International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article

A Comparative Study to Evaluate the Effects of Nitroglycerin and Esmolol on Haemodynamic Parameters in Controlled Hypertensive Patients During Emergence From Anaesthesia and Extubation

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ABSTRACT

Introduction: Tracheal extubation is performed when the patient is in lighter stages of anaesthesia, which produces significant increase in heart rate & arterial pressure. These changes in physiology are a matter of concern in Hypertensive patients. So our aim was to compare the effects of Nitroglycerin & Esmolol on haemodynamic parameters in controlled hypertensive patients during emergence from anaesthesia & extubation.

Material & Methods: The patients were randomly divided into two groups Group I (NTG group) (n=30): received nitroglycerin 0.5µg/kg/min, IV infusion Group II (Esmoolol group) (n=30): received Esmolol 100 µg/kg/min, IV infusion.

Observations: Administration of Nitroglycerin & Esmolol in controlled hypertensive patients during emergence from anaesthesia & extubation in ASA gr II & III pts helps in controlling hypertension. However Esmolol has better control on heart rate & thus on Rate pressure product.

Conclusion: Esmolol is better than NTG in controlling the haemodynamic parameters during extubation in controlled hypertensive patients, where rate pressure product is important predictor of complications (myocardial ischaemia).

Keywords: Extubation, Hypertension, Esmolol, Nitroglycerine, Haemodynamic Effects.

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Article History:

Received: 10-03-2017, **Revised:** 29-03-2017, **Accepted:** 14-04-2017

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2017.3.3.019	

INTRODUCTION

One of the key factors contributing to the development of modern anaesthesia is safe outcome. Tracheal intubation & extubation alter the cardiovascular physiology both via reflex response & by the presence of endotracheal tube.[1] Tracheal extubation has always received less emphasis than intubation, however anaesthesiologists quite frequently experience problems during tracheal extubation & they exceed those relating to tracheal intubation.[2]

Tracheal extubation is performed when the patient is in lighter stages of anaesthesia, which produces significant increase in heart rate & arterial pressure, which persist into recovery period.[3] These changes in physiology are a matter of concern in Hypertensive patients.[4] Hypertensive patients have been shown to exhibit exaggerated cardiovascular responses at extubation when compared with normotensive patients.[2] The hypertensive episodes following tracheal extubation have been found to be associated with an increased incidence of cerebral haemorrhage, Myocardial ischemia, and Pulmonary oedema. Prevention of these adverse responses is therefore desirable in hypertensive patients.[2]

Various drugs are used to control hemodynamic changes during tracheal intubation and extubation.[5,6] Esmolol is an ultra-short-acting, beta-adrenergic receptor antagonist; with proven efficacy to provide hemodynamic stability during laryngoscopy and tracheal intubation without severe side-effects.[7-9] Intravenous or sublingual NTG has been used for attenuating hypertensive response during laryngoscopy, tracheal intubation[10-12] and also for controlling hypertension during extubation while studying efficacy of other drugs.[13-15]

Because of potential advantage of short duration of action and easy titrability of nitroglycerin and Esmolol, we undertook this study to evaluate the effects of nitroglycerin and esmolol on haemodynamic responses in controlled hypertensive patients during emergence from anaesthesia and extubation.

MATERIAL & METHODS

Study Design

It is prospective randomised study. A total of 60 controlled hypertensive patients were included in the study.

Exclusion Criteria

- Patients with uncontrolled hypertension
- Heart Block
- Bronchial Asthma
- Cerebrovascular disease

Inclusion Criteria

- ASA II-III patients
- Age 30-65yrs
- Controlled Hypertensive patients

Randomization & Grouping

Patients were randomly divided into 2 groups

Group I: Nitroglycerin group (NTG infusion 0.5µg/kg/min)

Group II: Esmolol group (Esmolol 100µg/kg/min)

Premedication

All patients were given tab. Lorazepam 2mg, night before surgery. Patients continued antihypertensive medication till the morning of surgery.

Induction Protocol

Baseline HR, SBP & DBP was recorded on arrival in OT. Patients were given 2mg midazolam and 2µg/kg Fentanyl. Induction was done with Thiopentone sodium 5mg/kg IV. 0.1mg/kg iv Vecuronium was used as relaxant. Anaesthesia was maintained with 60% nitrous oxide in oxygen, Isoflurane & intermittent doses of Vecuronium. After the completion of surgery & before reversal of neuromuscular blockade the study drug was started & continued during extubation, post extubation till preoperative baseline BP was achieved. Residual neuromuscular blockade was reversed with Neostigmine 0.05mg/kg & Atropine 0.02mg/kg.

Haemodynamic monitoring included ECG for HR & ECG changes. BP measurement (SBP, DBP, MAP), Pulse oximetry. RPP was calculated from HR and BP.

Data were recorded at following stages

1) Preop values (baseline),
2) Just before reversal of neuromuscular blockade,
3) Just after reversal of neuromuscular blockade,
4) At the time of extubation
5) 1 and 3 minutes after extubation

Statistics Comparison of drugs was done by students "t" test.

P value <0.05- Significant

P value <0.001- Highly significant

RESULTS AND DISCUSSION

In this study baseline heart rate was comparable in both groups. Just before reversal there was increase in heart rate in both groups. Heart rate decreased significantly in Esmolol group just after reversal, at extubation, 1min, 3min after extubation whereas tachycardia persisted till 3min after extubation in nitroglycerine group.

Findings of this study are similar to findings of study by Dutta et al. which states that patients who received esmolol infusion 100 µg/kg/min before extubation had significantly less rise in heart rate compared to patients who received nitro-glycerine infusion 0.2 µg/kg/min.[1]

Table 1: Pulse Rate Comparison Between NTG and Esmolol Group

Group	Duration					
	Baseline	Just before reversal of neuromuscular blockade	Just after reversal of neuromuscular blockade	At extubation	After 1 min	After3 min
Group I	87.03 ± 10.34	88.46 ± 14.72	93.1 ± 8.86	97.1 ± 8.87	94.6 ± 9.79	90.03 ± 8.27
Group II	86.1 ± 8.49	95.5 ± 8.08	86.8 ± 6.65	79.36 ± 7.83	73.03 ± 5.96	67.23 ± 8.68
P value	P-NS	P-NS	P < 0.001	P < 0.001	P < 0.001	P < 0.001

Table 2: Systolic Blood Pressure Comparison Between NTG and Esmolol Group

Group	Duration					
	Baseline	Just before reversal of neuromuscular blockade	Just after reversal of neuromuscular blockade	At extubation	After 1 min	After3 min
Group I	143.36±17.35	137.83±12.59	145.2±13.10	144.73±12.44	141.8±9.41	135.63±9.71
Group II	139.56±9.52	146.46±9.24	140.93±10.11	136.66±9.84	130.6±9.21	127.56±9.01
P value	P-NS	P<0.001	P-NS	P<0.001	P<0.001	P<0.001

Baseline systolic blood pressure was comparable in both groups. Just before reversal systolic blood pressure increased in both groups more in esmolol group, this can be attributed to low dose esmolol infusion which took time to achieve peak effect Systolic blood pressure showed significant decrease in Esmolol group after reversal, at extubation, 1min and 3min after extubation. In nitro- glycerine group blood pressure decreased at extubation, 1min and 3min after extubation. Kumar et al found that patients who received bolus dose of esmolol had significant fall in systolic and diastolic blood pressure.[16]

In our study baseline diastolic pressure was comparable in both groups. Just before reversal diastolic blood pressure was significantly low in NTG group as compared to Esmolol group. This may be due to venodilating effects of nitroglycerin at doses

used in this study. Diastolic blood pressure was significantly low in esmolol group at extubation, 1min, 3min, after extubation as compared to nitoglycerin group. Diastolic blood pressure reached baseline at extubation in Esmolol group, and at 1min, after extubation in nitroglycerin group.

Snyder et al have stated that nitroglycerin may be effective in controlling acute increases in blood pressure that accompany noxious stimulation in the parturient.[17]

In our study baseline mean arterial pressure was comparable in both groups. Just before reversal mean arterial increased in both groups more in Esmolol group as compared to NTG group. This may be due to less effective control of hypertensive response as compared to tachycardia response with Esmolol.

Mean arterial pressure was significantly low in Esmolol group at extubation, 1min, 3min, after extubation as compared to nitoglycerin group.

S. Dutta et al, found that patients who received Esmolol infusion 100 µg /kg /min & nitro-glycerine infusion 0.2µg /kg /min both had significantly lower mean arterial pressure as compared to control group. In our study baseline rate pressure product was comparable in both groups. Just before reversal rate pressure product increased in both groups more in Esmolol group. This may be due to less effective control of hypertensive response as compared to tachycardia response with Esmolol.

Rate pressure product decreased significantly at extubation, 1min, 3min, after extubation in Esmolol group as compared to nitoglycerin group which had significantly high rate pressure product till 3min after extubation.

S. Dutta et al, found that patients who received Esmolol infusion 100 µg/kg/min had significantly lower rate pressure product compared to patients who received nitro-glycerine infusion 0.2 µg/kg/min. They advocated the use of Esmolol during extubation to provide protection from increases in heart rate, blood pressure & rate pressure product. They found that benefit of reduction of mean arterial pressure by nitroglycerin during intubation & extubation was offset by its tendency to produce tachycardia.

Table 3: Diastolic Blood Pressure Comparison Between NTG and Esmolol Group

Group	Duration					
	Baseline	Just before reversal of neuromuscular blockade	Just after reversal of neuromuscular blockade	At extubation	After 1 min	After3 min
Group I	88.16±9.56	85.86 ±7.52	91.03 ±6.26	90.83±8.28	87.43±8.10	83.63±7.56
Group II	84.8 ± 5.57	90.53±6.96	89.03±5.90	84.26±6.51	79.7±5.89	76.96±4.83
P value	P-NS	P<0.001	P-NS	P<0.001	P<0.001	P<0.001

Table 4: Mean Arterial Pressure Comparison Between NTG and Esmolol Group

Group	Duration					
	Baseline	Just before reversal of neuromuscular blockade	Just after reversal of neuromuscular blockade	At extubation	After 1 min	After3 min
Group I	105.83±1.55	102.86±8.52	108.46±7.75	109.76±7.99	105.53±7.26	100.43±7.54
Group II	102.36±6.61	109.43±8.01	105.62±7.00	102.3±6.80	97.1±6.41	93.26±5.20
P value	P-NS	P<0.001	P-NS	P<0.001	P<0.001	P<0.001

Table 5: Rate Pressure Product Comparison Between NTG and Esmolol Group

Group	Duration					
	Baseline	Just before reversal of neuromuscular blockade	Just after reversal of neuromuscular blockade	At extubation	After 1 min	After3 min
Group I	12676.1±2289.50	12111.5±1876	13132.93±1753.51	13966.13± 1886.75	13145.8± 1842.62	11984.2± 1653.52
Group II	11944.96±1406.69	13921.53±1782.67	12216±1620	10970.23± 1467.58	9579.63± 1196.63	8650±948.77
P value	P-NS	P<0.001	P<0.05	P<0.001	P<0.001	P<0.001

CONCLUSION

From our study we concluded that Esmolol was effective in controlling the hemodynamic responses to extubation in adult patients. It controlled tachycardia more effectively as compared to hypertension. It effectively attenuated rate pressure product during & after extubation.

Nitroglycerin is commonly used drug in operating room for control of hypertension, however it produced reflex tachycardia & increased rate pressure product in our study. It decreased blood pressure as compared to baseline but it was less as compared to esmolol group.

In our study dose related complication of NTG were not seen while only single patient of Esmolol had bradycardia (< 60/min). No ECG changes were seen in any patients of both groups.

Thus we summarize that according to our observations, Esmolol infusion was better than nitroglycerin in controlling the haemodynamic responses to extubation in adult patients with controlled hypertension.

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Source of Support: Nil. **Conflict of Interest:** None Declared.

Cite this article as: R. Vachhani, Rahul Gulati. A Comparative Study to Evaluate the Effects of Nitroglycerin and Esmolol on Haemodynamic Parameters in Controlled Hypertensive Patients During Emergence From Anaesthesia and Extubation. Int J Med Res Prof. 2017; 3(3):90-93. DOI:10.21276/ijmrp.2017.3.3.019