Attenuation of Haemodynamic Response To Laryngoscopy And Intubation With Nitroglycerin

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ABSTRACT

Background: Laryngoscopy and intubation are common procedures in anesthesia. Hemodynamic responses to mechanical stimulation of the laryngopharynx and tracheobronchial tree cause stimulation of sympathetic efferent fibres leading to an increased pressor response. We in the current study tried to evaluate the effect of nitroglycerine in the attenuation of hemodynamic responses due to laryngoscopy and intubation.

Methods : Based on the inclusion and exclusion criteria n=80 cases were divided into two groups Group A (n=40) control group and group B (n=40) study group randomly by computer-generated number. A detailed history is taken and a complete physical examination is performed and the presence of any medical disorder and history of drug intake was ruled out. All patients were screened by radiological, biochemical, and histological investigations, in addition to routine pre-operative ECG.Pre-medication, induction agent and muscle relaxant to facilitate intubation was standardized for both groups.

Results : The parameters recorded in the control group at one minute showed hemodynamic values were increased. The difference of SBP with the study group was 14.75 mm Hg, diastolic blood pressure by 5 mm Hg, mean blood pressure by 8.5 mm Hg, HR was 8 beats per minute al these values were p-values <0.05 hence considered significant. At the end of three minutes, the comparison shows all the parameters SBP, DBP, MBP, HR, and RPP still increased significantly in the control group as compared to the test group. At the end of five minutes, all the parameters were found to still significantly higher in the control group (<0.05) as compared to the study group except for SBP change which was found not to be significant between both the groups.

Conclusion: The study establishes the usefulness of intravenous Nitroglycerine to attenuate hemodynamic to laryngoscopy and tracheal intubation. The hemodynamic changes in the study group were well within the limits as compared to the control group. The study also shows that there were no incidences of adverse effects with nitroglycerine. Therefore, nitroglycerine must be considered for attenuation of hemodynamic responses to laryngoscopy in cases where it is indicated.

Keywords:

Laryngoscopy, Intubation, Nitroglycerine, Attenuation Of Hemodynamic Response.

Introduction

Hemodynamic changes in response to laryngoscopy and intubation were first described by Reid and Brace in 1940. [1]The changes in Pulse Rate and BP are transient and unpredictable and generally are well tolerated by healthy individuals. However, these changes may prove to be detrimental in patients with hypertension, coronary artery disease, or intracranial hypertension. Hypertension with tachycardia was reported in anaesthetic practice since the 1950s was commonly associated with intubation under light anaesthesia. [2]This is usually most evident during laryngoscopy and manipulation, of epiglottis (King). Tomoriet al; [3] observed that mechanical stimulation of four areas ofthe upper respiratory tract, the nose, the epipharynx, the laryngopharynx, and the tracheobronchial tree, induced reflex cardiovascular responses, associated with enhanced neuronal activity in cervical sympathetic efferent fibers. Direct recording of sympathetic nervous activity is difficult and has consistently demonstrated an increase in noradrenaline following laryngoscopy. Cummings et al; [4] Derbyshire et al; [5] have demonstrated a correlation between pressor response and plasma catecholamine concentration. The systolic pressure may increase a mean of +45 mm Hg. It is accompanied by pulse changes especially sinus and even ventricular tachycardia. Intubation following barbiturate and suxamethonium induction is accompanied by a 25-50% increase in mean arterial pressure and heart rate beginning with laryngoscopy peaking at 1-2 minutes and returning to baseline within 5-10 minutes. Attempts were made to differentiate between the effects of laryngoscopy and those of tracheal intubation and their contribution to hemodynamic changes.Brown BR et al; [6] observed that most patients produced reflex tachycardia and hypertension well before the act of intubation and was often enhanced by intubation. So, it is laryngoscopy rather than endotracheal intubation which generates the stimulus. Cardiovascular response to intubation is of serious concern in patients with hypertension, raised intracranial pressure, diseased cerebral vasculature, or with ischemic heart disease where an increase in myocardial oxygen consumptioncan leads to myocardial infarction. [7]Complications that might arise because of cardiovascular responses to laryngoscopy and intubation are acute left ventricular failure, arrhythmias, intracranial hemorrhage, and pulmonary edema. A convulsion may be precipitated in eclamptic patients.Almost all types of dysrhythmias have been reported, in addition to sinus tachycardia and sinus bradycardia. Common abnormalities are nodal rhythm, and ventricular extrasystoles, and pulsus alternans. Less commonly multifocal extrasystoles, pulsus bigeminus, and atrial fibrillations have been reported.Heart block, ventricular tachycardia, and fibrillation are fortunately rare.Radionucleotide studies have shown the stress response to laryngoscopyand endotracheal intubation produces a rapid decline in global left ventricularfunction (ejection fraction) within seconds, often exceeding that seen followingexercise in patients with symptomatic coronary artery disease. Herniation of intracranial contents and cerebral ischemia can occur in patients with raised intracranial pressure.Because of these findings methods and techniques to attenuate these responses should be employed in high-risk patients. We in the current study tried to study the attenuation of hemodynamics to laryngoscopy and intubation with nitroglycerine.

Material and Methods

This prospective study was done in the Department of Anaesthesias, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study.

Inclusion criteria

1. ASA grade I patients scheduled for elective surgery under General Anesthesia.

2. Patient’s age group between 20 – 60 years.

3. Male and females

Exclusion criteria

1. Baseline Heart rates < 60 per minute

2. History of airway diseases

3. History of cardiac disease of hypertension

4. Heart blocks

5. History of hepatic, renal diseases, and diabetes mellitus.

Based on the inclusion and exclusion criteria n=80 cases were divided into two groups Group A (n=40) control group and group B (n=40) study group randomly by computer-generated number. A detailed history is taken and a complete physical examination is performed and the presence of any medical disorder and history of drug intake was ruled out. All patients were screened by radiological, biochemical, and histological investigations, in addition to routine pre-operative ECG.Pre-medication, induction agent and muscle relaxants to facilitate intubation were standardized for both groups.

Premedication was with Midazolam 0.07 – 0.15 mg/kg IM and Atropine0.01 mg/kg intramuscular 60 and 30 minutes.Monitoring equipment consisted of a standard mercury manometer with a Riva-Rocci cuff. ECG machine used was a portable BPL-ECG recorder.

Standard limb lead II was monitored.Approximately half an hour before surgery both groups of patients were premedicated with Tramadol 2mg/kg and Ondansetron 100 µg/kg weight by Intravenous for premedication. On the operation table just before surgery, a Teflon IV cannula of 18 G size was inserted into a peripheral vein of the left forearm. An adult Sphygmomanometer cuff was tied to the right arm attached to a Non-invasive blood pressure monitor. Leads of ECG were attached to the patient andpulse oximeter attached to the patient.Patients were pre oxygenated with 100% oxygen for 3 minutes. Induction of anesthesia achieved with a sleep dose of 5 mg/kg body weight of thiopentone.The drug was given slowly over a period of 45-60 sec. Blood pressure, pulse rate,ECG were recorded at this state - Induction Values.Succinylcholine 2mg/mg body weight given intravenously to facilitate intubation. Laryngoscopy was performed with a curved bladed Macintosh laryngoscope. Magills oral cuffed endotracheal tube of appropriate size was passed and the endotracheal tube was securely fixed.Any patient who strained or required a second attempt at intubation were excluded from the study. Blood pressure, pulse rate, and ECG were record ed immediately, 1 minute, 3 minute, and 5 minutes after intubation. During this period stimulation of any kind - positioning, cleaning, draping, catheterization, etc., was avoided.Anesthesia was maintained with 33% oxygen in N_2O delivered through Boyle's machine with a circle absorber. Ventilation was controlled manually using the non-depolarizing agent Vecuronium for maintenance of relaxation. At the end of the surgery, residual neuromuscular block wasreversed with neostigmine and atropine.

Results

The age group of the control group (Group A) ranged from 20 – 58 years and the mean age was 42.8 years and out of n=40, n=21 were male, and n=19 were females. The weight range was 40 – 60 kgs and the mean was 55 Kgs. In the study group (Group B) the age range was 20 – 60 years and the mean age was 40.92 years, out of n=40 cases n=20 each were male and females. The weight ranged from 42 – 60 Kgs and the mean was 56Kgs. The p-values were not found to be significant. The baseline hemodynamic readings were recorded before induction in the control group (group A) the mean SBP was 122.4 mmHg and the Mean diastolic BP was 78.6 mmHg and the mean heart rate was 80.2 per minute. The readings of group B were mean SBP 121.3mmHg and DBP was 80.2 mmHg and the mean heart rates were 81.4 mmHg. The p-values of all parameters in both groups compared were found to be >0.05 hence not significant at the pre-induction readings. Time taken for laryngoscopy and intubation was almost the same in all patients and was always less than 20 seconds. The values of parameters didn't differ significantly between the two groups in the post-induction period. After laryngoscopy and intubation, the difference in hemodynamic parameters was found to be significantly different (p<0.05) the values of SBP, DBP, MBP, HR, and RPP were higher in the control group as compared to the study group depicted in table 1.

Table 1: Haemodynamic values after Induction and Laryngoscopy and Intubation

Variable	Post Induction		After laryngoscopy and intubation	
	Group A	Group B	Group A	Group B
SBP	120.75 ± 9.7	122 ± 9.1	151.68 ± 15.32	139.06 ± 8.64
DBP	78.25 ± 6.75	79.25 ± 4.74	102.75 ± 8.6	95.52 ± 5.86
MBP	92.35 ±7.2	93.83 ± 5.9	119.06 ± 8.3	110.03 ±6.2
Heat Rate	85.85 ± 7	87.1 ± 7.2	106.38 ± 8.82	99.44 ± 8.10
RPP	10,366.38	10,626.2	16006.34	13822.56

The parameters recorded in the control group at one minute showed hemodynamic values were increased. The difference of SBP with the study group was 14.75 mm Hg, diastolic blood pressure by 5 mm Hg, mean blood pressure by 8.5 mm Hg, HR was 8 beats per minute al these values were p-values <0.05 hence considered significant. At the end of three minutes, the comparison shows all the parameters SBP, DBP, MBP, HR, and RPP still increased significantly in the control group as compared to the test group. At the end of five minutes, all the parameters were found to still significantly higher in the control group (<0.05) as compared to the study group except for SBP change which was found not to be significant between both the groups (Table 2).

Variable	After one minute of Intubation		After three minutes of Intubation		After five minutes of Intubation	
	Group A	Group B	Group A	Group B	Group A	Group B
SBP	152.16 ± 16.47	138.00 ± 7.97	142.24± 15.8	132.64 ± 7.64	127.40 ±13.17	131.94 ± 7.82
DBP	98 ± 7.2	93.52 ± 6.12	91.75 ± 8.12	81.75 ± 0.5	83.6 ± 5.7	78.5 ± 3.42
MBP	116 ± 9.1	108.01 ± 11.2	108.02 ± 98.7	98.56 ±5.8	98.63 ± 4.28	96.26 ± 5.12
Heat Rate	109.20 ± 8.81	101.04 ± 8.16	100.40 ± 8.38	99.24 ± 8.30	93.20 ±7.57	96.04 ±7.76
RPP	16568.44	13938.9	14200.85	13068	12090	12576

Discussion

Reflex cardiovascular effects of laryngoscopy and intubation in anesthetized patients have been described previously.[8] These reflex changes which include the rise in arterial pressure (SBP, DBP, MBP) and heart rate are at their peak approximately 30-45 sec after laryngoscopy. Attempts to attenuate these responses by various drugs or techniques or their combinations have met with varying success. In this study, both the study group and control group cases received the same pre-medications. Studies have shown the impact of different drugs on hypertension. Studies have reviewed the impact of different drugs on hypertension following intubation; the most important were lidocaine, esmolol, fentanyl, and sodium nitroprusside. [9, 10] Opiates were reported to have the most stable effect on the blood pressure, but they elongate the recovery time. [11] Fassoulaki A et al; [12] reported the effect of intranasal Nitroglycerine inpreventing an increase in blood pressure following intubation. H Singhet al; [13] compared the effects of sulfate magnesium, esmolol, lidocaine, nitroglycerine, andplacebo as inducing medication before cataract surgery.This study revealed esmolol to be the most effective drug in preventing an increase in heart rate. Nitroglycerine was shown to successfully prevent an increasein blood pressure.however, its use was accompanied by significant tachycardia.H. Yakuet al; [14]in their study was documented that administration of a single dose of intravenous nitroglycerine, was a safe and effective method inreducing the hypertensive response following intubation.H Singh et al;[13]compared the effects of lidocaine, esmolol, and nitroglycerine and found a significant increase in the mean arterial pressure following intubation. They also reported less increase in the heart rate values in the group who had received esmolol.According to the results of this study, nitroglycerine had an effective influence on post-intubation blood pressure diminution, with no effect on heart rate. Several reports have studied the effectiveness of various doses of nitroglycerine. JJ Hwang et al; [16] showed nitroglycerine 0.5 mg (intranasal) as the dosage accompanied by the least increase in blood pressure.Laryngoscopy and endotracheal intubation can cause striking changes inhemodynamics and intracranial pressure probably because of intense sympathetic nervous system stimulation.[16] In patients who are at risk of developing increased intracranial pressure, arterial hypertension, myocardial ischemia, these changes may be life-threatening.Abbasivashet al [17]and using the similar dose of NTG as200 µg, the sensory and motor block onset time were shortened, the recovery time of sensory and motor block and the onset of tourniquet pain were prolonged,analgesia time after tourniquet deflation was prolonged and tourniquet pain intensity was also lowered in the study group with no significant side effects.

Honarmand et al; [18]revealed that the addition of 400 µg NTG to LID improved the speed of onset and the quality of anesthesia and decreased tourniquet pain and intraoperative and postoperative analgesia consumption better than the addition of the other two doses of 200 µg or 300 µg NTG, without any significant side effects. Although administration of NTG 200 µg can be appropriate for obtaining optimal time for the onset of sensory and motor block and recovery time of sensory blockade, the increase of its dosages up to 400µg can lead to achieving a higher quality of anaesthesia and more decrease in tourniquet pain.In the present study, nitroglycerin was selected because of its pharmacokinetic profile i.e. rapid onset of action, short duration of action, rapid elimination, and termination of action on discontinuation of the infusion[19]. Thus, intravenous nitroglycerin 1-2 mg/Kg/min is a safe and useful adjuvant to anesthesia as suggested by less blood loss, the better working field for the surgeon,reduced operative time, and faster recovery.

Conclusion

The following conclusion can be drawn from the present study. The study establishes the usefulness of intravenous Nitroglycerine to attenuate hemodynamics to laryngoscopy and tracheal intubation. The hemodynamic changes in the study group were well within the limits as compared to the control group. The study also shows that there were no incidences of adverse effects with nitroglycerine. Therefore, nitroglycerine must be considered for attenuation of hemodynamic responses to laryngoscopy in cases where it is indicated.

REFERENCES

1. Reid LC, Brace DE. Irritation of the respiratory tract and its reflex effect upon heart. SurgGynaec&Obst; 1940; 70: 157-62.
2. Forbes, A.M., Dally, F.G. Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man; Br. J. Anaesthesia 1970; 42: 618-24.
3. Tomori Z, Widdicombe JG. Muscular, bronchomotor and cardiovascular reflexes elicited by mechanical stimulation of the respiratory tract. J Physiol. 1969;200(1):25–49.
4. Cummings, M.F., Russel, W.J., Frewin, O.B., Miller, W.A. The effect of gallamine and a mixture of pancuronium and alcuronium on pressor and plasma catecholamine responses to tracheal intubation, Anaesth. Intens. Care 1984;12: 22.
5. Derbyshire, D.R., Chimielewski, A., Fell, D., Water, M., Achola, K., Smith, G. Plasma catecholamine responses to tracheal intubation. Br. J. Anaesth 1983;55: 855.
6. Brown BR, Prys-Roberts C. Anaesthesia for ear, nose, throat and maxillofacial procedures in International Practice of Anaesthesia. Prys Roberts C, Brown BR, Eds, Butterworth-Heinemann, Oxford: 1996, 2-9.
7. Roy WL, Edelist G, Gilbert B. Myocardial ischemia during non-cardiac surgical procedures in patients with coronary-artery disease. Anesthesiology. 1979;51(5):393–397.
8. C. G. Raghuram, Deepraj Singh, Aditya Vikram Kabra. Attenuation of Haemodynamic Response to Laryngoscopy and Endotracheal Intubation using Intra-Oral Ivabradine: A Clinical Study. Journal of Evolution of Medical and Dental Sciences 2014; 3(39): 9944-55.
9. Curran J, Crowley M, O'Sullivan G. Droperidol and endotracheal intubation. Attenuation of pressor response to laryngoscopy and intubation. Anaesthesia. 1980; 35(3):290-94.
10. Theodore. H, Stanley MD. The History and Development of the FentanylSeries - TH Stanley - J Pain Symptom Manage, Apr 1992; 7(3) Suppl1:S3-S7.

11. Coleman AJ, Jordan C.; Cardiovascular responses to anaesthesia. Influence of beta-adrenoreceptor blockade with metoprolol. Anaesthesia. 1980; 35(10):972–978.
12. Fassoulaki, A., Kaniaris, P. Intranasal administration of nitroglycerin attenuates the pressor response to laryngoscopy and intubation of the trachea; British Journal of Anaesthesia 1983; 55: 49-52.
13. H Singh, P Vichitvejpaisal, GY Gaines, PF white. Comparative effects of lidocaine, esmolol, and nitroglycerin in modifying the hemodynamic response to laryngoscopy and intubation. J Clin Anesth 1995; 7(1):5-8.
14. H. Yaku, K.Mikawa, N. Maekawa and H. Obara. Effect of Verapamil on the Cardiovascular Responses to Tracheal intubation. British Journal of Anaesthesia 1992; 68: 58 – 59.
15. JJ Hwang, YP Ko, RK Jen, YW Hsu et al. The use of intranasal nitroglycerin to prevent pressor responses during intubation in general anesthesia - A comparison of various doses. Acta Anesthesiol sin 1995; 33(4): 205-10.
16. Shribman AJ. Smith g. Achola KJ. Cardiovscular and catecholmine response to laryngoscopy with and without tracheal intubation. British journal of anaesthesia 1986; 59:295-99.
17. Abbasivash R, Hassani E, Aghdashi MM, Shirvani M. The effect of nitroglycerin as an adjuvant to lidocaine in intravenous regional anesthesia. Middle East J Anesthesiol. 2009; 20:265-69.
18. Honarmand A, Safavi M, Fatemy A. The analgesic effect of three different doses of nitroglycerine when added to lidocaine for intravenous regional anesthesia in trauma patients. Ulus TravmaAcilCerrahiDerg. 2011; 17:497-503.
19. Gururaj N, Voruganti N. The Prevalence of low T3 syndrome in chronic heart failure:A Hospital-based study. PERSPECTIVES IN MEDICAL RESEARCH [Internet]. Prathima Institute of Medical Sciences; 2021 Apr 6;8(3):20–4. Available from: http://dx.doi.org/10.47799/pimr.0803.05

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