

Comparison of the Complications of Endotracheal Intubation with Laryngeal Mask Airway in Patients Under General Anesthesia

Mojgan Rahimi¹, Hussam Kareem², Afzal Shamsi³, Hossein Majedi⁴, Haitham abdulkareem⁵

¹Associate Professor, Department of Anesthesiology and Critical Care, Tehran University of Medical Sciences, Tehran, Iran

Email: dr.mojganrahimii@gmail.com

²Al Imam Ali General Hospital, Department of Anesthesiology and Intensive care, Baghdad, Iraq

Email: Hussamkareem11@gmail.com

³Anesthesia Group, School of Allied Medicine, Tehran University of Medical Sciences, Tehran, Iran, Nursing and Midwifery Care Research Center, Tehran University of Medical Sciences, Tehran, Iran

Email: Afzal_sh63@yahoo.com

⁴MD, AFSA, Associate Professor, Pain Research Center, Neuroscience Institute, Imam Khomeini Hospital Complex, Department of Anesthesiology&Pain Medicine, Tehran University of Medical Sciences, Tehran, Iran

Email: hmajedi@tums.ac.ir

⁵MSc student of anesthesia, School of Allied Medicine, Tehran University of Medical Sciences, Tehran, Iran

Corresponding. Email: haithamabdulkareem28@gmail.com

Abstract

Introduction: The two most popular methods for stabilizing the airway during general anesthesia are inserting the LMA and endotracheal intubation. The most critical stage in giving general anesthesia to patients who need artificial airway support because they are unable to keep their airways open enough on their own while sedated., the supports for establishing proper airway control, providing anesthetic, and avoiding aspiration have been laryngoscopy and endotracheal intubation. Inappropriate endotracheal tube size, cuff design, lack of airway humidity, trauma during insertion and suctioning, high anesthetic gas flow rates and manipulation of the airway and surrounding tissues are just a few of the numerous factors causing respiratory tract complications in the perioperative period. **Aim:** To determine complications of endotracheal intubation with laryngeal mask airway in patients under general anesthesia. **Patients & Methods:** 200 adult participants were enrolled in the LMA and ETT group male and female age range (18-60 years old) who were a candidate for elective surgery and were in classes 1 and 2 of ASA, Participated in this study. Postoperative complications, including cough, sore throat, bloody ETT&LMA, laryngospasm, delayed extubation, and re-intubation, also assessed cardiovascular difficulty in all patients before and after insertion of ETT & LMA. Analysis of data by spss v.25. **Results:** Cases of cough, sore throat, bloody ETT&LMA, laryngospasm, delay extubation, and re-intubation in the LMA group were less than in the ETT group and showed no significant difference ($P>0.05$). In cardiovascular complications, when compared before and after intubation of two groups (ETT&LMA) showed no significant difference in each group($p>0.05$). **Conclusion:** In this trial, the addition of both the LMA and ETT resulted in a substantial hemodynamic response that included an increase in H.R and ETCO₂, Additionally, it was noted that compared to LMA insertion, laryngoscopy and ETT insertion produce a substantially larger hemodynamic response.

Keywords: postoperative complication, Laryngeal Mask Airway, endotracheal tube.

1. Introduction

During general anesthesia, inserting the LMA or performing endotracheal intubation are standard options for securing the airway (1). The most crucial step in administering general anesthesia to individuals who require artificial airway maintenance is because they cannot maintain a sufficient airway

on their while under anesthesia. Laryngoscopy and endotracheal intubation have usually supported ensuring reasonable airway control, administering anesthesia, and preventing aspiration. Even though intubation has many benefits, such as providing a reliable airway, preventing aspiration, and delivering anesthetic gases, it is not without risks. These risks are mostly noticed during intubation,

immediately after, and immediately after extubation. They include airway trauma, physiological reflexes such as hypoxia, tachycardia, hypertension, malposition, laryngospasm, narrowing, and increased airway resistance, as well as negative pulmonary pressure (2). The laryngeal mask airway, which is detected over the glottis rather than passing completely, is a far less intrusive method of preserving the airway. There is no need for a laryngoscope. It attends as a bridge between the oropharyngeal airway and the endotracheal tube, providing some benefits while outweighing some drawbacks, such as laryngopharyngeal reflex stimulation(3).

It is the accountability of the anesthetist to ensure that anesthesia is administered safely; therefore, the importance of finding new techniques to enhance patient care while reducing unnecessary difficulties cannot be overstated. To prevent the hemodynamic reaction associated with laryngoscopy, it is crucial to develop a better method of administering an anesthetic to patients with cardiovascular or cerebrovascular dysfunction. (4).

On occasion, the distal tip of the collar on the LMA may move upwards during insertion, which could prevent the device from being appropriately positioned. To avoid this issue, some experts advise partially inflating the cuff before insertion or putting the LMA upside-down and rotating it into position; however, there is inadequate data to support these recommendations(5). The pharyngeal tissues may become abraded or bleed due to forceful insertion. Stomach insufflation could happen. In patients at risk for vomiting and aspiration, an LMA should be used as a temporary or rescue measure rather than as a substitute for endotracheal intubation because it is unknown how well it will prevent aspiration of gastric contents. In patients with high airway pressures, it could be challenging to keep an efficient seal. It could be hard to keep an efficient seal in patients with high airway pressures. The device must be supported in the midline because it can quickly become mispositioned while performing CPR or if the patient is shifted during transport(6). LMAs are not an appropriate primary airway device because these patients need higher positive airway pressures, which could lead to leaks around the LMA cuff. Additionally, because of the position of the patient and the weight of the belly, allowing morbidly obese patients to breathe on their own through an LMA during anesthesia may result in substantial hypoventilation(7).

This study aims to Compare the respiratory complications& cardiovascular system between LMA and ETT (before _ and after insertion of ETT and LMA) in general anesthesia.

2. Method and Materials

Subjects: Subsequent agreement by the ethics variety design of study prospective study. A sample of 200 adult participants was enrolled in the LMA

and ETT group male and female age range (18-60 years old).

Study design: The design for this study is cross-sectional. The study was approved by the Human Ethics Committee of the Tehran University of Medical Sciences and the Republican General Teaching Hospital in Iraq.

Inclusion Criteria: All patients who require surgery under general anesthesia ages (18-60 years old). As well as patients according to the classification Grade I and II of the American Society of Anesthesiology (ASA) Patients of either sex scheduled for elective, patients scheduled for general anesthesia. These patients consented to participate in the study. While exclusion criteria, All patients in the emergency operations and all patients coming from ICU with a tube. Additionally, patients who declined to participate in the trial and for whom endotracheal intubation or the insertion of a laryngeal mask airway was not possible and uncooperative patients.

Sampling: Participants who recently underwent laryngeal mask airway and endotracheal intubation will be included in the study. Samples will be chosen cross-sectional using convince sampling. Individuals who had endotracheal intubation and laryngeal mask airway in a medical facility will be selected for the study provided they have informed consent, meet the inclusion criteria, and do not meet the exclusion criteria.

3. Data Collection

Information was gathered from patient charts using structured questionnaires.

- Preoperative vital signs before surgery.
- Monitoring heart rate, blood pressure(MAP), SPO2 and end-tidal CO2 (ETCO2).
- After establishing intravenous (IV) access.

Procedure: All patients were induced by premedication of anesthesia with 0.03mg/kg midazolam + fentanyl 3µg/kg and initiation anesthesia with 2 mg/kg propofol and 0.6mg/kg of atracurium (muscle relaxant). Anesthesia was maintained using isoflurane in oxygen. At the end of the surgery, Neostigmine and atropine in the proper dosages were used to counteract the remaining N.M. blockage. All patients had their vital signs (heart rate, blood pressure (MAP), SPO2, and ETCO2) checked before and after insertion of LMA or ETT. All patients were then monitored for postoperative problems (also known as postoperative complications which can include postoperative cough, laryngospasm, sore throat, bloody ETT, bloody LMA, delayed extubation, and re-intubation. The researcher performed all evaluations before and following the insertion of the ETT and LMA, as well as following extubation.

Data processing and analysis: The data was a collection by sheets that were checked daily for consistency. Data collected was coded and obtainable, presented into the SPSS software, then

analyzed using SPSS version 23. Analysis between the groups was done using the unpaired sample t-test, while within-group research was done using the paired sample t-test. Continuous variables were described. Continuous variables were using mean ± standard deviation (mean ±SD). A p-value less than 0.05 was measured as statistically significant. To compare percentages, A chi-squared test.

4. Results

participants were made up of 57% men and 43% women LMA, while the ETT group, which included 53% men and 47% women, revealed a non-significant difference between the two groups (P = 0.335). According to the table, there was a considerable disparity in the ages of the two groups. In the LMA and ETT groups, the anesthesia duration is shown in table 1.

Table (1): General demographic character of participants.

Variable	LMA n=(100)		ETT n=(100)		P –value
	Range (Frequency)	Mean ± SD	Range (Frequency)	Mean + SD	
Gender M/F	57% / 43%		53% / 47%		X ² = 0.323 Df = 1 P = 0.335
Age	35.78±11.38		33.03±11.30		T =1.715 Df = 198 P =0.088
Age	>30	44(22%)	>30	49(24.5%)	X ² = 2.256 Df = 3 P = 0.521
	30-40	25(12.5%)	30-40	29(14.5%)	
	40-50	18(9%)	40-50	14(7%)	
	<50	13(6.5%)	<50	8(4%)	
Duration	50.84±9.74391		52.43±10.28410		T =-1.122 Df =198 P =0.263

The SPSS program tested the descriptive data.
A chi-squared test

Table 2 outlines the results of Heart rate that show non-significant differences in heart rate between two groups, LMA and ETT, in comparison before intubation (P=0.831). Still, they are non-significantly different in contrast between the two groups after

intubation (P=0.457). When compared before and after LMA, one group showed a non-significant difference (P=0.413), While when Compared before and after ETT, one groups showed non-significant (P=0.182).

Table (2): Assessment of Heart rate in Patients in Two Group LMA and ETT.

H.R. (Mean ± S.D.)				
	Before	After	Difference	P- value
LMA	80.23±10.48795 (A, a)	81.44±10.36049 (B, a)	1.21	T =-0.821 Df =198 P =0.413
ETT	80.51±9.90000 (A, a)	82.43±10.35165 (B, b)	1.92	T =-1.340 Df =198 P =0.182
P- value	T =-0.194 Df =99 P =0.831	T =-0.747 Df =99 P =0.457		

As displayed in table 3, Mean arterial pressure produced a non-significant difference before the intubation of two groups, LMA &ETT (P=0.608); also when comparison after intubation of two groups LMA &ETT showed non-significant differences (P=

0.271). When compared before and after LMA, one group showed a non-significant difference (P=0.512), While when Compared before and after ETT, one groups showed non-significant (P=0.230).

Table (3): Assessment of Mean arterial pressure (MAP)of Patients in Two Group LMA and ETT.

MAP (Mean ± S.D.)				
	Before	After	Difference	P- value
LMA	83.39±10.84500 (A, a)	84.39± 10.67698 (B, a)	1	T =-0.657 Df =198 P =0.512
ETT	84.14±10.66669 (A, b)	85.95±10.58336 (B, a)	1.81	T =-1.205 Df =198 P =0.230
P-value	T =-0.515 Df =99 P =0.608	T =-1.107 Df =99 P =0.271		

The evaluation oxygen saturation (SpO2)that occur are shown in table 4; in comparison, SpO2 yields a

non-significant difference before intubation of two groups LMA &ETT (P=0.320). When comparing

after intubation of the two groups, LMA &ETT showed non-significant differences (P= 0.250). When compared before and after LMA, one group

showed a non-significant difference (P=0.176), While when Compared before and after ETT, one group showed non-significant (P=0.122).

Table (4): Evaluation of Mean Oxygen saturation (SpO2) of Patients in Two Groups, LMA and ETT.

SPO2 (Mean ± S.D)				
	Before	After	Difference	P- value
LMA	99.99±0.10000 (A, a)	99.96±0.19695 (A, a)	-0.03	T = 1.358 Df =198 P = 0.176
ETT	99.97±0.17145 (A, b)	99.92±0.27266 (A, a)	-0.05	T =1.552 Df =198 P =0.122
P- value	T =-1.000 Df =99 P =0.230	T =1.157 Df =99 P =0.250		

As displayed in table 5, In comparison, Mean End-Tidal Carbon Dioxide produced a non-significant difference before the intubation of two groups, LMA &ETT showed (P=0.356). When comparing after intubation of the two groups, LMA &ETT

showed significant differences (P= 0.120). And when reached before and after intubation, two groups showed a significant difference in each group (before and after one group LMA&ETT).

Table (5): Evaluation of Mean End-Tidal Carbon Dioxide of Patients in Two Group LMA and ETT.

ETCO ₂ (Mean ± S.D)				
	Before	After	Difference	P- value
LMA	23.07±2.89986	34.40±2.58590	11.33	T =-29161 Df =198 P =0.000**
ETT	23.39±2.65488	35.02±2.416585	11.63	T =-32.097 Df =198 P =0.000**
P- value	T =-0.928 Df =99 P =0.356	T =-1.567 Df =99 P =0.120		

Before statistical analysis, all groups are tested to see if the data is distributed normally. Normality tests (Kolmogorov-Smirnov, Shapiro-Wilk) in all groups Independent T-Test tested the values in the vertical column. The small superscript letters (a,b) mean the same letter with no difference between groups, while different letters mean a difference between groups. Horizontal values were tested using a Paired-sample T-test to determine the difference * Significant difference at p < 0.05, ** highly significant p< 0.01.

As presented in table 6, respiratory complications for patients of the two groups showed. Cough in the LMA group was 3% person, while in the ETT group, 7% person showed a non-significant difference (p=0.166). Sore throat in the LMA group was 0% person, while in the ETT group, 4% person and showed a non-significant difference (p=0.061). The bloody LMA group noted 2% of a person, while the bloody ETT said 7% and showed a non-

significant difference (p=0.085). Laryngospasm in the LMA group was 1% person, while in the ETT group, 4% person and showed a non-significant difference (p=0.369). Delayed extubation in the LMA group was 0%, while in the ETT group, 2% of persons showed a non-significant difference (p=0.249). Re-intubation in the LMA group was 0% person, while in the ETT group, 1% person and showed a non-significant difference (p=0.500).

Table (6): Assessment of Postoperative Respiratory Complications for Patients of Two Groups.

		Cough	Sore Throat	Bloody	Laryngospasm	Delay Extubation	Re-intubation
LMA n=100	Yes	3%	0%	2%	1%	0%	0%
	No	97%	100%	98%	99%	100%	100%
ETT n=100	Yes	7%	4%	7%	4%	2%	1%
	No	93%	96%	93%	96%	98%	98%
P- value		P=0.166	P=0.061	P=0.085	P=0.369	P=0.249	P=0.500

5. Discussion

This study showed that laryngoscopy with ETT insertion resulted in a hemodynamic response that increased heart rate, ETCO₂, and MAP. However, the response brought on by laryngoscopy with ETT insertion was much higher than that of LMA insertion. Additionally, the insertion of an LMA was shown to be simpler and quicker than the insertion

of an ETT by laryngoscopy. Both groups' heart rates and MAP, were higher than before induction. These outcomes were comparable to those shown in a Scottish investigation where it was demonstrated that arterial pressure declined considerably after inducing anesthesia and heart rate rise dramatically. The identical results were also seen in several earlier research. (8) The utilized induction medicines' hypotensive effects may be to blame for this outcome.

Compared to pre-intubation readings, the H.R. and MAP were all considerably higher in the study's ETT group after the endotracheal tube was inserted. The parameters reverted to their pre-intubation values after the elevation lasted for 5 minutes. These findings concur with those made by Millar and colleagues, who discovered that in normotensive individuals, laryngoscopy and tracheal tube insertion are followed immediately by an average rise in mean arterial pressure of 25 mmHg.(9) It's likely that the observed modifications result from the sympathoadrenal response brought on by stimulation of the supraglottic and tracheal regions. After the insertion of the LMA, the LMA group in this research also demonstrated non-significantly H.R., SBP, DBP, and MAP. These findings are consistent with research that was conducted to look at the cardiovascular consequences connected to the insertion of the Following the introduction of the laryngeal mask and the Guedel oral airway, there was no difference between the two groups at any point in time in arterial pressure or heart rate, compared to those following the insertion of the brain laryngeal mask and the Guedel oral airway. (10) It is predicted that there would be such a resemblance between the two devices since neither passed through the trachea. The activation of the hemodynamic response reflex by stimulation of the supraglottic area might be the explanation for this reaction. Such parallelism between the two is expected because neither device passed through the trachea. This reaction may be accounted for by the hemodynamic response reflex being activated as a result of stimulation of the supraglottic area. (11) The LMA's decreased reaction could be because it avoids the sympathoadrenal response brought on by introducing the endotracheal tube via the trachea. Ubale, (2020). the et al. study, 's which showed that direct stimulation via a tracheal tube causes more significant cardiovascular reactions than stimulation of the glottis by laryngoscopy alone, supports this idea. (11) . The findings of this study were no different from those of Griffin and colleagues, who showed that there was no statistically significant difference between the LMA and ETT groups in terms of hemodynamics. (12). The findings of this study were no different from those of Griffin and colleagues, who showed that the differences in hemodynamics between the LMA and ETT groups were not statistically significant. Similar to their research findings, the ETT group's heart rate rise persisted longer in our investigation. In the LMA group, it took around 3 minutes for the hemodynamic alterations to revert to their pre-insertion levels, but in the ETT group, it took about 5 minutes. Other investigations have shown that the hemodynamic response to LMA is less prolonged than the reaction to ETT.(12). Higher catecholamine levels in the ETT group, as found in other research, are likely the cause of the more significant and more permanent alterations in cardiovascular parameters

observed with ETT as compared to LMA insertion.(13) In the assessment of postoperative respiratory complications for the patient of the two groups, We noted no significant difference between the two groups; also, The frequency of issues relating to the airways, like laryngospasm, Croup, a sore throat, frequent coughing, and arrhythmias was equally common in people who were intubated while awake or anesthetized.(14) The most typical side effect of intubation, particularly when combined with anesthesia, is probably sore throat. The incidence varies depending on the author, from 5% and 100%(15). Also, show similar results. zimmert and zwirner, showed that, compared to the ETT group, the LMA group had a lower risk of laryngeal problems in the postoperative period. (16)

6. Conclusion

In this trial, adding the LMA and ETT resulted in a substantial hemodynamic response that increased H.R., ETCO₂, and MAP. Additionally, it was noted that compared to LMA insertion, laryngoscopy and ETT insertion produce a substantially larger hemodynamic response. Compared to the ETT group, the reaction is likewise transient in the LMA group. Corresponding LMA insertion to laryngoscopy and ETT insertion, LMA insertion required much less time and was more straightforward. These variables may cause the increased hemodynamic alterations observed with laryngoscopy and ETT implantation. LMA seems feasible and secure as the airway device in a specific patient group undergoing general anesthesia. However, in some difficult situations, anesthesiologists may choose ETT over LMA.

7. Ethical Approval:

The ethical consideration of the study was examined by the ethical committee of the Tehran university of medical sciences, and ethical approval for the study was obtained (ethical code: IR.TUMS.SPH.REC.1401.194).

Reference

1. Thomas JT, Sankaranarayana SP, Manjuladevi M. Comparison of the Hemodynamic Responses with Laryngeal Mask Airway vs. Endotracheal Intubation in Adults undergoing General Anesthesia for Elective Surgeries. *J Med Sci.* 2017;3(3):69–75.
2. Gaszyński T. Airway management for general anesthesia in patients with rheumatic diseases - new possibilities. Vol. 57, *Reumatologia.* Poland; 2019. p. 69–71.
3. Masson AHB. Pulmonary edema during or after surgery: PART I. *Anesth Analg.* 1964;43(4):440–5.
4. Wilson IG, Fell D, Robinson SL, Smith G. Cardiovascular responses to insertion of the laryngeal mask. *Anaesthesia.* 1992;47(4):300–2.
5. Fagundes CP, Shi Q, Vaporciyan AA, Rice

- DC, Popat KU, Cleeland CS, et al. Symptom recovery after thoracic surgery: Measuring patient-reported outcomes with the MD Anderson Symptom Inventory. *J Thorac Cardiovasc Surg.* 2015;150(3):613–9.
6. Sabuncu U, Kusderci HS, Oterkus M, Abdullayev R, Demir A, Uludag O, et al. AuraGain™ and i-Gel® laryngeal masks in general anesthesia for laparoscopic cholecystectomy: Performance characteristics and effects on hemodynamics. *Saudi Med J.* 2018;39(11):1082.
 7. Kim HY, Baek S-H, Cho YH, Kim J-Y, Choi YM, Choi EJ, et al. Iatrogenic intramural dissection of the esophagus after insertion of a laryngeal mask airway. *Acute Crit Care.* 2018;33(4):276–9.
 8. Yip P, Middleton P, Cyna AM, Carlyle A V. Cochrane Review: Non-pharmacological interventions for assisting the induction of anaesthesia in children. *Evidence-Based Child Heal A Cochrane Rev J.* 2011;6(1):71–134.
 9. Uddin B, Talukder MH, Ahmed M, Hossain KS, Ahmed F. Hemodynamic Changes Between Endotracheal Intubation And Laryngeal Mask Airway Insertion. *Glob Acad J Med Sci.* 2022;4.
 10. Wali D, Mehta A, Gupta AK, Gupta V, Darswal P, Khanna J, et al. A prospective, randomized, controlled trial study of comparison of two techniques for laryngeal mask airway insertion. *Anaesthesia, Pain Intensive Care.* 2019;93–8.
 11. Ubale P, Jadhav A. An Observational Study to Evaluate the Haemodynamic Changes between Endotracheal Intubation and Laryngeal Mask Airway Insertion. 2020;
 12. Poudel H, Shrestha RS, Bawa SN. Comparative Study of Cardiovascular Response to Laryngoscopy With Endotracheal Intubation and Laryngeal Mask Airway Insertion. *Med J Pokhara Acad Heal Sci.* 2019;2(2):197–204.
 13. Sharma S. A Comparative Study of Haemodynamic Response with Laryngoscopic Endotracheal Intubation and Laryngeal Mask Airway Insertion in Hypertensive Patients at Tertiary Care Hospital. *Sree Mookambika Institute of Medical Sciences, Kulasekharam;* 2019.
 14. Airways D. Extubation in Children with. *Manag Difficult Pediatr Airw.* 2019;161.
 15. Allman K, Wilson I, O'Donnell A. *Oxford handbook of anaesthesia.* Oxford university press; 2016.
 16. Zimmert M, Zwirner E, Braun KU. Effects on vocal function and incidence of laryngeal disorder when using a laryngeal mask airway in comparison with an endotracheal tube. *European Journal of Anaesthesiology* 2007; 16 (8): 511-15.