

# A Comparative Evaluation of Nitroglycerine and Esmolol in Attenuating the Haemodynamic Response to Laryngoscopy and Intubation

Arun Kumar Saxena<sup>1</sup>, Ravneet Kaur<sup>2</sup>, B L Mathur<sup>3</sup>, A P Verma<sup>4</sup>

<sup>1</sup>Assistant Professor, Department of Anaesthesia JNU Medical College Jaipur, <sup>2</sup>Senior Resident, Department of Anaesthesia JNU Medical College Jaipur, <sup>3</sup>Professor and Head, Department of Anaesthesia JNU Medical College Jaipur, <sup>4</sup>Professor, Department of Anaesthesia JNU Medical College Jaipur.

## Abstract

**Background:** Laryngoscopy and tracheal intubation provoke stress response manifesting as hypertension and tachycardia. There is urgent need for drug which can attenuate the cardiovascular response to the laryngoscopy and intubation. **Subjects and Methods:** The study was conducted in department of anaesthesia in JNUIMSRC. 50 Patients belonging to ASA grade 1 and 2 posted for surgery under general anaesthesia were randomly divided into two groups of 25 each. Premedication with Midazolam and Glycopyrolate was done. Patients were divided randomly in two groups: Group N- Nitroglycerine ointment 2%, 2.5 cm topically applied on forehead, 10 min prior to induction. Group E- Esmolol 0.6 mg/kg IV 2 min. prior to induction. Both group were induced and laryngoscopy and tracheal intubation was done within 20 sec. Heart rate, blood pressure and mean arterial pressure was recorded before induction and at 1,2,3,5,10 and 15 min after laryngoscopy and intubation. Statistical analysis was done using students 't' test and was considered significant if  $p < 0.05$ . **Results:** Patients in esmolol group remained haemodynamically more stable than nitroglycerine group. **Conclusion:** In our study it is concluded that Esmolol is more effective than Nitroglycerine in attenuating the haemodynamic response to laryngoscopy and intubation.

**Keywords:** Nitroglycerine, Esmolol, Laryngoscopy, intubation.

**Corresponding Author:** Dr Ravneet Kaur, Department of Anaesthesia JNU Medical College Jaipur.

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## Introduction

Laryngoscopy and tracheal intubation provoke stress response manifesting as hypertension and tachycardia. These transitory changes are maximum at 1 minute following intubation and lasts for 5-10 minutes.<sup>[1]</sup> These changes are more significant and pose serious challenges in patients with cardiovascular diseases like hypertension, coronary artery disease, aneurysmal vascular disease.<sup>[2]</sup>

There is urgent need for drug which can attenuate the cardiovascular response to the laryngoscopy and intubation. Various drugs eg  $\beta$  blockers, calcium channel blockers, Nitroglycerine, opioids,  $\alpha_2$  adrenergic agonists, inhalational agents, Lidocaine etc have been used to suppress this response.<sup>[3]</sup>

Esmolol, cardioselective competitive  $\beta$  antagonist has a rapid onset of action and short half life of 9 minutes.<sup>[4]</sup> It prevents rise in heart rate, stroke volume and cardiac output.

Nitroglycerine exerts its action by combining with receptors situated in the wall of blood vessels and causes generalized vasodilatation resulting in suppression of pressor response. Nitroglycerine ointment 2% in doses of 12.5mg to 40mg has duration of action of 3-4 hours.

The present study is undertaken to determine the efficacy of

Esmolol 0.6mg/kg IV and 2% Nitroglycerine 2.5cm topically in attenuating the sympathetic responses to laryngoscopy and tracheal intubation.

## Aims and Objectives

- To compare the effects of transdermal nitroglycerine and intravenous Esmolol on hemodynamic response to Laryngoscopy and intubation in terms of:
  - Heart rate
  - Systolic and diastolic blood pressure
  - Mean arterial pressure.
- To compare the effectiveness of Esmolol 0.6mg/kg IV over Nitroglycerine 2.5cm topically or vice versa.

## Subjects and Methods

A randomized double blind study was conducted in department of anaesthesia, JNUIMSRC. 50 Patients of age group 22 and 55 years belonging to ASA grade I and II posted for surgery under general anaesthesia were randomly divided into two groups of 25 each.

Patients were assessed preoperatively and informed consent obtained. In the operation theatre, intravenous line was started with Ringer lactate. Premedication with Midazolam 0.07 mg/kg and Glycopyrrolate 0.01mg/kg was done.

Patients were divided randomly in two groups:

- Group N- received Nitroglycerine ointment 2% a column of 2.5 cm taken on a graduated paper strip and topically applied on forehead, 10 min prior to induction.
- Group E- received Esmolol 0.6 mg/kg IV 2 min. prior to induction.

After pre-oxygenation, both groups were induced with 2.5% Thiopentone sodium 5mg/kg and inj Succinyl -choline 2mg/kg. Laryngoscopy and tracheal intubation was done within 20 sec after fasciculations due to Succinyl- choline subsided. Heart rate, blood pressure and mean arterial pressure were recorded before induction and at 1,2,3,5,10 and 15 min after laryngoscopy and intubation.

On completion of surgery, patients were reversed with glycopyrrolate and neostigmine.

Statistical analysis was done using students ‘t’ test and was considered significant if  $p < 0.05$ .

[Table 2] shows mean age and mean weight with standard deviations. Both the groups are comparable with regards to age and weight as difference is statistically insignificant.

[Table 4] shows highly significant changes in pulse rate upto 3 minutes after laryngoscopy and intubation. Esmolol group shows less changes than nitroglycerine group.

[Table 5] shows raised systolic blood pressure in both groups. Significant rise in blood pressure persisted upto 5 minutes after laryngoscopy and intubation in nitroglycerine group but it reached to basal value at 3 minutes in Esmolol group.

**Table 1: Distribution of patients according to age.**

S. No	Groups	Age in years			
		21-30	31-40	41-50	51-60
1	Nitroglycerine	2	14	8	1
2	Esmolol	4	10	10	1

**Table 2: Mean age and mean weight.**

Groups	Age In Years	Weight Kg
Nitroglycerine	39.68±6.14	50.36±6.46
Esmolol	39.76±8.3	49.16±5.03

## Results

[Table 1] shows distribution of patients according to age. Maximum patients were in fourth and fifth decade.

**Table 3: Pulse Rate per Min. Mean ± Standard Deviation**

S. No.	Observation Time	Nitroglycerine	Esmolol
1	After premedication	95.84±13.58	91.64±11.95
2	Before laryngoscopy and intubation	115.72±11.19	106±12.85
3	Just after laryngoscopy and intubation	128.52±15.27	110.8±15.64
4	After laryngoscopy and intubation at		
	1 min	121.32±14.69	107.32±16.74
	2 min	115.88±13.47	109±11.01
	3 min	110±15.47	105.68±11.4
	5 min	105.88±16.53	103.44±14.47
	10 min	104.56±14.7	98.84±14.11
	15 min	101.88±13.76	94.52±12.88

**Table 4: Mean Changes In Pulse Rate**

S No.	Observation Time	Nitroglycerine		Esmolol	
		Mean Change	P Value	Mean Change	P VALUE
1	Before laryngoscopy and intubation	19.8±11.75	<.001	14.36±14.8	<.001
2	Just after laryngoscopy and intubation	32.68±14.34	<.001	19.16±17.1	<.001
3	After laryngoscopy and intubation at				
	1 min	25.48±14.23	<.001	15.68±15.82	<.001
	2min	20.04±12.6	<.001	17.36±15.16	<.001
	3min	14.16±13.7	<.001	14.04±15.2	<.001
	5min	10.0±15.16	<.01	11.8±17.5	<.01
	10min	8.72±14.3	<.01	9.28±10.8	<.05
	15min	6.0±14	>.05	3.36±14.1	>.05

**Table 5: Mean Systolic Blood Pressure MmHg Mean± Standard Deviation**

S. No.	Observation Time	Nitroglycerine	Esmolol
1	After premedication	135.2±10.4	132.96±9.6
2	Before laryngoscopy and intubation	133±13.35	131.92±15.43
3	Just after laryngoscopy and intubation	167.2±16.46	164.56±16.97
4	After laryngoscopy and intubation at		
	1 min	165.84±17.6	153.6±13.96
	2 min	154.56±20.04	141.44±15.34
	3 min	148.48±15.93	138.16±16.1
	5 min	143.28±15.93	137.36±12.15
	10 min	137.52±14.18	134.64±10.22
	15 min	131.2±12.44	131.6±10.07

**Table 6: Mean Changes and p Value of Systolic Blood Pressure (compared to basal value)**

S No.	Observation Time	Nitroglycerine		Esmolol	
		Mean Change	P Value	Mean Change	P VALUE
1	Before laryngoscopy and intubation	-2.16±11.3	<.001	14.36±14.8	<.001

2	Just after laryngoscopy and intubation	30.8±13.4	<.001	19.16±17.1	<.001
3	After laryngoscopy and intubation at				
	1 min	30.6±14.3	<.001	20.6±17.9	<.001
	2min	19.36±15.8	<.001	8.5±17.9	<.05
	3min	13.3±13.1	<.001	5.2±15.6	>.05
	5min	8.08±11.9	<.01	4.4±15.7	>.05
	10min	2.32±12.8	>.05	1.68±14.55	>.05
	15min	-4±11.13	>.05	-1.36±13.16	>.05

Table 7: Diastolic Blood Pressure MMHG (Mean±Standard Deviation)

S. No.	Observation Time	Nitroglycerine	Esmolol
1	Before laryngoscopy and intubation	85.92±5.81	87.12±4.36
2	Just after laryngoscopy and intubation	120.56±9.2	118.08±14.33
3	After laryngoscopy and intubation at		
	1 min	118.24±9.56	112.56±11.79
	2 min	110.32±10.30	104±11.2
	3 min	107.68±10.62	101.6±9.38
	5 min	103.6±11.61	100.4±8.8
	10 min	98.4±10.66	97.2±8.45
	15 min	90.4±9.08	93.44±8.11

Table 8 MEAN CHANGES AND p VALUE OF DIASTOLIC BLOOD PRESSURE (compared to basal value)

S No.	Observation Time	Nitroglycerine		Esmolol	
		Mean Change	P Value	Mean Change	P VALUE
1	Before laryngoscopy and intubation	7.44±9.75	<.001	14.36±14.8	<.001
2	Just after laryngoscopy and intubation	34.64±9.5	<.001	19.16±17.1	<.001
3	After laryngoscopy and intubation at				
	1 min	32.32±10.17	<.001	25.44±12.03	<.001
	2min	24.4±10.29	<.001	16.88±10.65	<.001
	3min	21.76±10.1	<.001	14.48±8.89	<.001
	5min	17.60±11.63	<.001	13.8±8.79	<.001
	10min	12.48±10.65	<.001	10.08±9.77	<.001
	15min	4.48±9.51	<.05	6.32±8.73	<.01

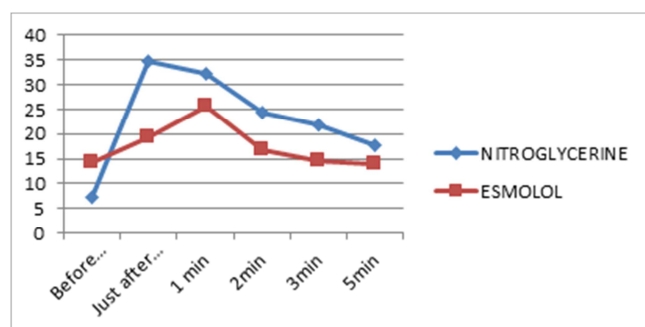


Figure 1: Mean Change in Pulse Rate

Mean changes in pulse rate was less in esmolol group as compared to nitroglycerine group. So pulse rate was more stable in esmolol group.

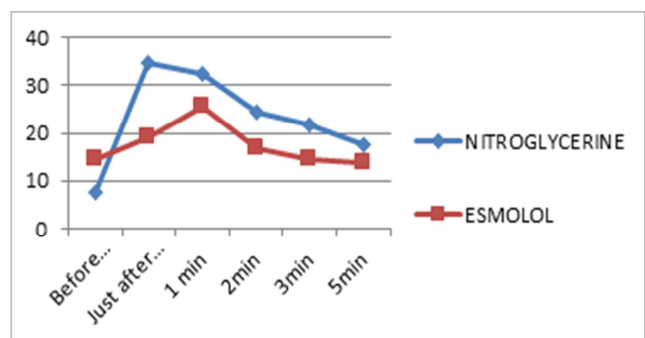


Figure 2: Mean Change in Systolic Blood Pressure

As shown in the graph, systolic blood pressure reached

baseline value in 3 minutes in Esmolol group. Hence patient remained haemodynamically more stable in Esmolol group as compared to nitroglycerine group.

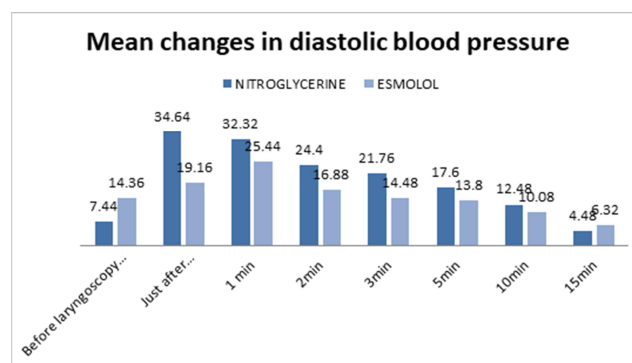


Figure 3: Mean Change in Diastolic Blood Pressure

[Table 6] shows mean changes in systolic blood pressure after laryngoscopy and intubation.

[Table 7] shows raised diastolic blood pressure in both groups. [Table 8] shows rise in diastolic blood pressure was statistically significant till 15 minutes after laryngoscopy and intubation in both the groups.

## Discussion

Intubation is associated with a cardiovascular response in the form of elevated blood pressure, heart rate and occasional dysrhythmias so the anesthesiologist and pharmacologist are in search of the drug to hamper these responses.1 This study

was undertaken to compare Esmolol and Nitroglycerine with different mechanism of action to reduce haemodynamic response to laryngoscopy and intubation.

Nitroglycerine produces generalized vasodilatation including coronary artery dilation, which leads to decrease in blood pressure, lowers the myocardial oxygen demand on one hand and on the other side myocardial oxygen supply is increased by coronary artery dilatation. It is being used intravenously, topically, intranasally and sublingually.

Esmolol is a new ultra-short acting beta blocker with selective  $\beta_1$  blocking activity. Beta blockers in therapeutic doses has no marked effect on normal heart rate but are effective in the presence of increased sympathetic activity.

In our study there are statistically no significant differences between both groups regarding age and body weight.

Significant increase in heart rate was observed in both groups after laryngoscopy and intubation, but it was less in Esmolol group as compared to nitroglycerine group because  $\beta$ -1 receptors were blocked in Esmolol group. This is in concordance with study done by Ugur et al,<sup>[5]</sup> who compared the efficacy of Esmolol 1.5 mg/kg, Fentanyl 1 $\mu$ g/kg, Lignocaine 1.5 mg/kg and control. This study showed significant decrease in H.R. in Esmolol group as compared to control group, immediately after induction and 1 min after intubation.

Attenuation of heart rate in Esmolol group was also observed by Singh H et al,<sup>[6]</sup> when Esmolol, Lignocaine, Nitroglycerine and control group were compared for attenuation of haemodynamic response.

In our study highly significant increase in systolic blood pressure was observed just after laryngoscopy and intubation compared to basal values with a rise of 30.8 mmHg (22.58%) and 31.6mmHg (23.76%) in Nitroglycerine and Esmolol groups respectively. Increased systolic blood pressure after laryngoscopy and intubation remained significant upto 5 minutes in Nitroglycerine group while it was significant only for 1 min in Esmolol group.

These results are in agreement with Helfman SM et al<sup>7</sup> and Sahare KK et al,<sup>[8]</sup> where significant rise in SBP after laryngoscopy and intubation was noted with Esmolol and topical Nitroglycerine treated patients respectively.

Rise in diastolic blood pressure was 34.64 mmHg (40.3 %) and 30.96(35.5) in Nitroglycerine and Esmolol group respectively immediately after laryngoscopy and intubation. This is in concordance with Sahare KK et al,<sup>[8]</sup> where topical Nitroglycerine was used in attenuating pressor response.

Singh et al,<sup>[6]</sup> also concluded in its study that Esmolol boluses has overall higher level of efficacy than Nitroglycerine.

## Conclusion

In our study it is concluded that Esmolol is more effective than Nitroglycerine in attenuating the haemodynamic response to laryngoscopy and intubation.

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