Original Article

Bull Emerg Trauma 2024;12(3):111-116.

Bulletin of Emergency And Trauma

Comparing the Efficiency of Laryngeal Mask Airway and Endotracheal Tube Insertion in Airway Management in Patients Planning for Elective Orthopedic Surgery under General Anesthesia: A Randomized Clinical Trial

Mehrdad Malekshoar[1], Pourya Adibi[1], Hashem Jarineshin[1], Ehsan Tavassoli[1], Navid Kalani[1], Tayyebeh Zarei[1], Mehrdad Sayadinia[2], Majid Vatankhah[1*]

[1]Anesthesiology, Critical Care and Pain Management Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran

***Corresponding author:** Majid Vatankhah*
Address: Critical Care and Pain Management Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
e-mail: hormozgan91@yahoo.com

Received: April 20, 2024
Revised: May 20, 2024
Accepted: June 15, 2024

ABSTRACT

Objectives: The present study compared respiratory parameters between the two methods of airway establishment, ETT and LMA, for patients scheduled for orthopedic surgery with general anesthesia.
Methods: This randomized double-blinded clinical trial was conducted on patients scheduled for elective orthopedic surgery under general anesthesia, in Bandar Abbas, Iran, from January 2021 to December 2021. Using a random allocation table, the study participants were randomly divided into two groups, to employ either ETT (n=48) or LMA insertion (n=48). The study's ultimate goal was to assess the respiratory parameters in 1, 3, 5, 10, and 15 minutes following intubation.
Results: At all-time points, the average of peak airway pressure (P peak) and P plateau parameters in the ETT group was much higher than the EMA group (p<0.001 in all comparisons). The value of dynamic lung compliance in the LMA group was significantly higher than the ETT group in all considered time periods (p<0.001 in all comparisons). The upward trend in the value of this index was significant only in the LMA group (p=0.030). There were no significant differences in arterial oxygen saturation and end-tidal carbon dioxide levels between the two groups (p>0.05).
Conclusion: In terms of arterial oxygen saturation stability and at the same time providing respiratory dynamic compliance, the LMA device outperformed the ETT.

Keywords: Laryngeal mask airway, Endotracheal intubation, Dynamic lung compliance.

Please cite this paper as:
Malekshoar M, Adibi P, Jarineshin H, Tavassoli E, Kalani N, Zarei T, Sayadinia M, Vatankhah M. Comparing the Efficiency of Laryngeal Mask Airway and Endotracheal Tube Insertion in Airway Management in Patients Planning for Elective Orthopedic Surgery under General Anesthesia: A Randomized Clinical Trialy. *Bull Emerg Trauma*. 2024;12(3):111-116. doi: 10.30476/beat.2024.102372.1509.

Introduction

During general anesthesia, endotracheal intubation may stimulate the sympathetic system because of the hemodynamic response to laryngoscopy, causing an increase in blood pressure, heart rate, and cardiac load due to the release of catecholamine [1]. These changes last a maximum of 1 minute after intubation and can last up to 5-10 minutes [2]. In fact, reflex vasoconstriction occurs within a few seconds, followed by sinus tachycardia, which reaches its peak within 2 minutes and lasts for 2 minutes. These changes are mostly transient and do not have any adverse consequences for the patient. However, sometimes the mentioned responses are life-threatening and could lead to the occurrence of left ventricular failure and cerebral ischemia [3]. In other words, these responses are threatening and dangerous in people who have coronary failure or high blood pressure. The induction of anesthesia causes a loss of airway control and airway protective reflexes [4]. In this context, supraglottic airway devices are often used as an alternative to tracheal intubation [5]. Laryngeal mask airway (LMA) was introduced between 1983 and 1985 for airway management when endotracheal intubation was not required. However, this method was associated with an increased risk of aspiration [6]. Nevertheless, the ProSeal laryngeal mask airway (PLMA) has a dorsal cuff in addition to the peripheral LMA cuff, which compresses the anterior mask to minimize air leakage and aspiration [7]. One of the advantages of using a laryngeal mask to create an airway is that it improves hemodynamic stability, reduces coughing during awake, and reduces postoperative sore throat [8]. LMA is the most effective supraglottic device currently used in airway management. Although LMA can be utilized in pediatric airway management, its use is contraindicated in patients at risk of aspiration of gastric contents. However, if it is properly inserted and mechanical ventilation is set to positive pressure, aspiration of gastric contents is rarely observed [9]. The LMA provides advantages over the endotracheal tube, such as less airway manipulation and easier application. Besides, it is a viable alternative to the endotracheal tube, especially in short-term procedures [10]. LMA is less invasive and causes less discomfort afterward. It causes fewer hemodynamic alterations than endotracheal tubes [11]. The present study aimed to compare respiratory parameters in patients scheduled for orthopedic surgery with general anesthesia using endotracheal intubation or a laryngeal mask.

Materials and Methods

This randomized double-blinded clinical trial was conducted on patients planning for elective orthopedic surgery under general anesthesia at a referral hospital in Bandar Abbas, Iran, from January 2021 to December 2021. All patients aged 20 to 65 years, with the American Society of Anesthesiologists (ASA) score I to II. Those with a history of chronic obstructive pulmonary diseases, asthma, interstitial lung disease, pulmonary fibrosis with an active lung infection, left ventricular ejection fraction of less than 40%, body mass index (BMI) higher than 35 Kg/m^2, requiring emergency surgery, or airway malformation were all excluded from the study. The study protocol was ethically approved by the Ethics Committee of Hormozgan University of Medical Sciences (ethical code: IR.HUMS.REC.1400.344). After receiving sufficient information about the details of the study design, all patients signed a written informed consent form. This study was also registered in the Iranian Registry of Clinical Trials (code: IRCT20220612055153N1).

Using a random allocation table, the study participants were randomly assigned to two groups. Before surgery, two units of blood were reserved for each patient, and baseline routine laboratory parameters were measured. All patients received 40 mg of pantoprazole and 1 mg of lorazepam orally the day before the operation and the morning of the operation. In the operating room, all patients were monitored for heart rate, pulse oximetry, and blood pressure. Induction of general anesthesia was considered with similar planning for all participants using propofol (2 mg/Kg) and atracurium (0.5 mg/Kg). In the first study group, tracheal intubation was performed with the tube no. 7.5 for females and 8.0 for males (manufactured by Jahan Tajhiz Hakim Company, Iran), three minutes after atracurium injection and placing ventilation mask with oxygen 100% (ETT group, n=48). In the second group, a laryngeal mask (of the classic silicone type) was installed with the proper size based on the patient's weight (LMA group, n=48). It should be noted that laryngoscopy, tracheal intubation, and the placement of a laryngeal mask were all performed by an experienced anesthesiologist. The duration of surgery for all patients (from the beginning of anesthetic induction until the time of transfer to recovery) was documented. In terms of blinding, the patient was unaware of the process used to establish their airway (blinded patient). Moreover, the person who collected the data about respiratory parameters was not involved in the airway establishment process and was unaware of the type of employed airway device (blinding of the evaluator). The study endpoint was to measure respiratory parameters including arterial oxygen saturation (SpO_2), peak airway pressure (P peak), end-tidal carbon dioxide ($EtCO_2$), and dynamic lung compliance (DLC) in 1, 3, 5, 10, and 15 minutes after intubation. DLC was calculated as tidal volume (mL) divided by peak pressure—PEEP (mL/cm), with the normal range of 40 to 80 mm/cmH_2O.

For the statistical analysis, the statistical SPSS software version 23.0 for Windows (IBM, Armonk, New York) was used. The results were presented as mean±standard deviation (SD) for quantitative

variables and frequency (%) for categorical variables. When there was a violation of the assumption of equal variances among the research groups or when the data did not seem to have a normal distribution, continuous variables were compared using the t-test or Mann-Whitney test. The Chi-Square test or Fisher's exact test was used to compare the categorical variables. The Repeated Measure ANOVA test was used to assess the changes in study parameters. General linear modeling was used to examine the difference in the trend of parameter changes between the ETT and EMA groups after considering baseline factors such as sex, age, and length of operation. P values of less than 0.05 were considered statistically significant.

Results

The mean age of the patients in the ETT and LMA groups was 36.08±14.94 years and 42.04±15.16 years, respectively (p=0.095). There was similarity between the two groups, with 58.3% and 66.7% of the population being male (p=0.399). The mean body weight was also 70.50±9.66 and 68.88±5.63 Kg, with no significant difference (p=0.321). Table 1 shows that the mean operation time in the ETT and LMA groups was 1.66±0.70 hours and 1.15±0.52 hours, respectively, which was significantly higher in the

Table 1. Demographic and Surgical Characteristics of ETT and LMA Groups

Characteristics	ETT Group	LMA Group	*p*-value
Mean Age (years)	36.08±14.94	42.04±15.16	0.095
Male (%)	58.3%	66.7%	0.399
Mean Body Weight (Kg)	70.50±9.66	68.88±5.63	0.321
Mean Operation Time (hours)	1.66±0.70	1.15±0.52	0.001

Table 2. Respiratory parameters at different time points of assessment

Parameters	ETT group (n=48)	LMA group (n=48)	*p*-value
Arterial oxygen saturation, %			
Minute 1	99.71±0.62	99.77±0.49	0.217
Minute 3	99.61±0.69	99.65±0.48	0.309
Minute 5	99.73±0.64	99.65±0.48	0.115
Minute 10	99.79±0.46	99.71±0.46	0.263
Minute 15	99.79±0.46	99.71±0.46	0.263
p-value	0.939	0.871	
P peak (mmHg)			
Minute 1	23.88±5.51	13.60±1.77	<0.001
Minute 3	23.06±5.53	13.06±1.62	<0.001
Minute 5	23.17±5.36	13.13±1.93	<0.001
Minute 10	22.79±5.45	12.98±1.92	<0.001
Minute 15	23.10±5.36	12.58±1.61	<0.001
p-value	<0.001	<0.001	
P plateau (mmHg)			
Minute 1	17.69±4.59	10.44±1.17	<0.001
Minute 3	16.77±4.04	10.44±1.15	<0.001
Minute 5	16.94±4.09	10.52±1.38	<0.001
Minute 10	16.98±4.02	10.21±1.24	<0.001
Minute 15	17.10±4.04	10.15±1.39	<0.001
p-value	0.114	0.235	
$EtCO_2$ (mmHg)			
Minute 1	30.85±4.51	31.19±2.94	0.596
Minute 3	30.88±4.12	31.33±3.34	0.915
Minute 5	30.88±4.49	31.23±3.33	0.959
Minute 10	30.69±4.32	31.96±3.43	0.138
Minute 15	30.67±4.23	31.75±3.43	0.065
p-value	0.706	0.115	
DLC (mL/cm)			
Minute 1	37.52±7.69	46.60±5.29	<0.001
Minute 3	37.75±7.92	46.88±5.23	<0.001
Minute 5	36.88±7.01	47.73±4.95	<0.001
Minute 10	37.58±8.28	47.21±5.11	<0.001
Minute 15	37.50±7.66	48.50±4.34	<0.001
p-value	0.835	0.030	

ETT group (p=0.001).

Table 2 summarizes the respiratory parameters of the two studied groups. First, there was no significant difference in the trends of changes in arterial oxygen saturation and $EtCO_2$ between the two groups. In terms of changes in P peak, both groups indicated a significant decrease in the mean of this parameter during the first 15 minutes after airway management. Furthermore, at all-time points, the average of the P peak parameter in the ETT group was significantly higher than in the EMA group. With regard to the values of the P plateau, although the value of this index in the ETT group was higher than the EMA group at all-time points, there was no difference in the trend of the changes in this index between the two groups during the first 15 minutes. In terms of DLC changes, the LMA group had significantly higher values than the ETT group in all considered time periods. However, the upward trend in the value of this index was only significant in the LMA group.

When the trend of changes in study parameters (including P peak, P plateau, and DLC) was compared between the LMA and ETT groups, after adjusting the background variables such as sex, age, and duration of surgery, there was a significant difference between the two groups. Indeed, the trend of the changes in pointed parameters was independent of baseline variables (Tables 3-5).

Discussion

Supraglottic airway devices are now considered routine and standard techniques for airway management. Such devices, such as tracheal tubes and face masks, can provide a suitable gastight airway to provide proper hemodynamic stability before, during, and after procedural interventions [12]. However, one of the main limitations of some of these devices is poor pulmonary compliance due to setting positive pressure ventilation, particularly in obese patients. Therefore, certain modifications have been proposed to address this issue [13]. In this regard, some modifications have been made to the cuff and drain tube in the new generation of these devices known as PLMA, which could protect against gastric contents regurgitation, while also improving ventilatory mechanical characteristics, reducing the risk of sore throat, lowering hemodynamic upset during induction, and maintain proper oxygenation within emergent conditions []14, 15]. Today, the aforementioned designed tools have replaced the older ones including the endotracheal tube; nevertheless, it is still not clear how much the new tools affect the respiratory parameters compared to the previous ones [16]. Moreover, applying LMA instead of a tracheal tube could significantly reduce the risk of tracheal intubation-related morbidities, reduce stress during intubation, and result in faster recovery [17]. As indicated in the present study, although no difference was found in the status of arterial oxygen saturation and $EtCO_2$ between the two techniques, including LMA and ETT; the LMA technique was superior to ETT in terms of providing DLC and establishing proper conditions for P peak

Table 3. The results of general linear modeling assessed the difference in the trend of the changes in the P peak parameter between ETT and LMA groups (adjusted for baseline variables)

Source	Mean Square	F value	*p*-value	Partial Eta Squared	Observed Power
Intercept	805.443	17.887	<0.001	0.158	0.987
Sex	50.380	1.119	0.293	0.012	0.182
Age	668.078	14.836	<0.001	0.135	0.968
Duration of surgery	244.776	5.436	<0.001	0.054	0.636
ETT vs. LMA	50152.595	1.114	<0.001	0.921	1.000

Table 4. The results of general linear modeling assessed the difference in the trend of the changes in the P plateau parameter between ETT and LMA groups (adjusted for baseline variables)

Source	Mean Square	F value	*p*-value	Partial Eta Squared	Observed Power
Intercept	764.430	14.526	<0.001	0.136	0.925
Sex	47.814	1.121	0.097	0.046	0.456
Age	634.059	13.699	<0.001	0.225	0.997
Duration of surgery	232.312	4.778	0.022	0.064	0.722
ETT vs. LMA	47598.828	1.256	<0.001	0.658	0.999

Table 5. The results of general linear modeling assessed the difference in the trend of the changes in DLC parameters between ETT and LMA groups (adjusted for baseline variables)

Source	Mean Square	F value	*p*-value	Partial Eta Squared	Observed Power
Intercept	536.914	17.425	<0.001	0.158	0.998
Sex	33.583	1.475	0.293	0.012	0.252
Age	445.345	14.717	<0.001	0.135	0.923
Duration of surgery	163.170	5.417	0.046	0.054	0.546
ETT vs. LMA	33432.052	1.226	<0.001	0.921	0.999

and P plateau. Remarkably, the marked advantage was completely independent of age, BMI, and time of operation. Ultimately, it seems that using LMA could result in less stress reaction and could be utilized with higher safety. It has been clearly shown that applying ETT might lead to serious postoperative complications, including pharyngalgia, pharyngeal pain, and tachycardia mainly due to the need for using a laryngoscope in the ETT technique [18, 19]. In other words, employing LMA instead of a laryngoscope reduces the risk of damaging the tracheal mucosa or regional circulation system. In addition, LMA can be easily installed, even by non-professional and non-specialist personnel, and does not require specific training, lowering the risk of airway failure [20].

Our findings indicated that LMA could achieve appropriate DLC more successfully than ETT devices. Almost all previous studies emphasized the superiority of the LMA method over the ETT in terms of establishing DLC [21-23]. As shown by Wei *et al.,* no significant $PaCO_2$ change was noted in either group 5 minutes after Time Zero. However, there was a significantly lower PaO_2 in the ETT Group at that time point [21]. Additionally, coughs and snores were far more frequent in the ETT group, necessitating more interventions to maintain adequate respiratory function. Xu *et al.,* also reported that the LMA group had a shorter anesthetic recovery time, indwelling days of chest catheter, and postoperative hospital stay as well as a considerably higher intraoperative partial pressure of CO_2 [22]. In their study, the arterial blood gas analysis after the operation showed no significant difference between the two groups. Regarding the difference in respiratory mechanics and similar to the findings of the present study, Mahdavi *et al.,* found that using an LMA increased pulmonary dynamic compliance more than using an ETT. However, their study was conducted on young people [23]. Finally, Brimacombe conducted an extensive systematic review and reported that the main advantages of LMA over traditional ETT devices included ease of LMA placement by inexperienced personnel, improved hemodynamic stability, reduced airway tolerance, as well as lower rate anesthetic requirements for overcoming this resistance, and reduced the rate of sore throat [24]. Considering the obtained results, especially in providing optimal pulmonary acceptance, the LMA method could still be superior in providing an airway in major surgeries. However several other confounding factors, such as the performer's experience or the tracheal tube cuff pressure, might affect outcome [25].

In conclusion, the findings of the present study indicated that using LMA instead of ETT in airway management was completely preferable due to optimal acceptance of lung dynamics and stabilization of peak pressure and pulmonary plateau, as well as maintaining respiratory oxygen and carbon dioxide pressure. In this regard, it seems that the use of LMA could be used successfully for different age groups, both sexes and even regardless of the patient's weight status.

Declaration

Ethics approval and consent to participate: All patient information was anonymized to maintain confidentiality. The study adhered to the ethical principles of the Helsinki Declaration. Additionally, it received approval from the Ethics Committee of Hormozgan University of Medical Sciences (code: IR.HUMS.REC.1400.344). It was also registered in the Iranian Registry of Clinical Trials (code: IRCT20220612055153N1).

Consent for publication: All the authors, collectively, grant consent for the publication of this content.

Conflict of Interest: The authors declared that they had no conflict of interest.

Funding: This study was financially supported by the Hormozgan University of Medical Sciences (grant number: 4000415)

Acknowledgment: The research presented in this paper has been made possible through generous funding support from Shahid Mohammadi Hospital. The financial support provided by the hospital has played a crucial role in facilitating the necessary resources, equipment, and personnel required for the successful execution of our study. We extend our sincere appreciation to Shahid Mohammadi Hospital for its commitment to advancing research initiatives and contributing to the dissemination of valuable knowledge in the medical field.
Moreover, the authors would like to thank the Clinical Research Development Unit of Peymanieh Educational and Research and Therapeutic Center of Jahrom University of Medical Sciences for editorial assistance.

Authors' Contribution: MM and MV were primarily responsible for the conception and design of the study, as well as the acquisition and analysis of data. NK, PA, ET, and TZ played key roles in drafting and critically revising the manuscript for intellectual content. HJ contributed significantly to the interpretation of data and provided valuable insights throughout the research process. TZ and MS participated in the statistical analysis and data interpretation. All authors have read and approved the final version of the manuscript, demonstrating a collaborative effort in the development of this research work.

References

1. Mangahas AM, Talugula S, Husain IA. Anesthesia considerations during management of airway stenosis: A systematic review. *Am J Otolaryngol*. 2023;**44**(2):103767.
2. Atanelov Z, Aina T, Smith T, Rebstock SE. Nasopharyngeal Airway. StatPearls.; 2022.
3. Zaman B, Noorizad S, Safari S, Javadi Larijani SMH, Seyed Siamdoust SA. Efficacy of Laryngeal Mask Airway Compared to Endotracheal Tube: A Randomized Clinical Trial. *Anesth Pain Med*. 2022;**12**(1):e120478.
4. Yilmaz M, Turan A, Saracoglu A, K TS. Comparison of LMA Protector vs. endotracheal tube in patients undergoing laparoscopic surgery: a randomised controlled trial. *Anaesthesiol Intensive Ther*. 2022;**54**(3):247-52.
5. Park S, Lee JE, Choi GS, Kim JM, Ko JS, Choi DH, et al. Second-generation laryngeal mask airway as an alternative to endotracheal tube in prolonged laparoscopic abdominal surgery: a comparative analysis of intraoperative gas exchanges. *Singapore Med J*. 2023;**64**(11):651-6.
6. Vivian VH, Pardon TL, Vivian S, Van Zundert A. Characteristics of a New Device for Intubation Through a Laryngeal Mask Airway Over a Flexible Endoscope. *Med Devices (Auckl)*. 2021;**14**:217-23.
7. Menna C, Fiorelli S, Massullo D, Ibrahim M, Rocco M, Rendina EA. Laryngeal mask versus endotracheal tube for airway management in tracheal surgery: a case-control matching analysis and review of the current literature. *Interact Cardiovasc Thorac Surg*. 2021;**33**(3):426-33.
8. Ling X, Chen X, Liu G, Ma X, Xiao M, Xiao P, et al. Safety and Efficacy of a Novel Intubating Laryngeal Mask during the recovery period following Supratentorial Tumour Surgery. *J Int Med Res*. 2021;**49**(3):300060521999768.
9. Karaaslan E, Akbas S, Ozkan AS, Colak C, Begec Z. A comparison of laryngeal mask airway-supreme and endotracheal tube use with respect to airway protection in patients undergoing septoplasty: a randomized, single-blind, controlled clinical trial. *BMC Anesthesiol*. 2021;**21**(1):5.
10. Hinkelbein J, Schmitz J, Mathes A, E DER. Performance of the laryngeal tube for airway management during cardiopulmonary resuscitation. *Minerva Anestesiol*. 2021;**87**(5):580-90.
11. Mani S, Rawat M. Proficiency of Laryngeal Mask Airway Insertion Skill in NRP Certified Providers. *Am J Perinatol*. 2022;**39**(9):1008-14.
12. Hanna SF, Mikat-Stevens M, Loo J, Uppal R, Jellish WS, Adams M. Awake tracheal intubation in anticipated difficult airways: LMA Fastrach vs flexible bronchoscope: A pilot study. *J Clin Anesth*. 2017;**37**:31-7.
13. Shavit I, Aviram E, Hoffmann Y, Biton O, Glassberg E. Laryngeal mask airway as a rescue device for failed endotracheal intubation during scene-to-hospital air transport of combat casualties. *Eur J Emerg Med*. 2018;**25**(5):368-71.
14. Yang C, Zhu X, Lin W, Zhang Q, Su J, Lin B, et al. Randomized, controlled trial comparing laryngeal mask versus endotracheal intubation during neonatal resuscitation---a secondary publication. *BMC Pediatr*. 2016;**16**:17.
15. Benger JR, Voss S, Coates D, Greenwood R, Nolan J, Rawstorne S, et al. Randomised comparison of the effectiveness of the laryngeal mask airway supreme, i-gel and current practice in the initial airway management of prehospital cardiac arrest (REVIVE-Airways): a feasibility study research protocol. *BMJ Open*. 2013;**3**(2).
16. Alexander CA. A modified Intavent laryngeal mask for ENT and dental anaesthesia. *Anaesthesia*. 1990;**45**(10):892-3.
17. Leventis C, Chalkias A, Sampanis MA, Foulidou X, Xanthos T. Emergency airway management by paramedics: comparison between standard endotracheal intubation, laryngeal mask airway, and I-gel. *Eur J Emerg Med*. 2014;**21**(5):371-3.
18. Chun BJ, Bae JS, Lee SH, Joo J, Kim ES, Sun DI. A prospective randomized controlled trial of the laryngeal mask airway versus the endotracheal intubation in the thyroid surgery: evaluation of postoperative voice, and laryngopharyngeal symptom. *World J Surg*. 2015;**39**(7):1713-20.
19. van Esch BF, Stegeman I, Smit AL. Comparison of laryngeal mask airway vs tracheal intubation: a systematic review on airway complications. *J Clin Anesth*. 2017;**36**:142-50.
20. Goldmann K, Roettger C, Wulf H. Use of the ProSeal laryngeal mask airway for pressure-controlled ventilation with and without positive end-expiratory pressure in paediatric patients: a randomized, controlled study. *Br J Anaesth*. 2005;**95**(6):831-4.
21. Wei CF, Chung YT. Laryngeal mask airway facilitates a safe and smooth emergence from anesthesia in patients undergoing craniotomy: a prospective randomized controlled study. *BMC Anesthesiol*. 2023;**23**(1):29.
22. Xu K, Zhang Y, Cui Y, Tian F. Patient-reported outcomes of laryngeal mask anesthesia in thoracoscopic pulmonary wedge resection: A randomized controlled study. *Thorac Cancer*. 2022;**13**(22):3192-9.
23. Mahdavi A, Razavi SS, Malekianzadeh B, Sadeghi A. Comparison of the Peak Inspiratory Pressure and Lung Dynamic Compliance between a Classic Laryngeal Mask Airway and an Endotracheal Tube in Children Under Mechanical Ventilation. *Tanaffos*. 2017;**16**(4):289-94.
24. Brimacombe J. The advantages of the LMA over the tracheal tube or facemask: a meta-analysis. *Can J Anaesth*. 1995;**42**(11):1017-23.
25. Sanie Jahromi MS, Zarei M, Taheri L. Comparison of two methods of tracheal tube cuff pressure measurement with two instrumental and conventional methods in patients with prone position undergoing lumbar disc surgery. Update in Emerg Med. 2024; 3(2).