

Thoracic surgery for haemoptysis in the context of tuberculosis: what is the best management approach?

Semih Halezeroğlu, Erdal Okur

Thoracic Surgery Department, Acibadem University, Faculty of Medicine, Istanbul, Turkey

ABSTRACT

Haemoptysis is not an unusual finding in patients with old or active pulmonary tuberculosis. Because of bronchial artery or a branch of pulmonary artery erosion due to cavitary infiltration, bronchiectasis, fungus ball, broncholithiasis or destroyed lung, the bleeding can sometimes be a life-threatening situation. Assessment of the patient and finding the exact site of bleeding can be difficult especially in a patient with disseminated lung disease. Chest computerized tomography and bronchoscopy remain the methods of choice for lateralization of the disease. Some patients can be treated successfully with endobronchial interventions. Bronchial artery embolization can be rewarding in some patients but the recurrence rate is higher in tuberculosis than other etiologies of haemoptysis. Surgical resection of the lung, mainly lobectomy, remains a life-saving procedure but it should be performed very selectively to avoid higher postoperative morbidity and mortality. Different management options of haemoptysis in patients with pulmonary tuberculosis are discussed in this manuscript.

KEYWORDS

Tuberculosis; haemoptysis; treatment; management; surgery

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Introduction

Haemoptysis in a patient with tuberculosis is not an unusual condition, especially before the antibiotics are administered. This complaint reduces by time with treatment. However, the amount of bleeding can be very high and some patients are lost due to this massive or major haemoptysis.

The definition of major and massive haemoptysis may vary in the literature. Expectoration of 200 to 600 mL of blood in a day is defined as “major” haemoptysis while the amount above this level is generally accepted as “massive” haemoptysis (1,2). Sometimes, lower amount of bleeding in a patient having limited respiratory function may cause life threatening respiratory compromise. Actually, the definition of massive haemoptysis is not only related to the amount of blood expectorated but also

to the risk of aspiration and the degree of respiratory collapse. Clinical deterioration is, most of the time, depends not only to the amount of bleeding but also to the amount of blood aspirated.

Massive haemoptysis constitutes 1-1.5% of all haemoptysis cases and, can be life threatening either as a result of compromised gas exchange or because of circulatory collapse secondary to acute blood loss (3). Without appropriate treatment, life-threatening haemoptysis has a mortality rate of up to 50-100% (4,5).

In etiology of haemoptysis, geographic distribution and socioeconomic level may have importance (6). Pulmonary tuberculosis, with its chronic sequel, is the most common cause of haemoptysis in the third world (6).

Etiologies of haemoptysis in a tuberculosis patient

Bronchial artery is the major cause for bleeding in most patients with haemoptysis. However, in a patient with tuberculosis, the erosion of a ‘Rasmussen aneurysm’, (dilatation of pulmonary artery branches due to chronic inflammation in a tuberculosis cavity) may be responsible for haemoptysis. Chronic inflammation of bronchial walls in tuberculosis bronchitis may cause destruction and, as in the case of bronchiectasis, may lead bronchial artery bleeding. Since bronchial arteries have higher

Corresponding to: Semih Halezeroğlu, MD, FETCS, Professor of Thoracic Surgery. Acibadem Maslak Hospital, Büyükdere Cad. 40, Maslak 34457 Istanbul, Turkey. Email: semihh@atlas.net.tr.

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pressure than the pulmonary arteries, such bleeding may also be severe and difficult to control.

When a tuberculosis cavity invades parietal pleura and chest wall, erosion of intercostal arteries or subclavian or internal mammary arteries may also be associated with haemoptysis.

Development of fungal infection in old tuberculosis cavity is another important cause of haemoptysis. *Aspergillum* species are most commonly the causative organism but infection with *monosporium* has also been reported (7). Intracavitary mycetomas may be seen with either of these infections.

Broncholithiasis is development of calcium deposits on peribronchial lymph nodes during healing process of chronic granulomatous condition, most commonly tuberculosis. Erosion of bronchial wall and peribronchial arteries by broncholiths may be another cause of severe haemoptysis.

Assessment of the patients

Whatever the etiological factor is, massive haemoptysis in a tuberculosis patient may be a life-threatening situation and immediate medical and surgical management is needed. A brief history may give you valuable information; previous attacks of haemoptysis, amount and duration of bleeding, use of medication (anticoagulants or antithrombotics) should be noted. Patient should be followed in intensive care or high-dependency unit if he or she has a major or massive haemoptysis. Prevention of asphyxiation should be the major goal in such a patient.

Determining the cause and the location of bleeding is an important issue. Radiologic examinations (chest X-ray, thorax computerized tomography) provide valuable information such as presence of an active tuberculosis infiltration or cavity in the lung, mycotic ball in a cavity or broncholiths. Sometimes both lungs may have pathological findings where lateralization and localization of bleeding becomes an important issue. Some patients describe a dull pain at the same side with the pathology but this is not enough to diagnose the side of the bleeding in a patient with bilateral lung infiltration.

The obvious cause of haemoptysis should be treated with specific measures (reversal of anticoagulants, anti-tuberculosis treatment, antibiotics for bronchiectasis).

A bronchoscopic examination is always needed to determine the bleeding site definitely. Rigid bronchoscopy should be preferred over fiberoptic bronchoscopy for its advantages of better ventilation and suctioning. Prompt localization of bleeding site has outmost importance. It should be remembered that the clots could be aspirated to the contralateral lung or to other lobe(s) in the same side and may be misleading to understand the main source of bleeding.

Non-surgical managements

Once the bleeding site is determined, application of iced isotonic saline lavage, adrenalin or thrombin-fibrinogen compounds may be helpful to stop bleeding. Electro-cautery or argon plasma coagulation machine can also be used. Another method for stopping a bronchial bleeding is the insertion of a Fogarty catheter and inflating it in order to create a pressure over the site of bleeding (balloon tamponade). If all these maneuvers fail, intubation by a double-lumen tube may help to stabilize patient until the preparations for definitive surgical treatment done (8).

Bronchial artery embolization

Availability of endobronchial techniques and bronchial artery embolization may control massive bleeding, at least temporarily, and prevents emergency surgical treatment (9). The first report for controlling life-threatening haemoptysis by bronchial artery embolization was done in 1973 by Remi and colleagues (10). By selective bronchial artery angiography, the site of bleeding of a bronchial artery is determined first and then application of embolization material obliterates the site of leak from bronchial artery. Some studies report a 75-94% success rate in immediate termination of bleeding (11,12). Mal and colleagues evaluated 56 patients who had been embolized for haemoptysis and noted that immediate control was achieved in 43 patients.

These series cover patients having haemoptysis due to different kind of etiology, not only due to patients with tuberculosis. A study consisting of only tuberculosis patients having haemoptysis is a few. Since different mechanisms play role in tuberculosis patients (i.e., bleeding also from pulmonary artery) the success rate of embolization may be expected to be lower in this group of patients.

Ramakantan and colleagues performed bronchial artery embolization in 140 patients with haemoptysis due to active or old tuberculosis (13). They report that, 38 (27%) had recurrent haemoptysis that needed other intervention. Hwang and colleagues performed bronchial artery embolization in 72 patients with haemoptysis due to active or old tuberculosis infection (14). They report 40.3% re-bleeding rate after first embolization and argue that the existence of a shunt in angiographic findings; aspergilloma and diabetes mellitus were the risk factors of re-bleeding. Gross and colleagues performed emergency bronchial artery embolization in 61 patients with haemoptysis due to tuberculosis (15). Of these, 11 had died before discharge, while none of the patients who underwent surgical resection died. Lee and colleagues compared their long-term results of embolization in two groups of patients;

patients with chronic tuberculosis and bronchiectasis (16). They found recurrence rate of 56.7% in tuberculosis group and 26% in bronchiectasis group. They argued that presence of fungus ball was an important risk factor for re-bleeding.

White and colleagues suggest that bronchial artery embolization is a palliative procedure and the potential for recurrent haemoptysis exists as long as the disease process is not cured by drug therapy or removed surgically (12). Recurrence after bronchial artery embolization may be related to incomplete embolization, recanalization of embolized vessel, revascularization of collateral vessels associated with the progression of the underlying disease, or bleeding coming from a pulmonary artery branch as in the case of cavitary tuberculosis (17). In patients deemed too ill to undergo elective surgery, embolization may be repeated successfully for repeated haemoptysis (18).

Potential risks of embolization are mediastinal hematoma due to subintimal aortic dissection and neurological damage. The former may occur due to unwanted occlusion of spinal arteries during embolization.

Resectional surgery

Management of massive haemoptysis and timing of surgical intervention pose difficult problems. Gourin and Garzon have recommended prompt surgical resection for patients having more than 600 mL blood in 24 hours (19). For such a patient mortality rate is 18% by surgery as compared to 75% rate in those treated conservatively. Emergency surgery should be reserved only for those patients: (I) having adequate lung function; (II) exact site of bleeding definitely defined; (III) continuing bleeding despite the adequate measures taken (20). Emergency surgery performed for massive haemoptysis has always higher risk than a planned surgery as reported by Jougon and colleagues (21). Most important reasons for increased mortality in emergency situation are the continuing bleeding during the operation and proceeding aspiration to uninvolved lung and hypovolemia. So, deciding to perform an emergency surgical resection in a patient with massive haemoptysis remains a real challenge.

A double lumen endotracheal intubation for the conduction of anesthesia should be preferred in order to block the bronchus of the bleeding site and prevent aspiration to uninvolved site. A balloon Fogarty catheter occlusion of involved site together with a single lumen tube may also be preferred.

In most emergency cases, the patient had already aspirated some blood to the other lobe(s) and lung functions were already disturbed. Resection of the lung parenchyma may lead respiratory insufficiency. For this reason, the amount of lung

resection should be as small as possible while resecting the main source of bleeding. In most cases, a lobectomy is the standard operation. Because in most cases it is not possible to define the bleeding segment, a segmental resection is rare. In some cases, pneumonectomy is inevitable due to whole lung involvement (destroyed lung) or when the bleeding site is lateralized but not localized. The complication rate is reported to increase by emergency pneumonectomy compared to emergency lobectomy (72% vs. 52%) (2).

Another factor that increases the operative risk is the condition of the lung. Generally accompanying dense pleural adhesions, presence of enlarged sticky lymph nodes, bronchiectasis or broncholithiasis make the surgery very complex and difficult one. Some authors described a method called 'lung exclusion' in patients having dense adhesions making the hilar dissection impossible. In that method, only the bronchus and the artery of affected lobe or lung are obliterated without resection (22).

Erdogan and colleagues reported a series of 59 tuberculosis patients with haemoptysis who underwent surgical resection (20). The pneumonectomy rate was 7% while lobectomy was performed in 65% and the lesser resections in 28% with an overall perioperative mortality about 7%.

An analysis of the nationwide inpatient sample database study was performed recently to define the prevalence and outcomes of anatomic lung resection for haemoptysis in the USA covering a 10-year period (23). Over 457,000 admissions for the diagnosis of haemoptysis were identified. The rate of tuberculosis patients was 0.8% [4,322]. Of all patients with haemoptysis, 2,671 patients (0.58%) underwent surgical resection, 47 (1.8%) for tuberculosis and 157 (5.9%) for fungal infection. This study showed that the increased age and pneumonectomy were the most important risk factors for operative mortality while tuberculosis was not.

Erdogan and colleagues reported three cases of empyema and broncho-pleural fistula in their series containing 59 patients who were operated for tuberculosis related hemoptysis (20). Two of the broncho-pleural fistulas were reported to develop after pneumonectomy (50%) showing the increased risk after pneumonectomy.

In our experience, the rate postoperative surgical bleeding is also increased in this group of patients even if any coagulation abnormality is not detected during preoperative evaluation. Disturbed nutritional balance and low levels of blood proteins may cause increased surgical bleeding in this group of patients.

Conclusions

Haemoptysis in an active or previous tuberculosis patient is a

complex situation. Locating the site of the haemoptysis and defining the etiology may be difficult especially in case of a massive haemoptysis. Bronchial artery embolization may be a good method for controlling haemoptysis and gaining time for a planned surgery in general population. However, in tuberculosis patients the success rate of this method seems to be decreased probably due to the presence of bleeding also from a pulmonary artery branch in this group of patients. In case of massive bleeding, emergency surgery becomes inevitable but carries higher risk than a planned surgery. Surgical resection is still the definitive treatment with acceptable rate of morbidity and mortality.

Haemoptysis can be life threatening in the course of pulmonary tuberculosis. Careful assessment of the condition and quick management remains rewarding.

Deciding the best management option among drugs, bronchoscopic procedures, interventional radiology or resectional surgery is the highlight of the treatment.

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