DOUBLE-LUMEN TUBES

PLASTIC vs RUBBER - Plastic, disposable DLTs are available in sizes 26 - 41 Fr. The clear material allows observation of moisture during ventilation and/or the presence of secretions or blood in either lumen. The blue bronchial cuff is easily visualized by a fiberoptic bronchoscope (FOB). The high volume/low pressure bronchial cuff reduces the danger of ischemic pressure damage to airway. The lumens are larger than equivalent size rubber DLTs; this allows passage of a FOB or suction catheter.

SIZE - Use the largest plastic DLT that can be atraumatically introduced into the bronchus. Large DLTs cannot be advanced as far.

### Guidelines For Selection Of Left-sided DLTs

<table>
<thead>
<tr>
<th>Measured TW (mm) from CXR</th>
<th>Left –BW (mm (TW-10%) x 0.73</th>
<th>Recommended Size (Fr) left-sided double-lumen tubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 18</td>
<td>≥ 11.83</td>
<td>41 Fr (M,R,S,P)</td>
</tr>
<tr>
<td>≥ 17</td>
<td>≥ 11.17</td>
<td>41 Fr (M,S) 39 Fr (R,P)</td>
</tr>
<tr>
<td>≥ 16</td>
<td>≥ 10.52</td>
<td>39 Fr (M,S) 37 Fr (R,P)</td>
</tr>
<tr>
<td>≥ 15.5</td>
<td>≥ 10.22</td>
<td>37 Fr (M,S) 35 Fr (R,P)</td>
</tr>
<tr>
<td>≥ 15</td>
<td>≥ 9.86</td>
<td>35 Fr (M,R,S,P)</td>
</tr>
<tr>
<td>≥ 14</td>
<td>≥ 9.20</td>
<td>32 Fr (M)</td>
</tr>
<tr>
<td>≥ 13</td>
<td>≥ 8.54</td>
<td>32 Fr (M)</td>
</tr>
<tr>
<td>≥ 12</td>
<td>≥ 7.88</td>
<td>28 Fr (M)</td>
</tr>
<tr>
<td>≥ 11</td>
<td>≥ 7.23</td>
<td>26 Fr (R)</td>
</tr>
</tbody>
</table>

TW = tracheal width; left-BW = left bronchial width
M=Mallinckrodt (St. Louis, MO)
R= Rusch (Duluth, GA)
S= Sheridan (Argyle, NY)
P= Portex (Keene, NH)
as thinner tubes so there is less chance of upper-lobe obstruction. Their bronchial cuff requires less air to seal the airway reducing the risk of trauma from over-inflation and cuff herniation into the carina. Larger internal lumens have less resistance to airflow.

Tracheal width measured from the chest radiograph can be used to select DLTs. Although average tracheal diameter varies (17.0 mm, range 13.0-22.0 mm for women, 20.6 mm, range 16.0-29.0 mm for men) for any individual the diameter of the left bronchus is directly proportional (68%) to tracheal diameter. Therefore, if tracheal width is known left bronchial width can be estimated and the appropriate (large) DLT selected.

**LEFT vs RIGHT DLT** - The rationale for intubating the operated (right or left) lung is that a malpositioned DLT will usually obstruct the upper-lobe causing collapse. A poorly positioned DLT on the operated side will be obvious once the chest is opened. The intubated lung is visible so a FOB should not be needed. Others recommend intubation of the non-operated (right or left) lung. They feel a DLT in the operated lung bronchus complicates airway management and there is an increased risk of displacement from surgical retraction and manipulation. The DLT in the dependent, non-operated lung stents the bronchus open.

We use a *left-DLT* for both right and left thoracic procedures since the "margin of safety" is greater. The human airway is asymmetric. The right bronchus is short (2.3 cm in males, 2.1 cm in females) compared to the left bronchus (5.4 cm in
males, 5.0 cm in females). There is a higher risk of upper-lobe obstruction with a right-DLT. Because of carinal and tracheal origin of the right upper-lobe bronchus as many as 10% of the population cannot be safely intubated with a right-DLT. If a right-DLT is indicated a rubber Robertshaw right-DLT is preferable since its upper-lobe ventilation slot is much longer than a plastic DLT.

INDICATIONS FOR RIGHT-SIDED DLT
- Obstruction of left-bronchus
  - Intrinsic – tumor, stenosis
  - Extrinsic – tumor, adenopathy, aortic aneurysm
- Unilateral left lung transplant
- Sleeve resection left-bronchus

DLT POSITIONING - We use clinical signs to place DLTs. The routine use of FOB is time consuming, expensive and a potential source of airway injury and contamination.

First, the distal tip of the DLT is advanced just past the vocal cords, the stylet in the bronchial lumen is withdrawn, and the tube is then rotated 90-180° counter-clockwise. There is a highly significant correlation between depth of DLT insertion and height. For adults (men and women 170 cm tall) average DLT depth of placement is 29 cm. For every 10 cm (4 inch) increase or
decrease in height, the DLT is advanced or withdrawn 1 cm.

After the tube is advanced into the bronchus, both the bronchial and tracheal cuffs are inflated. The bronchial cuff should require only 1-2 ml to seal the airway. If >3 ml of air is needed the cuff is probably in the trachea and the tube should be advanced further into the bronchus. The tension in the pilot balloon to the bronchial cuff is noted. If the DLT is later displaced the pilot balloon will soften if the bronchial cuff is in the trachea.

Both lungs are then ventilated. A capnograph should reveal the appearance of CO₂, there should be water vapor in both lumens, bilateral chest wall excursion should occur, and bilateral breath sounds should be heard. The tracheal lumen is clamped and ventilation continues through the bronchial lumen.
Breath sounds should be heard only over the (intubated) left lung. If breath sounds are present only over the right lung then the DLT is in the right-bronchus. In this situation both cuffs are deflated and the DLT withdrawn several centimeters.

The DLT is then rerotated to the left and readvanced after bending and turning the patient’s chin to the left and the head and ear to the right.

If this maneuver fails after several attempts a FOB in the bronchial lumen can be used as a stylet to guide the tube into the left-bronchus.

FOB SIZE AND DLT SIZE
OUTSIDE DIAMETER (mm)
<4.5  fit 35, 37, 39, 41 Fr DLTs
4.9  fit 39, 41 Fr DLTs
>5.6  will not fit 41 Fr DLT

Once the DLT is in the left-bronchus, the left lumen is clamped and only the tracheal lumen is ventilated. Breath sounds should be heard only over the right lung.

If there is difficulty ventilating the patient (very high peak inspiratory pressure or no breath sounds) only the bronchial cuff is deflated while ventilation through the tracheal lumen continues. If the DLT is not deep enough bilateral breath sounds will now be present. If the tube is too deep breath sounds will be heard only over the left-lung.

A FOB can confirm DLT position. The FOB advanced down the tracheal lumen should demonstrate the blue bronchial cuff just below the carina in the appropriate (left) bronchus. The FOB down the bronchial lumen should demonstrate an open upper-lobe bronchus.
Figure 5 – Correcting the position of a left-sided double-lumen tube

When both lumens are open

**Evidence:** Unilateral left breath sounds are heard.
**Problem:** The tube is too deep into the left bronchus.
**Solution:** Deflate the tracheal and bronchial cuffs and pull the tube back. Reinflate both cuffs and listen for breath sounds in both lungs.

When the tracheal lumen is clamped

**Evidence:** Bilateral breath sounds are heard.
**Problem:** Either the bronchial cuff is not sealing the bronchus or the tube is not deep enough in the bronchus.
**Solution:** If more than 3 mL of air is sufflated into the bronchial cuff still fails to seal the bronchus, deflate both cuffs and advance the tube farther into the bronchus. Reinflate both cuffs and clamp the tracheal lumen. Listen for breath sounds.

**Evidence:** Breath sounds are heard only on the right.
**Problem:** Right bronchus was unintentionally intubated.
**Solution:** Deflate both cuffs and withdraw the tube's tip above the carina. Turn the patient's head and neck to the right and down, re-rotate the tube to the left, and then advance it to the correct position. Reinflate both cuffs and clamp the tracheal lumen. Listen for breath sounds.

When the bronchial lumen is clamped

**Evidence:** Bilateral breath sounds are heard.
**Problem:** Tube is so deep that the bronchial cuff is below the left upper lobe bronchus.
**Solution:** Deflate both cuffs and withdraw the tube slightly. Reinflate both cuffs and clamp the bronchial lumen. Listen for breath sounds.

**Evidence:** Very high peak inspiratory pressures are required for ventilation; deflation of the bronchial cuff produces bilateral breath sounds.
**Problem:** Tube is not deep enough.
**Solution:** Deflate both cuffs and advance the tube's position. Reinflate both cuffs and clamp the bronchial lumen. Listen for breath sounds.

**Evidence:** Very high peak inspiratory pressures are required for ventilation; deflation of the bronchial cuff produces breath sounds only on the left side.
**Problem:** Tube is too deep.
**Solution:** Deflate both cuffs and withdraw the tube slightly. Reinflate both cuffs and clamp the tracheal lumen. Listen for breath sounds.
FURTHER READING


