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A comparative study of two different doses of dexmedetomidine for attenuating the haemodynamic response to tracheal intubation

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Abstract

Back ground: Reflex sympathetic discharge caused by laryngo-pharyngeal stimulus with laryngoscopy may lead to hypertension and tachycardia. It is one of the cause for morbidity during general anesthesia. We in our study compared the two doses of Dexmedetomidine 1 µg/kg and 0.5 µg/kg for attenuating this response.

Material and Methods: In this study ninety patients were randomly divided into two groups. Group A Received: 0.5µg/kg Injection Dexmedetomidine as bolus dose over 10 minutes & Group B - Received: 1µg/kg Injection Dexmedetomidine as a bolus dose over 10 minutes. The heart rate and blood pressure (Systolic, diastolic and mean) of the patient were noted at following intervals preoperative i.e. Baseline, during administration of the study drug at 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes, immediately at induction, At intubation and Post intubation at 1min, 5 min and 10 min. Statistical significance in mean difference was calculated using student's t test. *P* value of < 0.05 was regarded as statistically significant and *p* < 0.001 was taken as highly significant.

Results: Compared to the baseline all the hemodynamic parameters (HR, SBP, DBP and MAP) showed decrease during administration of the study drug which continued throughout the study period except at intubation and 1 min post intubation in both the groups. These values still remained below the baseline value. Highly significant difference in heart rate in both the groups was noted at 5 and 10min post intubation Group B showing more decrease than A(*p*=0.000, 0.001). Same statistical significance is noted in systolic blood pressure at induction and at 10 min. post intubation (*p*=0.000, 0.000). Mean blood pressure (*p*=0.03, 0.03) and diastolic blood pressure (*p*=0.000, 0.001) also showed more decrease in Group B than A at 5 and 10 min post intubation with high statistical significance.

Conclusion: Dexmedetomidine in the dose of 0.5 µg/kg and 1µg/kg is effective in attenuating the hemodynamic response to laryngoscopy and tracheal intubation

Keywords: Dexmedetomidine, Haemodynamic response, tracheal intubation

Introduction

Laryngoscopy and endotracheal intubation during general anesthesia result in hypertension and tachycardia. These haemodynamic changes are due to reflex sympathetic discharge caused by laryngo-pharyngeal stimulus^[1]. These responses are transient but in patients with cardiovascular compromise and disorders like intracranial aneurysm even these small and temporary changes may result in damaging effects^[2]. Various pharmacological agents which include opioids^[3], calcium channel blockers, β-blockers, Clonidine^[4] have been tried by several researchers for diminishing this hemodynamic response

Dexmedetomidine a newer α₂agonist have also been used for attenuating the sympathetic response. Dexmedetomidine shows a high ratio of specificity for the α₂ receptor (α₂/α₁ 1600:1) compared with Clonidine (α₂/α₁ 200:1), leading to sympatholytic effect and blunting of the exaggerated hemodynamic responses^[5]. Dexmedetomidine also gives additional benefit by its other actions like sedation, analgesia, anxiolysis, improved hemodynamic stability with decrease in requirement of Anaesthetics i.e. up to 90% decrease in minimum alveolar concentration (MAC) of volatile Anaesthetics^[6]. There are several studies which have used number of doses of dexmedetomidine for attenuation of hemodynamic response to laryngoscopy and intubation but particular dose is still not been recommended.

We have come across very few studies comparing 1 µg/kg body weight and 0.5 µg/kg weight. Dexmedetomidine. Hence, we decided to compare these two doses for attenuation

of response to laryngoscopy followed by endotracheal intubation.

Material and Methods

After ethical committee approval and the informed consent from all patients, this study was undertaken in, our hospital, during the period October 2016 to September 2018. Before the study was carried out, a power analysis indicated that 23 patients per group would be required to detect a 10% difference in haemodynamic parameters. The α error was set at 0.05 and β error at 0.9. Thus a sample size of $n=30$ per group was considered for our study.

Sixty adult patients of both sexes aged between 18 and 65 years, ASA class I and II, weight 40 kg to 80 kg, under general anesthesia, posted for elective surgeries were included in the study. Patients having hypertension, heart rate < 60, heart block, systolic blood pressure < 100 mm of Hg, difficult airway, obesity i.e. Body Mass Index > 30, were excluded along with pregnant and lactating females. After securing wide bore Intravenous (I.V.) line with 20 G, Electrocardiogram (ECG), Blood Pressure (B.P.) and oxygen saturation monitors were attached. Randomization done by sealed envelope method.

Group A: N=30, Received: 0.5 μ g/kg Injection (Inj.) Dexmedetomidine (Neon) as bolus dose over 10 minutes with Life Care 5000 Infusion System, Abbott, Ireland.

Group B: N=30, Received: 1 μ g/kg Inj. Dexmedetomidine (Neon) as bolus dose over 10 minutes with Life Care 5000 Infusion System, Abbott, Ireland.

Anesthesiologist preparing the study drug did not take part in further study. The observer noting the reading was unaware about the drug given. Consequently, making the study double blind as the observer as well as the patient was blind for the study. Parameters like heart rate, blood pressure including systolic, diastolic and mean arterial pressure, were recorded at the following time: Preoperative (Baseline), during administration of the study drug at 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes, immediately at induction, At intubation and Post intubation at 1min, 5 min and 10 min.

Two minutes after stopping the infusion of study drug, patient was pre medicated with Inj. Midazolam (0.05 mg/kg) and Inj. Pentazocine (0.5 mg/kg). Preoxygenation of the patients was done via a face mask with Bain's circuit for 3 minute. Induction done with Inj. Propofol 2mg/kg, Inj. Vecuronium 0.1mg/kg was given immediately and intubation was facilitated after 3 minutes, with appropriate sized endotracheal tube. Patients with more than three attempts for intubation were excluded from the study. Patients were maintained with O₂ + N₂O (50%/50%) and Isoflurane.

Hypertensive episodes i.e. increase in mean BP by 30% from baseline were taken care by inhalational dose adjustments. Hypotensive episodes i.e. decrease in mean BP by 30% from baseline were treated by IV fluids & Inj.

Mephentermine 6mg IV if required. Tachycardia (HR>110/min) was treated by Inj. Esmolol 0.5 mg /kg IV & bradycardia (HR<50 /min) was treated by Inj. Atropine 0.3 mg IV.

Statistical analysis

All data was presented as Mean \pm Standard Deviation (SD). Demographic data was analyzed using Chi-square test and statistical significance in mean difference was done using student's t test. *P* value of < 0.05 was regarded as statistically significant and *p* < 0.001 was taken as highly significant.

Results

In our study both the groups were comparable with regard to demographic parameters like age and sex.

Table 1: Distribution of patients according to Age in percentage

Age	Group A		Group B		p Value
	N	%	N	%	
<20 years	3	10.0	1	3.3	0.685 NS
21-30 years	6	20.0	7	23.3	
31-40 years	8	26.7	4	13.3	
41-50 years	4	13.3	10	33.3	
51-60 years	4	13.3	6	20.0	
61-65 years	5	16.7	2	6.7	
Sex					0.4362 NS
Male	18	60	15	50	
Female	12	40	15	50	

There was decrease in the mean heart rate (HR) after administration of the study drug, throughout the study period in both the groups.

Table 2: Comparison of Mean Heart Rate changes between Group A and Group B

	Group A	Group B	p value
	Mean \pm SD	Mean \pm SD	
Pre-op(baseline)	84.93 \pm 4.13	83.30 \pm 4.35	0.141 NS
(Study Drug Started) 0 min	82.33 \pm 4.29	80.80 \pm 3.68	0.143 NS
2 min	80.77 \pm 3.19	78.97 \pm 4.07	0.062 NS
4 min	78.70 \pm 3.83	76.57 \pm 3.14	0.043 S
6 min	78.13 \pm 6.34	74.9 \pm 10.5	0.001 HS
8 min	76.60 \pm 3.82	72.10 \pm 5.05	0.000 HS
10min	74.33 \pm 3.37	69.33 \pm 1.99	0.000 HS
At Induction	69.07 \pm 2.38	67.10 \pm 2.14	0.082 NS
At Intubation	76.70 \pm 3.82	74.57 \pm 3.13	0.071 NS
Post Intubation (1min)	71.80 \pm 2.04	70.27 \pm 2.83	0.025 S
5min	66.80 \pm 4.11	64.93 \pm 4.08	0.000 HS
10 min	65.37 \pm 3.02	63.07 \pm 2.97	0.001 HS

S – Significant, HS – Highly Significant, NS – Non-Significant

As compared to the baseline mean systolic blood pressure (SBP), mean diastolic blood pressure (DBP), mean blood pressure (MBP) was decreased in both the groups which continued throughout the study period.

Table 3: Comparison of mean Systolic Blood Pressure Changes between Group A and Group B

SBP (mm of Hg)	Group A	Group B	p value
	Mean \pm SD	Mean \pm SD	
Pre-op (baseline)	122.70 \pm 6.64	120.83 \pm 4.76	0.216 NS
(Study Drug Started) 0 min	118.63 \pm 3.36	117.13 \pm 3.68	0.105 NS

2 min	117.87±4.03	115.13±4.50	0.000 HS
4 min	116.20±7.48	113.67±9.36	0.000HS
6 min	111.07±9.66	109.1±10.9	0.000 HS
8 min	110.33±7.90	107.80±6.98	0.000 HS
10 min	109.97±7.66	105.70±4.09	0.000 HS
At Induction	111.83±6.86	109.60±7.89	0.000 HS
At Intubation	116.20±7.48	110.67±6.32	0.000 more
Post Intubation (1min)	115.77 ±6.45	106.5±11.8	0.776 NS
5min	109.03±5.40	100.83±6.24	0.238 NS
10 min	99.23±2.74	96.43±3.49	0.000 HS

S – Significant, HS – Highly Significant, NS – Non-Significant

Table 4: Comparison of Mean Diastolic Blood Pressure Changes Group A and Group B

DBP (mm of Hg)	Group A	Group B	p value
	Mean± SD	Mean± SD	
Pre-op (baseline)	74.60± 5.18	73.73±3.26	0.208 NS
(Study Drug Started) 0 min	73.20±6.80	72.10±5.40	0.573 NS
2 min	72.07±5.78	70.09±4.78	0.001 HS
4 min	71.73±4.72	65.47±6.17	0.002 HS
6 min	69.10±6.97	67.7±10.8	0.001 HS
8 min	67.13±5.15	66.60±5.57	0.000 HS
10 min	65.10±3.81	64.63±6.46	0.000 HS
At Induction	63.03±3.48	60.07±4.62	0.000 HS
At Intubation	70.73 ±4.71	68.47±4.34	0.000 HS
Post Intubation 1min	71.10±3.87	67.27±5.78	0.000 HS
5min	66.33±3.09	62.13±3.56	0.000 HS
10 min	61.97±2.74	59.63±2.24	0.001 HS

S – Significant, HS – Highly Significant, NS – Non-Significant

Group B showed more fall in the HR from 4th minute of drug administration up to 10th min. At intubation, it showed slight rise in both the groups compared to pre induction value though actual value being less compared to the baseline (Group A: 76.70±3.82, - 9.79% vs. Group B: 74.57 ±3.13, percentage value -10.51%) (P value >0.05). The fall was also seen post intubation from 1 min up to 10 min, the difference in HR being statistically significant at 5 and 10min. Maximum fall in the HR was observed in both the groups post intubation at 10 minutes. Fall in heart rate was more in Group B than Group A.

At induction, at intubation and post intubation at 1 min, the fall in all types of blood pressure was noted in both the groups. This fall in blood pressure is less as compared to baseline not requiring any treatment. Here also Group B showing more fall than Group A. Post intubation fall in SBP at 1min, and 5 min was statistically not significant. There was decrease in SBP in both the groups post intubation at 10 min which was statistically highly significant in Group B than in Group A. There was decrease in DBP in both the groups post intubation at 5 min and 10 min which was statistically highly significant.

At intubation and post intubation at 1 min, the fall in MBP was less as compared to the baseline in both the groups. Group B showing more fall than Group A. There was decrease in MBP in both the groups post intubation at 10 min which was statistically significant. Fall in mean blood pressure was more in Group B than in Group A. In Group A, one patient and in Group B, 2 patients had bradycardia (HR<50bpm) none of the patients in both the groups had hypotension (BP >30%) from the baseline.

Discussion

Dexmedetomidine, an alpha-2 agonists drug has been tried for reducing the intubation response and found to have

better effects compared to other drugs with reduced or no side effects like respiratory depression. When used intravenously it inhibits the release of nor-epinephrine by presynaptic activation of the α -2 adrenoceptor in the Locus coeruleus. Post synaptic activation of α -2 adrenoceptor in the central nervous system by this drug results in decrease in sympathetic activity. Its use decreases the serum catecholamine levels by 90% and suppresses the hemodynamic response of laryngoscopy.

Dexmedetomidine decreases heart rate by augmenting the vagal nerve and blocking the cardio-accelerator nerves. This negative chronotropic effect is also attributed to reflex response for transient hypertension during initial part of infusion and subsequently it was due to diminished nor-epinephrine release and inhibition of central sympathetic outflow [7, 8].

In our study after administration of the study drug, we observed the similar effect i.e. decrease in the mean heart rate compared to the baseline in both the groups which continued throughout the study period. At intubation, mean heart rate showed slight rise in both the groups compared to pre induction value, though actual value was less than the baseline and the values were comparable in both the groups. Post intubation at 5 min and 10 min there was statistical significant difference noted in two group with group B showing more fall. Hasan A *et al.* 2016 [9] compared the dose of 0.6 μ g/kg versus 1 μ g/kg and observed continuous decrease in the mean heart rate throughout the study period in both the groups. Raval D L *et al.* 2014 (8,29), They found in their study that the fall in mean HR in Group A (1.0 μ g/kg dexmedetomidine) was more as compared to Group B (0.5 μ g/kg dexmedetomidine), during laryngoscopy and intubation, 1 min after intubation, 2 min after intubation and 5 min after intubation which was statistically highly significant (p <0.01), while mean HR at pre induction were comparable in between groups (p >0.05). Their findings were almost similar with our study. We noted bradycardia (HR<50bpm) in one patient in Group A and three patients in Group B, which was easily treated with Inj. Atropine 0.3mgIV. Nanda *et al.* [10] found 2 cases of bradycardia (HR < 50/min) in Group B (0.5 μ g/kg dexmedetomidine), and 2 cases of bradycardia (HR < 50/min) in Group C (1 μ g/kg dexmedetomidine), respectively.

In our study, after administration of the study drug, there was decrease in SBP, DBP, MBP compared to the baseline in both the groups which continued throughout the study period. Reduction of tonic levels of sympathetic outflow and an augmentation of cardiac-vagal activity due to Dexmedetomidine can result in decrease in cardiac output which in turn causes decrease in blood pressure.

At induction, at intubation and post intubation at 1 min, the fall in SBP, DBP, and MAP was less as compared to the baseline in both the groups. Group B showing more fall than

Group A. Post intubation fall in SBP at 1min, and 5 min was comparable in both the groups. There was decrease in mean SBP, DBP, MBP in both the groups post intubation at 10 min which was statistically highly significant in Group B than in Group A. Smitha *et al.* 2014^[11] compared the effect of 0.5 µg/kg, 1 µg/kg of dexmedetomidine and normal saline. They had similar findings for SBP like our study. In a similar study done by A EsraSagi roglu *et al.*^[12] they noted statistically highly significant difference between 1 µg/kg (Group A) and (Group B) 0.5 µg/kg. As compared to baseline SBP had increased in both the groups 60 sec after induction which is not matching with our study. It might be because of the difference in the induction agents and inhalational agents as we used Inj. Propofol instead of Inj. Thiopentone and Isoflurane as an inhalational agent. Rashmi *et al.* 2013^[13] compared the two different doses of Dexmedetomidine, 0.6µ g/kg and 1µ g/kg and control group of NS. As seen in our study they also found fall in DBP after the start of Dexmedetomidine. At 1 min post intubation they have noted the rise in DBP above the baseline in both Dexmedetomidine groups. We noted rise in diastolic pressure but it was not more than that of Baseline, Smitha *et al.*^[11] noted that values of diastolic blood pressure were statistically lower at all intervals in 1 µg/kg than 0.5 µg/kg of dexmedetomidine including 1 min post intubation value. This change in this study may be attributed to use of different opioids (Fentanyl 1-2 mcg/kg for induction) Modh B. Dixitkumar *et al.*^[14] observed fall in MBP in Group D1(1mcg/kg Dexmedetomidine) till induction (baseline vs. induction) which was less at 1 min (value)and 2 min (value) post intubation. This was like our Group B study. Rawal. D *et al.*^[8] noticed fall in MBP in both the groups at all time intervals which was more in 1mcg/kg Dexmedetomidine compared to the baseline. At 1 min after intubation, less fall was noticed as compared to the baseline. This finding is unlike our study Jarineshin H^[15] noticed fall in MBP from baseline after study drug infusion. At intubation and at 3 min post intubation there was less fall compared to the baseline. Their study findings were correlating our study. H S Nanda *et al.* 2016^[10] noticed fall in the MBP in Group B: 0.5 µg/kg and Group C: 1 µg/kg from the baseline after completion of the study drug. In Group B, there was slight rise in the MBP immediately after intubation, at 1min and it was above the baseline. At 3min the value matches the baseline. At 5 min and 10 min again fall was seen. In Group C, There was fall in mean blood pressure throughout the study period, Less fall was seen immediately after intubation and at 1 min post intubation and it was statistically highly significant as compared to Group B. These findings were found to be similar with our study. None of the patients in our study had hypotension. Our findings match with the study by Allam Hasan *et al.* and Nanda *et al.*^[9, 10].

Conclusion

Dexmedetomidine in the dose of 0.5 µg/kg and 1µg/kg is effective in attenuating the hemodynamic response to laryngoscopy and tracheal intubation.

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