Original Research Paper

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Anaesthesiology

A COMPARATIVE STUDY TO EVALUATE HEMODYNAMIC CHANGES BETWEEN ENDOTRACHEAL INTUBATION AND PROSEAL LARYNGEAL MASK AIRWAY INSERTION IN PATIENTS UNDERGOING GENERAL ANAESTHESIA

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ABSTRACT **Background:** Hemodynamic stability is an important aspect to the anesthesiologist for patients. Laryngoscopy and endotracheal intubation can cause striking changes in Hemodynamics as result of intense stimulation of sympathetic nervous system. ProSeal LMA (PLMA)minimizes this response without compromising the airway. The aim of this study was to compare PLMA and Endotracheal tube with respect to intra-operative hemodynamic responses in patients undergoing general anaesthesia. **Material and Methods:** This prospective observational study was conducted on 30 patients of either sex, age group of 18-60 years, ASA (I or II), Mallam Pati (I or II) posted for elective surgery under general anaesthesia. They were randomly divided into two group 15 each. For group A, airway was secured with laryngoscopy and intubation with appropriate size endotracheal tube and for group B, appropriate size PLMA was inserted to secure airway. The hemodynamic responses like Heart rate and Blood pressure were recorded at base line, at insertion, after 1st min, 3rd min, 5th min and after extubation. **Results:** Mean increase was statistically more after endotracheal intubation than PLMA insertion. The elevation in these hemodynamic parameters significantly persisted for a longer period of time in the ETT group, where it returned to the baseline value by 5 minutes as compared to the PLMA group where it returned by 3 minutes. **Conclusion:** The hemodynamic response produced when PLMA was used for securing airway was less than the laryngoscopy and endotracheal intubation. Thus, PLMA proved to be a suitable alternative to endotracheal tube for airway management with stable hemodynamic.

KEYWORDS : Pro seal laryngeal mask airway; Endotracheal tube; Hemodynamic changes

INTRODUCTION:

The provision of adequate unobstructed airway is the major responsibility of the anesthesiologist towards the patient. The cuffed endotracheal tube was considered as the gold standard technique in anaesthesia since prolonged period of time for providing an adequate and effective glottic seal for positive pressure ventilation, prevents gastric insufflation and aspiration but not without a complication. These includes dental trauma, soft tissue injury, airway trauma, malposition, laryngospasm, sore throat postoperatively, narrowing and increased airway resistance as well as pulmonary edema.

Control of heart rate and blood pressure are the important aspect to the anesthesiologist for the benefit of the patients. During laryngoscopy and endotracheal intubation significant changes in hemodynamics can result in intense stimulation of sympathetic nervous system [3]. These changes are potentially dangerous in patients with cardiovascular or cerebrovascular disease as they may lead to intra & post-operative life-threatening ischemia, infarction or cerebral hemorrhage. To prevent these complications laryngeal mask airway can be used as alternative to endotracheal intubation for airway management for short case procedure during anaesthesia [4].

In 2000, Dr. Brain invented the ProSeal laryngeal mask airway with a double cuff and a double lumen which was a useful advancement in the field of anaesthesia for providing an effective seal, improved and adequate controlled ventilation [5]. Double lumen which separates the respiratory and gastrointestinal tract while double cuffed which improves the seal around the glottis. Its cuff extends over the posterior surface of the mask as well as around its periphery. This pushes the mask anteriorly to provide a better seal around the glottic aperture and permits peak airway pressure >30cm water without leak. A drain tube, parallel to the ventilation tube, passes through the bowl of the mask and tip of the cuff to lie at the upper esophageal sphincter. This permits drainage of passively regurgitated fluid away from the airway (or) blind passage of a gastric drain tube.

Advantages of ProSeal laryngeal mask airway (PLMA) devices: i) Avoidance of laryngoscopy ii) Less invasive iii) Ease of placement in inexperienced and experienced hands iv) Improved hemodynamic stability. v) useful in unrecognized difficult airway, especially in a "Cannot ventilate cannot intubate" situation. vi) better tolerance by patients.

This study was conducted to compare ProSeal LMA and Endotracheal tube with respect to intra-operative hemodynamic responses in patients undergoing general anaesthesia.

METHODOLOGY:

This prospective randomized, observational, comparative study was conducted in the Department of Anesthesiology at our medical college Pacific Institute of Medical Sciences, Udaipur after obtaining approval from the institutional ethical committee and patient's written and informed consent.

All the patients were randomly allocated to one of the following two groups of 15 each.

Group A: Laryngoscopy and endotracheal intubation.
Group B: Insertion of ProSeal laryngeal mask airway.

Inclusion criteria:
(1) patients of either sex.
(2) Age between 18-60 years.
(3) Patients with ASA grade I and II.
(4) The patients with Mallam Pati grade I or II
(5) Patients coming for elective surgeries

Exclusion criteria:
(1) Patients below 18 years and above 60 years.
(2) Patients with ASA grade >= III
(3) The patients with Mallam Pati grade III or IV
(4) Patients coming for emergency surgery.
(5) Patients at risk of aspiration before induction of anaesthesia
(6) Poor lung compliance or high airway resistance.
(7) Glottic or subglottic airway obstruction.
(8) Anticipated difficult airway.

All the patients were undergone routine preanesthetic evaluation a day before the surgery. Detailed history, physical examination and airway

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assessment done to rule out those coming under the exclusion criteria. They were explained about the anesthetic technique and kept nil per oral overnight.

On the day of the surgery Intravenous access was achieved with Intravenous cannula and Base line values of Heart Rate (HR), blood pressure (systolic and diastolic) was recorded before induction of anaesthesia.

Patients were premedicated with, Intravenous midazolam 0.05mg/kg, glycopyrrolate 0.01 mg/kg, and ondansetron 0.1 mg/kg were administered 1-2 min before induction.

After preoxygenation with 100% oxygen for 3-5 minutes using Bain's circuit, anaesthesia was induced with propofol 2-2.5 mg/kg and full relaxation is achieved with inj. Succinylcholine 2mg/kg.

The patient was manually ventilated by facemask using intermittent positive pressure ventilation (IPPV) with 100% oxygen for 90 seconds.

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

For the group A, smooth, direct laryngoscopy with McIntosh blade and endotracheal intubation was done with appropriate portex, cuffed endotracheal tube of required size, considering age and sex of the patient

For the group B, PLMA based on patient weight was inserted (using appropriate size 3, 4) by the classical approach and once PLMA is in position 25ml of air for size 3 and 30ml of air for size 4 was injected to provide adequate seal.

Correct placement of the devices was confirmed by adequate bilateral chest movement on manual ventilation, bilateral equal air entry on chest auscultation, normal capnography waveforms and oxygen saturation more than 95%. ETT/PLMA was connected to closed circle circuit and controlled ventilation was instituted.

Maintenance was achieved by O2+air, Sevoflurane at MAC 1-2 and inj. atracurium 0.5mg/kg initial dose and subsequently with 0.1 mg/ kg after 20 min of the first dose.

The patients' Hemodynamic parameters (HR, SBP, DBP) were recorded at:

Preoperatively (baseline), at the time of insertion, at 1,2 and 5 mins after insertion of device, after extubation

At the end of the surgery, In group A, reversal of the neuromuscular block was done with combination of inj. Neostigmine 0.05mg/ kg and inj. Glycopyrrolate 0.01mg/kg and extubated after the return of adequate muscle power and spontaneous breathing, ET tube removed after deflating the cuff.

In group B, patient reversed with combination of inj. Neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg and After return of adequate muscle power and spontaneous breathing, PLMA was removed after deflating the cuff.

STATISTICALANALYSIS:

Sample size was calculated from Difference between two means using data of previous study where $n=Z^2$ S.D[1- S.D]/d. Power of study is 80% and alfa error is 5%. Z score for 95% confidence interval =1.95; so, from changes in systolic blood pressure in two studied groups of previous study, value of n comes 10,14 and 26 respectively at 1min. 3 min. and 5 min. after considering drops out total sample size comes out to be 30 with 15 patients in each group [1]. Sample size was calculated from http://www.gpower.hhu.de/-sample size. After data collection, data entry was done in Excel. quantitative variables such as hemodynamic parameters like heart rate, non-invasive blood pressures with two Subgroups were done using unpaired t-test Quantitative data was represented using Mean ± SD.

[Level of significance: P > 0.05: statistically not significant P < 0.005: statistically significant]

RESULTS:

Our study consisted of 30 patients belong to ASA grade I & II of either sex aged between 18-60 years, posted for elective surgeries under general anaesthesia. These patients were randomly allocated to group A, in whom smooth, direct laryngoscopy with McIntosh blade and endotracheal intubation was done with approximate portex, cuffed endotracheal tubes of required size, considering the age and sex of the patient and in group B, PLMA was inserted to secure the air way.

All values were expressed as mean±SD. Statistical comparison were performed by repeated measure of variance followed by unpaired student's 't' test. A probability value (p) of less than 0.05 was considered statistically significant.

The two groups were comparable in terms of demographic data as there were no significant differences between the 2 groups in terms of age and sex. (p value>0.01)

Table- 1: Age Distribution

Age Distribution		
Age (yr.)	**Group A**	**Group B**
18-25	8	6
26-46	4	7
46-60	3	2

Figure- 1 Age Distribution

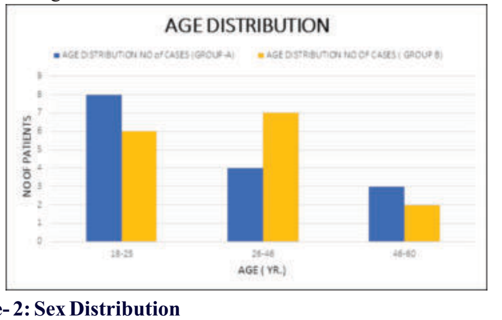


Table- 2: Sex Distribution

Sex Distribution		
Division	**Male**	**Female**
GROUP A	9	6
GROUP B	7	8

Figure- 2: Sex Distribution

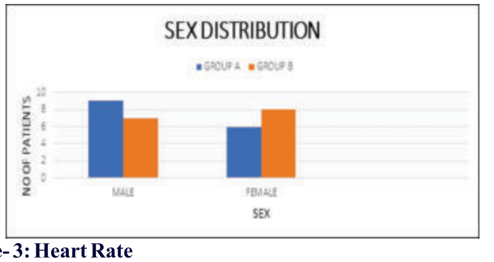
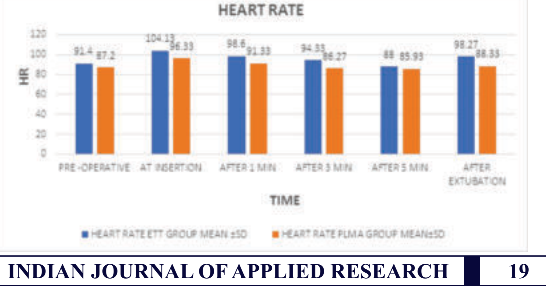


Table- 3: Heart Rate

Heart Rate			
Time Of Recording	**ETT Group MEAN ±SD**	**PLMA Group MEAN±SD**	**P Value**
Pre -Operative	91.40±4.01	87.20±2.01	<0.01
At Insertion	104.13±4.21	96.33±2.94	<0.01
After 1 Min	98.60±2.92	91.33±2.97	<0.01
After 3 Min	94.33±3.18	86.27±2.15	<0.01
After 5 Min	88.00±4.55	85.93±2.43	<0.01
After Extubation	98.27±3.33	88.33±1.63	<0.01

Figure-3:Heart Rate



Pre induction heart rate was taken as baseline values for comparison. In group A: The baseline heart rate was 91.40±4.01, which increased significantly to 104.13±4.21 at insertion. Heart rate then started falling gradually from this peak value, even then the values recorded at 1st min and 3rd min after intubation were significantly higher than the baseline. At 1st min HR was 98.60±2.92 and at 3rd min it was 94.33±3.18. It returned to the baseline value by 5th min and it was 88.00±4.55. Heart rate further increased to 98.27±3.33 after extubation which was significantly higher than the baseline.

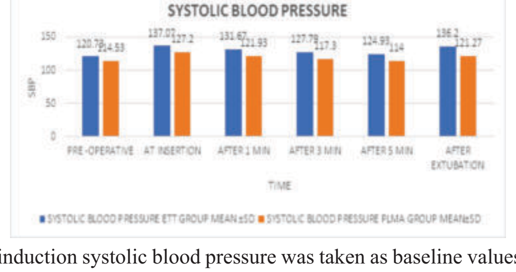
In group B: The baseline heart rate was 87.20±2.01, which increased significantly to 96.33±2.94 at insertion. Heart rate then started falling gradually from this peak value, even then the values recorded at 1st min after intubation were significantly higher than the baseline. At 1st min HR was 91.33±2.97. It returned to the baseline value by 3rd min. At 3rd min it was 86.27±2.15 and at 5th min it was 85.93±2.43. Heart rate further increased to 88.33±1.63 after extubation which was significantly higher than the baseline.

Difference was statistically significant between two groups with p value of <0.01.

Table- 4: Systolic Blood Pressure

Systolic Blood Pressure			
Time Of Recording	**ETT Group**	**PLMA Group**	**P Value**
	Mean ± Sd	**Mean±Sd**	
Pre -Operative	120.73±5.98	114.53±6.00	<0.01
At Insertion	137.07±3.43	127.20±2.70	<0.01
After 1 Min	131.67±2.72	121.93±3.08	<0.01
After 3 Min	127.79±2.52	117.30±2.44	<0.01
After 5 Min	124.93±3.59	114.00±3.12	<0.01
After Extubation	136.20±3.69	121.27±2.96	<0.01

Figure- 4: Systolic Blood Pressure



Pre induction systolic blood pressure was taken as baseline values for comparison.

In group A: The baseline systolic blood pressure was 120.73±5.98, which increased significantly to 137.07±3.43 at insertion. Systolic blood pressure then started falling gradually from this peak value, even then the values recorded at 1st min and 3rd min after intubation were significantly higher than the baseline. At 1st min SBP was 131.67±2.72, at 3rd min it was 127.79±2.52. It returned near to the baseline value by 5th min and it was 124.93±3.59. systolic blood pressure further increased to 136.20±3.69 after extubation which was significantly higher than the baseline.

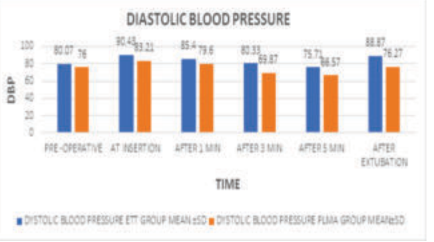
In group B: The baseline systolic blood pressure was 114.53±6.00, which increased significantly to 127.20±2.70 at insertion. Systolic blood pressure then started falling gradually from this peak value, even then the values recorded at 1st min after intubation were significantly higher than the baseline. At 1st min SBP was 121.93±3.08. It returned near to the baseline value by 3rd min and at 3rd min it was 117.30±2.44. At 5th min it was 114.00±3.12. systolic blood pressure further increased to 121.27±2.96 after extubation which was significantly higher than the baseline.

Difference was statistically significant between two groups with p value of <0.01.

Table-5: Diastolic Blood Pressure

Diastolic Blood Pressure			
Time Of Recording	**ETT Group**	**PLMA Group**	**P Value**
	Mean ± Sd	**Mean ± Sd**	
Pre -Operative	80.07±3.59	76.00±3.82	<0.01
At Insertion	90.43±2.79	83.21±2.72	<0.01
After 1 Min	85.40±2.44	79.60±3.38	<0.01
After 3 Min	80.33±3.44	69.87±4.60	<0.01
After 5 Min	75.71±3.47	66.57±4.07	<0.01
After Extubation	88.87±3.25	76.27±3.43	<0.01

Figure-5: Diastolic Blood Pressure



Pre induction diastolic blood pressure was taken as baseline values for comparison.

In group A: The baseline diastolic blood pressure was 80.07±3.59, which increased significantly to 90.43±2.79 at insertion. Diastolic blood pressure then started falling gradually from this peak value, even then the values recorded at 1st min after intubation were significantly higher than the baseline. At 1st min DBP was 85.40±2.44. It returned to the baseline value by 3rd min and at 3rd min it was 80.33±3.44. At 5th min it was 75.71±3.47. Diastolic blood pressure further increased to 88.87±3.25 after extubation which was significantly higher than the baseline.

In group B: The baseline diastolic blood pressure was 76.00±3.82, which increased significantly to 83.21±2.72 at insertion. Diastolic blood pressure then started falling gradually from this peak value, even then the values recorded at 1st min after intubation were significantly higher than the baseline. At 1st min DBP was 79.60±3.38. It returned to the baseline value by 3rd min and at 3rd min it was 69.87±4.60. At 5th min it was 66.57±4.07. Diastolic blood pressure further increased to 76.27±3.43 after extubation which was significantly higher than the baseline.

Difference was statistically significant between two groups with p value of <0.01.

DISCUSSION:

This study was conducted on a total of 30 patients, aimed to evaluate and compare the hemodynamic responses elicited by endotracheal intubation, to those elicited by laryngeal mask airway insertion. The two groups consisting of 15 participants each were comparable in terms of hemodynamic parameters. This study demonstrated that there is a hemodynamic response consisting of an increase in Heart rate, SBP and DBP with ETT insertion as well as with PLMA insertion. However, the response caused by ETT insertion is significantly greater than that caused by PLMA insertion.

During general anaesthesia, important goal of an anesthetic is to achieve smooth induction and recovery with intraoperative stable hemodynamics and postoperative minimal complications. The laryngoscopy and tracheal intubation prove to be detrimental for the patients with low cardiac reserve as they produce hemodynamic pressor response due to oropharyngeal stimulation.

However, Lalwani et al and Dave et al found that heart rate was increased significantly in both ETT and PLMA group same as in our study [2,3]. This hemodynamic pressor response due to stimulation of the pharyngeal wall and supraglottic region by tissue tension mediated via vagal and glossopharyngeal afferents resulting in sympathoadrenal response to laryngoscopy and tracheal intubation.

This is the reflex circulatory response is seen with an increase in the plasma catecholamine levels after laryngoscopy [4]. After laryngoscopy and intubation, higher noradrenaline level produces transient pressor response like hypertension and tachycardia. The release of catecholamine due to stress response also increase myocardial oxygen demand or consumption led to cardiac arrhythmias and myocardial ischemia.

The ProSeal LMA is a supraglottic airway device which does not require laryngoscopy and visualization of vocal cords for insertion So, it provokes a lesser sympathetic response as compared to ETT. The attenuation of the pressor response is due to diminished catecholamine release and lower cortisol levels after insertion of the ProSeal LMA [4,5,6].

Maltby et al also reported equal effectiveness in adequate ventilation and oxygenation in their study groups [7]. The PLMA has a gastric drainage channel and higher sealing pressures which may protect against regurgitation and gastric aspiration [6]. The HR, SBP and DBP significantly increased from the baseline value at intubation that persisted till 5 minutes in the ETT group.

Saraswat et al reported significant increase in heart rate and blood pressure 10 seconds after intubation which was lasted for 3 minutes after and also during the time of extubation in the ETT group[8].

Braude et al observed a significant rise in SBP and DBP and increase in heart rate by maximum mean of 17.1%, 26.8% and 13.2% respectively which will fall in 5 min after induction in both ETT and LMA group [9]. Bukhari et al in their comparison of the hemodynamics between endotracheal intubation and LMA insertion observed similar results like our observation [10].

Hence from our observation, supported with the above discussed review of literature, we can say that a judicious use of ProSeal laryngeal mask airway in selected patients like patient with limited cardiac reserve will be rewarding.

CONCLUSION:

We conclude that ProSeal laryngeal mask airway is a better alternative to endotracheal tube in securing the airway in cases where an attenuated pressor response is of primary concern, as in providing anaesthesia to patients with ischemic heart disease, valvular he art disease, hypertension intracranial aneurysms etc. ProSeal LMA provides a reliable and secured airway with stable intraoperative hemodynamics and lesser postoperative complications so can be effectively used as an alternative to endotracheal tube in surgeries under general anaesthesia.

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