

Provision of stable lung isolation in an unstable patient: an endobronchial blocker through the Murphy eye of the in situ endotracheal tube

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Abstract Shortly after repair of a type A aortic dissection, re sternotomy was required because of tamponade. During the exploration, it was discovered that the source of bleeding was in the right pleura. Collapse of the right lung was requested. A double-lumen tube would have necessitated changing the endotracheal tube (ETT) in an unstable patient in the middle of surgery. Instead, a Coopdech endobronchial blocker was passed into the right lung through the lumen of the in situ ETT. To ensure that the blocker did not migrate into the trachea, it was deliberately passed through the Murphy eye of the ETT, which had been deliberately passed distally to almost touch the carina. This arrangement provided reliable right-lung collapse to facilitate right pleural hemostasis.

Keywords Aortic dissection · Cardiac surgery · Endobronchial blocker · One-lung anesthesia

All anesthesiologists should have a strategy for providing expedient and reliable lung isolation in a patient whose trachea has already been intubated with a standard endotracheal tube (ETT). We recently encountered a case of unexpected need for intraoperative collapse of the right

lung. A 69-year-old man presented with type A aortic dissection. Anesthesia was induced and intubation was with an uncut 9-mm internal diameter (ID) ETT. Laryngoscopy grade was Cormack and Lehane III. Replacement of the ascending aorta through a median sternotomy with an interposition Dacron graft was performed. Intraoperatively, the right pleura was deliberately opened to preempt cardiac tamponade from potential rapid accumulation of blood in the mediastinum. Right pleural and mediastinal drains were placed prior to sternal closure.

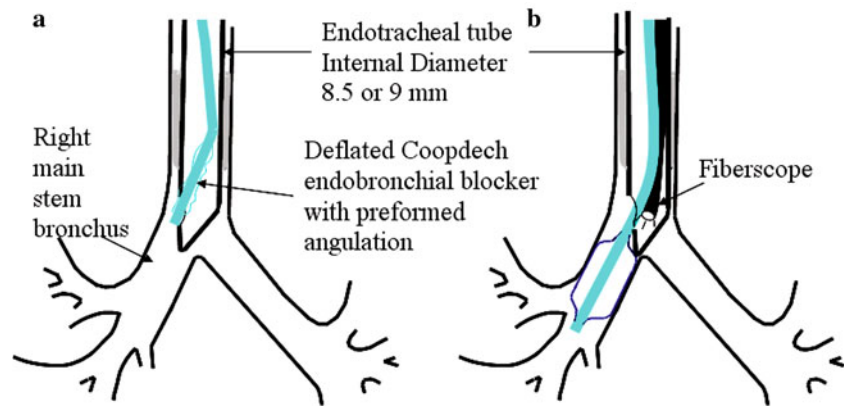
In the intensive care unit (ICU), the patient had high output from both drains. X-ray showed a right pleural fluid collection. An additional 28-F right chest drain was inserted and 1 l of bloody fluid was drained. In view of the persistent high drain output and suspicion of tamponade, the patient was taken back to the operating room 12 h after ICU admission. Intraoperatively, large amounts of blood clots were noted in the right hemithorax. Visualization of the right posterolateral pleural cavity and identification of the source of bleeding were difficult. Expedient collapse of the right lung to facilitate exploration was necessary.

An endobronchial blocker (EB) was chosen as the bronchus blocking device. The in situ ETT was first deliberately passed distally so that its tip was close to the carina and that further advancement would result in loss of easy bilateral ventilation, as observed through the sternotomy. Fiberoscopy confirmed that the Murphy eye was “looking” at the right main-stem orifice, and the bevel was “looking” at the left main-stem orifice. A Coopdech adult EB (Daiken Medical, Osaka, Japan) was coaxially passed blindly with the built-in tip angulation adjusted toward the right and allowed to emerge through the Murphy eye into the right main-stem bronchus (Fig. 1a). The depth at which the EB catheter tip was expected to reach the Murphy eye had been preestimated using an identical ETT. The final

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Fig. 1 The Coopdech adult endobronchial blocker with an angulated tip was passed blindly through the right-facing Murphy eye of an endotracheal tube of internal diameter ≥ 8.5 mm (a). Note that fiberoscopy was optional during insertion. Upon placement of the endobronchial balloon, fiberoscopy was used to check positioning (b)



positioning of the EB was confirmed using a fiberscope (Fig. 1b). No injury on account of ETT and EB placement was seen. Lung collapse was excellent. Through a video-scope, the surgeons saw over the posterolateral aspect of the pleural cavity a heavy bleed, which was controlled. The EB was removed upon resumption of bilateral ventilation and the ETT was retracted to a normal depth. There was no blood on suctioning via the ETT. The patient was transferred back to the ICU after hemostasis and hemodynamic stabilization.

Our case represents one of several clinical scenarios in which patients with an ETT in situ would require, unexpectedly or expectedly, one-lung anesthesia (OLA) [1–3]. When that happens, options include changing to a double-lumen tube (DLT), intubating the appropriate bronchus with the in situ ETT, and passing an EB. In our case, placement of a DLT would have been difficult because of the barrier bar and sterile drapes above the patient's face, and the grade III laryngoscopy view. Besides, extubation followed by reintubation with a DLT in an unstable patient is very risky. Pushing the ETT distally into the left main-stem bronchus might have worked, but there was no guarantee that the ETT 9-mm ID would fit, and its cuff would not block the left upper lobe [4]. Another option was to pass an EB through the ETT lumen to block the right bronchus. EB balloons are, however, prone to dislocation into the trachea. Given the urgency to stem the bleeding and the need to perform a thorough examination of the right pleura, we needed expedient and, importantly, reliable collapse of the right lung. The technique of preventing the EB balloon from retrograde migration by passing it through the Murphy eye of an ETT deliberately placed deep to block the orifice of the main stem bronchus has been applied in children and adults [4, 5]. Specifically, the ease with which a Coopdech EB (with its uniquely preformed angulation at the tip) could be blindly passed through the Murphy eye of a distally placed ETT of ID ≥ 8.5 mm makes this technique simple to perform [4]. Alternatively, the Coopdech EB could also be guided

through the Murphy eye with a fiberscope within the ETT lumen.

Because the EB is prevented from migrating into the trachea, this technique is particularly suitable when the right upper lobe orifice is close to the carina, necessitating the EB to be placed also very close to the carina, with attendant risk of retrograde migration. With the ETT tip near the carina, the operator must be mindful of the risks of carina irritation and trauma and endobronchial intubation. We made sure during EB positioning that the ETT tip was not touching the carina, but we did not perform a fiberoptic examination of the airway after the case. The risk of injury should be small because the duration of one-lung ventilation was brief, and bilateral ventilation immediately before and after one-lung ventilation revealed normal respiratory parameters as well as good lung inflation under direct vision. Close monitoring will allow the immediate detection of airway obstruction caused by the ETT tip migrating into the main-stem bronchus being blocked. The distal position of the ETT tip does make it marginally harder to visualize the EB. The EB can be seen through the Murphy eye, the translucent ETT tip, and just beyond the ETT tip.

We were fortunate because the lung that required blocking was the right. Had it been the left lung, we would have had to rotate the in situ ETT by 180°. Experience has told us that this is difficult and time consuming. In very urgent cases, it may be easier to have the EB emerge from the tip of the in situ ETT. Retrograde migration of the EB can still be discouraged by the ETT tip placed just above the carina. Other EBs are also available. In a simulated bench-work experiment using the Arndt EB (Cook Medical, Bloomington, IN, USA), we could not push its non-angulated tip and the wire loop at its tip through the Murphy eye of a 9-mm-ID ETT. The Cohen Flexitip EB (Cook) has an adjustable flexible tip that could potentially achieve what the Coopdech catheter does.

In summary, use of an EB blocker is an option for achieving lung isolation in a patient with a standard ETT in situ. If this ETT happens to be ≥ 8.5 -mm ID, an adult

Coopdech EB can be passed blindly or under fiberoptic guidance through the Murphy eye of an ETT that has been deliberately placed deep so that its tip almost touches the carina and the ETT orientated so that its Murphy eye faces the main-stem bronchus to be blocked.

Conflict of interest None.

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