these, 101 patients (58.7%) had massive hemoptysis (68 males and 33 females; a ratio of 2.1 to 1). Patients averaged 47.1 (SD 16.8) years of age (minimum, 16; maximum, 83). Half the patients were subsistence farmers. The average duration of symptoms before admission was 10.5 (SD 12.4) days. The average number of days of massive hemoptysis was 3.2 (SD 3.7) days. In addition to massive hemoptysis, other symptoms included: fever (24.7%), weight loss (10.9%), and chest discomfort (8.9%). Three-quarters (74/101) of the patients had underlying diseases, the most common being old pulmonary tuberculosis (41.6%), bronchiectasis (9.9%), malignancy (4.0%), mitral stenosis (4.0%), and diabetes mellitus (3.0%) (Table 1).

Initial laboratory results indicated 35 patients (34.6%) had a hematocrit of less than or

Table 1
Patient characteristics.

Characteristic	N = 101
Age, year (mean, SD)	47.1 (16.8)
Male to female ratio	68 : 33
Duration of symptoms, days (mean, SD)	10.5 (12.4)
Duration of massive hemoptysis, days (mean, SD)	3.2 (3.7)
Symptoms (N, %)	
Massive hemoptysis	101 (100)
Fever	25 (24.7)
Weight loss	11 (10.9)
Chest pain	9 (8.9)
Underlying disease	
Normal	27 (26.7)
Old pulmonary tuberculosis	42 (41.6)
Bronchiectasis	10 (9.9)
Malignancy	4 (4.0)
Mitral stenosis	4 (4.0)
Diabetes mellitus	3 (3.0)

Table 2
Intitial laboratory finding.

Laboratory	N = 101
Hematocrit ≤ 30% (N, %)	35 (34.6)
Coagulopathy (N, %)	4 (4.0)
Thrombocytopenia (N, %)	2 (2.0)
Chest radiographs (N, %)	
Unilataral lesion	58 (57.4)
Bilateral lesion	41 (40.6)
Normal	2 (2.0)

equal to 30%, 4 had a prolonged prothrombin time, and 2 had thrombocytopenia (Table 2). Abnormal chest radiographs were found in 99 patients: 58 had unilateral lung lesions and 41 had bilateral lung lesions. Two of them had normal chest radiographs. After admission, further investigation was done. Chest computed tomography (CT) was requested for 15 patients (14.8%), and bronchoscopy was performed on 20 (19.8%), to identify the location of bleeding and to collect bronchoalveolar lavage fluid for diagnosis.

In our series, bronchiectasis was the most common cause of massive hemoptysis (34). The second cause was active pulmonary tuberculosis (21) and the third was malignancy (11). The primary site of malignancy was: bronchogenic carcinoma (8), mesothelioma (1), metastatic laryngeal carcinoma (1), and metastatic adenocarcinoma of unknown origin (1). Other causes of massive hemoptysis were: lung abscess (7), bacterial pneumonia (7), severe mitral stenosis with pulmonary hypertension (4), coagulopathy (4), aspergilloma (4), old pulmonary tuberculosis with destroyed lung (3), Bechet's disease (2), thrombocytopenia (2), systemic lupus erythematosus (1), pulmonary renal syndrome (1), ventricular septal defect with pulmonary hypertension (1), nocardia (1), invasive aspergillosis (1), and pulmonary non-tuberculous mycobacterium (1) (Table 3).

Table 3
Etiology of massive hemoptysis.

Etiology[a]	N	%
1. Bronchiectasis	34	33.7
2. Active pulmonary tuberculosis	21	20.8
3. Malignancy	11	10.9
4. Lung abscess	7	6.9
5. Bacterial pneumonia	7	6.9
6. Severe mitral stenosis with pulmonary hypertension	4	4.0
7. Coagulopathy	4	4.0
8. Aspergilloma	4	4.0
9. Old pulmonary tuberculosis with destroyed lung	3	3.0
10. Bechet's disease	2	2.0
11. Thrombocytopenia	2	2.0
12. Systemic lupus erythematosus	1	1.0
13. Pulmonary renal syndrome	1	1.0
14. Ventricular septal defect with pulmonary hypertension	1	1.0
15. Nocardia	1	1.0
16. Invasive aspergyllosis	1	1.0
17. Pulmonary nontuberculous mycobacterium	1	1.0

[a]Four Patients had two etiologic causes: severe mitral stenosis + coagulopathy (2), active pulmonary tuberculosis + coagulopathy (1), thrombocytopenia + coagulopathy (1).

Half of the patients (49/101) were admitted to the intensive care unit (ICU), the rest to a medical ward. One to five units of packed red blood cells were administered to 49 patients (48.5%). After analysis, the data were categorized according to initial management: conservative treatment (88), emergency bronchial artery embolization (7), or emergency surgery (6) (Fig 1).

Conservative treatment was defined as close observation, airway care, recording volume of expectorated blood, oxygen therapy, and blood transfusion when indicated. In 71 of the 88 patients (80.7%) who received conservative treatment, the bleeding was arrested. In 14 patients (15.9%), the bleeding continued. One patient died with ARDS and two with sepsis.

In cases of continuous bleeding after conservative treatment, 9 were not clinically stable and died, 2 underwent surgery and the bleeding was stopped, 3 underwent bronchial artery embolization (2 successfully and 1 died).

In the 71 patients whose bleeding was controlled with conservative treatment, 26 underwent elective intervention after 5 to 7 days: 16 for bronchial artery embolization, 8 for surgery, and 2 for bronchial artery embolization followed by surgery. All were successful.

In the patients who had emergency intervention within 24 hours, the bleeding was controlled in 6 of 7 with bronchial artery embolization, and in all of the patients with emergency surgery.

Recurrent hemoptysis during hospitalization arose within 7 days of the first episode. In the conservative treatment group, 4 patients had recurrent hemoptysis (1 underwent surgery but

died; 3 continued with conservative treatment, 1 successfully and 2 died). In the emergency bronchial artery embolization group, 1 patient had recurrent hemoptysis controlled with repeated bronchial artery embolization. In the emergency surgery group, 1 patient had recurrent hemoptysis controlled with bronchial artery embolization but died with sepsis.

The outcome of treatment in our hospital was that 83 patients were discharged. Hospitalization averaged 11.8 (SD 9.0) days. The most common complication was acute respiratory failure (35.6%). Seventeen patients were intubated with a double lumen endobronchial tube and 19 with an endotracheal tube. Other complications included shock (13.9%), hospital acquired pneumonia (5.0%), acute renal failure (2.0%), empyema thoracis (1.0%), and pneumothorax (1.0%). The disease had a 17.8% mortality rate (Table 4).

Of the 83 patients discharged from the hospital, 54 had medical records indicating follow-up treatment at Srinagarind Hospital. The duration of follow-up ranged between <3 and >12 months (Table 5). From this data, the 30 patients had recurrent hemoptysis after being discharged accounted for 36.1% of the surviving patients. Most of them had recurrent hemoptysis within one month of being discharged. Two patients died after recurrent hemoptysis, 4 underwent bronchial artery embolization, 1 surgery, and the rest received conservative treatment.

Table 4
Treatment outcome.

Outcome	N = 101
Mortality rate (%)	17.8%
Hospital stay (days)	11.8 (SD 9.0)
Complication (N, %)	
Acute respiratory failure	36 (35.6)
Shock	14 (13.9)
Acute renal failure	2 (2.0)
Hospital acquired pneumonia	5 (5.0)
Empyema thoracis	1 (1.0)
Pneumothorax	1 (1.0)

Table 5
Clinical course of 83 patients after being discharged.

Duration of follow-up	N = 83
No data of follow-up	29
Follow-up < 3 months (N = 11)	
Recurrent hemoptysis	5
No recurrent hemoptysis	6
Follow-up 3-6 months (N = 5)	
Recurrent hemoptysis	3
No recurrent hemoptysis	2
Follow-up 6-9 months (N = 4)	
Recurrent hemoptysis	0
No recurrent hemoptysis	4
Follow-up 9-12 months (N = 2)	
Recurrent hemoptysis	0
No recurrent hemoptysis	2
Follow-up > 12 months (N = 32)	
Recurrent hemoptysis	22
No recurrent hemoptysis	10

DISCUSSION

Hemoptysis is often an alarming presenting symptom. The most common causes of hemoptysis in our study, as in others (Gourin and Garzon, 1974; Garzon and Gourin, 1977; Conlan *et al*, 1983), were infection, bronchiectasis and active pulmonary tuberculosis. Malignancy was the third most common disease, most of them were primarily lung cancer. The prognosis of massive hemoptysis from malignant diseases, such as lung cancer and leukemia, is poor compared with benign disease (Corey and Hla, 1987; Hirshberg *et al*, 1997). Bleeding diathesis secondary to coagulopathy or thrombocytopenia is uncommon but can be corrected by fresh frozen plasma or concentrated platelets.

Every patient with massive hemoptysis was recommended for admission to the ICU because airway or hemodynamic compromise might occur (Ong and Eng, 2003); however, only 48.5% of our patients were admitted to the intensive care unit. This is limited to the care of a tertiary referral hospital. For patients with airway compromise, double lumen endobronchial tube intubation and independent lung ventilation prevented blood flooding the good lung, thereby

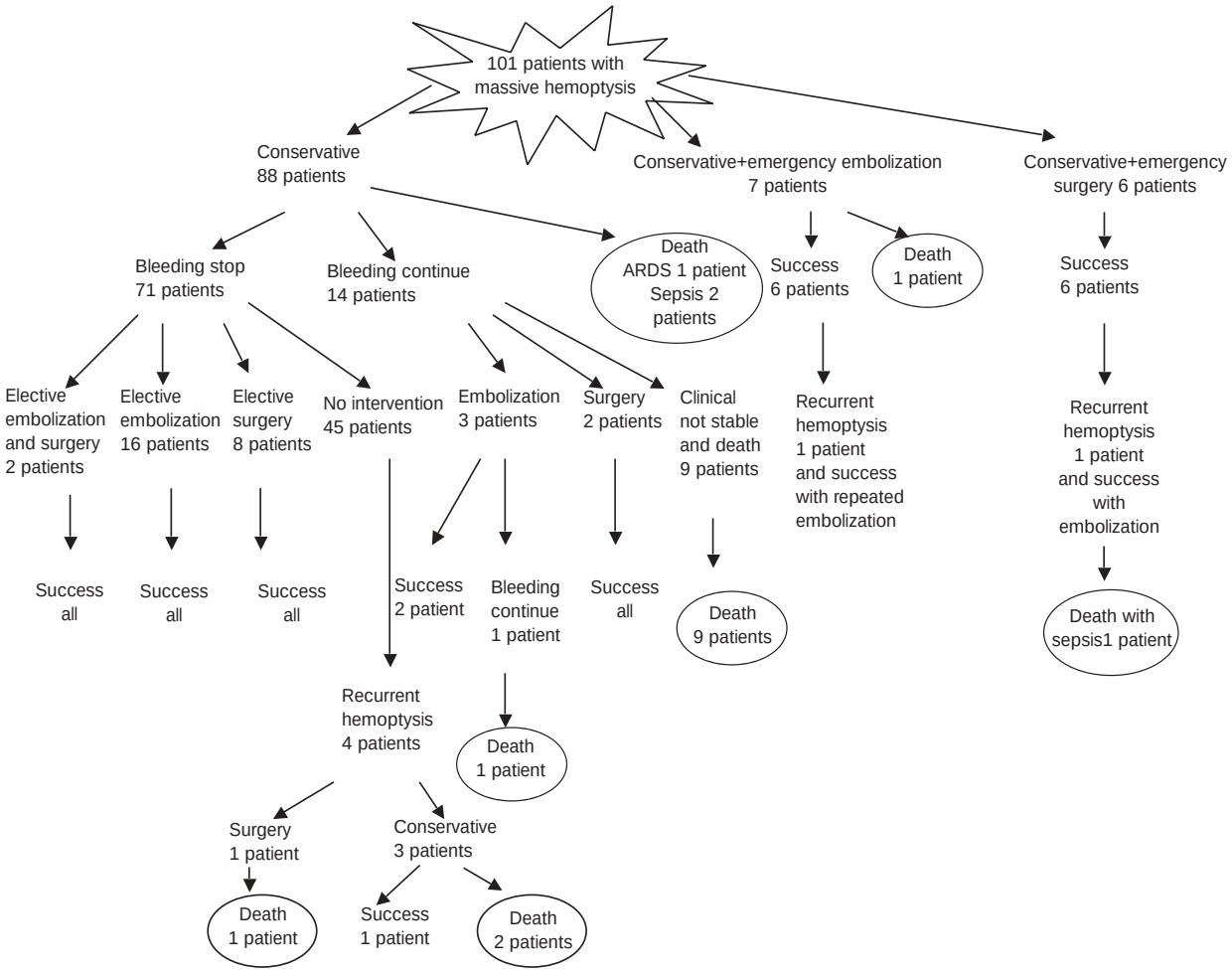

Fig 1–Diagram of management.

saving the patients' life (Ost and Corbridge, 1996). Unfortunately, intubating patients with massive hemoptysis is technically difficult and requires a well-trained anesthesiologist.

Initial laboratory work-up to ascertain hematocrit, prothrombin time, and platelet count should be done. A hematocrit corrected to over 30% will improve the hemodynamic compromise. Even though coagulopathy and thrombocytopenia were not common causes of massive hemoptysis, these are correctable medical conditions. The benefit of bronchoscopy in stable patients with minimal hemoptysis is to localize the bleeding and diagnose the specific cause (Dweik and Stoller, 1999). In cases of massive or life-threatening bleeding, bronchoscopy is primarily used to maintain ventilation and direct endobronchial blockade (Kato *et al*, 1996; Dweik and Stoller, 1999). Once isolation of the bleeding has been achieved, the choice between embolization, surgery, or both must be made. Bronchoscopy should be performed after airway protection and patient stabilization.

Double-lumen endobronchial tubes, such as Carlens or Robertshaw, are used to protect the non-bleeding lung from blood aspiration (Morell *et al*, 1995). This is done to stabilize the airway and ventilate the normal lung. Misplacement of the double lumen tube is a serious error. Fiberoptic bronchoscopy is used in con-

junction with the double lumen tube to make sure it is in the correct position (Klein *et al*, 1998). Computed tomography (CT) of the chest may demonstrate lesion(s) not visible on the radiograph, such as bronchiectasis, small bronchial carcinomas, aspergillomas and arteriovenous malformations (Millar *et al*, 1992; McGuinness *et al*, 1994). This should be done in cases of unexplained hemoptysis.

Conservative treatment in the ICU with a well-organized team of doctors (chest physician, anesthesiologist, radiologist, and surgeon) is the primary management (Corey and Hla, 1987; Jean-Baptiste, 2000). The patients should rest, receive oxygen therapy, intravenous fluid therapy or blood components (if indicated), have the amount of expectorated blood recorded, airway secured, and specific therapy given, such as antibiotics or antituberculous drugs. In our series, bleeding in 80.7% of our patients was controlled by conservative treatment.

After stabilizing a patient over 24-48 hours, if the bleeding does not stop, bronchial artery embolization should be considered (Uflacker *et al*, 1985; Knott-Craig *et al*, 1993; Swanson *et al*, 2002), because it is useful for controlling bleeding and may obviate surgery. However, surgery is still recommended in patients with massive hemoptysis caused by thoracic vascular injury, arteriovenous malformation, or a leaking thoracic aneurysm, for which bronchial artery embolization would be inadequate. Other conditions for which surgery is the treatment of choice, such as aspergilloma, early stage lung cancer and localized bronchiectasis, should be considered for elective surgery after stopping the bleeding by bronchial artery embolization because the reported risk of emergency surgery is high (Jougon *et al*, 2002). In Thailand, bronchial artery embolization is only performed in tertiary care centers. Good conservative care surgery for localized disease provide a reliable treatment alternative.

The most common complication of massive hemoptysis is acute respiratory failure. Such cases should receive intensive care and monitoring. The mortality rate in our series was 17.8%, similar to Singapore, where the common causes of hemoptysis are pulmonary tuberculosis and post-tuberculous bronchiectasis (Stebbings and Lim, 1999). Recurrent in-hospital hemoptysis arose within 7 days in 6 patients (10.5%). We recommend observing the patient about 1 week after primary treatment. Most patients responded to repeated bronchial artery embolization. After being discharged, recurrence was 36.1%, mostly within one month.

We conclude that the most common etiology of massive hemoptysis in Thailand is benign treatable disease. Intensive care with conservative treatment can stop bleeding in about 80% of patients. In cases of nonstop bleeding, bronchial artery embolization should be considered. Surgical intervention should be done in some cases as an elective surgery. A well-organized team of doctors and nurses decreases the mortality rate of this serious life-threatening condition.

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