Back To The Blockers?

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For over half a century, the gold standard for achieving lung separation was and continues to be the use of a double lumen tube (DLT). (1) However, anesthesiologists may face the need to use alternative methods to provide lung separation for the following reasons. Firstly, DLT’s are non-friendly, bulky and often difficult to insert and position. Secondly, the use of a DLT requires the need to change the tube to a single lumen tube (SLT) if the patient requires postoperative ventilatory support. And third, a patient’s airway that is considered easy for insertion of a single-lumen tube may present a challenge for a DLT insertion.

Once placed in the patient, DLT’s have a high incidence of malposition or intraoperative dislodgement, which results in failure to collapse the lung or hypoxemia. (2) These may include: surgical manipulation, neck extension, cuff migration or over inflation. Insertion of these tubes may lead to airway trauma primarily in the membranous portion of the trachea including tracheal rupture or arytenoid cartilage dislocation. (3-6) Knoll et. al. reported a higher incidence of postoperative soar throat, hoarseness and vocal cord bleeding compared to endobronchial blockers (44% vs. 17% respectively). They concluded “ the risk for airway complications might increase when using DLT’s instead of a bronchial blocker to achieve one-lung ventilation”. (7) Airway laceration may also result from the use of tube exchangers when switching from DLT’s to SLT’s or vice versa.

Over time, it has become clear that modern thoracic anesthesiologists need an alternative to DLT’s. In the past, Fogarty embolectomy catheters were used to achieve lung isolation. Placement may be difficult, due to its lack of directing mechanism and high pressure low volume spherical shaped cuff, which poorly occluded the elliptic shape of the bronchus is poorly occluded. Fogarty catheters have no use in thoracic anesthesia practice.

In modern thoracic anesthesia, 3 independent 9F endobronchial blockers (EBB) were introduced to clinical practice. (8) All 3 have a steering mechanism and a patent 1.6 mm lumen. The lumen allows the application of suction to facilitate the collapse of the lung or oxygen insufflation (CPAP) to the nondependent lung to improve oxygenation during OLV. The Arndt blocker (9-11) uses a wire-guided mechanism while the Cohen blocker (12) possesses a rotating wheel that allows it to flex the tip of the blocker. Both blockers use a multiport adapter. The Arndt blocker is also available in 7F and 5F for small adults and the pediatric population. Recently, the Uniblocker that has a fix curve similar to a hockey stick was introduced to clinical practice. It is essentially the same blocker as the Univent tube that is now available as an independent blocker. It is supposed to replace the Univent tube, which is somewhat bulky, containing a large external diameter. (13-14) Regardless of the type of EBB selected to provide OLV, the decision of which technique to use depends on the clinical circumstances and the physician’s experience with the devices.

The indications for using endobronchial blockers are summarized in Table 1.
Lung separation and lung isolation: It may be appropriate to distinguish between the need for lung isolation and for lung separation. Lung isolations are the classical absolute indication which includes life-threatening complications, such as massive bleeding, sepsis and pus, where the non-diseased contra lateral lung must be protected from contamination. The use of EBB in any of these indications since the seal of the EBB cuff is low-pressure high volume, and would be less then ideal. In all other indications for one lung ventilation, which I define as lung separations, in which there is no risk of contamination of the dependent lung, EBB can be used safely. These include all the relative indications that are primarily for surgical exposure. Video assisted thoracoscopy (VAT) for diagnostic and therapeutic procedures, which requires a well-collapsed lung, should be included in this category. The majority of the procedures of OLV are for lung separation and only a small fraction require lung isolation.

Difficult intubation and tube exchanging: The anesthesiologists may face the need to use alternative methods to provide lung separation. These are primarily due to 2 major reasons. (15-17) Either the patient has a difficult airway in which DLT could not be placed or the anesthesiologist prefers to avoid changing tubes during the procedure. Often a flexible bronchoscope is performed using first an 8.0 mm SLT, then a DLT is placed immediately following. Or at the end of the procedure, the patient required ventilator support and the DLT needed to be changed to a SLT. In some institutions, the DLT is routinely changed to a single lumen or to a LMA to perform another flexible bronchoscopy with a 6.0 FB for pulmonary toilet or for checking the staple lines in case of bronchial resection.

The increasing popularity of VAT can be attributed to a considerable number of successful procedures, diagnostic or therapeutic, performed by this technique. Unlike thoracotomies, during VAT, the lung should be well collapsed to allow the surgeon optimal view of the surgical field through the video camera. VAT increases the likelihood of requiring lung separation in a patient who has a difficult airway in whom placing a DLT may be difficult or impossible. Finally, depending on the extent and duration of the procedure, an airway, initially not classified as difficult, may become difficult secondary to facial edema, secretions and laryngeal trauma from the initial intubation. In these cases, when planning to provide lung separation, the postoperative period must be considered. Changing tubes is not without risk. Airway trauma, dental damage, aspiration from unprotected airways, or most severe, losing control of the airway, are all possible outcomes. The use of an endobronchial blocker bypasses all of these airway manipulations.

Patient with difficult airways, Mallampati grade view 3 or 4, often requires lung separation or in some patients in whom it is possible to insert a SLT but difficult to place a DLT. The criteria for a difficult airway for a DLT insertion are not well defined. Tracheal intubation of patients with restricted mouth opening, protruding teeth, large tongue, limited neck extension, and small laryngeal openings may be difficult particularly for DLT insertion. In some patients with distorted upper airway anatomy, who had radical neck dissection, laryngectomy, hemiglossectomy or musculoscutaneous flap and radiation therapy makes the insertion of the bulky DLT practically impossible. In these patients the goal would be to establish an awake airway with a guided FB followed by the insertion of EBB for lung separation. That would avoid the need to manipulate the airway with difficult tubes and to change tubes perioperatively.
A number of surgical procedures are performed through a transthoracic approach without lung resection which requires a collapse lung for optimal surgical view. These include the thoraco-abdominal esophagectomies, tumors of the thoracic spine and minimally invasive cardiac surgery. These procedures are frequently associated with a large fluid shift and extended surgical time and often require postoperative ventilatory support. If a DLT was used, it will be necessary to change tubes to an SLT since DLT are too bulky to keep for an extended period of time. Furthermore, most ICU nurses are not comfortable in managing DLT’s. In addition, the airways at the conclusion of the procedure may differ from the beginning of the procedure. Facial edema, secretions, laryngeal trauma and bleeding are not uncommon. Switching the tube at the end of the procedures can be a challenge. If an EBB blocker was used, there is no need to switch tubes and expose the patients to risks of aspiration, and potentially losing control of the airway.

Some patients with limited mouth opening may require nasal intubation. The larger outer diameter and distal curvature of the double-lumen tube or a Univent would have made nasal intubation impractical, if not impossible. These patients are best managed by nasal intubation with a SLT followed by the insertion of EBB. (18)

Other groups of patients include those with an existing tracheostomy or with fresh tracheotomy with a Shiley tube in place. Passing a rigid large diameter DLT through an old stoma is not recommended. These patients are managed best by passing an independent blocker through a single tube inserted in the stoma or through a Shiley that is already in place. (19-20) EBB may pass along side the SLT and directed into the desired side to be blocked. Finally, in some patients that had a previous tracheostomy which is presently closed, may have a narrow airway creating resistance for passing a DLT.

Selective lobar blockade: In patients with severe respiratory compromise or with previous lung resection in the dependent lung, who cannot tolerate OLV who are scheduled for lung resection in the ipsilateral lung, it is possible to provide selective lobar blockade using EBB. (21) That would prevent the collapse of the entire lung and will allow all non operated on lobes to participate in the gas exchange. Ruiz described a case of Sequential lobar-lung-lobar isolation using a Cohen EBB in a patient with compromised pulmonary function preoperatively who would not tolerate common depended lung (22). Finally, some patients arrived to the OR intubated from the ICU or those who are already in the lateral position and the need for lung collapse arise intraoperatively, insertion of EBB would be the best option to avoid changing of the existing SLT. (23-24) These creative solutions to problems encountered with the use of DLT’s highlight the fact that these two methods of lung separation are, in fact, complementary in certain clinical situations.

Management of Endobronchial Blockers

Effectiveness of lung collapse: Regardless of the type of EBB selected to provide OLV, one of the major drawbacks of the use of these blockers is the extended time necessary for lung deflation. Resistance to laminar flow is directly proportional to the length and inversely proportional to the radius. The 9F EBB is longer (65cm vs. 60cm)
40cm) and has a smaller diameter (1.6mm vs. 5.0 mm each lumen) than a 35F DLT. The resistance to flow and the efficacy of suctioning is clearly in favor of the DLT with the larger lumen.

Sometime surgeons are reluctant to use EBB under the perception that lung deflation with the blockers is time consuming. Campos et al (25) reported that the average time for optimal lung deflation was achieved on average of 17 minutes for the DLT while 23 minutes for EBB. Once deflation was achieved there was no difference in the quality of the lung deflation.

In a recent study, the 3 blockers were compared to left sided DLT in 52 patients. The mean time for lung isolation was 1.5 minutes for the DLT versus 4 minutes for the EBB. There were no differences in the lung deflation score after 10 or 20 minutes following opening of the chest. (26) The slightly longer time necessary to achieve lung separation with EBB is irrelevant considering the total length of the surgery. Furthermore, it reconfirms the findings that within 10 minutes following opening of the chest there is no difference between the EBB and the DLT as per the quality of the lung deflation.

A common concern is the use of EBB for right side blockade. In one study Campos et al. right-sided DLT’s were compared with right-sided bronchial blockers (Univent; Vitaid Ltd.). Both devices were successfully placed with minimal initial malpositions which were eventually corrected. (27) Therefore, both devices for the right-sided blockade were equally comparable, showing no advantage of one versus the other.

**Learning curve:** Like any other device, there is a significant learning curve for the use of EBB. The anesthesiologist should be familiar and comfortable in using these devices. The practitioner should not be in the predicament of having to use a blocker for the first time, in an emergency situation or during a difficult airway. The techniques should be practiced in a controlled situation. The present generation of anesthesiologists is generally unfamiliar with the EBB and need to familiarize with these devices and pass on the teachings to future generations. In a Pro and Con on the use of EBB, it was concluded that “It is unreasonable to expect that anesthesiologists use EBB in situations in which the advantages are clear if they do not gain sufficient experience in using EBB in less critical situations. Just as using an LMA as a rescue device requires experience gained in routine cases, EBB should be used routinely to become a familiar part of the thoracic anesthesiologist’s “toolbox.”” (28)

Finally, the cost of the EBB can be 2-3 times that of a DLT. Equipment expenses are a major consideration in departmental budget. However, the risks/benefits for the patient and the best quality of care should be the primary factor in choosing the right device for a particular patient. The additional cost of EBB is insignificant compared to the total cost of lung surgery.

**In Conclusion:** DLT’s have been used for over 50 years. They are and will remain the standard of care for lung separation. However, there are many clinical situations where DLT is not the best choice. The anesthesiologist should be familiar with the devices and should have the additional option to use them as an initial or alternative method to DLT. The use of bronchial blockers has increased in recent years with improvements in design and development of fiberoptic bronchoscopy techniques. EBB can be safely and effectively used for simple procedures such as a brief wedge resection or for more complex extended procedures such as lobectomies or pneumonectomies. The slightly added time necessary for lung deflation or the
additional cost of the EBB should not be the primary concern. It is a benefit to the patient to avoid changing tubes and exposes them to a period of an unprotected airway. It is ultimately the level of familiarity and comfort of the anesthesiologist and surgeon to decide what is best for the management of their patient.

References


TABLE 1: INDICATION FOR THE USE OF ENDOBRONCHIAL BLOCKERS

The Difficult Airway
- Avoid the need for tube exchange
- Patients post laryngeal/pharengeal surgery
- Patients with tracheotomy
- Patients with distorted bronchial anatomy from aneurysm compression or intraluminal tumor
- Patients who requires nasotracheal intubation

Management:
- Possible segmental blockade in patient intolerable to OLV
- Morbidly obese
- Small size adult or pediatrics
- Patients who arrive intubated to the OR from the ICU

Surgical Procedures Non-Involving the Lung
- Esophageal surgery
- Spine surgery that required transthoracic approach
- Minimally invasive cardiac surgery