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Original Research Article

Attenuation of haemodynamic response to laryngoscopy and endotracheal intubation a comparative study between I.V. labetalol and I.V. lignocaine

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ABSTRACT

Introduction: One of the most common procedures performed by the anaesthisiologists is the Endotracheal Intubation. During this procedure, hemodynamic changes, which may be rapid and dramatic and adverse to the patient may occur. Lignocaine is an excellent drug for the attenuation of pressor events and Labetalol is a potent antihypertensive drug.

Materials and Methods: 50 patients between the ages 18 to 60 years who were scheduled for various procedures under general anaesthesia with ASA Grade I status were included into the study and divided into 2 groups of 25 each. One group was given intravenous Labetalol 0.75mg/kg 10 minutes before intubation and the other group received intravenous injection of Lignocaine hydrochloride (without preservative) 2% in a dose of 1.5 mg/kg over a period of 10 seconds, before 90 seconds of laryngoscopy and intubation.

Results: The parameters were lower in Labetalol group ($P<0.05$) compared to the lignocaine group. The arterial pressures in the Labetalol group attained basal value, and heart rate nearing basal value. The arterial pressures in the Lignocaine group were slightly higher a than basal values and the heart rate is higher than baseline value.

Conclusion: Labetalol given intravenous was more advantageous compared to other methods for attenution of hemodynamic changes after laryngoscopy and intubation as it has a good attenuation of pressor response and heart rate and provides a good intra operative profession against haemodynamics response to surgical stimuli.

1. Introduction

One of the most common procedures performed by the anaesthesiologists is the Endotracheal Intubation. The translaryngeal placement of endotracheal tube into the trachea is called endotracheal intubation. This procedure is done via the nose or mouth. During this procedure, hemodynamic changes, which may be rapid and dramatic and adverse to the patient may occur. Some of the commonly associated morbidities with intubation when the patient is under light anaesthesia are Hypertension, tachycardia and increase in serum catecholamine. This is normally seen during laryngoscopy and during manipulation of epiglottis.[1,2] In case of healthy patients, these changes will be tolerated well both under stress but in patients who have comorbidities, these changes will be highly exaggerated and detrimental.[3,4] Many a times, these stress responses may even be life threatening such as aneurism, myocardial ischemia, left ventricular failure and cerebral haemorrhage.[5]

Hence, one of the most interesting research topics of late is the attenuation of this stress response to laryngoscopy and other surgeries. Attenuation has been done with limitation of duration of laryngoscopy to 15 secs, use of b- blockers such as lignocaine, esmolol, low dose opiods such as fentanyl, or alfentanil, morphine.[6]

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One of the oldest and cheapest not to mention easily available drug which can be used for this purpose of attenuation of the hemodynamic stress is Lignocaine.[7,8] Lignocaine is said to be more effective when used prior to induction of anesthesia. This prevents the arterial hypertension and tachycardia which may occur in response to endotracheal intubation.[9,10]

Labetalol is an oral and parenteral antihypertensive drug which is α1-.and nonselective β1-.and β2-adrenergic antagonist.[11] It reaches its peak in 5-15 mins after an IV injection and gets redistributed, as a result decreasing the blood pressure by reduction in the systemic vascular resistance and increase in reflex tachycardia. Thus the cardiac output remains unchanged.[12]

This study was therefore performed to compare the attenuation of the hemodynamic changes between lignocaine and labetalol in laryngoscopy and endotracheal intubation cases.

2. Materials and Methods

This study was performed by the Department of anaesthesiology at Shadan institute of medical sciences, Teaching hospital and research center over period of two years. 50 patients between the ages 18 to 60 years who were scheduled for various procedures under general anaesthesia with ASA Grade I status were included into the study. After obtaining the clearance from the Institutional Ethical Committee, the procedure was thoroughly explained to the patients and their relatives and informed consent was taken from all of them.

The procedures performed were Laparoscopic Assisted Vaginal Hysterectomy, and Diagnostic Laparoscopy and ENT procedures like Functional Endoscopic Sinus Surgery, Parotidectomy and Modified Radical Mastoidectomy and General Surgical Procedures like Hemithyroidectomy and Laparascopic Cholecystectomy and Laparoscopic Appendicectomy.

A thorough clinical assessment was done for all the patients. Presence of a medical disorder or intake of drug prescription was noted. History of chest pains/syncope/ palpitations, any respiratory problems, or any other hepatic or renal issues were noted and such patients were excluded from the study. Also patients who had a hear rate <60 beats per minute, any abmormalitites in the ECG, a systolic blood pressure if <10mmHg were also excluded from the study. Investigations such as hemogram, complete urine analysis, various biochemical tests, chest Xray, and ECG was done for all the patients.

All patients were random assigned into one of the two Groups Group-1 and Group-2. Each group had 25 patients each. Group I, received Labetalol 0.75mg/kg 10 minutes intravenously before intubation and Group II received intravenous injection of Lignocaine hydrochloride(without preservative) 2% in a dose of 1.5 mg/kg over a period of 10 seconds, before 90 seconds of laryngoscopy and intubation.

Before the introduction of muscle relaxtant and the induction into the patients, they were standardized. 18G cannula was used for the intravenous cannulation when the patient was shifted the pre operation waiting room annexure of the operation theatre. This was introduced through the ringer lactate solution drip. Tramadol hydrochloride 1mg/kg body weight, Ondansetron 4mg and Glycopyrrolate 0.1mg, were given to the patient intravenously. Non invasive monitors were connected to the patient such as blood pressure monitors, ECG and pulse oximeter. Preoxygenation with 100% oxygen was done for 3 minutes. Then, Thiopentone sodium (5mg/kg body weight) was introduced. Vecuronium bromide 0.1mg/kg was used to facilitate the intubation procedure. 100% oxygen for 180 seconds was given as ventilation for the lungs. 10 mins after the Labetalol pre treatment which is the duration of the peak action of the drug, intubation was achieved using oral cuffed, portex endotracheal tube with the help of Macintosh laryngoscope blade. The total time taken for this did not exceed 20 seconds. Patients in whom the time exceeded 20 seconds were also excluded from the study. Vecuronium bromide 0.08mg/kg top-up doses was used to maintain anaesthesia, along with intermittent positive pressure ventilation with nitrous oxide and oxygen in the ratio of 66%: 33% using circle absorber system connected to the Boyle's machine. After all the readings were recorded, the surgery commenced. After the surgery, reversal of the neuromuscular blockage with Neostigmine (0.05mg/kg) and Atropine (0.02mg/kg) was done. Followup was done for all the patients postoperatively.

In group II, after the patient was shifted to the operation theatre annex, IV cannulation was performed using 18G cannula and this was connected to the ringer lactate solution. Slow administration of Tramadol hydrochloride 1mg/kg body weight, Glycopyrrolate 0.1mg and Ondensetron 4mg was done. All these patients were also connected to the non invasive monitors of ECG, pulse oximeter and blood pressure monitor. Preoxygenation was done for all of them with 100% oxygen for 180 seconds. Induction of the patient was done using Thiopentone sodium (5mg/kg body weight) and intubation was done with Vecuronium bromide 0.1mg/kg. Ventilation of the lungs were done with 100% oxygen for 3 minutes. 2% Lignocaine hydrochloride in 1.5 mg/kg was given to the patients over a period of 10 seconds 90 seconds before laryngoscopy and intubation. Intubation was done using an appropriate size oral cuffed portex endotracheal tube with the help of Macintosh laryngoscope blade. The total time taken was 20 seconds for the procedure and more than that was excluded from the study. Vecuronium bromide 0.08mg/kg top-up doses was used to maintain anaesthesia, along with intermittent positive pressure ventilation with nitrous oxide and oxygen in the ratio of 66%: 33% using circle absorber system

connected to the Boyle's machine. All the recordings were completed before the onset of surgery. After the surgery, reversal of the neuromuscular blockage with Neostigmine (0.05mg/kg) and Atropine (0.02mg/kg) was done. Followup was done for all the patients postoperatively.

In each case, Heart Rate, Systolic Blood Pressure, Diastolic Pressure and Mean Arterial Pressure were recorded. Other parameters noted were Pre- induction i.e. after premedication, after induction, at laryngoscopy and intubation, 1 minute after intubation, 3 minutes after intubation and 5 minutes after intubation.

3. Results

The number of males and females were the same in both the groups, with males being 13 nd females 12. Similar was the case with age which was around 35 years and weight around 56 kgs (Table 1).

Table 1: Demographic details of the patients

Details	Group I Labetalol	Group II Lignocaine
Gender (M/F)	13/12	13/12
Age (in years)	34.6	36.1
Weight (in kgs)	57.7	56.4

Tables showing the haemodynamic parameters in Labetalol and Lignocaine groups recorded during the pre-induction time i.e. after premedication. There was no significant difference in these readings (P> 0.05) (Table 2).

Table 2: Parameters recorded during Preinduction Time

Parameter	Labetalol	Lignocaine
Systolic Blood Pressure(mm of Hg)	118.42 ±6.16	122.12 ±8.32
Diastolic Blood pressure(mm of Hg)	77.32 ±3.86	76.24 ±6.52
Mean arterial pressure(mm of Hg)	91.66 ±4.42	94.12± 7.72
Heart rateRate per min	88.20 ±9.42	99.28 ±15.47
Rate Pressure Product (mm of Hg)	10112.6 ±938.82	10542.53±1662.39

Haemodynamic parameters of both the groups following induction. In both the groups, there was a decline in the systolic, diastolic and mean Arterial pressures. When compared to pre-induction values, these changes were statistically significant (P<0.05). There was a slight increase in the heart rate in the Labetalol group while a more increase in heart rate was observed in the Lignocaine group. The increase in the heart rate was significant in Lignocaine group (P<0.05) but the rise in the heart rate in the Labetalol group was not statistically significant (Table 3).

Table 3: Parameters recorded following induction

Parameter	Labetalol	Lignocaine
Systolic Blood Pressure (mm of Hg)	107.42 (±6.54)	110.64±10.65
Diastolic Blood pressure(mm of Hg)	71.84 ±4.40)	65.68 (±8.91
Mean arterial pressure(mm of Hg)	82.60 ±4.28	83.80(± 8.15)
Heart rate Rate per min	89.60 ±10.68	111.28 ±14.98
Rate Pressure Product (mm of Hg)	9453±1164.83	9214±1624.87

A rise in all the parameters was noticed in both the groups. The rise was significantly low in the Labetalol group. (P<0.05). The heart rate and arterial pressures showed a continuous rise to the point of 1 minute after intubation in both groups. But, the heart rate is slightly decreased and arterial pressures are almost reaching base line values in the Labetalol group from the intubation values to 1 minute after intubation. The parameters were lower and statistically significant(P<0.01) in the Labetalol group compared to their counter parts in the Lignocaine group.Though there were a rise in heart rate and arterial pressures in both the groups after 1 minute of intubation, the rise was significantly lower (P<0.01) in case of Labetalol group. When the difference in the Labetalol group parameters only were compared, it shows that the systolic, diastolic and mean arterial pressures at 1minute after intubation were almost nearing the baseline values, but there was no significant statistical difference (P<0.05). All the parameters in both the groups showed a declining trend after 3 minute of intubation compared to 1- minute values. The parameters were still high in the Lignocaine group. The parameters were significantly lower in Labetalol group (P<0.05). The arterial pressures in the Labetalol group attained basal value, and heart rate nearing basal value. The arterial pressures in the Lignocaine group were slightly higher a than basal values and the heart rate is higher than baseline value (Table 4).

4. Discussion

In general anesthesia, laryngoscopy and endotracheal intubation are considered to be the most critical events as they are involved in the marked sympathoadrenal response, that is hypertension and tachycardia.[13–15] These responses are especially fatal in cases of elderly, people with hypertension, ischemic heart disease, cerebrovascular disease and diabetes mellitus, leading to myocardial infarction or aneurysm or other cerebrovascular events.[16]

Postintubation response have been associated with ST segment changes, ventricular arrhythmias, pulmonary

Table 4: Parameters recorded during and after intubation

Parameter	During intubation		1 min after intubation		3 min after intubation		3 min after intubation	
	Labetalol	Lignocaine	Labetalol	Lignocaine	Labetalol	Lignocaine	Labetalol	Lignocaine
SBP	115.20 ±9.84	149.80 ±8.12	119.26±9.45	139.80±10.34	116.48±10.64	127.24±7.40	114.42 ±7.42	118.86 ±8.06
DBP	79.43 ±9.13	96.84 ±8.35	78.8 ±7.80)	87.32±6.80	76.33±7.21	79.92 ±7.83	74.63±6.88	73.40 ±9.76
MAP	92.46±10.38	116.30 ±7.71	92.38 ±9.48	106.92 ±6.85	89.45 ±9.46	98.28± 7.93	86.92 ±12.66	90.78±7.75
HR	90.22±16.20	121.36 ±8.49	89.62 ±14.98	119.16 ±12.23	86.64±15.82	114 ±10.01	85.4014.82	108.60 ±9.29
RPP	11928.75 ±1372.23	17628.18 ± 2138.5	11448.43 ±889.48	18736.52 ±1893.65	10234.26±1215.82	17526.42±2160.50	9878.28±898.65	15126.13±126.17

edema, rupture cerebral aneurysm. In hypertensive patients, this hyperdynamic response is exaggerated and undoubtedly a large increase in myocardial oxygen demand. Infact the anesthetic stress can induce myocardial ischemia. Some authours, infact considered the intubation period one of the periods of greatest risk in surgical patients with coronaries artery disease. It may also be dangerous in increased intracranial pressure. The haemodynamic response is dangerous when perfusion of vital tissue is compromised.[17]

Lignocaine is an excellent drug for the attenuation of pressor events and Labetalol is a potent antihypertensive drug. In the present study, the labetalol group, received intravenous labetalol 0.75 mg/kg body weight 10 minutes before intubation in 25 adult, healthy ASA class 1 patients belongingto age group between 20-55 yrs undergoing electives surgeries

The lignocaine group consisted of 25 healthy ASA class 1 patients comparable in age, sex, weight and type of surgery. Both groups were premedicated with tramadol hydrochloride I mg/kg body weight and glycopyrrolate 0.1 mg approximately 20 minutes before pre-treatment.

After induction with thiopentone there was a fall in systolic blood pressure and increased in heart rate in both the groups, but the difference was not significant.

In the lignociane group there was increased in haemodynamic values after laryngoscopy and intubation. The increase is as follows; systolic blood pressure increased by 27 mmHg, diastolic blood pressure by 20 mmHg and mean arterial pressure by 22 mmHg. Heart rate increased by 23 beats per minute. The increase was significant when compared to preinduction values group. In the labetalol group, systolic B.P decreased by 3 mmHg where as diastolic B.P, mean arterial pressure and heart rate were similar to base line values.

The changes when compared to changes in lignocaine group were statistically significant. This shows that labetalol effectively attenuates the haemodynamic response to laryngoscopy and endotracheal intubation.

Our study was corroborated by a study by Jaiswal et al, where it was found that the Lignocaine group could not prevent the rise in heartrate but bunted the rise although vould not totally attenuate it, though the labetalol group, though an increase in heartrate was observed initially, there was an attenuation after 15 minutes of intubation.[18] In another study by Ramakrishna et al, where when they have used intravenous labetalol 0.75 mg/kg and 1 mg/kg and they observed no increase in systolic, diastolic, mean blood pressure and heart rate after laryngoscopy and intubation. They have concluded that intravenous labetalol is an easy and effective means of attenuating the pressor response to endotracheal intubation. A study by Leslie et al. reported that the attenuation of heartrate after intubation was dose dependent.[19]

The attenuation of heart rate and blood pressure response to laryngoscopy and endotracheal intubation can be explained, due to blockade of beta 1, beta 2 and alpha 1 adrenoceptors activity by labetalol.

5. Conclusion

Labetalol given intravenous was more advantageous compared to other methods for attenution of hemodynamic changes after laryngoscopy and intubation as it has a good attenuation of pressor response and heart rate and provides a good intra operative profession against haemodynamics response to surgical stimuli. Labetalol provides protection against adverse haemodynamic response at the time of extubation in the most of cases because it half life is 5.5 hours. In conditions where deep sedation or deeper plane of inhalational anaesthesia is undesirable, those conditions alpha and beta blocked patient under light general anaesthesia is better and stable. Moreover, this drug is freely available, easy to administer and highly cost effective, with minimal side effects.

6. Source of Funding

None.

7. Conflict of Interest

None.

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