

Life-Threatening Massive Hemoptysis: A Unique Option Using Customized Endobronchial Silicone Blocker

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Abstract

Airway bleeding with massive hemoptysis (MH) has a high morbidity and mortality. With rapid deterioration, conventional methods such as bronchial artery embolization or surgery are not possible, and unconventional methods are described. We describe a situation of airway bleed leading to MH of left main bronchial origin, where emergent placement of a customized endobronchial silicone blocker (CESB) was done to contain bleeding. We propose the CESB as a useful modality in life-threatening MH, when conventional options are not feasible.

Keywords: Hemoptysis; Quality of care; Management; Silicone; Blocker

Introduction

Airway bleeding with massive hemoptysis (MH) is a life threatening condition with high mortality [1]. Conventional MH management includes supportive care, cardio-pulmonary stabilization and source control, which includes bronchoscopy, bronchial artery embolization (BAE), and rarely emergent surgery. Therapeutic bronchoscopy in MH is predominantly for cauterization of endobronchial lesions. In severe ongoing bleeding, culprit segment occlusion with a silicone spigot [Endoscopic Watanabe Spigot (EWS)] has been described as a temporizing measure [2]. We recently described a silicone blocker, the CESB (customized endobronchial silicone blocker) as an innovative strategy for broncho-pleural fistula (BPF) [3]. We report its utility in life-threatening MH from a large airway bleed.

Case Report

A 31-year-old male was referred with cough, weight loss and intermittent hemoptysis for 3 days. Laboratory tests were unremarkable. Computed tomography pulmonary angiography showed a subcarinal soft tissue lesion extending caudally and encasing the left hilar structures (Figure 1). Bronchoscopy with endobronchial ultrasound (EBUS) guided lesion aspiration was planned. Diagnostic bronchoscopy showed mucosal irregularity, and endobronchial biopsy was done in the distal left main bronchus. After the biopsy, a gradual ooze started, which triggered more cough, and in minutes escalated to rapid welling of blood not responding to local iced saline and diluted epinephrine (Figure 2a). The bronchoscope was wedged into the left main bronchus to tamponade the bleed, but did not succeed in controlling it. Argon photo-coagulation (APC) of the bleeding site slowed the bleed, but it resumed shortly thereafter. The patient was getting progressively hypoxic, a Fogarty balloon was inflated in the left main bronchus, but the bleeding recurred after balloon deflation. The oxygen saturation (SpO₂) was dropping to the low 70's. Rigid bronchoscopy was emergently done, the Fogarty balloon was re-inserted, but hypoxemia progressed with progressive bradycardia followed by cardiac arrest. Cardiopulmonary resuscitation was done, with return of spontaneous circulation after 3-4 minutes. The bleed recurred with return of spontaneous circulation. To tide over the crisis, a different solution was envisaged. As an emergent measure, a large CESB (25 × 13 × 5 mms - Figure 2b), as mentioned earlier, with a tapering bronchial contour was inserted in the left main bronchus to wedge and occlude it (Figure 1) [3]. The tamponade effect of the CESB succeeded in controlling the bleeding (Figure 2c).

To prevent migration, 1 ml of bioglue (N-butyl cyanoacrylate) was inserted around the CESB (Figure 2d). The rigid scope was replaced with an endotracheal tube, and ventilation of the normal right lung was continued. SpO₂ rose to 95%, no fresh bleeding was seen, and there was full neurological recovery after the cardiac arrest. Thoracic consultation was obtained, and in view of life-threatening MH, left pneumonectomy was done after 2 days. A final diagnosis of fibrosing mediastinitis was made. The patient completely recovered, and 6 months follow up shows no disease recurrence.

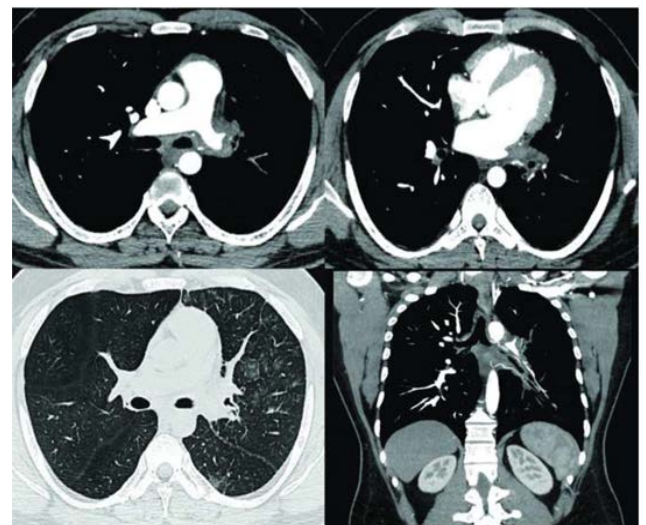


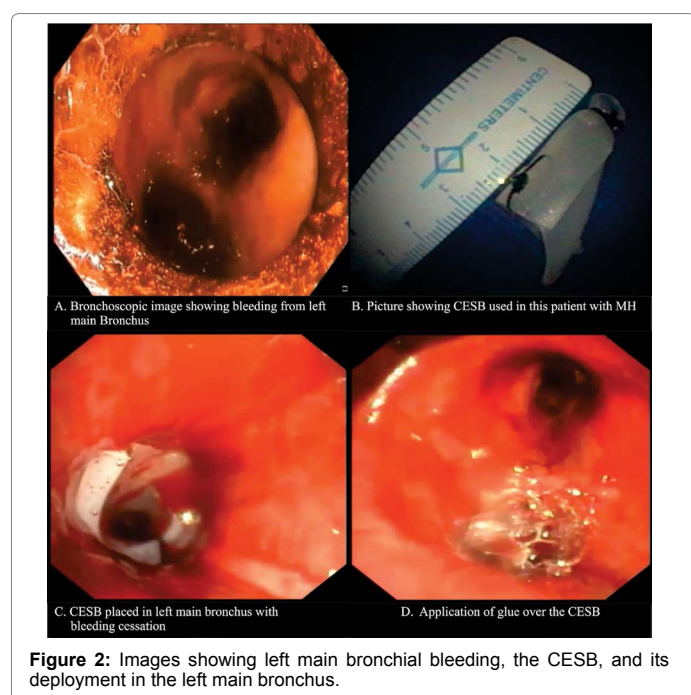
Figure 1: Computed tomography showing an ill-defined soft tissue lesion related to the left pulmonary artery, with a coronal image demonstrating a soft tissue lesion surrounding the left hilar structures.

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Discussion

Airway bleeding with MH is life-threatening, and large or rapid bleeding can lead to cardiorespiratory collapse. Bronchoscopy is predominantly a diagnostic tool, with limited therapeutic utility for endobronchial lesions using thermal (laser, electro-cautery) or cold therapy (cryotherapy) [4]. The EWS has been used for culprit segment occlusion to prevent normal lung flooding, pending definitive management [3]. EWS shortcomings include limited sizes (5,6,7 mm), which restrict application to larger segments, migration risk, and scant experience with EWS in MH. We have extended the EWS principle to conceptualize a next generation blocker, the CESB, in severe MH with certain advantages. The CESB principle is similar to the EWS. Both act as culprit segment blockers, and have the dual advantage of restricting bleeding to the involved area, and promoting clot formation. The CESB has several advantages compared to the EWS. First, due to the unique customization concept, the CESB can be moulded to fit any segment including the main stem bronchus-this was very useful in our case, as the EWS was too small to be used here. The CESB is an indigenous replicable blocker, which has a low learning curve to manufacture using readily available silicone stents. The conical tapering CESB, compared to the cylindrical EWS, fits better and firmly in the bronchi. We recently reported our experience with CESB's in patients with BPF and listed

advantages over the EWS [3]. The CESB adds to the available tools, which can be deployed in emergent MH situations.

Where does the CESB fit in the algorithm of emergent life-threatening MH? In this case, the sudden, rapid and critical nature of the bleeding to the point of cardiac arrest, obviated the use of other methods. Local hemostatic and isolation tools such as cold saline, adrenaline, scope compression, APC and Fogarty balloon occlusion had little or transient impact. After the failure of every available conventional method, we decided to put a CESB as a last option, which helped to tide over the situation. Other options mentioned in such catastrophic hemoptysis include the Arndt blocker and double lumen intubation. The Arndt blocker, originally described for bronchial blockade in elective surgery, has the limitation of time consuming and difficult insertion in an emergent hypoxemic bleeding situation, can slip in transfer, and it can be difficult to maintain sustained balloon inflation pressure [5]. In our case, the Fogarty balloon had not succeeded, and we were reluctant to try another balloon strategy such as the Arndt blocker after the cardiac arrest, and chose the more definitive CESB. Double lumen intubation is challenging to perform expeditiously with such rapid bleeding, and also has significant issues with suctioning through the small bronchial lumen.

The limitations of this technique are the learning curve, as the art of manufacturing and deployment of the CESB is a new concept. The CESB needs rigid bronchoscopy for deployment. Despite limitations, this emergent MH situation exemplifies a potential use of the CESB.

Conclusion

In conclusion, our case demonstrates that CESB's offer a useful addition to the treatment pathway of emergent and imminently life-threatening MH. Generalization of this technique and defining its precise role in the algorithm of MH needs further study.

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