ORIGINAL ARTICLE

Hemodynamic Stress Response During Insertion Of Proseal Laryngeal Mask Airway And Endotracheal Tube - A Prospective Randomized Comparative Study

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ABSTRACT

BACKGROUND AND OBJECTIVES: Laryngoscopy and endotracheal intubation (ETT) is the commonest method of securing a definitive airway but, is associated with significant hemodynamic stress response. Use of Laryngeal Mask Airway (LMA) in place of ETT is shown to have less hemodynamic response as it avoids laryngoscopy and penetration of larynx, thus less stimulating the sympathetic response. The study was carried out to compare the haemodynamics, insertion characteristics and complications where airway was secured by ETT and PLMA in elective surgical procedures requiring **G**eneral **A**nesthesia. **METHODS:** A prospective, randomized study in 100 female patients, aged 20-40 yrs of ASA I and II posted for elective surgery under GA. Patients randomized to two groups. Group A – ETT (7 or 7.5 mm ID) and Group B - PLMA (size 3 or 3.5) was inserted. **RESULTS**: The increase in the HR from baseline was more during ETT intubation than PLMA insertion (94.24 ± 13.47 Vs 88.72 ± 10.27). ($P<0.05$) Increase in MAP from baseline was more during ETT intubation than PLMA insertion (98.06 ± 7.51 Vs 93.88 ± 4.42). ($P<0.05$) The duration of device insertion was comparable in two groups. (20.02 ± 2.45 Vs 20.60 ± 2.35 sec). Postoperatively, sore throat and coughing was noted in two and four cases and minor trauma in one and two cases of ETT and PLMA respectively ($P>0.05$). **CONCLUSION:** PLMA insertion evokes significantly less hemodynamic stress response than ETT with comparable safety profile.

Keywords: PLMA, ETT, laryngoscopy, hemodynamic stress response, safety profile.

INTRODUCTION

Laryngoscopy and endotracheal intubation is the commonest method of securing a definitive airway for administering anaesthesia. However, it is associated with significant hemodynamic stress response in the form of tachycardia, hypertension, arrhythmias etc occurring due to reflex sympathetic discharge in response to laryngotracheal stimulation, which in turn increases catecholamine release.[1,2] These hemodynamic changes are probably of little consequence in normal, healthy individuals but may be more severe or even dangerous in patients with hypertension, myocardial insufficiency and cerebrovascular diseases.[3] Use of supraglottic airway devices like laryngeal mask airway in place of endotracheal tube has shown to have less hemodynamic responses after its insertion as its insertion requires neither laryngoscopy for visualization of vocal cords nor the penetration of larynx, making it less stimulating the sympathetic response.[4] The Proseal Laryngeal Mask Airway (PLMA), a successive generation of C LMA, with its improved features of cuff design and incorporation of gastric drain channel led to better seal achievement around the glottis thus minimizing the risk of pulmonary aspiration.[5-8] The drain channel prevents gastric insufflation, allows easy placement of gastric tube and also helps in placement of PLMA with the help of bougie. However, improved anatomical design to prevent aspiration made the Proseal LMA a bulkier device which is somewhat difficult to insert with a possibility of higher hemodynamic stress response in comparison to classic LMA Based on these facts, we decided to

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undertake the present study for comparing the hemodynamic stress response, insertion characteristics in terms of number of attempts, duration of insertion and failure of the device insertion along with the intra operative and post operative complications if any between PLMA insertion and endotracheal intubation in elective surgical procedures requiring general anaesthesia.

MATERIAL AND METHODS

After the institutional review board approval and informed written consent, a total of 100 female patients were randomly selected from the list of elective surgical procedures under general anaesthesia. They were divided randomly by computer generated number method into two groups of 50 patients each.

Group ET (n=50): Laryngoscopy and endotracheal intubation with appropriate sized cuffed PVC endotracheal tube (7 or 7.5 mm ID) will be done.

Group PLMA (n=50): PLMA size 3 or 3.5 will be inserted and cuff will be inflated with recommended volume of air.

Patients were kept nil by mouth (NBM) for 6 hrs pre operatively. On the day of surgery, patients were shifted to the preanaesthetic preparation room, identity of the patients and NBM status were confirmed and informed written consent was obtained from the patients. Baseline vital parameters were recorded by multipara monitor consisting of ECG for heart rate (HR), Non Invasive Blood Pressure (NIBP), Mean Arterial Pressure (MAP) and peripheral oxygen saturation (SpO_2). Intavenous access with 18G indwelling cannula was established and slow infusion of DNS at 100ml/hr was started. All patients were premedicated with Glycopyrrolate 0.004mg/kg, Ondansetron 0.08mg/Kg, Fentanyl 1.5mcg/kg and Ranitidine 1mg/kg intravenously, 30 minutes before shifting the patient in the operation theatre. In operation theatre, patients were pre oxygenated with 100% oxygen for 3 min. Anaesthesia was induced with Propofol 2mg/kg slowly intravenously till loss of eyelash reflex and jaw relaxation. This was considered as the end point of induction. After induction, succinylcholine 2mg/kg intravenously was given to facilitate intubation of endotracheal tube or insertion of PLMA as per the group assigned. Devices were inserted by the team member well experienced with the above procedure. Time required for the procedure will be counted from picking up the device to successful confirmation of placement of the device. Proper intubation of endotracheal tube/insertion of PLMA was confirmed by capnography in addition to other clinical parameters. If the ventilation with the device was not satisfactory, the device was removed by anaesthesiologist and another attempt was made to insert it. Maximum three attempts were permitted before failure of insertion was stamped. Whenever required, an additional dose of propofol 0.5mg/kg was given if more than one attempt is required. During the course of surgery, anaesthesia was maintained with O_2 and N_2O (50:50), sevoflurane and neuro muscular blocking agent vecuronium 0.08mg/kg bolus and then $1/4^{th}$ of the bolus dose intermittently whenever required. Hemodynamic parameters like HR, MAP as well as SpO_2 was recorded 30 min after premedication, during intubation with ET/insertion of PLMA and at 1,3,5,7,10,15 min post intubation/insertion. After completion of surgery, neuromuscular blockade was reversed with neostigmine 0.05mg/ kg and glycopyrrolate 0.008mg/ kg intravenously and ET/PLMA was removed after full return of reflexes and consciousness. The insertion characteristics were recorded in terms of number of attempts required for the insertion, time taken for insertion and number of incidences of the failure of the insertion of device. Complications like trauma, cough, and sore throat, nausea/vomiting/regurgitation during intubation/insertion or 24 hours postoperatively were noted.

STATISTICAL ANALYSIS

Considering the hemodynamic changes, ease of insertion, number of attempts required for PLMA insertion, as the main outcome measure of interest in this study with at least 10% efficacy shown by the treatment group with permitted alpha error

of 0.5 and beta error of 0.2 the power of study comes out to be 80%. Data collected was analyzed as mean ± S.D and % which ever applied. Statistical analysis was done by graph pad instat 3.0 software. Inter group comparison between two groups was done using the unpaired student T test for quantitative data and chi square test for qualitative data ($p < 0.05$ was considered as statistical significant).

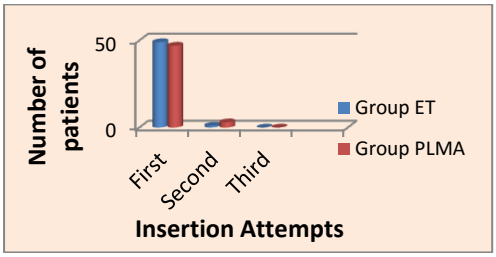
OBSERVATIONS AND RESULTS

Table1: Demographic Profile

Patient characteristics	Group ET Mean± S.D	Group PLMA Mean ± S.D	P value
Age (Yrs)	30.80	± 7.35	28.90 ± 7.24
Weight (Kgs)	53.80	± 5.29	56.52V ± 6.84
ASA Physical Status (I/II)	30/20	36/14	0.06

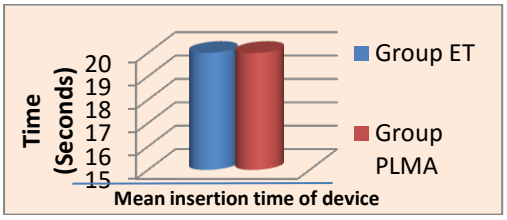
The demographic profile of the patients in Group ETT and Group PLMA were comparable (P>0.05).

Figure1: Insertion characteristics of the device.



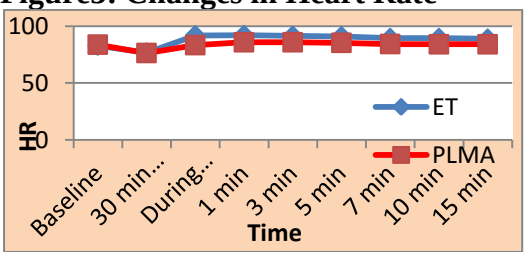
Inference: There is no statistical difference in insertion attempts between endotracheal tube and PLMA.

Figure2: Mean insertion time of the device



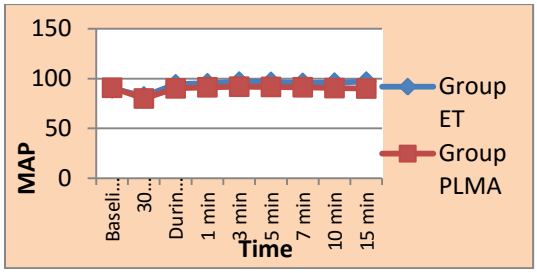
Inference: The difference in time required for endotracheal intubation and PLMA insertion is not statistically significant.

Figure3: Changes in Heart Rate



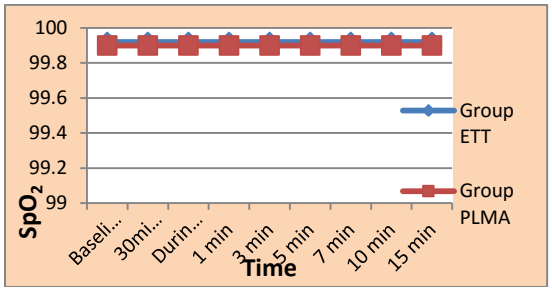
Inference: There was a rise in heart rate seen after insertion of both devices, but there was comparatively higher rise in endotracheal tube than PLMA, and it was statistically significant.

Figure4: Changes in Mean Arterial Pressure



Inference: There was a rise in mean arterial pressure seen after insertion of both devices, but there was comparatively higher rise in endotracheal tube than PLMA, and it was statistically significant.

Figure5: Changes in peripheral arterial saturation



Inference: SpO_2 remained stable and comparable to baseline in both the groups (p>0.05).

Table2: Intra Operative and Post Operative Complications

Variable		Group A		Group B		P Value
		N	%	N	%	
Arrhythmias	Yes	00	00	00	00	
	No	00	00	00	00	
Trauma	Yes	01	02	02	04	0.86
	No	49	98	48	96	
Cough	Yes	02	04	04	08	
	No	48	96	46	92	0.72
Sore throat	Yes	02	04	04	08	
	No	48	96	46	92	0.72
Nausea/Vomiting/Regurgitation	Yes	00	00	00	00	
	No	00	00	00	00	

DISCUSSION

Invention of supraglottic airway devices can be considered as a revolution in anaesthesiology. They cause lesser sympathetic stimulation and avoid hemodynamic variability during both insertion and emergence.[9] With addition of latest devices having separate gastric channel such as PLMA, minimizes the risk of aspiration also. They are good alternative to endotracheal intubation in

patients who require ventilation for general anaesthesia in planned and emergency surgeries.[10, 11] The present study showed that there was rise in HR and MAP during endotracheal intubation and PLMA insertion from baseline. In comparison to ETT group, HR and MAP increase during insertion was significantly less in PLMA group (P<0.05). The present study showed that the HR and MAP returned to baseline within 10 minutes of PLMA insertion while it remained elevated even beyond 15 minutes of insertion in ETT group. Similar results were obtained in other studies[12-17] wherein hemodynamic responses were lower for the placement of PLMA than ETT and returned to normal significantly earlier in PLMA group as compared to ETT group. Akhtar TM et al compared the insertion of LMA with endotracheal intubation and observed that insignificant changes in HR, MAP and intraocular pressure were produced after insertion of LMA or endotracheal tube.[17] Our results are contrary to this study. Release of catecholamines in plasma has been incriminated to play a role in the development of abnormal cardiovascular responses to laryngoscopy and endotracheal intubation. Attenuation of such responses with the use of LMA may be due to diminished catecholamine release as suggested by Lamba K et al.[15] This could in turn be due to the fact that LMA is relatively simple and atraumatic to insert and does not require laryngoscopy before insertion. The present study demonstrates that there is no statistical difference in the number of attempts required for endotracheal intubation/PLMA insertion. However, only one patient in group ETT and three patients in group PLMA required second attempt, but this difference is statistically insignificant (P>0.05). None of the patient in either group required more than two attempts for intubation or PLMA insertion hence there was no failure of insertion/intubation. The duration of endotracheal intubation and PLMA insertion was comparable. (20.02 ± 2.45 Vs 20.60 ± 2.35 sec. (P>0.05) The results of the study correlated with the study of Namita Saraswat, Aditya Kumar and coworkers[14] which showed that the mean time of insertion required for endotracheal intubation was 16.93 sec and for PLMA insertion was 15.77 sec which was not statistically significant and there was no incidence of failure of intubation/insertion reported in either of the group. In the present study postoperatively, sore throat and coughing was noted in two and four cases of ETT and PLMA respectively which was short lived and didn't need any treatment except saline gargles The incidence of sore throat varies in due to variation in size of LMA and endotracheal tube used in different studies, the design and the type of ETT and lubricating material which is used. The sore throat and dysphagia that occurs in the post operative period is usually short lived and does not require treatment. Only one patient in ETT group and two patients in PLMA group showed evidence of trauma (blood stains on device during extubation). Incidence of trauma was statistically not significant between two groups. No other complication was reported in either group.

CONCLUSION

From the finding of present study it is concluded that PLMA insertion cause significantly less and short lived hemodynamic response in comparison to endotracheal intubation. Hence it could be useful in situations where minimal changes in haemodynamics are desirable. PLMA is also found to be equally safe compared to endotracheal tube as not a single incidence of aspiration was noted with its use. We recommend routine use of PLMA in place of endotracheal intubation for elective surgical procedures lasting 1 to 2 hours.

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