Original Research Article

Efficacy of intravenous nitroglycerine in attenuation of hemodynamic response to tracheal extubation

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Abstract

Background: Extubation is associated with awakening, pain, anxiety, and airway irritation which may lead to hemodynamic responses similar to intubation resulting in hypertension, tachycardia, and arrhythmia. Ideal agent for bunting the extubation response should be non-sedative short-acting with no respiratory depressant action and non-anesthetic. **Objective:** To evaluate the efficacy of intravenous nitroglycerine for attenuating hemodynamic response to tracheal extubation in normotensive and hypertensive patients. **Methods:** After ethical committee approval, 100 patients aged between 18 – 60 years ASA I & II patients posted for elective surgeries after taking informed consent were included in the study and divided in four groups with 25 members in each group. We have excluded patients with pre-existing hemodynamic instability, ASA III, IV& V patients, emergency surgeries, bleeding disorders, pregnant, lactating females and patients requiring post operative ventilator support. GROUP A: Normotensive with NTG. GROUP C: Hypertensive with NTG. Group B and D are given placebo with NS. **Results:** Results showed significant increase in heart rate in all the groups During extubation the increase in heart rate was not increased statistically in group A when compared to group B,C,D. There is significant increase in systolic, diastolic and mean arterial blood pressure in all the groups, and during extubation, attenuation of extubation response is seen in groups treated with NTG. **Conclusion:** Administration of IV NTG in a dose of 1-2 mcg/kg body weight proved to be effective and easy and safe in normotensive and hypertensive patients during extubation. Rise in systolic, diastolic and MAP are significantly controlled with NTG. After surgery, it stabilizes hemodynamics and allows easy recovery.

Key Word: intravenous nitroglycerine, hemodynamic.

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INTRODUCTION

Tracheal extubation is the discontinuation of an artificial airway when the indications for its placement like general anesthesia, airway obstruction, protection of airway, suctioning, ventilatory failure and hypoxemia no longer exist. Many investigators have documented that tracheal extubation causes transient increase in blood pressure and heart rate.[1-3] Stimulus causing such increase in hemodynamic are multifactorial like, light plane of anesthesia, pain at surgical site, emergence from anesthesia or tracheobronchial irritation and reflex sympathetic discharge caused by epipharyngeal and laryngopharyngeal stimulation.[4] This results in hypertension, tachycardia and arrhythmias, which are usually variable and unpredictable. Airway irritation during tracheal extubation may cause cough or difficulty in breathing which contributes change in hemodynamics.[5] The majority of patients are able to tolerate those responses without any significant consequences. However some patients with co-existing disease may not tolerate these responses.[5] There is a risk of myocardial ischemia/ infarction, cerebrovascular accident. Laryngoscopy and tracheal intubation in patient with

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hypertension, produces greater increase in arterial pressure than in normotensive patients. Thus it is reasonable to expect that hypertensive patients may exhibit an exaggerated hypertensive response to awakening and extubation compared to normotensive patients. Such hypertensive episodes may result in cardiac or cerebral complications.[6] In the patient with coronary artery disease, hemodynamic response like tachycardia to extubation may lead to imbalance between myocardial oxygen supply and demand, resulting in myocardial ischemia. The occurrence of perioperative myocardial ischemia may be associated with subsequent development of postoperative myocardial infarction. Various drugs have been used to inhibit or reduce the hemodynamic response, including verapamil,[7] diltiazem, esmolol,[8] and magnesium sulfate.[9] In cases where preadministration with fentanyl is insufficient, nitroglycerin is another option used in some studies to prevent hemodynamic stress-induced ischemia.[10] Nitroglycerin is a vasodilator that acts on vascular smooth muscle and is taken intravenously mixed with 5% dextrose or propylene glycol. Also, it is used as topical or as a spray in the nose. This drug is not toxic and rapidly metabolizes. Its dilating effect on the veins is noticeable, but it also dilates the arteries dose dependently. This drug is used in heart surgeries and hip surgery. Its rapid, reversible effect is similar to nitroprusside and is a reason for its use in anesthesia and CCU.[11] It has a beneficial effect on reducing afterload and preload in patients with heart failure.[12] So the present study was carried out to evaluate the efficacy of intravenous nitroglycerine for attenuating hemodynamic response to tracheal extubation in normotensive and hypertensive patients.

MATERIALS AND METHODS

Sample size: Based on a pilot study, we found that the systolic blood pressure (SBP) increased in 70% of patients in the control group as compared to 25% of patients who received IV NTG. Taking into account an alpha error of <0.05 and a power of 0.8 we calculated that a total of 100 patients divided into four groups each consisting of 25 patients were required to detect a significant difference.

$$n = \frac{(Z\alpha_{/2} + Z_\beta)^2 \times 2\sigma^2}{(\mu_1 - \mu_2)^2}$$

n= sample size per group before dropout

$Z_{\alpha/2}$- Standard normal z-value for a significance level of α=0.05, which is 1.96

Z_β- Standard normal z-value for a power of 80%, which is 0.8

After ethical committee approval, 100 patients aged between 18 – 60 years ASA I and II patients posted for elective surgeries after taking informed consent were included in the study and divided in four groups with 25 members in each group. We have excluded patients with pre-existing hemodynamic instability, ASA III, IV patients, emergency surgeries, bleeding disorders, pregnant, lactating females and patients requiring post operative ventilator support.

GROUP A: Normotensive with NTG

GROUP C: Hypertensive with NTG

Group B: Normotensive with Placebo

Group D: Hypertensive with Placebo

Monitoring: Values of HR, SBP, DBP, and MAP noted immediately after extubation at 1, 2, 3, 5, and 10 min after tracheal extubation. IV NTG is started with 1-2 mcg/kg during surgery and continued till extubation. Reversal injection NTG is started with 1-2 mcg/kg during surgery and continued till extubation. neostigmine 0.05 mg/kg + injection glycopyrrolate 0.01 mg/kg i.v. were given.

Statistical analysis: Statistical evaluation of data or parameters will be done using-mean, average, standard deviation, and ANOVA for comparison of results. Data were entered into Microsoft excel data sheet and were analyzed using SPSS 22 Statistics Desktop-IBM. USA.

RESULTS

There was no significant difference in the demographics among the study groups. The results were shown in table 1.

Parameters	Group A	Group B	Group C	Group D	P value
Age	56.76±3.76	52.65±4.12	54.12±6.74	55.34±7.21	0.876
Weight	63.4±8.7	61.1±10.3	63.3±7.0	63.7±8.1	0.466
Gender (M/F)	15/10	17/8	13/12	16/9	0.346
ASA (I/II)	16/9	15/10	14/11	12/13	0.876

Heart rate: At prereversal, no difference in HR was observed between four groups Whereas postextubation significant difference in HR was observed from 1 to 10 min between four groups. *Post hoc* Bonferroni analysis showed that the difference in mean HR was statistically significant between Group C in comparison with Group A and Group B from 1 min postextubation to 10 min. There was no significant difference in HR between Group A and Group B at all the intervals (table 1)

Table 1: Heart rate among the groups

Heart rate	Group A	Group B	Group C	Group D	P value
Prereversal	109.9±8.0	110.3±10.6	109.1±11.0	111.2±14.0	0.866
Postextubation					
1 min	99.3±8.4	100.9±10.9	106.2±11.9	101.45±12.6	0.019*
2 min	91.9±8.1	94.2±8.9	103.7±12.2	95.65±8.92	<0.001*
3 min	85.3±7.0	87.4±6.6	101.1±11.8	88.12±9.12	<0.001*
5 min	78.3±5.7	81.5±6.0	99.4±11.8	80.23±8.12	<0.001*
10 min	71.9±5.3	74.6±5.5	97.7±12.0	73.45±7.12	<0.001*

***Significant. SD=Standard deviation**

Systolic blood pressure: At prereversal, significant difference in SBP was observed between four groups. During postextubation, significant difference in SBP was observed from 2 to 10 min between four groups. Post hoc Bonferroni analysis showed that the difference in mean SBP was statistically significant between Group C in comparison with Group A, Group B and Group D from 2 min postextubation to 10 min. There was no significant difference in SBP between Group A, Group B and Group D at all the intervals.

Table 2: Comparison of systolic blood pressure among the groups

SBP	Group A	Group B	Group C	Group D	P value
Prereversal	160.5±12.3	155.8±9.6	153.2±9.6	161.2±11.2	0.016*
Postextubation					
1 min	151.1±12.3	147.1±9.6	151.5±10.0	152.7±10.4	0.167
2 min	142.5±11.0	140.1±9.2	149.7±10.5	141.2±8.0	<0.001*
3 min	135.5±10.8	133.7±8.7	147.9±10.3	134.1±11.2	<0.001*
5 min	127.4±9.4	127.5±8.4	146.2±10.1	128.6±11.4	<0.001*
10 min	119.0±8.6	118.4±7.4	144.6±10.1	120.4±9.4	<0.001*

Diastolic blood pressure: At prereversal, no significant difference in DBP was observed between four groups. During postextubation, significant difference in DBP was observed from 1 to 10 min between four groups. *Post hoc* Bonferroni analysis showed that the difference in mean SBP was statistically significant between Group C in comparison with Group A, Group B and Group D from 1 min postextubation to 10 min. There was also significant difference in DBP between Group A, Group B and Group D at 2 and 3 min intervals (table 3).

Table 3: Comparison of diastolic blood pressure among the groups

DBP	Group A	Group B	Group C	Group D	P value
Prereversal	102.1±6.4	104.2±7.4	103.9±7.1	103.1±9.4	0.379
Postextubation					
1 min	93.1±5.3	96.5±5.1	101.7±7.2	98.8±7.1	<0.001
2 min	86.9±5.2	90.7±4.2	100.2±7.3	91.2±6.6	<0.001*
3 min	81.0±6.3	84.7±5.2	98.8±7.1	86.6±5.2	<0.001*
5 min	75.3±6.4	78.7±6.1	97.2±7.3	79.1±8.2	<0.001*
10 min	69.4±6.4	72.2±6.5	95.5±7.5	75.1±7.8	<0.001*

Mean arterial pressure: At prereversal no significant difference in MAP was observed b/w four groups. During postextubation significant difference in MAP was observed from 1 to 10 min between four groups. *Post hoc* Bonferroni analysis showed that the difference in mean SBP was statistically significant between Group C in comparison with Group A, Group B and Group D from 1 min postextubation to 10 min. There was no significant difference in MAP between Group A, Group B and Group D at all intervals (table 4).

Table 4: Mean arterial pressure among the study groups

MAP	Group A	Group B	Group C	Group D	P value
Prereversal	121.5±6.7	121.4±7.1	120.3±7.3	122.5±8.2	0.731
Postextubation					
1 min	112.5±6.2	113.1±5.5	118.1±7.4	114.2±6.2	0.001*
2 min	105.3±6.1	107.0±4.8	116.6±7.6	108.0±7.8	<0.001*
3 min	99.1±6.6	101.0±5.5	115.1±7.5	102.8±5.8	<0.001*
5 min	92.5±6.4	94.7±6.1	113.5±7.7	91.2±8.2	<0.001*
10 min	85.7±6.1	87.4±6.0	111.9±7.9	88.5±7.2	<0.001*

DISCUSSION

The basic idea of using any drug for attenuating the hypertensive response to tracheal extubation is that its peak effect should correspond to that of the stimulus. During extubation, heart rate was found to be increased in NTG groups, it was not statistically significant in normotensive group, but was found to be significant in hypertensive group when compared with control group. The systolic, diastolic and mean arterial blood pressure was found to be significantly lower in NTG groups as compared to control groups during extubation. After NTG, systolic, diastolic and mean arterial blood pressure were under control within two minutes of medication and remained close to baseline during extubation, whereas in control group systolic, diastolic and mean arterial blood pressure were found to be persistently high during extubation, coming to baseline after six minutes of extubation.

CONCLUSION

This study concludes that intravenous NTG before extubation significantly attenuates the hemodynamic and airway responses to extubation with prolonged time for extubation and with side effects like bradycardia and hypotension compared to placebo.

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