Comparative Study of Cardiovascular Responses Due To Endotracheal Tube Extubation Versus Lma Removal, In Normotensive Patients

Manisha Tirkey*, Ladhu Lakra, Usha Suwalka***, Azizul Haque****, Manisha Bhagat*****, Ranjit Kaur Arora******

* Junior Resident (3rd Year), ** Associate Professor, *** Professor & HOD, **** Associate Professor, ***** Senior Resident, Department Of Anaesthesiology, ****** Associate Professor, Department Of Physiology, Rajendra Institute Of Medical Sciences, Ranchi- 834009, Jharkhand, India

Abstacts: Background and Objectives: Laryngeal, tracheal and bronchial receptors are stimulated during laryngoscopy, intubation and extubation. The reflex increases in sympathoadrenergic activity caused by these manipulations leads to increase in heart rate and blood pressure. The aim of the present study was to evaluate and compare the hemodynamic changes during removal of LMA versus Endotracheal tube extubation. Methods: The study was conducted in 60 patients of both gender, aged 20-60 years, of ASA grade I and II physical status, undergoing elective surgery under general anaesthesia. The patients were randomly divided into two groups by sealed envelope method containing 30 patients each. Group 1 - for LMA insertion and Group 2 - for Endotrachel tube insertion. Pre-induction values of heart rate and blood pressure was recorded as baseline values. Subsequent measurement were recorded immediately before extubation or removal of LMA and at 1,2,3,5,10 and 15 minutes after extubation or removal of LMA. Results: Intergroup comparison showed more increase of heart rate,systolic and diastolic blood pressure in group 2 than in group 1. Conclusion: The conclusion drawn from this study is that the hemodynamic responses produced by LMA removal are lesser and short lived as compared to Endotracheal tube extubation. [Manisha T SEAJCRR 2017; 6(1):16-20]

Key Words: LMA, Endotracheal Tube, Extubation

Author for correspondence: Manisha Tirkey, department of anaesthesiology, RIMS, PO-RMC Campus, Bariatu, Ranchi, Jarkhand-834009 E**mail:** manishaonchu88.mt@gmail.com M: 9955310303

Introduction: Airway management is the utmost important during delivery of General Anaesthesia. Patients who have been anaesthetized are unable to maintain an adequate airway on their own and artificial airway maintenance devices are employed[1]. Discovery of Endotracheal tube intubation has not only made administration and maintenance of anaesthesia easy but it has also helped in saving several lives[2].

Endotracheal intubation is usually carried out under direct vision made possible by direct laryngoscopy and visualization of the cords, this involves distortion of the upper airway to bring the glottis into the line of vision, which causes increase in heart rate and blood pressure. Even Endotracheal tube extubation is performed usually when the patient is in lighter plane of anaesthesia and this produces significant increase in heart rate and blood pressure which persists even into the recovery period[3,4,5].

Such transitory hypertension and tachycardia are not a matter of concern in healthy individuals, but these responses causes deleterious effects in patients with cardiovascular diseases like hypertension and coronary artery diseases[6]. These sudden sympathetic adrenergic responses may lead to complications like myocardial infarction, left ventricular failure, cerebro vascular accident, intracranial hypertension, arrythmias etc[7]. In these conditions, it can even be life threatening.

There are also several alternatives to Endotracheal tube Intubation, both for elective airway management as well as emergency airway management, when Endotracheal tube intubation is difficult or has failed. These include Laryngeal Mask Airway and the Combitube etc. The standard LMA first described by Dr. Archie Brain[8] in 1985 has shown to play an important role in rescue ventilation in difficult airway management.

The LMA invented by Dr. Archie Brain is a novel device that fills the gap between Endotracheal tube intubation and the use of face mask. The LMA offers a much less invasive way of maintaining the airways as it does not pass through the glottis but it is placed over the glottis. It does not require any instrumentation i.e. use of laryngoscope[9].

This newer device besides being useful in airway management causes minimal cardiovascular responses at insertion and extubation as compared to endotracheal tube intubation and extubation[10]. We

undertook this study with the objective of assessing the cardiovascular responses to LMA removal and comparing these with cardiovascular responses to extubation of endotracheal tube.

Methods: After approval from the institutional ethical committee and informed written consent the study was conducted in sixty patients of both gender aged 20-60 years, undergoing elective surgical procedures in general surgery department in RIMS, Ranchi. Patients were in ASA grade I and II. The patients were assigned into two groups by randomised, double blind method by closed envelope system. All the patients participating in the study were explained clearly about the purpose and nature of the study in the language they can understand.The study was performed on wide range of routine surgery under general anaesthesia.

Group 1- (n=30) for LMA insertion
Group 2 - (n=30) for endotracheal tube insertion

During preoperative visits, before surgery patients were assesed and the procedure was explained to them. All patients received 0.5mg tab. alprazolam at bed time. In pre-operative preparation room, an 18 gauge cannula was inserted to secure intravenous line. Datex multiparamonitor was used for continuous monitoring of ECG, heart rate, blood pressure (systolic and diastolic) and oxygen saturation.

Pre-medication was done with inj glycopyrrolate 0.2 mg iv, inj ranitidine 150 mg iv, inj metoclopramide 10 mg iv, inj butorphanol 1 mg iv, just before induction.

After pre-oxygenation with 100% oxygen for 3-5 minutes all the patients in the study group were induced with inj thiopentone 3-6 mg/kg iv and inj succinylcholine 1-2 mg/kg iv was used to facilitate the endotracheal intubation or LMA insertion.Lubricant jelly 2% lidocaine was applied to both ETT or LMA before insertion. Patients were intubated with appropriate sized endotracheal tube in Group 2 or LMA in Group 1,in a randomized manner and placement was confirmed. Anaesthesia was maintained with N_2O:O_2 - 60:40% and Isoflurane 1% with controlled ventilation , inj vecuronium bromide was used as muscle relaxant with loading dose of 0.08-0.12mg/kg followed by a incremental dose of 0.04mg/kg. At the end of surgery after adequate spontaneous respiratory effort, and fulfilling the criteria for extubation, patients were reversed with inj neostigmine 0.05mg/kg with inj glycopyrrolate 0.01mg/kg followed by extubation or removal of LMA when the patients fulfilled extubation criteria.

Observations And Results: In our study, the demographic data regarding age,sex,weight and ASA physical status were comparable.

Table 1: Patient's Demographic Profile

Variables	Group 1(LMA) (n=30)	Group 2(ETT) (n=30)
Age	36.63±11.96	40±10.66
Weight(kg)	57.76±5.73	57.43±3.76
Height(cm)	163.16±6.99	168.66±3.43
Sex(M/F)	25:5	26:4
ASA Grade(I/II)	25:5	26:4

Table 2: Types of surgery performed on patients in this study

Name of operation	Number of cases	
	Group 1(LMA)	Group 2(ETT)
PBC	4	4
MRM	10	16
Incisional Hernia	4	2
Skin Grafting	2	1
Fibroadenoma	9	6
AVM	1	1
Total	30	30

Maximum patients in our study were posted for MRM and Fibroadenoma.

Table 3: Mean ± SD of systolic blood pressure at various time intervals in Group 1 and Group 2

Time interval	Systolic blood pressure		
	Group 1(LMA) Mean±SD	Group 2(ETT) Mean±SD	P value
Baseline	116.23±6.84	118.13±7.84	0.152
Immediately before extubation	116.43±7.68	121.10±9.28	0.295
After 1 min	141.43±5.34	156.73±9.38	0.001
After 2 min	134.83±5.36	148.93±7.33	0.041
After 3 min	129.83±4.69	141.40±6.66	0.010
After 5 min	122.33±3.74	132.70±5.29	0.082
After 10 min	118.56±4.88	125.56±6.00	0.481
After 15 min	115.80±4.34	120.30±7.04	0.111

The difference in SBP between groups were statistically significant (P<0.05).

Table 4: Mean ± S.D of Diastolic blood pressure at various time intervals in Group 1 and 2

Time Interval	Diastolic blood pressure		
	Group 1(LMA) Mean±SD	Group 2(ETT) Mean±SD	P value
Baseline	75.20±4.41	78.66±5.28	0.309
Immediately before extubation	76.13±4.78	81.16±5.27	0.462
After 1 min	90.20±3.64	101.60±6.34	0.009
After 2 min	86.00±3.28	95.80±6.10	0.033
After 3 min	82.10±2.56	91.03±4.03	0.029
After 5 min	79.73±2.99	84.86±3.17	0.286
After 10 min	75.86±3.44	77.73±3.92	0.311
After 15 min	74.50±3.66	77.73±3.92	0.780

The difference in DBP between groups were statistically significant (p<0.05).

Table 5: Mean ± SD of Heart rate at various time intervals in Group 1 and 2

Time interval	Heart rate(beats/minute)		
	Group 1 (LMA) Mean±SD	Group 2(ETT) Mean ±SD	P value
Baseline	81.80±5.26	81.90±6.66	0.256
Immediately before extubation	83.76±3.50	84.13±4.67	0.155
After 1 min	105±4.53	113.10±7.32	0.009
After 2 min	97.13±5.90	107.70±8.05	0.019
After 3 min	90.80±3.85	101.10±7.70	0.000
After 5 min	86.90±3.46	94.86±6.29	0.006
After 10 min	83.63±3.18	89.03±4.23	0.038
After 15 min	82.16±3.66	84.93±5.13	0.015

The difference in Heart Rate between groups were statistically significant (p<0.05).

Pre-induction values of heart rate and blood pressure,SpO2 were recorded as baseline values. Subsequent measurement were recorded immediately before extubation or removal of LMA and at 1,2,3,5,10 and 15 minutes after extubation or removal of LMA.

Data were collected and analysed using unpaired t test for intergroup comparision and paired t for intragroup comparison.Values were expressed as mean±SD. P value of<0.05 was considered statistically significant.

Discussion: Manipulation of the airway , particularly during laryngoscopy and endotracheal intubation, alters cardiovascular physiology both via reflex responses and the physical presence of endotracheal tube. Endotracheal intubation is usually carried out under direct vision made possible by direct laryngoscopy and visualization of the cords, this involves distortion of the upper airway to bring the glottis into the line of vision, which causes increase in heart rate and blood pressure. Even Endotracheal tube extubation is performed usually when the patient is in lighter plane of anaesthesia and this produces significant increase in heart rate and blood pressure which persists even into the recovery period[3,4,5].

In intergroup comparison of our study,the systolic blood pressure was comparable in both groups during pre- induction period (P>0.05).In inter-group comparison the percentage rise in SBP were statistically significant 1,2,3,and 5 minutes time interval it was 17.81%, 13.79%, 10.47%, 4.98%,respectively whereas in group 2 at 1,2,3,5 and 10 minutes the percentage rise from baseline was 24.62%, 20.68%, 16.45%, 10.97%, 5.91%,respectively (P<0.05). At 10 and 15 min interval in group 1 and and at 15 min interval in group 2 there was no significant change in SBP(P>0.05).

In within group analysis, significant changes in SBP was observed at 1,2,3 and 5 minutes in both the groups, but was more in group 2 compared to group 1. At 10 and 15 minutes the SBP returned to baseline value in group 1 and in group 2 SBP returned to baseline after 15 minutes.

Intergroup analysis of DBP showed that at 1,2,3 and 5 minutes after removal of LMA,the percentage rise was 16.62%,12.55%, 8.40%, and 5.68% respectively from the baseline, whereas in group 2 the percentage rise was more at 1,2,3 and 5 minutes with 22.16%,77.8%,13.58% and7.30% espectively(P<0.05). At 10 and 15 minutes statistical difference was not present.

In within group analysis, significant changes in DBP were observed at 1,2,3 and 5 min, which was more in group 2 than in group 1(P<0.05). It returned to baseline in both the groups.

In intergroup comparison, the pre-induction heart rate was statistically comparable P>0.05. In group 1 at 1,2,3 and 5 minutes time interval the rise in heart rate was 22.09%, 15.78%, 9.91%, 5.86%, respectively and

in group 2 at 1,2,3 and 5 min, perentage rise was 27.58%,23.95%,18.99% and 13.66%,thus the rise was more in group 2(P<0.05). At 10 and 15 minutes the rise was not significant in both the groups.

In within group analysis, significant changes in heart rate from baseline was seen in both groups at 1,2,3 and 5 minutes, but the rise was more in group 2 than in group 1(P<0.05). At 10 and 15 minutes interval there was no significant change in HR from baseline in both the groups.

Fujii Y, Tayooka H, Tanaka H (1997)[11] studied the haemodynamic responses to tracheal extubation or removal of LMA in normotensive and hypertensive patients. In normotensive patients, HR, MAP, RPP increased following tracheal extubationor LMA removal, and remained elevated or a maximum three minutes(P< 0.05).In hypertensive patients,thehaemodynamic increases in response to extubation or LMA removal were observed for upto five minutes(P< 0.05).

Fujii Y, Tayooka H, Tanaka H (1998)[12] :studied the cardiovascular response to tracheal extubation or LMA removal in children.The maximum change in heart rate,systolic blood pressure and diastolic blood pressure were less in group LMA than in Group ET during the observation period. Thus LMA removal elicited less haemodynamic change than tracheal extubation in paediatric patients.

Roofa Mushtaq; MD; Syed Amer Zahoor et al (2003)[13] conducted a study in normotensive patients to evaluate the cardiovascular response to LMA removal and endotracheal tube extubation. It was observed that HR, BP, and RPP increased significantly and was prolonged in the ETT group as compared to LMA group. In conclusion, the LMA removal caused minimal cardiovascular changes as compared to endotracheal tube extubation.

Dr Murali Prabhakar, Dr Raghu Praveen Kumar (2015)[14] conducted a randomized controlled trial of comparison of pressure responses during and after tracheal extubation and LMA removal in controlled hypertensive patients.They found that both endotracheal extubation and LMA removal were associated with a statistically significant rise in pulse rate, rate pressure product, and mean arterial pressure when compared with baseline values. The rise was significantly higher in the extubation group as compared to LMA removal group.The values did not return to baseline even after 10 min of extubation, whereas in LMA group the haemodynamic values returned to baseline levels 5min after removal of LMA. Thus in controlled hypertensive patients haemodynamic responses produced by LMA removal are lesser and short lived as compared to endotracheal extubation.

Our study shows that maximum increase in systolic blood pressure, diastolic blood pressure and heart rate in group 2 (direct laryngoscopy) were higher than in group 1 (LMA). The reason might be that there is less manipulation of airways during LMA group. There was no significant difference in peri-operative adverse events in both the groups. The results of our study are comparable with the study done by Dr. Murali Prabhakar, Dr. Raghu Praveen Kumar (2015).

Conclusion: The conclusion drawn from this study is that the haemodynamic responses produced by laryngeal mask airway removal are of lesser and short lived as compared to endotracheal tube extubation thus LMA should be used to substitute a tracheal tube for airway management during anaesthesia in situations where aspiration is not a danger, to obtain a much smoother extubation and minimal cardiovascular disturbances.

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