



# Open bronchus technique: another arrow in the quiver for the minimally invasive thoracic surgeon

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The evolution of minimally invasive thoracic surgery (MITS) over time has been quite fascinating. As surgeons have gained more experience in thoracoscopic operations, they have become more prolific in innovating techniques to overcome various challenges and improve patient outcomes. There are few remaining absolute contraindications to MITS thanks to the patience, persistence and ability to think outside the box demonstrated by minimally invasive surgeons worldwide.

Pulmonary vascular anomalies and unforeseen severe intrathoracic adhesions encountered in some surgical patients are some of the remaining major obstacles to MITS. Anticipating a problem is the first step in preventing a major complication during surgery. When calcified lymph nodes or tumor invasion of the pulmonary vessels around the hilum are seen on preoperative computed tomography (CT) scans, a fused hilum can be expected. The pulmonary vessels may also become more fragile after chemotherapy while prior radiation treatment or lung surgery can cause desmoplastic changes and dense adhesions. Although there are scarce data regarding the safety of lung surgery after immunotherapy, this may be another situation where a difficult hilar dissection can be expected due to the severe inflammation often associated with these medications. Indiscriminate dissection in aforementioned situations can lead to injury of an adherent vessel resulting in significant bleeding.

Bleeding from injury to the pulmonary vessels is a well-known complication of MITS (1,2) and can quickly turn a relatively quiet operating room into a place of intense activity. Not uncommonly, rupture of small pulmonary

arterial branches that are hidden from thoracoscopic view can be the source of such profuse bleeding. The anatomy of the left upper lobe (LUL) is the most variable among all lobes of the lung (3). The number of pulmonary arterial branches supplying the LUL may range from 2–7 and can be difficult to anticipate preoperatively. Trying to forcefully advance a stapler without adequately developing a window between the bronchus and pulmonary artery (PA) can also lead to vascular injury. It is therefore important to adequately separate the intervascular or bronchovascular planes and to visualize the tip of the stapler prior to division of the relevant structure. Fortunately, most of these injuries can be easily tamponaded by applying pressure using a sponge stick until they can be repaired or ligated.

Lin *et al.* present their technique of dividing the LUL bronchus sharply when it cannot be easily separated from the PA without the risk of injury (4). The accompanying video to the manuscript demonstrates their technique quite nicely. The open bronchus technique appears to be a reasonable strategy to use during left upper lobectomy when severe hilar adhesions are present. In the video, the authors developed a small window behind the bronchus allowing it to be safely transected. If such a window cannot be developed then caution should be applied with this technique since there is a high risk of sharp injury to the adherent PA when transecting the bronchus. If readily available, an angled tip stapler can be used to navigate through the window. A similar open bronchus technique was reported by Hou *et al.* (5). Other authors have described various innovative ways to deal with the LUL PA (6)

and hilar lymphadenopathy (7). Having a repertoire of different techniques to deal with difficult situations can help reduce the risks of severe injury and conversion to open thoracotomy.

The open bronchus technique is not without some limitations. In the LUL, the bronchus is anterior to the PA whereas in the other lobes the artery is anterior. This may prevent sharp division of the bronchus first for non-LUL lobectomies during conventional VATS. However, the dexterity of the robotic arms and camera during robotic surgery may allow this technique to be expanded to the other lobes and needs to be further explored. Another concern is that for proximal endobronchial tumors, there is the potential to violate the tumor and spill tumor cells in the pleural cavity or in the case of post obstructive pneumonias, spillage of infected material. From a technical point of caution, the divided bronchial stump may retract into the hilum and can be difficult to pull up to allow proper stapling. Hence, when openly transecting the bronchus, it is important to leave enough length to allow all rows of the stapler to fire across. If there is any doubt about the integrity of the staple line on the bronchial stump it should be reinforced with sutures (5).

In closing, creative techniques to navigate difficult situations as demonstrated by Lin *et al.* have been fundamental in increasing the scope of minimally invasive surgery and should be strongly encouraged. It is, however, important to remember that if the safety of any new MITS technique is in question, conversion to a limited or even conventional thoracotomy does not signal defeat or failure but maturity, sound judgment and care for the patient's well-being.

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### Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

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