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A Comparative Study to Know the Effects of Insertion of LMA Vs ETT on Heart Rate in Children Undergoing Elective Surgery

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Abstract

Introduction: This prospective comparative trial was under-taken to compare the effects of insertion of laryngeal mask airway (LMA) and Endotracheal tube on heart rate response, evaluate the safety and efficacy of LMA as an airway device, and evaluate the changes in heart rate in pediatrics patients undergoing elective surgeries under general anaesthesia. *Material and Methods:* 60 cases which met all the inclusion criteria were selected and the study was carried out on patients of ASA I and II, aged 2 - 14 years of either sex, weighing 3-45kg undergoing elective surgery Group-L: LMA for airway management Group-E: Endotracheal Tube (ETT) for airway management. *Results:* Both ETT and LMA cause increase in heart rate (HR), but the magnitude and duration of response is less in LMA. The heart rate response to LMA insertion has reached the basal values in 3 minutes where as in endotracheal group it was still higher even in 5 minutes. Mean difference in the heart rate at different intervals with that of basal values showed significant results. *Conclusion:* Heart response is less and short lived with LMA as compared to endotracheal intubation. Therefore LMA is a suitable alternative to endotracheal intubation for elective surgical procedures in paediatric patients.

Keywords: Heart Rate Response; Laryngeal Mask Airway; Endotracheal Intubation; Children.

Introduction

Airway management is of utmost importance during delivery of general anaesthesia. Laryngoscopy and tracheal intubation or laryngeal mask airway insertion are noxious stimuli which provoke a transient but marked sympathetic response manifesting as hypertension and tachycardia. The laryngeal mask airway (LMA) was developed by British anaesthetist Dr Archie I. J. Brain in 1983 [1]. LMA was approved by the FDA in 1991, and its use in airway management has been gaining popularity ever since [2].

Direct laryngoscopy by activating proprioceptors, induces arterial hypertension, tachycardia and increased catecholamine con-centration proportional to the intensity of stimulus exerted against the base of the tongue [3]. The Laryngeal Mask Airway is designed to establish effective seal around the laryngeal inlet with an inflatable cuff. It is a useful advancement in airway management [4]. The LMA is one of the most promising non-pharmacolog-ical methods to attenuate the sympatho-adrenal response to tracheal intubation, causing less sympathetic response and catecholamine release [5].

The LMA causes less pressure response during insertion compared to tracheal intubation and the increase in heart rate is very short lived [6,7]. Recently there is increasing use of LMA in children because of ease of insertion and removal as compared to endotracheal intubation with minimal disturbances in cardiovascular and respiratory system and lesser risk of airway injury during the perioperative period [8]. Wilson IG et al found that insertion of the LMA has smaller cardiovascular responses than those after laryngoscopy and endotracheal intubation and it is useful in those patients who has marked pressor response [9].

The objective of the present study is to determine the heart rate response elicited by laryngoscopy and endotracheal intubation and compare it with that elicited by laryngeal mask insertion in ASA I and ASA II patients, undergoing elective surgeries in children.

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Methodology

After obtaining approval from hospital Ethical Committee, details of the procedure was explained to the patient's guard-ian and a written informed consent was taken. 60 cases which met all the inclusion criteria were selected for the study. The study was carried out on children of ASA I and II, aged 2 – 14 years of either sex, undergoing elective surgeries were randomly allocated to one of the two groups of 30 patients each. Group L (n = 30) LMA-classic group. Group E (n=30) Endotracheal tube- intubation group. All patients were assessed clinically preoperatively and investigated to rule out any systemic diseases.

All patients were premedicated with Inj. Glycopyrolate 0.004mg/kg IV, Inj.Ondansetaron 0.1mg/kg IV, Inj. Midazolam 0.03mg/kg IV, Inj.Tramadol 1mg/kg IV and were pre-oxygenated for three minutes. Induction of anaesthesia was done with Inj. Propofol 2mg/kg IV. Intubation / LMA insertion was facilitated by using Inj. Succinylcholine 1.5 mg/kg IV. Patients were ventilated with 100 percent oxygen for a brief period and intubation with the aid of Macintosh laryngoscope or insertion of LMA was carried out. Time taken for intubation or insertion of LMA did not exceed 20 seconds. Anaesthesia was maintained with intermittent positive pressure ventilation with Nitrous oxide and Oxygen (66:33), Halothane (0.5%-1%) and Inj. Vecuronium 0.1mg/kg IV.

Surgery was not allowed to commence till the study was completed i.e. for 5 minutes after intubation / insertion. At the end of surgery residual neuromuscular block was reversed with the mixture of Inj Glycopyrolate 0.008 mg/kg IV and Inj Neostigmine 0.05mg/kg IV.

Monitoring of HR, before induc-tion as baseline, after intubation or placement of LMA, at 1mins, 3mins and 5mins. For both the groups, baseline value for ETCO2 was taken after place-ment of airway devices (ETT/ PLMA). For statistical analysis of data between groups' students 't' test was used. Results were considered statistically significant for p values <0.05. SPSS 16.0 version was used for statistical analysis.

Results

The observations were compiled and the results were presented in tables, graphs. The demographic data was comparable in both the groups. There was no statistically significant difference.

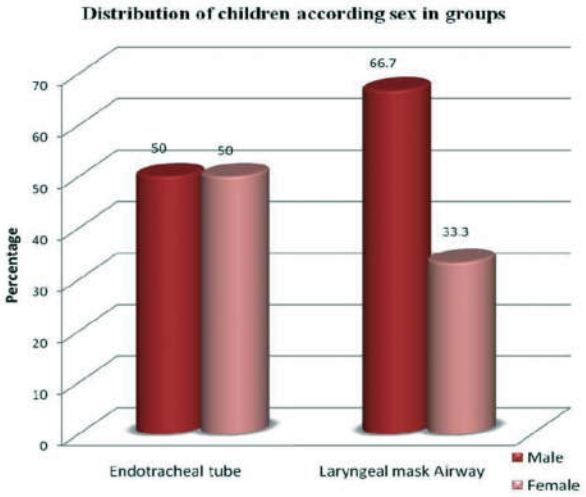

Fig. 1: Sex-wise distribution of the study participants

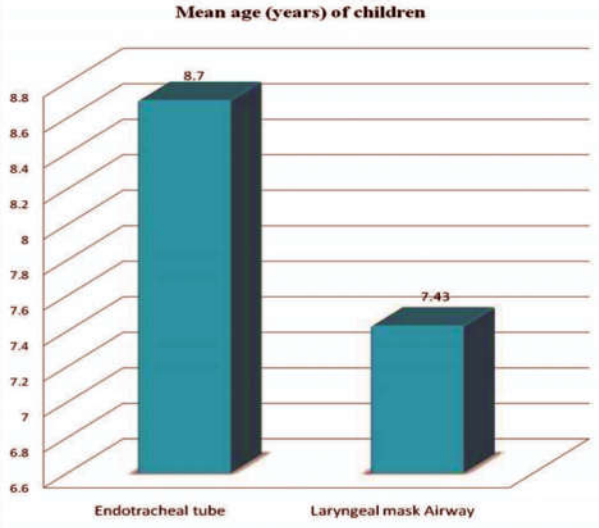

Fig. 2: Distribution of study participants according to mean age

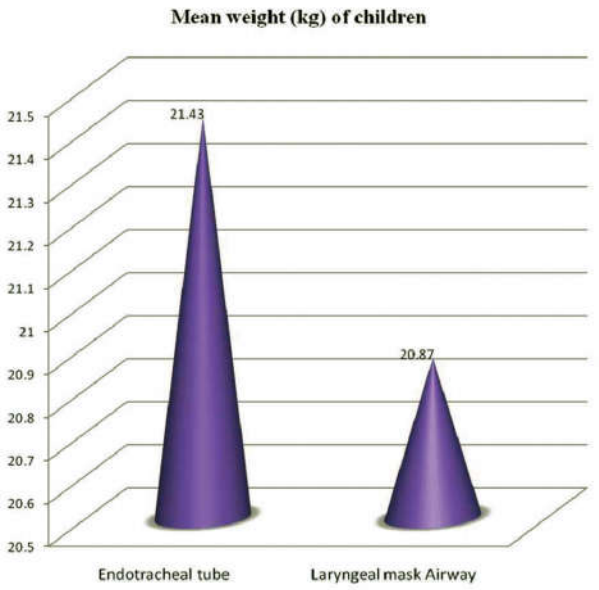

Fig. 3: Distribution of study participants according to mean weight

Table 1: Mean heart rate at different times among ETT and LMA study participants

Parameters	ETT	LMA	Mean difference	95% CI	p value
Baseline	100.2±14.7	101.5±15.3	1.27	-8.99–6.46	0.744
Pre Induction	110.9 ± 15.6	104.9 ± 15.9	6.03	-2.11–14.17	0.143
0' minute	135.6±13.4	116.2±13.5	19.4	12.45–26.35	0.0001
1' minute	132.8±12.1	113.7±20.9	19.17	10.29–28.04	0.0001
3' minute	122.5±12.9	107.0±12.8	15.5	8.85–22.15	0.0001
5' minute	113.5±10.9	100.4±13.4	13.17	6.85–19.48	0.0001

Table 2: Mean difference in heart rate at different times with basal heart rate among ETT and LMA study participants

Parameters	ETT	LMA	p value
Pre - Induction	-11.06±7.99	-3.43±4.07	0.0001
0' minute	-35.43±11.6	-14.76±3.68	0.0001
1' minute	-32.63±12.22	-12.2±19.23	0.0001
3' minute	-22.33±12.74	-5.56±7.69	0.0001
5' minute	-13.33±12.36	1.1±5.76	0.0001

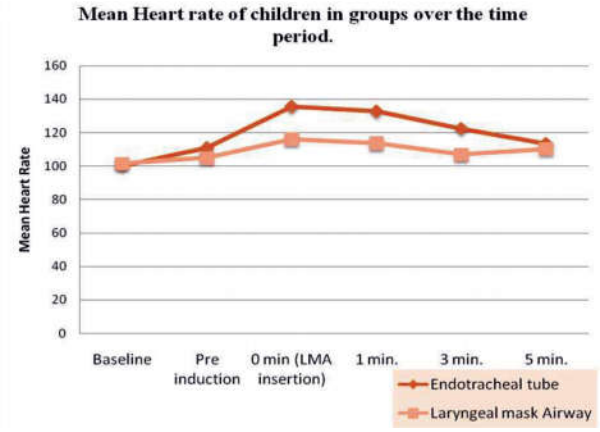

Fig. 4: Mean heart rate of study participants in both groups over the time

Table 1 show that heart rate in both the groups which were recorded at baseline, pre-induction, 0, 1, 3 and 5 minutes. There was no significant difference in heart rate at baseline and pre-induction recordings. Heart rate remained high in ETT group at 0, 1, 3 and 5 minutes as compared with LMA group. The difference was statistically significant ($p<0.05$).

Table 2 shows that mean difference in heart rate at different time intervals with that of basal values, is much lower in LMA group as compared with that of ETT group, and which is highly statistical significant ($p < 0.01$).

Discussion

This prospective comparative trial was conducted to com-pare LMA as an alternative airway device to ETT in 60 pae-diatric patients undergoing elective surgery. The LMA has been proved to be adequate in previous studies by Sinha A. et al. 2007 [10]; Patel et al. 2010[11]; Lalwani et al, 2010 [12].

We compared the LMA with ETT in terms of mean heart rate and also mean difference in the heart rates at different intervals of time pre-induction, zero, one, three and five minutes with that of basal values. The anthropometric (height, weight) data was comparable in both the groups. The pre-induction values in both the groups were comparable and there was no statistically significant difference between them ($p<0.05$).

Patel et al 2010, [11] found that there was no change in haemo-dynamic parameters in Group PLMA during insertion and removal of the ProSeal LMA whereas there was rise in both heart rates during insertion and extubation in ETT group, and the change was statistically highly significant. In our study, heart rate was increased in both the groups after placement of the air-way devices but the magnitude and duration of increase in HR was less in LMA group than in ETT group.

Garima Agrawal (2011)[13], found that following insertion of endotracheal tube, there was a highly significant rise in heart rate ($P=0.000$) but there was no significant rise in the heart rate ($P=0.921$) in the PLMA group.

Dave et al, [14] also found rise in heart rate after insertion of the PLMA which was statistically insignificant ($P>0.05$) but in our study the rise in heart rate after insertion of PLMA was found to be highly significant (<0.01).

Shahin N Jamil et al, [8] have performed randomized prospective study to examine the effects of tracheal intubation and LMA insertion in children of age 2 to 10 years. They found that heart rate

increased significantly in both groups after insertion of ETT / LMA ($p<0.01$). This increase in heart rate persisted up to 5 minutes in Group A was 105.7±8.3 (ETT group), while it came to baseline 107.2±9.3 within 3 minutes in Group B (LMA group) 7, where as in our study changes in heart rate was significant at 0,1,3,5 minutes.

The heart rate increased significantly in both groups after insertion of ETT/ LMA ($p<0.01$). This increase in heart rate persisted up to 5 min in Group A (ETT group), while it came to baseline within 3 min in Group B (LMA group). The mean changes in heart rate at 0, 1, 3 min were highly significant in Group A as compared to Group B ($p<0.001$, <0.001, <0.05 at 0, 1 and 3 min respectively), similar to the findings of our study [2].

Mehernoor F. Watcha et al [15] compared the heart rate responses and found that immediately after insertion of the ETT airway device; there was a significant increase in HR above baseline values. In contrast, there were no significant differences in HR compared with baseline values in the LMA group 22. Where as in our study mean difference in heart rate at different intervals of time showed significant rise compared with baseline values, but in ETT group values were more compared with LMA group.

In conclusion, we can say that during routine pediatric use, LMA provides a satisfactory airway for PPV. Heart rate response is less and is short lived with LMA as compared to endo-tracheal intubation. Mean difference in heart rate at different intervals is more in ETT group compared to LMA group.

Limitations

- Number of cases in each group was only thirty (30), to find statistical significance in these groups will be very difficult as it may not show the actual outcomes.
- A Randomized Controlled Trial, triple blinded or double blinded in nature, involving a large number of patients with long term follow-up is clearly needed to bring the differences between the two tech-niques.

Conflicts of Interest: None

Source of Support: Nil

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