Massive Hemoptysis and Pulmonary Thromboembolism in a Patient with Pulmonary Tuberculosis: A Therapeutic Conundrum Managed with Bronchial Artery Embolization

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ABSTRACT

Hemoptysis is a crucial entity taking into account its morbidity and mortality. Pulmonary tuberculosis is the leading cause for massive hemoptysis in our part of the world, which if left untreated may be life threatening. We present a case of a 37-year-old male patient with pulmonary tuberculosis with concurrent pulmonary thromboembolism presenting with massive hemoptysis, which was successfully managed with Bronchial Artery Embolization. This case represents that this measure can be a viable therapeutic choice for a patient with a severe life-threatening hemoptysis, particularly when other treatment options are unavailable or ineffective.

KEY WORDS

Bronchial arteries, Embolization, Hemoptysis, Therapeutic

INTRODUCTION

Hemoptysis, the expectoration of blood or blood mixed sputum is a commonly encountered clinical event. Tuberculosis (TB), Bronchiectasis, lung cancer, pneumonia, bronchitis and mycetomas are the leading causes of massive hemoptysis worldwide.[1] Among them in South-Asian countries (India), pulmonary tuberculosis alone accounts for almost two third of the cases of massive and recurrent hemoptysis.[2]

Chest CT and bronchoscopy are commonly required modalities for identifying the cause of massive hemoptysis but on occasions, CT pulmonary angiography should be performed in patients with recurrent hemoptysis.[3] We present a case of massive hemoptysis due to Bronchial artery aneurysm secondary to pulmonary tuberculosis which was diagnosed from CT pulmonary angiography. The hemoptysis was successfully managed with Bronchial Artery Embolization (BAE).

CASE REPORT

A 51-year-old male presented to our center with a history of an episode of hemoptysis, a day prior to presentation, and five such similar episodes in the last 2 months. The hemoptysis contained mucus mixed blood which was around 200 ml in the latest episode, and 5-10 ml in the previous ones. There was a history of pulmonary tuberculosis 13 years back, for which he was treated with anti-tubercular medications. The patient was clinically stable, and investigations revealed active pulmonary tuberculosis. A CT pulmonary angiography (CTPA) was done to determine the source of hemoptysis, which revealed several left bronchial artery aneurysms along with the presence of pulmonary embolism in multiple segmental pulmonary arteries. The patient was then planned for left bronchial artery embolization in a catheterization laboratory. Access was made via right femoral artery. The micro guide wire used was Avigo (Medtronic/Rebar) with

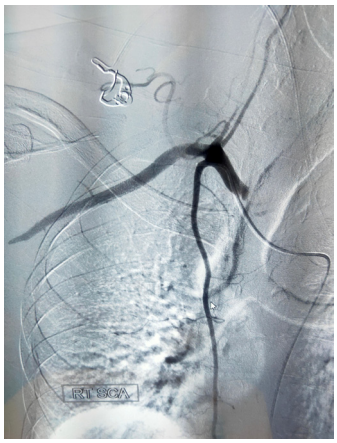

Figure 1. Selective catheterization and initial digital subtracted angiography (DSA) of Right Subclavian Artery showing no abnormal vessels.

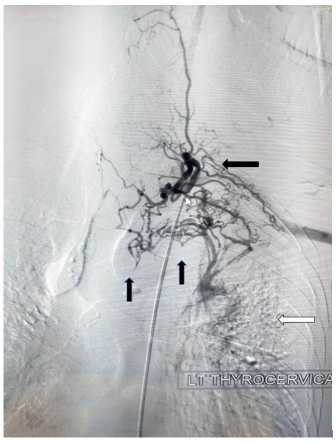

Figure 2. Super-selective distal catheterization of the left subclavian artery with a micro-catheter demonstrating blushing and extravasation of contrast just prior to embolization (white arrow). Abnormally tortuous and dilated bronchial arteries originating from thyrocervical trunk, dorsal scapular artery were present (black arrows).

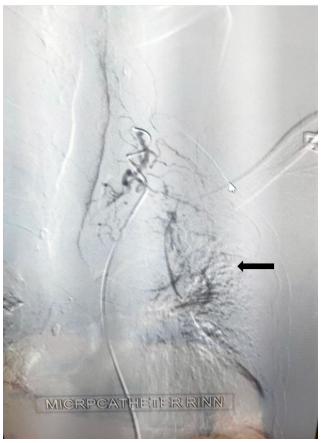

Figure 3. Super selective DSA of left abnormal bronchial artery after embolization showing residual flushing from branches of dorsal scapular artery (black arrow).

Figure 4. Super-selective DSA following embolization of branches of dorsal scapular artery.

diameter of 0.014 inch, length 205 cm, coil length 5 cm, 38 cm hydrophilic polymer coating. Diagnostic angiogram was done in right subclavian artery which showed no abnormal vessel (Fig. 1). Selective distal catheterization of the left bronchial artery with a micro-catheter demonstrated blushing and extravasation of contrast. Angiogram of left subclavian artery showed abnormally tortuous and dilated arteries originating from thyrocervical trunk and dorsal scapular artery. There was also a tortuous left bronchial vessel as a direct branch from descending thoracic aorta (Fig. 2). Selective access to these vessels were made by the use of picard Catheter (5f) and terumo (0.035) guide wire with embolization of the abnormally dilated thyrocervical trunk and intercostal arteries were done through super selective catheterization using progreatmicro catheter (2.4f) using gel foam, polyvinyl alcohol (Cook Medical) and contrast under fluoroscopic monitoring. Total of 6 ml of contrast mixed polyvinyl alcohol particles (500 micron) was used. Post embolization digital subtraction angiography (DSA) of left abnormal bronchial artery showed residual flushing of dorsal scapular artery (Fig. 3) which resolved after embolization of the same artery (Fig. 4). Patient developed severe pain in posterior part of left chest probably due to ischemia following embolization of dorsal scapular artery. The pain subsided in about 30 minutes following intravenous analgesics.

There was no evidence of a remnant aneurysmal segment. The right side's bronchial artery was found to be normal. The patient was admitted for two days and was discharged with oral anticoagulant agents to prevent further embolic episodes along with anti-tubercular therapy. Following the procedure, the patient hasn't complained of hemoptysis till the current follow-up of two months.

DISCUSSION

Hemoptysis can be classified as mild and massive hemoptysis. Mild hemoptysis is defined as blood loss of around 100 ml/24 hour whereas blood loss of at least 200 mL/24 hours or 50 mL per episode or 100 ml per hour, it is termed as massive hemoptysis.[4] However, there exists a wide range of variation in medical literature about the exact amount of blood volume to be constituted a massive hemoptysis. Also, it is not always certain that the severity of hemoptysis strictly correlates with the amount of blood. With regard to this, much emphasis on the term "life threatening hemoptysis "has been given, which takes into account hemodynamic instability, gas exchange abnormalities along with volume of expectorated blood as markers of severity.[5]

The leading cause of massive hemoptysis varies according to the geographical location. In developing countries of South Asia, Tuberculosis (TB) alone accounts for about 65% cases of massive hemoptysis followed by pneumonia (11%), bronchiectasis (9%), other causes like heart failure, pulmonary embolism, mitral stenosis, vasculitis, and lung abscess (9%), and lung cancer (7%). Likewise, developed countries have higher likelihood of bronchiectasis followed by lung cancer for the cause of massive hemoptysis Bleeding from tracheobronchial trees can either be from bronchial or pulmonary circulation.[1] As bronchial circulation is a higher-pressure system, it is responsible for 90% of massive hemoptysis. In case of pulmonary tuberculosis, bronchial vessels become more prone to bleeding due to structural changes like hyper vascularity, loss of architectural support and open exposure of these vessels brought by tuberculous fibro-cavitation and bronchiectasis.[6] Erosion of adjacent vasculature in pulmonary aspergillosis occurring in 7-11%

of post-TB patient, erosion by calcified nodes following granulomatous inflammation and lymphadenitis and rarely pseudo-aneurysm of the pulmonary artery adjacent to a tuberculous cavity due to granulomatous vacuities called Rasmussen's aneurysm are some causes of hemoptysis in patient with pulmonary tuberculosis. Our case was further complicated by concurrent presence of pulmonary thromboembolism.

Sub massive Pulmonary Embolism can progress to Pulmonary Infarction in 10%-20% patients which can result in hemoptysis in 5%-7% of patients.[7] The resultant ischemic parenchymal necrosis in pulmonary embolism is probably responsible for hemoptysis in these patients.[8]

Airway and hemodynamic stability is the first priority in a patient with hemoptysis. In case of patients with massive hemoptysis, definitive management like embolization or surgery may be planned without the need of CT, but the American College of Radiology recommends initial evaluation of all patients with hemoptysis be done with chest radiograph for localization and finding the cause of bleeding. CT pulmonary angiography is the next appropriate modality which is similar to bronchoscopy in terms of locating bleeding, but it is superior in terms of determining the etiology and establishing a vascular roadmap for therapeutic measures.[9]

As a measure for controlling bleeding, though numerous endobronchial measures like ice cold saline lavage, balloon tamponade, pulmonary isolation, mechanical ventilation with PEEP, and intracavitary instillation of sodium or potassium chloride are practiced, angioembolization of bronchial artery remains the treatment of choice for hemoptysis.[10,11] Failure of conservative management, massive recurrent hemoptysis, and surgery unfit cases are the indications for BAE. For patients who are actively bleeding and with poor pulmonary function, BAE is suitable treatment rather than surgery since it preserves pulmonary function.[10]

Our patient with a past history of pulmonary TB presented with hemoptysis originating from the bronchial artery with concomitant finding of pulmonary artery embolism. The management of the case seems to revolve around setting the fine balance between procoagulant therapy to control the ongoing hemorrhage and anticoagulant therapy to treat thrombosis. Contrary to routine treatment of pulmonary embolism, the primary treatment done for our patient was BAE along with use of Tranexamic acid to control the hemorrhage followed by use of anticoagulants a day later. The use of Tranexamic acid has been found to decrease in-hospital mortality as well as volume and duration of hemoptysis.[6,12,13] Our case failed to control hemoptysis with this medicine. BAE was chosen in our case as a definitive measure as endobronchial measures were not available in our center and concurrent pulmonary thromboembolism itself poses a significant mortality risk which warrants prompt institution of anticoagulation.

BAE was first used for management of massive hemoptysis in 1973.[14] Common indications for BAE are pulmonary, post-tubercular sequelae, bronchiectasis, and aspergillomas.[15]

The procedure can be done under general anesthesia or moderate sedation. After initial diagnostic work up, the delineation of bronchial and non-bronchial systemic arteries is done with DSA. Femoral artery access is gained via 5 French vascular access in an attempt of both catheterization of the bronchial arteries and introducing embolic agents. Subsequently, selected bronchial or intercostobronchial arteriography is done to show any active extravasation, pseudo aneurysms and increased abnormal vascularity. Furthermore, abnormalities such as anterior medullary spinal arteries and big bronchial arteries to pulmonary venous shunts should be recognized as they can increase the risk of BAE complications. Following that, micro catheter sub selection is done to minimize the risk of vasospasm and to achieve sufficient distal vascular access to prevent reflux of embolic agents into the aorta during embolization. For progressive diseases such as interstitial lung disease and neoplasm which have higher recurrence rate, particle embolization is much preferable technique than coil for future embolization techniques if required.[9]

In order to minimize the risk of shunting to the pulmonary venous circulation or distal embolization of the anterior medullary spinal circulation, the use of large particles (> 500 microns) are considered preferable. Embolizing agents include Absorbable gelatin sponge, Polyvinyl alcohol (PVA) particles, Microspheres, liquid embolic agents such as n-butyl-2-cyanoacrylate, ethylene vinyl alcohol polymer. PVA provides more durable occlusion as compared to absorbable gelatin sponge, which is considerably an economical agent. Microspheres, on the other hand are advantageous over PVA as they are less prone to clumping. The role of Metallic coils has become obsolete in present BAE and limited only to treatment in cases of pseudo aneurysm in the bronchial arteries.[16]

A study done in Thailand in 145 individuals showed that the operations had a technical and clinical success rate of 92.4% and 70.1%, respectively.[17] Shigemura et al. stated immediate success in hemoptysis control in 88% of cases in a study of 55 patients with 70% of patient having no recurrence after one year of follow-up. The most common complication of BAE is transient chest pain (89%) followed by dysphagia and post- embolization syndrome presenting as fever, leukocytosis and pain. Vascular injuries like vasospasm, dissection and perforation were seen in 0.3%-13%. Similarly, paraparesis or paraplegia was also seen in 0.6%-4.4% due to spinal cord ischemia caused by embolization to spinal arteries arising from bronchial or intercostobronchial arteries and other less common complications are bronchial infarction, esophagobronchial fistula, ischemic colitis, transient cortical blindness, and stroke.[9,10] Our patient developed severe pain over posterior

part of left chest following BAE, probably because of ischemia following embolization of dorsal scapular artery.

Following, the procedure, the patient has not developed any episode of hemoptysis and is under therapeutic anticoagulation for pulmonary thromboembolism.

Thus, our case justifies that BAE can be a fair option to a patient presenting with massive life threatening hemoptysis, especially in conditions when other modalities of treatment are either not available or could not be provided.

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