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Comparative study of haemodynamic response to laryngeal mask airway versus endotracheal tube in hypertensive patients

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ABSTRACT

Background: The hemodynamic response associated with laryngoscopy and tracheal intubation may be harmful to certain patients. The laryngeal mask airway (LMA) avoids the need for laryngoscopy and allows positive pressure ventilation of the lungs in appropriate patients. **Aim**: Study compared the haemodynamic response of tracheal intubation with that of laryngeal mask insertion in hypertensive patients. **Methodology**: Sixty hypertensive patients between 40-60 years of either sex of ASA grade II were randomly allotted to one of the two groups of 30 each (group ET vs group LMA). LMA insertion or tracheal intubation was performed after induction of anaesthesia with thiopentone, and muscle relaxation with succinylcholine. Anaesthesia was maintained with nitrous oxide, oxygen, and inhalational anaesthetic as per the need. The heart rate, systolic BP, diastolic BP, mean arterial pressure (MAP),SpO2 were measured after induction, immediately after intubation or insertion and at minute 1, 3 and 5. **Results:** There was a very highly significant difference ($P < 0.001$) in mean peak increase in heart rate (59.2% in group ET vs 36% in group LMA). There was a fall in both systolic and diastolic BP after induction in both the groups of our study. This was followed by a very highly significant increase in both systolic and diastolic BP after airway instrumentation in both the groups. However the values in group LMA were significantly lower compared to group ET after 1 minute and 3 minutes. The MAP reached maximum value immediately after airway instrumentation. However, the values after LMA insertion were significantly lower compared to tracheal intubation after 1,3 and 5 minutes. **Conclusion:** Use of LMA may therefore offer some advantages over tracheal intubation in the anaesthetic management of patients where the avoidance of the pressor response is of particular concern.

Keywords: Laryngeal mask airway, Endotracheal tube, Tracheal intubation, Hemodynamic response.

Introduction

Endotracheal intubation with the help of a laryngoscope has become a routine part of delivering a general anaesthetic. In general, intubation is indicated for patients who are at risk of aspiration and for those undergoing surgical procedure[1-3].

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Laryngoscopy and tracheal intubation after induction of anaesthesia are frequently associated with transient hypertension, tachycardia and arrhythmias. Although these hemodynamic responses are probably of little consequence in healthy individuals, they are more concerned and hazardous with hypertensive patients, and in ischemic heart disease[3.4].

Laryngoscopic stimulation of oropharyngolaryngeal structures may be an important factor in the hemodynamic response associated with tracheal intubation. Various nonlaryngoscopic intubation devices have provided conflicting evidence of an attenuated hemodynamic response. In general, techniques that avoid or minimize oropharyngolaryngeal stimulation might attenuate the

hemodynamic stress response[5,6].
The laryngeal mask airway has proved to be a popular addition to the range of equipment available for airway management. The laryngeal mask airway is intermediate in design and fills a niche between oropharyngeal airway and endotracheal tube. The laryngeal mask airway is designed primarily as a means of offering some of the advantages of endotracheal tube while avoiding its fundamental disadvantages, since the vocal cords need to be neither visualized nor forced upon[7].The laryngeal mask airway has its own limitations as it is contraindicated in patients at risk of aspiration, with low airway compliance and in bleeding diathesis.
In this comparative study, the hemodynamic stress response to laryngoscopic tracheal intubation and laryngeal mask airway insertion in hypertensive patients were evaluated.

Methodology

The study was done for a period of 4 months ie from October 2014 to January 2015 at Siddhartha medical college and Government general hospital which includes 60 hypertensive patients of either sex aged between 40-60 years after institutional ethical committee approval. They belong to ASA grade II with their hypertension under control with oral antihypertensives. The patients were undergoing elective surgeries lasting for not more than one hour thirty minutes.

Inclusion criteria

Hypertensive patients of 40-60years undergoing elective surgery.

Exclusion criteria

Patients with History of pulmonary, central nervous system or cervical spine disease, difficult intubation, gastro oesophageal reflux disease and those belonging to vysya community.

Each patient was visited preoperatively when the procedures were explained and informed written consent was obtained. All the patients were kept fasting for at least for 6 hours prior surgery. They were briefly counselled regarding the type of anaesthetic procedure. Patients were advised to take Tablet diazepam 0.2mg/ kg orally on previous night. The patients were taken up for the study with systolic BP $\leq$ 160 mm Hg and diastolic BP <110 mm Hg. Investigations like Hb%, TC, DC, ESR, random blood sugar, serum electrolytes, urine albumin, sugar, chest x-ray and ECG were done. Patients were advised to take oral antihypertensives as per schedule with the last dose 6 hours prior to surgery.
After securing an intravenous line, Injection Ranitidine 0.25-1 mg/Kg (I.V) and metaclopromide 0.15mg/kg (I.V) were given as antacid prophylaxis. Inj.Glycopyrrolate 0.004 mg/kg and midazolam 0.03-0.05 mg /kg (I.V) were given 5 minutes before the induction. The patients were randomly allotted to one of the two groups (of 30 patients each) group ET and group LMA.The patients in group ET were intubated using macintosh laryngoscope. The patients in group LMA received laryngeal mask insertion. A size 4 macintosh blade with an appropriate size endotracheal tube was used in patients of group ET and size 4 LMA was used in all patients in group LMA.

Procedure

After the arrival of the patients into the operation theatre, they were made to lie in the supine position. Pulse oxymeter and noninvasive BP apparatus were connected to the patient. After stabilization period of 5 minutes, the baseline values of heart rate, systolic, diastolic BP and MAP were recorded.
Patients in both groups received preoxygenation via a face mask for 5 minutes. Anaesthesia was induced with thiopentone sodium 5 Mg/Kg I.V and after confirming loss of the eye lash reflex, succinylcholine 2Mg/Kg I.V was given for endotracheal intubation or LMA insertion. After the disappearance of fasciculations, tracheal intubation was performed in group ET and LMA was inserted using the standard technique in group LMA.
2% xylocaine gel was used as lubricant for both the endotracheal tube cuff and LMA cuff. Air was injected into the endotracheal tube or LMA cuff as per recommendation.
Anaesthesia was maintained with intermittent positive pressure ventilation using bain's circuit with N2O 4 L/Min and O2 3 L/Min and inhalational aneasthetic as per the need.
The values of heart rate, systolic BP, diastolic BP, MAP and spo2 were recorded after induction, immediately after intubation or insertion and at minute 1,3 and 5. Reversal was done with inj Neostigmine 0.05mg/kg +Inj Glycopyrrolate 0.007 mg/kg. Removal of LMA in group LMA patients and extubation in Group ETT patients was done. Inj.Diclofenac Sodium was given intramuscularly as

postoperative analgesic. The data was collected, compiled and analyzed statistically using Student 't' test.

Results

The present study was conducted on 60 consenting patients aged between 40-60 years. All were hypertensives receiving various types of oral antihypertensives for variable periods of time. Group ET consisted of patients in whom endotracheal intubation was done using macintosh laryngoscope. Group LMA consisted of patients in whom laryngeal mask was inserted.

Table 1: Demographic Data

	Group ET	Group LMA
Male/Female	18/12	21/9
Mean Age(Years)	47.93	47.57
Weight (Kgs)	51.67	51.60
Anti hypertensives Drugs		
- ACE Inhibitors	8	5
- Angiotensin receptor blockers	1	2
- β – Blockers	6	1
- Calcium Channel Blockers	1 5	1 3

Two groups are similar in age, weight and type of anti hypertensive drugs used.

Table 2: Comparison o f Mean Heart Rate

Time of Measurement	Group ET	Group LMA
Baseline	70.53±6.23	73.07±9.11
Post Induction	78.43±6.33***	81.40±7.66***
Post Intubation/Insertion		
- Immediate	111.00±17.19***	103.80±12.80***
- Minute 1	101.10±16.35***	98.40±11.52***
- Minute 3	94.67±13.50***	91.50±8.7***
- Minute 5	86.70±11.41***	86.93±8.55***

*** P < 0.001 highly significant (Vs Baseline)

Table 3: Comparison o f Mean Systolic Blood Pressure

Time of measurement	Group ET	Group LMA
	Systolic B.P	Systolic B.P
Baseline	147.03 ± 8.10	142.67 ± 11.33
Post Induction	143.77 ± 8.39	140.03 ± 11.91

□ Post intubation/ insertion		
- Immediate	190.23 ± 14.62***	180.37 ± 19.12***+
- Minute 1	180.33 ± 14.31***	173.03 ±13.16***+
- Minute 3	164.93 ± 11.13***	155.67 ±10.80***++
- Minute 5	155.06 ± 8.68***	146.87 ± 13.51*++

* P < 0.05 Significant (Vs Baseline), *** P < 0.001 Very Highly Significant (Vs Baseline, + P < 0.05 Significant (Group ET Vs LMA), ++ P < 0.01 Highly Significant (Group ET Vs LMA)

Table 4: Comparison Of Mean Diastolic Blood Pressure

Time of measurement	Group ET	Group LMA
	Diastolic B.P	Diastolic B.P
□ Baseline	94.90 ± 5.38	94.13 ± 7.43
□ Post Induction	93.30 ± 4.57	90.93 ± 9.19
□ Post intubation/ Insertion		
- Immediate	108.97 ± 10.40***	108.37 ± 11.18***
- Minute 1	107.07 ± 9.00***	102.17 ± 8.35***+
- Minute 3	101.33 ± 7.72***	97.67 ± 6.32+
- Minute 5	96.70 ± 5.00	94.97 ± 8.39

*** P < 0.001 Very Highly Significant (Vs Base line), + P < 0.05 Significant (Group ET Vs LMA)

Table 5 : Comparison of Mean Arterial Pressure

Time of measurement	Group ET	Group LMA
	MA P	MA P
□ Baseline	112.27 ± 4.47	110.30 ± 7.67
□ Post Induction	109.79 ± 4.89	107.30 ± 9.29
□ Post intubation/ Insertion		
- Immediate	136.05 ±10.23***	132.36 ± 11.75***
- Minute 1	132.52 ± 9.02***	127.35 ± 10.11***+
- Minute 3	122.53 ± 7.77***	116.99 ± 6.61**++
- Minute 5	116.15 ± 5.09***	112.26 ± 9.41+

** P < 0.01 Highly Significant (Vs Base line), *** P < 0.001 Very Highly Significant (Vs Base line) ++ P < 0.01 Highly Significant (Group ET Vs LMA), + P < 0.05 Significant (Group ET Vs LMA)

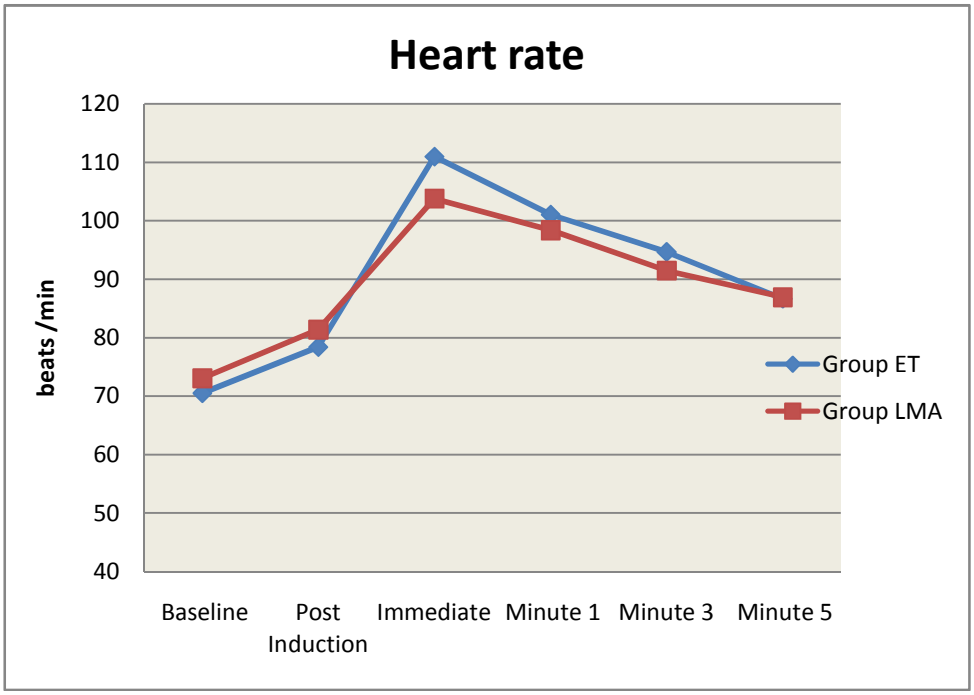

Figure 1: Comparison of Mean Heart Rate

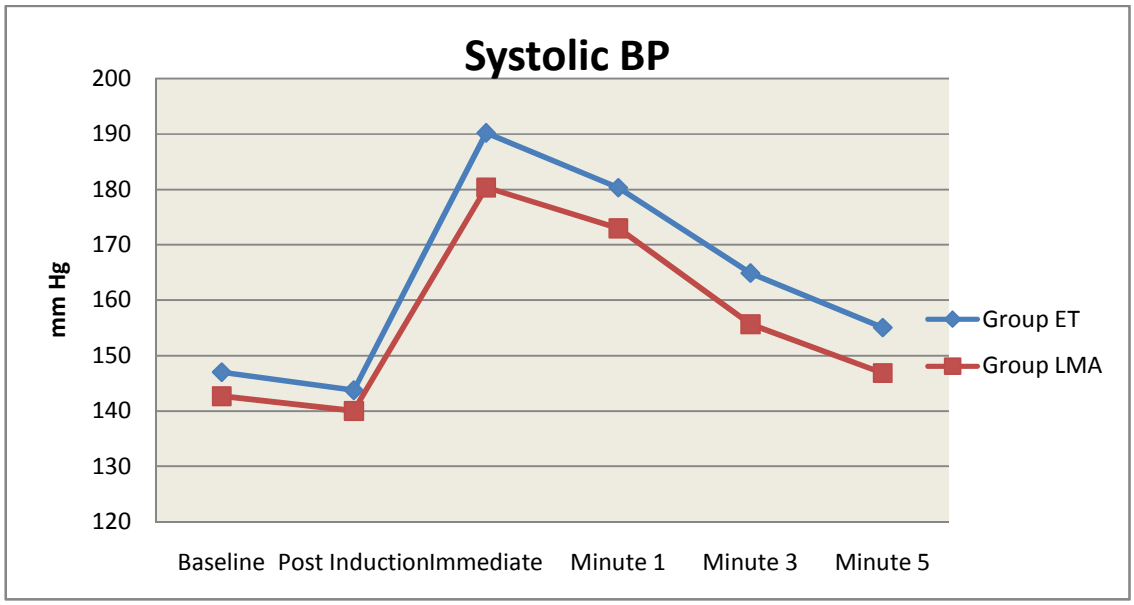

Figure 2 : Comparison of Mean Systolic Blood Pressure

The mean systolic BP increased after both intubation and LMA insertion. Even though the values remained elevated in both the groups,at the end of minute 5 they were significantly lower in group LMA compared to group ET. ($P<0.05$).

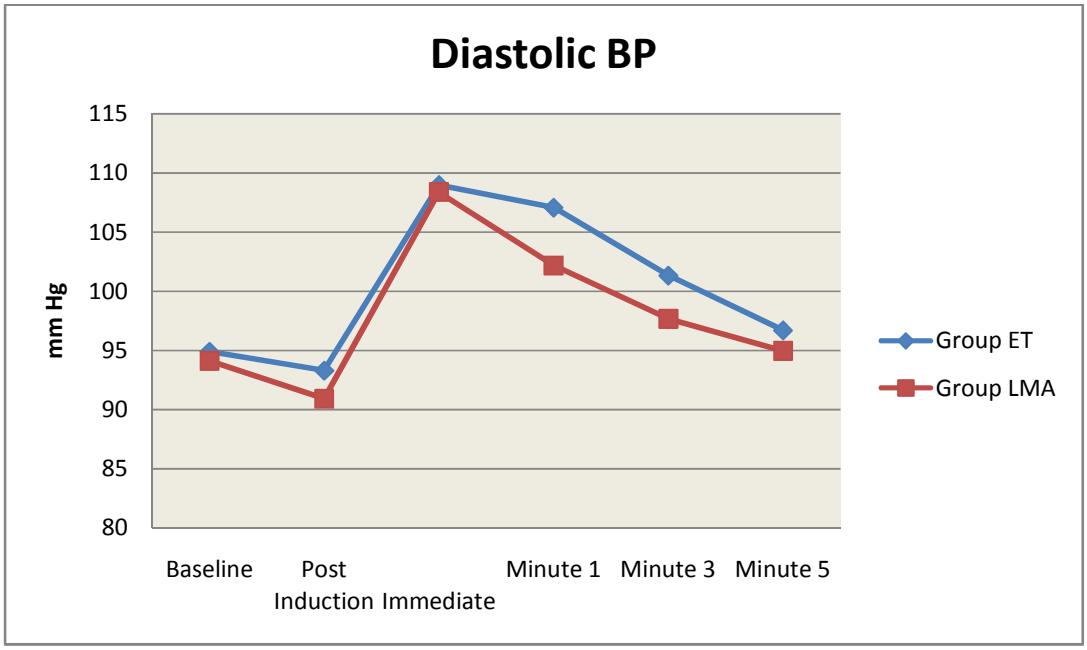

Figure 3: Comparison of Mean Diastolic Blood Pressure

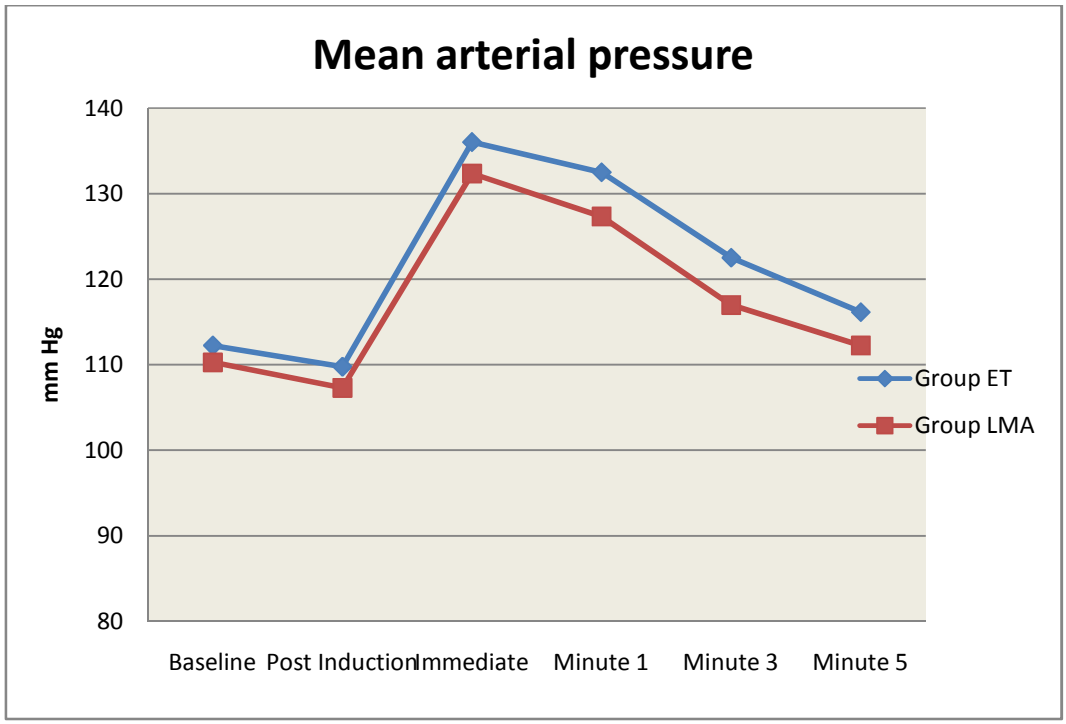

Figure 4: Comparison of Mean Arterial Pressure

The MAP values increased in both the groups after intubation or LMA insertion. The values remained elevated for up to 5 minutes in group ET. In group LMA the values were high for upto 3 minutes. The values were significantly lower in group LMA at minutes 1,3 and 5 compared to group ET.

Discussion

Endotracheal intubation has a long history as one of the most widely accepted techniques in anaesthesia practice. The hemodynamic response to laryngoscopy and tracheal intubation reflect the increase in response to oropharyngeal and tracheal stimulation. The possible complications include transient hypertension, tachycardia and arrhythmias. Although these complications are of little significance in normotensive subjects they may be harmful to patients with hypertension, ischemic heart disease or cerebrovascular disease[2,8].

The laryngeal mask airway has proved to be a popular addition in the range of equipment available for airway management. The laryngeal mask was designed primarily as a means of offering some of the advantages of endotracheal intubation while avoiding it's fundamental disadvantage. The laryngeal mask appears to be more suitable where concern about the hemodynamic response exists. The simplicity of the design and the ease of insertion has made laryngeal mask airway to gain a firm position in anaesthesia practice.

We conducted study on 60hypertensive patients with demographic data in terms of age, weight and sex distribution being similar in both the groups. There was no difference in the baseline values of hemodynamic variables between the two groups. In our study the heart rate increased after induction and again after endotracheal intubation or insertion of LMA. The values remained elevated for up to 5 minutes when compared with the baseline. These results were very similar to those of similar study by Yoshitaka Fujii8 and colleagues who found that the hemodynamic changes were greater after intubation than after laryngeal mask airway insertion.

We have found that even though the increase in mean heart rate were similar when the two groups were compared, the mean peak increase in heart rate was 59.2% in group ET and 36% in group LMA with $P < 0.001$ which is very highly significant. This difference was probably because insertion of LMA produced a balanced stimulation of vagal and cardiac accelerator fibers but intubation of trachea produced lesser vagal stimulus.

There was a fall in both systolic and diastolic BP after induction in both the groups of our study. This was followed by a very highly significant increase in both systolic and diastolic BP after airway instrumentation in both the groups. However the values in group LMA were significantly lower compared to group ET, after 1 and 3 minutes. This reflects a smaller degree of total afferent stimulation in group LMA and a continued effect of tracheal tube.

The results of our study support the findings of Wilson *et al*.[9] who found that insertion of the laryngeal mask airway produced a small but not significant increase in both systolic and diastolic arterial pressure. However, this increase was considerably less and significantly so, in comparison with that associated with laryngoscopy and tracheal intubation. Similar to our study results Hickey *et al*.[10]and other studies[11] found that insertion of LMA was associated with significant increase in arterial pressure and heart rate. But the changes were short lived.

In our study the insertion of LMA was associated with a less hemodynamic response comparable to endotracheal intubation. Shribman[12] and colleagues concluded that stimulation of the supragrottic region by tissue tension is the major cause of the sympathoadrenal response. However, the short lived nature of this response in group LMA was explained by Marjot *et al*.[13] who found that lateral pressure of the LMA cuff on the pharyngeal mucosa was not a sustained one and the fact that transmitted pressure decreased during the time mask was insitu.

Studies by Anita N. Shetty *et al*.[4] Siddiqui NT *et al* [14]and Bharti N *et al* [15] found an attenuated hemodynamic response after insertion of laryngeal mask airway compared to endotracheal intubation. The mean arterial pressure (MAP) values in our study increased after tracheal intubation or insertion of LMA. Similar to other hemodynamic variables the MAP in group LMA was significantly lower than group ET.

The results of our study were similar to the study of Yoshitaka Fujii[8] and colleagues who found that MAP values increased after airway instrumentation in both the groups with an attenuated response in group LMA.

Our results suggest that insertion of LMA is associated with attenuated hemodynamic response compared with tracheal intubation and may be useful in situation where the pressor response to intubation should be avoided as in hypertensive states. Our results also suggest that there is no significance with different antihypertensives on hemodynamic response in either group. (p value is >0.05 which is not statistically significant).

Conclusion

It is concluded from present study that hemodynamic response to laryngeal mask insertion is much less than that of laryngoscopy and endotracheal intubation. Hemodynamic response to laryngeal mask insertion is transient. No untoward incidents with airway

management by laryngeal mask airway. Laryngeal mask airway may be used for airway management during anaesthesia in hypertensive patients on treatment in whom the pressor response would be deleterious.

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