Original Article

Comparative Study of Hemodynamic Changes Using Proseal Laryngeal Mask Airway, Intubating Laryngeal Mask Airway or Laryngoscopic Endotracheal Intubation under General Anesthesia in Patients Undergoing Coronary Artery Bypass Grafting Surgery

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Abstract

Introduction: Laryngoscopy and endotracheal intubation alter cardiovascular physiology both via reflex responses and physical presence of an endotracheal tube (ETT). Stress response caused by laryngoscopic endotracheal intubation may be harmful for the coronary or cerebral circulation of high-risk patients. This study aimed to evaluate the hypothesis that placement of Proseal laryngeal mask airway (PLMA) and intubating laryngeal mask airway (ILMA) are associated with less cardiovascular response than the endotracheal intubation via conventional technique. **Materials and Methods:** In this hospital-based, randomized, interventional study, 105 patients of the American Society of Anesthesiologists Grade II and III undergoing coronary artery bypass grafting surgery under general anesthesia were randomly allocated into three groups, that is, PLMA, ILMA, and ETT. Hemodynamic parameters such as heart rate, blood pressure, cardiac output, cardiac index, systemic vascular resistance (SVR,) and SVR index baseline, during induction and after insertion of device were compared. **Results:** The study groups were comparable with respect to age, weight, height, gender, and baseline hemodynamic parameters. The heart rate, systolic blood pressure, diastolic blood pressure, and MAP were significantly higher ($P < 0.05$) in endotracheal group as compared to PLMA and ILMA groups for 15 min following intubation, that is, throughout the study period. However, there was no significant difference between PLMA and ILMA group ($P > 0.05$). SVR was significantly higher in endotracheal group as compared to PLMA and ILMA group throughout the study ($P < 0.05$). The cardiac index at all time was not significantly different among the three groups. **Conclusion:** PLMA and ILMA insertion is accompanied by minimal cardiovascular responses than those associated with direct laryngoscopic endotracheal intubation, so it can be used for patients in whom a marked pressor response would be deleterious.

Keywords: Coronary artery bypass grafting surgery, intubating laryngeal mask airway, Proseal laryngeal mask airway

Introduction

Optimum airway management and controlled ventilation are crucial issue and are a fundamental duty of an anesthetist. Laryngoscopy and endotracheal intubation is an integral part of general anesthesia for cardiac surgery. Direct laryngoscopy and passage of endotracheal tube (ETT) through the larynx are a noxious stimulus, which can provoke untoward response in the cardiovascular, respiratory, and other physiological systems.[1]

Such hemodynamic changes that occur during intubation may alter the delicate balance between myocardial oxygen demand and supply and precipitate myocardial ischemia in patients with coronary artery disease. Methods to attenuate these responses, both pharmacological and otherwise, have also been studied.[2-4] During laryngoscopy and tracheal intubation, cardiovascular

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changes occur due to the forces exerted by the laryngoscope blade on the base of the tongue when lifting the epiglottis.[5]

The hemodynamic response to laryngoscopy and intubation was first described by Reid and Brace in 1940. A typical pressor response can lead to an average increase in blood pressure by 40%–50% and heart rate by 20% and an elevation of both epinephrine and norepinephrine levels. These effects are generally well tolerated by overall healthy patients but can be lethal to patients with preexisting conditions such as coronary artery disease, recent myocardial infarction, hypertension (HT), geriatric population preeclampsia, and cerebrovascular pathologies such as tumors, aneurysms, or increased intracranial pressure are at increased risk of morbidity and mortality.[6]

The most elective cardiac surgical patients are either New York Heart Association (NYHA) Physical status and American Society of Anesthesiologists (ASA) Status II or III when they present for surgical interventions. Many of these patients also have fixed cardiac output (CO) and their compensatory mechanisms are not fully functional. Therefore, any increase or decrease in systemic vascular resistance (SVR) and heart rate, which occurs during laryngoscopy and tracheal intubation due to sympathetic activation, can adversely affect the hemodynamics. Thus, the duration and number of such activities should be restricted to the minimum during anesthesia management.[7]

The development of the laryngeal mask airway (LMA) airway in 1981 was an important first step toward widespread use and acceptance of the extraglottic airway (EGA). Other more recent EGA devices are Proseal LMA (PMLA) and intubating LMA (ILMA).

In routine practice, conventional method of endotracheal intubation via direct laryngoscopy by Macintosh blade is used during induction of coronary artery bypass grafting (CABG) cases.

The cardiovascular effect of inserting an LMA has been shown to be no greater than with an oropharyngeal airway and to be less than that resulting from tracheal intubation. Furthermore, blind intubation via an ILMA has a smaller associated cardiovascular response than direct laryngoscopy and subsequent tracheal intubation.[8]

In long duration surgeries such as CABG, the use of ETT is associated with various hemodynamic complications such as HT, tachycardia, and arrhythmia. PLMA offers the advantage of minimal hemodynamic complications over ETT. It causes minimal disturbances in the cardiovascular and respiratory systems. Another advantage is that the LMA can be used both as a ventilatory device and for intubation of the airway. In addition, insertion of the LMA is atraumatic and does not reduce the chances of other techniques in subsequent succeeding.[9]

This study planned to evaluate the hypothesis that the placement of PLMA and ILMA will impose the least cardiovascular effects comparable to the conventional method of airway management.

Materials and Methods

After ethical committee approval and informed and written consent, NYHA, and ASA physical status II and III patients of age 45–65 years scheduled to undergo elective CABG surgery under GA were enrolled after exercising inclusion and exclusion criteria.

Patients with ejection fraction <35%, obese patients (body mass index >35 kg/m^2), patients who had oropharyngeal pathology, ASA Grade IV and V, Redo surgery, patients with pulmonary HT, preoperative insertion of IABP, intraoperative TEE, patients at risk of regurgitation, and aspiration (previous upper gastrointestinal tract surgery, known or symptomatic hiatus hernia, esophageal reflux, peptic ulceration, not fasted, and pregnant patients) were excluded from the study.

Randomization was done 1 day before surgery by chit in box method. We divided these cases into three groups: Group P where PLMA was used, Group I where ILMA was used, and Group T where ETT was used, each comprising of 35 patients.

All the patients were assessed properly in preanesthetic clinic before surgery. The detailed history was taken and physical and airway examination was done for assessment of difficult intubation. Routine and special investigations were performed in each case. All the preoperative medications were continued until the morning of surgery, except angiotensin-converting enzyme inhibitors. Patients had also been off antiplatelet agents for 5–7 days before the date of surgery.

On arrival in the operation theater, weight, fasting status, consent, and PAC was checked. All routine parameters (5 lead electrocardiogram [ECG], SPO_2, pulse rate [PR], systolic blood pressure [SBP], diastolic blood pressure, and mean arterial blood pressure) were recorded.

Intravenous (IV) line with 18/20 G cannula secured and Ringer lactate drip started at 5 ml/kg/h. Patients were premedicated with IntraMuscular(IM) injection Morphine (0.1mg/kg) and promethazine (0.5mg/kg) 45 minutes prior to induction. Injection ranitidine 50 mg and injection ondansetron 4 mg IV slowly administered immediately before induction. Femoral arterial cannulation and central venous catheter insertion into the right internal jugular vein performed under local anesthesia. Flotrac continuous CO monitor attached. Here, the parameters noted as baseline parameters.

After preoxygenation with 100% O_2 for 3–5 min, anesthesia induced with injection of midazolam 0.05 mg/kg, injection fentanyl 5 µg/kg, and injection etomidate 0.3 mg/kg IVdrug administered slowly over a period of 60–90 s until there was a loss of eyelash reflex and lack of response to verbal commands. Injection rocuronium bromide 0.9 mg/kg IV was given to facilitate intubation. All parameters noted just after induction of anesthesia.

Following induction and adequate paralysis, the corresponding airway device was inserted in each group.

- In Group P, PLMA inserted (No. 4 or 5 according to weight and sex of the patient)
- In Group I, ILMA inserted (No. 4 or 5 according to weight and sex of the patient)
- And in Group T, we intubated the patient with ETT under direct laryngoscopy.

Data recorded were heart rate, systolic, diastolic and mean arterial blood pressure, CVP, CO, and cardiac index. We have also noted the SVR index (SVRI) and stroke volume variability (SVV) and any side effects or complications, occurred due to insertion of devices.

All data was monitored at following time intervals:

Baseline, after induction of anesthesia (or just before insertion of device), and 1, 3, 5, 10, 15 min after insertion of devices. The last observation at the end of 15 min was considered at the end of study.

Maintenance of anesthesia continued with 100% oxygen, injection midazolam, injection fentanyl at hourly interval, injection vecuronium at 30-min interval. Routine hemodynamic monitoring was done in intraoperative period. On the completion of surgery, the patient shifted to Intensive Care Unit (ICU) on positive pressure ventilation. Patients were allowed to recover spontaneously and were monitored throughout the period in the ICU. They were followed for sore throat, hoarseness of voice, and oral cavity contusion till next 24 h.

The intraoperative and postoperative complications if any, were noted.

Statistical analysis

The data were presented in MS Worksheet. The qualitative data were presented as proportion and percentage and the quantitative data were presented as mean ± standard deviation.

The difference in the mean was analyzed using ANOVA test and *post hoc* Tukey's test was applied to analyze difference in mean between two groups. Difference in the proportion was analyzed using Chi-square test. The level of significance was considered as $P < 0.05$.

Results

There were no statistically significant differences in either the demographic data or the baseline vitals between the two groups [Table 1]. Statistically significant rise in hemodynamic parameters, for example, heart rate (HR), mean arterial pressure (MAP), and systemic vascular resistance (SVR) from baseline value occurred after laryngoscopic endotracheal intubation in Group T ($P < 0.05$), while it was not statistically significant in Group P and Group I [Tables 2, 3 and Figure 1].

Table 1: Demographic and baseline data of patients in two groups

	Proseal LMA	Intubating LMA	ET intubation	*P*
Age	60.5±7.5	57.7±7.9	58.8±9.2	>0.05
Sex male/female	28/7	30/5	28/7	>0.05
Body weight	70.2±10.1	67.5±7.4	66.2±9.8	>0.05
ASA physical status II/III	27/8	30/5	27/8	>0.05
HR	77.9±14.6	76.8±11.7	81.7±13.5	>0.05
MAP	105.8±13.7	109.1±21.2	111.6±22.1	>0.05
Cardiac index	3.62±0.61	3.7±0.66	3.62±0.87	>0.05
SVR	1328.5±228.1	1452.7±390.6	1445.1±416.6	>0.05

ASA: American society of anesthesiologists, HR: Heart rate, MAP: Mean arterial pressure, SVR: Systemic vascular resistance, LMA: Laryngeal mask airway, ET: Endotracheal tube

Table 2: Changes in heart rate (beats/min) at different time intervals

Time	Proseal LMA	Intubating LMA	ET intubation	*P*
After induction	86.8±15.4	85.3±11.5	92.1±13.1	0.091
After insertion (min)				
1	83.8±14.0	94.5±11.1	109.1±13.0	<0.001
3	82.0±12.2	92.0±11.1	103.3±12.0	<0.001
5	81.0±11.0	87.7±10.1	95.9±12.3	<0.001
10	80.5±10.2	84.1±10.1	89.5±10.0	0.001
15	80.2±9.4	81.0±9.7	86.8±9.0	0.007

LMA: Laryngeal mask airway, ET: Endotracheal tube

Table 3: Changes in mean arterial pressure (mmHg) at different time intervals

Time	Proseal LMA	Intubating LMA	ET intubation	*P*
After induction	86.2±13.2	87.5±18.4	86.0±21.4	0.935
After insertion (min)				
1	92.6±9.7	102.2±18.3	124.4±18.9	<0.001
3	90.0±9.1	95.5±13.6	110.9±16.2	<0.001
5	89.4±7.3	89.6±10.4	102.0±13.7	<0.001
10	87.9±6.8	88.2±9.5	95.2±12.7	0.003
15	86.9±6.6	87.9±6.0	90.1±7.6	0.140

LMA: Laryngeal mask airway, ET: Endotracheal tube

None of the patients in all the groups desaturated and suffered any type of dental injury. The frequency of soreness was comparatively more in Group T (48.6%) than the Group P (5.7%) and Group I (20%). In our study, 14.3% patients in Group T had sore throat while none of the patients in Group PLMA or ILMA had sore throat. The incidence of arrhythmia was 5.7% in Group PLMA, 14.3% in Group ILMA, while it was 22.8% in Group ETT. All arrhythmias subsided spontaneously. Twenty percent of the patients developed ST-T changes in Group T, which was significant as compared to Group P and I.

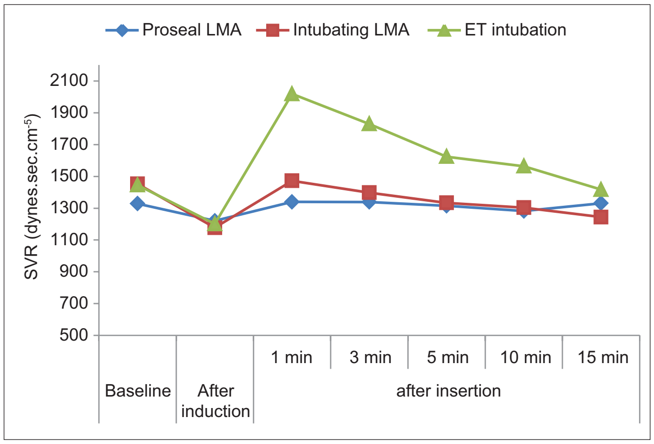

Figure 1: Changes in systemic vascular resistance at different time intervals. It suggests that there is statistically significant difference when we compare changes in systemic vascular resistance after insertion of Proseal laryngeal mask airway, intubating laryngeal mask airway, or endotracheal tube

Discussion

Achieving safe and effective airway is the principal aim during anesthesia and is more so important during CABG. Laryngoscopy and endotracheal intubation is an integral part of general anesthesia for cardiac surgery. Direct laryngoscopy and passage of ETT through the larynx is a noxious stimulus, which can provoke untoward response in the cardiovascular, respiratory, and other physiological systems.[1] The magnitude of cardiovascular response is directly related to the force and duration of laryngoscopy.[10] Both laryngoscopy and intubation separately result in sympathetic stimulation, but the catecholamine rise with intubation exceeds that with laryngoscopy alone.[11] Hence, the need to attenuate the sympathetic response to laryngoscopy and endotracheal intubation is important in patients with coronary artery disease undergoing coronary revascularization. Newer airway aids have always been a part of the evolution of anesthetic equipment and have been used either to facilitate laryngoscopy and intubation so as to avoid major sympathetic stimulation or to aid in a scenario of difficult intubation. A relatively new device, PLMA, is an improved version of the classic LMA and offers some added safety features over the classic LMA, in that it provides a better glottic seal at low mucosal pressures and a drain tube to vent out air and regurgitant material from the stomach.[12]

The ILMA a new-modified LMA that facilitates tracheal intubation without doing laryngoscopy. As stimulation of oropharyngolaryngeal structures and distension of the supraglottic tissue would be less in this method, similar hemodynamic response should be attenuated in comparison with endotracheal intubation via direct laryngoscopy. This probable attenuation can be beneficial, especially in patients with underlying cardiovascular and cerebral disease.[13]

With this background, the present study was performed to compare hemodynamic changes using PLMA, ILMA, and laryngoscopic endotracheal intubation under general anesthesia in patients undergoing CABG.

The present study was conducted in the department of anesthesiology in a tertiary care hospital with due permission from committee of the research review board. One hundred and five patients of either sex belonging to age group of 45–65 year and ASA or NYHA Grade 2 and 3 were scheduled to undergo CABG surgery either using PLMA ($n = 35$), ILMA ($n = 35$), and conventional laryngoscopic ETT ($n = 35$).

There was no statistically significant difference among the three groups in terms of age, sex, weight, and ASA physical status [Table 1]. In the present study, HR, MAP, and SVR significantly increased after laryngoscopic endotracheal intubation compared to the insertion of PLMA and ILMA ($P < 0.05$). The changes in cardiac index were not significant and at all times it remains near to baseline in all groups ($P > 0.05$).

Various studies have been performed to see the effect of PLMA and ILMA insertion on hemodynamic parameters and compared it with conventional endotracheal intubation. But none of the studies compared all three devices in a single study. In our study, we found that hemodynamic parameters, for example, heart rate and mean arterial pressure was significantly ($P < 0.05$) lower in PLMA and ILMA group as compared to ETT group. This is in accordance with previous studies.

Kalpana Shah *et al*. (2017)[9] studied 200 patients undergoing beating heart CABG and they found that patients in PLMA group had a mean PR of 74.52 ± 10.79 per min and MAP 77 mmHg after PLMA insertion, while after ET tube insertion, heart rate was 81.72 ± 9.8/min and MAP was 82 mmHg. This difference was statistically significant ($P < 0.05$). In our study, we also found similar results. In our study, after PLMA insertion heart rate was 83.8 ± 14/min [Table 2] and MAP was 92.6 ± 9.7 mmHg [Table 3], while after ET intubation, heart rate was 109.1 ± 13.0 per min [Table 2] and MAP was 124.4 ± 18.9 mmHg [Table 3], this difference was statistically significant ($P < 0.05$). Hence, we can say that all the hemodynamic variations in PLMA group were significantly less than the ETT group.

The reason for less hemodynamic changes with PLMA could be because PLMA being a supraglottic device does not require laryngoscopy and probably does not evoke a significant sympathetic response. Therefore, attenuation of this response may be due to diminished catecholamine release.[14] This could be because the PLMA is relatively simple and atraumatic to insert and does not require laryngoscopy.[15]

It was also seen that the requirement of muscle relaxants and opioids was less in PLMA group than in the ETT group; furthermore, the use of beta-blocker was less in the PLMA group than in the ETT group. It was also observed that the duration of stay in the Intensive Cardiac Care unit was less in PLMA group than in the ETT group.

Theoretically, ILMA-guided intubation should produce less hemodynamic stress response as there is less stimulation of base of the tongue, epiglottis, and pharyngeal mucosa compared to DLS. The present study confirms these findings.

In a study done by Bhawna Rastogi *et al.* (2015),[16] eighty adult patients were studied to compare intubation either by ILMA or endotracheal intubation by Macintosh laryngoscope. They observed that postintubation heart rate was 88.72 ± 17.42/min. 102.62 ± 20.71/min respective groups. Mean SBP after ILMA insertion was 124.3 ± 14.2 mmHg, while after ET intubation it was 147.87 ± 21.89 mmHg. The difference was statistically significant ($P < 0.05$). In our study, postintubation heart rate in ILMA group was 94.5 ± 11.1/min [Table 2], While it was 109.1 ± 13.0/min in ET intubation group [Table 2]. Mean SBP after ILMA insertion was 134.7 ± 20.7 mmHg [Table 3], while after ET intubation, it was 166 ± 21.6 mmHg [Table 3], which was statistically significant.

Bennett *et al.* (2004).[17] studied ILMA comparison with ET intubation in 27 patients undergoing CABG. Moreover, they found that LMA allows airway management without HT and tachycardia and should be considered when anesthetized patients with coronary disease.

Our results in relation to hemodynamic changes correlate well with the abovementioned studies. The possible cause attributed to less pressor response in ILMA group may be that ILMA neither requires elevation of the epiglottis nor does it stimulates the proprioceptors at the base of the tongue as occur during laryngoscopy.

In our study, we have seen that the hemodynamic responses following the insertion of PLMA and ILMA were lesser than laryngoscopic endotracheal intubation till 15 min after insertion, that is, during the whole study. Intubation using the ILMA causes more increase in hemodynamic parameters than PLMA up to 10 min after insertion, but this is not significant. But the difference between hemodynamic parameters using laryngoscopic endotracheal intubation and LMA were statistically significant throughout the study.

Our studies showed consistent results with Bennett S R *et al.* (2004).[17] They studied 27 patients having CABG randomized to be managed with either the LMA or tracheal intubation using either laryngoscopy or the ILMA. They observed that Cardiac index in LMA group after LMA insertion was 2.2 ± 0.5. In ILMA group, it was 2.3 ± 0.3. In ETT group, cardiac index was 2.2 ± 0.5. They observed that the changes in cardiac index were not significant and at all times it remains near to baseline. In our study, we observed that cardiac index in PLMA group after LMA insertion was 3.3 ± 0.48 [Figure 2]. In ILMA group, it was 3.1 ± 0.52 [Figure 2], and 3.27 ± 0.83 respectively after insertion of devices [Figure 2]. This showed that changes in cardiac index were not significant and it remained near to baseline.

In our study, we observed that SVR after PLMA insertion was 1339.4 ± 186.5 [Figure 1]. After intubation with ILMA, SVR was 1472 ± 295.3 [Figure 1]. And after laryngoscopic endotracheal intubation, SVR was 2018.3 ± 395.5 [Figure 1]. With our study, we observed that after PLMA and ILMA insertion, SVR remained near to baseline. While after laryngoscopic endotracheal intubation, SVR was significantly increased and this change was statistically significant ($P < 0.05$) [Figure 1]. By this result, we can also say that PLMA and ILMA insertion is associated with minimum changes in hemodynamic parameters due to less sympathetic stimulation.

Kalpana Shah *et al.* (2017)[9] done a study and they observed that in the PLMA group, there were fewer adverse events (AEs) than in the ETT group. In the PLMA group, only four AEs were observed, which included secretion ($n = 1$) and hypoxemia ($n = 3$) while 17 AEs were observed in the ETT group which included bronchospasm ($n = 4$), secretion ($n = 6$), soreness ($n = 3$), trauma to the upper respiratory tract ($n = 2$), and hypoxemia ($n = 2$). While in our study, we observed that in PLMA, only 2 patients (5.7%) developed soreness. None of the patients in PLMA group developed sore throat or throat pain. While in ETT group, 17 patients (48.6%) developed soreness, 5 patients (14.3%) developed sore throat, and 2 patients (5.7%) developed throat pain [Table 4].

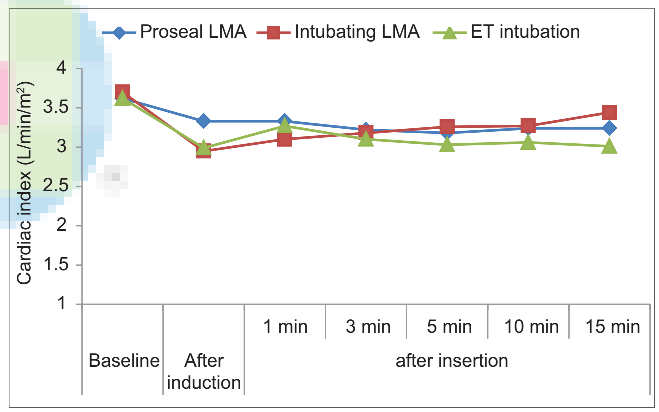

Figure 2: Changes in cardiac index (L/min/m²) at different time intervals. It suggests that there was no statistically significant difference in cardiac index for 10 min after insertion of device, when we compare changes in cardiac index after insertion of Proseal laryngeal mask airway, intubating laryngeal mask airway, or endotracheal tube

Table 4: Percentage of distribution of complications in the study groups

Complication	Proseal LMA, *n* (%)	Intubating LMA, *n* (%)	ET intubation, *n* (%)	*P*
Soreness	2 (5.7)	7 (20)	17 (48.6)	<0.001
Sore throat	0	0	5 (14.3)	-
Throat pain	0	0	2 (5.7)	-
Arrythmia	2 (5.7)	5 (14.3)	8 (22.8)	0.122
ST-T changes in ECG	0	3 (8.6)	7 (20.0)	0.017

ECG: Electrocardiogram, LMA: Laryngeal mask airway, ET: Endotracheal tube

In the present study, there were no episodes of desaturation (<92%) in all three groups emphasizing the fact that PLMA and LMA CTrach™, that is, ILMA can maintain an airway and oxygenation of the patient.

Evans N. R. *et al*. (2002)[13] also observed that sore throat after PLMA insertion was reported by 23% patients in the recovery room. 90% of them described the sore throat as mild and 10% described it as moderate. There were no reports of a severe sore throat.

Bhawna Rastogi *et al*. (2015)[16] observed that two patients (5%) in Group I (ILMA) had mucosal injury during intubation and none of the patients had mucosal injury in Group M (Macintosh). Group I had postoperative pharyngeal complications as sore throat in two patients (5%), whereas Group M had an incidence of sore throat in three patients (7.5%). There was no statistically significant difference between the two groups with regard to complications. While in our study, we observed that seven patients (20%) in Group ILMA developed soreness, whereas 17 patients (48.6%) in Group ETT developed soreness. In our study, none of the patients in ILMA group developed sore throat or throat pain, while 5 patients (14.3%) in ETT group developed sore throat and 2 patients (5.7%) in ETT group developed throat pain [Table 4].

Adequate precaution like adequate lubrication of ILMA has decreased the complications tremendously. The low incidence of complications coupled with good success rate profile makes ILMA suitable for use in a wider patient profile.

Kahl M *et al*. (2004)[18] observed that in 5 patients of conventional laryngoscopy group and 2 patients of ILM group, there were signs of cardiac ischemia (defined as ST-T changes >0.1 mV in any ECG lead). There were no major adverse events during the entire induction period. The clinical outcome after surgery (major complications, time to discharge from ICU, total stay in the hospital, or deaths) was not different between the two groups. In our study, the incidence of ST-T changes was not found in any patient in PLMA group. Three patients in ILMA group and six patients in laryngoscopic endotracheal intubation group developed ST-T changes >0.1 mV. One patient in laryngoscopic endotracheal intubation group developed arrhythmia after intubation which was managed by active pharmacological approach [Table 4].

Yoshitaka Fujii *et al*. (1994)[19] found that no arrhythmia was observed after LMA insertion in either normotensive or hypertensive patients. No patient revealed ECG evidence of myocardial ischemia.

In the present study, there were no episodes of desaturation (<92%) in both the groups emphasizing the fact that PLMA as well as LMA CTrach™ can maintain an airway and oxygenation of the patient throughout the intubation procedure.

Limitations

The main limitation of the study was that it was not blinded. Although it is recognized that lack of masking can affect the assessment of clinical parameters, all patients were managed according to strict protocols, and data were collected in a consistent manner throughout.

1. We have not found any study showing changes in SVR, SVRI, and SVV with the insertion of supraglottic devices in cardiac surgeries
2. Cost-effectiveness was not included in the study.

Conclusion

Our study suggests that the use of PLMA and ILMA is a better choice than ETT in terms of hemodynamic stability with limited metabolic stress responses and side effects and complications in patients undergoing long-term surgeries such as CABG.

Thus, it can be safely concluded that PLMA and ILMA can be used in patients undergoing long-term surgeries such as CABG with skill hands in the present trend of fast-track cardiac surgery case.

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Conflicts of interest

There are no conflicts of interest.

References

1. Henderson J. Airway management in the adult. In: Miller RD, editor. Miller's Anaesthesia. 7th ed. Philadelphia: Churchill Livingstone; 2010. p. 1573-610.
2. Helfman SM, Gold MI, DeLisser EA, Herrington CA. Which drug prevents tachycardia and hypertension associated with tracheal intubation: Lidocaine, fentanyl, or esmolol? Anesth Analg 1991;72:482-6.
3. Thompson JP, Hall AP, Russell J, Cagney B, Rowbotham DJ. Effect of remifentanil on the haemodynamic response to orotracheal intubation. Br J Anaesth 1998;80:467-9.
4. McCoy EP, Mirakhur RK, McCloskey BV. A comparison of the stress response to laryngoscopy. The Macintosh versus the McCoy blade. Anaesthesia 1995;50:943-6.
5. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth 1987;59:295-9.
6. Reid LC, Brace DE. Irritation of the respiratory tract and its reflex effect upon heart. Surg Gynaecol Obstet 1940;70:157-62.
7. Nørskov AK, Wetterslev J, Rosenstock CV, Afshari A, Astrup G, Jakobsen JC, *et al.* Effects of using the simplified airway risk index vs. usual airway assessment on unanticipated difficult tracheal intubation – A cluster randomized trial with 64,273 participants. Br J Anaesth 2016;116:680-9.
8. Choyce A, Avidan MS, Harvey A, Patel C, Timberlake C, Sarang K, *et al.* The cardiovascular response to insertion of the intubating laryngeal mask airway. Anaesthesia 2002;57:330-3.
9. Shah K. ProSeal laryngeal mask airway as an alternative to standard endotracheal tube in securing upper airway in the patients undergoing beating-heart coronary artery bypass grafting. Ann Card Anaesth 2017;20:61-6.
10. Rose DK, Cohen MM. The airway: Problems and predictions in 18,500 patients. Can J Anaesth 1994;41:372-83.
11. Fox EJ, Sklar GS, Hill CH, Villanueva R, King BD. Complications related to the pressor response to endotracheal intubation. Anesthesiology 1977;47:524-5.
12. Brimacombe J, Keller C. The ProSeal laryngeal mask airway:

A randomized, crossover study with the standard laryngeal mask airway in paralyzed, anesthetized patients. Anesthesiology 2000;93:104-9.
13. Akhlagh SH, Vaziri MT, Masoumi T, Anbardan SJ. Hemodynamic response to tracheal intubation via direct laryngoscopy and intubating laryngeal mask airway (ILMA) in patients undergoing coronary artery bypass graft (CABG). Middle East J Anaesthesiol 2011;21:99-103.
14. Lamb K, James MF, Janicki PK. The laryngeal mask airway for intraocular surgery: Effects on intraocular pressure and stress responses. Br J Anaesth 1992;69:143-7.
15. Evans NR, Gardner SV, James MF, King JA, Roux P, Bennett P, *et al.* The proseal laryngeal mask: Results of a descriptive trial with experience of 300 cases. Br J Anaesth 2002;88:534-9.
16. Rastogi B, Singh VP, Gandhi A, Jain M, Gupta K, Singh M, *et al*. Comparative evaluation of hemodynamic response with intubating laryngeal mask airway and intubation with Macintosh Blade – A prospective study. Glob Anaesth Perioper Med 2015. [Doi: 10.15761/GAPM.1000110].
17. Bennett SR, Grace D, Griffin SC. Cardiovascular changes with the laryngeal mask airway in cardiac anaesthesia. Br J Anaesth 2004;92:885-7.
18. Kahl M, Eberhart LH, Behnke H, Sänger S, Schwarz U, Vogt S, *et al.* Stress response to tracheal intubation in patients undergoing coronary artery surgery: Direct laryngoscopy versus an intubating laryngeal mask airway. J Cardiothorac Vasc Anesth 2004;18:275-80.
19. Fujii Y, Tanaka H, Toyooka H. Circulatory responses to laryngeal mask airway insertion or tracheal intubation in normotensive and hypertensive patients. Can J Anaesth 1995;42:32-6.