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Original Research Article

To study the effect of iv dexmedetomidine versus iv labetalol for the suppression of sympathoadrenal response to extubation

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ABSTRACT

Background: Tracheal extubation evokes various degrees of disturbances in the autonomic nervous system in the form of tachycardia, hypertension which can cause deleterious consequences in susceptible patients. Hence this study was conducted between iv Dexmedetomidine and iv Labetalol to compare their effectiveness in the suppression of haemodynamic response to tracheal extubation.

Materials and Methods: 60 participants aged between 18-55 yrs belonging to ASA 1 or 2 were randomly allocated into 2 groups. Group Dd received injection Dexmedetomidine 0.6mcg/kg iv and Group Ll received injection Labetalol 0.25mg/kg body weight. Heart rate, systolic and diastolic blood pressure were recorded at baseline, 2,5,8 minutes after drug infusion, at extubation and 1,3,5,8,10 and 15 minutes post extubation.

Results: Group Dd showed a better decrease in heart rate, systolic and diastolic blood pressure at extubation, and 15 minutes post extubation compared to Group Ll.

Conclusion: Injection Dexmedetomidine 0.6μg/kg showed a better attenuation of sympathoadrenal response to extubation compared to injection Labetalol 0.25mg/kg.

1. Introduction

The gold standard procedure of Direct laryngoscopy and endotracheal intubation for general anaesthesia is known to produce autonomic disturbances. Similary the stormy extubation is known to produce deleterious complications such as arrhythmias, bronchospasm, tachycardia, hypertension,myocardial insufficiency, cerebrovascular accidents in susceptible patients. [1,2]

Various methods had been tried to attenuate the sympathoadrenal response to extubation like usage of pharmacological agents such as nitroglycerine, opioids, lignocaine spray and inhalational agents to deepen the plane of anaesthesia but each associated with their own limitations. [3]

Alpha-2 agonists attenuate the sympathoadrenal response by reducing the tonic levels of sympathetic outflow. [4] Among the alpha-2 agonists, Dexmedetomidine [5,6] is the dextro-isomer of medetomidine exhibiting more specificity towards alpha-2 adrenoceptors with alpha-2:alpha -1 binding ratio of 1620:1.

Labetalol is an antihypertensive drug with mild alpha-1 and predominant beta adrenergic receptor blocking effect. [7]

Since both Dexmedetomidine and Labetalol can attenuate the sympathoadrenal response, a study is needed to compare between Dexmedetomidine and Labetalol to know which is more efficacious and statisfactorily attenuate the sympathoadrenal response to extubation.

Thus the present study is conducted to compare between iv Dexmedetomidine 0.6μg/kg and iv Labetalol 0.25mg/kg in the suppression of sympathoadrenal response to extubation.

2. Materials and Methods

Ethical committee clearance was obtained and informed risk consent was taken from all the 60 patients who were

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belonging to ASA class 1 or 2 and of the age group 18–55 yrs.

Patients were allocated into two groups based on shuffled opaque sealed envelopes containing the name of the group. Patients with cardiac, renal and hepatic impairement, cerebral disease, difficult airway, heart blocks, bradycardia(heart rate <60bpm) were excluded from the study.

Group Dd- received injection Dexmedetomidine 0.6μg/kg body weight diluted upto 10ml with normal saline intravenously over 10 minutes using a syringe pump before extubation.

Group Ll - received injection Labetalol 0.25mg/kg body weight diluted upto 10ml with normal saline given intravenously over 10 minutes using a syringe pump before extubation.

All the subjects were premedicated with injection Midazolam 0.05mg/kg body weight and injection ondansetron 0.1mg/kg body weight and induced with injection thiopentone 5mg/kg and injection vecuronium 0.1 mg/kg.

Anaesthesia was maintained with oxygen, nitrous oxide, isoflurane with intermittent dose of injection vecuronium.

Group Dd received injection Dexmedetomidine 0.6μg/kg diluted upto 10ml with normal saline intravenously over 10 minutes using a syringe pump before extubation and Group Ll - received injection Labetalol 0.25mg/kg diluted upto 10ml with normal saline given intravenously over 10 minutes before extubation. At the end of the procedure, neuromuscular blockade was reversed with Inj neostigmine 0.05mg/kg body weight and Inj glycopyrrolate 0.01mg/kg body weight.

Haemodynamic parameters such as heart rate, systolic and diastolic blood pressure were recorded at baseline, 2, 5, 8 minutes after drug infusion, at the time of extubation and at 1, 3, 5, 8, 10 and 15 minutes postextubation.

2.1. Statistical analysis

The calculation of sample size was done after discussion with the statistician, on the basis of pilot study observations. The observation conducted showed approximately each group should have 23 patients for ensuring a power of study 0.80. With assumption of 5% patients would drop out, the final study sample size was fixed at 30 patients in each group, allowing a type 1 alpha error =0.05 and a type 2 error of beta=0.2 and power of 0.8. All the statistical methods were carried out through Microsoft excel SPSS for Windows (version 20.0)

3. Results

Demographic variables were comparable with respect to age, sex and weight.

3.1. Heart rate

Between group Dd and Group Ll, the baseline mean heart rate was comparable and was statistically insignificant.

In both the groups there was a decrease in mean heart rate after drug infusion and 1,3,5,8,10 and 15 minutes postextubation but Group Dd showed a better decrease in mean heart rate at 2,5,8 minutes after drug infusion, at the time of extubation and 1,3,5,8,10 and 15 minutes postextubation compared to group Ll which was statistically significant.

At extubation, the mean heart rate was decreased by 3.57% (3bpm) in Group Dd whereas in Group Ll, the mean heart rate was increased by 10.57% (9bpm) which was statistically significant.

In both the groups the mean heart rate was below the baseline value even at 15th minute post extubation.

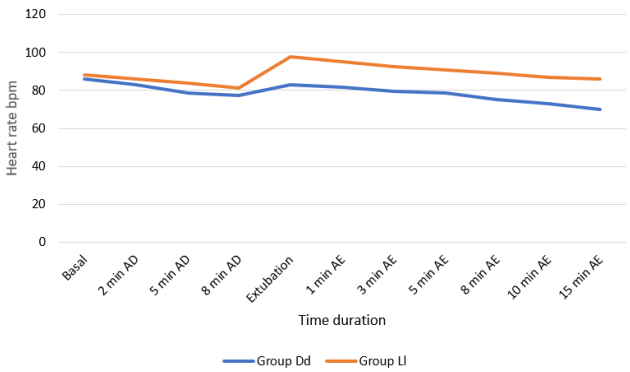

Fig. 1: Showing changes in mean heart rate between Dexmedetomidine and Labetalol group

3.2. Systolic and diastolic blood pressure

In both the groups, the baseline systolic and diastolic blood pressure were comparable and statistically not significant.

In both the groups there was a decrease in mean systolic and diastolic blood pressure but group Dd showed a better decrease in mean systolic and diastolic blood pressure at 2, 5, 8 minutes after drug infusion, at extubation and till 15 minutes postextubation compared to group Ll which was statistically significant.

At extubation, the mean systolic and diastolic blood pressure was decreased by 9.9% (13mmhg) and 12%(10mmhg) respectively in Group Dd whereas in Group Ll, the mean systolic and diastolic blood pressure was decreased by 4%(5mmhg) and 4.2% (3mmhg) respectively which was statistically significant.

In both the groups the systolic and diastolic blood pressure was remained below the baseline even at 15th minute postextubation.

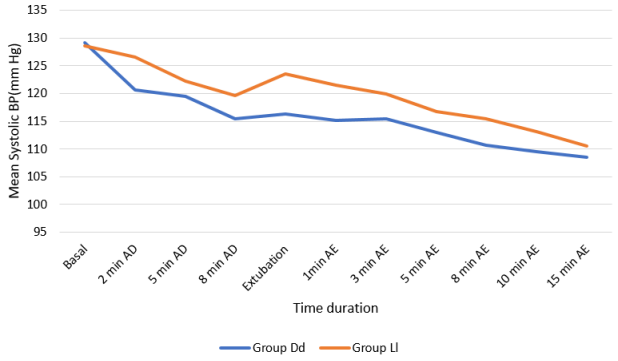

Fig. 2: Showing changes in mean Systolic blood pressure between Dexmedetomidine and Labetalol group

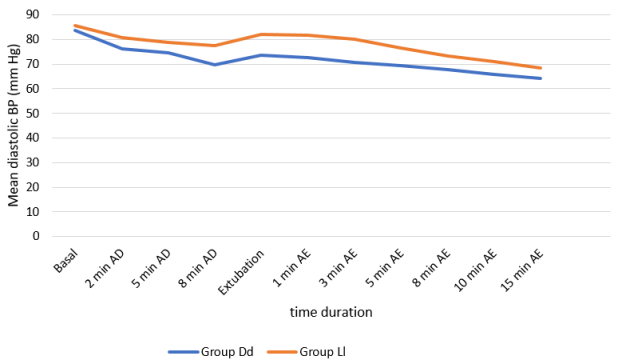

Fig. 3: Showing changes in mean diastolic blood pressure between Dexmedetomidine and Labetalol group

4. Discussion

Endotracheal extubation evokes noxious stress response by creating disturbances in the haemodynamic parameters which manifests in the form of tachycardia, hypertension, changes in heart rhythm and also evokes coughing, bronchospasm, raised intracranial and intraocular pressure. These changes may lead to hazardous consequences in vulnerable patients.[8]

Dexmedetomidine is an alpha-2 adrenergic agonist with unique effects such as sympatholysis, titratable sedation without causing severe respiratory depression and analgesia. It also reduces the dosage of opioids required.[9]The chemical structure of dexmedetomidine contains a small molecule with an imidazole ring.[10] Since Dexmedetomidine exhibits eight times more affinity towards alpha-2 adrenoceptors compared to clonidine, it is often considered as a full alpha-2 adrenoceptor agonist.[11] On intravenous administration, the distribution half-life is 6-8 minutes.[12] The Dexmedetomidine activates presynaptic alpha-2 receptors which leads to inhibition of release of norephinephrine and thereby terminates the transmission of noxious stimuli. The changes in haemodynamic parameters such as decrease in heart rate and blood pressure is caused by Dexmedetomidine by inhibiting the sympathetic activity through activation of postsynaptic alpha-2 receptors.[13] Thus Dexmedetomidine helps to attenuate the sympathoadrenal stress response.

Labetalol is an antihypertensive drug with alpha-1 and nonselective beta-1 and beta-2 adrenergic antagonist.[7] Out of four isomers of Labetalol, the vasodilatory effect of Labetalol is mainly due to the R, R isomer possessing intrinsic sympathomimetic effect on beta adrenergic receptors.[14] The peak effect of Labetalol reaches by 5-15minutes on intravenous administration.[15] Labetalol decreases the blood pressure by blocking alpha-1 adrenergic receptors and decreases the heart rate by blocking beta adrenergic receptors.[16] Thus Labetalol also helps to attenuates the sympathoadrenal stress response.

In the study conducted by Kotak N[17] et al comparing Dexmedetomidine with esmolol, the Dexmedetomidine group showed better control over haemodynamic parameters at extubation and till 15minutes postextubation.

The study results of Younes M M[18] et al showed Labetalol as a better agent in attenuating the stress response to extubation in comparision with fentanyl and lidocaine.

El-Shmaa NS et al[5] conducted a study using Dexmedetomidine 1μg/kg and Labetalol 0.25mg/kg for attenuation of haemodynamic response to laryngoscopy and intubation and concluded that Dexmedetomidine effectively attenuated the haemodynamic response to intubation compared to Labetalol.

Studies are lacking comparing Dexmedetomidine with Labetalol for attenuation of haemodynamic stress response to extubation.Thus we chose this study comparing Dexmedetomidine with Labetalol for suppression of sympathoadrenal response to extubation.

We chose to administer Dexmedetomidine 0.6μg/kg diluted upto 10ml with normal saline given slow iv using syringe pump because rapid administartion leads to transient increase in blood pressure and decrease in heart rate due to its stimulation of peripheral alpha-2B adrenoceptor. Considering the peak effect of Labetalol, we chose to administer 0.25mg/kg iv Labetalol diluted to 10ml with normal saline over 10 minutes with syringe pump.

On analysis of our study results, at extubation the Dexmedetomidine group showed decrease in mean heart rate by 3bpm(0.3%) and decrease in mean systolic and diastolic blood pressure by 13mmhg(9.9%) and 10mmhg(12%) respectively whereas in Labetalol group, at extubation, the mean heart rate was increased by 9bpm(9%), and mean systolic and diastolic blood pressure was decreased by 5mmhg(4%) and 3mmhg(4.2%) respectively. Even though the mean heart rate, systolic and diastolic blood pressure remained below the baseline value even at 15minutes postextubation in both the groups Dexmedetomidine was better in maintaining stable haemodynamic parameters compared to Labetalol.

The study of Kewalramani et al[19] who compared Dexmedetomidine 0.5μg/kg with Labetalol 0.25mg/kg showed the attenuation of haemodynamic response for intubation and extubation was better with Dexmedetomidine compared to Labetalol . At intubation the increase in mean heart rate was 11bpm in Labetalol group whereas Dexmedetomidine group showed a decrease in heart rate by 6bpm. At the time of extubation, Labetalol group showed a increase in heart rate by 6bpm whereas in Dexmedetomidine group the increase in heart was 2bpm. From this study it was found that Dexmedetomidine was better in suppressing sympathoadrenal response and maintain better haemodynamic parameters compared to Labetalol which correlates with our study.

The study conducted by D Singla[20] et al compared Dexmedetomidine with Labetalol for attenuation of haemodynamic stress response in borderline hypertensive patients undergoing laproscopic cholecystectomy found that at intubation, the Labetalol group showed a higher value for mean systolic (128.0 $\pm$ 13.866 vs 123.2 $\pm$ 10.672) and diastolic blood pressure (79.2$\pm$ 14.153 vs 73.1 $\pm$ 9.683) compared to Dexmedetomidine group. Thus the study results concluded that Dexmedetomidine was better in maintaining the stable haemodynamics compared to Labetalol which was on par with our study where Dexmedetomidine maintained a better haemodynamics in our study compared to Labetalol.

5. Limitation of Study

More accurate results can be obtained if invasive blood pressure monitoring is done.

6. Benefits of our study

From our study results we found that Dexmedetomidine can suppress the extubation response effectively and thereby prevents untoward complications such as arrhythmias, hypertension, tachycardia and cerebrovascular accidents that may arise in susceptible patients due to sympathoadrenal response of extubation.

There was no statistically significant side effects in our study.

7. Conclusion

From our study we found that injection Dexmedetomidine 0.6μg/kg given iv over 10 minutes before extubation effectively suppressed the sympathoadrenal response to extubation compared to injection Labetalol 0.25mg/kg iv.

8. Source of Funding

None.

9. Conflict of Interest

None.

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