Original Article

Bull Emerg Trauma 2024;12(2):2-10.

Bulletin of Emergency And Trauma

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Impact of Oropharyngeal Stimulation during Laryngeal Mask Insertion on Cardiovascular Response in adult patients. A Double-blind Clinical Trial Study

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Received: January 22, 2024
Revised: March 4, 2024
Accepted: March 25, 2024

ABSTRACT

Objective: Laryngeal mask airway (LMA) insertion has been found to reduce cardiovascular responses when compared to laryngoscopy and intubation. This research aimed to examine the impact of various techniques employed for LMA insertion on cardiovascular response.
Methods: This randomized, double-blind clinical trial included 90 elective surgery candidates divided into three groups of 30. All patients underwent similar anesthesia. The LMA was inserted using the classical technique, 180° rotation technique, and face-to-face triple maneuver technique (FFTMT). The cardiovascular responses, the success rate of LMA placement, and other outcomes were documented and compared among the three methods.
Results: The study revealed that the blood pressure of patients 10 minutes after LMA insertion using the rotational technique was higher than the standard technique (p=0.019). The pulse rate in the third (p=0.044, p=0.024) and fifth minutes (p=0.028, p=0.048) following the insertion of LMA demonstrated higher values when utilizing the FFTMT than the standard and rotational technique groups, respectively. Moreover, the incidence of sore throat following surgery in the FTFTM group was slightly greater than that observed with the standard and rotation techniques (p=0.389 and p=0.688, respectively).
Conclusion: The findings of the present investigation indicated that implementing the classic technique for LMA placement resulted in a more consistent blood pressure (BP) and pulse rate (PR) response than the 180° rotation and FFTMT. Furthermore, the classical method exhibited a marginally lower success rate in terms of LMA insertion than the alternative methods.

Keywords: Hemodynamic, Insertion technique, Laryngeal mask airway, Supraglottic airway device.

Please cite this paper as:
Shetabi HR, Naserzadeh Z. Impact of Oropharyngeal Stimulation during Laryngeal Mask Insertion on Cardiovascular Response in adult patients. A Double-blind Clinical Trial Study. *Bull Emerg Trauma*. 2024;12(2):2-10. doi: 10.30476/BEAT.2024.101902.1499.

Introduction

Airway management and patient safety have always been a top priority for physicians, which has resulted in the development of various tools and techniques [1]. The Laryngeal Mask Airway (LMA) is a simple supraglottic device that can be inserted without requiring direct laryngoscopy [2]. Advancements in anesthesia and airway management have resulted in improved methods for placing supraglottic airways [3]. One of the advantages of using an LMA is its ability to prevent complications such as laryngospasm, bronchospasm, sore throat, postoperative hoarse voice, and cough [2]. Additionally, the LMA could be utilized in emergency situations and even by individuals with limited experience [4].

The LMA is an invaluable tool for protecting the airway of patients who have undergone short-term elective surgeries and possess spontaneous breathing [5]. Its adaptability and user-friendly nature make it an essential instrument in ensuring patient safety during such procedures. The utilization of an LMA presents a minimally invasive approach to airway maintenance, as it circumvents the need to pass through the glottis. Both the insertion of a laryngeal mask and tracheal intubation are considered unpleasant stimuli that trigger a temporary or pronounced sympathetic response. The activation of the sympathetic reflex tone can cause an increase in blood pressure and heart rate. While this may have minimal effects on healthy people, it can be detrimental or even fatal for patients with hypertension, myocardial insufficiency, or cardiovascular disease. Additionally, a sudden surge in blood pressure can result in left ventricular failure, cerebral hemorrhage, and myocardial ischemia [6-11].

After conducting a thorough examination of the existing literature, it was found that few studies have investigated the cardiovascular response to various techniques for laryngeal mask insertion. As a result, the present study aimed to investigate the effects of classical, rotational, and triple maneuver (FFTM) techniques of laryngeal mask insertion. Until today, this study is considered the first of its kind.

Materials and Methods

This randomized, double-blind clinical trial was conducted on 90 patients who were candidates for elective surgery in Faiz Educational Hospital affiliated with Isfahan University of Medical Sciences (Isfahan, Iran), from December 2022 to September 2023. The study was approved by the Research Ethics Committee of Isfahan University of Medical Sciences (code: IR.MUI.MED.REC.1401.353). Moreover, it was also registered in the Iranian Registry of Clinical Trials (code: IRCT20180416039326N22).

At first, 115 patients were included in the study based on the inclusion criteria of this study. Then, 25 patients were excluded. 19 patients did not meet the inclusion criteria, and 6 patients declined to participate in the study (Figure 1).

Inclusion criteria included being 18 years of age or older, having American Society of Anesthesiologists (ASA) grade I and II, and providing informed consent to participate in the study.

The study exclusion criteria were the predicted difficult airway (Mallampati class 4, mouth opening <3 cm, or thyromental distance (TMD) <6 cm), body mass index (BMI) of greater than 30 Kg/m^2, increased risk of aspiration, including people who were not fasting, gastroesophageal reflux disease (GERD), being pregnant, and hypersensitivities including asthma, chronic obstructive pulmonary disease (COPD), the upper respiratory tract infection (URTI), and neuromuscular disease. In addition, in case of prolonged surgery (more than 2 hours), the occurrence of allergic reactions to anesthetic drugs, or the need for more than 2 attempts to insert an LMA, the patient was excluded from the study and was replaced with another sample.

The patients were divided into three distinct groups using a table of random numbers generated by random allocation software. These groups were differentiated based on the method employed to insert the LMA, which included the standard technique, rotational technique, and triple airway maneuver. Figure 1 illustrates the mentioned division.

Before commencing the study, the patient's demographic data, including age, sex, weight, height, and BMI were documented. All participants fasted for 8 hours before the planned surgical procedure. Once admitted to the operating room, the medical staff continuously monitored the patients using instruments, such as electrocardiogram (ECG), non-invasive blood pressure (NIBP), pulse oximeter (SPO_2), and end-tidal carbon dioxide ($EtCO_2$).

Before the initiation of the surgical procedure, a range of hemodynamic parameters were documented, encompassing systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and peripheral oxygen saturation (SPO_2). The anesthesia was initiated after preoxygenation by administering intravenous fentanyl (2 µg/Kg), propofol (2 mg/Kg), and atracurium (0.3 mg/Kg). However, in elderly patients aged over 65 years, the dose of propofol used for anesthesia induction was reduced by 20%.

Following the induction of anesthesia, patients were ventilated with oxygen through a face mask for 2 minutes The LMA was then inserted by a skilled 4^{th}-year anesthesiology resident, who was familiar with both methods of LMA placement. Throughout the procedure, anesthesia was maintained by administering isoflurane in combination with oxygen and atracurium. Atracurium was initially administered at a dose of 0.3 mg/Kg, with repeated doses of 0.1 mg/Kg every 30 minutes.

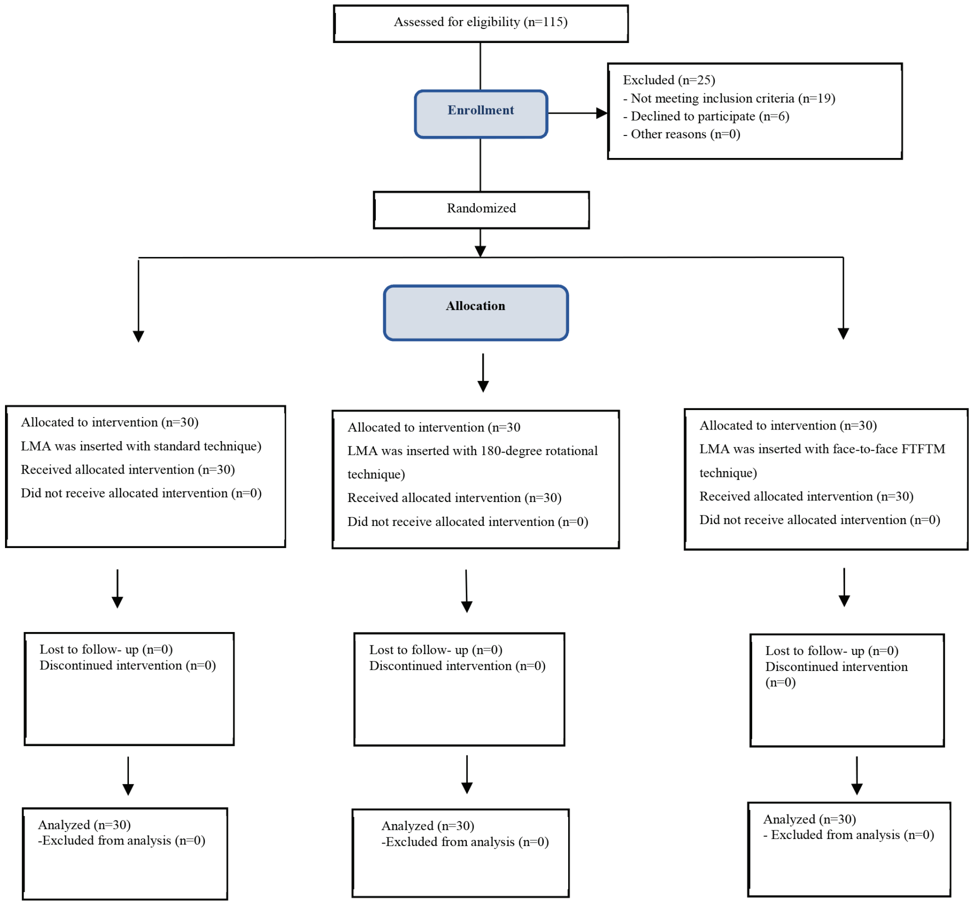

Figure 1. Consort flow diagram of the study.

To facilitate mechanical ventilation, a volume-controlled and time-cycled method was employed, with a tidal volume set between 5-8 mL/Kg. This ensured that the peak inspiratory pressure remained less than 20 cm of H_2O. Additionally, the frequency of the ventilator was adjusted to maintain $EtCO_2$ levels between 35- and 40-mm Hg, while maintaining an inspiratory to expiratory ratio of 1:2.

The appropriate size of the LMA Classic (LMA-C) was selected based on the manufacturer's guidelines and the patient's body weight. Patients weighing less than 50 Kg were fitted with a size 3 LMA-C, those with a weight between 50 Kg and 70 Kg received a size 4 LMA-C, and individuals weighing more than 70 Kg were provided with a size 5 LMA-C. During the insertion of the LMA, the patient's head was placed in the sniffing position, with the atlanto-occipital joint extended and the neck flexed.

The LMA was inserted by an experienced anesthesiologist with at least 5 years of experience, utilizing one of the standard, rotational, or FFTM techniques. Each of the three methods involved applying a water-based lubricant to the LMA's cuff.

In the standard technique, the LMA cuff was completely deflated and grasped as a pen; then, inserted by pressing upwards along the palatopharyngeal curve using the index finger. The LMA was then carefully advanced into the hypopharynx until a clear resistance was encountered.

In the rotational technique, the LMA was inserted using the guedel airway insertion technique [12]. The patient's head was placed in a certain position, with the head extended at the Atlanta-axial joint and flexed at the neck. The LMA was inserted with the cuff facing the nose and hard palate; then, advanced into the base of the hypopharynx until resistance was detected. At this stage, the LMA was rotated 180° counterclockwise.

In the FFTMT, the LMA was inserted utilizing the triple airway maneuver, which involved head tilt, chin lift, and jaw thrust. The anesthesiologist positioned themselves face to face with the patient and performed the following steps: the second and third fingers of the non-dominant hand were advanced from the tongue's surface towards the oropharynx as far as possible. Subsequently, the triple airway maneuver was performed, involving head tilt, chin lift, and jaw thrust. The dominant hand then placed the LMA cuff on the non-dominant hand's fingers and pushed them forward until the LMA was appropriately positioned in the throat. The fingers of the non-dominant hand were then removed from the patient's mouth, while the dominant hand held the LMA, and the head was returned to its normal posture [13].

Finally, for three techniques, the LMA was inflated with 20 cc of air (size 3), 30 cc (size 4), and 40 cc (size 5), and the leakage was measured using tidal volume and a capnograph.

Outcome Measurement

Hemodynamic parameters such as BP, DBP, MAP, PR, and SPO_2 were measured and recorded at specific time intervals after the insertion of the LMA.

The criteria for proper LMA placement included maintaining a stable airway, lifting the LMA when the cuff was inflated, observing the prominence of the anterior part of the neck while inflating the cuff, and positioning the LMA in the center line and at the level of the patient's upper incisors. To assess proper ventilation, several criteria were considered. These criteria included adequate expansion of the chest, maintaining stable oxygen delivery, observing a nearly square wave pattern on the capnograph, and providing a minimum tidal volume of 7 mL/Kg. If all four of these criteria were met, ventilation was considered optimal. Conversely, if none of these criteria were met, ventilation was deemed insufficient [14].

The LMA sealing pressure, also known as oropharyngeal leak pressure (OLP), was evaluated by determining the maximum available airway pressure before air leakage occurred. To determine the OLP, the ventilator was turned off and an adjustable pressure limiting (APL) valve was set at 30 cm H_2O. The fresh gas flow (FGF) was then set to 3 L/min, and the airway pressure was gradually increased until it reached a plateau pressure or an air leakage was observed. The airway pressure at this point was considered to be the OLP. A higher OLP indicated better placement of the LMA and a reduced risk of aspiration and gastric distension [8].

The ease of LMA placement was graded on a scale from 1 to 4, with 1 indicating no resistance, 2 suggesting mild resistance, 3 indicating moderate resistance, and 4 indicating inability to place the device [15].

Additionally, the ease rate of LMA insertion and the number of attempts required for successful placement of the LMA were recorded. If two failed attempts occurred due to increased oropharyngeal irritation and their potential impact on the results, the subject was excluded from the study and replaced with another participant. However, it was important to note that no individual required more than two attempts to insert the LMA. Other factors such as bleeding after surgery, laryngospasm, and the time required for LMA insertion were also documented.

All statistical analysis was performed using SPSS version 26. Both the quantitative and qualitative data were presented as mean±SD and n (%), respectively. As the Kolmogorov-Smirnov test results showed that the data were normally distributed, the one-way analysis of variance (ANOVA) was used to compare the mean of the quantitative variables among the three groups, as well as a post hoc test to compare the mean of the quantitative variables between the two groups. Moreover, the repeated measures ANOVA was applied to compare the changes in the mean of quantitative variables among the three groups 10 min after the insertion of LMA. In addition, the Chi-Square test and Fisher's exact test were used to compare the frequency distribution of qualitative variables among the three groups. A *p*-value less than 0.05 was considered statistically significant.

Results

In the present study, patients with three different techniques of LMA insertion, including standard, triple, and rotational, had no significant differences with each other in terms of basic and clinical characteristics, including age, sex, ASA, weight, height, BMI, and duration of surgery ($p>0.05$) (Table 1).

The analysis of the hemodynamic parameters of the patients across the three different techniques of LMA insertion revealed significant findings. Following the insertion of the LMA using the rotational method, there was a significant increase in the mean values of SBP, DBP, and MAP compared to the classic method at the 10-minute mark (114.27±16.36 mmHg vs. 103.27±16.27 mmHg for SBP, 72.93±14.48 mmHg vs. 63.67±12.04 mmHg for DBP, and 91.63±14.11 mmHg vs. 79.27±15.97 mmHg for MAP) ($p=0.019$, $p=0.008$, and $p=0.003$, respectively). In contrast, the aforementioned parameters indicated no significant differences between the FFTMT and the rotational methods. The mean values for SBP were 107.40±20.48 mmHg and 114.27±16.36 mmHg,

Table 1. Demographic and clinical characteristics of patients among three groups

Variables	Classic technique (n=30)	FFTM technique (n=30)	Rotational technique (n=30)	*P*-value
Sex				
Male	13(43.3%)	9(30.0%)	18(60.0%)	0.064
Female	17(56.7%)	21(70.0%)	12(40.0%)	
Age; year	54.79±17.68	55.63±18.27	56.67±11.20	0.904
ASA				
I	12(40.0%)	14(46.7%)	18(60.0%)	0.288
II	18(60.0%)	16(53.3%)	12(40.0%)	
Weight; Kg	67.77±10.32	65.77±12.42	70.70±12.48	0.270
Height; cm	167.90±8.99	165.53±8.97	169.07±7.31	0.263
BMI; Kg/m^2	23.94±2.41	23.91±3.67	24.72±3.93	0.584
Surgery Duration; min	39.94±12.14	33.11±13.06	38.17±13.19	0.128

while the mean values for DBP were 69.23±13.05 mmHg and 72.93±14.48 mmHg, and the mean values for MAP were 86.53±16.62 mmHg and 91.63±14.11 mmHg, respectively (*p*=0.139, *p*=0.282, and *p*=0.462). Furthermore, the PR measured at the third and fifth minutes post-LMA insertion in the FFTMT technique (75.73±12.49 and 70.60±10.97) were significantly higher than those in the classic (69.73±14.60 and 64.40±11.91) and rotational techniques (68.40±9.59 and 65.03±9.26) (*p*=0.044, *p*=0.678, and *p*=0.024). Nevertheless, there were no significant variances in mean SPO_2 levels among the three groups at any of the evaluated time points (*p*=0.824, *p*=0.106, *p*=0.532, and *p*=0.790). These findings are summarized in Table 2 and illustrated in Figure 2.

Moreover, the initial endeavor at LMA insertion utilizing the standard method resulted in a success rate of 93.3%, while both the traditional and rotational methods achieved a success rate of 96.7%.

There was a statistically significant difference between the standard method and the triple method (*p*=0.254), between the standard method and the rotational method (*p*=0.492), and between the triple method and the rotational method (*p*=0.492).

The ease of LMA insertion was 66.7% in the standard method, 83.3% in the triple method, and 83.3% in the rotational method. LMA insertion was achieved

Table 2. Comparison of hemodynamic parameters mean of patients among three groups

Variables	Classic technique (n=30)	FFTM technique (n=30)	Rotational technique (n=30)	P1	P2	P3
Systolic Blood pressure; mmHg						
Baseline	138.10±18.94	139.07±20.89	136.13±16.09	0.842	0.685	0.546
T_1	127.40±19.42	124.97±26.85	116.43±20.01	0.674	0.061	0.143
T_3	107.50±21.17	109.80±24.01	108.37±20.69	0.687	0.879	0.801
T_5	102.07±20.40	106.23±21.66	105.87±16.69	0.415	0.457	0.943
T_{10}	103.27±16.27	107.40±20.48	114.27±16.36	0.371	0.019	0.139
P4	<0.001	<0.001	<0.001			
Diastolic Blood pressure; mmHg						
Baseline	83.47±10.09	88.67±12.91	84.17±10.60	0.077	0.810	0.126
T_1	79.87±15.42	80.90±16.39	78.80±13.40	0.439	0.124	0.072
T_3	70.77±14.90	72.30±14.10	69.03±13.21	0.674	0.635	0.372
T_5	63.70±12.88	67.43±12.75	66.00±12.67	0.261	0.487	0.665
T_{10}	63.67±12.04	69.23±13.05	72.93±14.48	0.107	0.008	0.282
p value[2]	<0.001	<0.001	<0.001			
Mean arterial pressure; mmHg						
Baseline	109.67±15.03	110.30±18.26	107.03±16.99	0.884	0.546	0.454
T_1	97.90±18.68	99.93±21.23	98.90±15.97	0.407	0.152	0.085
T_3	84.33±19.02	88.83±19.07	84.77±17.32	0.348	0.928	0.397
T_5	80.17±16.31	84.73±16.34	81.73±14.42	0.264	0.700	0.462
T_{10}	79.27±15.97	86.53±16.62	91.63±14.11	0.075	0.003	0.209
p value[2]	<0.001	<0.001	<0.001			
Pulse Rate; bpm						
Baseline	74.40±11.18	79.53±14.66	73.33±14.83	0.149	0.763	0.082
T_1	74.63±13.29	77.40±12.04	72.13±10.88	0.379	0.426	0.096
T_3	69.73±14.60	75.73±12.49	68.40±9.59	0.044	0.678	0.024
T_5	64.40±11.91	70.60±10.97	65.03±9.26	0.028	0.820	0.048
T_{10}	63.67±10.51	68.67±9.81	65.07±11.16	0.069	0.607	0.188
p value[2]	<0.001	<0.001	0.002			
SPO_2; %						
Baseline	97.43±1.61	97.30±1.92	97.43±1.57	0.763	0.126	0.145
T_1	99.40±0.97	99.43±0.86	99.83±1.18	0.899	0.732	0.824
T_3	99.40±0.77	99.53±0.73	99.23±0.63	0.470	0.367	0.106
T_5	99.23±1.10	99.43±0.73	99.30±0.54	0.350	0.755	0.532
T_{10}	99.13±1.28	99.33±0.92	99.40±0.56	0.425	0.288	0.790
p value[2]	<0.001	<0.001	<0.001			

P1: The significance level obtained from Tukey's post hoc test comparing the mean of quantitative variables in the standard technique with the triple technique in each of the follow-up times. P2: The significance level obtained from Tukey's post hoc test comparing the mean of quantitative variables in the standard technique with the rotational technique in each of the follow-up times. P3: The significance level obtained from Tukey's post hoc test comparing the mean of quantitative variables in the triple technique with the rotational technique in each of the follow-up times. P4: The significance level obtained from the Repeated Measurements ANOVA comparing the mean of quantitative variables over time within 10 minutes after LMA insertion in each of the three studied techniques. T1: one minute after LMA insertion, T3: three minutes after LMA insertion, T5: five minutes after LMA insertion, T10: ten minutes after LMA insertion

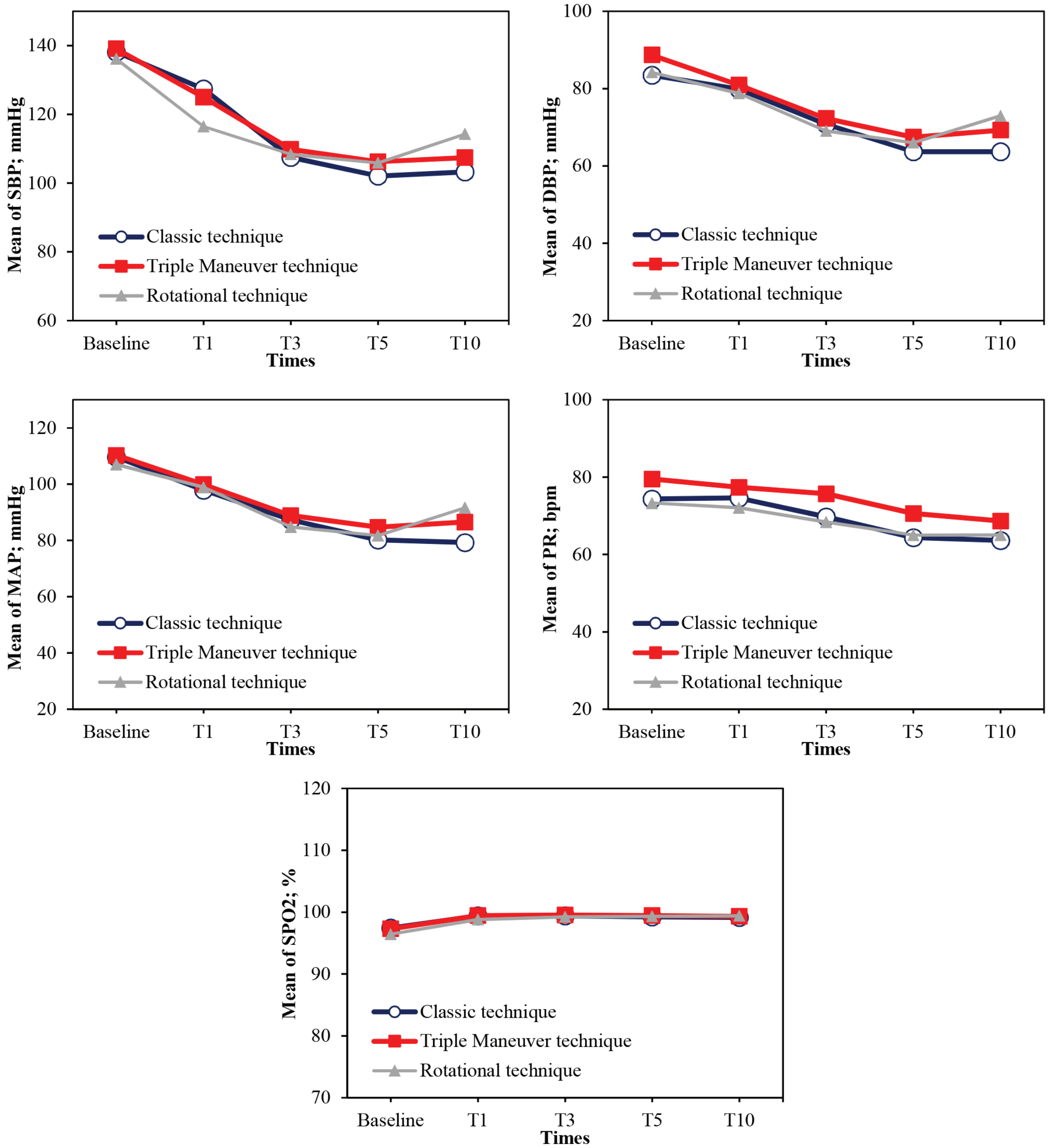

Figure 2. Linear chart of the mean hemodynamic parameters in the three groups

without resistance (p-value between standard and triple=0.430, between standard and rotational p=0.124, and between triple and rotational p=0.261).

In terms of the average time required for LMA insertion, the standard and triple methods had average times of 10.5±4.7 and 10±4.03 seconds, respectively, which were higher than the rotational method with 9.7±4.7 seconds. The p-value between standard and triple was 0.659, between standard and rotational was 0.512, and between rotational and triple was 0.792.

The oropharyngeal leakage pressure measured 22.93±4.02 cm H_2O in the classic method, 22.97±3.69 cm H_2O in the triple method, and 22.00±2.96 cm H_2O in the rotational method. The p-value between standard and triple was 0.968, between standard and rotational was 0.312, and between rotational and triple was 0.266.

The incidence of blood in the LMA cuff was 6.7% in the classic method, with no occurrences in the other two methods. As indicated in Table 3, there were no significant differences between the classic method the triple method, and the rotational method (p=0.492, p=0.492, respectively).

Discussion

The results of the present study demonstrated that the blood pressure 10 min after LMA insertion in the rotational technique was significantly higher than that of the standard method. However, there was no significant difference between the patients in the rotational group and the FFTM technique. In addition, PR in the third and fifth minutes after LMA insertion in the FFTM technique was significantly higher than in the other two groups. There was no significant difference in SPO_2 levels among the three groups.

Table 3. Comparison of the distribution of primary and secondary outcome measures of patients among three groups

Insertion parameters	Classic technique (n=30)	FFTM technique (n=30)	Rotational technique (n=30)	P1	P2	P3
LMA placement attempt						
Success at First Attempt	28 (93.3%)	29 (96.7%)	29 (96.7%)	0.254	0.492	0.492
Need for a second attempt	2 (6.7%)	1 (3.3%)	1 (3.3%)			
Ease of insertion of LMA						
No resistance	20 (66.7%)	25 (83.3%)	25 (83.3%)	0.430	0.124	0.261
Mild resistance	10 (33.3%)	5 (16.7%)	4 (13.3%)			
Moderate resistance	0 (0%)	0 (0%)	1 (3.3%)			
Insertion Time (Sec)	10.5±4.7	10±4.03	9.7±4.7	0.659	0.512	0.792
Oropharyngeal Leak Pressure (cm H_2O)	22.93±4.02	22.97±3.69	22.00±2.96	0.968	0.312	0.266
Post-Operative Sore Throat	2 (6.7%)	4 (13.3%)	3 (10%)	0.389	0.640	0.688
Laryngospasm	0 (0%)	0 (0%)	0 (0%)	-	-	-
Blood-stained LMA (Trauma %)	2 (6.7%)	0 (0%)	0 (0%)	0.492	0.492	-

P1: The significance level resulting from comparing the mean of quantitative variables or the frequency distribution of qualitative variables in the standard technique with the FTFTM technique in each of the follow-up times, respectively, by Tukey's post hoc test and Fisher's exact test. P2: The significance level resulting from comparing the mean of quantitative variables or the frequency distribution of qualitative variables in the standard technique with the rotational technique in each of the follow-up times by Tukey's post hoc test and Fisher's exact test, respectively. P3: The significance level resulting from comparing the mean of quantitative variables or the frequency distribution of qualitative variables in the FTFTM technique with the rotational technique in each of the follow-up times by Tukey's post hoc test and Fisher's exact test, respectively.

In this regard, the results of the study by Shetabi *et al.,* indicated that the hemodynamic parameters including SPO_2, SBP, DBP, MAP, and HR were not significantly different between the standard and FFTM techniques in LMA insertion in any of the follow-up times [13]. Bennett *et al.,* also showed that the use of LMA instead of tracheal intubation could provide airway management without hypertension and tachycardia and could be considered during anesthesia for individuals with coronary artery disease [16].

Some previous studies reported that patients with LMA had superior hemodynamic stability and better cardiovascular response than those with other airway management techniques, such as endotracheal intubation and combi-tube [17, 18].

Chen *et al.,* compared the effectiveness of ProSeal LMA insertion guided by a soft, direct optical Foley Airway Stylet Tool (FAST) with the standard introducer tool (IT), and found no significant difference between the two groups in terms of hemodynamic responses to insertion [19].

As shown in the present study, the classical technique resulted in more stability of BP or HR than the other two groups, whereas the rotational techniques and FFTM were less different in terms of hemodynamic response. The present investigation revealed that the initial attempt to insert the LMA using the rotational and FFTM methods had a success rate of 96.7%, while the classic technique had a success rate of 93.3%. Based on the findings, there was no statistically significant variance in the success rate of the first attempt for LMA insertion between the three groups. Furthermore, no significant differences were observed between the three groups concerning the ease of LMA insertion, oropharyngeal leak pressure (OLP), the occurrence of blood-stained LMA, and the incidence of sore throat.

In the study by Eglen *et al.,* the success rate of LMA insertion on the first attempt was 88.3% in the standard group, 78.3% in the rotational group, and 88.3% in the triple group. The time taken for LAM insertion in the triple group was significantly less than the other two groups [7]. In their study, the success rate of LMA insertion in the triple and standard groups was the same or more than the rotational group. However, in the present study, the success rate of LMA insertion in the rotational group was higher than the other two groups. Besides, the ease of LMA insertion in the rotational group was greater than in the triple group.

Shyam *et al.,* found that the first attempt success rate in the standard technique was 83.9%, in the 90-degree rotational technique was 75%, and in the 180-degree rotational technique was 93.5%. No statistically significant difference was observed between the three groups in terms of the secondary outcomes [20], which was consistent with the findings of the present study, because the 180-degree rotational technique had the highest rate of the first attempt success.

Shetabi *et al.,* showed that the performance of LMA in the FFTMT was as good as the classical technique. Therefore, the number of attempts to place LMA did not differ between the two groups. Besides, laryngeal mask placement time, oropharyngeal leak pressure, frequency of hoarseness, and laryngospasm had no significant difference between the two groups. However, the ease of insertion was reported to be better in the second method [13].

In line with the present study, previous studies also indicated that the 180-degree rotational technique could improve the ease and success rate of LMA insertion in children and adults compared to the standard technique [9, 21], and it was also more successful than the 90-degree rotational technique [19, 20].

It should be noted that the rotational technique could increase the risk of mucosal damage, but in the present study, no sore throat or blood stains were observed in the patient's mouth. Therefore, in line with previous studies, this technique was not associated with any special secondary outcome [22].

In another study, the success rate of the first attempt to insert was reported as 86%, although this was attributed to the use of neuromuscular blocking medication to facilitate the insertion [8, 24]. LMA insertion with its lumen facing backward facilitates advancement at a right angle against the posterior wall of the pharynx. According to our experience, another advantage of this technique was that it did not require intraoral manipulation or assistance. In children, the rotational technique was associated with a higher success rate for insertion and fewer complications [14, 25]. The lower success rate reported in adults might be due to differences between the airway anatomy of children and adults and the larger size of the airway apparatus in adults.

However, some other researchers recommended the triple or rotational technique when they have to use a disposable LMA and reported that having experience in using the triple technique might be regarded as important in terms of operating speed and LMA insertion success rate [21-23].

Another study demonstrated that the thumb insertion technique was just as successful as the index finger insertion technique in terms of ease and success rate of LMA insertion. However, the type of LMA could be effective in the success rate of the insertion using intraoral manipulation. They found that the folding of the epiglottis could be one of the outcomes that was mostly reported in the standard technique but rarely seen in the triple or rotational technique [9, 24, 25].

It is also worth mentioning that the success rate of the LMA insertion, in addition to the insertion technique, could be influenced by the depth of anesthesia and the anesthetic drugs used; as it could be effective in the removal of airway reflexes, movement, hemodynamic responses, and airway response during LMA insertion. Therefore, given that muscle relaxants were effective in facilitating the LMA insertion. In the present study, an anesthetic regimen including midazolam, fentanyl, propofol, and atracurium was used for all patients.

Despite the limitation of a small sample size, this study had certain strengths. The utilization of a consistent anesthesia method and the inclusion of atracurium in the anesthesia regimen were notable strengths. Furthermore, the comparative assessment of cardiovascular and hemodynamic responses among patients using the three aforementioned techniques, as the initial clinical trial study, added to the overall strength of this research. Nevertheless, evaluating the efficacy and physiological responses of patients undergoing LMA insertion with various techniques might provide valuable insights into the various anesthesia modalities. Hence, it is recommended that future research take this aspect into consideration.

The findings of the present study demonstrated that the conventional method for LMA implantation could lead to greater stability in BP and PR response than the 180° rotation and FFTM techniques. Moreover, the success rates of LMA insertion using the 180° rotational and FFTM methods were slightly higher than the classical method.

Declaration

Ethics approval and consent to participate: The research protocol received approval from the ethics committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1401.353). All patients signed an informed consent to before enrolling in the study.

Consent for publication: All authors expressed their consent to the publication of this study.

Conflict of Interest: The authors declared that there was no conflict of interest.

Funding: There was no funding support for this study.

Authors' Contribution: The conception and design of the work by H.S; Data acquisition by Z. NZ; Analysis and interpretation of data by Z. NZ; Drafting the work by HS; Revising it critically for important intellectual content by HS; All the authors approved the final version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work.

Acknowledgment: The authors sincerely thank the staff of Faiz Hospital for their invaluable support and active involvement in facilitating the execution of the present study.

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