ORIGINAL RESEARCH PAPER

Anaesthesiology

# COMPARATIVE STUDY BETWEEN INTRAVENOUS DEXMEDETOMIDINE AND ESMOLOL FOR ATTENUATION OF HEMODYNAMIC RESPONSE TO ENDOTRACHEAL INTUBATION-A DOUBLE BLINDED STUDY

KEY WORDS:

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**ABSTRACT**

**Background:** On laryngoscopy patients protective airway reflex are triggered which in turn triggers the sympathetic nervous system and causes release of catecholamines. These release of hormones causes hemodynamic changes such as tachycardia, raises blood pressure and arrhythmias. **Materials And Methods:** This is a randomised control study, to be done in total of 60 American Society of Anaesthesiologists 1 and 2 patients, aged 18–60 years randomly divided into two groups; who are posted for undergoing elective surgeries under department of anaesthesia at Sree Balaji medical college and hospital, Chennai. Group D includes 30 patients received intravenous dexmedetomidine 1mcg/kg in 50 ml normal saline which was infused in 10 minutes before induction and 2 mins prior to intubation 20 ml normal saline was given as bolus over 30 seconds. Group E includes 30 patients received intravenous 50 ml of normal saline which was infused 10 minutes before induction and 2 mins prior to intubation 20 ml of normal saline containing 0.5mg/kg esmolol was given as bolus over 30 seconds. **Results:** Among the total participants means age was 48.47 in group E and 47.87 in group D. There was no statistically significance found among the age between two study groups (P value 0.605). There is no statistical difference in baseline parameters between two groups for heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure. There is statistically significant difference between the both group with respect to Heart rate, systolic BP, diastolic BP and MAP (P=0.0002) for 1 min, 3mins and 5 mins post intubation. Hence it showed that group D had better control over the heart rate when compared to group E. **Conclusion:** We conclude in this study that dexmedetomidine and esmolol both has significant effect in reducing the hemodynamic related stress response to laryngoscope as well as intubation with less adverse effects.

## INTRODUCTION

It is well known that the hemodynamic pressor reaction is brought on by instrumenting the upper airway for intubation. Blood pressure, heart rate, and serum catecholamine levels may all increase in reaction to stress [1]. A normal fit American Society of Anaesthesiologists (ASA) 1 patient may be able to endure these noxious stimuli caused by laryngoscopy and intubation which in turn increases the heart rate and blood pressure. These changes are at their peak right after intubation and linger for 5–10 minutes. These negative consequences increase heart workload, which increases the risk of having myocardial ischemia and cardiac failure especially in vulnerable patient. Additionally, these outcomes are not desired in cardiac patients undergoing any kind of surgical procedure. In patients with systemic hypertension, it has particularly negative effects on cerebral and coronary circulation [2-3]. There are many methods and drugs which can be used to control these stress response such as using vasodilators such as sodium nitroprusside, nitro-glycerine, doing laryngoscopy and intubation under deep plane of anaesthesia by using inhalational / intravenous medications or usage of higher dosage of opioids [4] .Calcium channel blockers, beta blockers are the various other drugs which has been used in reducing these response. Even though there are numerous studies and researches are still ongoing on how to reduce the stress response to laryngoscopy and intubation there hasn't been much of study which showed superior to other drug with lesser adverse effects.

Esmolol, is an ultra-short acting beta adrenergic receptor blocker, has been shown to be effective in maintaining hemodynamic stability during laryngoscopy and tracheal intubation without causing serious adverse effects [5-6]. Contrarily, there are not many reports on the side effects of dexmedetomidine.

Dexmedetomidine is an imidazole derivative with highly selective alpha 2 adrenergic receptor agonist. Dexmedetomidine is a centrally acting sympatholytic drug which mainly act on locus cerelous in brain causing decrease in release of noradrenaline, these reduces the sympathoadrenal responses and helps in stabilising hemodynamic stress response during laryngoscopy and intubation [7]. The stress response caused by laryngoscopy and endotracheal intubation can be reduced with a variety of methods using pharmacological and non-pharmacological methods (insertion of supraglottic device, smooth and gentle intubation, short duration of laryngoscopy). The purpose of this study was to show that these drugs can help in reducing these stress response especially in those individuals with cardiovascular disease have an exaggerated stress response when compared to normal healthy individuals.

In other researches both esmolol and dexmedetomidine has shown to reduce the stress response to laryngoscopy as well as intubation [8-9]. Our purpose in this study was to find which drug had better outcome in reducing the stress response with lesser adverse effect. In order to compare both the drug in best possible and effective way we have a used a blinding approach called double dummy method. In this study we are going to hypothesis that dexmedetomidine Intravenous 1mcg/kg given over 10 minutes before laryngoscopy and intubation would lessen the stress response compared to esmolol give as intravenous bolus two minutes before laryngoscopy and intubation. Intravenous esmolol given as a bolus dose two minutes before intubation. In this study we opted for prospective randomised double blind study in which both the Esmolol and dexmedetomidine were tested to see its effect on the hemodynamic stress response.

## 2. MATERIALS AND METHODS

This is a randomised control study, to be done in total of 60 American Society of Anaesthesiologists I and 2 patients, aged 18–60 years randomly divided into two groups; who are posted for undergoing elective surgeries under department of anaesthesia at Sree Balaji medical college and hospital, Chennai. After obtaining Institutional Ethical committee approval patients divided into two groups.

Group D includes 30 patients received intravenous

dexmedetomidine 1mcg/kg in 50 ml normal saline which was infused in 10 minutes before induction and 2 mins prior to intubation 20 ml normal saline was given as bolus over 30 seconds. Group E includes 30 patients received intravenous 50 ml of normal saline which was infused 10 minutes before induction and 2 mins prior to intubation 20 ml of normal saline containing 0.5mg/kg esmolol was given as bolus over 30 seconds.

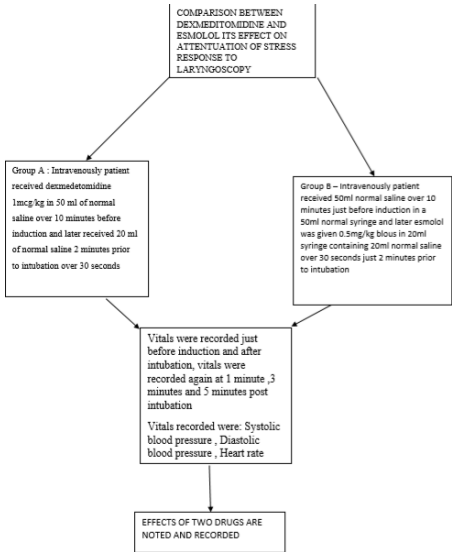


**Figure 1:** Methodology

Standard induction protocols were followed. Vitals such as Systolic blood pressure, heartrate, diastolic blood pressure and mean arterial pressure were recorded prior to induction and soon after intubation at 1 minutes then 3 minutes and 5 minutes. Standard monitors were connected to the patient and baseline values of vital were noted. Two wide bore iv cannula were inserted. Patient then were randomly allocated by the computer generated numbers into two groups A and B which was concealed in a seal envelop. An Anaesthesiologist was assigned who was not aware of the study protocol and was not involved in the study, allocated the patient according to the envelop .Patient also was not aware of the group which was allocated to them.

Initially IV access was secured with 18 gauge cannula for all the patient. Anaesthesiologist who was not aware of the study protocol was made to load the drugs in infusion and bolus syringes. Infusion pump was arranged in the operation theatre for infusion of drugs. Ringer lactate fluid was started at maintenance rate before shifting the patient to the operating room.

In operating theatre parameter required for the study is recorded before giving 50 ml infusion of the study drug which is taken as the baseline values. Study parameter were then recorded post endotracheal intubation after 1 minute, 3 minutes and 5minutes.Just 10 minutes prior to induction both group receive 50 ml of study drug infused over 10 minutes and 2 minutes prior to intubation both group receives 20 ml of study drug as stated above. Patient was preoxygenated for 3 minutes as standard protocol with 100 percent oxygen and then induced with fentanyl 2mcg/kg IV, propofol IV 2.5mg/kg and sevoflurane was use 2percent concentration in 100 percent oxygen following which atracurium of 0.5mg/kg was given.End tidal carbon dioxide level was maintained below 40mmhg to prevent the effect of hypercarbia on the hemodynamic during the study. Laryngoscopy and intubation was performed by a senior anaesthesiologist who was blinded for the group allotment.

All cases was intubated with the help of 3 size Macintosh blade laryngoscope. Endotracheal tubes were cuffed and of size of 8 was used for males and size 7 was used in females. Intubation pillow were used as per standard protocol in all patients. After intubating bilateral air entry was checked and confirmed with EtCO2. Anaesthesia was maintained with sevoflurane in oxygen 40 percent and 60 percent nitrous oxide. All the study parameter was collected by a single anaethesiologist who also was blinded from the study. No other medication was administrated during the study period of 5 minutes post intubation. The data is tabulated using Microsoft Excel and analysed with software SPSS version 23. Descriptive statistics is given by frequency, percentage for categorical variables; mean ± Standard deviation is given for continuous variables. Chi - Square test is applied to find the relationship between Group E and Group D when comparison with outcome for categorical variables. p value less than 0.05 is considered to be significant throughout the study.

## 3. RESULTS

Among the total participants means age was 48.47 in group E and 47.87 in group D. There was no statistically significance found among the age between two study groups (P value 0.605). Among the total participants about 20 male and 10 females were in allocated in group E and 16 males and 14 females were allocated in group D. There was no statistical difference found in gender between the two study groups (P Value – 0.44).Among the total participants group E had 25 patient of ASA 1 and 5 patients of ASA 2, Group D had 26 patients of ASA 1 and 4 patients of ASA 2. There was no statistical difference found in ASA Grading between two study groups (P value -0.78). There is no statistical difference in baseline parameters between two groups for heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure.

**Table1: Demographic Details And Baseline Parameters**

| Parameters | Group E | Group D | P value |
|---|---|---|---|
| Age | 48.47±6.3 | 47.87±8.4 | 0.93 |
| Gender<br>Male<br>Female | 20<br>10 | 16<br>14 | 0.44 |
| ASA<br>I<br>II | <br>25<br>26 | <br>5<br>4 | 0.78 |
| Baseline Heartrate | 84.4±17.17 | 74.33±17.49 | 0.027 |
| Baseline systolic BP | 132±5.70 | 131±5.47 | 0.027 |
| Baseline Diastolic BP | 81.93±3.63 | 81.13±3.49 | 0.0387 |
| Baseline MAP | 98.7±2.62 | 98.03±3.42 | 0.0397 |

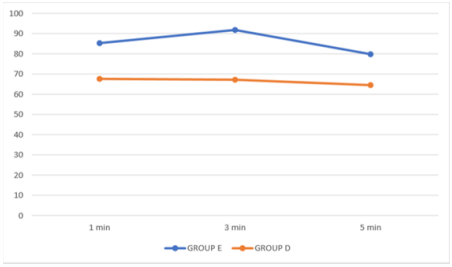


**Figure 2:** Comparison of Heartrate between groups

There is statistically significant difference between the both group with respect to Heart rate (P=0.0002) for 1 min, 3mins and 5 mins post intubation. Hence it showed that group D had better control over the heart rate when compared to group E.

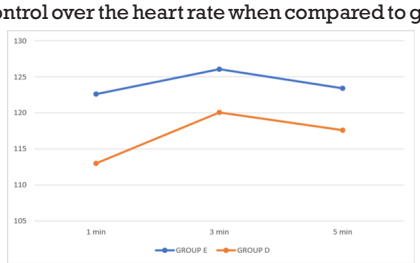

**Figure 3:** Comparison of systolic BP between groups

There is statistically significant difference between both the groups with respect to systolic blood pressure (P<0.0002) for 1 min, 3mins and 5 mins post intubation.

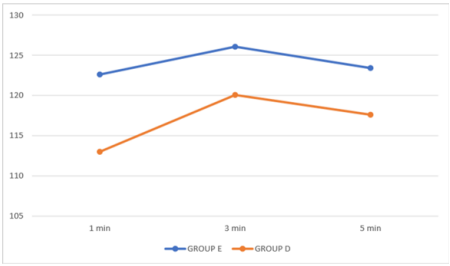


**Figure 4:** Comparison of Diastolic BP between groups

There is statistically significant difference between both the groups with respect to Diastolic blood pressure (P<0.0002) for 1 min, 3mins and 5 mins post intubation.

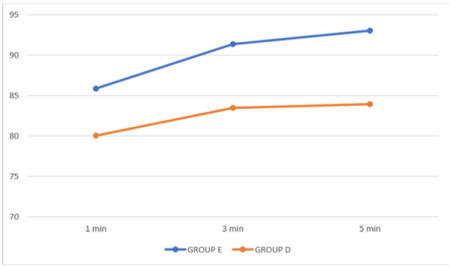


**Figure 5:** Comparison of mean arterial pressure between groups

There is statistically significant difference between both the groups with respect of mean arterial pressure (P<0.0002) for 1 min, 3mins and 5 mins post intubation.

## DISCUSSION

Laryngoscopy and endotracheal intubation causes to activate the sympathoadrenal reflex and sudden release of catecholamine which results in tachycardia and hypertension which can be withstood by normal individuals. Complication such as arrhythmias, raised intraocular and intracranial pressure, laryngospasm and bronchospasm has a profound effect on patient with limited cardiac reserve due to imbalance in demand and supply of cardiac oxygen. Recently there many studies carried out between newer alpha agonist 2 such as dexmedetomidine and beta blockers such as esmolol with different dosage in attenuation of hemodynamic response .In this study the response for laryngoscopy escalates around 1 -2 mins and gradually return to pre-laryngoscopy level around 5 mins.

The groups are comparable with respect to age sex and ASA grading. Patient in two groups are comparable with respect of hemodynamic parameters such as heart rate, systolic BP ,diastolic BP and mean arterial pressure .Patient in Group D had better attenuation of hemodynamic response towards laryngoscopy reflex .There is statistically significant difference between two groups(P<0.0005). Sharma et al in 1996 study showed that bolus of esmolol 100mg suppressed the stress response in hypertensive patient to laryngoscopy and intubation [10]. Miller et al in 1989 study showed that bolus of esmolol 100mg suppressed the stress response to laryngoscopy and intubation [11]. Oxon et al in 1990 study had two group of patient; one group was given esmolol 100mg and other group esmolol 200mg given as bolus [12]. The study showed both group significantly reduced the cardiovascular response to tracheal intubation. Kindler et al in 1996 in study came into conclusion that esmolol when given for attenuation of stress response to laryngoscopy and intubations showed in controlling the heart rate but it did not have any effect on the systolic arterial pressure. Scheinin et al in 1992 study showed that dexmedetomidine given at a dosage of 0.6mcg/kg to healthy individuals had decreased stress response but it did not eliminate the whole stress response to laryngoscopy and intubation. Menda et al in 2010 study was done on patient who was undergoing myocardial revascularization and study showed when dexmedetomidine is combined with fentanyl it attenuated the stress response caused by intubation [13].

## CONCLUSION

We conclude in this study that dexmedetomidine and esmolol both has significant effect in reducing the hemodynamic related stress response to laryngoscope as well as intubation with less adverse effects. Although dexmedetomidine showed superior control over attenuation of hemodynamic related stress response when compared to esmolol.

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