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Research Article

Which Criterion Is Appropriate for Laryngeal Mask Airway Size in Women: Weight or Height?

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ABSTRACT

Background: In this study, we try to determine which of this two criteria (height or weight) is a better for determining the appropriate size of the laryngeal mask airway for Iranian women.

Methods: This randomized controlled trial was performed on 300 females with ASA I-II who were candidate for eye surgery. In the weight group, the size of the laryngeal mask airway was selected according to the classical method and in the height group (height less than 170 cm: size 3, height above 170 cm: size 4) based on researcher's experience. Number of attempts, leakage and complications were evaluated during surgery, recovery and 24 hours later. Data was analyzed with SPSS v.16 and $P<0.05$ was meaningful.

Results: There weren't significant difference between 2 groups for demographic parameters. Our study shows significant decrease in the number of laryngeal mask airway insertion attempts, the amount of air leakage, the sore throat at recovery and the day after the surgery, and the bloody laryngeal mask airway cuff, in the height group than weight group.

Conclusion: We concluded that laryngeal mask airway size based on the patients' height leads to faster and easier application and fewer side effects than choosing the size based on the patients' weight.

Laryngeal Mask Airway (LMA) is necessary for keeping the airway open and proper ventilation on general anesthesia. LMA is more tolerable than tracheal intubation, and also, with fewer complications, such as laryngospasm, dysphonia, cough and faster recovery [1-3]. Therefore, the LMA is a good selection for everyday use, especially in outpatient surgeries. But, it can cause mucosal injury and postoperative sore throat. Postoperative sore throat has been reported from 5.8% to 34% [3-5]. The appropriate size of LMA, the lack of a leakage and less pressure on the pharynx reduces the incidence of sore throats [5-7]. With the manufacturer's recommendation, the size of the LMA is chosen on the weight. But studies have shown that high weight is not a factor for larger pharynx's space, and may even be less the pharyngeal space in obese patients [8-9]. In other studies, selection of the LMA size on gender (size 4 for women and size 5 for men) provides better ventilation versus weight [10-13]. In a study, the size of a LMA based on the width of the tongue has been introduced as an appropriate method [6]. In this study, we try to determine which of two criteria (height or weight) is a better for determining the appropriate size of the LMA, and causes better ventilation and fewer complications for the patient.

Methods

After approval by the Local Ethics Committee No 950640, this randomized clinical trial was performed on 300 female patients with ASA I-II who were candidated for cataract surgery on general anesthesia. Obese people with Body Mass Index (BMI) greater than 40, patients with restricted mouth opening, gastroesophageal reflux, history of recent upper respiratory tract infection and sore throat were excluded from study.

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Patients were randomly assigned to one of the two groups with closed envelopes. After obtaining informed consent, in weight group, the size of the LMA was selected according to the classical method (weight 30-50 kg: size 3, weight 50-70 kg: size 4, weight above 70 kg: size 5); and in the height group based on researcher's experience (height less than 170 cm: size 3, height above 170 cm: size 4). General anesthesia induced with fentanyl 1-2 µg/kg, atracurium 0.3 mg/kg and Propofol 2 mg/kg. After about 2 minutes and jaw relaxation, an appropriate size of LMA was inserted in each group by classical method. LMA cuff was completely empty before insertion, and then was inflated at the recommended volume of each size (20, 30, 40 cc for 3, 4, 5 respectively). After confirmation with bag, the patient was ventilated mechanically. At the end of the surgery, with neostigmine and atropine injection, after return of respiration and consciousness, the LMA was removed and the patients were transferred to recovery.

The number of attempts for proper placement of the LMA, the amount of gas leakage around the cuff of the LMA at 10-15 cmH2o and the difference between expiratory volume and tidal volume were recorded. EtCo2 and SpO2 were recorded after the start of ventilation and during the surgery. After LMA removal were evaluated bloody LMA cuff, respiratory distress and laryngospasm. Patients' sore throat in recovery and after 24 hours were evaluated with Verbal Analogue Scale (VAS) (painless, mild pain VAS≤3, moderate pain VAS=4-6, and severe pain VAS≥7).

Statistically study

All patients referred to Eye Hospital in the 2-month period who were eligible for entry and exit criteria were randomly assigned to one of the two group of weight and height. Data for the demographic and clinical observations of patients were analyzed with using SPSS software version 16. To describe the data, descriptive statistical methods including central indices and frequency distribution were used. Chi-square or Fishers exact test was used to compare the frequency of study outcomes in the weight and height groups; and the independent sample t-test or Mann-Whitney test was used to compare the quantitative variables in the two groups. To evaluate normality of distribution of qualitative variables, Kolmogorov-smirnov and Shapiro-Wilks tests were performed. In all tests, $p<0.05$ was considered as a significant level.

Results

In general, 300 women were studied. There were 145(48.3%) patients in the weight group (WG) and 155(51.7%) patients in the height group (HG). There was no statistically significant difference between the two groups based on the demographic variables (Table 1). In the weight group, the LMA size was 3, 4 and 5 for 20.7%, 60.0% and 19.3% of patients respectively; Also, in the height group, the LMA size was 3 and 4 for 83.9% and 16.1% of patients respectively that were significantly different ($p<0.001$). The first successful attempt for placement of LMA in the weight group was 69.4% and in the height group was 94.3% and statistically, the number of attempts in the height group was different than the weight group ($p<0.001$) (Table 2). In the weight group, the difference between expiratory to inspiratory Volume was 73.1 ± 41.6 ml and in the height group was 21.7 ± 12 ml, which was statistically significant and lower in height group ($p<0.001$). The SpO2 and EtCO2 in 1, 5, 10, and 15 minutes after placement had no significant difference in the two groups (P= 0.34 and 0.72 respectively).

Table 1- Demographic parameters in the two groups (mean±sd)

Variables	Weight group n=145	Height group n=155	P-value
Age (Year)	55.0±15.5	54.8±15.1	0.982
Weight (Kg)	62.0±12.6	61.7±12.1	0.869
Height (Cm)	158.1±4.7	160.1±6.9	0.056

Table 2- The number of attempts to LMA insertion in two groups. N (%) P<0.0

Attempts	Weight group n=145	Height group n=155
once	101 (69.4)	146 (94.3)
Twice	32 (21.8)	6 (3.6)
thrice	12 (8.1)	3 (1.4)

The amount of gas leakage from the LMA cuff in the weight group was significantly different than the height group (Table 3). Bloody LMA cuff was 18% in the weight group; and was 5.9% in the height group, significantly was higher in the weight group ($p < 0.001$). The incidence of recovery sore throat in the weight group was significantly higher than height group ($p < 0.001$) (Table 4). Sore throat was 16.7% in the weight group, and only 2.0% in the height group after 24 hours. None of the patients in the two groups experienced Laryngospasm. Only 2 patients in the weight group and 1 patient in the height group after removal of the laryngeal mask showed a mild respiratory distress ($p = 0.51$).

Table 3- Incidence of the patients with gas leakage in two groups. N (%) P<0.001

Gas leakage (CMH2O)	Weight group n=145	Height group n=155
No leakage	97 (67.1)	136 (87.7)
Low	26 (18.2)	18 (11.7)
Much	22 (14.7)	1 (0.6)
Total	145 (100.0)	155 (100.0)

Table 4. Incidence of sore throat in two groups. N (%) P<0.001

Sore throat in recovery	Weight group N=145	Height group N=155
painless	118 (81.4)	146 (94.2)
Mild pain	27 (18.6)	8 (5.2)
Moderate pain	--	1 (0.6)
Severe pain	--	--

Discussion

The main findings of our study show that a significant decrease in the variables of the number of attempts, the amount of air leakage, sore throat at recovery and the day after, and also bloody LMA cuff were seen in the height group than weight group. There was no significant difference in the incidence of laryngospasm, respiratory distress, SpO2 and EtCO2 between the two groups.

The number of attempts for LMA placement is the main variables in determining the success rate. With the height criterion to determine the appropriate size of LMA can use the smaller laryngeal mask sizes, which makes it easy to use and it reduces the pharyngeal trauma and sore throat. Surprisingly, the smaller size of the LMA not only did not increase the gas leakage, but also, the amount of gas leaks was lower in this study.

Some researchers have concluded that larger masks increase the likelihood of cuff placement in the oral cavity and can increase sore throat and nerve injury. Then they suggested that if LMA cuff is seen in the mouth, it is better to replace [14]. On the other hand, in patients of the same height, those with a higher weight have not necessarily a larger airway, even due to more soft tissues may have a smaller hypopharynx. Therefore, the LMA will have better performance and fewer complications, due to better cuff placement. For this reason, Kim et al. suggested to use the ideal body weight to determine the size of the LMA [9]. In the present study, unlike most studies, the use of a smaller LMA than what was proposed by the manufacturing companies had not more gas leakage. In addition, the first success placement was desirable, compared to other studies (in the height group 94% in this study versus 77% to 97% in other studies) [9, 15-16]. Berry et al. considered that LMA with size 5 for all adults taller than 165 centimeters and size 4 for people less than 165 centimeters can be appropriate. Their suggestion is to use a size 5 mask for men and a size 4 for women and did not considered the size 3 appropriate [11]. Other similar studies have reported the same results [12-13]. The results of these studies are not similar with the present study. Of course, our study was conducted only in women, and in most studies, the appropriate size of a laryngeal mask in women was one number less than that of men. In our study, the size 4 for women with height above 170 centimeters and size 3 for women with height of 170 centimeters was desirable. In fact, the appropriate size of Iranian adult woman is often 3, which is different from the study by Rao et al. [17] on Malaysian adult women that the size 4 are appropriate for them, although this difference can be due to racial and anatomical differences.

Brimacombe and keller said that in men the LMA size 5 is better than the size 4, they showed that in women, both 4 and 5 have equal ventilation and equal pressure to the larynx, and the placement of masks is the same in both sizes; and also size 3 of LMA in adults is not appropriate [13]. On the other hand, some also believe that the use of a size 5 mask, especially in women, may be too large [13,18].

The weight criterion has been challenged by various researchers to select the size of the LMA. And in contrast; they have introduced criteria such as ideal weight, gender, age and height [6, 9, 12, 14, 18-19]. The use of weight criterion which is determined by the manufacturer's factories in obese patients, especially without regard to gender, may increase the risk of injury to the airway mucosa.

Conclusion

In this study, we compared height and weight in determining the size of LMA for women who candidates for cataract surgery. Determining the size of LMA by height was associated with easier placement and fewer complications. In our study LMA size 3 for women <170cm and size 4 for women >170cm were appropriate. It is recommended that this study be carried out on a more statistical society in a larger regional area, preferably in the whole country as well as in men, in order to disseminate the results to the Iranian community.

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