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A Double Blind Comparative Study on the Hemodynamic Parameters in Response to Insertion of Laryngeal Mask Airway and Endotracheal Intubation in Children Undergoing Elective Surgeries

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Abstract

Background: Airway management is of one of most important task during delivery of general anaesthesia. It was then established that laryngo-tracheal stimulation can lead to sympatho adrenal stimulation. This can cause a sudden rise in blood pressure leading to left ventricular failure, cerebral haemorrhage and myocardial ischemia. In normotensive patients laryngoscopy and insertion of an endotracheal tube is immediately followed by an average increase of mean arterial pressure of 25 mm Hg. There is no evidence that this effect causes lasting damage in normotensive patients. It was concluded that the use of the laryngeal mask airway (LMA) may therefore offer few advantages than tracheal intubation in the anaesthetic management of patients where the avoidance of pressor response is of particular concern. *Objective:* 1. To determine the pressor response elicited by laryngoscopy and endotracheal intubation in ASA I and ASA II patients, undergoing elective surgeries. 2. To determine the pressor response elicited by laryngeal mask insertion in ASA I and ASA II patients, undergoing elective surgeries. 3. To study the difference between the pressor response seen with ETT and that seen with LMA in patients undergoing elective surgeries. *Methods:* A hospital based prospective randomized study was conducted to determine the haemodynamic response elicited by laryngoscopy and endotracheal intubation and we compared the response with that elicited by laryngeal mask insertion in ASA I and ASA II patients, listed for elective surgeries. Either an ETT or LMA was inserted after induction of anaesthesia. Evaluations included measurement of heart rate and blood pressure before insertion, after insertion of device, 1 minute, 3 minutes and 5 minutes after insertion. *Results:* In a prospective randomized trial, 60 ASA I and II children weighing between 8 to 45 kg in the range of 2 to 14 years of age, planned for elective surgery were randomly allocated to one of the two groups of 30 patients each. The change in pressor response was significantly higher in endotracheal intubation children as compared to LMA placement. Furthermore these changes persisted for longer duration in children with endotracheal intubation in comparison to LMA insertion (5 min vs 3 min). *Conclusion:* LMA can be routinely used as a safe and effective alternative airway device to endotracheal intubation for positive pressure ventilation in pediatric patients' listed for elective surgical procedure.

Keywords: Hemodynamic Response; Laryngeal Mask Airway; Endotracheal Intubation; Children; Elective Surgeries.

Introduction

Airway management is of utmost importance during delivery of general anesthesia. Anaesthetized patients are unable to maintain an adequate airway on their own and require maintenance with artificial airway devices [1].

Traditionally, laryngoscopy and endotracheal intubation (ETT) has been the mainstay in providing adequate airway management, delivering anaesthesia and helps in avoidance of aspiration in anaesthetized patients. It has both advantages and disadvantages [2]. Laryngeal mask airway (LMA) insertion implicate lesser mechanical manipulation of upper airway than endotracheal intubation, but it has its own contraindications as well as limitations [3].

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Insertion of laryngeal mask airway does not require the visualization of cords or the penetration of larynx, which makes placement less stimulating than tracheal tube insertion and which can lead to less sympathetic response and catecholamine release. Therefore during laryngeal mask airway insertion there is less likelihood of pressor responses or coughing than with conventional endotracheal tube anaesthesia [4].

ETT or LMA are noxious stimuli which provoke a transient but marked sympathetic response manifesting as hypertension and tachycardia [5]. LMA can also be used as an alternative in children without co-existing upper respiratory tract infections, since it reduces chances of bronchospasm, oxygen desaturation and coughing and also reduces trauma to the structures in and around the larynx when compared to endotracheal intubation 14. And incidence of sore throat is also less.

Although a number of researches comparing the pressor changes seen with either ETT or LMA have been done around the world, no such study has been done in our set up. ETT is the main method used for airway management and delivery of anaesthesia in our setting. While the laryngeal mask airway is not routinely used in our setting for the same purpose, it has been shown to have positive effects in other populations, with respect to pressor changes and ease of insertion.

In order to improve the quality of care of our patients and decrease morbidity related with the conventional method of ETT for anaesthesia delivery, this study aims at comparing the hemodynamic responses of ETT versus LMA in our population.

Methodology

Patients were grouped into two groups comprising of 30 patients using the block randomization method. Group-L: LMA for airway management. Group-E: EndoTracheal Tube for airway management.

After receiving approval from Hospital Ethical Committee, details pertaining to the procedure were explained to the patient's guard-ian and a written informed consent was taken. On arrival in the preoperating room, identity of the patient was confirmed along with consent form; the preop-erative assessment was reviewed and up dated. Confirmation regarding nil by mouth was done and premedicated with syrup Mida-zolam (0.5mg/kg) to sedate the patient 40 minutes before the surgery. Later the patient was shifted to the operation theatre. ECG, NIBP and pulse oxi-meter were applied and noted baseline readings of parameters like HR, SBP, DBP, MAP and SpO2. After intubation attachment of ETCO2 was done. A 22 G IV cannula was fixed. Premedication for all patients was same with intravenous Glycopyrrolate 8-10μg/kg, Tramadol and Ondansetron. A standard technique of General Anaesthesia was adopted in all patients consisting of pre-oxygenation for 3 minutes, induction with Inj Propofol 1% (2mg/kg) followed by Inj. Atracurium (0.6 mg/kg).

Correct placement of both ETT and LMA was confirmed by: Chest movement, Bilateral chest auscultation, ETCO2 waveform, Easy passage of the nasogastric tube through the gastric tube of LMA. A nasogastric tube (8/10 French) was passed in every patient of both groups. Anaesthesia was maintained with Nitrous oxide 66% in 33% Oxygen and 0.2% halothane. Neuromuscular blockade was maintained with Inj. Atracurium with top up of 0.1mg/kg. Ventilation was set at a tidal volume of 8ml/kg, respiratory rate of 20-22 /min and I/E ratio of 1:2. Patients of both the groups were placed in the left lateral position and caudal epidural regional block with Bupivacaine 0.2% and Clonidine 1μg/kg was giv-en for intraoperative and post-operative analgesia. After the completion of surgery, reversal of the residual neuro-mus-cular blockade was done with Inj. Neostigmine (0.05mg/kg) and Inj. Glycopyrrolate (0.01 mg/ kg).

Monitoring of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) before induc-tion as baseline, after intubation or placement of LMA, at 1 mins, 3 mins, 5mins and there after every 5mins till removal of ETT or LMA. Data were expressed in mean ± SD. Comparison between groups was done using student's t-test. Results were considered statistically significant for p values < 0.05. Data were analyzed using software SPSS v16.0

Results

The observations were compiled and the results were analyz-ed statistically. The observations are tabulated as:

Demographic Variables (Table-1) - Age distribution, Weight, Sex, ASA status

Haemodynamic Variables (Figures 1-6): Heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pres-sure

Figure 1 shows the baseline reading of haemodynamic parameters. And there was no significant difference in heart rate and systolic blood pressure readings ($p > 0.05$).Statistically significant difference was observed between the two groups with respect to DBP and MAP ($p < 0.05$).

Table 1: Demographic variables of the study subjects (Mean ± SD) (n=30)

Variables	Group	
	Endotracheal tube group	**LMA group**
Age (years)	8.70±3.659	7.433±4.423
Weight	21.43±7.86	20.87±12.05
Male/Female	15/15	20/10
ASA Grade 1	30	30

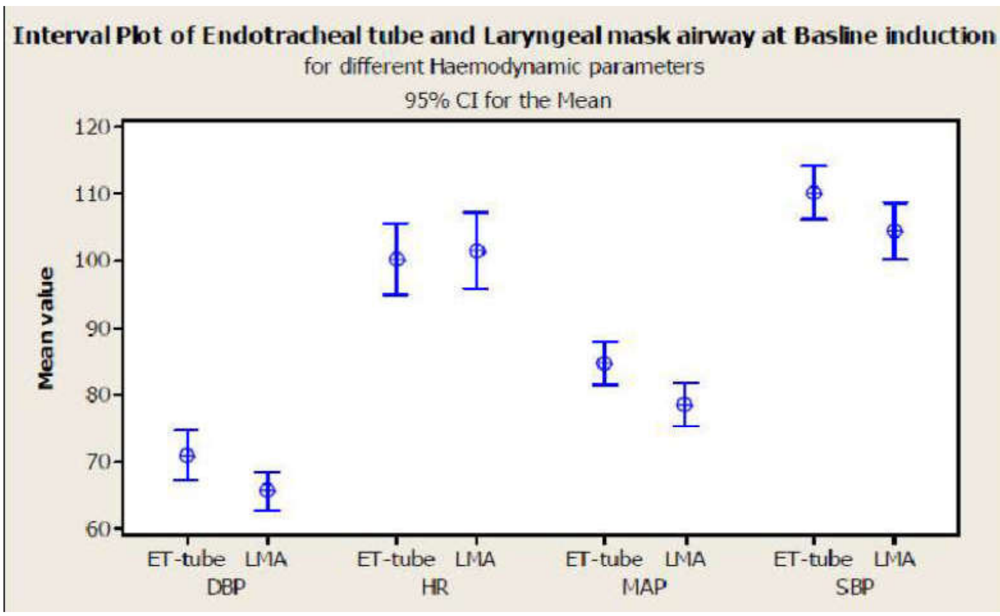

Fig. 1: Interval Plot of Endotracheal tube and Laryngeal mask airway at Baseline induction for different Haemodynamic parameters 95% CI for the Mean

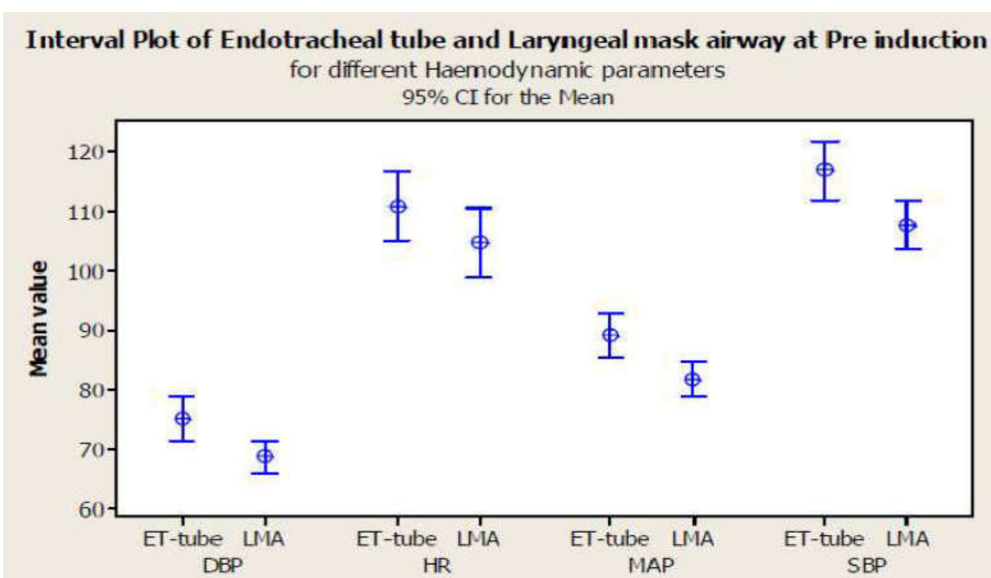

Fig. 2: Interval Plot of Endotracheal tube and Laryngeal mask airway at Pre induction for different Haemodynamic parameters 95% CI for the Mean

Figure 2 is showing the haemodynamic parameters in the two groups, recorded during the pre - induction time i.e. just before pre-oxygenation. There was no significant difference in these readings ($p > 0.05$).

Figure 3 is showing the values of heamodynamic parameters at laryngoscopy and intubation / insertion of LMA. There was rise in all the parameters in both the groups but the rise was significantly low in the LMA group ($p < 0.05$).

Whereas one minute after insertion of laryngoscopy and intubation / LMA insertion, in the E Group all the values were significantly well above the pre-induction values. We can see there is statistically significant change in E group compare to L group ($p < 0.05$) (Figure 4).

At three minutes after insertion of the tubes, the parameters were still high in E group compared to L group. The difference was statistically significant ($p<0.05$) (Figure 5). At 5 minutes after insertion again

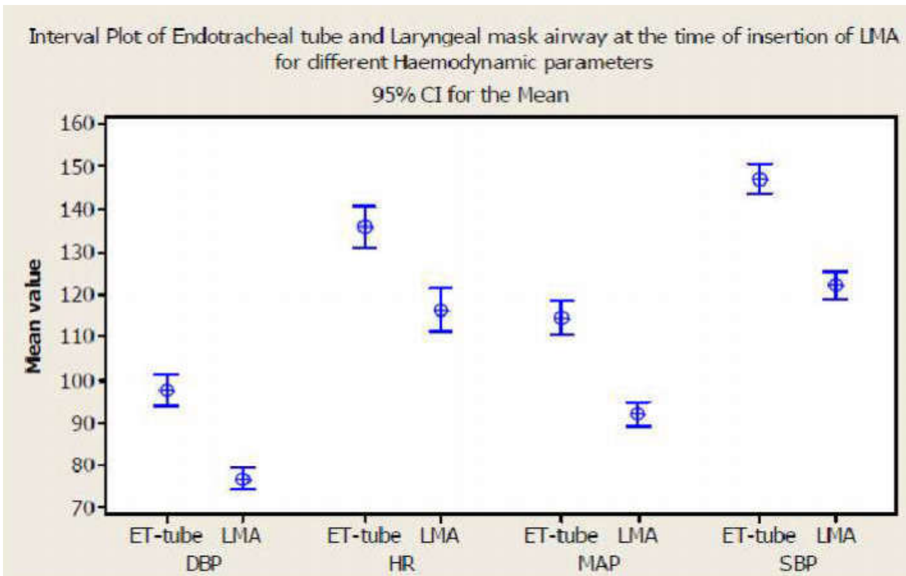

Fig. 3: Interval Plot of Endotracheal tube and Laryngeal mask airway at the time of insertion (zero minute) for different Haemodynamic parameters 95% CI for the Mean

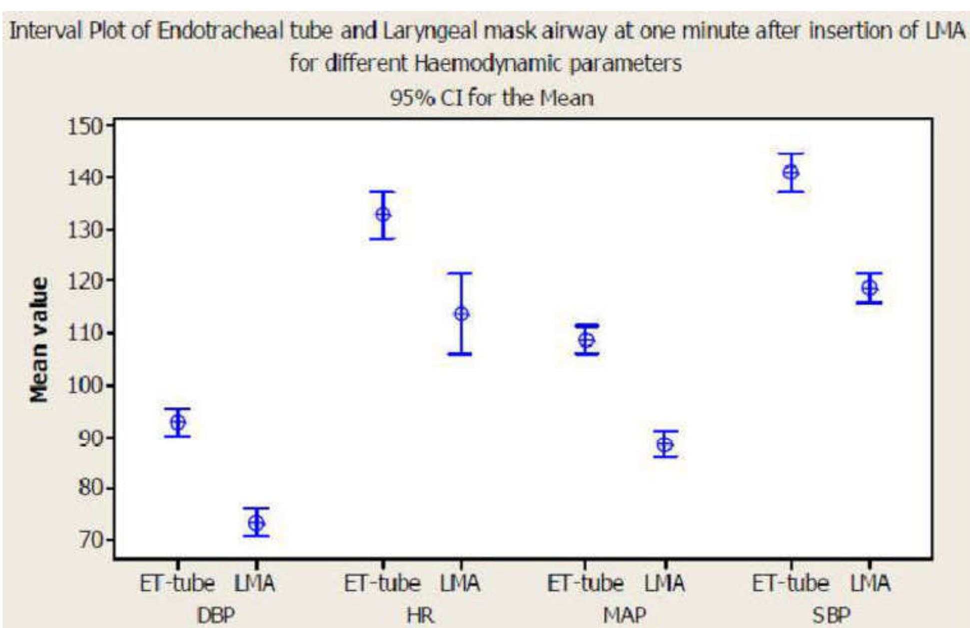

Fig. 4: Interval Plot of Endotracheal tube and Laryngeal mask airway at one minute after insertion for different Haemodynamic parameters 95% CI for the Mean

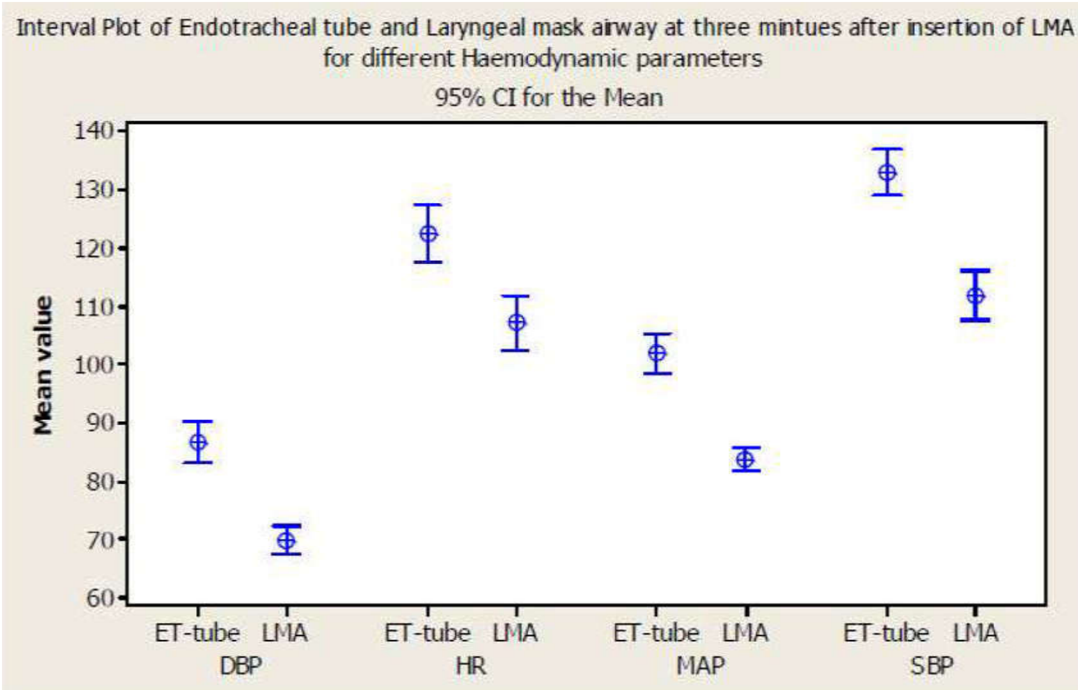

Fig. 5: Interval Plot of Endotracheal tube and Laryngeal mask airway at three minute after insertion for different Haemodynamic parameters 95% CI for the Mean

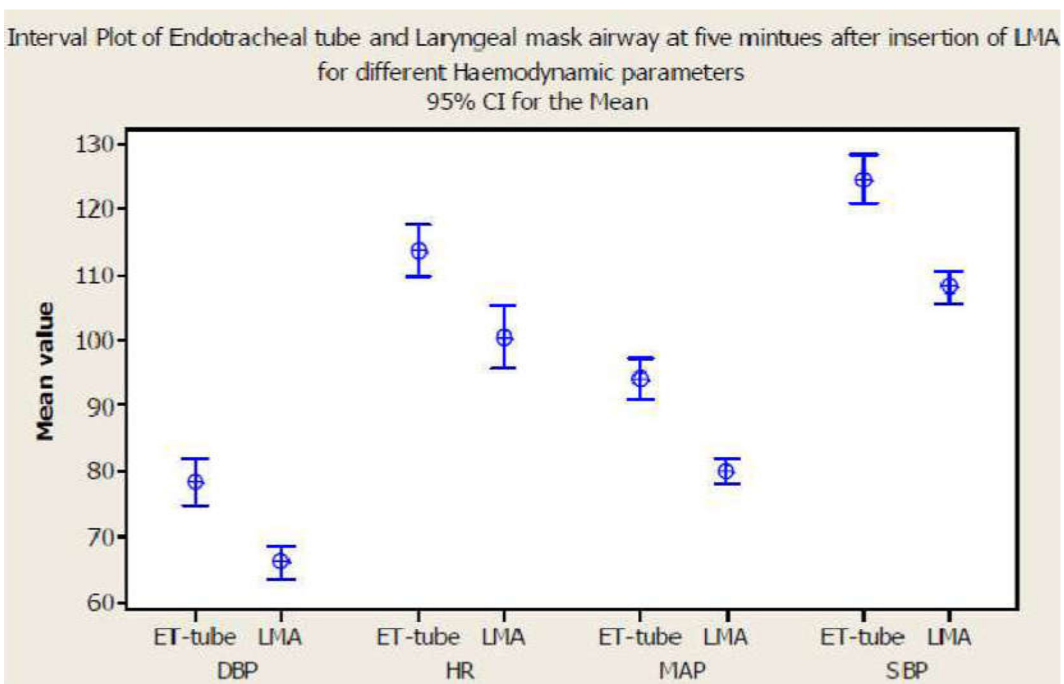

Fig. 6: Interval Plot of Endotracheal tube and Laryngeal mask airway at five minutes, for different Haemodynamic parameters 95% CI for the Mean

the comparison of parameters in both groups shows that the values were still high in the E group than the L group. The difference was statistically significant ($p<0.05$).

Discussion

Modern anaesthesia practice in children was made possible by the invention of the endotracheal tube

(ET), which made lengthy and complex surgical procedures feasible without the disastrous complications of airway obstruction, aspiration of gastric contents or asphyxia. For decades, endotracheal intubation or bag-and-mask ventilation were the mainstays of airway management. The two groups consisting of 30 participants each were comparable in terms of age, sex, ASA class, weight and baseline HR and SBP parameters, where as both group differed in DBP and MAP which was statistically significant ($p<0.05$).

In the present study, the changes in haemodynamics in LMA group were significantly lower compared to those seen with the ETT group. Similar findings were reported by the study done by Anita and colleagues who demonstrated that endotracheal intubation was associated with a significant increase in heart rate and arterial pressure compared to LMA insertion [6]. Several other studies have shown results similar to those of this study [7,8,9].

Mehernoor F. Watcha et al [10] compared the haemodynamic responses and found that immediately after insertion of the airway device, there was a significant increase in HR and systolic, diastolic, and mean arterial pressures after intubation above baseline values. In contrast, there were no significant differences in HR, systolic, diastolic, and mean arterial pressures compared with baseline values in the LMA group.

Present study revealed that the haemodynamic changes in the LMA group took about 3 minutes to return to pre insertion values while it took about 5 minutes for the changes to return to pre intubation values in the ETT group. Several other studies have demonstrated that the haemodynamic response to LMA is short lived compared to that to ETT [7,9,11]. The greater and more persistent changes in cardiovascular parameters seen with ETT as compared to LMA insertion probably reflect higher catecholamine levels in the ETT group as seen in previous studies [12,13,14]. This increase in heart rate persisted up to 5 minutes in Group E it was 113.5±10.9, while it was closer to baseline 107.0±12.8 within 3 minutes in Group L (LMA group). MAP reached the basal values 83.72± 5.21 within 3 minutes in L group, whereas MAP was still high 94.0±8.55 in E group even after 5 minutes. Similar finding from other studies [15,16].

Conclusion

A significant haemodynamic response consisting of an increase in HR, SBP, DBP and MAP was seen after the insertion of both the LMA and ETT in this study. It was also observed that the haemodynamic response to laryngoscopy and ETT insertion is significantly greater than that to LMA insertion. The response is also short lived in the LMA group compared to ETT group.

Limitation: Patients, who were enrolled in this study, were all successfully intubated in the first attempt. Perhaps the haemodynamic parameters would show a different picture in patients with difficult intubation.

Recommendation

1. As the LMA is not routinely used in our setting, it is recommended that strategies be developed that will encourage the routine use of the LMA in our setting.
2. This study was done at tertiary care center institution. A bigger study that will cover a larger sample undergoing surgery at different levels of health facilities also needs to be carried out so as to get a bigger picture of how the effect of the LMA would be in our setting.

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