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A Comparative Study of the Effects of Placement of Laryngeal Mask Airway Vs Endotracheal Tube on Haemodynamic Parameters in Children.

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Research Article

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ABSTRACT

Various pharmacologic and non-pharmacologic methods have been tried to limit the pressor responses and intraocular pressure changes following the insertion of endotracheal tube. One such attempt is the use of laryngeal mask airway. To compare the effects of placement of laryngeal mask airway with endotracheal tube on hemodynamic parameters in children. 100 ASA I and II children weighing between 10-20 kg, scheduled for elective surgery were randomly allocated to one of the two groups of 50 patients each. The ease of insertion of laryngeal mask airway in children during positive pressure ventilation, its haemodynamic changes and postoperative complications were compared to endotracheal intubation. Placement of laryngeal mask airway was successful in first attempt in 84% of patients whereas endotracheal intubation was successful in first attempt in 92% of patients (p=0.056- not significant). The changes in haemodynamic parameters- heart rate, systolic, diastolic and mean arterial blood pressure were significantly higher after endotracheal intubation. To conclude that laryngeal mask airway is a suitable alternative to endotracheal intubation for elective surgical procedures which do not carry risk of aspiration for securing the airwayin paediatric patients.

INTRODUCTION

Laryngoscopy and endotracheal intubation is the commonest method of securing a definitive airway for administering anaesthesia. However it is associated with tachycardia and hypertension and an increase in intraocular pressure [1]. These changes have been observed to be associated with rise in plasma noradrenaline levels, confirming a predominantly sympathetic response to it [2].

The laryngeal mask airway (LMA) was developed by British anaesthetist Dr Archie I. J. Brain in 1983 [3]. LMA was approved by the FDA in 1991, and its use in airway management has been gaining popularity ever since [4].

Insertion of laryngeal mask airway requires neither the visualization of cords nor the penetration of larynx, making the placement less stimulating than trachealtube insertionand it may provoke 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 and as a consequence the increase inintraocular pressure may be diminished [5]. It is relatively non-invasive as compared to endotracheal intubation and causes minimal disturbances in cardiovascular and respiratory system [6]. There is a decrease in the incidence of arterial oxygen desaturation, less airway stimulation. Changes in intraocular pressure are also blunted with the use of LMA as compared to endotracheal intubation [7, 8, 9].

Formerly, use of LMA was limited to those patients with difficult airways but now it is popular for all cases of general anaesthesia unless contra-indicated. Ease of insertion and removal makes the LMA an appealing alternative to tracheal intubation in some circumstances [10]. In addition, the LMA may facilitate airway management when conventional tracheal intubation is either difficult or impossible [11].

The LMA does not isolate the laryngeal inlet from the piriform fossae and, consequently, may not prevent aspiration of gastric fluid refluxing to the upper oesophagus. Accordingly, elective use of the LMA should be limited to fasted patients who are not at increased risk for gastroesophageal reflux. Even though the LMA provides incomplete laryngeal protection against aspiration, the reported incidence of aspiration for fasted patients is similar to that observed with tracheal intubation [12].

The present study was done to compare ease of insertion of laryngeal mask airway and endotracheal intubation, to compare hemodynamic changes during insertion of laryngeal mask airway and endotracheal intubation and to compare postoperative complications of laryngeal mask airway and endotracheal intubation in children.

PATIENTS AND METHODS

The study was carried out as a prospective randomized trial, 100 ASA I and II children weighing between 10-20 kg, scheduled for elective surgery were randomly allocated to one of the two groups of 50 patients each.

Consent was obtained from the parents after briefly explaining the procedure and informing the nature of the study.

All patients were premedicated with Syrup Midazolam 0.5mg/kg orally half an hour prior to surgery. After shifting patient to operating room, IV line was secured in non-dominant upper limb and patient started on crystalloid IV fluid. Patient connected to monitors and baseline blood pressure and heart rate measured. All patients premedicated with inj Atropine 0.02mg/kg iv and inj Fentanyl 2μg/kg iv. Induction of anaesthesia was done with injection Propofol 2mg/kg until unresponsive to verbal stimulus. Neuromuscular blockade was by injection Atracurium 0.5mg/kg iv to facilitate insertion of endotracheal tube/ LMA. The position of endotracheal tube (ETT) or LMA was checked by observing movements of chest wall and auscultation for breath sounds during controlled ventilation. The efficacy of positive pressure ventilation was assessed by observing adequate chest rise on manual ventilation, bilateral equal air entry on auscultation and normal rectangular shape capnograph tracing. The person who performed these manoeuvres had an experience of more than 2 years duration in endotracheal intubation/ LMA placement.

Ease of insertion of LMA/ endotracheal tube was assessed as: Easy= successful at the first attempt; Difficult= successful but with some difficulty for any reason; Impossible= not successful.

Number of attempts required for the proper placement of LMA/endotracheal tube was recorded.

Following successful ETT or LMA insertion, anaesthesia was maintained with N_2O+ O_2 + Isofluorane 0.5-1% and intermittent doses of Atracurium at 0.1mg/kg as intravenous injections. Ventilation was controlled such as to maintain end tidal carbon dioxide concentration ($EtCO_2$) between 30-35 mmHg. Monitoring of airway pressure (kept below 15cm of water) and of vital signs i.e. non-invasive blood pressure, pulse oximeter, $EtCO_2$ and EKG lead- II to be done during the perioperative period. Haemodynamic changes were recorded before induction (baseline), just after intubation (0 min), then at 1, 3, 5 and 10 min after intubation.

At the end of surgery the residual neuromuscular blockade was reversed with Neostigmine 0.05mg/kg and Glycopyrrolate 0.01 mg/kg iv and the patient was extubated or LMA removed and patient was shifted to recovery room when fully awake.

Incidence of postoperative complications like sore throat, post-operative nausea and vomiting were recorded every half an hour after surgery for 2 hours.

RESULTS

The ease of insertion and number of attempts for insertion was compared in both groups. It was found that intubation was successful in first attempt in 92% of patients in endotracheal tube group and in 84% of patients in laryngeal mask airway group. Two attempts for intubation were required in 4% of patients in endotracheal group and 16% of patients with laryngeal mask airway. Whereas intubation was successful after three attempts in 4% of endotracheal intubations, all the laryngeal mask airways were placed at 2 attempts. None of the patients required more than three attempts for intubation. There were no cases where intubation was impossible (Table 1).

In our study we compared the heart rate changes in laryngeal mask airway and endotracheal intubation at 1, 3, 5 and 10 minutes as compared to induction value. In our study the heart rate change at 1 minute was .58±14.7 compared to intubation 10.4±10.2. At 3 minutes the changes in laryngeal mask airway was .8±7.2 and intubation 9.1±12.7. At 5 minutes the change in laryngeal mask airway was -2.8±10.2 and in intubation 6.6±14.7. The p values in all the groups were <0.001 very highly significant. At 10 minutes the changes in laryngeal mask airway group were -5.1±10.6 and intubation group was 3.04±15.2. P value was 0.003 which was still highly significant (Table 2).

Table 1: No. of attempts for insertion

			Group		Total
			LMA	Intubation	
No. of attempts of placement	1	Count	42	46	88
		%	84%	92%	88%
	2	Count	8	2	10
		%	16%	4%	10%
	3	Count	0	2	2
		%	0%	4%	2%
Total		Count	50	50	100
		%	100%	100%	100%

x2=5.782 p=0.056- not significant

Table 2: Heart rate - Difference from induction

Heart rate difference	Group	N	Mean	Standard Deviation	t
1 min	LMA	50	-.5800	14.75665	3.89400
	Intubation	50	-10.4600	10.20446	<0.001 vhs
3 min	LMA	50	-.8000	7.26187	4.00000
	Intubation	50	-9.1200	12.78813	<0.001 vhs
5 min	LMA	50	2.8000	10.29959	3.72000
	Intubation	50	-6.6800	14.78615	<0.001 vhs
10 min	LMA	50	5.1200	10.66683	3.10300
	Intubation	50	-3.0400	15.23685	p=.003 hs

hs- highly significant; vhs- very highly significant

The systolic blood pressure change at 1 minute in laryngeal mask airway placement was 2.9±6.8 compared to intubation 9.6±8.2. At 3 minutes the changes in laryngeal mask airway was -1.1±8.2 and intubation 6±12.1. The p values were <0.001- very highly significant. At 5 minutes the change in laryngeal mask airway was –4±7.9 and in intubation 2.5±11.9. The p value was 0.002 highly significant. At 10 minutes the changes in laryngeal mask airway group were -4.1±8 and intubation group was .66±9.7. P value was 0.009 which was still highly significant (Table 3).

Table 3: Systolic blood pressure changes from induction

Systolic BP difference	Group	N	Mean	Standard Deviation	T
1 min	LMA	50	-2.9800	6.84967	3.72
	Intubation	50	-9.6600	10.69734	<0.001 vhs
3 min	LMA	50	1.1600	8.23472	3.47
	Intubation	50	-6.0200	12.11424	<0.001 vhs
5 min	LMA	50	4.0000	7.98979	3.22
	Intubation	50	-2.5400	11.95777	p=.002 hs
10 min	LMA	50	4.1000	8.01847	2.66
	Intubation	50	-.6600	9.77629	p=.009 hs

hs- highly significant, vhs- very highly significant

The diastolic blood pressure change at 1 minute in laryngeal mask airway placement was 11.3±71 compared to intubation 5.4±10.9. P value was 0.479 which was not significant. But at 3 minutes the changes in laryngeal mask airway was -1.7±5.9 and intubation 3±9.8. The p values were 0.008- highly significant At 5 minutes the change in laryngeal mask airway was –4.6±6.1 and in intubation 0.06±9.2. The p value was 0.006- highly significant. At 10 minutes the changes in laryngeal mask airway group were -4.9±6.4 and intubation group was -1.1±6.9. P value was 0.008 which was still highly significant (Table 4).

The mean blood pressure change at 1 minute in laryngeal mask airway placement was 7.7±9.8 compared to intubation 2.2±6.6. But at 3 minutes the changes in laryngeal mask airway was -1.6±6.2 and intubation

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4.7±10.8. At 5 minutes the change in laryngeal mask airway was −4.1±6.5 and in intubation 1.3±10.1. The p values in all these groups were <0.001- very highly significant. At 10 minutes the changes in laryngeal mask airway group were -4.8±6.4 and intubation group was -0.9±7.4. P value was 0.006 which was still highly significant (Table 5).

Table 4: Diastolic blood pressure changes from induction

Systolic BP difference	Group	N	Mean	Standard Deviation	T
1 min	LMA	50	-11.3400	71.05060	0.58
	Intubation	50	-5.4600	10.99946	P=.479 ns
3 min	LMA	50	1.7000	5.94619	2.9
	Intubation	50	-3.0200	9.85919	p=.008 hs
5 min	LMA	50	-.0600	6.17764	2.96
	Intubation	50	-2.5400	11.95777	p=.006 hs
10 min	LMA	50	4.9400	6.41557	2.83
	Intubation	50	1.1600	6.93809	p=.008 hs

ns- not significant, hs- highly significant

Table 5: Mean blood pressure changes from induction

Systolic BP difference	Group	N	Mean	Standard Deviation	T
1 min	LMA	50	-2.2200	6.62183	3.28
	Intubation	50	-7.7060	9.81377	<0.001 vhs
3 min	LMA	50	1.6000	6.26620	3.58
	Intubation	50	-4.7460	10.83992	<0.001 vhs
5 min	LMA	50	4.1600	6.59734	3.2
	Intubation	50	-1.3260	10.16414	<0.001 vhs
10 min	LMA	50	4.8800	6.49534	2.8
	Intubation	50	.9740	7.41159	p=.006 hs

vhs- very highly significant, hs- highly significant

The post-operative complications were compared in both the groups and 90% of patients in laryngeal mask airway group and 68% of patients intubated didn't have any complications in post-operative period. 4 (8%) of patients in laryngeal mask airway group and 6 (12%) of intubated patients had post-operative nausea vomiting. 1 patient (2%) in laryngeal mask airway group and 7 (14%) of patients intubated had post-operative sore throat. 2 patients (4%) of patients intubated had laryngospasm during recovery in post-operative period where as none in laryngeal mask airway group had laryngospasm. 1 patient (2%) intubated had upper lip injury whereas none of the patient in laryngeal mask airway had similar complication (Table 6).

Table 6: Complications

Complications		Group		Total
		LMA	Intubation	
Nil	Count	45	34	79
	%	90%	68%	79%
Nausea & vomiting	Count	4	6	10
	%	8%	12%	10%
Sore throat	Count	1	7	8
	%	2%	14%	8%
Laryngospasm	Count	0	2	2
	%	0%	4%	2%
Upper lip injury	Count	0	1	1
	%	0%	2%	1%
Total	Count	50	50	100
	%	100.0%	100.0%	100.0%

X2=19.032 p=.002 hs

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DISCUSSION

In a similar study conducted by Shahin N Jamil and colleagues found out that the changes in hemodynamic 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. Incidence of postoperative complications i.e. bronchospasm, laryngospasm and soft tissue trauma was significantly higher after endotracheal intubation [13]. In our study also we found similar results.

Syed Altaf Bukhari and colleagues studied pressor responses and intraocular pressure changes following insertion of laryngeal mask airway and endotracheal tube. They found out significant increase in systolic and diastolic blood pressure, heart rate as well as in intraocular pressure in endotracheal tube group as compared to laryngeal mask airway group [5].

S. R. Bennett and colleagues studied the effects of endotracheal intubation and laryngeal mask airway placement in patients undergoing coronary artery bypass grafting. They found out that laryngeal mask airway (LMA) causes fewer haemodynamic changes, particularly in mean arterial pressure and heart rate, than tracheal intubation. They found out that LMA allows airway management without hypertension and tachycardia and should be considered when anaesthetizing patients with coronary disease [14].

Our findings were in contrast with Kihara et al [15], who showed that during insertion/ intubation of ILMA there was no significant increase in MAP, and significant changes in HR. This inter study difference may be related to their use of IV lignocaine and propofol at induction that causes decrease in MAP and reflex increase in heart rate.

CONCLUSION

From our study we found out that for paediatric use, laryngeal mask airway provides a satisfactory airway for positive pressure ventilation. Haemodynamic response is less and is short lived with laryngeal mask airway as compared to endotracheal intubation. Incidence of postoperative complications is also less with laryngeal mask airway than with endotracheal intubation. Therefore we conclude that laryngeal mask airway is a suitable alternative to endotracheal intubation for elective surgical procedures which do not carry risk of aspiration for securing the airwayin paediatric patients.

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