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Editorial

The Video Double-Lumen Endobronchial Tube: Is the Benefit Worth the Cost?

OVER THE PAST 15 years, several different bronchial blockers have been developed, offering advantages and novel approaches to insertion and placement for one-lung ventilation. However, there have been few, if any, significant improvements to the double-lumen endobronchial tube (DLT) during this time. DLTs remain the most commonly used device for one-lung ventilation despite their size and potential for glottic and pharyngeal injuries.[1] The intraoperative positional stability, ease of placement, and ability to ventilate and suction each lung individually clearly drive the use of DLTs in thoracic surgery.

Videolaryngoscopy has greatly added to our ability to safely intubate patients with complicated airway issues. This technology now has been incorporated into the construction of a left-sided DLT, providing visualization of the trachea and carina during intubation and positioning of the video double-lumen tube (VDLT). Available since 2012, the VivaSight VDLT (ETView Medical Ltd., Misgav, Israel) is the only VDLT approved for use in thoracic surgery. Since that time, several retrospective and prospective observational studies have been published.[2–5] The findings in these studies demonstrated a reduced time for tube placement and a significant reduction in the use of a fiberoptic bronchoscope (FOB), although an FOB still was required in a minority of patients. In addition, there may be a potential advantage to continuous observation of the carina with the VDLT. Authors were able to observe and rectify episodes of VLDT movement during lateral positioning of the patient before incision and during surgical manipulation. In some patients, the investigators were able to alert the surgeon to significant anatomic distortions during surgery, preventing imminent dislodgment of the VDLT. Although other secondary outcomes showed no real differences between the VDLT and DLTs, there was a trend toward more sore throats and pharyngeal discomfort in patients who received a VDLT.

In the current issue of the *Journal*, Heir et al described a randomized prospective trial in 80 patients comparing VDLT to a standard Mallinckrodt (Medtronic, Dublin, Ireland) left-sided DLT.[6] The primary outcome of this study was a comparison of the need for an FOB in the placement and confirmation of the correct position of a DLT versus a VDLT. The FOB was necessary in 13% of patients in the VDLT group compared with 100% of patients with the standard DLT. More importantly, only one patient in the VDLT group required the use of an FOB when it became dislodged, compared with 14 patients in the DLT group. In a recent article describing a 6-month prospective experience in 72 patients with the VDLT in Australia, only 4% of patients with a VDLT required the use of an FOB to reposition the device intraoperatively.[7] Unfortunately, the result and primary outcome of this study seemed to be entirely self-evident because the method used by the members of the study team for placement and confirmation of a standard DLT required the use of an FOB 100% of the time. This created a perfunctory power analysis to justify a larger number of patients than seems necessary to draw the summary conclusion made by the investigators. Although the use of an FOB was diminished significantly, there clearly remains a number of patients for whom an FOB is required to confirm placement. The authors also found that the speed and accuracy of placement and the need for repositioning were superior with the VDLT. Even though the difference in time to placement is statistically significant, it is likely that a mean difference of 19 seconds is not clinically relevant. However, the improved accuracy in placement of the VDLT might be advantageous to anesthesiologists, who are less experienced in performing flexible bronchoscopy, performing thoracic cases. The time saved not having to wait for the arrival of an anesthesiologist skilled in fiberoptic bronchoscopy and DLT management could be significant, especially if it happens multiple times in a single case.

The authors argued that the significant reduction in the use of an FOB for placement can reduce the overall cost of lung isolation in these patients, therefore justifying the increased expense of the VDLT, which is more than four times the cost of a standard DLT. However, the real cost of maintaining an FOB remains because it must be available, even if it is required only in a minority of cases. Furthermore, the cost analysis can be widely different for different institutions

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depending on the type of FOB, service and repair contracts, and the variation in expense of processing an FOB. The authors calculated a net loss per use, despite the very high volume of thoracic cases at their institution. For lower-volume centers, the cost of using the VDLT may be even less after the reduced expense of fewer bronchoscope utilization/cleaning cycles leading to extended length of life of the equipment. In facilities with a limited number of bronchoscopes, the VDLT also may free up resources for other patients throughout the hospital. When we consider the expense and routine use of bronchial blockers, which in some cases may be within 10% of the cost of the VDLT, in addition to incurring the expense of an FOB 100% of the time, the cost of the VDLT seems less significant. Ultimately, the onus of determining the cost-benefit for any new technology falls on individual providers and may be beyond the scope of any single research endeavor.

There are other concerns about the article and safety of the device. The most disappointing omission of the article is the lack of a more in-depth description of the reasons for intraoperative repositionings in both groups. Repositioning a dislodged DLT intraoperatively often can be technically challenging. It would be helpful to have included a description of what types of interventions were necessary, what types of repositionings were performed, and how this was accomplished or, in some cases anticipated, in the VDLT group. For each intervention in both groups, an evaluation of the time involved, any degree of desaturation, loss of isolation, and other clinical differences would have been useful information to report. In another observational study, one group observed thermal damage to the end of the VDLT from the camera assembly overheating.[3] This occurred immediately before the intended placement of the VDLT in a patient and led to premature termination of an observational trial examining this device. This event was investigated and has been duplicated by the manufacturer. The manufacturing defect and attendant quality oversight process supposedly have been addressed to correct this. In theory, though, there still may be a remote chance of thermal injury to a patient, especially in the hyperoxic environment within the trachea during one-lung ventilation

What is the role for the VDLT in lung isolation and thoracic surgery? The potential benefit of real-time visualization of the trachea and VDLT to maintain lung isolation and the ease of repositioning when the VDLT becomes dislodged potentially are compelling reasons to use this device. Limitations to the use of this device in thoracic surgery would be any procedure requiring the use of a right-sided DLT, such as proximal obstruction or narrowing of the left mainstem bronchus, left pneumonectomy, or thoracic aortic aneurysm repair. In addition, double-lumen tubes are used for lung isolation to prevent contamination from the contralateral lung with blood and purulent secretions. Koopman et al reported that by the end of the case, in some patients secretions had obscured the view of the carina with the VDLT.[4] Furthermore, some patients with chronic obstructive pulmonary disease and viscous secretions/mucous plugs require aggressive pulmonary toilet with lavage and therapeutic intraoperative fiberoptic bronchoscopy before thoracic surgery in order to provide adequate oxygenation of the ventilated lung and proper deflation of the operative lung. Many surgeons may require an FOB before surgery to determine the anatomy of tumors to be resected, to assess whether enough bronchial cuff may be present to allow for lobectomy, or whether pneumonectomy may be required.

In summary, the authors should be congratulated for sharing another report of their experience with the VivaSight VDLT. The major advantage of the VDLT appears to be the continuous, real-time observation of the carina during surgery, which may, in some patients, help prevent dislodgement and assist in repositioning the VDLT during one-lung ventilation. Despite the reduced need for fiberoptic bronchoscopy in this article, an FOB must be available in every case. Furthermore, significant variances in the cost of maintaining an FOB at different institutions may affect the authors' proposed argument that there may be a cost savings with the VDLT despite its higher unit cost. It remains to be seen what the true effect of the VDLT will be for thoracic surgery until physicians gain more experience and collect more clinical data with the use of this novel DLT.

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