

## Con: A Bronchial Blocker Is Not a Substitute for a Double-Lumen Endobronchial Tube

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**T**HE MODERN PRACTICE of thoracic surgery depends on the ability of the anesthesiologist to dependably isolate and selectively ventilate the patient's lungs. By doing so, the clinician can provide both a collapsed lung and quiet operative field for the surgeon while also protecting the healthy lung from cross-contamination. In adults, these goals are achieved by either endobronchial intubation with a double-lumen tube (DLT) or by obstructing a bronchus with a bronchial blocker (BB). There are certain clinical situations in which one of these lung isolation techniques may be superior to the other (Table 1). For most thoracic procedures, however, either method can be used safely. The majority of anesthesiologists, when surveyed, continue to prefer a DLT in their routine practice.<sup>1,2</sup> The author believes there are good reasons for that choice.

DLTs have been called "difficult tubes."<sup>3</sup> Concerns about problems with tracheal intubation and bronchial positioning with a DLT often are cited as reasons for selecting a BB. DLT placement may have been a challenge in the past with the bulky rubber DLTs that were used prior to the introduction of fiberoptic bronchoscopy. By choosing an appropriate size (large) plastic DLT, first advancing the tube to a depth either based on the patient's height and/or under direct fiberoptic visual guidance and then using a fiberscope to confirm placement, modern DLTs can be safely, easily, quickly, and accurately placed.<sup>4</sup> In fact, studies have reported that DLTs are easier to place and require significantly less time to isolate the lungs than do BBs.<sup>5</sup> One study compared the time from the start of laryngoscopy until lung isolation was achieved with either a DLT or 1 of 3 BBs.<sup>6</sup> The time to lung isolation was significantly shorter (mean  $93 \pm 62$  seconds) with the DLT compared with an average time of  $203 \pm 132$  seconds with each of the 3 BBs. The time to isolation did not vary among the different BBs.

A major advantage of a DLT is that it allows the anesthesiologist to safely collapse and re-inflate the operated lung as often as needed during a procedure. Sequential inflation/deflation of the operated lung with a conventional BB greatly increases the risk of blocker balloon displacement. If the blocker's balloon is no longer in correct position, it will fail to isolate the operative lung, which then may re-expand and interfere with the surgery. Intraoperative BB displacement occurs much more frequently than DLT displacement, especially when changing the patient's position from supine to lateral and/or from surgical manipulation of the operated lung. In the study in which patients underwent surgery with either a DLT or 1 of 3 BBs, there were very significant differences in the need to reposition each device during surgery.<sup>6</sup> Repositioning of the DLT (Mallinckrodt Medical, Athlone, Ireland) was necessary in only 2 out of 26 patients, while the Arndt BB (Cook Critical Care, Bloomington, IN) needed to be repositioned in 16 out of 26 patients, the Uniblocker BB (Vitaaid Ltd, Lewiston NY) in 11 out of 26, and the Cohen BB (Cook Critical Care, Bloomington, IN) in 8 out of 26 patients. If a blocker's balloon herniates into the trachea, it not only will

allow re-expansion of the operated lung but also may obstruct ventilation to both lungs. The latter complication, if unrecognized, can lead to very serious life-threatening consequences.<sup>7</sup>

Another benefit, especially for very short procedures, is the more rapid lung deflation that occurs with a DLT. Although it takes longer for the lung to initially collapse using a BB, once the lung is fully deflated there are no differences between techniques.<sup>8</sup>

In the author's opinion, a collapsed, operated lung always should be suctioned prior to re-expansion in order to avoid spillage into the healthy airway. The large lumens of a DLT allow either lung to be suctioned at any time during the procedure without interrupting ventilation to the non-operated lung. Adequate suctioning of the operative lung is difficult or impossible through the very narrow lumens (1.6 mm ID) of a BB catheter. Whenever a BB's balloon is deflated, either during the procedure or at the completion of surgery, the contralateral healthy airway is exposed immediately to potential contamination by pus, blood, or even tumor material from the now re-inflated operative lung. The large lumens of a DLT also allow examination of the operated lung with a fiberoptic bronchoscope during surgery; again, intraoperative visual examination of the operated lung is not possible with a BB.

During one-lung ventilation, continuous positive airway pressure to the collapsed lung can be applied easily with a DLT to improve oxygenation in a hypoxemic patient.<sup>9,10</sup> In theory, continuous positive airway pressure also can be applied via the small lumen of a BB, but to do so may require special equipment and certainly is not achieved as easily and quickly as with a DLT.<sup>11,12</sup>

One argument by proponents of bronchial blockade focuses on the greater potential for airway trauma with a DLT. Although serious complications can occur from plastic DLTs, they are very rare.<sup>13</sup> Mild laryngitis and sore throat have been reported to occur more frequently with a DLT, but most complaints are minor and are clinically insignificant.<sup>14,15</sup>

Unique complications have been reported with both DLTs and BBs. Since a BB is positioned in the bronchus of the operated lung, its balloon must be deflated and withdrawn before that bronchus is stapled during a pulmonary resection. If the BB is not withdrawn completely the catheter can be sheared or even incorporated into the staple line.<sup>16</sup>

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Table 1. Lung Isolation Techniques

Favors Double-Lumen Tube (DLT)	Favors Bronchial Blocker (BB)
<ul style="list-style-type: none"> <li>• Quicker and easier to place               <ul style="list-style-type: none"> <li>◦ “Blind” placement possible if fiberoptic not available</li> </ul> </li> <li>• More rapid lung deflation</li> <li>• Intraoperative tube displacement less frequent</li> <li>• Allows bronchoscopic examination of operated lung during surgery</li> <li>• CPAP easily applied</li> <li>• Allows suctioning before re-inflation of operative lung</li> <li>• Allows operative lung to be safely re-expanded and collapsed as often as needed during procedure</li> <li>• Single tube can be used for sequential surgery to both lungs during same procedure</li> <li>• Can be used for operations on either ipsilateral and/or contralateral lung if main bronchus obstructed</li> <li>• Only technique for bronchopulmonary lavage</li> <li>• Allows “split-lung” ventilation in ICU</li> </ul>	<ul style="list-style-type: none"> <li>• Placed through or alongside an endotracheal tube or LMA               <ul style="list-style-type: none"> <li>◦ Patients with “difficult” airway when DLT difficult or impossible to use</li> <li>◦ Can be placed through oral, nasal, or tracheostomy tubes</li> <li>◦ Useful for patients with in situ endotracheal tube</li> <li>◦ Advantage when tube exchange considered dangerous                   <ul style="list-style-type: none"> <li>□ Patients requiring postoperative ventilation</li> </ul> </li> </ul> </li> <li>• Ventilation through multiport adaptor can continue during BB placement</li> <li>• Less potential for airway trauma</li> <li>• Allows selective lobar isolation</li> <li>• Children too small for a DLT</li> </ul>

Abbreviations: BB, bronchial blocker; CPAP, continuous positive airway pressure; DLT, double-lumen tube; LMA, laryngeal mask airway.

By selecting either a left- or right-sided DLT, a DLT can be used for almost every intrathoracic procedure. This is not true with a BB. A BB cannot be used for any operation that involves either the main bronchus itself or the lung on that side if there is pathology in the main bronchus. For example, a sleeve resection, a major bronchopleural fistula, or a lung transplant cannot be performed using a BB. In these instances, a DLT placed on the contralateral side will allow surgery to proceed on the involved lung or bronchus. Likewise, a BB cannot be used for bronchopulmonary lavage procedures, or in the presence of atypical bronchial anatomy, such as a tracheal or carinal origination of the right upper lobe bronchus.<sup>17</sup>

There are relatively few situations when a BB may be advantageous to using a DLT. Since a BB is passed through or alongside an endotracheal tube, a BB is the best choice for patients with “difficult” airways in whom placement of a DLT might be challenging or perhaps not even possible.<sup>18,19</sup> Once an appropriate size of endotracheal tube is placed by any route (oral, nasal, tracheostomy), then bronchial blockade should be possible. Patients who arrive to the operating room with an endotracheal tube already in place, either from the ICU or emergency room, may be at risk for tube exchange to a DLT. Using a BB through the in situ endotracheal tube allows this risk to be avoided. Likewise, if the possibility of postoperative ventilation is anticipated or when changing tubes at the completion of surgery is potentially dangerous, using a BB through an endotracheal tube at the start of surgery is a good choice. However, the great majority of patients undergoing thoracic procedures will not have a “difficult airway” and do not

require postoperative ventilation. For most patients, there are no special reasons to choose a BB, and either method can be used.

A BB can be used to selectively block a lobar bronchus. This may be beneficial in patients with limited respiratory reserves, especially those who have had a previous pulmonary resection on the same or contralateral lung. Selective lobar collapse is not possible with a DLT. Finally, a BB can be used for lung isolation in children too small for a DLT.<sup>20</sup>

Today, any discussion involving clinical care also requires consideration of the costs of medical equipment. Actual cost will vary with supplier and institution, but in general, single-use BBs are much more expensive than disposable DLTs. For example, at the author’s institution, Stanford University Medical Center, a Cohen BB costs \$266.67, an Arndt BB \$204.24, and a Univent BB \$137.50. The cost of a Mallinckrodt DLT is just \$55.44. Therefore, unless there is a clear-cut clinical advantage, from an economic perspective, a DLT usually is the better choice.

Although the topic of DLT versus BB has been debated in this journal and elsewhere for more than 20 years,<sup>21–24</sup> there is still no consensus as to which is the “best” method for lung separation.<sup>25</sup> The choice between BB and DLT depends on the requirements of the specific case, the patient’s airway, and the preferences and experiences of the anesthesiologist. Every anesthesiologist must be familiar with both lung isolation techniques since there are times when one method will be a better choice. However, for most patients undergoing thoracic surgery, a DLT is easier to use and offers many more advantages than a BB.

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