CASE REPORTS

Intentional Occlusion of the Right Upper Lobe Bronchial Orifice to Tamponade Life-threatening Hemoptysis


THE double-lumen endotracheal tube may be used to isolate and protect the nonhemorrhagic lung during life-threatening hemoptysis. We report a case of massive hemoptysis, in which a right-sided double-lumen endotracheal tube was intentionally malpositioned to deliberately occlude the orifice of the right upper lobe bronchus and thereby tamponade the active site of hemorrhage. Thus, the cuff of the endobronchial portion of the double-lumen endotracheal tube was used to control the source of the massive pulmonary hemorrhage. This maneuver simultaneously isolated and protected the nonhemorrhagic left lung as well as the right middle and right lower lobes.

Report of a Case

A 56-yr-old woman with a medical history of pulmonary sarcoidosis had previously presented to a local hospital with a 2-week history of progressive hemoptysis and pleuritic chest pain. She had required tracheal intubation and mechanical ventilation to treat her respiratory failure. She was subsequently transferred to our intensive care unit with radiographically documented right upper lobe opacification. Prior flexible fiberoptic bronchoscopy revealed endobronchial hemorrhage from the right upper lobe bronchus. Her episodes of hemoptysis worsened, and she required 80% \( \text{FiO}_2 \), 10 cmH\(_2\)O PEEP, multiple blood transfusions, and an intravenous epinephrine infusion titrated to keep her systolic blood pressure > 90 mmHg. After medical stabilization, she was scheduled for a rigid bronchoscopy and possible laser coagulation of the bleeding lesion. On transport to the operating room, she experienced intermittent hemoglobin desaturation to an \( \text{SpO}_2 \) of 30% associated with bronchial occlusion by clot, despite administration of 100% \( \text{O}_2 \). Endotracheal suctioning and saline lavage were successful in restoring her \( \text{SpO}_2 \), to >90%. No active hemorrhage was evident at that time. Anesthesia was induced with isoflurane and intravenous fentanyl. The endotracheal tube was removed, and rigid bronchoscopy was performed. Ventilation was continued with isoflurane and 100% \( \text{O}_2 \) via the side port of the rigid bronchoscope. The surgeon identified a blood clot located at the orifice of the right upper lobe bronchus and attempted to remove the clot by rigid suction. Immediate and profuse hemorrhage ensued, filling the lumen of the rigid bronchoscope with bright red blood. The \( \text{SpO}_2 \), again decreased to a nadir of 30%. Before removal of the rigid bronchoscope, 20 ml of saline with 1:200,000 epinephrine was administered through the bronchoscope lumen. Simultaneous blood transfusion was initiated. The rigid bronchoscope was removed with continued brisk hemorrhage, making mask ventilation ineffective. The trachea was intubated with a 37-French right-sided double-lumen endotracheal tube (Mallinckrodt, St. Louis, MO). Fiberoptic-assisted repositioning of the double-lumen endotracheal tube resulted in an \( \text{SpO}_2 \), of 100% with adequate ventilation and peak inspiratory pressures < 40 cmH\(_2\)O. All hemorrhage ceased after inflation of the bronchial cuff. The patient was transported to the intensive care unit, where mechanical ventilation and sedation were continued. Neuromuscular blockade was required to control ventilation, lower peak airway pressures, and minimize the risk of displacing the double-lumen endotracheal tube. A radiograph of the chest was obtained, which demonstrated placement of the endobronchial cuff just below the tracheal bifurcation (fig. 1). The endobronchial cuff was kept inflated for 72 h, during which time no further hemoptysis occurred. On postoperative day 5, the endobronchial cuff was deflated. The position of the double-lumen endotracheal tube was not altered because of concerns regarding possible rebreeding. On postoperative day 7, the patient was transported to the radiology suite for a computed tomogram of the chest. After return transport to the intensive care unit, hemoptysis recurred, which was treated with intratracheal racemic epinephrine and reinflation of the endobronchial cuff. The hemorrhage ceased. The patient subsequently underwent radiographically guided bronchial arterial embolization. The day after embolization, the double-lumen endotracheal tube was changed to a single-lumen endotracheal tube. No further hemorrhage occurred. Because of pre-
CASE REPORTS

Fig. 1. Portable radiograph of the chest demonstrating position of the endobronchial tube at the right upper lobe bronchial orifice.

longed respiratory failure, the patient underwent elective tracheostomy. She was discharged to a rehabilitation facility 8 weeks after admission. Her neurologic status was normal.

Discussion

We report the use of a double-lumen endotracheal tube to intentionally occlude the right upper lobe bronchus to tamponade life-threatening hemoptysis. The bronchial cuff served to occlude the orifice of the hemorrhagic bronchus, thereby facilitating stabilization of blood pressure, oxygenation, and ventilation. The nonhemorrhagic left lung was simultaneously protected and isolated. This intentional double-lumen endotracheal tube malposition was life-saving.

Severe pulmonary hemorrhage occurs infrequently and is usually attributable to bronchitis and bronchietasis, tuberculosis, other infections (e.g., aspergillosis), bronchogenic carcinoma, and arteriovenous malformations.5 Iatrogenic causes, such as complications from pulmonary artery catheters, are also possible.6 Previous reports document the majority of these episodes are due to bronchial arterial bleeding.4,5 Death from hemoptysis is attributable to asphyxi, rather than exsanguination.5 Many therapeutic options are advocated to localize and treat the site of hemorrhage, but all require initial stabilization of ventilation, oxygenation, and blood pressure.6–8

Indications for lung separation using a double-lumen endotracheal tube include unilateral lavage, unilateral cyst or giant bullae, major tracheobronchial disruption, and pulmonary hemorrhage. Single-lumen endotracheal tubes also may be placed into a mainstem bronchus to provide lung isolation. Double-lumen tubes are not indicated to tamponade or directly control pulmonary hemorrhage. In our case, right-sided endobronchial intubation successfully provided a mechanism to tamponade ongoing hemorrhage from the right upper lobe bronchus. This technique simultaneously isolated the nonhemorrhagic right middle and right lower lobes, as well as the normal left lung.

A right-sided endobronchial tube was chosen because a left-sided double-lumen endotracheal tube could not directly tamponade the hemorrhage. In addition, although a left-sided double-lumen endotracheal tube would protect the left lung, the uncontrolled bleeding from the right upper lobe bronchus would have jeopardized ventilation to the remaining lobes of the right lung. Correct positioning of a right-sided double-lumen endotracheal tube would not have occluded the origin of the right upper lobe bronchus with the endobronchial cuff and therefore would not have controlled the hemorrhage. Placement of a bronchial blocker in the right mainstem would have sacrificed ventilation to the entire right lung. Fiberoptic visualization of the bronchial anatomy was difficult because of the ongoing hemorrhage. Thus, more specific fiberoptic-guided placement of a bronchial blocker in the right upper lobe bronchus would have been difficult if not impossible. Initial placement of the right-sided double-lumen endotracheal tube provided adequate conditions for fiberoptic visualization and assistance in the final malpositioning of the endobronchial portion of the double-lumen endotracheal tube.9 Use of a double-lumen endotracheal tube manufactured with a slotted endobronchial cuff may not have been as effective in this situation. This patient’s favorable outcome was directly related to the use of a right-sided double-lumen endotracheal tube to occlude the orifice of the hemorrhagic right upper lobe bronchus. This technique is best suited for life-threatening hemoptysis, which originates from the right upper lobe bronchial orifice. One would expect greater difficulty in positioning a double-lumen endotracheal tube to control hemorrhage from the more distal right middle lobe or the left upper lobe.

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References

CASE REPORTS

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