Double lumen tubes (DLTs) are most commonly used to achieve one lung ventilation (OLV) in most thoracic surgical procedures unless contraindicated. Left-sided DLT (LDLT) is most commonly used nowadays for most thoracic surgical procedures. Though the use of LDLT goes way back in history, two clinical and technical issues are yet to be resolved. The first issue is the ideal size of DLT which is defined as that which provides near-complete seal of the bronchial lumen without cuff inflation. There are no guidelines in literature which help in selecting the size of DLT. However, general consensus among thoracic anesthesiologists recommends the use of smaller sizes to avoid airway trauma. In our practice and for the last few years, we are using smaller size LDLT 35 F for females and 37 F for males with minimal airway trauma and had encouraging results. The second issue is the insertion depth of the LDLT. We have introduced a height-based formula to predict the insertion depth of LDLT with encouraging results. However, even with the use of the formula, we still recommend the use of fiberoptic bronchoscopic confirmation method for final positioning of the LDLT.

Key words: Double lumen tube; surgery; thoracic anesthesia

In this brief review, we are going to address the aforementioned two issues: size and insertion depth of LDLT.

Size of LDLT

In the literature, there is scarce evidence on how to select the proper size of LDLT for a particular subject undergoing thoracic surgical procedure with lung isolation. Most anesthesiologists select the LDLT based on patient height and gender. Brodsky et al.[1] and Hannallah et al.[2] have introduced a table on how to choose the LDLT size based on radiological imaging. Tracheal diameter is measured at the level of the clavicles on the posterior–anterior chest radiograph and the bronchial diameter is measured on the computed tomography (CT) scan 1-2 mm of carina since the...
The size of the DLT was selected based on the TD-US. Considering that the deflated tracheal cuff adds about 0.5 mm to the external diameter of the DLT, the sizes of DLT were selected as follows: 37 F for TD-US > 14.0 mm, 35 F for 13 mm < TD-US < 14.0 mm, and 32 F for 11.8 mm < TD-US < 13.0 mm. The authors concluded that the TD of the cricoid cartilage in most Asian women can be accurately measured by US and correctly predicted the size of the DLT.[10]

**Insertion Depth of LDLT**

Insertion depth is another issue related to LDLT. Two methods were described to accurately place the LDLT. The first and most common is the traditional method where the tip of the endobronchial tube is advanced through the larynx under direct vision, rotated 90 degrees to the left (counterclockwise), and then advanced blindly into the left mainstem bronchus followed by fiberoptic bronchoscope (FOB) confirmation. The second and less common is the direct method where the LDLT is placed under vision with FOB placed through the bronchial lumen. Both methods resulted in a successful left mainstem placement of the endobronchial tube with more time required for the direct method.[11] Several studies showed positive correlation between body height (BH) and the optimal insertion depth of a LDLT. Several methods have been described to predict the correct insertion depth of LDLT. Chow et al.[12] developed a formula based on the clavicular-to-carinal distance of the trachea and the BH in 78% of their patients. Brodsky et al.[13] demonstrated that a height-and-gender-based formula could predict the insertion depth of LDLT. Liu et al.[14] reported an accurate insertion depth of LDLT in 90% of their patients by measuring the distance between the vocal cords and the carina according to chest CT scan. In a pilot study, we recruited our patients whose tracheas were intubated correctly with LDLT using FOB confirmation and examined the published formulae aiming to achieve an accurate estimation of the optimal insertion depth LDLT. We prospectively recruited 41 adult patients who underwent thoracic surgery with OLV.

The study included patients whose procedure required placement of a LDLT. We have used LDLT 35 F for females and 37 F for males. The optimal position of the LDLT was confirmed using FOB and defined when the inflated endobronchial cuff was placed in the left main bronchus just below the carina. We compared the insertion depth achieved with the conventional method of LDLT insertion by the following five formulae: 0.11 × BH + 10.53 (cm) by Brodsky et al.[13]; 0.15 × BH + 3.96 (cm) by Bahk et al.[15]; 0.148 × BH + 3.8 (cm) by Chow et al.[12]; 0.1 × BH + 12.5 (cm) by Takita et al.[16]; and 0.1977 × BH – 4.2423 (cm) by Lin et al.[17]
The insertion depth of LDLT in our series was positively correlated with all the studied formulae and best correlated to Brodsky et al. formula. We were able to find another height-based formula out of this pilot study suitable for our patients: the insertion depth of LDLT = 0.249 × (BH)0.916. Chow et al. reported that their formula, based on the clavicular-carinal distance of the trachea and patient’s height, provided an acceptable position of the LDLT without further adjustment in 78% of the patients. In another study, which was published recently, we hypothesized that our formula would predict the accurate insertion depth of LDLT at least as accurately as Chow et al.’s formula. In a prospective observational study on 66 patients who underwent thoracic surgery required OLV using LDLT. We used the formula LDLT = 0.249 × (BH)0.916 to determine the insertion depth of the LDLT. We used an application (app) saved on a smartphone to perform the calculation of the LDLT’s depth of insertion. After the user installs the application, they are presented with the calculator where they enter the height of the patient. This is then fed as an input to the formula to produce the insertion depth of the tube in centimeters. In this study, we calculated the insertion depth of LDLT using a free Android app on the Play Store: https://play.google.com/store/apps/details?id=com.ldlt.ldltCalculator. We found that our formula provided satisfactory positioning of LDLT in about 70% of the patients and that in the remaining patients, the adjustments required to achieve satisfactory positioning under FOB guidance were minimal.

In conclusion, there are no guidelines in literature which help in selecting the size of DLT. However, general consensus among thoracic anesthesiologists exists in using smaller sizes to avoid airway trauma. In our practice, and for the last few years, we are using smaller size LDLT 35F for females and 37F for males with minimal airway trauma and encouraging results. Regarding the insertion depth of LDLT, our height-based formula could be used as an initial default to guide the initial insertion depth of LDLT. We found that the formula provided satisfactory positioning in most of our patients, and that in the remaining patients, the adjustments required to achieve satisfactory positioning under FOB guidance were minimal. Even with the use of our formula to predict the insertion depth of LDLT, we still recommend the use of FOB confirmation method for the final positioning of the LDLT.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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