



# The Success Rate of Classic Laryngeal Mask Airway Insertion During General Anesthesia in Different Age Groups

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## Abstract

**Objectives:** Considering uncertainty about the effect of age on the success rate of laryngeal mask airway (LMA) insertion, the present study aimed to evaluate the success rate of LMA in airway management in different age groups.

**Materials and Methods:** A total of 183 patients, admitted to the Shohada hospital (Tabriz, Iran) during 2018-2019, were enrolled in this descriptive, cross-sectional, prospective study. The patients were selected through the convenience sampling method and divided into 4 age groups. After anesthesia, patients were compared in terms of duration and the number of LMA insertion attempts and LMA insertion complications. The data were analyzed in SPSS20 through ANOVA and the chi-square test at  $P < 0.05$ .

**Results:** There were statistically significant differences between different age groups regarding resistance against LMA insertion ( $P = 0.008$ ) so that insertion was mostly comfortable and easy in the first attempt in the adult group compared to other groups. However, no statistically significant difference was observed between different groups in terms of the rate of air leakage ( $P = 0.129$ ), the duration of successful LMA insertion ( $P = 0.119$ ), and the number of LMA insertion attempts ( $P = 0.091$ ). Regarding the LMA insertion complications, laryngospasm was significantly higher in the middle-aged and aged group ( $P = 0.009$ ), and blood observation on LMA was significantly higher in the pre-school and child group ( $P = 0.005$ ).

**Conclusions:** According to the results of this study, there was no difference between different groups in terms of successful LMA insertion and post-LMA insertion complications.

**Keywords:** Oxygenation, Ventilation, Laryngeal mask airway, Complications

## Introduction

The laryngeal mask airway (LMA) is a useful device designed for managing airways during general anesthesia. LMA has become a common alternative to airway management. The device is easily used by inexperienced people and provides proper management of airways both in patients with mechanical ventilation and those with spontaneous breathing. Due to the problems encountered in successful airway management, especially when it is done by novice users such as assistants and health care providers working in the trauma and emergency units, LMA can be highly helpful for the users (1-3).

There are many advantages for using an LMA over an endotracheal tube, the most important of which are the prevention of laryngospasm and non-irritation of the larynx. On the one hand, LMA insertion may be unsuccessful since it is inserted blindly without direct vision (4, 5). The difficult insertion of LMA in some people is another limitation of this device thus its proper insertion can ensure the maximum efficiency of using LMA in auxiliary ventilation. Research has shown that LMA is not properly inserted in one-third of attempts, and incorrect insertion can endanger the patients' life (6,7). Therefore, it is necessary to identify factors affecting the incorrect

insertion of this valuable device. In the meantime, obesity, head anatomy, neck problems, and airway trauma are among the contributing factors to the improper insertion of LMA. However, there are other factors, the effects of which have not been precisely determined yet (8,9).

The success rate of LMA insertion in different age groups has not been so far studied coherently, and laryngeal masks are mostly used in adults. Thus, there is no information about the success rate in different age groups. Given the importance of this subject, the present study aimed at evaluating the success rate of LMA insertion in airway management in four age groups. Achieving acceptable results regarding its efficiency, ease of use, and complications can help determine in which age group it could be used more or with caution so that to reduce airway complications and problems.

## Materials and Methods

### Study Design

This descriptive, cross-sectional, prospective study was conducted between June 20, 2018 and November 20, 2019 at Shohada hospital affiliated with Tabriz University of Medical Sciences. The sample size was determined based on the results of a pilot study on 5-patient groups.



## Key Messages

**What is the current knowledge?**

- ▶ LMA has the least complications for ventilation and oxygenation.
- ▶ LMA can be inserted in a short time and help with timely oxygenation.

**What are the innovations of this study?**

- ▶ LMA can be inserted in a shorter time in adults.
- ▶ LMA insertion is associated with complications in the children and aged groups.
- ▶ LMA is easier and more comfortable for adults than other age groups.

Successful LMA insertion was the primary outcome of this study. Considering  $\alpha = 0.05$ , the power of 80%, and an acceptable clinical difference, the final sample size was calculated to be 183 patients who were divided into 4 groups (10). The samples were enrolled in the study through the convenience sampling method according to inclusion and exclusion criteria. The inclusion criteria were an indication for LMA insertion and consent to participate in the study. On the other hand, the exclusion criteria were problems and pathologies of the pharynx, any anatomical problems of the mouth, throat, or larynx, pregnancy, hiatal hernia, patients prone to aspiration, those with airway problems, high airway resistance, patients with a body mass index of above 30, a history of cardiopulmonary problems, trauma and head and face injuries, any head and neck abnormalities, and people with airway problems in terms of intubation.

**Procedure**

Patients' airways were examined by an anesthesiologist the night before the surgery to make sure if they meet the inclusion criteria. They were then classified by age based on a study entitled "Age-specific search strategies for Medline." Then, the participants were assigned to four groups of pre-school and child (2-12 years old), adolescent (13-18 years old), adult (19-45 years old), and middle-aged and aged (45-80 years old) according to (11). After entering the operating room, receiving 500 mL of normal saline intravenously, and undergoing hemodynamic monitoring (heart rate, systolic and diastolic blood pressure, and arterial oxygen saturation measurement), the patients were routinely anesthetized using the classic LMA (TUOREN, Henan Tuoren Medical Device Company). Anesthesia was performed and managed by two anesthesiologists with a work experience of more than 5 years.

**Data Collection Tools**

The data collection tool had three parts:

1. Demographic information including age and gender.
2. The tool determining the number of LMA insertion attempts (which is classified as an easy insertion in

the first attempt without any resistance, easy insertion in the first attempt but with a little resistance, and slightly difficult insertion but successful in the second attempt), the duration and the number of attempts for successful LMA insertion, and the success rate of LMA insertion.

3. Complications associated with LMA insertion including air leakage and other complications (abdominal distension examined through hearing and stomach percussion, laryngospasm, and blood observation on LMA).

**Statistical Analysis**

Finally, the collected data were analyzed in SPSS 20 in four groups using the one-way ANOVA test. The data were presented as mean ( $\pm$  standard deviation) and frequency (percentage) for quantitative and qualitative variables, respectively. Descriptive measures such as skewness and kurtosis indicators, as well as fitness and reasonableness of the standard deviation (compared to the mean) were also evaluated, and P-values of less than 0.05 were considered statistically significant.

**Results**

The patients consisted of 130 males (71%) and 53 females (29%) in the age range of 26 months to 78 years with a mean age of  $27.03 \pm 18.46$  years, a median of 26 years, and an interquartile range of 24 years. The patients were assigned to four age groups of pre-school and child (2-12 years old,  $n=44$ ), adolescent (13-18 years old,  $n=35$ ), adult (19-45 years old,  $n=69$ ), and middle-aged and aged (45-80 years,  $n=35$ ). According to demographic characteristics, there was a statistically significant difference between different age groups in terms of demographic characteristics (Table 1).

The highest rate of slightly difficult LMA insertion but successful in the second attempt was observed in the pre-school and child group (11.4%), followed by the middle-aged and aged group (5.7%). The highest rate of easy LMA insertion in the first attempt but with little resistance was found in the middle-aged and aged group (14.3%), followed by the pre-school and child group (11.4%). Based on the results, the highest rate of easy LMA insertion in the first attempt without resistance was reported in the adolescent group (97.1%) and then in the adult group (91.3%). On the other hand, the lowest rate of easy LMA insertion in the first attempt without resistance was observed in the pre-school and child group (77.3%). This rate was 80% in the middle-aged and aged group (Figure 1). Finally, the highest frequency of easy LMA insertion in the first attempt was detected in the adult group which should be taken into account. However, slightly difficult LMA insertion in the second attempt was also found in the pre-school and child group. According to the results of ANOVA, a statistically significant difference existed between different age groups in terms of resistance to

**Table 1.** Comparison of the Demographic Characteristics of Participants

Variable	Groups (N=183)				P Value <sup>a</sup>
	Preschool and Child (n=44)	Adolescent (n=35)	Adult (n=69)	Middle-Aged and Aged (n=35)	
Age (Mean ± SD)	07.12 ± 01.45	15.43 ± 02.20	21.20 ± 01.55	49.44 ± 01.29	0.211
Gender/Male, N(%)	35 (26.92)	28 (21.53)	41 (59.42)	26 (20%)	0.259

Note. SD: Standard deviation.

<sup>a</sup>The applied test: ANOVA.

LMA insertion ( $P=0.008$ ) so that comfortable and easy LMA insertion in the first attempt was observed in the adult group.

Regarding the complications, there was no air leakage in 125 patients (68.3%) although slight, intermediate, and high rates of air leakage were observed in 50 (27.3%) and 7 (3.8%) patients and 1 patient (0.5%), respectively. LMA implantation lasted less than 15 seconds in 163 patients (89%) and more than 15 seconds in 19 patients (10.8%). Laryngeal mask was successfully implanted in only 101 patients (55.2%) in 5 seconds and only in 4.2% of patients the successful implantation time of the mask lasted more than 20 seconds. Based on the results (Table 2), the mask was successfully inserted in the first attempt in about 95% of patients, and after 3 attempts in only one patient (0.55%). There were no significant statistical differences between the groups in terms of the air leakage rate ( $P=0.129$ ), the duration of successful insertion ( $P=0.119$ ), and the number of insertion attempts ( $P=0.091$ ).

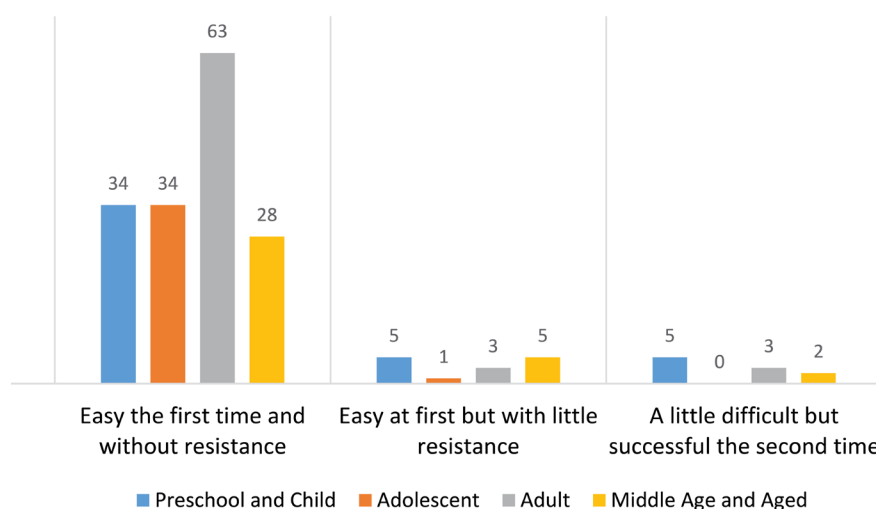
As regards LMA insertion complications, laryngospasm was observed in only one patient (0.5%) and blood on LMA in two patients (1.1%). However, no distention was observed in the remaining 180 participants (98.4%). The comparison of complications through ANOVA indicated that there were no significant statistical differences between different age groups (Table 3). The study of LMA-associated complications revealed significant statistical differences between different groups in terms

of laryngospasm ( $P=0.009$ ) and blood observations on LMA ( $P=0.005$ ) while there were no significant statistical differences between different age groups in terms of LMA-associated distention ( $P>0.999$ ).

## Discussion

The present study sought to examine the success rate of classic LMA insertion during general anesthesia in different age groups. The results indicated significant statistical differences between different age groups in terms of the resistance to LMA insertion so that the comfortable and easy insertion in the first attempt was mostly observed in the adult group compared with other groups. Therefore, LMA insertion in adults is extremely easier than in others. The use of LMA has been considered as a convenient way for maintaining mechanical ventilation in recent years, and many anesthesiologists use this method for mechanical ventilation. Meanwhile, many anesthesiologists apply this method more in adults because it has been more successful in this age group, which is in line with the results of our study. However, no study has evaluated the effects and success rate of LMA at different ages given that it can be used at different ages. Accordingly, anesthesiologists are cautious about using this method.

A similar study investigated the success rate of LMA insertion and supraglottic gel device (I-GEL) on 61 ASA Class I-II patients aging 18-70 years who were admitted



**Figure 1.** Resistance to LMA Embedding in Different Age Groups.

**Table 2.** Comparison of the LMA Insertion Duration, the Number of Required Attempts, and the Leakage Rate Between Different Age Groups Participating in the Study

Variable	Groups (N=183)				P Value	
	Preschool and Child (n=44)	Adolescent (n=35)	Adult (n=69)	Middle-age and Aged (n=35)		
Leakage of air	No leaks	37-20.21%	18-09.83%	55-30.05%	20-10.92%	0.129
	Low leakage	11-06.01%	9-04.91%	15-08.19%	15-08.19%	
	Medium leakage	1-0.54%	2-01.08%	2-01.08%	2-01.08%	
	High leakage	1-0.54%	0-0%	0-0%	0-0%	
Successful embedding time (s)	5	30-16.39%	15-08.19%	30-16.39%	12.01-10%	0.119
	6	1-0.54%	1-0.54%	2-01.08%	1-0.54%	
	10	6-03.27%	9-04.91%	25-13.66%	09.28-10%	
	15	0-0%	1-0.54%	2-01.08%	3-01.62%	
	20	0-0%	0-0%	2-01.08%	4-02.16%	
	> 20	1-0.54%	0-0%	3-01.62%	4-02.16%	
The number of attempts	1 time	42-22.95%	33-18.03%	66-36.06%	32-17.48%	0.091
	2 times	2-01.08%	2-01.08%	3-01.62%	1-0.54%	
	3 times	0-0%	0-100	0-0%	1-0.54%	

Note. SD: Standard deviation. Data are expressed as number-percent.

<sup>a</sup> The applied test: ANOVA.

**Table 3.** Comparison of LMA Insertion Complications Between Different Age Groups Participating in the Study

Variable	Groups (N=183)				P Value
	Preschool and Child (n=44)	Adolescent (n=35)	Adult (n=69)	Middle-age and Aged (n=35)	
Laryngospasm	0-0%	0-0%	0-0%	1-0.54%	0.009
Blood on LMA	2-01.08%	0-0%	0-0%	0-0%	0.005
Distension	0-0%	0-0%	0-0%	0-0%	<0.999

Note. SD: Standard deviation. Data are expressed as number-percent.

<sup>a</sup> The applied test: ANOVA.

for minor orthopedic surgery with a duration of less than 1 hour (12). In this study, the success rate of LMA insertion was reported to be 80.6% and 12.9% in the first and second attempts, respectively. The rate of unsuccessful LMA insertion was reported to be 6.5%. Our findings are in line with the theory that the overall success rate of LMA insertion is 100%. The development of oral and dental status, the presence of teeth, as well as adequate moisture in the mouth in the adult group seem to be the reasons for the greater success of LMA insertion in this group compared to other age groups.

Regarding the complications associated with LMA insertion, the rate of observed complications was extremely low. The only complication was laryngospasm which was mostly observed in the middle-aged and aged and in the pre-school and child groups (13,14), which is consistent with the results of the present study. Like this study, the complications associated with MLA insertion were not common in similar studies. These complications are mainly observed in the aged and child groups compared to other groups (1), which corroborate the results of the present study. The use of an LMA seems to be a semi-invasive procedure and the LMA is soft and does not put pressure on the nerves in the tracheal area or irritate the tracheal area. The method has the least side effects in the airway.

There were no significant statistical differences between different age groups in terms of air leakage, the successful LMA insertion duration, and the number of successful attempts. Other similar studies have also shown that LMA insertion is performed in a short time, and the rate of leakage after LMA insertion is often extremely low that it does not pose a problem for ventilation and oxygenation. Regarding the number of LMA insertion attempts, factors such as oral health, proper morphology of the mouth and teeth, and head and neck development are highly effective in this regard. The results of the present study are consistent with those of similar studies conducted in this field (15, 16). Considering that laryngeal mask placement does not require much skill and is easy to install, it would have been extremely easier for other skilled people if it had been embedded by skilled people. It was done in a short time. It should also be noted that the amount of air leakage depends on the patient's weight so that the size of the LMA should be larger (the choice of size is based on weight) as the patient's weight increases, and if the size of the LMA is chosen correctly, the amount leakage will represent a natural decrease.

#### Limitations of the Study

Failure to pay attention to the length of the operation, the lack of examination and attention to the presence/absence



of artificial teeth, and the lack of mucosal examination are some of the limitations of the present study.

### Conclusions

LMA can be used as a convenient and easy intubation method in all groups. The results of the present study revealed no difference between different groups in terms of successful LMA insertion and the related complications. However, it is better to use this method in the adult group more than others.

### Suggestions for Future Studies

Researchers suggest that this study be done after removing the limitations and weaknesses on a larger sample size to determine its exact effectiveness in different age groups.

### Authors' Contribution

MM: intervention, Study design; AS: follow-up; MP: intervention, article preparation, article submission.

### Conflict of Interests

Authors have no conflict of interests.

### Ethical Issues

In this study, the procedure was performed according to the operating room routines. All steps such as recording personal information and filling out the questionnaires were performed with the informed consent of patients without inserting the patient's name (from the previous file) and all patient information was considered confidential throughout the study. This study was commenced after obtaining the code of ethics from the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1398.179) and the required permissions from the authorities of Shohada Hospital (Tabriz University of Medical Sciences).

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