ATTENUATION OF HAEMODYNAMIC RESPONSES TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION: ROLE OF I.V. BOLUS DOSE OF ESMOLOL HYDROCHLORIDE AND LIGNOCAINE HYDROCHLORIDE: A COMPARATIVE STUDY

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ABSTRACT: AIM: The aim of the study is to compare the efficacy of intravenous Bolus dose of Esmolol Hydrochloride and Lignocaine Hydrochloride to attenuate the Haemodynamic responses to Laryngoscopy and Endotracheal intubation. MATERIALS & METHODS: A study of Esmolol hydrochloride and Lignocaine hydrochloride in attenuation of the cardiovascular response during Laryngoscopy and intubation was compared in 50 adult patient, undergoing surgery under general anaesthesia. This study was taken in 2 groups. Group - I consists of 25 patients, where Lignocaine hydrochloride 2 mg per kg IV was used for attenuation of cardiovascular response to Laryngoscopy and intubation. Group -II consists of 25 patients where Esmolol hydrochloride 200 mg IV bolus was used as study drug. RESULTS: Results of the present study are consistent with the studies in attenuating haemodynamic responses to Laryngoscopy and intubation by the use of intravenous bolus dose of 200 mg of Esmolol is superior to Lignocaine hydrochloride. 2mg per kg body weight IV bolus. CONCLUSION: It establishes the usefulness of intravenous bolus dose of Esmolol to attenuate the haemodynamic responses to Laryngoscopy and endotracheal intubation. This study shows the 200 mg of bolus dose of Esmolol hydrochloride is superior to intravenous Lignocaine hydrochloride 2 mg per kg body weight IV bolus to attenuate the haemodynamic responses to Laryngoscopy and endotracheal intubation. No side effects were noted with Esmolol and Lignocaine hydrochloride

KEYWORDS: Esmolol hydrochloride, Lignocaine hydrochloride Laryngoscopy.

INTRODUCTION: Intubation is a very stress full condition. Laryngoscopy stimulates haemodynamic response and increases the blood pressure and heart rate, sometimes the increasing blood pressure may affects adversely to high risk and normal patients also. So many dugs are used to attenuate the haemodynamic response like Lignocaine, Esmolol, NTG, Labetelol.

MATERIALS AND METHODS: A study of Esmolol hydrochloride and Lignocaine hydrochloride in attenuation of the cardiovascular response during Laryngoscopy and intubation was compared in 50 adult patient, undergoing surgery under general anaesthesia, inclusion criteria will be patients of ASA Grade - I and Mallampatti: grade - I.,. The patients were of both sexes and age ranging from 20- 60 years. Patients underwent gynaecological procedures like vaginal hysterectomy, Total abdominal hysterectomy, Diagnostic laparoscopy, laparatomy and other general surgeries. Exclusion criteria will be -History of respiratory problems, History of heart block (atrioventricular...
conduction block) greater than first degree, congestive heart failure, cardiac arrhythmias, history of angina, coronary artery diseases. DM, HTN and other major medical problems. Baseline heart rate <60/min, Baseline systolic BP <100mmHg, Treatment with beta blockers or calcium channel blockers, Hepatic/renal problems. This study was taken in 2 groups. Group - I consists of 25 patients, where Lignocaine hydrochloride 2mg per kg IV was used for attenuation of cardiovascular response to Laryngoscopy and intubation. Group -II consists of 25 patients where Esmolol hydrochloride 200 mg IV bolus was used as study drug. All the patients were assessed clinically preoperatively and investigated to rule out following problems. The following investigations were carried out before subjecting the patients for surgery, namely, complete Haemogram, urine analysis, Blood chemistry, electrocardiogram, and X-ray chest. PA view.

All the patients were preoxygenated for 3 minutes, with 100% oxygen before induction of anaesthesia. Induction was achieved with injection thiopentone sodium 2.5% solution given in a dose of 5 mg per kg body weight. Further sequence varied between the two groups. In Group I after induction of anaesthesia with thiopentone sodium was followed with injection of Lignocaine hydrochloride (Without preservative) 2% in a dose of 2 mg per kg body weight, over a period of 10 seconds. Then blood pressure and pulse rate were recorded in all patients. This is followed by injection suxamethonium 1.5mg per kg body weight. After 60 seconds Laryngoscopy was performed and was intubated. The duration of Laryngoscopy was within 15-20 seconds. Patients in whom Laryngoscopy was difficult or in whom it exceeded 20 seconds were excluded from the study. Patients were then connected to and ventilated with closed circuit with a circle absorber for controlled ventilation anaesthesia. Anaesthesia was maintained with nitrous oxide (67%) and oxygen (33%) and non - depolarising muscle relaxant vecuronium bromide was used in a dose of 0.08 mg per kg body weight in all cases. Heart rate and blood pressure were noted immediately after intubation. Then measurements were repeated every minute for ten minutes after intubation. After 10 minutes recording of the heart rate and blood pressure, surgery was started as to avoid surgical stimulus. All throughout the surgery saturation was maintained between 99 - 100%.

In Group II after induction of anaesthesia with thiopentone sodium was followed by intravenous injection of Esmolol hydrochloride 200 mg IV bolus. Then blood pressure and pulse rate were recorded in all patients. This is followed by injection suxamethonium 1.5 mg per kg body weight. After 60 seconds Laryngoscopy was performed and intubated with Rusch red rubber endotracheal tube without any lubrication jelly. Patients were then connected with closed circuit with a circle absorber. Anaesthesia was maintained with nitrous oxide (67%) and oxygen (33%) and non-depolarising muscle relaxant vecuronium bromide was used in a dose of 0.08 mg per kg body weight in all cases. Heart rate and blood pressure were noted immediately after intubation. Then measurements were repeated every minute for ten minutes, after intubation. All throughout the surgery saturation was maintained at 99%.

RESULTS: From the study conducted the following observations were made at: Pre-operative (initial recording), Pre induction (Basal value), After induction, Laryngoscopy and intubation, 1 minute after intubation, 2 minutes after intubation, 3 minutes after intubation, 4 minutes after intubation, 5 minutes after intubation, 6 minutes after intubation.
The above table showing age, weight and sex distribution in both Lignocaine and Esmolol groups. The lignocaine group comprises of 6 males and 19 females and esmolol group comprises of 11 males and 14 female patients. The age range for both Lignocaine and Esmolol groups is 21-60 years. And the weight range for Lignocaine and Esmolol is 40-60kgs. When age group was taken into consideration there was a gross difference between the two groups and its P-value was <0.05, hence statically significant. With regard to weight, the difference between Lignocaine and Esmolol group is not statistically significant. (P > 0.05).

### TABLE 1

| AGE (YEARS) | WEIGHT (KG) | MALE/FEMALE | 
|-------------|-------------|-------------|
| Lignocaine (n=25) | 46.6 (21-60) | 49.2 (40-60) | 6 / 19 Age P < 0.05 |
| Esmolol (n=25) | 40.8 (21-60) | 47.52 (40-60) | 11 / 14 Weight P > 0.05 |

The above table showing the haemodynamic parameters in Lignocaine and Esmolol groups recorded during the pre-induction time indicate that the difference is not statistically significant (P > 0.05). Pre induction readings are taken as basal values

### TABLE 2: PRE INDUCTION PARAMETERS

| PARAMETERS | LIGNOCAINE (S.D) | ESMOLOL (S.D) |
|------------|------------------|--------------|
| HR         | 90.28 (±7.618)   | 91.56 (±7.627) |
| SBP        | 123.8 (±7.79)    | 125.64 (±7.80) |
| DBP        | 74.48 (±6.88)    | 76.76 (±7.63)  |
| MAP        | 91.16 (±6.68)    | 93.56 (±8.02)  |

The above table showing haemodynamic parameters of both the groups following induction. In both the groups there is a fall in systolic, diastolic and mean arterial pressures. The fall is not statistically significant. A slight increase in the heart rate was observed. It was not statistically significant (P > 0.05).

### TABLE 3: PARAMETERS FOLLOWING INDUCTION TIME

| PARAMETERS | LIGNOCAINE (S.D) | ESMOLOL (S.D) |
|------------|------------------|--------------|
| HR         | 90.52 (±8.342)   | 92.92 (±7.70) |
| SBP        | 121.44 (±7.86)   | 123.76 (±7.90) |
| DBP        | 73.36 (±6.8)     | 75 (±7.51)    |
| MAP        | 88.64 (±6.03)    | 90.64 (±5.99) |

J of Evidence Based Med & Hlthcare, pISSN- 2349-2562, eISSN- 2349-2570/ Vol. 2/Issue 39/Sept. 28, 2015  Page 6276
The above table showing the values of haemodynamic parameters at Laryngoscopy and intubation. Though there was increase in all the parameters in both Lignocaine and Esmolol groups, the increase in the parameters, in the Esmolol group was not much significant. It was statistically significant (P < 0.05)

The above table showing the values of haemodynamic parameters one minutes after Laryngoscopy and intubation. In both the groups the values are significantly well above the pre induction values, however the parameter in the Esmolol group were lower compared to Lignocaine group which was statistically significant. (P<0.05)

The above table showing the haemodynamic parameters 2 minutes after intubation, with Lignocaine and Esmolol. The attenuation of reflex response was statistically significant in the Esmolol group and values were nearest to the basal recordings (P < 0.05).
The above table showing the haemodynamic parameters 3 minutes after intubation, the parameters were still high in Lignocaine group. The attenuation of reflex response was significant in the Esmolol group (P <0.05). In the Esmolol group the values were almost similar to the basal recordings. It was statistically significant.

| PARAMETERS | LIGNOCAINE (S.D) | ESMOLOL (S.D) | P VALUES |
|------------|-----------------|--------------|----------|
| HR         | 99.52 (±7.605)  | 91.16 (±8.07) | P <0.05 - significant |
| SBP        | 128.48 (±7.7)   | 125.64 (±7.8) | P >0.05 - insignificant |
| DBP        | 76.04 (±7.67)   | 76.76 (±7.63) | P >0.05 - insignificant |
| MAP        | 93.6 (±6.94)    | 93.56 (±8.021) | P >0.05 – insignificant |

**TABLE 8: PARAMETERS AFTER 4 MINUTES**

The above table showing haemodynamic parameters 4 minutes after intubation. The parameters after 4 minutes have reached the basal values in Esmolol group, while in Lignocaine group they were still high. The difference of systolic, diastolic and mean arterial pressures was statistically insignificant when compared to basal values (P > 0.05). But the heart rate was statistically significant (P < 0.05).

| PARAMETERS | LIGNOCAINE (S.D) | ESMOLOL (S.D) |
|------------|-----------------|--------------|
| HR         | 94.48(±7.528)   | 91.16 (±8.070) |
| SBP        | 123.88(±7.74)   | 125.64 (±7.8)  |
| DBP        | 75.2 (±7.32)    | 76.76 (±7.63)  |
| MAP        | 91.16(±6.68)    | 93.56(±8.021)  |

**TABLE 9: PARAMETERS AFTER 5 MINUTES**

The above table showing the haemodynamic parameters 5 minutes after intubation. Comparison of the parameters in both the groups shows that the values were almost similar to basal recordings and there was no statistically significant difference. (P>0.05)

| PARAMETERS | LIGNOCAINE (S.D) | ESMOLOL (S.D) |
|------------|-----------------|--------------|
| HR         | 94.76 (±7.6)    | 93.56 (±8.327) |
| SBP        | 125.6 (±8.20)   | 129.24 (±7.18) |
| DBP        | 77.76 (±6.86)   | 77.2 (±7.956) |
| MAP        | 93.76 (±6.450)  | 94.64 (±7.305) |

**TABLE 10: PARAMETERS AFTER 6 MINUTES**

The above table showing the haemodynamic parameters 6 minutes after intubation. Comparison of parameters in both the groups, shows that the values were slightly increasing to the basal recordings. (P > 0.05) there was no statistically significant difference.
DISCUSSION: Anaesthesiologists may want to suppress sympathetic nervous system responses cardiovascular system at one time (eg: before tracheal intubation). Strategies to blunt his responses include minimizing the duration of Laryngoscopy to less than fifteen seconds, by the use of intravenous Lidocaine/vasodilators/narcotics/beta blockers. Esmolol is a beta blocking agent with several desirable properties. It is relatively Cardioselective, ultra-short acting, with rapid onset of action.

Adjusting bolus dose of Esmolol for body weight is not likely to be necessary (Anthony L Sintelos 1987). The rationale for administering Esmolol as a bolus is not only to treat transient increases in heart rate and blood pressure, but also to prevent heart rate values from reaching the ischaemic threshold in the predisposed patients.

Donald R. Miller, Raymond J. Martineau studied the dose response and side effects of Esmolol when administered as a bolus prior to induction for controlling the haemodynamic response to intubation they concluded that a 200 mg w bolus dose of Esmolol is safe, efficacious and devoid of adverse effects in controlling the haemodynamic response to tracheal intubation.

Shane Sheppard, Chris J. Eagle, Leo Strunin used Esmolol as a bolus for control of haemodynamic response to intubation. The bolus dose of Esmolol was administered in two groups. One group received 100 mg and the other group 200 mg. In their study adequate haemodynamic control was observed following administration of 200 mg bolus dose of Esmolol.

In our study we concluded that bolus dose of Esmolol (200 mg) given intravenously, provided consistent and reliable protection from increases in both heart rate and systolic blood pressure during and after intubation, compared to Lignocaine hydrochloride (2 mg per kg body weight) N bolus.

Following induction with Thiopentone there was a slight fall in systolic and diastolic blood pressure and a slight increase in the heart rate. This was not statistically significant. The haemodynamic parameters were found to be increased at Laryngoscopy and intubation in both Lignocaine and Esmolol groups. The increase in the parameters in the Esmolol group was not as much as in the Lignocaine group. It was statistically significant.

Observations at one minute after intubation revealed that the haemodynamic parameters were significantly higher in the Lignocaine group. In the Esmolol group the values were not significantly increased then basal values. It was statistically significant. Observations at 2nd and 3rd minutes after intubation showed that the values in the Lignocaine group were still higher than in the Esmolol group. The values in the Esmolol group were nearest close to the basal values. Observations at fourth minute after intubation showed that the values were still high in Lignocaine group, compared to basal recordings. In Esmolol group the parameters were similar to basal recordings. The difference of systolic, diastolic and mean arterial pressures were statistically insignificant (p > 0.05) Observations at the five minutes after intubation showed that the values were similar to basal recordings in both Lignocaine and Esmolol groups, there was no statistically significant difference. Observations at 6 minutes after intubation showed that the values in the Esmolol and Lignocaine groups were slightly increasing to the basal values, there was no statistically significant difference. During 7-10 minutes period after intubation the parameters were maintained near the basal values. Donald Oxorn, JWD Knon and Jereny Hill have used Esmolol as a single bolus of 100 mg and 200 mg in a double blind fashion. The systolic blood
pressure post intubation was lower in the Esmolol 200 mg group (p < 0.05). They summarised that Esmolol 200 mg was effective in mitigating the haemodynamic response to tracheal intubation. Results of the present study are consistent with the above studies in attenuating haemodynamic responses to Laryngoscopy and intubation by the use of intravenous bolus dose of 200 mg of Esmolol is superior to Lignocaine hydrochloride. 2mg per kg body weight IV bolus.

CONCLUSION: The following conclusions can be drawn from our study. It establishes the usefulness of intravenous bolus dose of Esmolol to attenuate the haemodynamic responses to Laryngoscopy and endotracheal intubation. This study shows the 200 mg of bolus dose of Esmolol hydrochloride is superior to intravenous Lignocaine hydrochloride 2 mg per kg body weight IV bolus to attenuate the haemodynamic responses to Laryngoscopy and endotracheal intubation. No side effects were noted with Esmolol and Lignocaine hydrochloride.

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