Optimal Size Selection of Laryngeal Mask Airway in Malaysian Female Adult Population

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Summary

Background: The summary of various studies done looking at size selection of the laryngeal mask airway (LMA) in adults is that, selection based on sex is appropriate, and that both sizes 4 or 5 are adequate for adult females. However in our local population these sizes may be too large especially the size 5 for adult females. **Objective**: To determine the optimal size of LMA in Malaysian female adults. **Method**: 135 ASA 1 or 2 adult female patients coming for elective surgery, requiring general anaesthesia suitable for LMA insertion, were randomised into 3 groups to receive either a size 3, 4 or 5 LMA. Optimal size of the LMA was assessed based on 4 parameters: the number of attempts at placement, the oropharyngeal leak pressure (OLP), fibre-optic score and the percentage of the vocal cords seen. **Results**: The 3 groups were demographically similar. There was no difference in the 3 groups in terms of number of attempts of placement, OLP and fibre-optic score. The percentage of vocal cords seen with the size 3 LMA was significantly less than for the size 4 and size 5 ($p=0.009$). For the size 5 LMA group, in 10 / 45 patients, the size 5 LMA was too big making it incorrectly positioned after successful insertion and in another 3 / 45 patients it was difficult to pass the size 5 LMA past the open mouth during insertion. There were no such problems with the size 3 or 4 LMA groups. **Conclusion**: The optimal size of LMA for the female Malaysian adult is size 4.

Key Words: Equipment, Laryngeal mask airway, Size selection

Introduction

The use of the laryngeal mask airway has gained wide acceptance worldwide for use during general anaesthesia. In the United Kingdom, the usage rates are in the range of 30-60% of all anaesthetics given [1].

Selection of the appropriate size of laryngeal mask airway (LMA) is very important for the safe and effective use of the LMA [1]. Thus, various studies have been done looking for the appropriate size of the laryngeal mask airway (LMA) in the adult population[2-6].

The summary of these studies is that in adults, selection of the size based on sex is appropriate, and that both sizes 4 or 5 are adequate for adult females [7]. However these studies have been done mainly in the Caucasian population.

The current practice of most Malaysian anaesthesiologists is to use the size 3 LMA for adult females. This is because most Malaysian anaesthesiologists feel that size 5 and even size 4 may often be too large especially for the Malaysian female adult population. Thus, we decided to look at the suitability of these sizes in the female adult Malaysian population.

The aim of our study was to determine the optimum size of the LMA for the Malaysian female adult

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population in terms of ease of insertion, optimal positioning (fibre-optic score and the percentage of vocal cords visualised through the fibre-optic scope) and oropharyngeal leak pressure (OLP).

Materials and Methods

A total of 135 adult women, of ASA 1 or 2 physical status, above the age of 18 years who came for elective surgery requiring general anaesthesia were included in this study. We obtained approval from the Medical Research and Ethics Committee, Ministry of Health and informed consent from these patients before commencing the study.

The exclusion criteria included patients inadequately fasted or having increased risk of aspiration, patients who were morbidly obese with a body weight more than 100kg and patients with chronic respiratory disease. The following preoperative data was collected: age, weight, maximum inter-incisor distance and maximum sterno-mental distance (anterior tip of chin to sternal notch).

Patients were randomly allocated to one of three different groups to receive either a size 3,4 or 5 LMA. The method of randomisation used was the random permuted block method. This was transferred to a series of 135 opaque, sealed envelopes labelled with either size 3, 4 or 5.

The anaesthetic technique was standardised according to a set protocol. Monitoring was established pre-induction and included an electrocardiograph, pulse oximeter, capnograph and non-invasive blood pressure monitor. The head and neck of all patients was placed in the sniffing position using the same firm indented intubating pillow.

All patients were preoxygenated for 3 minutes and anaesthesia induced with i/v fentanyl 1 µg/kg followed 2 minutes later by propofol 3.0 mg/kg given over 30 seconds. Anaesthesia was subsequently maintained with 1-2% sevoflurane in oxygen. Nitrous oxide was avoided until all the data was collected. Additional boluses of propofol 20-30mg were given if necessary to reach adequate depth for insertion of the LMA.

Insertion of the LMA was only done when adequate depth of anaesthesia was reached i.e. loss of eyelash reflex, patient apnoeic, jaw relaxed with no response to jaw manipulation. The method used for insertion and the shape of the cuff before insertion (fully deflated, smooth leaf shaped) was done according to the inventor's instructions [1].

Following insertion, the mask was inflated to and maintained at a standard intra-cuff pressure of 60-cm H_2O. This was to ensure that the OLP was independent of the intra-cuff pressure for all the three groups of patients. Cuff pressure was measured with a hand-held, high volume, low pressure cuff inflator (VBM® Control Inflator Monitor).

Successful placement of the LMA was defined as adequate chest rise and normal capnograph (end-tidal carbon dioxide within normal range) during manually assisted ventilation. Following successful insertion, the anaesthetic assistant fixed the tube of the LMA so that the natural caudal curve was maintained.

A maximum of three attempts was given for successful insertion of the LMA. An attempt was defined as a downward and forward movement of the device. A successful attempt was defined as a downward and forward movement of the device with evidence of successful placement of the LMA. If this was still unsuccessful after three attempts, then the patient was considered as a failed insertion.

Oropharyngeal leak pressures (OLP) was then assessed by closing the expiratory valve of the circle breathing system at a fixed fresh gas flow rate of 3 litres/min and observing the dial of the aneroid pressure gauge attached to the expiratory limb of the circle breathing system. Once the expiratory valve of the circle breathing system was closed, the airway pressure (and thus the dial of the aneroid pressure gauge) would start to go up. The OLP was defined as the airway pressure when the dial on the aneroid pressure gauge reached stability (i.e. the airway pressure at which the leak was in equilibrium with the fresh gas flow rate) [8].

The position of the LMA was then assessed with a fibre-optic scope being passed just 1cm proximal to the mask aperture bars and scored as follows [9]. Score 4 - Only vocal cords seen; Score 3 - Vocal cords and posterior epiglottis seen; Score 2 - Vocal cords and anterior epiglottis seen and Score 1 - Cords not seen but function adequate. Clinically acceptable scores were scores of 2 and above.

In addition, the percentage of the vocal cords that was visualised through the fibre-optic scope was graded as follows: Score 4 - excellent (76-100% of the vocal cords visualised); Score 3 - good (51-75% of the vocal cords visualised); Score 2 - fair (26-50% of the vocal cords visualised) and Score 1 - poor (0-25% of the vocal cords visualised). Clinically acceptable scores were scores of 2 and above.

All LMA's were inserted by the same experienced LMA user (1st investigator). Trained observers who were blinded to the size of the LMA inserted did the OLP and fibre-optic scoring. All data was collected prior to the start of surgery with the patient apnoeic. Patients were followed up for 24-hours to look out for the occurrence of pharyngeal morbidity.

Assessment of the optimal choice of size of the LMA was made on the basis of the number of attempts of insertion, optimal positioning (fibre-optic score and the percentage of the vocal cords visualised via the fibre-optic scope) and oropharyngeal leak pressure (OLP).

Sample size calculation was done using the confidence interval single mean approach. Using data (mean and standard deviation for OLP) from a previous study [3], we calculated that we would need a sample size of 45 per group in order to achieve a significance level of 0.05 and a power of 80%. All continuous data was tested for normality using the *Wilks-Shapiro* test and we used *ANOVA* for normally distributed data i.e. age, sterno-mental distance, inter-incisor gap and *Kruskal-Wallis* for non-normally distributed data i.e. OLP, weight, dose of propofol. For qualitative data, we used the *Pearson's Chi-squared* test (% vocal cords seen, fibre-optic score, number of insertion attempts and incidence of sore throat).

Results

There was no difference between the three groups in terms of age, weight, inter-incisor distance, sterno-mental distance or dose of propofol used (Table I).

There was also no difference between the three groups in the number of attempts needed to insert the LMA (Table II), the oro-pharyngeal leak pressure (Table III) and the fibre-optic score (Table IV). However the percentage of vocal cords visualised was significantly less for the size 3 LMA compare to the size 4 and size 5 LMA (p=0.009) (Table V).

For the size 5 LMA group, in 10/45 patients, the size 5 LMA was too big making it incorrectly positioned after successful insertion and in another 3/45 patients it was difficult to pass the size 5 LMA past the open mouth during insertion. There were no such problems with the size 3 or 4 LMA groups (Table VI).

There were no differences in the incidence of post-operative pharyngeal morbidity between the three groups (Table VII).

Table I: Demographic Data

Characteristics	Size of LMA			
	Size 3 LMA, n=45	Size 4 LMA, n=45	Size 5 LMA, n=45	p value
Age, years, mean (SD)	38.78 (9.86)	40.45 (12.38)	37.11 (10.88)	0.37
Weight, kg, mean (SD)	58.91 (12.28)	62.02 (11.13)	60.98 (13.90)	0.55
Sterno-mental distance, cm, mean (SD)	14.47 (1.22)	14.51 (1.17)	14.62 (1.20)	0.82
Inter-incisor gap, cm, mean (SD)	4.14 (0.46)	4.16 (0.55)	4.16 (0.55)	0.98
Dose of propofol, mg, mean (SD)	178.67 (36.64)	182.80 (27.93)	183.10 (35.86)	0.88

Table II: Number of Insertion Attempts vs Size of LMA

No of attempts	Size of LMA		
	3	4	5
1	38	40	37
2	7	5	8
Total	45	45	45

(p=0.66)

Table III: Oropharyngeal Leak Pressure vs Size of LMA

	Size of LMA			
	3	4	5	p value
Oro-pharyngeal leak pressure, cm H2O, mean (SD)	20.98 (5.21)	21.91 (4.48)	22.49 (4.61)	0.38

Table IV: Fibre-optic Score vs Size of LMA

Fibre-optic score	Size of LMA		
	3	4	5
4 (only VC seen)	2	9	7
3 (VC and post epiglottis)	7	6	9
2 (VC and ant epiglottis)	28	26	24
1(Function OK, No VC seen)	8	4	3
Total	45	45	43

(p value = 0.24)

Table V: Percentage of Vocal Cords seen vs Size of LMA

% vocal cords seen	Size of LMA		
	3	4	5
51-100	16	29	33
0-50	29	16	10
Total	45	45	43

(p value =0.009)

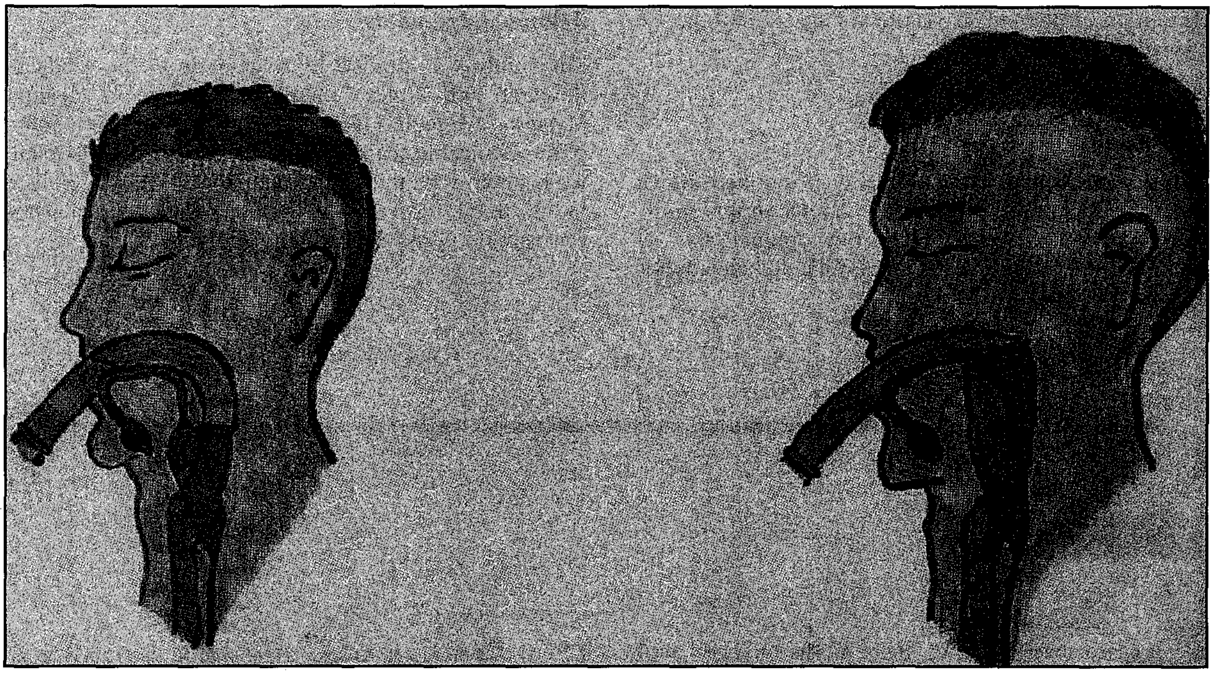
Table VI: Positioning Difficulties

% vocal cords seen	Size of LMA		
	Size 3 (n = 45)	Size 4 (n = 45)	Size 5 (n = 45)
Difficulty passing FOS via LMA tube (kinked LMA tube)	0	0	10
Difficulty passing LMA via open mouth	0	0	3

Table VII: Incidence of Sore Throat 24 Hours Postoperatively

Presence of Sore Throat	Size of LMA		
	3 (n = 45)	4 (n = 45)	5 (n = 45)
Yes	9	8	10
No	32	32	32
Total	41	40	42

(p value =0.32)



Optimal fit LMA **Too Large LMA**

Fig.1

Discussion

We have shown that the size 3 LMA was less optimally positioned compared to the size 4 or size 5 LMA in terms of the percentage of vocal cords visualised. The size 4 LMA could be inserted and functioned well in all patients and was more optimally positioned compared to the size 3 LMA.

The cuff of the size 5 LMA was too large in three patients making it difficult to pass it through the open mouth while in another 10 patients, the tube of the LMA was kinked after it was inserted in place. This made it difficult for the fibre-optic scope to pass down the LMA tube in order to visualise the vocal cords. This meant that the LMA was too big and thus the natural curve of the LMA was lost after it was inserted in these patients (Figure 1).

The oro-pharyngeal leak pressure or in other words airway sealing pressure was not significantly different between the three groups although there was a trend towards increasing OLP as the size of the LMA increased. It has been shown that with a larger sized LMA, the disadvantage is that it may protrude into the mouth and may lead to a higher incidence of side effects e.g. sore throat or lingual nerve damage [7].

Thus, there appears to be a balance between the choice of a larger sized LMA, which would increase the airway sealing pressure but lead to a loss of the natural curve of the LMA. There would also be a risk of increased oro-pharyngeal pathology particularly if the cuff of the LMA could be seen at the back of the open mouth. On the other hand, too small a sized LMA would not be optimally positioned over the vocal cords and theoretically might lead to excessive leak particularly if positive pressure ventilation is used [1].

Thus, the suggested method of size selection of LMA for Malaysian female adults is to first choose the size 4 and adjusting the cuff volume to the minimum necessary to achieve adequate seal. If the airtight seal is still unsatisfactory, slight flexion of head or gentle application of pressure to front of neck [3,10] are some useful manoeuvres that can be tried. If the seal is yet still unsatisfactory, then a larger sized LMA should be chosen and if the cuff is visible at back of mouth, use a smaller sized LMA.

Conclusion

A size 4 LMA was more optimally positioned and it fitted and functioned well for all patients in this study. Thus, we can conclude that the optimal size of laryngeal mask airway for the Malaysian female adult is the size 4.

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References

1. Brimacombe J, Brain AIJ, Berry A. The Laryngeal Mask Airway: A Review and Practical Guide. London: WB Saunders Company Ltd, 1997.
2. Voyagis GS, Batziouulis PG, Secha-Doussaitou PN. Selection of the proper size of laryngeal mask airway in adults. Anaesth and Analg 1996; 83: 663-4.
3. Berry AM, Brimacombe J, McManus KF, Goldblatt M. An evaluation of the factors influencing selection of the optimal size of laryngeal mask airway in normal adults. Anaesthesia 1998; 53: 565-70.
4. Brimacombe J, Keller C. Laryngeal mask airway size selection in males and females: ease of insertion, oropharyngeal leak pressure, pharyngeal mucosal pressures and anatomical position. Br J Anaesth 1999; 82: 703-7.
5. Asai T, Howell TK, Koga K, Morris S. Appropriate size and inflation of the laryngeal mask airway. Br J Anaesth 1998; 80: 470-4.
6. Asai T, Murao K, Yukawa H, Shingu K. Re-evaluation of appropriate size of the laryngeal mask airway. Br J Anaesth 1999; 83: 478-9.
7. Asai T, Brimacombe J. Cuff volume and size selection with the laryngeal mask. Anaesthesia 2000; 55: 1179-184.
8. Keller C, Brimacombe J, Keller K, Morris R. Comparison of four methods for assessing airway sealing pressure with the laryngeal mask airway in adult patients. Br J Anaesth 1999; (82): 286-7.
9. Brimacombe J, Berry A. A proposed fibre-optic scoring system to standardise the assessment of the laryngeal mask airway position. Anesth Analg 1993; 76: 457.
10. Keller C, Brimacombe J. The influence of head and neck position on OLP and cuff position with the flexible and standard LMA. Anesth Analg. 1999; 88: 913-6.