www.jmscr.igmpublication.org Impact Factor 3.79
ISSN (e)-2347-176x
crossref DOI: http://dx.doi.org/10.18535/jmscr/v3i8.04

IGM Publication Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Comparison of Hemodynamic Responses and Postoperative Airway Complications between ET Tube and LMA in Pediatric Short Surgical Procedures

Authors

G.Kiran Kumar[1], Abhimanyu Singh[2*], Uppalapati Bhavana[3]

[1]Associate Professor , [2*]Associate Professor, [3]Senior Resident

Department of Anesthesiology, Government Siddhartha Medical College, Vijayawada

*Corresponding Author

Dr Abhimanyu Singh

Associate Professor, Department of Anesthesiology, Government Siddhartha Medical College, Vijayawada,

Email: *dr.ausingh@gmail.com*

ABSTRACT

Back ground: *Securing a safe airway is always the prime priority of an anaesthesiologist. Among the various methods to achieve this, laryngoscopy and endotracheal intubation enjoys a major role. Although it is very efficient in maintaining a patent airway, it has its own array of complications*

Aim: *The present study was designed to assess the suitability of LMA as a substitute to laryngoscopy and endotracheal intubation in pediatric patients undergoing short surgical procedures under general anesthesia posted in 11 months period.*

Materials and methods: *The study group consisted of 100 patients aged between 5 to 15 years, scheduled for various surgeries to which general anaesthesia was administered. Subjects were randomly allocated to one of the following two groups of 50 each as group-L with LMA insertion and controlled ventilation and group-T with Laryngoscopy and endotracheal intubation and controlled ventilation. The haemodynamic changes as noted in changes of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) observed during endotracheal intubation and LMA insertion were compared and studied and postoperative sore throat incidence was observed after 8, 24, 48 hours.*

Results: *There was a significant rise in HR in both the groups but the rise in endotracheal group was more significant and sustained, i.e., a rise of 16.2% from baseline after endotracheal intubation,14.2% after 1 min, 9.4% after 2 min and 4.8%after 3 min. while that of LMA group was 4.4%, 2.8%, 1.2%and 0.4%. The SBP at the same time intervals were 11.9%, 11.9%, 7.9%, 2.1% above baseline in group T and 3.6%, 5.2%, 5.3%, 5.4% below baseline for group L. The DBP were 11.2%, 8.9%, 5.6%, 2.1% above baseline in group T and in 3.2%, 5.1%, 5.6%, 6.2% below baseline for group L. The incidence of post operative sore throat was 8% in group L and in 20% in group T.*

Conclusions: *Laryngeal mask airway is a valuable and better alternative to endotracheal intubation in securing the airway, especially in pediatric patients in whom pressor response to endotracheal intubation is detrimental.*

Key words: *Laryngoscopy, Endotracheal intubation, Haemodynamic changes, Sore throat.*

INTRODUCTION

Securing a safe airway is always the prime priority of the anesthesiologist.

Among the various methods to achieve this, laryngoscopy and endotracheal intubation plays a major role. Since its invention by Magill& Rowbotham in 1941 for maxillofacial surgeries, it has become the gold standard for securing the airway and administering general anesthesia, in all age groups. Although it is very efficient in maintaining a patent airway, it has its own set of complications. Of the various complications, the pressor response generated by laryngoscopy and to a small extent by intubation is of special concern. This is generated mainly by the posterior pharyngeal wall stimulation which leads to a sympathetic response and increased plasma catecholamine levels resulting in increased heart rate and blood pressure. This response was described in, as early as 1951, and since then attenuation of this response has attracted the interest of many anesthesiologists.

Various pharmacological and mechanical methods have been tried to attenuate the pressor response generated by laryngoscopy and intubation. The development of Laryngeal mask airway (LMA) by Dr.Archie Brain in 1981 was one such attempt to attenuate the pressor response[1]. This device also avoids the post-operative airway complications associated with laryngoscopy and intubation, which is a desirable feature in the pediatric age group. In pediatric age group, post-extubation airway complications ranging from sore throat and croup to serious ones like laryngospasm also contribute to significant morbidity. Laryngeal croup can cause partial to near total respiratory obstruction, leading to hypoxia and unwanted cardiovascular and central nervous system complications.[2,3]

Many studies have been done to compare the cardiovascular response generated by laryngoscopy and intubation and that caused by insertion of LMA. Most of these studies were done on adult patients[4]. Very few studies were done in the pediatric age group, especially regarding post-operative airway complications. A comparative study was conducted in one hundred pediatric patients aged between 5 to 15 years of ASA grade I & II coming for elective short surgical procedures under general anesthesia (GA) with 50 patients (Group L) receiving GA via laryngeal mask airway and 50 patients (Group T) via endotracheal intubation, to evaluate.

MATERIALS AND METHODS

The present clinical study was undertaken to compare the haemodynamic responses and post-operative sore throat incidence due to laryngoscopy and endotracheal intubation with laryngeal mask airway insertion. The study was undertaken in the Government Siddhartha Medical College and Hospital during a period of 11 months (September 2014-june2015).

The study group consisted of 100 patients aged between 5 to 15 years, scheduled for various surgeries to which general anaesthesia was administered. The study was conducted after the approval from the Hospital Ethics Committee. All the patients were explained regarding the study and its objectives and written consent was obtained.

Subjects were randomly allocated to one of the following two groups of 50 each:

1) LMA insertion and controlled ventilation.

2) Laryngoscopy and endotracheal intubation and controlled ventilation.

Inclusion Criteria:

1. ASA grade I & II patients.
2. Aged between 5 to 15 years.
3. Either gender.
4. All elective procedures not exceeding 45 min - 60 min.

Exclusion Criteria:

1. ASA grade – III & IV patients.
2. Emergency procedures.
3. Patients with anticipated difficult intubation.
4. Patients with pharyngeal pathology.
5. Patients with full stomach, GERD, hiatus hernia (which are contraindications to LMA use).

The haemodynamic changes as noted in changes of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) observed during endotracheal intubation and LMA insertion were compared and studied and postoperative sore throat incidence was observed after 8, 24 48 hours. A thorough pre-anaesthetic evaluation was done for all the patients a day before the proposed surgery. Detailed history, physical examination and airway assessment was done to rule out those coming under the exclusion criteria. The results of the baseline investigations were also assessed. Intravenous access was achieved and intravenous fluid (Ringer Lactate) was started. Patients were premedicated with Inj. Glycopyrrolate 0.04 mg/kg I.V, Inj. Midazolam 0.05 mg/kg I.V, Inj. Fentanyl 1-2 µg/kg I.V.

All patients were monitored with multichannel monitors Pulse oximeter, Non invasive blood pressure, ECG, Base line values of HR, SBP, DBP, recorded, Patients were pre-oxygenated with 100% O2 for 5 min. All patients were induced with inj. Propofol 1-3 mg/kg and relaxed with Inj. Succinylcholine 1.5 mg/kg. After achieving full relaxation: For group L, LMA, based on of patient weight was inserted. (using the appropriate size 2, 2.5) by the classical approach and once LMA was in position, cuff was inflated to provide adequate seal. For group T, direct laryngoscopy with Macintosh blade and endotracheal intubation was done with appropriate sized endotracheal tube, considering the age of the patient.

Bilateral air entry was checked and also checked for any air leak. ET/LMA was then fixed and connected to breathing circuit and controlled ventilation was instituted. Maintenance was achieved by N2O and O2 at a ratio 3:2 and inj.Vecuronium 0.05mg/kg initial dose and subsequently with 0.5mg increments. Haemodynamic parameters HR, SBP, DBP, were recorded just before intubation/LMA insertion, 1 min, 2 min and 3 min after intubation /LMA insertion. Care was taken to avoid surgical stimuli during this period. At the end of the surgery, both groups were given inj. Neostigmine 0.05mg/kg and inj. Glycopyrrolate 0.04mg/kg IV for reversal of the neuromuscular block. Thorough suction of oral cavity was done.

In group L, LMA was removed after deflating the cuff, when the patient became fully awake. In group T, after return of adequate muscle power and spontaneous breathing, patient was extubated. All patients were observed in the post-operative period for incidence of sore throat, at 8 hrs, 24 hrs and 48 hrs.

All the values observed were analyzed and were expressed as mean ± SD. Statistical comparisons were performed by repeated measures of variance followed by ANOVA Fisher 'F'_test. Level of significance: P<0.05: Statistically significant.

RESULTS

Our study consisted of 100 patients belonging to ASA grade I & II of either sex aged between 5 – 15 years, posted for elective short surgical procedures under general anaesthesia. These patients were randomly allocated to Group L which denotes those with laryngeal mask airway insertion and Group T which denotes those in whom laryngoscopy and endotracheal tube was used to secure the airway.

TABLE 1: Descriptive Information

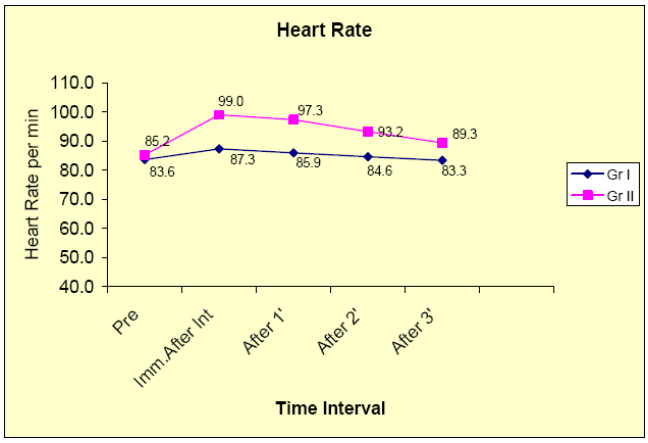
No. of patients in group		**GROUP L(n=50)**	**GROUP T(n=50)**
AGE	Mean ± SD	12.86±2.27	13.01±1.87
	Range	6-15	7-15
GENDER	Male	24	23
	Female	26	27
WEIGHT	Mean ± SD	20.94±3.09	21.32±2.89
	Range	15-25	15-27

The minimum age of the patient was 6 years and the maximum age of the patient was 15 years in the study groups. Both Groups L and T had a higher percentage of patients in the age group of 12 – 14 years.

There were 24 males and 26 females in group L while it was 23 males and 27 females in group T. In both group L and group T, significant difference was not seen in sex distribution.

The minimum body weight was 15 kg and the maximum body weight in our study group was 25.Difference in weight in both group L and group T was not significant.

FIGURE-1: Comparison Of Heart Rate In Groups

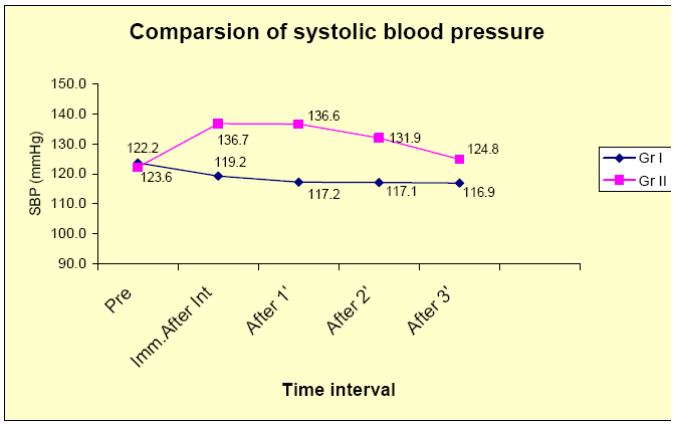


The baseline heart rate was 83.6±5.9, which increased to 87.3±8.8 immediately after LMA insertion (4.4% more than baseline), and after 1 min of LMA insertion heart rate started falling gradually to 85.9±8.3 (2.8% more than baseline), after 2 min further decreased to 84.6±8.1 (1.2% more than baseline) and after 3 min was 83.3±7.2 which came to the baseline value. This shows that changes were not significant.

The baseline heart rate was 85.2±10.1, which increased to 99.0±9.9 immediately after laryngoscopy and intubation (16.2% more than baseline), after 1 min of endotrachel intubation, heart rate was started falling gradually to 97.3±9.7 (14.2% more than baseline), after 2 min it further decreased to 93.2±9.6 (9.4% more than baseline) and after 3 min was 89.3±9.4 (4.8% more than baseline). This shows that changes in heart rate in this group were highly significant.

Hence there is a difference in the tachycardia caused by the laryngeal mask airway insertion and after laryngoscopy and intubation. The increase in heart rate came to base line value after 3 min with laryngeal mask airway, which did not happen in the case of endotracheal tube.

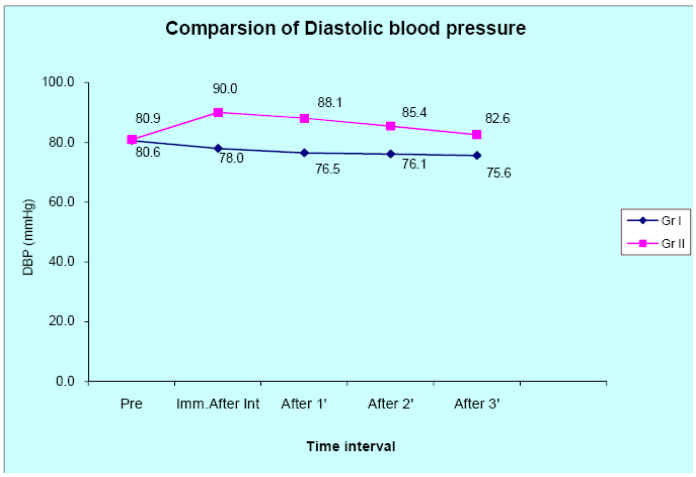
FIGURE-2: Comparison of Systolic Blood Pressure



Immediately after LMA insertion, SBP decreased to 119.2±6.4 from the baseline of 123.6±6.4. (3.6% below baseline). After 1 min of LMA insertion gradually decreased to 117.2±8.5 (5.2% below baseline), after 2 min further decreased to 117.1±6.9(5.3% below baseline) and after 3 min to 116.9±6.9 (5.4% below baseline), which shows significant .

Immediately after laryngoscopy and endotracheal intubation SBP increased to peak value of 136.7±10.9 from the baseline of 122.2±10.8 (11.9% above baseline). After 1 min of endotracheal intubation gradually decreased to 136.6±10.1 , after 2 min further decreased to 131.9±12.2 (7.9% above baseline) and after 3 min to 124.8±11.3 (2.1% above baseline), which shows highly significant , but coming to nearly baseline after 3 min.

FIGURE-3: Comparison of Diastolic Blood Pressure



Immediately after LMA insertion DBP decreased to 78.0±7.2 from the baseline of 80.6±4.9 (3.2% below baseline).After 1 min gradually decreased to 76.5±6.1 (5.1% below baseline), after 2 min further decreased to76.1±5.5 (5.6% below baseline) and after 3 min to 75.6±6.4 (6.2% below baseline), which shows significant. Immediately after endotracheal intubation DBP increased to 90.0 ±6.3 from the baseline of 80.9±5.5 (11.2% above baseline). After 1 min gradually decreased to 88.1±5.1 (8.9% above baseline), after 2 min 85.4±5.3 (5.6%above baseline) and after 3 min to 82.6±4.2 (2.1%above baseline), which shows highly significant by the test significance.

TABLE-2: Incidence of Postoperative Sore Throat in Groups

	8 hrs		**24 hrs**		**48 hrs**	
	Group L	**Group T**	**Group L**	**Group T**	**Group L**	**Group T**
Mild	1	2	2	3	1	2
Moderate	3	8	0	1	0	0
Total	4	10	2	4	1	2
Percentage	8	20	4	8	2	4

TABLE-3: Comparison of Pressor Response and Postoperative Sore Throat Incidence:

	GROUP I			**GROUP II**		
	HR (%)	**SBP (%)**	**DBP (%)**	**HR (%)**	**SBP (%)**	**DBP (%)**
Pre.op Vs immediately after intubation	4.4↑	3.6↓	3.2↓	16.2↑	11.9↑	11.2↑
Pre.op Vs After 1 min	2.8↑	5.2↓	5.1↓	14.2↑	11.9↑	8.9↑
Pre.op Vs After 2 min	1.2↑	5.3↓	5.6↓	9.4↑	7.9↑	5.6↑
Pre.op Vs After 3 min	0.4↑	5.4↓	6.2↓	4.8↑	2.1↑	2.1↑
	8 hrs	**24 hrs**	**48 hrs**	**8 hrs**	**24 hrs**	**48 hrs**
Post.op sore throat incidence (%)	8	4	2	20	8	4

DISCUSSION

Tracheal intubation, performed routinely during general anaesthesia in patients undergoing surgery may have adverse effects on cardiovascular function. The present study was designed to assess the suitability of laryngeal mask airway as a substitute for tracheal intubation.

All the patients in our study received identical premedication and anesthesia during surgery. Blood pressure and heart rate were recorded in the pre induction and post intubation period, with intervals of one minute up to 3 minutes. Pulse rate increased significantly soon after intubation in both groups. But in Group L it came to base line after 3 min, which was not seen with Group T.

Blood pressure increased significantly in Group T after intubation. These changes persisted after 1 min and gradual decreased after 2 min and further decreased after 3 min i.e came to nearly baseline values in majority of cases. In group L, most patients showed either no difference or a slight fall of blood pressure soon after intubation. In Group L these increases were significantly less and in some cases, these recordings came to the base line recording at 1 minute and further decreased at 2 minutes.

Similar study by Shetty AN et al[2] compared the pressor response to endotracheal intubation, COPA and LMA insertion and found that there was significant rise ($P<0.05$) in heart rate and arterial pressure during endotracheal intubation and remained high till one minute after intubation compared to pre-insertion values. Compared to preoperative values, changes in arterial pressure and heart rate after insertion of COPA and LMA were similar in both the groups and not significantly different from pre-insertion values. Postoperatively 16% of patients in endotracheal group complained of sore throat. Thus, they concluded that COPA and LMA are valuable alternatives to endotracheal intubation, with minimal haemodynamic responses and less post-operative airway complications.

Another study by N. Brande & E.A.F. [5] Clements studied the cardiovascular response induced by laryngoscopy and intubation and that with laryngeal mask airway in 24 and 23 healthy patients respectively. The study showed a maximum mean increase in systolic blood pressure of 17.1% and 8.6% in endotracheal tube & laryngeal mask airway group respectively. The diastolic maximum mean increase was 26.8% and 11.8% respectively. The maximum mean heart rate increase was 13.2% and 13.1% respectively i.e. heart rate changes were similar in both groups. In the same study they also concluded that five of the intubated patient group and one of the laryngeal mask airway group complained of sore throat post-operatively.

A study by Lamb K, James FM, Janiki PK[6] which compared the catecholamine responses that occurred during endotracheal intubation and LMA insertion, noted that there was an attenuated pressor response as well as an associated lower levels of plasma catecholamine concentrations in the LMA group in comparison with endotracheal group. This explains the findings obtained in the present study which are similar to those of Lamb K et al[6].

C.A. Alexander and A.B.Leach[7] showed a significant reduction in the sore throat occurrence in laryngeal mask airway group compared to endotracheal tube group i.e. 13 (7%) patients gave a positive history of mild sore throat in a group of 176 patients with laryngeal mask airway. In a group of 106 patients with endotracheal tube, 42 (40%) patients reported having mild sore throat, 7 (7%) moderate and 3 (3%) severe.

A study by I. G. Wilson .et al [3] compared the cardiovascular responses induced by laryngoscopy and intubation with those produced by laryngeal mask airway insertion in 40 patients. The study showed the mean maximum increase in systolic arterial pressure after laryngoscopy and tracheal intubation was 51.3% compared with 22.9% for laryngeal mask airway insertion. These findings were similar to those obtained in the present study.

In a study conducted by Lalwani et al[8] to compare the efficacy of ProSeal LMA with an endotracheal tube in pediatric patients with respect to haemodynamic responses and peri-operative respiratory complications hemodynamic responses were significantly higher ($P<0.05$) after endotracheal intubation as compared to the placement of PLMA. These findings corroborate the findings of the present study.

A prospective randomized trial conducted by SN Jamil et al [9], in 100 ASA I and II children posted for elective surgery, compared the efficacy of LMA in children during positive pressure ventilation, its haemodynamic changes and postoperative complications to that of endotracheal intubation. The changes in haemodynamic parameters were significantly higher after endotracheal intubation as compared to LMA placement. Furthermore, these changes

persisted for longer duration after endotracheal intubation in comparison to LMA insertion (5 min vs 3 min). These findings match with the findings of the present study. Incidence of postoperative complications i.e. bronchospasm, laryngospasm and soft tissue trauma was significantly higher ($p<0.05$) after endotracheal intubation as compared to LMA insertion. The present study also shows an increased incidence of postoperative sore throat with endotracheal intubation, though not statistically significant. They concluded that the laryngeal mask airway is a suitable alternative to endotracheal intubation for positive pressure ventilation in children.

Klockgether – Radke A, et al[10] conducted a study in 100 ASA I and II children, aged 4 to 14 years, scheduled for strabismus surgery, who were randomly assigned to one of the following groups : group I (n = 50) endotracheal tube, group 2 (n= 50) laryngeal mask airway. Group I children had a higher incidence of sore throats. The incidence of sore throat was found to be higher in the endotracheal intubation group in the present study also.

CONCLUSION

Securing a safe airway is always the prime priority of an anaesthesiologist. Endotracheal intubation and insertion of laryngeal mask airway as a method of airway control have their own advantages and disadvantages over each other. Our results suggested that the haemodynamic responses generated, measured in terms of heart rate, systolic blood pressure, diastolic blood pressure showed that the laryngeal mask airway is a better alternative to endotracheal intubation with an attenuated pressor response to insertion. Not only is the response produced by laryngeal mask airway less than endotracheal tube, but it is also short lived.

The study also showed lower incidence of post-operative sore throat with LMA insertion which is a desirable feature in pediatric patients.

REFERENCES

1. Brain AIJ. The laryngeal mask – new concept in airway management. Br. J Anaesth 1983; 55; 801-5.
2. Shetty AN, Shinde VS, Chaudhari LS. A comparative study of various airway devices as regards ease of insertion and haemodynamic responses. Indian J Anaesth 2004 ; 48(2) : 134 -137.
3. I.G. Wilson, D. Fell, S.L. Robinson and G. Smith : "Cardiovascular responses to insertion of the laryngeal mask". Anaesthesia 1992 ; volume 47, page 300-302.
4. S. Hickey, A.E. Cameron and A.J. Asbury : "Cardiovascular response to insertion of Brain's Laryngeal Mask." Anaesthesia 1990; Volume 45, Pages 629-633.
5. N. Braude, E.A.F. Clements, U.M. Hodges and B.P. Andrews : "The pressor response and laryngeal mask insertion." Anaesthesia 1989; volume 44, pages 551-554.
6. Lamb K, james FM, Janiki PK. The laryngeal mask airway for intraocular surgery effects on intraocular pressure and stress responses. Br J Anaesth 1992; 69:143-147.
7. ALEXANDER CA, LEACH AB, THOMPSON AR, LISTER JB. Use your Brain. Anaesthesia 1988; 43: 893.
8. Lalwani J, Dubey KP, Sahu BS, Shah PJ. ProSeal laryngeal mask airway: An alternative to endotracheal intubation in paediatric patients for short duration surgical procedures. Indian J Anaesth 2010;54:541-5
9. Jamil SN et al: Comparison of LMA and endotracheal intubation in children. Indian J Anaesth 2009; 53 (2):174-178
10. Klockgether-Radke A, Gerhardt D, Mulendyck H, Braun U. The effect of the laryngeal mask airway on the postop incidence of sore throat in children. Anaesthesist 1996;45(11):1085 8.