

Efficacy of intravenous nitroglycerine in attenuation of hemodynamics to laryngoscopy and intubation

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Abstract

Background: Different techniques with different drugs have been suggested to attenuate haemodynamics in responses to laryngoscopy and intubation. Some of these are: topical and intravenous lignocaine, deep inhalational anesthesia, ganglion blockers, pre-cauterization, narcotics, adrenoceptor blocking drugs, vasodilator, nitroglycerine ointment, and intra-nasal nitroglycerine, calcium channel blockers, reducing duration of direct laryngoscopy to less than 15 seconds, and avoiding laryngoscopy and resorting to blind nasal intubation.

Objective: To evaluate efficacy of intravenous nitroglycerine to attenuate hemodynamics to laryngoscopy and endotracheal intubation in healthy, normotensive ASA grade I patients.

Methods: A prospective study was undertaken for a period of two years. Institutional Ethics Committee permission was obtained. 80 patients with ASA grade I, scheduled for elective surgery under general anesthesia, aged between 20-40 years old, of either sex, and were included in the study after obtaining their informed and written consent. These 80 patients were randomly allocated to a study and a control group, (no = 40, each). The study group received intravenous nitroglycerine in the dose of 2.5 to 5 mcg/minute titrated till 5 minutes before intubation.

Results: There was an increase in hemodynamic parameters, which was less in the study group than in the control group, however still significantly to both groups. The values of pulse rate, blood pressure and rate pressure product returned to basal levels at the end of third minute in the study group; whereas in the control group it lasted for more than five minutes.

Conclusion: The present study established the usefulness of the intravenous nitroglycerine to attenuate hemodynamics to laryngoscopy and tracheal intubation. No side effects were noted with nitroglycerine in the present study.

Keywords: Nitroglycerine, Hemodynamics, Intubation

Introduction

In 1940, Reid and Brace first described a hemodynamic response to laryngoscopy and intubation. It leads to an average increase in blood pressure by 40-50% and 20% increase in heart rate (HR). The increase in blood pressure and HR is usually transient and variable but can be unpredictable and life-threatening if left unaddressed. This response is undesirable in susceptible patients, especially in patients with systemic hypertension, coronary artery disease and intracranial aneurysm and may result in potentially deleterious effects like left ventricular failure, arrhythmias, myocardial infarction, cerebral hemorrhage and rupture of cerebral aneurysm.⁽¹⁾

Therefore, many drugs are often used in combination with the primary anesthetic in an attempt to decrease the hemodynamic pressor response associated with intubation, while limiting patient risk.⁽²⁾

In cases where premedication with fentanyl is inadequate, nitroglycerin (NTG) is another option that studies have been shown, that can be used to prevent stress-induced ischemia and to relieve the constriction of coronary arteries.⁽³⁾

Nitroglycerin is a vasodilating agent by virtue of its actions on vascular smooth muscle fibers. It may be administered intravenously (using either 5 p. cent dextrose, or propylene-glycol solvent), sublingually,

orally or by topical administration. It is rapidly metabolized, principally by liver. It is not toxic. The vasodilatation that is produced is both arterial and venous and is dose-related in dog (1 microgram to 100 micrograms/ kg/ min). However, resistance and tachyphylaxis may occur. Its principal use is for angor treatment, but it has been used for the treatment of arteriopathy of the lower limbs, biliary hyper tony and arterial hypertension. It has been recently administered for the treatment of acute phase of myocardial infarction and during pre, per- and post-operative periods in cardiac surgery, neurosurgery and hip surgery, as myocardial protector or anti-hypertensive agent or hypotensive agent. The absence of toxicity and the rapid reversibility of its cardio-vascular effects which are similar to the effects of sodium nitroprusside are important reasons for its use in anesthesia and cardiac intensive care.⁽⁴⁾

Mahajan et al., found that topical nitroglycerin is a simple and useful pretreatment to prevent the pressor response to tracheal intubation and midline sternotomy in patients undergoing coronary artery bypass graft surgery.⁽⁵⁾

Nitroglycerin has been used in anesthetic practice for induced hypotension and managing perioperative hypertension and myocardial ischemia. Contrary to the continuous low dose infusions (5-20 mcg/min) used for the same, intravenous bolus dosages are sometimes

administered at the behest of obstetricians for removal of retained placenta. Use of nitroglycerine in managing retained placenta is undertaken as a last resort when other measures fail to relax the uterine smooth muscles. Intravenous nitroglycerine relaxes smooth muscle cells by releasing nitric oxide thus causing prompt cervico-uterine relaxation.⁽⁶⁾

Nitroglycerin and its derivatives have become widely used agents in the treatment of severe forms of heart failure. Their beneficial effects in this disease results from their ability to reduce preload and after load of the heart muscle leading to an increase of cardiac index, a decrease in mean pulmonary artery and wedge pressures as well as pulmonary and peripheral vascular resistances. This is associated with reducing the patients' complaints. Intravenous nitrates are used in the treatment of myocardial infarction complicated by an increased left ventricular filling pressure as well as in various forms of acute and worsening left ventricular failure, mainly in pulmonary edema. Oral and transdermal nitrates are administered in chronic congestive heart failure NYHA class III and IV.⁽⁷⁾

Hence, present study was undertaken to evaluate efficacy of intravenous nitroglycerine to attenuate hemodynamics to laryngoscopy and endotracheal intubation in normotensive ASA grade I patients.

Methods

A prospective study was undertaken for a period of two years. Institutional Ethics Committee permission was obtained. 80 healthy patients with ASA grade I scheduled for elective surgery under general anesthesia, aged between 20-40 years old, of either sex were included in the study, after obtaining their informed and written consent. These 80 patients were randomly allocated to a study and a control group, in equal numbers of 40 each. The study group received intravenous nitroglycerine in the dose of 2.5 to 5 mcg/minute titrated till 5 minutes before intubation.

Complete pre-anesthetic check-up was done for all patients one day prior to surgery. Detailed history was taken and complete physical examination was carried out. Presence of any medical disorder and history of drug intake was ruled out. All patients were screened by radiological, biochemical and investigations in addition to routine pre-operative ECG.

Exclusion criteria:

1. Baseline heart rate < 60 beats per minute
2. Baseline blood pressure < 100/50 mmHg
3. Patients with reactive airway disease, history of cardiac disease, hypotension
4. Patients taking treatment with adrenergic, augmenting or depleting drugs
5. ECG reading showing PR interval > 0.24 seconds, 2nd or 3rd degree heart block
6. Any patient with contraindication to use of nitroglycerine

7. Patients requiring two or more attempts for laryngoscopy and intubation
8. Patients with biochemical investigations suggestive of hepatic, renal disease or diabetes mellitus

Thus for final study, 80 patients qualified who were allocated randomly into two groups as described above.

Premedication was done with midazolam 0.07-0.15 mg/kg IM and atropine 0.01 mg/kg IM 60 and 30 minutes.

Monitoring equipment consisted of standard mercury manometer with riva-rocci cuff. ECG machine used was portable BPL-ECG recorder. Standard limb lead II was monitored.

Patients were wheeled into waiting area of operation theatre. Approximately half an hour before surgery, patients were pre-medicated with Tramadol 2 mg/kg and ondansetron 100 mcg/kg weights by IV for pre-medication. On the operation table, just before the surgery a Teflon IV canula of 18 G size was inserted into a peripheral vein of left forearm. An adult sphygmomanometer cuff was tied to right arm attached to non-invasive blood pressure monitor. Leads of ECG were attached to patient and pulse oximeter attached to patient.

Patients were pre-oxygenated with 100% oxygen for 3 minutes. Induction of anesthesia was achieved with sleep dose of 5 mg/kg of thiopentone. The drug was given slowly over a period of 45-60 seconds. Blood pressure, pulse rate, ECG was recorded at his state induction values.

Succinylcholine 2 mg/kg body weight was given IV to facilitate intubation. Laryngoscopy was performed with curved bladed Macintosh laryngoscope. Magills oral cuffed endotracheal tube of appropriate size was passed and endotracheal tube was securely fixed.

Any patients who strained or required a second attempt at intubation were excluded from the study. Blood pressure, pulse rate and ECG were recorded immediately, 1, 3 and 5 minute after intubation. During this period, stimulation of any kind like positioning, cleaning, draping, catheterization etc. was avoided.

Anesthesia was maintained with 33% oxygen in N₂O delivered through Boyle's machine with a circle absorber. Ventilation was controlled manually using non-depolarizing agent Vecuronium for maintenance of relaxation. At the end of surgery, residual neuromuscular block was reversed with neostigmine and atropine.

Data was analyzed using mean, standard deviation, and student's t test. P value of less than 0.05 was considered as statistically significant.

Results

The mean SBP at 1 minute was 138.00±7.97 in study group compared to 152.16±16.47 in control group which was significantly lower after intubation (p < 0.05). Similarly at 3 minute, it was significantly lower in study group, Table 1.

Table 1: The mean systolic blood pressure (SBP) between the study and the control group

Time after intubation (minutes)	SBP (mmHg)		T value	P value
	Control group (N = 40) mean±SD	Study group (N = 40) mean±SD		
1 minute	152.16±16.47	138.00±7.97	4.8945	0.00001
3 minute	142.24±15.8	132.64±7.64	3.4595	0.0009
5 minutes	127.40±13.17	131.94±7.82	1.8747	0.0646

The mean DBP was significantly lesser in the study group as compared to control group at 1, 3, and 5 minute after intubation, Table 2.

Table 2: Comparison of mean diastolic blood pressure (DBP) between the study and the control group

Time after intubation (minutes)	DBP (mmHg)		T value	P value
	Control group (N = 40) mean±SD	Study group (N = 40) mean±SD		
1 minute	98.16±7.2	93.52±6.12	2.9948	0.0036
3 minute	91.75±8.12	81.75±0.5	7.7741	0.00001
5 minutes	83.6±5.7	78.5±3.42	4.8524	0.00001

The mean heart rate at 1 minute was 109.20±8.81 in control group as compared to 101.04±8.16 among study group, and this difference was statistically significant. At 3 and 5 minute the difference in the heart rate between the two groups was statistically not significant, Table 3.

Table 3: Comparison of mean Heart Rate (HR) between study and control group

Time after intubation (minutes)	HR (beats/min)		T value	P value
	Control group (N = 40) mean±SD	Study group (N = 40) mean±SD		
1 minute	109.20±8.81	101.04±8.16	4.2977	0.00001
3 minute	100.40±8.38	99.24±8.30	0.6220	0.5357
5 minutes	93.20±7.57	96.04±7.76	1.6569	0.1016

Discussion

The present study revealed that intravenous nitroglycerine in doses of 2.5 to 5 mcg/minute titrated till 5 minutes before intubation was effective in reducing the hypertension and stabilizing the hemodynamics to laryngoscopy and endo-tracheal intubation.

Asaki et al⁽⁸⁾ showed the superiority of administering lidocaine(LID) combined with nitroglycerine (NTG) to isolated administration of LID with respect to shortening the onset of sensory and motor block, prolongation of the recovery time of sensory blockade and decreasing the frequencies of opioid injections. However, the two regimens had similar effects on pain severity after tourniquet deflation, onset time of pain appearance, quality of analgesia on both surgeon and patient view, and the time of the injected doses of opioids. In fact, the concurrent use of LID and NTG can result in high patient satisfaction and prolonged analgesic effects than the use of isolated LID. Furthermore, no drug related side effects were pointed.

Similar to our observations Sen et al⁽⁹⁾ demonstrated that the NTG with the similar dose of 200 microgram led to lower that post-operative VAS scores which was significantly lower for the first 4 hours post-operatively.

Abbasivash R et al⁽¹⁰⁾ used similar doses of NTG as in the present study and found that the sensory and motor block onset time was shortened, the recovery time of sensory and motor block and onset of tourniquet pain were prolonged, analgesia time after tourniquet deflation was prolonged, and tourniquet pain intensity was also lowered in study group with no significant side effects.

Honarmand A et al⁽¹¹⁾ revealed that the addition of 400 mcg of NTG to LID improved the speed of onset and the quality of anesthesia and decreased tourniquet pain and intra-operative and post-operative analgesic consumption better than the addition of two doses of 200 mcg or 300 mcg of NTG without any significant side effects. In fact, although administration of NTG 200 mcg can be appropriate for obtaining optimal time for the onset of sensory and motor block and recovery time of sensory blockade, but the increase of its dosages up to 400 mcg can lead to achieving higher quality anesthesia and more decrease in tourniquet pain.

Kumar N et al⁽¹²⁾ found a lower increase in systolic and diastolic blood pressure following administration of NTG at 2 mcg/kg. Such a difference was not reported between the heart rates of these groups. Similarly in the study by Nishikawa T et al⁽¹³⁾ they found that there was no increase in blood pressure in patients who received

NTG prior to CABG surgery. These results support the findings of the present study.

Dich-Nielsen J⁽¹⁴⁾ concluded that intranasally administered NTG effectively attenuates the pressor response to laryngoscopy and intubation in patients presenting for coronary artery by-pass surgery and that it is more effective and convenient method than intravenous lignocaine. Similarly Kadam PP et al⁽¹⁵⁾ showed that NTG induced hypotension was more effective than that by halothane in reducing blood loss intra-operatively. Only one patient in the NTG group required blood transfusion. The bleeding during operation was mainly of venous origin.

All these studies along with the present study support that nitroglycerine is effective to stabilize hemodynamics in patients undergoing surgery.

Conclusion

The present study established the usefulness of the intravenous nitroglycerine (2.5 to 5 mcg/minute titrated till 5 minutes before intubation) to attenuate hemodynamics to laryngoscopy and endo-tracheal intubation. No side effects were noted with nitroglycerine in the present study. Nitroglycerin was found to prevent the hypertension after laryngoscopy and endo-tracheal intubation. It also stabilized the heart rate.

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