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Original research article

A Comparative Study of Proseal Laryngeal Mask Airway Versus Endotracheal Tube as a Ventilatory Device in Anaesthetised, Paralysed Adult Patients

Dr. Satyapal Yadav[1], Dr. Ashok Kumar[2], Dr. Bijoy Kumar[3], Dr. Zubia Anjum[4]

1. Junior Resident, Department of Anaesthesiology NMCH Patna

2. Prof. & Head, Department of Anaesthesiology NMCH Patna

3. Associate Prof. Department of Anaesthesiology NMCH Patna

4. Senior Resident, Department of Anaesthesiology NMCH Patna

Corresponding Author: Dr. Zubia Anjum

Abstract

Background: The proseal laryngeal mask airway (PLMA) is a new laryngeal mask device with a modified cuff to improve seal and a draining tube toprovide a channel for regurgitated fluid and gastric tube placement. Since PLMA insertion doesn't require laryngoscopy, it causes less pharyngeal wall stimulation, and less incidence of postoperative sore throat in comparison with endotracheal intubation.

Methods: 100 patients of either sex, age group of 18-60 years, ASA I & II, posted for elective surgeries, to whom general anaesthesia was administered were selected. They were randomly divided into two group (n=50 each). For group A, airway was severed with laryngoscopy and intubation with appropriate size endotracheal tube and for groupB, appropriate size PLMA was inserted to secure airway. The hemodynamic responses like Heart Rate and Blood pressure, Oxygen saturation of hemoglobin, postoperative sore throat and abdominal girth were recorded at base line, before induction, after induction, 1st min, 3rd min, 5th min, 10th min after endotracheal intubation or PLMA insertion and after extubation or removal of PLMA.

Conclusion: The hemodynamic response produced when PLMA was used as the method of securing airway was less than the laryngoscopy and endotracheal intubation used for the same. SPO_2 was same in both groups and gastric insufflation was minimal in both groups. Incidence of postoperative sore throat, were more with ETT. Thus PLMA provide a better alternative to ETT in paralysed anaesthetized patients.

Keywords:, Endotracheal tube, Haemodynamic changes, SPO2 changes; Gastric insufflations

Introduction

The provision of adequate unobstructed airway is the major responsibility of the anesthesiologist towards the patient. Though many medical disciplines deals with airway management on emergency basis, few others are responsible for the routine, deliberate and usually elective ablation ofthe patients intrinsic control of respiration and artificially control their airway and respiration. The first tracheal tubes were developed for the

resuscitation of drowning victims, but were not in anaesthesia till 1878. Although endotracheal intubationhas a long history as one of the widely accepted techniques in anesthesiology practice, it is not without complications, most of which arise from need to visualizing and passing the Endotracheal tube through glottic inlet. Laryngoscopy and intubation are not entirely safe procedures. They can cause trauma to the soft tissues around the airway. The Endotracheal tubes (ETT) can be misplaced in the esophagus (or) bronchus and also causes sore throat post operatively. It was found out that an increase in mean arterial pressure and plasma noradrenaline levels, in cases of endotracheal intubation. This suggested that predominantly a sympathetic response occur during intubation and need for prophylaxis in patients who are at risk. The Laryngeal Mask Airway (LMA), introduced into clinical practicesin 1980's was approved as a substitute for the facemask during elective anaesthesia. It was also recommended as a substitute to endotracheal tube, in access where tracheal intubation was not necessary. Brain designed the original laryngeal mask airway and reported the successful use of an LMA prototype with IPPV for 16 cases of gynecologic laparoscopy in 1983, thus challenging the belief that tracheal intubation was always essential for IPPV.

The Proseal LMA (PLMA) is a modified laryngeal mask device with a double- cuffed design, 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 oesophageal spincter. This permits drainage of passively regurgitated fluid away from the airway (or) blind passage of agastric drain tube.

Objectives

To compare the hemodynamic changes, $SPO_{2,}$ abdominal girth, and post operative sore throat during endotracheal intubation and Proseal Laryngeal Mask Airway insertion for elective surgeries in paralyzed anaesthetized patients.

Material and Methods

The present clinical study was undertaken to compare the hemodynamic responses, ventilatory parameters, episodes of gastric insufflation and ease of gastric tube placement, postoperative sore throat between laryngoscopy following endotracheal intubation with ETT and PLMA insertion. The Study at Nalanda medical college and Hospital Patna, Bihar. Study duration of Two years. The study group consists of 100 patients scheduled for various surgeries to whom general anaesthesia was administered. All the patients were explained regarding the study and its objectives and written consent was obtained. 100 patients scheduled for different elective surgeries to whom general anaesthesia was administered, were randomly allocated to one of the following two groups of 50 each.
Group A: Laryngoscopy and endotracheal intubation. Group B: Insertion of Proseal laryngeal mask airway.

The hemodynamic changes as noted in changes heart rate (HR), blood pressure, ventilatory parameters like changes in SPO2, gastric insufflation as changes in abdominal girth, postoperative sore throat observed during laryngoscopy and endotracheal intubation and PLMA insertion were compared and studied.

Inclusion criteria

*Number of cases to be studied is about 100 of either sex.
*Age between 18-60 years.
*Patients with ASA grade I and II.
*Patients coming for elective surgeries (abdominal, ENT and upper limbsurgeries) requiring muscle relaxation.

Exclusion criteria

*Patients below 18 years and above 60 years.
*Patients coming for emergency laparotomy.
*Patients at risk of aspiration before induction of anaesthesia (eg. full stomach, Hiatus hernia, with significant gastroesophageal reflux, morbid obesity, intestinal obstruction delayed gastric emptying).

In both the groups insertion was gentle but fast so that the procedure lasted for less than 20 sec. Bilateral air entry was checked and also checked forair leak. ETT/PLMA was connected to Bains circuit and controlled ventilation was instituted.
Maintainence was achieved by N2O and O2 at a ratio of 3:2 and inj. Vecuronium 0.05mg/kg initial dose and subsequently with 0.5mg increments, after 20 min of the first dose.
Haemodynamic parameters like HR, BP (SBP and DBP), Ventilatory parameters – SPO2 were recorded at the time intervals of just before induction, after induction, 1 min after, 3 min, 5 min, and 10min after intubation / PLMA insertion and after extubation. Abdominal girth as recorded before induction and after extubation.

Results

Our study consisted of 100 patients belong to ASA grade I & II of either sex aged between 18-60 years, posted for elective surgeries under general anaesthesia requiring muscle relaxation. These patients were randomly allocated to group A, in whom smooth, direct laryngoscopy with No.3 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.

Table 1: AGE DISTRIBUTION

AGE	No of cases in Group A	No of cases in Group B
18 – 25	**23**	**16**
26 – 46	**21**	**26**
46 – 60	**6**	**8**

The minimum age of the patient was 18 years and the maximum age of the patient was 60 years in the study groups. Both group A and group B were statistically comparable with regard to the age group and the 'P' value derivedwas not significant.

Table 2: SEX DISTRIBUTION

GROUP	MALE	FEMALE
A	**26**	**24**
B	**24**	**26**

Both the study groups A and B were comparable with each other and theP- value derived was non significant

There were 26 males and 24 females in group A while it was 24 malesand 26 females in group B.The baseline DBP was 82.36±7.25 which decreased to 82.16±9.19 after induction. The DBP increased to peak value of 95.2±15.39 which was very significant at 1st min after direct laryngoscopy and intubation with ETT. Then DBP gradually decreased to 89.78±9.37 at 3rd min after intubation, to 85.64±7.63 at 5th min. At 10th min after intubation, it was 83.24±7.63. DBP again increased to 91.48±7.27 after extubation which is very significant.

The baseline DBP was 81.24±5.04 which decreases to 78.72±5.58. Then DBP increased to 86.44±7.58 1 min after insertion of PLMA which was significant. At 3rd min after insertion, DBP was 84.18±6.84. At 5th min after insertion, DBP was 81.46±6.80. At 10th min after insertion, was 80.2±5.31, which is even less than the base line. The DBP again increased to 84.4±6.15 after removal of PLMA which isvery significant.

The base line SPO2 was 99.52±0.57 which remained same after induction of the patient (99.52±0.54). Then SPO2 increased to a 99.56±0.50 1 min after with direct laryngoscopy and intubation with a difference of 0.04 which is clinically insignificant. At 3rd min after intubation SPO2 was 99.58±0.49 with a difference of 0.06, at 5th min after intubation SPO2 remainedsame as at 3rd min. At 10th min after intubation the SPO2 was 99.56±0.50. The baseline SPO2 in group B was 99.26±0.964, which increased to a value of 99.44±0.57 with a difference of 0.18. The SPO2 at 1st min after insertion of PLMA was 99.44±70 with a difference of 0.18 from the baseline. At 3rd min and at 5th min after insertion the SPO2 was 99.42±0.64 and 99.42±0.70 respectively. At 10th min after insertion the SPO2 increases mildly to 99.58±0.53 with a difference of 00.32 from the baseline value. Clinically the difference is insignificant.

Table 3:

	Group A	**Group B**	**Group A VsGroup B**	
	Mean ±SD	**Mean ±SD**	**'t'**	**p-value**
Pre induction	69.88±5.71	70.04±5.73	-0.139	0.89
Post extubation	71.24±5.93	71.66±5.73	-0.359	0.72

The abdominal girth before induction was taken as baseline.
In group A
The abdominal girth before induction of the patient was 69.88±5.71which increased to 71.24±5.93 after extubation with a difference of 1.36 whichis clinically insignificant.
In group B
The abdominal girth before induction of the patient was 70.04±5.73, which increased to 71.66±5.73 after extubation of PLMA with a difference of 1.62which is clinically not significant. Inter group comparisons using unpaired 't' test showed that the changes in the abdominal girth before induction and after extubation between the two groups were statistically insignificant with 'p' values 0.89 and 0.72 respectively.

Discussion

In a clinical study [1] of 36 anaesthetized paralyzed adult patients to study pulmonary airway resistance with ETT Vs LMA, it is concluded that LMA has lower pulmonary airway resistance than ETT in anaesthetized paralyszed patients, suggesting that LMA triggers less reflex bronchoconstriction and attenuatedhemodynamic responses than ETT. It is reported that, [2] PLMA reduces the risk of gastric insufflation and risk of aspiration of refluxed gastric

contents. In a comparative study between PLMA and ETT,[3] it is concluded that adequate pulmonary ventilation without gastric distension can be achieved equally well with PLMA or ETT in non-obese patients. In a clinical study it is reported that, [4] proseal LMA has been used to secure the airway after failure to intubate during rapid sequence induction. In a randomized, cross over study[6] it is concluded that PLMA is capable of achieving effective seal than the LMA and facilitates gastric tube placement, Laryngoscopy and intubation are potential noxious stimuli to the airway. It initiates a sympathetic response in the patients, by which the HR and BP gets elevated. In a randomized comparative study[7] it is found that nasogastric tube was inserted in all the cases after confirming that there was no evidence of leak via the drain tube. is expected to generate comparatively lesser amount of pressor response than the endotracheal intubation. Shribman et al[7] observed that, the pressor response to laryngoscopy and intubation stems largely from pharyngeal wall stimulation due to laryngoscopy, with intubation producing a smaller additional response. Braude et al[8] added that, insertion of the laryngeal mask and inflation of the cuff stimulates and exerts pressure on the anterior pharyngeal wall. This is almost certainly the mechanism by which the increase in BP and HR occur. The transient nature ofthe response suggests that this is not related to the continuous pressure exertedby the sealing cuff. The reduced response may reflect the lesser stimuli compared to laryngoscopy, the lack of direct laryngeal and tracheal stimulation or the shorter duration of stimulus that results from quick insertion. It has been postulated that heart rate increase may be a response to an imbalance between vagal and cardiac accelerator fibers. Review of literature highlights a number of studies which support the claim that LMA insertion has an attenuated pressor response than laryngoscopyand endotracheal intubation. Our study constituted 100 patients of ASA I &II physical status, who were randomly allocated to group A (endotracheal tube group) and group B (Proseal LMA group). Our objectives were to find out the hemodynamic responses, recorded in terms of HR, SBP and DBP, ventilatory parameter in terms of changes in SPO2, gastric insufflation in terms of changes in abdominalgirth and post operative sore throat in each group and to compare them between the two groups statistically. Braude et al[8] observed a significant increase in heart rate after inductionand fall in SBP 5 min after induction in both ETT and LMA group. In the endotracheal group, there was a significant rise in SBP and DBP and increase in heart rate by maximum mean of 17.1%, 26.8% and 13.2% respectively. Bukhari etal[9] in their comparison of the hemodynamics between endotracheal intubation and LMA insertion observed similar trend.

We also got the similar trend in o ur study. SBP was decreased soon after induction in both the groups. Our readings also showed a similar fall soon after induction in both group A and group B so as to maintain at a significantly higher values at 1 stmin, 3rd min, 5th min and 10 min following intubation or PLMA insertion. But rise in HR, SBP and DBP after insertion of PLMA were significantly lower than the changes following laryngoscopy and intubation. These observation are consistent with the reports of Ghai B. et al[10] and Wood Torret who have assessed and compared the hemodynamic changes that occurred while endotracheal intubation/LMA insertion in two independent studies. J. Roger Mattby et al observed, the median airway pressure leak test with continuous PPV immediately after inflation of the PLMA was 34 cms of H_2O. However, even when the leak test plateau pressure was low, adequate peak airway pressure without gas leak was achieved with intermittent PPV during surgical procedure. J.b. Brimacombe et al, [11] observed a less common incidence of gastric insufflation for the PLMA ($P<0.001$) and gastric tube insertion was successfulat the first attempt in 106/120 and at second attempt in 14/120. The mean value for residual gastric volume was 2.21 ml. In our study the incidence of gastric insufflation were not significant between the two groups. The abdominal girth measured between the

groups at pre induction and post extubation were statistically insignificant with p values of 0.204 and 0.89. Guiseppe Natalini et a[l2] observed the frequency of sore throat was scored as mild as 10% with PLMA and it was absent in remainingpatients. In our study the incidence of post operative sore throat was very lowwith PLMA than ETT. Hence from our own observation, supported with the above discussed review of literature, we would like to highlight that a judicious use of Proseal laryngeal mask airway in selected patients will be rewarding especiallyin those, where an exaggerated pressure response can be detrimental.

Conclusion

There are different methods for securing airway of the patients and providing adequate oxygenation. Endotracheal intubation and insertion of laryngeal mask airway as a method of airway control have their own advantages and disadvantages over each other. We compared the hemodynamic changes, ventilatory parameters, episodes of gastric insufflation and post operative sore throat during laryngoscopy and intubation and PLMA insertion.

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