Comparative Evaluation Of Hemodynamic Changes During Insertion And Removal Of Laryngeal Mask Airway And Intubating Laryngeal Mask Airway

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Citation

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Abstract

Pressure responses to intubation and laryngoscopy may have deleterious effects and measures to prevent these must be taken. A prospective randomized study of pressor responses following insertion and removal of laryngeal mask airway (LMA- group I) and Intubating laryngeal mask airway (ILMA- group II) were compared in two groups of 50 patients each of either sex belonging to the age group 20-70 years undergoing elective surgical procedures. Hemodynamic parameters were compared. Compared with the baseline there was no significant difference in MAP and HR during insertion and removal of LMA ($p>0.05$) but significant difference in rate pressure product ($p<0.05$). While in group II, during insertion/ intubation there was no significant difference in HR while significant increase in MAP and rate pressure product. During removal there was increase in HR, MAP and rate pressure product ($p<0.05$). It was concluded from the study that LMA may offer some advantages over ILMA in patients where minimal changes in hemodynamics are desirable like coronary artery disease and cerebrovascular disease.

INTRODUCTION

Discovery of endotracheal intubation has not only made administration and maintenance of anaesthesia easy but has also helped in saving several lives. Endotracheal intubation is usually carried out under direct vision made possible by direct laryngoscopy which in healthy patient may not lead to serious complications. However potential hazards of these procedures are the reflex cardiovascular responses mainly in the form of hypertension, tachycardia and dyasrrythmias. The sudden rise in blood pressure may cause left ventricular failure, myocardial ischemia or cerebral hemorrhage in the presence of coronary or cerebral atheroma or hypertension. In these conditions it can even become life threatening.[1]

Thus attempts must be made to prevent the pressor response to laryngoscopy and intubation. By using alternative guiding devices such as fibreoptic scope,[2]light wand[3]or laryngeal mask airway [4](LMA) the incidence of these problems may be reduced.

The LMA invented by Dr. Archie Brain is a novel device that fills the gap in airway management between endotracheal intubation and in the use of facemask.[5] .The hemodynamic responses to the insertion of the LMA is significantly less after laryngoscopy and endotracheal intubation.[6]

However, the standard LMA is not an ideal intubation aid as the airway tube is too narrow to accommodate an adult diameter tracheal tube , too long to ensure that a normal length tracheal tube will reach the trachea and not sufficiently rigid to function as a guide to exact alignment of the mask with glottis. In addition the mask aperture base may obstruct passage of the tracheal tube. In an attempt to overcome these limitations Intubating laryngeal mask airway (ILMA) has been developed.[7] ILMA placement does not require distortion of the pharyngeal structures and might be less stimulating with less hemodynamic changes.

Presently there are contradictory reports regarding hemodynamic changes during laryngoscopy, intubation and extubation with or without ILMA. Hence, this study was planned to evaluate hemodynamic changes to insertion and removal of LMA in comparison to ILMA in healthy patients as reduced hemodynamic response may be beneficial to the patients especially with cardiovascular and cerebral disease.

AIM & OBJECTIVES

To evaluate and compare the hemodynamic changes during insertion and removal of LMA, ILMA. To evaluate the choice of technique of airway instrumentation less likely to produce hemodynamic changes in patients undergoing elective surgery.

MATERIAL & METHODS

This study was conducted in the department of Anaesthesiology and Intensive care,HIMS, Dehradun from1st March 2005 to 30th October 20005.

After approval from hospital Ethics Committee and fully informed consent from the patient, this prospective study was conducted on 100 patients of either sex ranging from 20-70 years, belonging to ASA grade I and II scheduled to undergo elective surgical procedures under general Anaesthesia.

Patients belonging to ASA grade III, IV were excluded. Patients with blood pressure >150/100mm Hg, history of sore throat within 10 days , patient with full stomach , patient scheduled for head,neck surgery were excluded from the study. Patient with potential difficult airway, MP grade IV was also excluded.

After a detailed history, general and systemic examination and necessary investigations patients were graded for ASA status. Airway assessment using MP classification was done to predict the likelihood of difficult intubation. Patients were randomly allocated into two groups of 50 patients each. In group I, LMA was inserted and in group II, ILMA was placed.

All the patients were kept fasting for 10 hours before surgery. All the patients were given tab diazepam 10 mg at night and 5 mg at 6 am on the morning of surgery.

After confirming consent and fasting status the iv line was established with 18 G canula and ringer lactate was started. All the monitors were placed and baseline readings of HR, BP, SpO_2, ECG were noted. The patient was in supine position and head was placed on a pillow 7 cm in height. Preoxygenation with 100% oxygen was done. The patient was induced with Inj propofol 1.5-2.5mg/kg slowly. Inj vecuronium 0.1mg/kg was given to facilitate intubation.

Maintenance of anaesthesia was done with 66%N_2O in oxygen, muscle relaxant Inj vecuronium 0.015mg/kg and Inj morphine 0.1 mg/kg. LMA and ILMA were introduced using the standard techniques. The adequacy of ILMA placement was assessed as satisfactory if peak inspiratory pressure was <20 cm H_2O and $ETCO_2$ 35-40 mm Hg. We excluded those patients from the study in whom intubation failed at the first trial through ILMA.

Surgeons were requested not to clean, drape or position patient till 5 minutes after placement of LMA or ILMA so as to avoid any stimuli likely to interfere with the findings. Serial heart rate, arterial pressure , SpO_2 and ECG recordings were done at the time of insertion ,1,3 and 5 minutes following insertion and then at the time of removal and 1 min after that.

At the end of surgery the anaesthesia was reversed with Inj neostigmine 50µg/kg and Inj glycopyrrolate 10µg/kg and gentle assisted ventilation was done to allow patient to breathe spontaneously considering the extubation criteria.

When reflexes were restored and the patient was able to open mouth on command the cuff was deflated and the LMA was removed. Oral suctioning was done and the airway patency and respiratory depth was confirmed.

The statistical analysis was done using two sample‘t' test and by chi-square test.

RESULTS

Mean age, weight, height and type of surgery did not differ much between two groups (Table 1) and it was not statistically significant (p>0.05). In both groups patients were more in ASA grade II.

Table 1: Demographic Data: Patients particulars Age, Sex, ASA & Distribution of type of surgery

Figure 1

PARTICULAR	GROUP I	GROUP II	REMARKS
AGE (range) Mean±SD	21-70 40.67±14.27	22-70 39.40±13.73	X^2=4.06 Df=4 p>0.05
SEX MALE:FEMALE	60:30	65:35	X^2=0.64 Df=1 p>0.05
Type of surgery Ortho/uro/gynae/others	24:28:25:23	18:32:30:20	X^2=2.67 Df=3 p>0.05

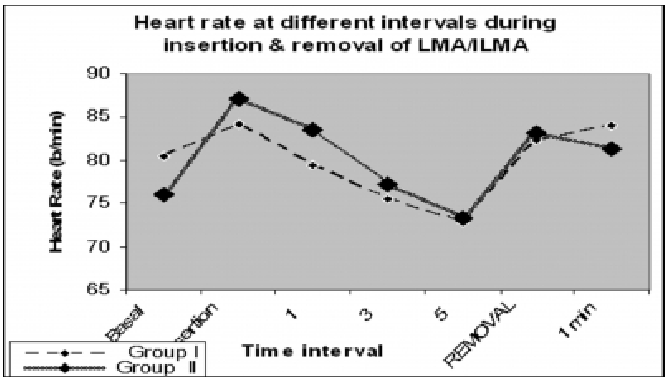
The values of HR, SBP, DBP, MAP, and rate pressure product in group II are higher than in group I at the corresponding time interval after insertion and removal.

Table 2: Mean & SD of hemodynamic responses in different intervals after insertion and removal of LMA/ ILMA

Figure 2

Haemodynamic Responses	MINUTES						
	BASAL	INSERTION	1	3	5	REMOVAL	1
HR Group I Group II		84.33±1.65 87.1±9.68	79.47±3.31 83.5±6.55	75.53±3.88 77.27±5.72	72.8±3.66 73.27±5.72	82.3±1.97 83.23±9.69	82..97±1.71 81.37±9.05
SBP Group I Group II		142.83±6.91 163.7±10.59	134.77±6.78 152.63±9.77	133.17±6.63 142.33±9.29	125.2±5.2 126.9±7.99	129.4±5.28 139.73±9.18	127.87±5.97 144.4±9.51
DBP Group I Group II		88.40±13.74 95.0±6.74	86.57±8.66 87.5±6.12	80.67±6.17 83.93±6.01	77.97±5.15 76.47±4.99	81.17±10.37 85.73±5.71	77.97±10.95 85.87±4.89
MAP Group I Group II		106.37±8.95 117.57±6.67	102.73±4.9 109.3±6.26	98.37±2.67 103.4±6.08	93.4±2.24 93.83±5.61	97.23±6.41 103.73±5.84	94.5±6.97 105.5±5.35
Rate pressure product Group I Group II		12043.17±575.06 14291.17±2006.97	10708.58±679.5 12759.67±1416.28	10057.6±709.76 11010.17±1197.42	9112.2±709.76 8967.41±1971.42	10649.67±508.85 11508.27±1667.61	10607.87±524 11777.22±1710.41

Figure 3



When Heart rate was compared between groups I, II at the basal and at the insertion level there was statistically no significant difference. At 1 min there was significant difference but after that there were no significant difference. (Table II, FIG 1.)

Figure 4

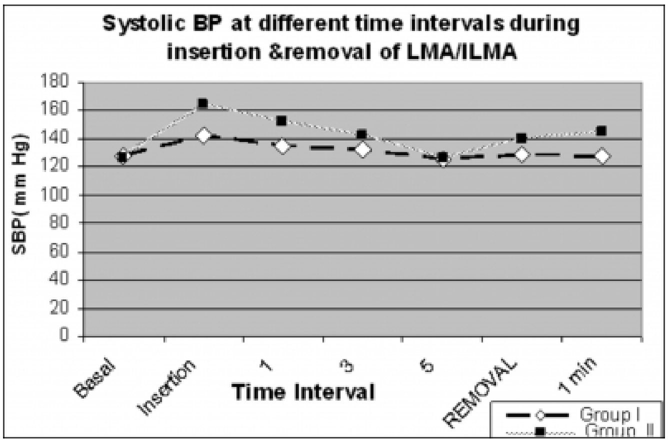
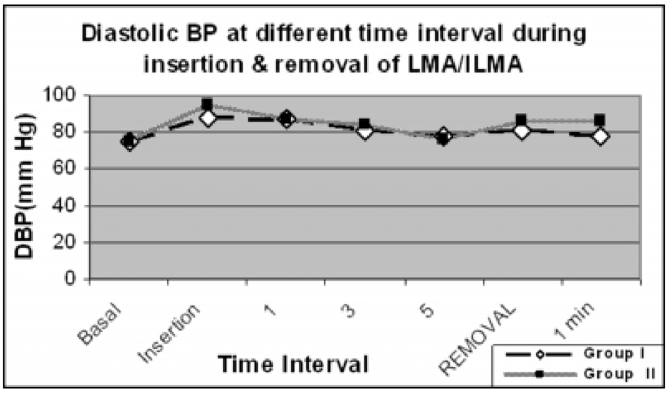
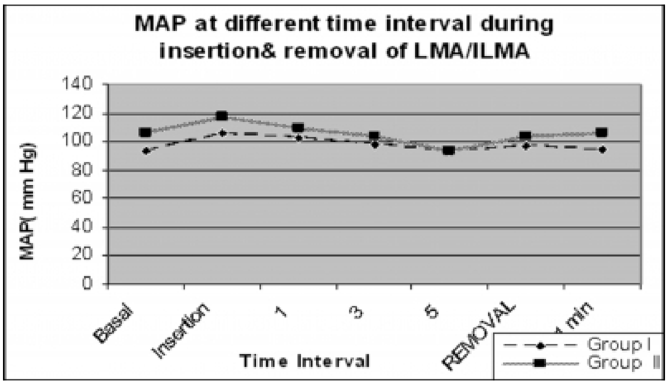


Figure 5



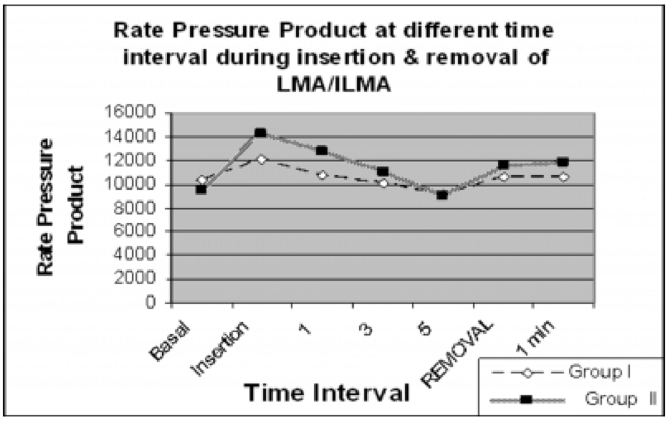
When Systolic, diastolic and mean arterial blood pressure were compared between groups I and II there was significant difference after 1 min of insertion while there was no significant difference at other levels (Table II, Fig 2, 3, 4).We observed that when SBP, MAP was compared between group I and II after 1 min of removal it was highly significant. When the mean HR, SBP, DBP of Group I was compared to the insertion and removal level it was found to be statistically significant and non significantly respectively. While in group II the basal heart rate when compared to insertion was not significant but at the time of removal the difference was significant. (Table II, Fig 1.) The basal SBP, DBP, MAP in group II when compared to insertion and removal the difference was highly significant. (Fig 2, 3, 4.)

Figure 6



When rate pressure product was compared between the two groups there was significant difference at the time of insertion and 1 and 3 minutes after insertion but during removal there was no significant difference.

Figure 7



Four patients (8%) in group I and ten (20%) patients in group II developed ventricular extrasystole immediately after insertion which was transient and disappeared within few seconds. No other arrhythmias were noted. ST segments or T wave changes were not seen in any patients.

DISCUSSION

Various pharmacological methods like ?- blockers, iv lignocaine, opiods, calcium channel blockers have been employed to attenuate deleterious hemodynamic consequences during induction of anaesthesia. The non pharmacological methods like a smooth induction, shorter duration of laryngoscopy, blocking glossopharyngeal and superior laryngeal nerve and putting LMA have been used to attenuate cardiovascular response to endotracheal intubation.

This prospective study was carried on 100 patients of either sex belonging to ASA grade I or II. Most of the patients were male and belonged to ASA grade II. There was no significant difference between the two groups in age, weight, height, sex and ASA grade.

We observed that in group I during insertion and removal of LMA there were increase in heart rate and MAP as compared to basal value but non significantly. In group I, there were significant increase in rate pressure product during insertion (12043.17±575.06 v/s 10346.17±647.7, p<0.05) as compared to basal value but non significant during removal (10649.67±508.85 v/s 10346.17±647.70, p> .05).The findings are in accordance to the results of Hollande[8] and Naqib et al[9]. But contrary to our findings Braude N et al [10]and Wilson IG et al[11]observed significant increase in hemodynamic variable which may be due to lack of proper analgesia. During insertion of LMA pressor responses i.e. increase in HR and MAP may be induced by the passage of the LMA through the oral and pharyngeal spaces, pressure on the larynx and the pharynx by an inflated cuff and the dome of the LMA. The signals are transferred to the brain through the trigeminal, glossopharyngeal and vagus nerve. These nerves carry the afferent impulses to the vasomotor centre which in turn activate sympathoadrenal system to release catecholamines resulting in increase of the HR and BP. The increase in blood pressure is due to increase in cardiac output rather than increase in systemic vascular resistance. The cardiovascular response is maximum during the stimulation of epipharynx whereas those arising from stimulation of tracheo bronchial tree are least marked. During removal of LMA, the hemodynamic response is probably triggered by pharyngeal stimulation during reverse rotation of cuff.

In our study, there was an increase in heart rate in order 3-4 beats /min and MAP from 93 to 106 mmHg during insertion of LMA. During removal again there was an increase in heart rate of 2-3 beats /min and increase in MAP from 93 to 97 mm Hg.

In group II there was no significant increase in heart rate during insertion and intubation as compared to baseline (87±10 v/s 76± 8 beats/min)but during removal there was highly significant increase in heart rate as compared to the basal value (83±10 v/s 8 b/min , p<.01).

In group II there was highly significant increase in MAP during insertion and removal as compared to baseline (118±7 v/s 92±5 mm Hg) and (104± 6 v/s 92± 5 mm Hg) respectively.

In group II there was highly significant increase in rate pressure product during insertion and removal as compared to baseline (14291.17±2006.97 v/s 9610.03±1346.25 mm Hg , p< .05) and (11508.27± 6 v/s 92± 5 mm Hg) respectively.

Our findings were in contrast with Kihara et al[12], who showed that during insertion/ intubation of ILMA there was no significant increase in MAP, and significant changes in HR. This interstudy 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. During removal MAP did not exceed preinduction value (78± 10.5 v/s 91± 13.5 mmHg) but heart rate was higher than preinduction value (82± 12 v/s 76± 14 mmHg). This may be due to greater depth of anaesthesia during maintenance with 2% Sevoflurane in oxygen 33%and nitrous oxide that causes non significant increase in MAP during removal as compared to the preinduction value. Shimoda et al [13]observed that removal of ILMA produced greater hemodynamic changes than insertion.

To prevent accidental extubation during removal of ILMA we tend to advance a tracheal tube towards the carina by pushing with the stabilizing rod. Movement of the tracheal tube probably provides the stimulus [14]which produces the magnitudes of hemodynamic responses to removal versus insertion of the ILMA.

In our study insertion /intubation of ILMA produces larger response than removal of ILMA. This may be due to the removal of ILMA after 1 min of successful intubation. Kihara et al12 observed that impact of ILMA removal on hemodynamic response depends on its timing. If ILMA removal is accomplished 1-2 minutes after the insertion MAP and HR are raised but if removal occurs more than 3 min after insertion the effect is less pronounced. This could be either due to summation of the two stimuli or changes in depth of anaesthesia over time.

The present study also demonstrated that insertion and removal of ILMA provokes greater hemodynamic response compared to insertion and removal of LMA. Our observations are in conformation with the study conducted by Bennett S.R. et al. [15]

Bennett S.R. et al 15observed that removal of the LMA and ILMA was not associated with hemodynamic changes suggesting that this is less stressful than airway insertion. Our results are contrary to their study this may be due to greater depth of anaesthesia by using sevoflurane, fentanyl and midazolam intermittently in their study.

Kellar and colleague[16] demonstrated that insertion of ILMA provides a more effective seal than the LMA but pharyngeal mucosal pressure for the ILMA are 3-70 times greater than for LMA and exceed capillary perfusion pressure at most location. The highest mucosal pressure for the ILMA was in the distal oropharynx where the rigid tube is firmly wedged against in bone of the anterior cervical vertebrae.

Their reports and our findings indicated that insertion/ intubation and removal of ILMA produces significant nociceptive stimuli to the upper airway compared to LMA and causes greater hemodynamic pressor responses.

CONCLUSION

It is concluded from our study that LMA could be useful in situation where minimal changes in hemodynamics are desirable like patients with coronary artery disease and cerebral vascular disease.

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