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CHANGES IN THE HAEMODYNAMIC RESPONSE FOLLOWING ENDOTRACHEAL INTUBATION AND LARYNGEAL MASK AIRWAY INSERTION IN HYPERTENSIVE PATIENTS- A COMPARATIVE STUDY

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ABSTRACT 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 procedures (1,2).
Tracheal intubation causes a reflex increase in sympathetic activity that may result in rise in blood pressure, heart rate, and arrhythmia (3). A change in plasma catecholamine concentrations also has been demonstrated to be a part of the stress response to tracheal intubation. Various supraglottic devices have provided conflicting evidence of an attenuated haemodynamic response.
Materials and Methods: 100 Patients divided into two groups (n=50)of 25-60 years of age of either sex with hypertension stage-1 of A SA grade II on oral anti-hypertensives drugs were selected for the study and endotracheal tube inserted in ET group where as LMA inserted in group LMA.
Results: Haemodynamics (heart rate, blood pressure, rate pressure product) changes is more in group ET after induction compared to group LMA.
Conclusion: Pressor response and duration of the pressor response to laryngeal mask airway insertion is much less than that of laryngoscopy and endotracheal intubation which establishes the usefulness of LMA in hypertensive patients.

KEYWORDS : haemodynamic response, endotracheal intubation, laryngeal mask airway, hypertensive patients.

INTRODUCTION

Airway management is of utmost importance during administration 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)**

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 procedures(**2**).

Tracheal intubation causes a reflex increase in sympathetic activity that may result in rise in blood pressure, heart rate, and arrhythmia (**3**). A change in plasma catecholamine concentrations also has been demonstrated to be a part of the stress response to tracheal intubation. The extent of the reaction is affected by many factors: the technique and duration of laryngoscopy and intubation.(**3**)

Despite the use of strong opioids, adequate anaesthetic depth and application of other stress reducing techniques and agents, there is release of catecholamines and cortisol which causes increase in heart rate and pressor response after pharyngeal and laryngotracheal manipulation, which is usually more after laryngoscopy and tracheal intubation **(4,5,6).** In susceptible patients particularly those with systemic hypertension, coronary heart disease, cerebrovascular disease and intracranial aneurysm, even these transient changes can result in potentially deleterious effects like left ventricular failure, arrhythmias, myocardial ischaemia, cerebral haemorrhage and rupture of cerebral aneurysm.**(7,8,9,10)**

Laryngoscopic stimulation of oropharyngo-laryngeal structures with tracheal intubation may be an important factor in the haemodynamic response. Various supraglottic devices have provided conflicting evidence of an attenuated haemodynamic response. In general, techniques that avoid or minimize oropharyngo-laryngeal stimulation might attenuate the haemodynamic stress response.

Lower pharynx, epiglottis and larynx contain numerous sensory receptors which respond to chemical, thermal and mechanica1 stimuli. The mechanoreceptors are abundant especially in the lower pharyngeal wall, epiglottis and vocal cords. Stimulation of these mechanoreceptors can produce reflex motor responses like cough, hiccup and also reflex sympathetic stimulation and cardiovascular pressor response.(**7**)

The laryngeal mask airway has proved to be a popular addition to the range of equipments available for airway management. Laryngeal mask airway insertion is an alternative method to endotracheal intubation for maintaining airway and anesthesia. In contrast to endotracheal intubation laryngeal mask airway insertion does not require instrumentation i.e. laryngoscopy of the upper airway. Moreover laryngeal mask airway does not pass through glottis but is placed over the glottis. The laryngeal mask airway 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 it's fundamental disadvantages, since the vocal cords need to be neither visualized nor forced upon **(11)** which is particularly helpful for hypertensive patients due to lack of sympathetic stimulation.

Laryngeal mask airway insertion involves lesser mechanical manipulation of upper airway than endotracheal intubation does, but it has its own limitations as it is contraindicated in patients who are at risk for aspiration, those with low pulmonary compliance and those with pharyngeal obstruction. **(12)**

In this comparative study, the haemodynamic stress response to laryngoscopic tracheal intubation and laryngeal mask airway insertion in hypertensive patients has been evaluated.

MATERIALS AND METHODS

The study had been done after receiving the approval of the ethical-cum-screening committee of Agartala Govt Medical College & GBP Hospital, Agartala. Written informed consent was obtained from all patients prior to the procedure.

1. STUDY SETTING:

The present study was conducted in the operation theatre under Department of Anesthesiology AGMC &GBP Hospital.

2. STUDY PERIOD:

January 2015 to June 2016

3. STUDY POPULATION:

Patients with 25-60 years of age of either sex with hypertension stage-1 of ASA grade II on oral anti-hypertensives drugs were selected for the study.

4. INCLUSION CRITERIA:

- Patients giving consent for the study
- Patients with 25-60 years of age of either sex with hypertension stage-I of ASA grade II on oral anti-hypertensives drugs

- Presenting for elective surgeries under general anesthesia.

5. EXCLUSION CRITERIA:
- History of LRTI/URTI, COPD, Active lung diseases.
- History of angina, IHD.
- Baseline heart rate< 60 per minute.
- ASA grade 3 and 4.
- History of DM.

Assessment of the patients was done after decision of surgery at PAC clinic and again one day before surgery in the ward. Exclusion of patients with cardiac and renal problems was based on history and pre-operative investigation results.

Patients undergoing elective orthopaedic, gynaecological, urological and general surgical procedures were selected for the study.

6.STUDY DESIGN
The proposed study will be a prospective, double blind, randomized study.

7) SAMPLE SIZE
Using the formula for continuous outcomes and means from a study which was done by Oczenski W et al (**31**) sample size has been calculated as following

$Z_{1-\alpha/2} = 1.96$ for a p = 0.05 (95% confidence interval)
$Z_{1-\beta} = 0.83$ for 20% beta error
S = standard deviation
$\mu 1 = 140 \pm 24$ mmHg Mean maximal systolic blood pressure increase in endotracheal intubation group
$\mu 0 = 115 \pm 33$ mmHg Mean maximal systolic blood pressure increase in laryngeal mask group,

$(Z_{1-\alpha/2} + Z_{1-\beta})^2 = n(\mu_1 - \mu_0)^2 / s_0^2 + S_1^2$
$(1.96 + 0.83)^2 = n\,(140-115)^2 / 24^2 + 33^2$
$7.7841 = n \times 255 / 244 + 1089$
$n = 7.7841 \times 1333 = 40.69$

n= 41 per group

For 2 groups N = 41 x 2 = 82

Adjusting for missing data, loss to follow up and non compliance sample size has been increased by 20% to be 98.

For convenience Total sample size has been taken as 100 (50 for each group)

8) SAMPLING PROCEDURE
Patients listed for surgery was enrolled and assessed for eligibility. Those not meeting the inclusion criteria or those refusing to participate was excluded. The patients then randomly allocated to two groups: ETT group and LMA group.

ETT group: The patients in group ET will be intubated using Macintosh laryngoscope.

LMA group: The patients in group LMA will be received laryngeal mask insertion

9. Parameters To Be Studied:
a. Demographic profiles:
- Age- 25-60 years
- Sex- Both sexes
- Body mass index/body weight
- Anti-hypertensive drug on treatment.

b. Clinical parameters
- Heart rate,
- Systolic BP,
- Diastolic BP and
- MAP
- Rate pressure product
- ECG
- ETCO2

10) Study tools:
- Bed head tickets of the patients
- Inform consent form.
- Table of randomization.
- Multi parameter monitor.
- Disposable syringe,
- I.V cannula,
- I.V. drip set,
- I.V .fluids
- Endotracheal tube of different sizes
- Laryngeal mask airway of different sizes
- Macintosh laryngoscope
- Malleable bougie & stylet
- Full functioning anesthesia machine
- Drugs:
  - Inj. etomidate
  - Inj. fentanyl
  - Inj. glycopyrrolate
  - Inj. midazolam
  - Inj. Ondansetron
  - Inj. succinyl choline
  - Inj. Pantoprazole

11. STUDY TECHNIQUE
After approval of the Hospital Ethics-cum-Screening committee, 100 patients with the above mentioned criteria were selected for the study. The patients was undergoing elective surgeries. Each patient was visited pre-operatively when the procedures was explained and informed written consent will be obtained. Blood pressure was recorded in the supine position on 3 occasions two hours apart and patients was taken up for the study.

Investigations like Hb%, TC, DC, ESR, random blood sugar, serum electrolytes, urine RE/ME, chest x-ray and ECG was done. Patients was advised to take oral anti-hypertensives as per schedule with the last dose 6 hours prior to surgery. Each patient pre-medicated with inj. ondensetron 4mg, inj.pantoprazol 40 mg, inj.glycopyrolate 0.5mg, inj. fentanyl 2 mcg/kg, inj. midazolam0.05mg/kg one hour prior to surgery.

The patients was randomly allotted to two groups (of 50 patients each) group ET and group LMA. The patients in group ET was intubated using Macintosh laryngoscope. The patients in group LMA was received laryngeal mask insertion. Appropriate macintosh blade with an appropriate size endotracheal tube used in patients of group ET and appropriate size LMA used in all patients in group LMA.

Intravenous access established with an 18 G Cannula after arrival in the anaesthetic preparation room. Pulse-oxymeter and non-invasive BP apparatus and ECG connected to patient in the operation theatre. After stabilization period of 5 minutes, the baseline values of heart rate, systolic BP, diastolic BP and MAP recorded.

Patients in both groups received pre-oxygenation with 100% oxygen via a face mask for 5 minute.

Anaesthesia was induced with Inj.Etomidate 0.3 mg/kg I.V and after confirming loss of the eyelash reflex, succinylcholine 2mg/kg I.V was given for endotracheal intubation or LMA insertion. After the disappearance of fasciculations, tracheal intubation performed in group ET and LMA inserted blindly using the standard technique in group LMA. 2% xylocaine gel used as a lubricant for both the endotracheal tube cuff and LMA cuff. Air injected into the endotracheal tube or LMA cuff as per recommendation.

Anaesthesia was maintained with intermittent positive pressure ventilation with N2O, O2 and sevoflurane. The values of heart rate, systolic BP, diastolic BP, MAP was recorded after induction, immediately after intubation or insertion and at 1, 3 and 5 min. Rate pressure product which is a product of systolic BP and heart rate was derived at all the interval.

At the end of five minutes the anaesthetic management deferred as per surgical requirements. Painful stimulus including surgical incision was not be allowed while the readings was recorded. Patients on whom more than one attempt at either intubation or LMA insertion was tried excluded from the study. Complications like leakage, coughing,

gagging, laryngospasm, gastric distension after airway instrumentation was not allowed during the study.

12) STATISTICAL EVALUTION-

All the values was expressed as mean ± standard deviation. Statistical comparison was performed by students paired and unpaired t -test for continuous data and chi-square test was applied for categorical data. P value of <0.05 considered as statistically significant.

RESULT & ANALYSIS

The present study was conducted on 100 consenting Patients with 25-60 years of age of either sex with hypertension stage-1 of ASA grade II on oral anti-hypertensives drugs posted for elective surgeries will be selected for the study.

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.

The two groups were similar in sex, age, weight and type of antihypertensive drugs used.

Comparison of Heart Rate, Mean Arterial Pressure, Pate Pressure Product (RPP) Between ETT And LMA Group

TABLE-I

		Baseline	Postinduction	Immediately After Intubation/insertion	After 1min	After 3 Min	After 5 Min
ETT	HR	70.20+-6.53	82.18+-6.2	112.38+-14	104.9+-12	97.5+-10.25	89.24+-8.8
	MAP	112.65+-4.7	110+-4.8	138.37+-7.95	133.23+-7.48	124.63+-6.2	117.63+-3.7
	RPP	10373.84+-1188	11948.54+-1149	21508+-3309	17496.6+-2764	16171+-1891	13748+-1884
LMA	HR	77.32+-7.8	83.24+-8	101.62+-8.98	97.86+-9.6	91.6+-8.72	86.86+-8.82
	MAP	110.31+-7	106.71+-8.8	132.1+-10.22	128.3+-11.29	116.72+-6.4	111.94+-9.4
	RPP	10985+-1268	11997+-1826	18923+-2957	17280+-2681	14337+-1606	12155+-1729
P-Value	HR	0.001	.462	0.001	.001	.003	.18
	MAP	0.054	0.021	0.001	0.012	0.001	0.001
	RPP	0.014	0.873	0.001	0.69	0.001	0.007

There was no statistically significant difference other than HR.. The demographic data was comparable in both the groups.

The mean peak increase in heart rate observed during immediately after Intubation/Insertion,after 1 minute and after 3 minutes but it is very high with ETT Intubation.

P-value immediately after Intubation/Insertion was 0.001 which is statistically very very significant, P-value after 1 minute was 0.001 and after 3 minutes 0.003 which is also statistically very significant.

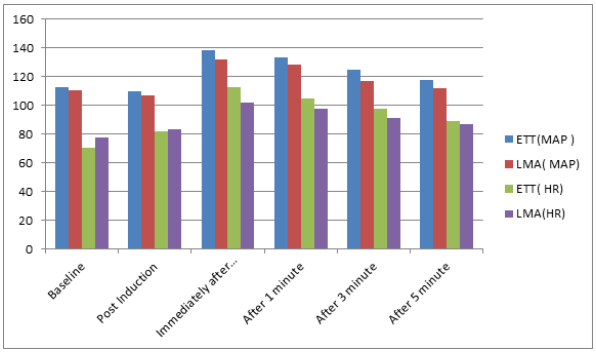
The MAP is increased in ETT and LMA group immediately after Intubation /Insertion, after 1 minute, after 3 minute and after 5 minute but higher with ETT group comparative with LMA group.

P-value immediately after Intubation/Insertion, 3 minute, 5 minute is 0.054 , 0.001 and 0.001 which statistically significant.

The RPP is increased in ETT and LMA group immediately after Intubation/ Insertion, after 1 minute,3 minute and after 5 minute but higher with ETT group comparative with LMA group.

P-Value immediately after Intubation/Insertion is 0.001 which is statistically very very significant. P-Value after 3 minute 0.001 and after 5 minute 0.007 which is also statistically significant.

GRAPH: 1 Graphical Presentation and comparison of HEART RATE , MAP changes in ETT and LMA Group



COMPARATIVE CHANGES OF ECG AND ETCO2 IN ETT AND LMA GROUP

On ECG- In ETT group 50% patients developed sinus tachycardia. Out of these 2 developed tachyarrythmias.

In LMA group 30% patients developed sinus tachycardia during the procedure which was subsequently become normal within 3 -5mins. No patient developed arrthythmia.

ETCO2 changes were not significant in both the group.

OTHER RELATED COMPLICATION-

-Injury related to laryngoscopy like gum injury, injury to oral cavity, bleeding Sore thorat very common with ETT group.

DISCUSSION

Endotracheal intubation following laryngoscopy has a long history as one of the most widely accepted techniques in anaesthetic practice. The haemodynamic 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 but it obviously harmful to patients with hypertension, ischaemic heart disease or cerebrovascular disease[2,13] .

The laryngeal mask airway has proved to be a popular addition in the range of equipment available for airway management.

We conducted studies on 100 patients with demographic data in terms of age, weight or the distribution of males and females being similar in both the groups. There was no difference in the baseline values of haemodynamic 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 Yoshitaka Fujii[14] and colleagues in contrast Braude et al.[15] found an attenuated pattern of response with increased values reaching the baseline within one minute in both the groups. This is probably because study was conducted on normotensive patients.

In our study there was a very highly significant difference in the increase in mean heart rate between the two groups. The mean peak increase in heart rate observed during immediately after Intubation/ Insertion, after 1 minute and after 3 minutes but it is very high with ETT Intubation. P-value immediately after Intubation/Insertion was 0.001 which is statistically very very significant,P-value after 1 minute was 0.001 and after 3 minutes 0.003 which is also statistically very significant. This difference was probably because insertion of LMA produced a balanced stimulation of vagal and cardiac accelerator fibres but intubation of trachea produced lesser vagal stimulus.

In contrast to our study results, Wilson et al.[16] found no difference in the mean peak increase in heart rate between the two groups (26.6% in-group ET and 25.7% in LMA group). The deeper levels of anaesthesia

achieved by use of volatile anaesthetic after induction for up to four minutes before airway instrumentation probably would have obtunded the haemodynamic response in group ET compared to our study.

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. 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.[16]

Similar to our study results Hickey et al.[17] found that insertion of LMA was associated with significant increase in arterial pressure and heart rate. But the changes were short -lived.

Studies by Anita N. Shetty et al.[18] also found an attenuated haemodynamic 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 haemodynamic variables the MAP in group LMA was significantly lower than group ET. The RPP values also increased after airway instrumentation in both the groups. The RPP values in group ET reached a mean peak increase of 21508, corresponding mean peak increase in group LMA was 18923.The results of our study were similar to the study of Yoshitaka Fujii[14] and colleagues.

In our study there was significant changes was observed in ECG. Almost 50% patients of ETT group developed sinus tachycardia immediately after intubation and out of these 2 patient developed tachyarrthmia which was treated accordingly. But on LMA group 30% developed sinus tachycardia.

CONCLUSIONS

The following conclusions can be drawn from our study.

- Pressor response to laryngeal mask airway insertion is much less than that of laryngoscopy and endotracheal intubation.
- Duration of the pressor response is also transient in response to laryngeal mask airway insertion.
- It establishes the usefulness of laryngeal mask airway in airway management during anaesthesia in hypertensive patients where marked pressor response would be deleterious.
- No untoward incident is seen with airway management by laryngeal mask airway.

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