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AN OBSERVATIONAL STUDY TO EVALUATE THE HAEMODYNAMIC CHANGES BETWEEN ENDOTRACHEAL INTUBATION AND LARYNGEAL MASK AIRWAY INSERTION

Anaesthesiology

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ABSTRACT

Introduction: Airway management is a crucial skill for the clinical anaesthesiologist. It is an integral part of general anesthesia, allowing ventilation and oxygenation as well as a mode for anesthetic gas delivery. The laryngeal mask airways (LMA) have become popular in airway management as a missing link between facemask and tracheal tube in terms of both anatomical position and degree of invasiveness. Haemodynamic stability is an important aspect to the anaesthesiologist for the benefit of the patients especially during intubations, laryngeal mask insertion. Laryngoscopy and endotracheal intubation can cause striking changes in Haemodynamics as result of intense stimulation of sympathetic nervous system. The aim of this study was to evaluate the hemodynamic changes between endotracheal intubation and laryngeal mask airway insertion.

Material And Methods: This was a prospective observational study on 46 patients of ASA I-II status divided into 2 groups of 23 each. In the ETT (Endotracheal tube) group endotracheal intubation was done using Macintosh laryngoscope by using portex cuffed endotracheal while in LMA (Laryngeal mask airway) group laryngeal mask airway was inserted according to the standard recommendation. Heart rate, Systolic, Diastolic and Mean arterial pressure and dysrhythmias were monitored.

Results: The two groups were comparable in terms of demographic data as there were no significant differences between the 2 groups in terms of age, sex, duration of surgery, ASA grades and MPC classification. Heart rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure(DBP), Mean arterial pressure (MAP) remains on higher side in ETT group than LMA group which was statistically significant. $P<0.05$. Dysrhythmias were noted in 2 patients of ETT group while LMA group did not notice any dysrhythmias.

Conclusion: This study demonstrated that there is a haemodynamic response consisting of an increase in Heart rate, SBP, DBP and MAP that comes with ETT insertion as well as with LMA insertion. However, the response caused by ETT insertion is significantly greater than that caused by LMA insertion.

KEYWORDS

Endotracheal Tube; Laryngeal Mask Airway, Hemodynamic Changes

INTRODUCTION

Airway management is a crucial skill for the clinical anesthesiologist. Airway management following general anesthesia, allows ventilation and oxygenation as well as delivery of the anesthetic gases. Complications following airway management in the operating room are very rare but may be life threatening.

Due to rapid achievements in airway management technology, many of the newer airways are unfamiliar to most of the anaesthesiologists. In recent years number of supraglottic airway devices have been introduced in practice of airway management, trying to offer a simple and effective alternative to endotracheal intubation thereby avoiding complications associated with endotracheal intubation.

Supraglottic airway devices are developed with increasing frequency following the overwhelming success of the laryngeal mask airway (LMA). The laryngeal mask airways(LMA) have become popular in airway management as a missing link between facemask and tracheal tube in terms of both anatomical position and degree of invasiveness. British Anesthesiologist Dr. Archie Brain, first designed a commercial laryngeal mask airway in 1987. The laryngeal mask airway avoids tracheal intubation and provides hands free means of achieving a gastight airway.1

Laryngeal mask airway (LMA) devices are those that ventilate the patient by delivering gases above the level of vocal cords. The laryngeal mask airway (LMA) devices are also indispensable and often the first to be used to secure airway in emergency situation and in those difficult to ventilate and intubate patients. Use of supraglottic airway devices when intubation problems occurs in a patient with previously unrecognized difficult airway, especially in a "Cannot ventilate cannot intubate" situation was suggested by The 'American Society of Anesthesiologist' task force on management of difficult airway.

Though endotracheal intubation has many advantages over laryngeal mask airway including provision of a definitive airway, prevention of aspiration and delivery of anaesthetic gases, it is not without complications. So complications can occur during endotracheal intubation, after endotracheal intubation and during extubation.

MATERIAL AND METHODS

This was prospective observational study conducted in Department of Anaesthesia, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar The study was conducted over a period of one year from December 2019 to November 2020. The study enrolled adult patients aged 18 to 60 years who presented American Society of Anaesthesiology (ASA) physical status I and II. Patient fulfilling the following inclusion criteria were enrolled.

A total of 46 patients were included in the study. The identity and consent of the patient were confirmed prior to induction of anaesthesia. A standard protocol has been followed for all the patients. A detailed history and examination was taken and the procedure to be done had been explained to the patient and a written informed consent was obtained for the general anaesthesia to be given. Monitoring in the form of Electrocardiogram, Pulse-oximeter, Non-invasive Blood pressure (SBP, DBP, MAP) were instituted. All the patients were premedicated with I.V. inj. glycopyrollate 0.004mg/kg I.V. inj. ondansetron 0.08mg/kg I.V, inj. midazolam 0.03 mg/kg I.V, inj. Fentanyl 2 micrograms/kg. Patient were pre-oxygenated for 3 mins with 100% oxygen.

Patients were induced with. Inj. thiopentone 5mg/kg body weight and after confirmation of loss of eye lash reflex inj. Atracurium 0.5 mg/kg I.V. to facilitate endotracheal intubation 0r LMA insertion. Size of the device was decided by the qualified anaesthesiologist conducting the case based on the age, weight and manufacturers recommendation. Endotracheal intubation or Laryngeal mask airway (LMA) device was

inserted by anaesthesiologist having at least 2 years' experience or at least 50 device insertions. Endotracheal tubes of size 7 for female and 8 for male patients or laryngeal mask size 3 for female and size 4 for male patients were used. Anaesthesia was maintained using oxygen/ nitrous and sevoflurane.

At the end of the surgical procedure, the neuromuscular block (NMB) was reversed with neostigmine and glycopyrrolate.

Heart rate, non-invasive blood pressure which included systolic, diastolic, mean arterial pressure and any dysrhythmias were monitored throughout the study and recorded at the following time points:
a) Pre-operative
b) At intubation/insertion
c) One minute after intubation or insertion of laryngeal mask.
d) Three minutes after intubation or insertion of laryngeal mask
e) Five minutes after endotracheal intubation or insertion of laryngeal mask
f) Post extubation

Statistical Analysis
Sample size was calculated from Difference between two means using data of previous study, where n=Z2 S.D[1-S.D]/d. Power of study is 80% and alfa error is 5%. Z score for 95% confidence interval =1.95; so from changes in systolic blood pressure in two studied groups of previous study(5), value of n comes 19,7 and 15 respectively at 1min. 3 min. and 5 min. after endotracheal/LMA insertion. Thus minimum number of sample size comes to be 19 in each group.

RESULTS
The present study was conducted on 46 patients aged between 18 & 60 years. In the ETT group endotracheal intubation was done using Macintosh laryngoscope while in LMA group laryngeal mask airway was inserted according to the manufacture's recommendation.

The LMA group had 13 males and 10 females and the ETT group had 13 males and 10 females. The ages ranged from 18 to 49 years and 26 to 48 years in the LMA and ETT groups respectively. The range for duration of surgery was 45 to 90 minutes for both LMA and ETT groups. The two groups were comparable in terms of demographic data as there were no significant differences between the 2 groups in terms of age, sex, duration of surgery, ASA grades and MPC classification. (P>0.01)

The heart rates of the 2 groups were comparable at preoperative stage. At insertion, the heart rate increased significantly in both groups, but the increase was substantially higher in the ETT group as compared to the LMA group. The elevation in heart rate significantly persisted for a longer period of time than LMA Group. Difference was statistically significant. (P<0.01) (Table 4).

Two patients in ETT group suffered from dysrhythmia at insertion. Dysrhythmia appeared in 8.69% cases in ETT group & 0% cases in LMA group. There was no statistically significant difference between the groups in respect of dysrhythmias. Although the statistical value did not show any difference (P Value 0.24), higher incidence of dysrhythmia in ETT group seems to be significant, which may become evident in large scale study.

Table – 1 : Mean Heart Rate At Different Times Among LMA And ETT Study Participnts

Time of recording of Heart Rate	LMA	ETT	P value
	Heart Rate		
	Mean±SD	Mean±SD	
Preoperative*	90.56±5.83	93.04±7.19	0.206
At Insertion	98.87±6.09	114.30±8.29	<0.01
1 minute after insertion	94.78±5.88	108.69±7.87	<0.01
3 minute after insertion	91.08±6.08	101.82±7.85	<0.01
5 minute after insertion	89.08±5.93	94.21±7.39	<0.01
After Extubation	90.13±5.68	101.21±7.89	<0.01
*Preoperative values are taken as Baseline values			

Table – 2 : Mean SBP At Different Times Among LMA And ETT Study Participants

Time of recording of SBP	LMA	ETT	P value
	Heart Rate		
	Mean±SD	Mean±SD	
Preoperative*	117.30±5.78	121.34±4.25	0.10
At Insertion	127.95±5.92	148.30±5.25	<0.01
1 minute after insertion	122.26±6.26	137.30±6.73	<0.01
3 minute after insertion	118.17±5.48	129.43±5.91	<0.01
5 minute after insertion	116.21±5.32	122.56±4.11	<0.01
After Extubation	118.73±5.38	135.60±5.53	<0.01
*Preoperative values are taken as Baseline values			

Table – 3 : Mean DBP At Different Times Among LMA And ETT Study Participants

Time of recording of DBP	LMA	ETT	P value
	Heart Rate		
	Mean±SD	Mean±SD	
Preoperative*	73.87±4.48	76.30±4.13	0.61
At Insertion	82.43±4.39	92.08±4.14	<0.01
1 minute after insertion	77.60±4.14	87.26±4.84	<0.01
3 minute after insertion	74.56±4.19	82.34±5.27	<0.01
5 minute after insertion	73.04±4.23	77.39±4.91	<0.01
After Extubation	75.04±3.95	86.43±4.02	<0.01
*Preoperative values are taken as Baseline values			

Table – 4 : Mean MAP At Different Times Among LMA And ETT Study Participants

Time of recording of MAP	LMA	ETT	P value
	Heart Rate		
	Mean±SD	Mean±SD	
Preoperative*	88.30±4.66	91.30±4.05	0.23
At Insertion	97.47±4.56	110.65±4.34	<0.01
1 minute after insertion	92.21±4.45	103.60±5.30	<0.01
3 minute after insertion	89.04±4.36	98.00±5.30	<0.01
5 minute after insertion	87.43±4.39	92.43±4.54	<0.01
After Extubation	89.56±4.18	102.78±3.98	<0.01
*Preoperative values are taken as Baseline values			

DISCUSSION
This study was conducted on a total of 46 patients, aimed to evaluate and comparing the haemodynamic responses elicited by endotracheal intubation, to those elicited by laryngeal mask airway insertion. The two groups consisting of 23 participants each were comparable in terms of Age, Sex, ASA class, MPC grade, duration of surgery and baseline haemodynamic parameters. This study demonstrated that there is a haemodynamic response consisting of an increase in Heart rate, SBP, DBP and MAP with ETT insertion as well as with LMA insertion. However, the response caused by ETT insertion is significantly greater than that caused by LMA insertion.

The HR, SBP, DBP as well as the MAP were significantly elevated after the insertion of the endotracheal tube in the ETT group of the study compared to the pre-intubation values. The elevation persisted for a period of 5 minutes by which the parameters returned to the pre-intubation values. These results are similar to those found by Millar and co-workers who found that in normotensive patients, laryngoscopy and insertion of a tracheal tube is immediately followed by an average increase in mean arterial pressure of 25 mmHg. The changes in haemodynamics in the 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. Several other studies have shown results similar to those of this study. The attenuated response shown by LMA could be due to the fact that the LMA avoids the sympathoadrenal response caused by insertion of the endotracheal tube through the trachea. This explanation is supported by the study done in Japan, which showed that direct stimulation by a tracheal tube induces greater cardiovascular responses than stimulation of the glottis by laryngoscopy alone. SBP and DBP were almost twice as high in the ETT study group compared to the LMA study group after insertion. These findings are similar to those of Wilson and colleagues, who reported that the cardiovascular responses induced by laryngoscopy and intubation were more than twice as high as those produced by the insertion of an LMA. However, the difference in heart rate in our study was significantly higher in the ETT group compared to the LMA group unlike in their study where there was an increase in heart rate in both groups with no significant difference between the groups. The HR increase in the ETT group lasted longer in our study similarly to the findings of their study.

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. 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.

The study by K. Montazari, Kh. Naghibi and S.J. Hashemi which was prospective, randomized, double blind investigation demonstrated that in healthy, normotensive patients the insertion of the LMA caused a smaller increase in MAP and HR than did FM or ETT.

Based on the literature, we anticipated that the insertion of a LMA would elicit a much smaller hemodynamic response than tracheal intubation. Hemodynamic responses to insertion of the LMA were minimal, which supports the findings of Oczenski et al. Wilson et al., and Marietta et al. who reported that the cardiovascular responses induced by laryngoscopy and intubation were more than twice as high as those produced by the insertion of a LMA.

Kihara et al. had demonstrated that LMA insertion has no significant haemodynamic effect compared to base line. They also have shown that LMA removal too did not change haemodynamic parameter significantly. In our study LMA insertion compared to ETT intubation demonstrated statistically significant haemodynamic effect in ETT group. Holden R et al showed an attenuated pressure response associated with laryngeal mask airway insertion compared with conventional laryngoscopy and tracheal intubation. In our Study we observed similar results.

In Md. Harun-Or-Rashid, et al study hemodynamic parameter i.e. pulse rate, systolic blood pressure, diastolic blood pressure and presence of any dysrhythmias were monitored after 1,3,5 & 10 minutes after LMA insertion or ETT intubations. There was statistically significant changes ($P<0.05$) in pulse rate, systolic blood pressure, diastolic blood pressure and (appearance of dysrhythmia in some patients) in group B(ETT) patients whereas there was less changes in pulse rate, systolic blood pressure, diastolic blood pressure whose airway was maintained by LMA insertion (Group-A). They conclude that LMA insertion causes less Haemodynamic changes than that of endotracheal intubation. The same effects have been proved in our study also.

CONCLUSION

This study demonstrated that there is a haemodynamic response consisting of an increase in Heart rate, SBP, DBP and MAP with ETT insertion as well as with LMA insertion. However, the response caused by ETT insertion is significantly greater than that caused by LMA insertion.

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