



Original Article

# Optimal size selection of the classic laryngeal mask airway by tongue width-based method in male adults

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## Abstract

**Background:** Proper size selection is crucial to the effective use of a laryngeal mask airway (LMA). The current choice of LMA size is based on body weight; in addition, the sex-based selection has also been suggested. However, the relationship between body weight, sex, and the dimension of hypopharynx where the LMA is positioned are inconsistent. Here we examined a tongue width-based method to determine the optimal size for the classic LMA (cLMA).

**Methods:** The enrolled patients had two different cLMA size selections, determined by both weight-based formula and tongue width-based method. Twenty-one male patients were studied. For the tongue width-based method, we made four rulers of different widths that corresponded to the four different cLMAs (Nos. 2.5, 3, 4, and 5). The patient was asked to open his mouth and protrude his tongue; the optimal size of cLMA was determined by the corresponding ruler which had the same tongue width of the patient. Two insertions with different-size cLMAs were randomly performed in every patient. Five parameters — frequency of insertion attempts, the presence of cuff in the mouth, end-tidal CO<sub>2</sub> shown on monitor, oropharyngeal leak pressure, and fiberoptic score — were measured following each cLMA insertion.

**Results:** For all of the five measured parameters, the tongue width-based method was better than weight-based formula in determining optimal cLMA size selection.

**Conclusion:** The tongue width-based method is a convenient and efficacious alternative for selecting an optimal cLMA size in male adults.

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**Keywords:** adult; laryngeal mask airway; size

## 1. Introduction

The laryngeal mask airway (LMA) is a useful device for airway management during anesthesia. Selection of an appropriate size is important for using an LMA. There are several factors to be considered when selecting an appropriate size of LMA, including maintaining an airtight seal during positive pressure ventilation, no excessive pressure on the pharynx, ability to fit around the hypopharynx, and not

too large to insert. According to a previous study regarding the optimal LMA size selection, the sex-related formula (size 4 for females and size 5 for males) was more preferable<sup>1</sup> than the manufacturer weight-based recommendations (size 3 for 30–50 kg; size 4 for 50–70 kg; and size 5 for >70 kg). However, these methods cannot always be correct because the relationship between sex, weight, and upper airway geometry appear inconsistent. No method has yet been found to easily measure the potential pharyngeal volume that closely correlates with appropriate LMA size. In the following crossover design study, we compared a tongue width-based method with the manufacturer's weight-based formula for proper size selection of the classic LMA (cLMA) by ease of insertion, oropharyngeal leak pressure (OLP), and anatomic positions.

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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## 2. Methods

Ethical approval for this study was provided by the Institutional Review Board of Tri-Service General Hospital (TSGHIRB) and National Defense Medical Center, Taipei, Taiwan. Informed consent was obtained from each patient enrolled in the study. Exclusion criteria from the trial were age younger than 18 years, a known or predicted difficult airway, mouth opening smaller than 2.5 cm, or risk of aspiration. In this crossover design study, participants with American Society of Anesthesiologists classification I–II were selected preoperatively. The enrolled patients had two different cLMA size selections, which were determined by both weight-based formula (size 3, 30–50 kg; size 4, 50–70 kg; size 5, >70 kg) and a tongue width-based method. The tongue width-based method was performed as follows. First, we made four rulers with different widths corresponding to the four different cLMAs (Nos. 2.5, 3, 4, and 5; Table 1, Fig. 1). Each ruler's width was determined by the widest width of each cLMA in which the cuff was minimally inflated. The patient was asked to open his mouth and protrude his tongue in a relaxed manner. The size of the cLMA was determined by the corresponding ruler which had the same width as that of the tongue (Fig. 2).

After preoxygenation, anesthesia was induced with intravenous propofol 2 mg/kg, supplemented with fentanyl 1 g/kg. The insertion order of the two different-size cLMAs (weight-based and tongue width-based) was randomized by tossing a coin. All insertions were performed by a single experienced cLMA user using the technique suggested by manufacturer instructions. After insertion, the cuff was inflated with air to an intracuff pressure of 60 cm H<sub>2</sub>O.<sup>2</sup> A maximum of three attempts were permitted prior to insertion, and failure in all three attempts was considered as insertion failure. Following successful insertion, the mouth was then opened to check if the cuff was visible. The OLP was measured by closing the expiratory valve of the circle system at a fixed gas flow of 3 L/minute and noting the airway pressure at which the manometer dial reached stability. The position of the cLMA was assessed by a fiberoptic scope that was passed through the laryngeal mask airway to a position just proximal to the mask aperture bars, and the view was scored as follows: 4 = only vocal cords visible; 3 = vocal cords and posterior part of epiglottis visible; 2 = vocal cords and anterior epiglottis visible; and 1 = vocal cords not seen.<sup>3</sup> After the assessments, the first cLMA was removed and a second cLMA was inserted subsequently. The patient was ventilated with oxygen by facemask for 5 minutes between the two insertions, and additional intravenous propofol 1 mg/kg was given. The assessments following the second cLMA insertion were the same as those following the

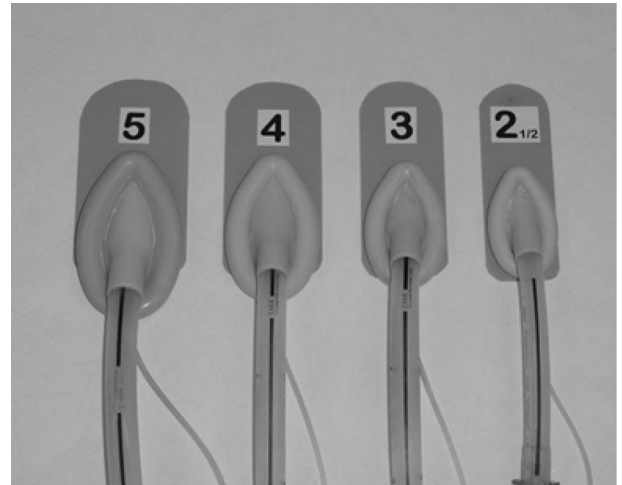


Fig. 1. The four rulers and the corresponding classic laryngeal mask airways with minimal cuff inflation.

first cLMA insertion. The optimal size of cLMA was chosen for the proceeded operation. The patients were anesthetized with sevoflurane and maintained spontaneous breathing during the operation.

All of the observations after cLMA insertion were performed by another anesthesiologist who was unaware of the cLMA that had been selected. Five parameters were recorded: the frequency of one attempt at insertion, the frequency of cuff presence in the mouth, the frequency of end-tidal CO<sub>2</sub> shown on monitor, OLP, and fiberoptic score (FOS).

Sample size for this crossover study was determined to detect a 20% difference in the success rates of first-attempt intubation for type I error of 0.05 and a power of 0.8. The calculation of the sample size was based on data from a previous similar study.<sup>4</sup> Statistical comparisons between the two methods were performed using paired Student *t* test for the continuous data, McNemar test for the categorical data, and Wilcoxon matched-pairs signed-rank test for the ordinal data. A *p* value <0.05 was considered statistically significant.



Fig. 2. A Number 4 ruler fits the tongue of a patient with mouth open and tongue protruded.

Table 1  
The width of rulers corresponding to each size of the classic laryngeal mask airway.

LMA size and ruler no.	2.5	3	4	5
Width (cm)	4.2	5.0	5.7	6.5

LMA = laryngeal mask airway.

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