

Comparison of haemodynamic responses to insertion of Classic LMA and endotracheal tube: A randomized controlled study in adult patients posted for elective surgery under general anaesthesia

Dr Venugopal K¹, Dr Vinuth K Murthy², Dr Pavankumar P³

¹Assistant Professor, Department of Anesthesiology, Kidwai Memorial Institute of Oncology, Bengaluru.

²Senior resident, Department of Anesthesiology, Kempegowda Institute of Medical Sciences, Bengaluru

³Senior resident, Department of Anesthesiology, VIMS, Ballary-583104

¹Email: venugopala246@gmail.com

Abstract

Aim: The purpose of this study is to compare the effects of Classic LMA insertion and Endotracheal intubation on heart rate, systolic and diastolic blood pressure and mean arterial blood pressure during elective surgeries under general anaesthesia in paralyzed patients.

Material and Methods: Eighty patients of American Society of Anaesthesiology Physical Status I or II undergoing general anaesthesia for General Surgery and ENT surgery procedures were randomly allocated in two groups of 40 patients each. Group E had laryngoscopy and endotracheal intubation done for their airway management and Group I underwent insertion of classic LMA. Both the groups were compared for haemodynamic parameters at induction of anaesthesia, then immediately after insertion or intubation, and subsequently at 1 minute, 3 minutes and 5 minutes after introduction of Classic LMA or Endotracheal tube.

Observations and Results: The increase in heart rate with Classic LMA insertion was significantly less than endotracheal intubation till 3 minutes ($p < 0.0001$). The increase in systolic blood pressure on comparison between the two groups immediately after insertion of device, 1 min, 3 min and 5 min after insertion of respective devices, was less with Classic LMA ($p < 0.05$). The diastolic blood pressure

increased more in Group E as compared to Group I ($p < 0.05$) and the rise in the mean arterial blood pressure was also lower in Group I.

Conclusion: Both Endotracheal intubation and Classic LMA insertion produced increase in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure, however the increase was less with insertion of Classic LMA. Hence, Classic LMA insertion has better haemodynamic stability compared to laryngoscopy and endotracheal intubation.

Key Words: Endotracheal tube, Classic LMA, laryngoscopy, haemodynamic response.

Address for Correspondence: Pavankumar P, Senior resident, Department of Anesthesiology, VIMS, Ballary-583104

Email: pavankumarpalmeeri@gmail.com

INTRODUCTION

Administration and maintenance of general anaesthesia necessitates tracheal intubation in most of the cases but the procedure is not without adverse effects. Induction of general anaesthesia is known to induce clinically relevant changes in hemodynamic variables probably generated by direct laryngoscopy and endotracheal intubation which appear to be attenuated by alternative airway managements. Tracheal intubation causes a reflex increase in sympathetic activity that may result in hypertension and tachycardia. Though in the majority of patients undergoing anaesthesia, these responses are transient and probably of little consequence, they may be harmful to some patients, mainly those with myocardial or cerebrovascular diseases¹. The extent of the reaction is affected by many factors: the technique of laryngoscopy and intubation and the use of various devices, like tracheal tube, laryngeal mask airway (LMA) supraglottic airway devices. The laryngeal mask airway (LMA) was designed as an alternative to tracheal intubation to maintain a patent airway during anaesthesia with minimal morbidity. Since the development of the LMA in 1983 by Archie I.J Brain, several other supraglottic devices have been introduced for management of airway, aiming to offer simple and effective alternatives to tracheal intubation². We are hypothesizing that there will be less hemodynamic response with Classic LMA insertion as compared to endotracheal tube intubation and therefore plan to conduct a prospective, randomized study to examine the hemodynamic changes produced by inserting an Classic LMA or endotracheal tube in consenting healthy normotensive anaesthetized patients after their approval for participating in the study.

MATERIAL AND METHODS

Following approval by the Board of Thesis/Research committee, Department of Anaesthesiology, and Ethical committee, at our institution, 80 patients posted for elective surgeries of specialties like general surgery and ENT surgery, belonging to ASA grade I or II of either sex, aged 18-60 yrs, weighing 50-80 kg and Mallampati class I or II were recruited for this study. The study was done from 2020 to 2021. Patients who refused for procedure, had probability of difficult intubation, Mallampati class >II, emergency surgery, full stomach, obesity (BMI >30 kg/m²), cardiovascular diseases and uncontrolled hypertension, high intra cranial pressure (ICP) and patient's with contraindications for insertion of supraglottic devices were excluded from the study. The patients were randomly divided into two groups: Group "I" and "E" with 40 patients in each group. In Group I, proper sized Classic LMA was used, while in Group E, endotracheal tube of appropriate size was used to manage the airway of the patient. All patients were kept nil per oral night before surgery and received Tab Ranitidine 150mg and Tab Alprazolam 0.25mg orally in night. On the day of surgery, intravenous drip was started 30 min before surgery and Inj. Glycopyrrolate 0.2mg was given. After shifting the patient to the operating room, monitors were attached and baseline readings were taken. Patients were premedicated with Inj. Ranitidine 50 mg, Inj. Ondansetron 4 mg, Inj. Butyropholol 1mg. Induction was done with propofol 2.5mg kg⁻¹ and succinylcholine 1.5mg kg⁻¹ and heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure were recorded. Intubation was done with either proper size Classic LMA supraglottic device or appropriate sized endotracheal tube. Confirmation of ventilation was done by adequate chest rise and auscultation. Patient was connected to ventilator with closed circuit. Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure was recorded after induction, then immediately after insertion or intubation, and subsequently at 1 minute, 3 minutes and 5 minutes after introduction of Classic LMA or Endotracheal tube. These parameters were recorded by an accompanying anaesthetist. In case of laparoscopic surgeries, the parameters were recorded before creation of pneumoperitoneum. Maintenance was done with O₂ and N₂O in the ratio 40:60 and 1% Isoflurane was started. Bolus dose of vecuronium (0.08- 0.1mg kg⁻¹) was given after intubation. 1mg of vecuronium was given as top up during surgery. Ventilator setting of Tidal Volume and Respiratory Rate was adjusted to keep the EtCO₂ 30-35mmHg. Respiratory rate was kept between 12 to 14 breaths per min. At the end of the surgery reversal was done with neostigmine 0.05mg kg⁻¹ and glycopyrrolate 0.008mg kg⁻¹. After pharyngo-tracheal suction, extubation was done.

Statistical Analysis: Data was summarized as mean $\pm$ standard deviation with confidence interval of 95% or as percentages. Statistical analysis was performed using SPSS version 26. Numerical variables were normally distributed and compared by unpaired 't' test. Paired t test was performed for comparing mean percentage of improvement in the groups. A p value less than 0.05 was considered as statistically significant.

RESULTS

No statistically significant difference between the two groups was seen with respect to age, sex, weight, ASA status and Mallampati class ($p>0.05$).

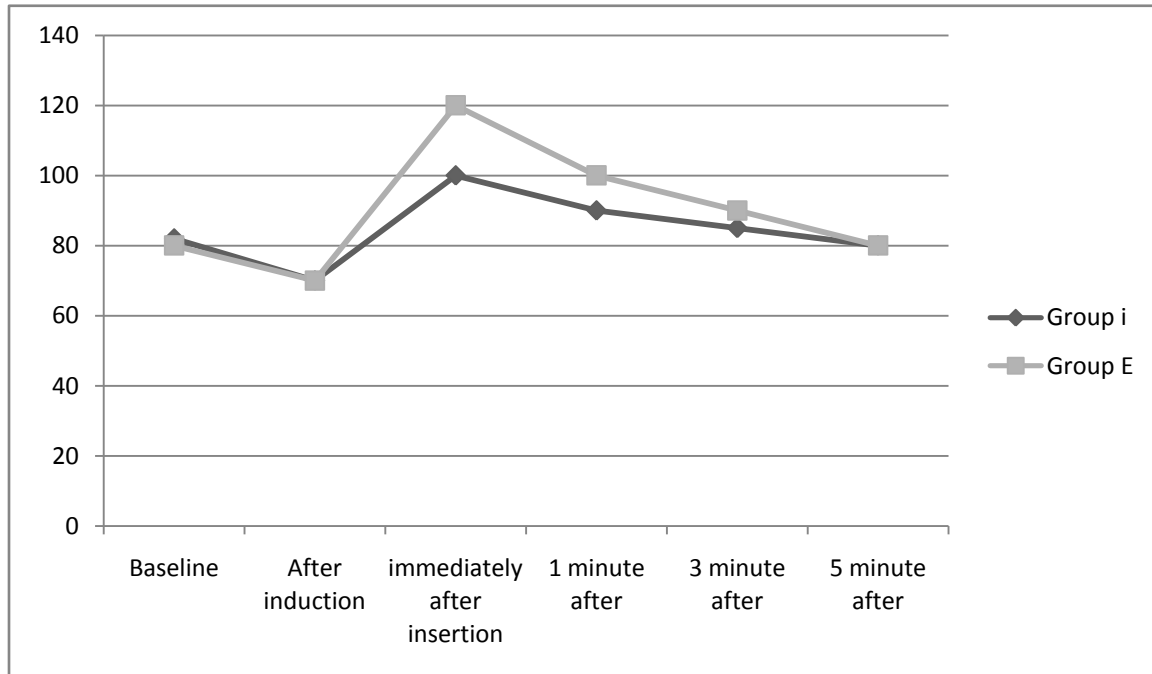


Figure 1: Comparison of mean heart rate;

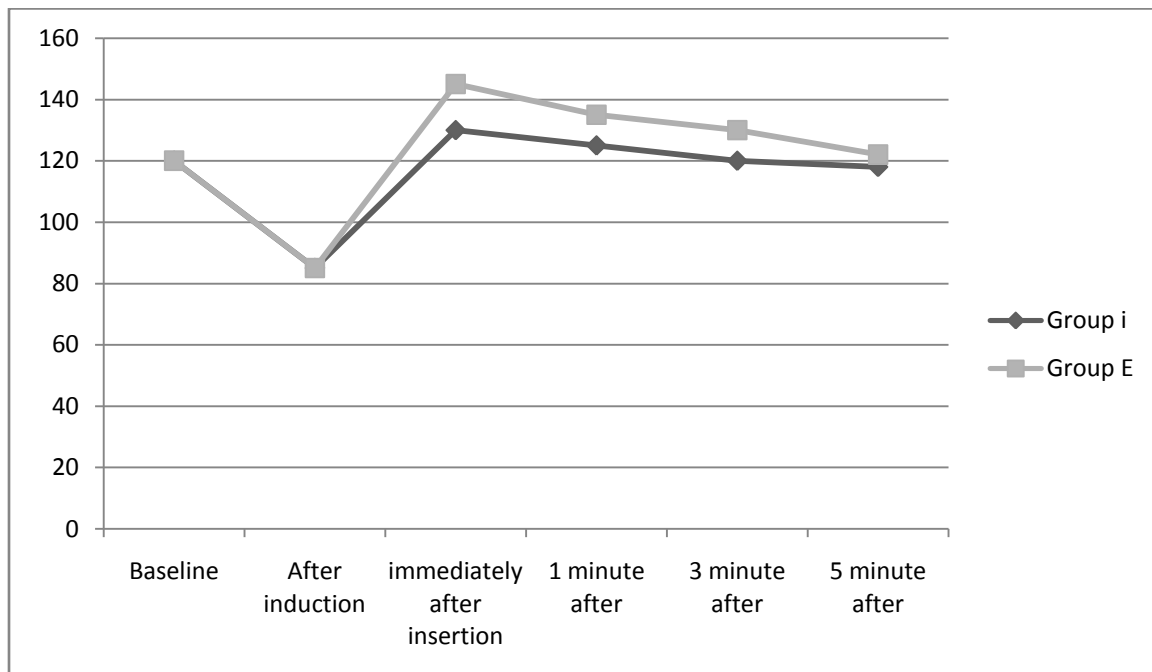


Figure 2: Comparison of Mean Systolic Blood Pressure;

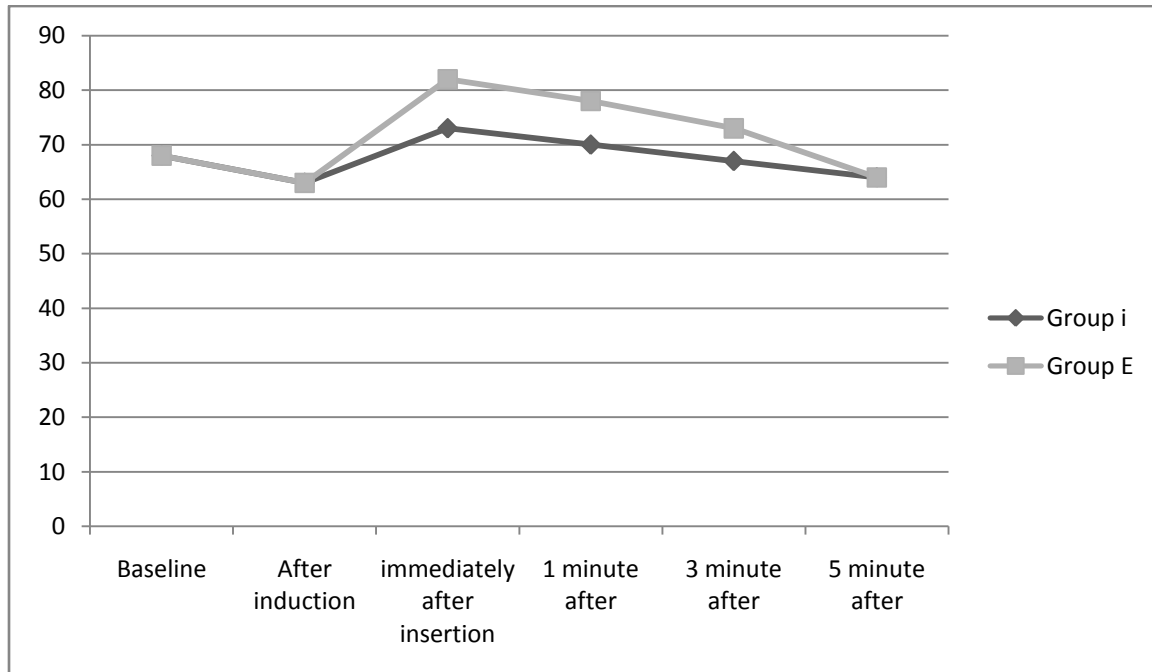


Figure 3: Comparison of Mean Diastolic Blood Pressure;

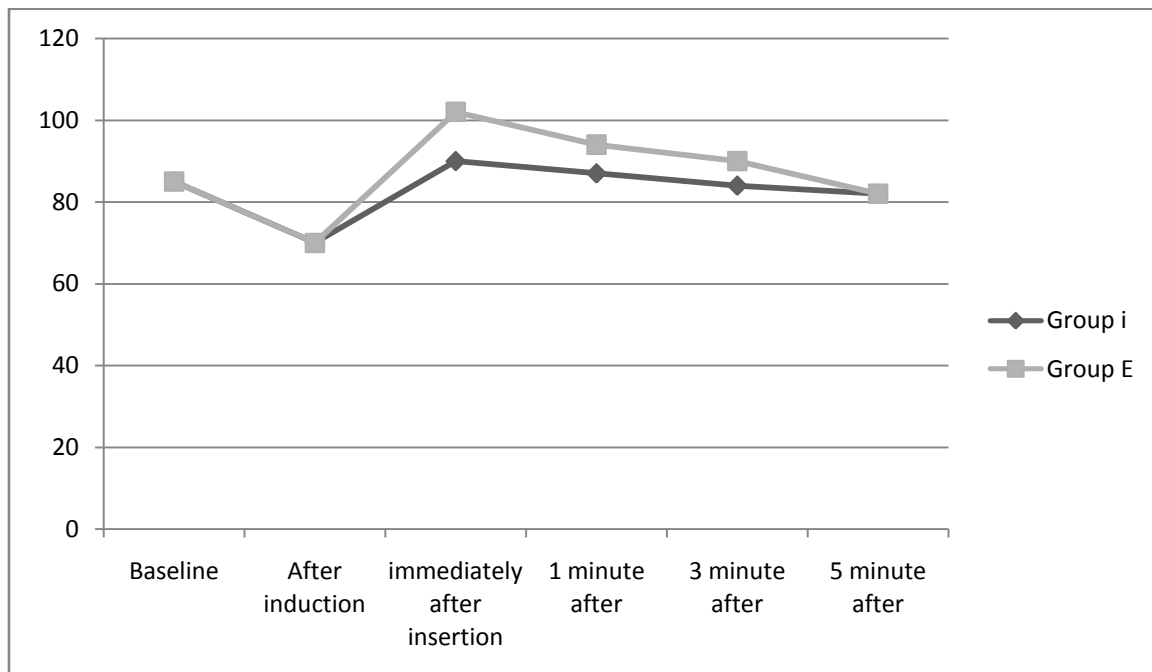


Figure 4: Comparison of Mean Arterial Blood Pressure

Figure 1, In our comparative study, changes in heart rate were seen in both the groups after insertion of Classic LMA or endotracheal intubation. The mean heart rate remained elevated for up to 3 minutes in both group I and group E. However, the increase in values were statistically significantly lower in group I immediately after insertion, 1 min and 3 min after as compared to group E ($p < 0.0001$).

Figure 2, In our comparative study, changes in mean systolic blood pressure were seen in both the groups after Classic LMA insertion/ endotracheal intubation. The mean systolic blood pressure was statistically highly significant between the two groups immediately after insertion, 1 min and 3 min ($p < 0.0001$) and statistically significant at 5 min ($p = 0.0029$).

Figure 3, In our comparative study, changes in mean diastolic blood pressure were seen in both the groups after Classic LMA insertion or endotracheal intubation. The mean diastolic blood pressure was statistically highly significant between the two groups immediately after insertion and 1 min ($p < 0.0001$), while it was statistically significant at 3 min ($p = 0.0002$). The mean diastolic blood pressure changes between the two groups became insignificant at 5 min ($p = 0.6976$).

Figure 4, In our comparative study, changes in mean arterial blood pressure were seen in both the groups after airway instrumentation. The increase in mean arterial blood pressure was statistically highly significant between the two groups immediately after insertion, 1 min and 3 min after ($p < 0.0001$), while it became statistically insignificant at 5 min ($p = 0.079$).

DISCUSSION

Laryngoscopy and endotracheal intubation has been the most widely accepted safest technique to secure the airway in patients under general anaesthesia. The haemodynamic response during laryngoscopy and endotracheal intubation is the result of oropharyngeal and tracheal stimulation. The possible complications include transient hypertension, tachycardia and arrhythmia. Most patients with normal heart functions may tolerate such changes without serious complications while in patients with altered cardiac reserves, these haemodynamic turbulences may be hazardous⁵. There was no significant difference in the age, sex, weight, ASA grading and Mallampati class between the two groups.

Haemodynamic parameters:

The cause and effect relationship that the induction agent might have had on the haemodynamic changes can be discounted owing to the use of similar premedication and induction agents and muscle relaxants in both the two groups. In our study we found that there was no significant difference between the two groups at the baseline. However, on insertion of the respective airway device, change in mean heart rate was seen which remained elevated for up to 3 minutes in both Group I and Group E. The increase in values was statistically significantly lower in Group I immediately after insertion, 1 and 3 minutes after insertion as compared to

Group E (p less than 0.0001 in all the three time intervals). At 5 minutes after insertion, the increase in heart rate in the two groups was not statistically significant ($p=0.4974$). This was similar to the studies done by Ismail *et al*⁶, Badheka *et al*⁷ and Das *et al*⁸. In our study, we found that changes in systolic blood pressure in Group I was less than Group E. The systolic blood pressure increased from baseline in both the groups and remained elevated for up to 3 minutes in both Group I and Group E. However, the increase in values was statistically highly significantly lower in Group I immediately after insertion, at minutes 1 and 3 as compared to Group E (p less than 0.0001 in all three intervals) which was in agreement with study conducted by Jinda *et al*⁹. In our study, it was seen that the diastolic blood pressure was increased from baseline in both the groups, but the increase was statistically more significant in Group E compared with Group I immediately after insertion, 1 min and 3 min but comparable in both the groups at the 5th min, similar to Jinda *et al*⁹ and Atef *et al*¹⁰. In our study, we noted that the increase in MAP from baseline values similar to Dhanda *et al*¹¹ and Zanfaly *et al*¹². Contrary to our study, Elgebaly *et al*¹³ did not document a significant change in haemodynamic parameters between the endotracheal tube and Classic LMA

which could be due to administration of fentanyl. However, they did report a larger requirement of fentanyl in the endotracheal tube group. The transient increase in haemodynamic parameters as seen in our study can be attributed to the increased sympathetic nerve activity resulting in release of catecholamine which have a short half life of 10 seconds to 1.7 minutes and are quickly degraded by catechol-O-methyltransferase or monoamine oxidase¹⁴. The lack of mechanical stimulation caused by laryngoscopy and ETT intubation during insertion of i-gel is a major reason for the attenuated haemodynamic responses¹⁵. The mechanical stimulation during laryngoscopy is transmitted by the trigeminal, glossopharyngeal and vagus nerves to the vasomotor centre in the brain which stimulates sympathoadrenal axis⁶. Supraglottic airway devices are generally thought to cause minimal stress responses; however, this might not be true in some supraglottic devices which have large oropharyngeal cuffs.

CONCLUSION

The present comparative study concluded that Classic LMA causes less haemodynamic changes (HR, SBP, DBP, and MAP) in anaesthetized patients compared to laryngoscopy and endotracheal intubation. Hence, we conclude that the Classic LMA is a suitable and safe alternative to cuffed Endotracheal tube for airway management in elective fasted adult patients undergoing surgeries under general anaesthesia.

REFERENCES

1. Barak M, Ziser A, Greenberg A, Lischinsky S, Rosenberg B. Hemodynamic and catecholamine response to tracheal intubation: direct laryngoscopy compared with fiberoptic intubation. *Journal of Clinical anesthesia*. 2003 Mar 31;15(2):132-6.
2. BRAIN A. The laryngeal mask—a new concept in airway management. *BJA: British Journal of Anaesthesia*. 1983 Aug 1;55(8):801-6.
3. Levitan RM, Kinkle WC. Initial anatomic investigation of the Classic LMA airway: a novel supraglottic airway without inflatable cuff. *Anaesthesia*. 2005 Oct 1;60(10):1022-6.
4. Uppal V, Fletcher G, Kinsella J. Comparison of the Classic LMA with the cuffed tracheal tube during pressure-controlled ventilation. *British journal of anaesthesia*. 2009 Feb 1;102(2):264-8.
5. Jarineshin H, Kashani S, Vatankhah M, Baghaee AA, Sattari S, Fekrat F. Better hemodynamic profile of laryngeal mask airway insertion compared to laryngoscopy and tracheal intubation. *Iranian Red Crescent Medical Journal*. 2015 Aug;17(8).
6. Ismail SA, Bisher NA, Kandil HW, Mowafi HA, Atawia HA. Intraocular pressure and haemodynamic responses to insertion of the Classic LMA, laryngeal mask airway or endotracheal tube. *European Journal of Anaesthesiology (EJA)*. 2011;28:443-8.
7. Badheka JP, Jadhwal RM, Chhaya VA, Parmar VS, Vasani A, Rajyaguru AM. Classic LMA as an alternative to endotracheal tube in adult laparoscopic surgeries: A comparative study. *Journal of minimal access surgery*. 2015;11:251.
8. Das A, Majumdar S, Mukherjee A, Mitra T, Kundu R, Hajra BK, Mukherjee D, Das B. Classic LMA™ in Ambulatory Surgery: A Comparison with LMA—ProSeal™ in Paralyzed Anaesthetized Patients. *Journal of clinical and diagnostic research: JCDR*. 2014 Mar;8(3):80.
9. Jindal P, Rizvi A, Sharma JP. Is Classic LMA a new revolution among supraglottic airway devices. *Department of Anesthesiology American University of Beirut Medical Center PO Box 11-0236. Beirut 1107-2020, Lebanon*. 2009 Feb;20(1):53.
10. Atef HM, Fattah SA, Gaffer ME, Al Rahman AA. Perfusion index versus non-invasive hemodynamic parameters during insertion of Classic LMA, classic laryngeal mask airway and endotracheal tube. *Indian journal of anaesthesia*. 2013;57:156.
11. Dhanda A, Singh S, Bhalotra AR, Chavali S. Clinical comparison of Classic LMA supraglottic airway device and cuffed endotracheal tube for pressure-controlled ventilation during routine surgical procedures. *Turkish journal of anaesthesiology and reanimation*. 2017 Oct;45(5):270.
12. Zanfaly HE, Hassan AM. Classic LMA against ProSeal laryngeal mask airway and endotracheal tube during minor surgical procedures: a comparative study. *Ain-Shams Journal of Anaesthesiology*. 2015;8:521.
13. Elgebaly AS, Eldabaa AA. Is Classic LMA airway a better option to endotracheal tube airway for sevoflurane-fentanyl anesthesia during cardiac surgery? *Anesthesia, essays and researches*. 2014;8:216.
14. McManus LM, Mitchell RN. *Pathobiology of human disease: a dynamic encyclopedia of disease mechanisms*. Elsevier; 2014 Aug 1.
15. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. *British journal of anaesthesia*. 1987 Mar 1;59(3):295-9.