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ATTENUATION OF PRESSURE RESPONSES TO TRACHEAL INTUBATION USING TOPICAL NITROGLYCERINE AND INTRAVENOUS DILTIAZEM

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ABSTRACT In order to attenuate the pressure responses to tracheal intubation, we have studied the effects of intravenous diltiazem 0.2mg/kg and transdermal nitroglycerine sustained release infusion system of 0.4mg/hour, applied one hour before intubation. A study was conducted with randomised design in 150 patients, 50 patients formed the control group, 50 patients received intravenous diltiazem 0.2mg/kg and the rest of the 50 patients received transdermal nitroglycerine infusion system. The maximum rise in systolic blood pressure was significantly lower in both nitroglycerine group (12%) and diltiazem group (5%) as compared to control group (29%) at intubation. Rise in arterial pressure persisted beyond 5 minutes in control group, whereas in nitroglycerine group and diltiazem group systolic pressure reduced to baseline value by 5 minutes . Pulse rate, however, increased in all three groups to an equal extent. We have found that application of nitroglycerine transdermal infusion system and intravenous diltiazem is a safe, inexpensive means of attenuating the pressure response to intubation of trachea.

KEYWORDS : Anaesthesia technique: laryngoscopy, tracheal intubation Blood pressure: hypertension

Introduction:

The frequent hemodynamic changes in response to laryngoscopy and tracheal intubation have gained attention of anaesthesiologists since 1950's. Laryngoscopy during general anaesthesia stimulates the pharynx, larynx and trachea, activating sympathetic system leading to increase in heart rate, blood pressure, intracranial tension, intraocular pressure, dysrrhythmias , cardiac asystole and even sudden death . This can be very dangerous in case of poor cardiac reserve, hypertensives, increased intracranial pressure . Attempt to attenuate these responses by various drugs or techniques or their combinations have met with varied success .

Nitroglycerine, a well known drug in treatment of coronary artery diseases has been used intravenously as an effective, short acting hypotensive agent in cardiac and cerebral aneurysm surgery . Intranasal nitroglycerine introduced through teflon cannula has been shown to attenuate the pressure response following laryngoscopy and tracheal intubation . However, an intranasal administration of the drug is somewhat cumbersome and may cause discomfort to awake patients, topical nitroglycerine 2% ointment has been used and shown to be effective, safe, comfortable to attenuate cardiovascular response following laryngoscopy, intubation and during sternotomy . We have evaluated a transdermal nitroglycerine infusion system, sustained release formula of 0.4mg/hour.

Diltiazem, a calcium channel blocker has been used as an antihypertensive, because of its vasodilation property. Diltiazem has been shown to be effective in attenuating pressure response in 0.3mg/kg body weight and 0.2 mg/kg body weight . We studied efficacy of diltiazem in attenuating pressure response to tracheal intubation and compared the same with topical nitroglycerine.

Methodology:

150 patients of either sex aged between 18 to 60 years undergoing elective surgical procedures were included in the study. All patients were normotensive, had a normal ECG, haemoglobin and electrolytes. Informed written consent was obtained from all patients. Patients were divided into three groups: group I- Control group, group II- Nitroglycerine treated group, group III – Diltiazem treated group. Premedication consisted of injection glycopyrolate and injection fentanyl intravenously, given 15 minutes before surgery. Transdermal nitroglycerine infusion system – 0.4 mg/hr was applied one hour before induction of anaesthesia, on arrival in theatre, the systolic and diastolic arterial pressure measured with sphygmomanometer and pulse rate recorded and designated as "preintubation value". Patients were preoxygenated for a period of five minutes, thiopentone 6 mg/kg was administered followed by suxamethonium – 2 mg/kg was administered to facilitate tracheal intubation. Sixty seconds before intubation, intravenous diltiazem was administered in the dose of 0.2 mg/kg of body weight. Nitroglycerine patch was removed immediately following intubation. Any patient, who strained or required second attempt or time of laryngoscopy exceeding 20 seconds were excluded from the study. During intubation, systolic arterial pressure (SAP) and heart rate (HR), diastolic pressure (DAP) were recorded and designated as "0 min recording". The recording in post intubation period of SAP, DAP and HR done at one minute, three minute and five minute and designated accordingly.

The rate pressure product (RPP) was calculated from corresponding observation of SAP and HR at various intervals. The Z test was applied for statistical analysis of observations Z value of more than 1.96 was considered as significant.

Results:

In all three groups, the mean age, weight, heart rate, systolic arterial pressures during preintubation period were compared.(Table no.1)

Systolic arterial pressure (SAP):

The maximum rise was 12% in topical nitroglycerine group and 5% in diltiazem treated group at the time of intubation (Table 2). This difference was highly significant. The rise in SAP lasted for full 5 minutes in control group, whereas it reached baseline value in nitroglycerine group and diltiazem group.

Mean value (+/- SD) of maximum increase in systolic arterial pressure (mmHg) with percentage increase, from preintubation value, and at time of intubation (0 min) in all three groups.

Heart rate:

There was significant heart rate increase in both topical nitroglycerine and diltiazem group. The heart rate values did not differ from those of control group all throughout five minutes interval. (Table no.3)

Rate pressure product:

RPP showed significant difference at 0,1 and 3 minute between control and nitroglycerine group. Similar was the case with diltiazem group. (Table no.4)

TABLE 1 Pre induction data: Result expressed in mean +/- SD

	GROUP I	GROUP II	GROUP III
Age (years)	37.94+/-13.5	33.6 +/- 10.96	34.5 +/- 13.96
Male:Female	28:22	26:24	28:22
Weight (kgs)	48.74	49.04	50.4
Heart rate (per minute)	*83.14+/- 9.21	*85.46+/-10.4	*83.12+/-12.5
SAP (mm Hg)	*126+/-11.6	*126.98+/-	*128+/-11.4

*: Z value less than 1.96, no statistically significant difference between the three groups.

TABLE 2 Change in systolic blood pressure at the time of pre intubation and at the time of intubation with standard deviation and %age rise)

GROUP	PREINTUBATION	0 MINUTE	% INCREASE
I	*126+/-11.6	**163+/-17.27	29%
II	*126.98+/-14.1	142.28+/-13.9	12%
III	*128.0+/-11.4	135.2+/-19.7	5%

*: statistically not significant (Z<1.96)
**: Statistically significant in comparison to group II and group III (Z>1.96)

TABLE 3 Change in heart rate in control, Nitroglycerine and Diltiazem treated groups at preintubation and at the time of intubation with standard deviation.

GROUP	PREINTUBATION	0 MINUTE
I	83.14+/-9	123.64+/-11
II	85.46+/-10	122+/-10
III	83.0+/-12	116+/-14

TABLE 4 Mean (+/-SD) of rate pressure product (RPP) in all three groups at various intervals (0 minute at the time of intubation and 1,3,5 minute after intubation.

	Mean pre intubation RPP	Mean post intubation RPP			
		0 min	1 min	3 min	5 min
Control group	*10500.24+/-1700	**2027 6+/-3166.6	**18743 +/-3587	**16710 +/-2634	13709+/-2979
Nitroglycerine	*10847+/-1724	**1744 7+/-2.79	**15992 +/-2635	**14182 +/-2366	*12791+/-2052
Diltiazem	*11010+/-2404	**1581 1+/-3239	**15074 +/-3146	**14195 +/-2961	*13233+/-2240

*: statistically not significant (Z<1.96)
**: statistically significant difference on analysis between the group

Discussion:

Our results indicate that nitroglycerine transdermal infusion system applied over area of 10 cm2 of 10 mg per 24 hrs applied one hour beforevsurgery and intravenous diltiazem 0.2 mg/kg prevents the reflex increase in arterial blood pressure associated with tracheal intubation. The drugs are administered so that their peak action coincides with the time of intubation.

The concentration reached in plasma after topical nitroglycerine is surprisingly high compared to those found after sublingual route of administration of nitroglycerine. However the skin absorption was affected by many factors including area of application, cutaneous blood flow at site of application, rate of evaporation and the dose. In the present study, it was applied on the forehead and the time period was such that their peak action coincides with the time of intubation. Intranasal nitroglycerine has been effectively used for pressure response attenuation, but the method is cumbersome.

Intravenous diltiazem has been shown to attenuate rise in systolic blood pressure. Calcium channel blockers act by interfering with calcium influx and produce peripheral arterial vasodilation.

Tachycardia produced as explained by arterial dilation, leads to hypotension stimulating sympatho-adrenal reflex.

Apart from attenuation of pressure response nitroglycerine may benefit ischemic myocardium by its coronary vasodilatation. Diltiazem also has been known to have protective effect on ischemic myocardium.

There were no side effects such as headache, nausea, dizziness, nasal congestion, hypotension in any of the patients studied.

Conclusion:

Nitroglycerine transdermal infusion system 0.4 mg/hr and diltiazem 0.2 mg/kg administered intravenously attenuate the cardiovascular response partially as they do not suppress the rise in heart rate. However, both the drugs suppressed rise in systolic blood pressure. Hence nitroglycerine transdermal infusion system and intravenous diltiazem are safe and convenient.

References:

1. Maekenzie D V, Goud AB, Bardsley. Cardiac arrhythmias with endotracheal intubation. Anaesthesiology. 1980; 53: p. 3.
2. RD, Miller: Anaesthesia, Fourth edition; 1429-30..
3. Forbes A M, Dally F G. Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man. BJA. 1970; 42: p. 618.
4. Hasegawa J, Mitsuhata H, Matsuhata S, Enzan K. attenuation of cardiovascular responses to laryngoscopy and intubation. Masui. 1991 October; 40(10): p. 1507-12.
5. Horton JAG. Electrocardiographic finding during laryngoscopy and endotracheal intubation. BJA. 1995; 64: p. 964-70.
6. Wycoff CC. Endotracheal intubation. Effects of blood pressure and pulse rate. Anaesthesiology. 1960; 21: p. 153-8.
7. Abou Madi M, Keszler H, Yacoub O. A method for prevention of cardiovascular reaction to laryngoscopy and intubation. The Canadian Anaesthetists' Society Journal. 1975; 22: p. 316-29.
8. Martin De, Rosenburg H, Aukberg S J. Low dose fentanyl blunts circulatory responses to tracheal intubation. Anaesthesia Analgesia. 1982; 61: p. 680.
9. Armstrong P W, Mathew M T, Boroomand K Parker J O. Nitroglycerine ointment in acute myocardial infarction. American Journal of Cardiology. 1976; 38: p. 474-8.
10. Blumenthal H P, Fung H L, McNiff E F, Yap S k. Plasma nitroglycerine level after sub lingual, oral and topical administration. British Journal of clinical pharmacology. 1977; 48: p. 241-2.
11. Steolting R K. Blood pressure and heart rate changes during short duration of laryngoscopy for tracheal intubation. Influence of viscous or intavenous lidocaine. Anaesthesia Analgesia. 1978; 57: p. 197-9.
12. Puri G D, Batra Y K. Effect of nifidepine on cardiovascular responses to laryngoscopy and intubation. BJA. 1988; 60: p. 579-81.
13. Mikawa K, Maekawa N, Nishina K, Obara H. Comparison of nicardepine , diltiazem and verapamil for controlling the cardiovascular responses to tracheal intubation. BJA. 1996; 76: p. 221-26.
14. Kamra S, Wig J, Sapru R P. Topical nitroglycerine, A safeguard against pressor responses to tracheal intubation. Anaesthesia. 1986; 41: p. 1087.
15. Indira Kumari, Uditha Naithani et all. Attentuation of pressor response following intubation: Efficacy of nitroglycerine lingual spray. Journal of anaesthesiolgy Clinical Pharmacology. 2016 Jan- Mar; 32(1): p. 69-73.
16. Kaplan J A, Dunbar R W, Jones E L. Nitroglycerine infusion during coronary artery surgery. Anaesthesiology. 1976; 45: p. 14-21.

17. Mahajan R P, Ramachandran R, Saxena N. topical nitroglycerine prevents pressor responses to tracheal intubation and sternotomy in patients undergoing coronary artery bypass surgery. BJA. 1993; 48: p. 297-300.
18. Gazi Parvez, Mohamad Ommid, Arun Kumar Gupta et all. Attentuation of pressor response to laryngoscopy and tracheal intubation with intravenous diltiazem and esmolol intravenous in controlled hypertensive surgical patients. Colombian Journal of Anaesthesiolgy. 2010 November; 38(4): p. 457-69.
19. Mikawa K, Ikegaki J, Maekawa N, Goto R, Kaeiso H, Obara H. The effect of diltiazem on cardiovascular responses to tracheal intubation. Anaesthesia. 1990; 45: p. 289-93.
20. Dr Santosh Kumar, Dr M. N. Mishra, Dr L.S. Mishra, Dr Sapna Bathla. Comparative study of the efficacy of IV esmolol, diltiazem and magnesium sulphate in attentuating hemodynamic response to laryngoscopy and tracheal intubation. Indian journal of anaesthesia. 2003; 47(1): p. 41-44.