COMPARISON OF HAEMODYNAMIC CHANGES IN RESPONSE TO ENDOTRACHEAL INTUBATION AND LARYNGEAL MASK AIRWAY IN CONTROLLED HYPERTENSIVE PATIENTS- A RANDOMISED STUDY

Vanilla Chopra[1], Vikas Gupta[2], Abdul Qayoom Lone[3], Imtiaz A. Naqash[4]

[1]Assistant Professor, Department of Anaesthesia and Critical Care, Acharya Shri Chander College of Medical Sciences.
[2]Assistant Surgeon, Department of Surgery, Jammu and Kashmir Health Services.
[3]Professor, Department of Anaesthesia and Critical Care, Sher-E-Kashmir Institute of Medical Sciences.
[4]Professor, Department of Anaesthesia and Critical Care, Sher-E-Kashmir Institute of Medical Sciences.

ABSTRACT

BACKGROUND

Context - Laryngeal Mask Airway (LMA) Classic™ and Endotracheal Tube (ETT) are two devices used for the maintenance of airway.

The aim of this study is to compare the haemodynamic responses of endotracheal intubation with that of laryngeal mask airway insertion in controlled hypertensive patients during general anaesthesia.

Settings and Design - This study was conducted as randomised observational study in a teaching hospital.

MATERIALS AND METHODS

We conducted a randomised controlled trial with sixty controlled hypertensive patients undergoing elective surgical procedures of 60 - 90 minutes' duration under general anaesthesia. Patients were randomly assigned to be either intubated with endotracheal tube (Group I) or laryngeal mask airway (Group II). The following study parameters were noted after insertion: heart rate, blood pressure (systolic, diastolic and mean arterial pressure) and thereafter rate pressure product was calculated.

Statistical Analysis Used - Descriptive analyses were expressed as a mean ± standard deviation. Independent t-test was used for parametric data and Chi-square test for non-parametric data. P-value less than 0.05 ($p < 0.05$) was taken to be statistically significant.

RESULTS

All the three study parameters, i.e. heart rate, blood pressure and rate pressure product showed a significant elevation compared to baseline in both groups. However, while comparing two groups the elevation was significantly higher and persisted for longer duration after endotracheal intubation as compared to placement of laryngeal mask airway.

CONCLUSION

Use of LMA Classic™ during general anaesthesia, unless contraindicated, is a better option to attenuate haemodynamic responses to laryngoscopy and endotracheal intubation, particularly in situations where such changes are highly undesirable, i.e. hypertensive patients.

KEYWORDS

Endotracheal Intubation, Laryngeal Mask Airway, Haemodynamics.

HOW TO CITE THIS ARTICLE: Chopra V, Gupta V, Lone AQ, et al. Comparison of haemodynamic changes in response to endotracheal intubation and laryngeal mask airway in controlled hypertensive patients- a randomised study. J. Evolution Med. Dent. Sci. 2017;6(17):1313-1316, DOI: 10.14260/Jemds/2017/285

BACKGROUND

Endotracheal Intubation (ETI) has facilitated efficient delivery of anaesthetic gases into the trachea besides proper control of airway and ventilation during intraoperative period. However, this procedure is associated with a sympathetic adrenergic pressor response leading to tachycardia and increase in systemic arterial pressure.[1] This is also reflected as excessive rise in plasma catecholamine levels.[2] The majority of these stimuli arise from the stimulation of the supraglottic region by tissue tension induced by laryngoscopy. Placement of Endotracheal Tube (ETT) and inflation of the cuff in the subglottic region produces a smaller additional response.[3]

Financial or Other, Competing Interest: None.
Submission 06-02-2017, Peer Review 19-02-2017,
Acceptance 21-02-2017, Published 27-02-2017.
Corresponding Author:
Vanilla Chopra,
49, 1-A, Trikuta Nagar, Jammu.
E-mail: vanillachopra@yahoo.co.in
DOI: 10.14260/jemds/2017/285

Complications of the pressor response following laryngoscopy may include myocardial ischaemia,[4] increase in intracranial pressure, intracranial haemorrhage and cardiac failure.[5] These complications are serious enough in normotensive patients, but an exaggerated response has been reported in hypertensive patients,[6] whether treated beforehand or not. In particular, surgical patients with Ischaemic Heart Disease (IHD) or Hypertension (HT) or both have been shown to carry an increased risk of perioperative complications.[7]

Attempts are made to attenuate this response with a variety of pharmacological manoeuvres and introduction of Laryngeal Mask Airway (LMA) Classic™ has made a step forward in this regard. LMA is a device that bridges the gap in airway management between tracheal intubation and conventional face mask. Insertion of LMA does not require laryngoscopy, although introduction of the device and inflation of the cuff may exert pressure on the anterior pharyngeal wall. However, lack of direct laryngeal trauma

and tracheal stimulation and quicker insertion may lead to a reduced response.

Based on the above facts, this scientific study was conducted to assess the cardiovascular response to the insertion of LMA in controlled hypertensive patients and to compare these changes with laryngoscopy and ETI.

MATERIALS AND METHODS

After obtaining Institute Ethics Committee approval and written informed consent of patients, this prospective randomised study was carried out in 60 controlled hypertensive patients of ASA Grade I and II of either sex, age between 30 - 65 years, undergoing elective surgery of up to 60 - 90 minutes' duration under general anaesthesia. Patients with history of epilepsy, oesophageal reflux, respiratory disease and myocardial infarction were excluded from the study.

Patients were randomly allocated into two groups of 30 patients each to be subjected either to LMA placement (Group I) or endotracheal tube insertion (Group II). During preoperative visit on the evening before surgery, patients were reassured and advised to continue oral antihypertensive treatment till 6 hours before surgery. Patients were premedicated with Tablet Alprazolam 0.25 mg and Tab. Pantoprazole 40 mg orally night prior to surgery.

On arrival in the operating room, an intravenous line was established. Baseline readings of Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP) were recorded before induction of anaesthesia. Anaesthesia was induced with Inj. propofol 1 - 2 mg/kg, Inj. tramadol 0.5 mg/kg and Inj. rocuronium bromide 0.6 mg/kg for neuromuscular blockade. After induction, patients were randomly allocated to be either intubated with a cuffed endotracheal tube (Group I) or Laryngeal Mask Airway (Group II). Thereafter, anaesthesia was maintained in the conventional manner. At the end of the surgery, residual neuromuscular blockade was antagonised with appropriate doses of Inj. neostigmine and Inj. glycopyrrolate.

The haemodynamic parameters, i.e. Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded before insertion and at 1, 2, 3, 4 and 5 minutes after insertion of LMA/ETT.

Rate pressure product (systolic blood pressure × heart rate) was calculated and tabulated for each patient thereafter.

Statistical Analysis

Parametric data was expressed as mean ± SD, thereby the intergroup comparison was made by student's t-test. The test was two-sided and referred for p-value for its significance. P-value less than 0.05 ($p < 0.05$) was taken to be statistically significant. All analysis was performed using the Statistical Package for Social Science (SPSS for Windows Version 16.0, SPSS Inc., Chicago, IL).

RESULTS

The demographic data for each group is summarised in Table 1. There was no significant difference between groups with regard to age, body weight and sex. In our study, females overall predominated in both groups (63.4% females compared to 36.6% males).

The differences observed in baseline heart rate, systolic, diastolic, mean arterial pressures and rate pressure product between the two groups was statistically insignificant. Subsequently, the mean heart rate in both groups showed an increased response. However, on comparing the two groups, the rise in heart rate was more in Group I and was statistically significant at 1 and 2 minutes interval while at 3, 4 and 5 minutes interval the increase was statistically not significant (Figure 1). The other study parameters (systolic, diastolic and mean arterial pressure and rate pressure product) in both the groups also showed an increased trend after insertion of ETT and LMA. However, the increase in ETT group was more and persisted for longer period as compared to LMA group. The difference between the two groups at 1, 2 and 3 minutes of ETT and LMA insertion was statistically significant, but at 4 and 5 minutes the difference was insignificant (Figure 2, 3, 4 and 5).

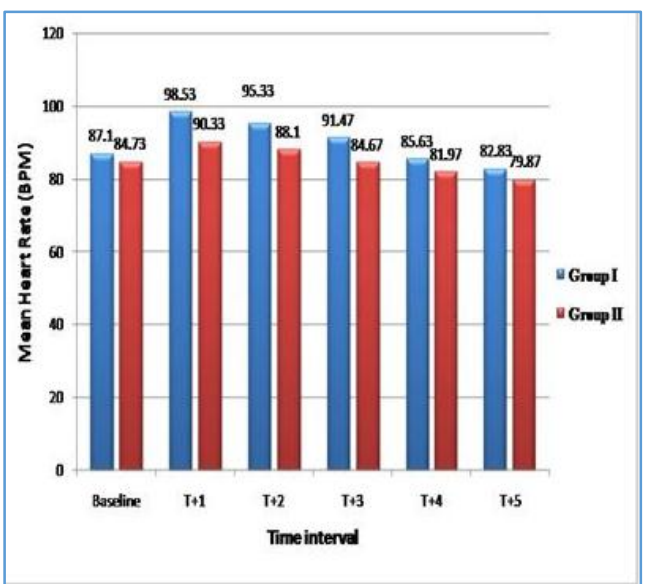

Figure I showing Mean heart rate in both the groups

T+1 = 1 minute after the intubation

T+2 = 2 minute after the intubation

T+3 = 3 minute after the intubation

T+4= 4 minute after the intubation

T+5= 5 minute after the intubation

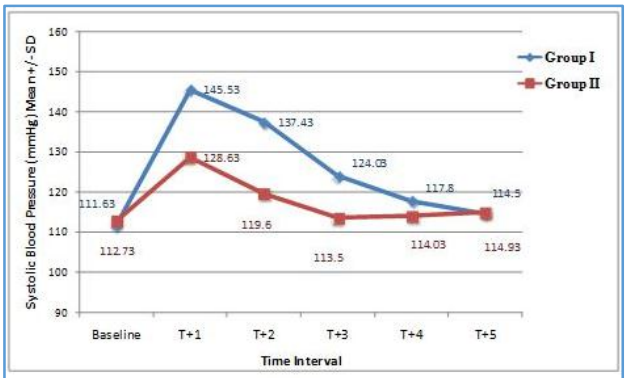

Figure 2 showing systolic blood pressure in both the groups

T+1 = 1 minute after the intubation

T+2 = 2 minute after the intubation

T+3 = 3 minute after the intubation

T+4=4 minute after the intubation

T+5=5 minute after the intubation

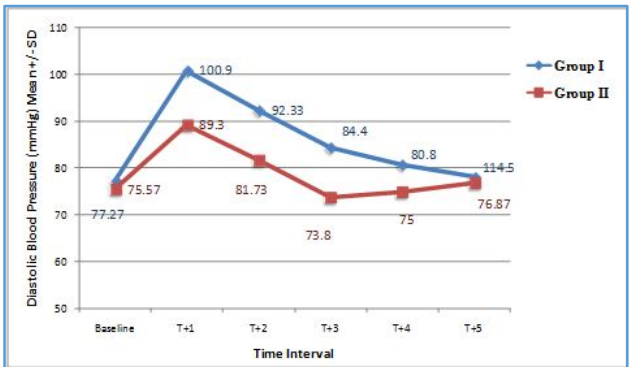

Figure 3 showing diastolic blood pressure (mmHg) in both the groups

T+1 = 1 minute after the intubation

T+2 = 2 minute after the intubation

T+3 = 3 minute after the intubation

T+4=4 minute after the intubation

T+5=5 minute after the intubation

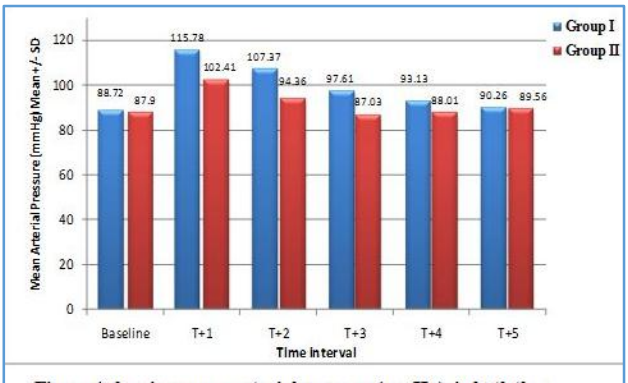

Figure 4 showing mean arterial pressure (mmHg) in both the groups.

T+1 = 1 minute after the intubation

T+2 = 2 minute after the intubation

T+3 = 3 minute after the intubation

T+4=4 minute after the intubation

T+5=5 minute after the intubation

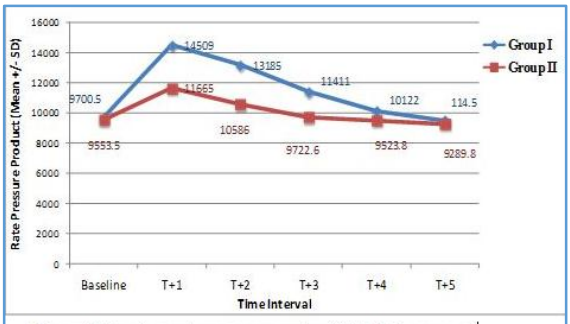

Figure 5 showing rate pressure product in both the groups.

T+1 = 1 minute after the intubation

T+2 = 2 minute after the intubation

T+3 = 3 minute after the intubation

T+4=4 minute after the intubation

T+5=5 minute after the intubation

Variable	Group 1	Group 2	P value	Remarks
Age (Years)	45.27 ± 9.46	44.07 ± 10.68	0.461	NS
Weight (Years)	64.53 ± 13.53	63.97 ± 6.68	0.765	NS
Male/ Female %	36.60 ± 63.40	36.60 ± 63.40	0.213	NS

Table 1. Demographic Characteristics

NS : Non-Significant
S : Significant

DISCUSSION

Stress response under anaesthesia has been universally recognised phenomenon, which occurs in the form of endocrine or autonomic disturbances.[3] The pressor response to laryngoscopy and endotracheal intubation reflect a response to oropharyngeal and tracheal stimulation during airway manipulation. The complications may be transient hypertension, tachycardia and arrhythmias. Although, these complications are of little significance in normotensive subjects, they may be harmful to patients with hypertension, ischaemic heart disease or cerebrovascular disease. It is also established that laryngoscopy and intubation in patients with hypertension, whether treated or not produces greater increase in arterial pressure than in normotensive patients.[6] Such hypertensive crisis may result in cardiac decompensation, pulmonary oedema or cerebral haemorrhage. Prevention of these adverse cardiovascular responses is therefore advocated, especially in hypertensive patients.

Investigators have used a number of pharmacological approaches to control the cardiovascular responses to intubation like use of remifentanil and alfentanil,[8] Ca^{++} channel blockers,[9] labetalol,[10] clonidine and gabapentin.[11]

Since insertion of LMA could avoid the need for laryngoscopy and endotracheal intubation, its use if feasible could be a better alternative way to overcome the unwanted haemodynamic changes during airway management, particularly in patients where such changes are highly undesirable.[12]

We conducted a study on 60 controlled hypertensive patients. There was no difference in the baseline values of haemodynamic variables, i.e. HR, SBP, DBP, MAP and RPP between the two groups.

There was an increase in the HR at 1 minute by 13.1% in ETT group and 6.6% in LMA group from pre-insertion values. Thereafter, heart rate returned to baseline earlier in LMA

group as compared to ETT and the difference was found to be statistically significant ($p < 0.05$). 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.[13] Our results are in agreement with the study conducted by N. Braude et al,[14] Yoshitaka Fuji et al[6] and Wilson et al[12] who observed increase in heart rate after both ETT and LMA insertion, although the difference between the two groups was not statistically significant. However, in contrast to our study Hollande J. et al[15] and Rooke GO et al[16] found that heart rate increased after ETI, but it was unchanged after LMA insertion.

SBP, DBP, MAP increased at 1 minute by 29 - 31% in ETT group as compared to 14 - 18% in LMA group and returned to baseline values earlier in LMA group. This reflects a smaller degree of total afferent stimulation in group LMA as compared to a continued effect of tracheal tube.[13] Our results are in accordance with the study conducted by Amit Kumar and K. K. Girdhar[17] who observed that systolic and diastolic blood pressures increased significantly and attained peak values at instrumentation and declined slowly towards baseline values in ETT group as compared to increase of lesser magnitude in LMA group, which persisted for shorter duration. Studies by Siddiqui NT et al[18] and Bharti N et al[19] found an attenuated haemodynamic response after insertion of laryngeal mask airway compared to endotracheal intubation.

In our study, Rate Pressure Product (RPP) increased at 1 minute by 49% in ETT group and 22% in LMA group as compared to pre-insertion values. However, it returned to baseline values at 5 and 3 minutes in ETT and LMA group respectively. Our results are in agreement with the study conducted by Yoshitaka Fuji et al,[6] who observed that rate pressure product increased immediately after both tracheal intubation and LMA insertion and remained elevated for 3 minutes after tracheal intubation and for 1 minute after LMA insertion.

Limitation of our study was that we have not used flexible intubating fiberscope for assessing the airway placement position in cases of LMA insertion.

CONCLUSION

Our study clearly shows that LMA insertion particularly in hypertensive patients, who are more prone to complications, is relatively safer as compared to laryngoscopy and endotracheal intubation. Therefore, we recommend use of LMA to attenuate the cardiovascular responses during intraoperative airway management, particularly in situations like hypertension where such reflexes are highly undesirable.

REFERENCES

[1] King BD, Harris LC, Greifenstein FE, et al. Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anaesthesia. Anaestheiology 1951;12(5):556-66.

[2] Derbyshire DR, Chmielewski A, Fell D, et al. Plasma catecholamine responses to tracheal intubation. Br J Anaesth 1983;55(9):855-60.

[3] Russell WJ, Morris RG, Frewin DB, et al. Changes in plasma catecholamine concentrations during endo-tracheal intubation. Br J Anaesth 1981;53(8):837-9.

[4] Prys-Roberts C, Greene LT, Meloche R, et al. Studies of anaesthesia in relation to hypertension. ll. Hemo-dynamic consequences of induction and endo-tracheal intubation. Br J Anaesth 1971;43(6):531-47.

[5] Power M, Kohli M, Usha C, et al. A comparative study of the effects of placement of LMA vs ETT on haemodynamic parameters and IOP in children. Ind J Anaesth 2001;45:123-7.

[6] Fuji Y, Tanaka H, Toyooka H. Circulatory responses to laryngeal mask airway insertion or tracheal intubation in normotensive and hypertensive patients. Can J Anaesth 1995;42(1):32-6.

[7] Pyrs-Roberts C, Foex P, Brio GP, et al. Studies of anaesthesia in relation to hypertension. Adrenergic beta receptor blockade. Br J Anaesth 1973;45(7):671-81.

[8] Habib AS, Parker JL, Maguire AM, et al. Effects of remifentanil and alfentanil on the cardiovascular responses to induction of anesthesia and tracheal intubation in elderly. Br J Anaesth 2002;88(3):430-3.

[9] Mikawa K, Nishina K, Takao Y, et al. Attenuation of cardiovascular responses to tracheal extubation. Comparison of verapamil, lidocaine and verapamil-lidocaine combination. Anaesthesia Analgesia 1997; 85(5):1005-10.

[10] Singh SP, Quadir A, Malhotra P. Comparison of esmolol and labetalol, in low doses, for attenuation of sympathomimetic response to laryngoscopy and intuba-tion. Saudi J Anaesth 2010;4(3):163-8.

[11] Marashi SM, Ghafari MH, Saliminia A. Attenuation of hemodynamic responses following laryngoscopy and tracheal intubation - comparative assessment of clonidine and gabapentin premedication. Middle East J Anesthesiol 2009;20(2):233-7.

[12] Wilson IG, Fell D, Robinson SL, et al. Cardiovascular response to insertion of laryngeal mask. Anaesthesia 1992;47(4):300-2.

[13] Kiran I, Balleda S, Kotturi AS. Comparative study of haemodynamic response to laryngeal mask airway versus endotracheal tube in hypertensive patients. Asian Pac J Health Sci 2015;2(1):10-17.

[14] Braude N, Clements EAF, Hodges UM, et al. The pressor response and LMA insertion. A comparison with tracheal intubation. Anaesthesia 1989;44(7):551-4.

[15] Hollande J, Riou B, Guerrero M, et al. Comparison of hemodynamic effects of laryngeal mask and orotracheal tube. Ann Fr Anaesth Reanim 1993;12(4):372-5.

[16] Rooke GO, Haridas RP, Rocke DA, et al. Hemodynamic responses to tracheal intubation or LMA insertion in hypertensive patients. S Afr J Surg 1997;35(1):24-6.

[17] Kumar A, Girdhar KK. A comparative study of the cardiovascular changes during introduction of LMA and endotracheal tube. Ind J Anaesth 2000;44:57-8.

[18] Siddiqui NT, Khan FH. Haemodynamic response to tracheal intubation via intubating laryngeal mask airway versus direct laryngoscopic tracheal intubation. Journal of Pak Med Assoc 2007;57(1):11-4.

[19] Bharti N, Mohanty B, Bithal PK, et al. Intra-ocular pressure changes associated with intubation with the intubating laryngeal mask airway compared with conventional laryngoscopy. Anaesth Intensive Care 2008;36(3):431-5