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ENDOTRACHEAL INTUBATION VERSUS PROSEAL LMA FOR SHORT DURATION INFRAUMBILICAL SURGERIES IN PEDIATRIC PATIENTS: A RANDOMISED COMPARATIVE STUDY

Anesthesiology

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ABSTRACT

Background & Aims: Supraglottic airway devices were invented to fill the niche between face mask and endotracheal tube. Now a day they have become an irreplaceable part of airway management. Proseal LMA, a modification over classic LMA, with dorsal cuff and a gastric drainage tube has shown to provide better glottic seal and safeguard against pulmonary aspiration. We undertook this study to compare the efficacy of endotracheal tube with Proseal LMA in paediatric patients in terms of ease of insertion, no of attempts of insertion, post insertion hemodynamic changes, ventilatory effectiveness and perioperative complications.

Material & Methods: 50 ASA I and II children, aged 2 to 8 years, weighing 10-20 kg, undergoing elective infraumbilical surgery were randomly divided into 2 groups. In group P- proseal LMA was inserted and in group E-endotracheal tube was placed.

Result: We found that mean insertion time of PLMA was significantly lower than ET tube. Hemodynamic responses were significantly higher after endotracheal intubation than PLMA. Adequate ventilation was achieved in both the groups with no episode of desaturation or hypercarbia. Extent of laryngopharyngeal morbidity was less in PLMA group, Fiberoptic examination revealed grade 1 fibreoptic view in 80 % patients after PLMA placement with adequate seal pressure (mean seal pressure 21)

Conclusion: The performance of PLMA is comparable to conventional endotracheal intubation, in providing effective ventilation during controlled ventilation in paediatric population.

KEYWORDS

Proseal LMA, paediatric, endotracheal tube, elective surgeries

INTRODUCTION

Endotracheal intubation is always considered a gold standard of airway management (1,2) as it effectively provides positive pressure ventilation without much risk of pulmonary aspiration, but laryngoscopy and tracheal intubation causes significant increase in heart rate and blood pressure. A similar set of hemodynamic derangements occur during extubation. Apart from hemodynamic changes, other disadvantages are airway trauma, sore throat and various scenario of failed intubation.

In 1981, Dr. Archie Brain (3) developed Classic LMA, a supraglottic airway device that has been found to be useful in airway management in difficult airway and failed intubation.To minimize the risk of aspiration , Dr. Archie Brain developed a new laryngeal mask airway incorporating a drainage tube (LMA DT), which was named Proseal LMA. Proseal LMA has a dorsal cuff, in addition to the peripheral cuff, to provide a better seal around the glottic aperture and permits high airway pressure without leak. A gastric drainage tube parallel to the ventilation tube permits drainage of passively regurgitated gastric fluid away from the airway and serves as a passage for gastric tube. The pediatric Proseal lacks the dorsal cuff (4) and is available in sizes 1,1.5,2 and 2.5.

In present study we have compared the PLMA size 2 and ET tube in terms of ease of insertion of devices, no of attempts of insertion, ease of gastric tube insertion, hemodynamic changes after insertion of devices in terms of heart rate, systolic blood pressure, diastolic blood pressure, ventilatory characteristics in terms of etCO2, spO2, leak pressure and perioperative complications.

MATERIAL & METHODS

After ethical committee approval and obtaining written informed consent from parents, 50 ASA I and II children of age group 2-8 years of either sex, weighing 10-20 kg scheduled for infraumbilical surgery were undertaken for study. All patients were randomly divided into 2 groups by chit in box method (simple randomization) to either PLMA group (group P) or ET group (group E).

Patients with lack of informed consent, with anticipated difficult airway, gastroesophageal reflux diseases, hiatus hernia, cardio respiratory disease, upper respiratory tract infection and full stomach were excluded from our study.

A thorough preoperative assessment was done day before surgery. In operation theatre, after confirmation of patient's identity, standard monitors like pulse oximeter, 5 lead ECG, noninvasive blood pressure and skin temperature probe were attached, and baseline parameters were recorded. Patients were premedicated with Inj.Glycopyrolate (0.005mg/kg), Inj Midazolam (0.05mg/kg) and Inj Fentanyl(2mcg/kg) i.v. After preoxygenation with 100% O2, patients were induced with injection Propofol 3mg/kg i. v., inj Atracurium 0.6 mg/kg was used as nm blocking drug .

In group P, size 2 PLMA was used. For standardization, we used the index finger technique for inserting the PLMA in all cases. The cuff was inflated with 7-10 ml of air. Cuff pressure was kept below 60cm of H2O. The number of attempts of insertion were noted. Three attempts were allowed for the placement of device before it was considered a failure and the device had to be replaced with an ET tube. Spontaneous removal of the device from mouth was termed as failed attempt. Gastric tube number 10 was inserted through a drain tube. Two attempts were allowed before gastric tube insertion was considered as failure and repositioning of PLMA had to be done.

In group E, appropriate sized endotracheal tube was inserted in a standard manner. Time taken for insertion (in seconds) was defined as the time interval between holding the airway device to confirmation of correct placement by bilateral air entry on chest auscultation. Correct placement of the devices was confirmed by adequate chest movement on manual ventilation, square wave on capnography, expired tidal volume of more than 8 ml/kg. The gel displacement test was done by placing a blob of gel at the tip of the drain tube (DT) and noting the airway pressure at which it was ejected. Number of attempts of insertion of devices were noted. The insertion of device was considered as failure if it took more than three attempts or any attempt required more than 120 seconds to accomplish the procedures. Once the position of endotracheal tube was confirmed, nasogastric tube was inserted and insertion characteristics like time taken for insertion, total number of attempts of insertion were noted.

Fibreoptic evaluation of PLMA was performed after successful insertion and determination of the airway pressures. The images were graded as: (grade 1- only larynx seen; grade 2- larynx and epiglottis posterior surface seen; grade 3- larynx and epiglottis tip of anterior surface seen, <50% visual obstruction of epiglottis to larynx; grade 4- epiglottis downfolded and its anterior surface seen, >50% visual obstruction of epiglottis to larynx; grade 5- epiglottis downfolded and

larynx cannot be seen)

Once PLMA was properly placed oropharyngeal leak pressure was checked. Adjustable pressure limiting valve was closed, fresh gas flow was fixed at 3lit/min and airway pressure was allowed to rise (not more than 40 cm of H_2O). The leak pressure was then measured by detection of audible noise or using a stethoscope placed just lateral to thyroid cartilage.

Maintenance of anaesthesia was done using sevoflurane, nitrous oxide and oxygen (60:40) and inj atracurium 0.15mg/kg intermittently. Intraoperative monitoring of heart rate, noninvasive blood pressure, SpO2 and EtCO2 were done post induction, after 1 min ,5 min and 10 min after insertion of devices. After completion of surgery, anaesthetic agents were discontinued and reversal of neuromuscular blockade was done with Inj neostigmine 0.06mg/kg and Inj. Glycopyrrolate 0.04mg/kg. After thorough suctioning and full deflation of cuff of the PLMA and ET tube were removed in awake patients with adequate breathing. During emergence, the occurrence of any complications like coughing, bronchospasm and laryngospasm were noted. After removal of both airway devices, blood staining of the ET tube and posterior aspect of cuff of PLMA, tongue-lip-dental trauma and hoarseness were recorded. The patients were followed for next 24 h for any sore throat and hoarseness.

Data analysis was carried out using SPSS (Statistical Package for Social Studies) Window version.20.0.Quantitative data were expressed in the form of mean and SD. Qualitative data were expressed in the form of proportions. Significance of difference of proportion were inferred by Chi square test. Significance of difference in mean were inferred by unpaired T test/ANOVA. Further, p>0.05 was taken as not significant.

RESULTS

The demographic profile of patients in both groups was comparable with respect to age (years), weight (Kg), ASA grade and duration of surgery. (Table 1)

Table 1: Demographic characteristics

Variables	Group E	Group P	P value
Age (Yrs)	4.9±1.6	4.9 ± 2	0.8445
Weight (Kg)	15.6 ± 2.7	14.7 ± 2.9	0.2312
ASA grade I/II	25/0	25/0	
Duration of surgery (mins)	33.6 ± 14.8	31.8 ± 16.4	0.6863

Time taken for insertion in group P was less (13.2 ± 3.4 secs) as compared to group E (25.6± 6.9 secs), which was statistically significant (p value=0.0000)

In Group E, the ET Tube was inserted in first attempt in 23 patients (92) and in 2 patients (8%) two attempts were made. No patient required third attempt.

In group P Proseal was inserted in first attempt in 22 patients (88%). Insertion was difficult in 3 patients. There was no failed insertion reported in either group.

Mean time for NG tube insertion was 16.2 and 18.7 secs in group P and group E respectively. The difference in insertion time was statistically significant (P=0.0168).

Regarding hemodynamic changes, the increase in heart rate was statistical significant till 5 min of intubation (4.6bpm) in group E, while statistically significant decrease in heart rate was noted even after 10 mins of device insertion in group P.(Table 2)

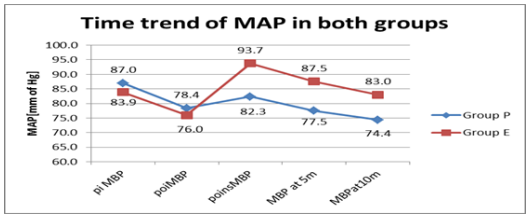
Table 2: Trend of Pulse Rate at different time interval

	Group E			Group P			P value b/w groups
	Mean (bpm)	SD	P value	Mean (bpm)	SD	P value	
Baseline	115.5	8.2		117.6	8.6		0.3858
Post induction	101.0	7.4	0.0000	101.8	8.2	0.0000	0.7589
Post Insertion	126.3	7.7	0.0000	113.0	7.5	0.0000	0.0000
5 MIN	120.1	7.0	0.0000	105.9	7.3	0.0000	0.0000
10 MIN	113.9	6.6	0.0796	100.3	6.7	0.0000	0.0000

In group E, there was statistical significant increase in SBP after endotracheal intubation (p value 0.0000) , which remain significant till 5 min of intubation (p value 0.0000) as compared to group P. Similarly statistical significant increase in DBP was observed in group E after intubation (p value 0.005), which remained significant 5 min after intubation(p value 0.005) as compared to group P.

When comparing group P from group E, there was statistical significant increase in MAP in group E after intubation (p value 0.0000) which remained significant till 5 min of intubation as compared to group P. (Figure 1)

FIGURE 1: COMPARING TREND OF MAP AT DIFFERENT TIME INTERVAL



There was no significant difference in mean SpO2 and EtCO2 at different time interval between the groups. (p>0.05)

Position of proseal LMA was confirmed after placement by flexible bronchoscope. Grade 1 was shown by 80% of patients whereas 20% showed Grade 2.

Leak pressure was determined after proper placement of proseal LMA. Maximum leak pressure detected was 23 cm of H2O and minimum pressure detected was 17 cm of H2O with mean of 21 and standard deviation of 1.7.

Coughing after removal of PLMA was seen in 8% patients, while it was seen in 20% patients in the ETT group. Blood staining of devices on removal was seen in 16% patients in group P and in 4% patients in group E. Although blood staining of PLMA was found to be higher as compared to ET tube, those were not statistically significant. (P=0.1493). There was no significant incidence of perioperative bronchospasm and laryngospasm in both the groups.

Sore throat was seen in 8% patients in group P and in 32% patients in group E during 1st hour postoperatively which was resolved in all patients in next 24 hours. None of the patient in either group complained of dysphagia, dysphonia or any other complication post operatively.(Table 3)

Table 3: Incidences of Complications

Complication	Group E		Group P		P-Value
	No	%	No	%	
Coughing	5	20	2	8	0.1596
Blood staining of device	1	4	4	16	0.1493
laryngospasm	1	4	0	0.0	0.5000
bronchospasm	0		0		
Hoarseness/sore throat	8	32	2	8	0.0339

DISCUSSION

Supraglottic airway devices have become the integral component in the management of pediatric airway (5). Proseal LMA, A modified classic LMA, has dorsal cuff to provide better seal, a drainage tube for isolation of alimentary from respiratory tract and an integral bite block. Thus, Proseal LMA is better suited for providing positive pressure ventilation and at a given intracuff pressure, provides twice the seal pressure of the Classic LMA.

In our study the first-time success rate for airway device insertion was higher for ET Tube (92%) than PLMA (88%) though insertion time was longer with the ET tube than Proseal LMA. This was in conformity with the study by Misra et al (2) and Saraswat et al (6) who found first attempt success rate for PLMA is 88 % and 86.7 % respectively.

We found that the mean insertion time of group P was 13.2 secs and for Group E it was 25.6 secs, which was significantly lower in PLMA group (p value=0.0000) than ET group. Lim Y et al (7) also noted the shorter effective airway time for the ProSeal laryngeal mask airway

(20 +/- 2s vs. 37 +/- 3 s, P < 0.001). Similar findings were noted by Shroff et al (8), Saraswat et al (6) and Patel et al (9).

The mean insertion time taken to insert NGT through PLMA (16.2 secs) was significantly less than that of E group (18.7secs) (P=0.0168). Shroff et al (8) (14 secs Vs 27 secs) and Saraswat at el (6) (9.77 sec Vs 11.5 secs) also found NG tube quicker to insert through PLMA than nose (ETT group).

The insertion of PLMA causes less hemodynamic derangement than endotracheal intubation, which was statistically significant. Shroff et al (8) & Lalwani et al (10) in their study found that the pulse rate in Proseal group was significantly lower in all times compared to baseline with significant difference in both groups. Studies by Lim Y et al (7), Piper SN et al (11)and El-Ganzouri et al (12) on PLMA showed that the hemodynamic stress responses to insertion was greater for the tracheal tube than the PLMA. Incidence of coughing were more in Group E (20%) than group P (8%), but this was statistically insignificant. Similar results were reported by Saraswat et al (6) Mucosal injury, recognized by blood on the PLMA after removal was present in 16% of patients. Blood staining was present in only 4% of patients of group E however this difference was statistically insignificant. (p 0.1493). Comparable results were found by Saraswat et al (6)

There was no significant incidence of intraoperative and postoperative bronchospasm, regurgitation or aspiration in either group. Similar results have been reported by Maltby et al (13) Sharma B et al (14)and Higgins et al (15).

The incidence of sore throat was comparatively higher in group E (32%) than in group P (8%) was resolved in all patients in next 24 hours. Higgins et al (15) and Shroff et al (8) also found the greater incidence of sore throat in patients undergoing intubation than in PLMA group.

CONCLUSION

Current study highlights that the performance of properly positioned PLMA is comparable to conventional endotracheal intubation, in providing effective ventilation in paediatric population undergoing infraumbilical surgeries with the advantage of less hemodynamic response to insertion, and postoperative laryngopharyngeal morbidity and therefore it may be a suitable alternative to endotracheal tube.

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