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

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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 Glycopyrrolate 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.

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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.¹ These changes are more significant and pose serious challenges in patients with cardiovascular diseases like hypertension, coronary artery disease, aneurysmal vascular disease.²

There is urgent need for drug which can attenuate the cardiovascular response to the laryngoscopy and intubation. Various drugs eg β blockers, calcium channel blockers, Nitroglycerine, opioids, α2 adrenergic agonists, inhalational agents, Lidocaine etc have been used to suppress this response.³

Esmolol, cardioselective competitive β antagonist has a rapid onset of action and short half life of 9 minutes.⁴ 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.

**Results**

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

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

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

[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 uptil 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 vale at 3 minutes in Esmolol group.

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

| S. No. | Observation Time | Nitroglycerine | Esmolol |
|--------|------------------|----------------|---------|
| 1      | After premedication | 95.8±13.58 | 91.6±11.95 |
| 2      | Before laryngoscopy and intubation | 115.7±11.19 | 106±12.85 |
| 3      | Just after laryngoscopy and intubation | 128.5±15.27 | 110.8±13.64 |
| 4      | After laryngoscopy and intubation at 1 min | 121.3±14.69 | 107.3±16.74 |
| 5      | 2 min | 115.8±13.47 | 109±11.01 |
| 6      | 3 min | 110±15.47 | 105.6±11.4 |
| 7      | 5 min | 105.8±16.53 | 103.4±14.47 |
| 8      | 10 min | 104.3±14.7 | 98.8±14.11 |
| 9      | 15 min | 101.8±13.76 | 94.5±12.88 |

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

| S. No. | Observation Time | Nitroglycerine | Esmolol |
|--------|------------------|----------------|---------|
| 1      | Before laryngoscopy and intubation | 19.8±11.75 | 14.3±14.8 | <.001 |
| 2      | Just after laryngoscopy and intubation | 32.6±13.44 | 19.6±17.1 | <.001 |
| 3      | After laryngoscopy and intubation at 1 min | 25.4±14.23 | 15.6±15.8 | <.001 |
| 4      | 2 min | 20.0±12.6 | 17.6±15.6 | <.001 |
| 5      | 3 min | 14.1±13.7 | 14.0±15.2 | <.001 |
| 6      | 5 min | 10.0±15.16 | 11.8±17.5 | <.01 |
| 7      | 10 min | 8.7±14.3 | 9.2±10.8 | <.05 |
| 8      | 15 min | 6.0±14 | 3.6±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 | 132.9±9.6 |
| 2      | Before laryngoscopy and intubation | 133±13.5 | 131.9±15.43 |
| 3      | Just after laryngoscopy and intubation | 167.2±16.46 | 164.5±16.97 |
| 4      | After laryngoscopy and intubation at 1 min | 165.8±17.6 | 153.6±13.96 |
| 5      | 2 min | 154.3±20.04 | 141.4±15.34 |
| 6      | 3 min | 148.4±15.93 | 138.1±16.1 |
| 7      | 5 min | 143.2±15.93 | 137.6±12.15 |
| 8      | 10 min | 137.5±14.18 | 134.6±10.22 |
| 9      | 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 |
|-------|------------------|----------------|---------|
| 1     | Before laryngoscopy and intubation | -2.1±11.3 | 14.3±14.8 | <.001 |
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| 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      | 112.5±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        | 93.4±8.11    |

| Table 8 MEAN CHANGES AND p VALUE OF DIASTOLIC BLOOD PRESSURE (compared to basal value) |
|----------|-----------------|-----------------|
| S No.   | Observation Time | Nitroglycerine   | Esmolol          |
|         | Nitrogl | 7.44±9.75 | 14.36±14.8 | <.001 | 19.16±17.1 | <.001 |
| 1        | Before laryngoscopy and intubation | 34.64±9.5 | 19.16±17.1 | <.001 | 19.16±17.1 | <.001 |
| 2        | Just after laryngoscopy and intubation | 25.44±12.63 | 14.48±8.89 | <.001 | 14.48±8.89 | <.001 |
| 3        | After laryngoscopy and intubation at |                 |                 |
| 1 min    | 32.32±10.17      | 25.44±12.63   | <.001 | 14.48±8.89 | <.001 |
| 2 min    | 24.4±10.29       | 16.88±10.65   | <.001 | 14.48±8.89 | <.001 |
| 3 min    | 21.76±10.1       | 14.48±8.89    | <.001 | 14.48±8.89 | <.001 |
| 5 min    | 17.6±11.63       | 13.8±8.79    | <.001 | 13.8±8.79    | <.001 |
| 10 min   | 12.4±10.65       | 10.08±9.77   | <.001 | 10.08±9.77   | <.001 |
| 15 min   | 4.48±9.51        | 3.62±8.73    | <.01 | 3.62±8.73    | <.01 |

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

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.

**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. 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 β1 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 β-1 receptors were blocked in Esmolol group. This is in concordance with study done by Ugur et al,[5] who compared the efficacy of Esmolol 1.5 mg/kg, Fentanyl 1µgm/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,[6] 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 up to 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[7] and Sahare KK et al,[8] 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,[8] where topical Nitroglycerine was used in attenuating pressor response. Singh et al,[6] 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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