ORIGINAL RESEARCH

Effect of pre-operative dexmedetomidine nebulisation on the hemodynamic response to laryngoscopy and intubation

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ABSTRACT

Introduction: Dexmedetomine is a highly potent alpha -2 receptor agonist.It has sympatholytic ,sedative and analgesic effects thus decreasing the sympathetic tone with attenuation of the hemodynamic responses to anesthesia i.e laryngoscopy and intubation.Various routes have been employed to attenuate the hemodynamic response to laryngoscopy and intubation.Nebulised dexmedetomidine provides an alternative to intravascular and intranasal routes due to its rapid absorption and better bio availability. We contemplated this study to evaluate the effect of nebulised dexmedetomidine in blunting the hemodynamic response to laryngoscopy and intubation. **Methods:** Randomized controlled study was done in 80 patients of ASA physical status 1,aged between 20-50 years of either sex, scheduled for elective surgeries under general anesthesia. Patients were assigned to two equal groups Group N: (Normal saline) patients received 0.9% saline nebulisation (3-4ml), 30 minutes before induction of anesthesia. Group D: (dexmedetomidine) patients received 1microgram/kg dexmedetomidine nebulisation diluted in 3-4ml of 0.9% saline, 30 minutes before induction of anesthesia.Hemodynamic parameters like HR and BP(SBP,DBP,MAP) was measured at various intervals:Before administration of nebulisation, after nebulisation but before induction of anesthesia (baseline),at every 2min interval until 10 min after laryngoscopy. **Results:** Nebulised dexmedetomidine was effective in blunting the haemodynamic response to laryngoscopy and intubation without any adverse effects. The increase in HR was significantly attenuated in the dexmedetomidine group versus saline following intubation .The mean heart rate immediately after intubation was 79.16±13 and at 2,4,6,8,and 10 minutes was76.08±5.89,74.08±4.83,74.2± 5.37,72.33± 4.84 respectively with p value <0.001. There was a statistically significant difference in SBP,DBP and MAP at 2,4,6 and 8 min after intubation in dexmedetomidine group.The decline in SBP was observed at (2min 98.28±12.28, 4min 99.18± 13.66, 6th min 98.9 ± 15.94 and 8th min 106.05± 13.56 with p value <0.001).Similarly, decline in DBP at 2,4,6 and 8 min was (61.15±9.88,63.2± 10.08,61.48 ±10.18 and 66.33± 10.4 with p value <0.001) and decline in MAP at similar time intervals was(75.3 ± 9.87, 75.8 ± 9.66,75.48 ± 11.35 and 80.63 ± 10.75 with p value <0.001). **Conclusion:** Nebulised dexmedetomidine blunts the stress response to laryngoscopy and intubation. Hence in a dose of 1mcg/kg can be used in patients safely without any adverse effect.

Keywords: DexmedetomidineNebulisation,Laryngoscopyandintubation, sympathetic response.

INTRODUCTION

Dexmedetomidine is a potent alpha -2 receptor agonist .It has sedative, anxiolytic, hypnotic, analgesic,anti-sialagogue and sympatholytic effects. It is a more selective alpha -2 agonist with a selectivity ratio for the alpha -2 receptor compared with the alpha -1 receptor of 1600:1.It is used for prolonged sedation and anxiolysis in the ICU, as an adjuant to provide sedation and analgesia in the operating room,withdrwal/detoxification amelioration in adult and pediatric patients.

Direct laryngoscopy and tracheal intubation following induction of anesthesia are associated with hemodynamic changes due to increased sympathoadrenal activity leading to hypertension and or tachycardia. Dexmedetomidine decrease the sympathetic tone, with attenuation of the neuroendocrine and hemodynamic responses to anesthesia and surgery; reduce anesthetic and opoid requirements; and cause sedation and analgesia.

The efficacy of dexmedetomidine in decreasing hemodynamic response to laryngoscopy and intubation has been studied via various routes like intravenous ,intanasal, and intramuscular routes.Use of Nebulised dexmedetomidine provides an alternative to intravenous and intranasal routes.

Nebulisation provides deposition of drug to nasal, oral ,buccal and respiratory mucosa.It has bioavailability of 65% through the nasal mucosa and 82% through the buccal mucosa thus leads to rapid absorption .

The primary aim of this study was to evaluate the effects of nebulised dexmedetomidine on hemodynamics(heart rate) following laryngoscopy and intubation.The secondary aim was to evaluate the effect on the systolic blood pressure response.

MATERIAL AND METHODS

The study was carried out in the department of anesthesiology (ASCOMS and Hospital) after obtaining institutional ethical committee approval and written and informed consent from the patients.

GROUP ALLOCATION

Randomized controlled double blind trial

Patients were assigned to two equal groups.Group N: (Normal saline) patients received 0.9% saline nebulisation (3-4ml), 30 minutes before induction of anesthesia **.**Group D: (dexmedetomidine) patients received 1microgram/kg dexmedetomidine nebulisation diluted in 3-4ml of 0.9% saline, 30 minutes before induction of anesthesia.

The patients with the following criteria were chosen for the study**:**Age (20-50 years),ASA 1,Gender :M/F,elective short duration,non-cardiac, non-neurological procedures with Written and informed consent. .

Pre -anesthetic preparation**:**Pre anesthetic preparation was done one day prior to surgery.Patients weight, height, BMI, baseline parameters like Heart rate, blood pressure were assessed one day prior to surgery.Complete physical examination and airway assessement was done .

Nebulisation procedure:Base line parameters like heart rate and blood pressure were assessed prior to nebulisation.In group D ,3-4 ml of normal saline and dexmedetomidine(1mcg/kg) were prepared according to the individual body weight. Nebulisation was done with a nebulizer 30 minutes prior to induction of anesthesia. Nebulisation continued for 15-20 minutes till no further mist appeared. Whereas in group N, 3-4 ml of normalsaline was used for nebulisation.

After completion of nebulisation , parameters like blood pressure (SBP,DBP)and heart rate were assessed and were considered as baseline.

ANESTHETIC PREPARATION

All patients were given ringers lactate solution @10ml/kg along with premedication of metoclopramide (10mg) i/v,15 minutes prior to surgery .After premedication with ondensetaron 8mg, Induction of anesthesia was carried out using 1-2 mcg/kg fentanyl, 2mg/kg propofol till the attainment of loss of verbal response . After achieving adequate bag and mask ventilation patient was paralysed with depolarizing muscle relaxant succenylcholine 100mg. Intubation was carried on and maintenance was done with isoflurane and intermediate acting non depolarizing muscle relaxant (rocuronium 0.06-0.12mg/kg). The parameters like heart rate and blood pressure(SBP,DBP,HR) were assessed at 2,4,6,8,and 10 minutes after the intubation.The antagonism was achieved by neostigmine 2.5mg and glycopyrrolate 0.4mg iv.

PARAMETERS MONITORED

HR and BP(SBP,DBP,MAP) was measured at various intervals:Before administration of nebulisation, after nebulisation but before induction of anesthesia (baseline),at every 2min interval until 10 min after laryngoscopy.

RESULTS AND OBSERVATION

Statistical analysis was done by using the statistical package IBM SPSS 21. Qualitative data were expressed in terms of percentages and compared by using chi square test where as quantitative data were expressed in terms of mean and standard deviation and compared by using independent t test. A value of $p< 0.05$ was considered as statistically significant other wise non significant.

Table 1: Demography of patients

Parameters	Group D	Group N	p-value
Total no. of patients	40	40	-
Age (in years), mean ± Sd	34.85 ± 7.74	36 ± 8.19	0.521 (N.S)
Male (%)	22	21	0.822 (N.S)
Female (%)	18	19	

Table1:states the comparison of demographic profile between the two groups. the mean age of dexmedetomidine group was 34.85 ± 7.74 years and the normal saline group was 36 ± 8.19years.the percentage of male:female in group D was 22 and 18% respectively where as in group N was 21 and 19 % respectively.the difference between the two groups was not statistically significant.

Table 2: Comparison of baseline parameters between group D and group N

Baseline parameter	Group D		Group N		p-value
	Mean	Sd	Mean	Sd	
SBP	118.3	7.7	121.23	7.27	0.084
DBP	72.1	9.04	75.65	8	0.066
MAP	88.13	7.73	90.53	6.68	0.141
HR	88.6	6.3	91.33	7.98	0.093

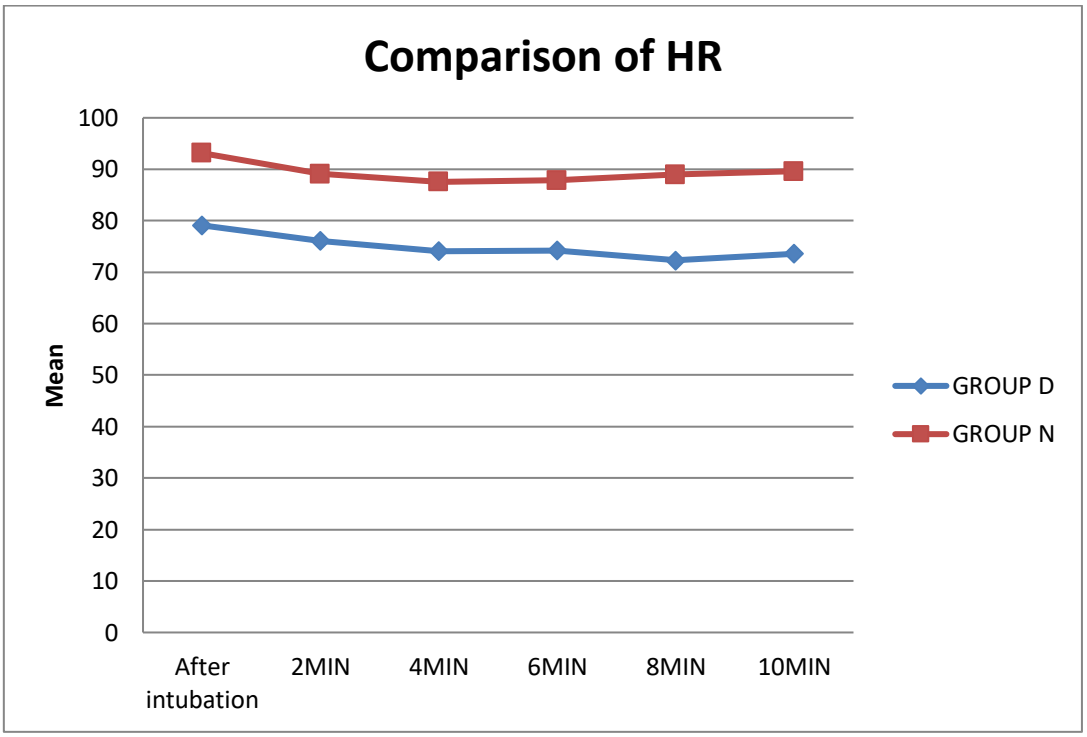
Table 2: states the comparison of baseline parameters obtained after nebulisation between two groups.there was no statistically significant relationship between two groups in terms of BP and HR.

Table 3: Comparison of intra operative HR between the two groups at various intervals of time

Time period of HR	Group D		Group N		p-value
	Mean	SD	Mean	SD	
After intubation	79.1	6.13	93.13	9.55	0.0001*
2MIN	76.08	5.89	89.11	11.11	0.0001*
4MIN	74.08	4.83	87.55	10.15	0.0001*
6MIN	74.2	5.37	87.82	8.84	0.0001*
8MIN	72.33	4.84	89	10.86	0.0001*
10MIN	73.6	4.48	89.58	11.96	0.0001*

Table 3states the mean heart rate difference between the two groups at various time intervals.the observed difference between the two groups was statistically significant at after intubation, 2,4,6,8 and 10th minutes interval.

Fig 1A



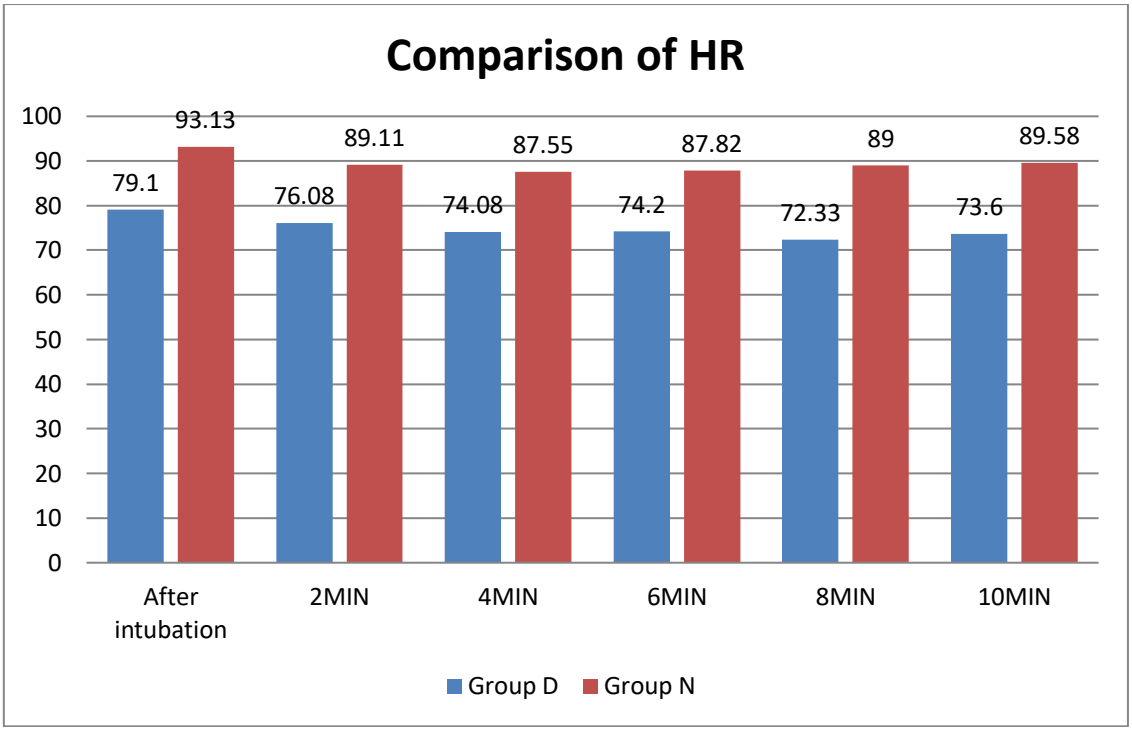


Fig 1B

Table 4: Comparison of intra operative SBP between the two groups at various intervals of time

Time period of SBP	Group D		Group N		p-value
	Mean	SD	Mean	SD	
After intubation	117.9	9.84	121	9.19	0.149
2MIN	98.28	12.28	122.58	10.43	0.0001*
4MIN	99.18	13.66	118.58	11.28	0.0001*
6MIN	98.9	15.94	119.4	12.77	0.0001*
8MIN	106.05	13.56	118.05	13	0.0001*
10MIN	112.2	11.4	117.2	11.36	0.053

Table 4:states the mean systolic blood pressure between the two groups at various time intervals.the observed difference between the two groups was statistically significant at 2,4,6 and 8th minutes.

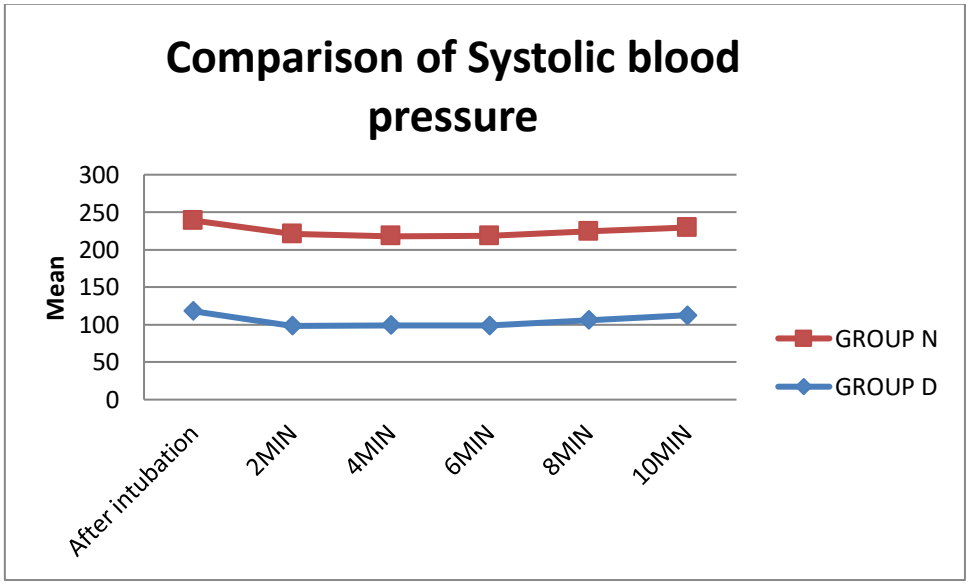


Fig 2

Table 5: Comparison of intra operative DBP between the two groups at various intervals of time

Time period of DBP	Group D		Group N		p-value
	Mean	SD	Mean	SD	
After intubation	71.38	9.03	74.9	10.16	0.105
2MIN	61.15	9.88	75.2	11.03	0.0001*
4MIN	63.2	10.08	72.55	12.25	0.0001*
6MIN	61.48	10.18	72.43	12.8	0.0001*
8MIN	66.33	10.4	72.5	12.67	0.0001*
10MIN	70.33	11.1	72.68	10.73	0.338

Table 5: States the mean diastolic blood pressure between the two groups at various time intervals.the observed difference between the two groups was statistically significant at 2,4,6 and 8th minutes.

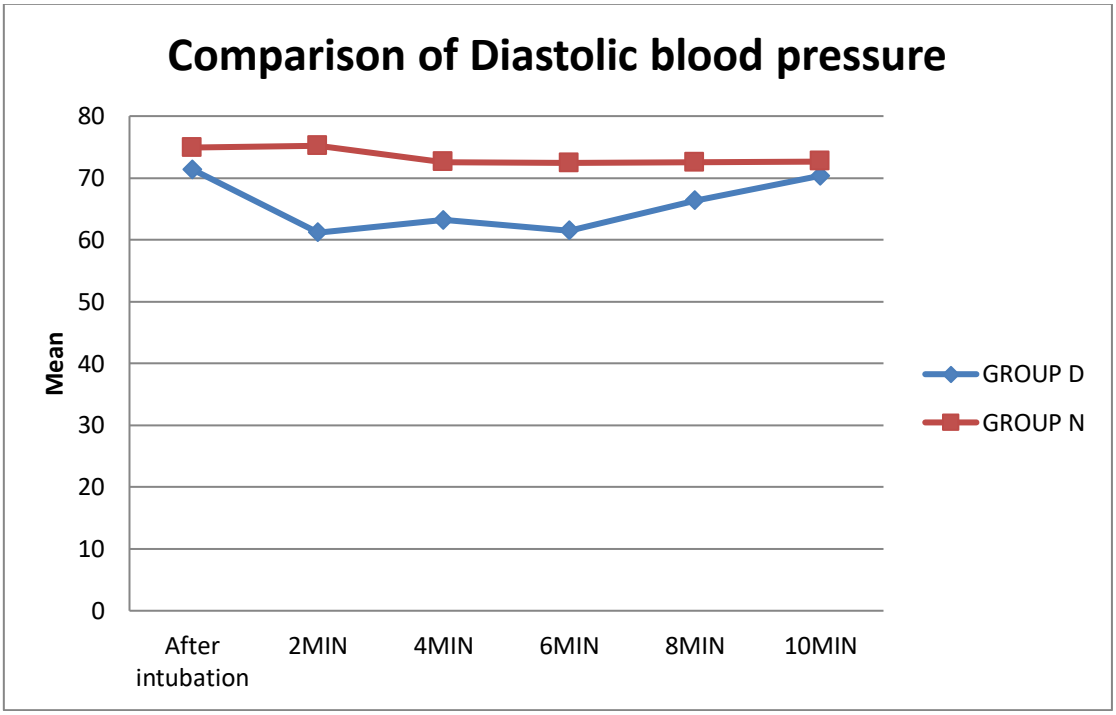
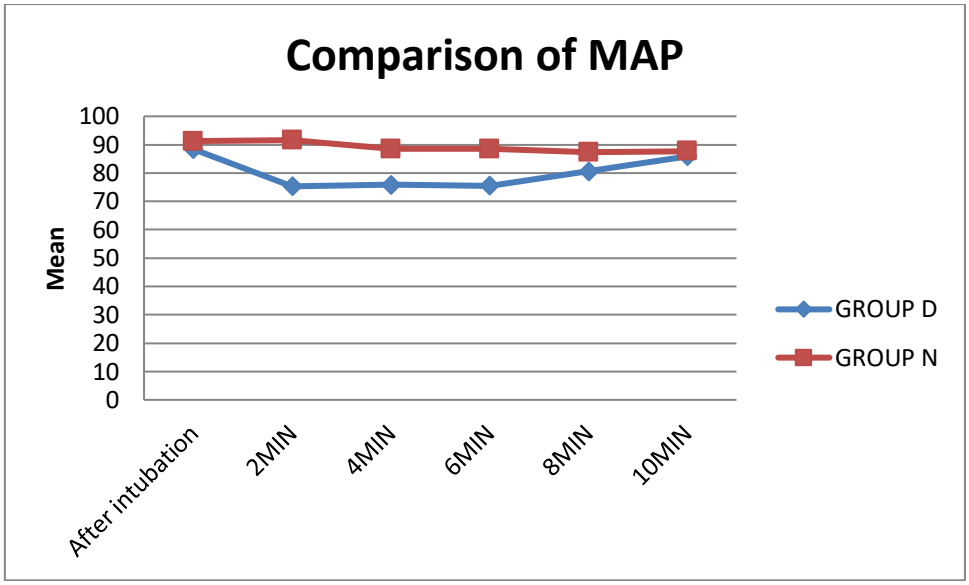


Fig 3

Table 6: Comparison of intra operative MAP between the two groups at various intervals of time

Time period of MAP	Group D		Group N		p-value
	Mean	SD	Mean	SD	
After intubation	88.4	7.12	91.25	8.53	0.108
2MIN	75.3	9.87	91.6	9.54	0.0001*
4MIN	75.8	9.66	88.45	10.64	0.0001*
6MIN	75.48	11.35	88.5	12.06	0.0001*
8MIN	80.63	10.75	87.35	11.8	0.0001*
10MIN	85.95	9.73	87.7	8.94	0.404

Table 6 states the mean arterial blood pressure between the two groups at various time intervals.the observed difference between the two groups was statistically significant at 2,4,6 and 8th minutes.



DISCUSSION

Dexmedetomidine is a useful sedative agent with analgesic properties,hemodynamic stability and ability to recover respiratory function in a mechanically ventilated patients facilitating early weaning. As Alpha -2 adrenoreceptor agonists, they provide an alternative to anesthetic adjuvants because of their anesthetic sparing and hemodynamic stabilizing effects [4].Nebulisation is an alternate method of drug delivery with higher bioavailability, greater ease of administration and less effect on haemodynamics as compared to the intravenous (IV) route. Nebulised dexmedetomidine before induction of anaesthesia was contemplated as it has a very short distribution half-life of 6 min and elimination half-time of 2 h without the adverse haemodynamic effects of IV dexmedetomidine. A dose of 1 µ/kg of dexmedetomidine was chosen in this study as it proved to be clinically effective both by the intranasal and IV routes

In a study conducted by kumar NRR et al., who studied the effect of nebulised dexmedetomidine on hemodynamics following laryngoscopy and intubation. He observed that the MAP values after intubation was lower in dexmedetomidine group ,which was statistically significant with mean, SD and P values of 99.68+-19.22;P 0.001 at 1min,84.08+_13.66 at 5 min and 81.74 +_ 14.97;P 0.008 at 10 min.Within the group ,comparison was statistically significant when compared to baseline values. SBP values after nebulisation and immediately after intubation were comparable in both groups. The SBP values at 1, 5 and 10 min after intubation were lower in group D in a statistically significant manner with *P* values of 0.01, 0.02, 0.03, respectively . DBP values after nebulisation and immediately after intubation were comparable in both groups. The DBP values following laryngoscopy and intubation at 1, 5 and 10 min were lower in group D, which was statistically significant with *P* values of 0.001, 0.001, 0.01, respectively.

This study was similar to our study it was found that nebulised dexmedetomidine was effective in blunting the haemodynamic response to laryngoscopy and intubation without any adverse effects. There was a statistically significant difference in SBP,DBP and MAP at 2,4,6 and 8 min after intubation in dexmedetomidine group and also a statistically significant intra-group decline in SBP,DBP and MAP as compared to the baseline . Such a decrease in in the hemodynamic can be attributed to dexmedetomidine's highly selective α_2 agonistic action that causes a decrease in serum norepinephrine concentration thus leading to a dose-dependent decrease in arterial blood pressure. Although there was no incidence of hypotension observed in dexmedetomidine group.

In a study conducted by Misra S et al., they observed a significant lower trend of increase in heart rate in the dexmedetomidine group versus the saline group, however there was no difference of SBP changes between the 2 groups.

Similar to our study, the increase in HR was significantly attenuated in the dexmedetomidine group versus saline following intubation and 2,4,6,8,and 10 minutes respectively. we did not find any incidence of bradycardia. The absence of bradycardia could probably be explained by the omission of the IV bolus dose of the drug.

Similar to our study ,Hussain M et al., in their study on the effect of nebulised dexmedetomidine on attenuation of hemodynamic responses to laryngoscopy observed that in dexmedetomidine group , the parameters like HR, SBP,DBP,MAP were lower than the baseline value at 3 min time after intubation. There was no incidence of bradycardia and hypotension in dexmedetomidine group after nebulisation with dose of 2mcg/kg .

Thus ,in our study we observed a decreasing trend of decline in hemodynamic parameters from baseline in

dexmedetomidine group.Thus, proved to be beneficial in blunting the hemodynamic response to laryngoscopy and intubation.

CONCLUSION

We concluded that Nebulised dexmedetomidine blunts the stress response to laryngoscopy and intubation. Hence in a dose of 1mcg/kg can be used in patients safely without any adverse effect.

LIMITATIONS

Patients with difficult airway were excluded from the study. Also the response couldnot be assessed in those in which manipulation occurred while intubation.
We did not observed other parameters like sedation, PONV.

REFRENCES

1. Kumar NRR, Jonnavithula N, Padhy S, Sanapala V, Naik VV. Evaluation of nebuliseddexmedetomidine in blunting haemodynamic response to intubation: A prospective randomised study. Indian J Anaesth. 2020;64(10):874-879.
2. Misra S,BeheraBK,MitraJK,Sahoo AK,Jena SS,Srinivasan A.Effect of preoperative dexmedetomidine nebulization on the hemodynamic response to laryngoscopy and intubation: a randomized control trial. Korean Journal of Anesthesiology 2021;74(2):150-157.
3. Hussain M, Arun N,Kumar S,Kumar A,Kumar R,Shekhar S.Effect of dexmedetomidine nebulization on attenuation of hemodynamic responses to laryngoscopy:randomized controlled study.Indian journal of anesthesia and analgesia.2019;6(4):1235-40.
4. Gertler R,Brown HC,Mitchell DH,SilviusEN.Dexmedetomidine :a novel sedative-analgesic agent.Proc(Bayluniv cent).2001;14(1);13-21.
5. El-shmaa NS, El-Baradey GF.The efficacy of labetalol vs dexmedetomidine for attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation.J ClinAnesth.2016;31267-73.
6. Kunisawa T, Nagata O, Nagashima M, Mitamura S, Ueno M, Suzuki A, et al. Dexmedetomidine suppresses the decrease in blood pressure during anesthetic induction and blunts the cardiovascular response to tracheal intubation. J ClinAnesth 2009; 21: 194-9.
7. Scheinin B, Lindgren L, Randell T, Scheinin H, Scheinin M. Dexmedetomidine attenuates sympathoadrenal responses to tracheal intubation and reduces the need for thiopentone and peroperative fentanyl. Br J Anaesth 1992; 68: 126-31.
8. Afonso J, Reis F. Dexmedetomidine: current role in anesthesia and intensive care. Rev Bras Anestesiol 2012; 62: 118-33.
9. Sebastian B, Talikoti AT, Krishnamurthy D. Attenuation of haemodynamic responses to laryngoscopy and endotracheal intubation with intravenous dexmedetomidine: A comparison between two doses. Indian J Anaesth. 2017;61(1):48-54.
10. Sulhyan SR, Vagarali AT, Patil SS, Dixit MD. A comparative clinical study of dexmedetomidine versus placebo to attenuate hemodynamic response to endotracheal intubation in patients undergoing off pump coronary arterial bypass grafting. *J Sci Soc*. 2014;41:151–5.
11. Manne GR, Upadhyay MR, Swadia V. Effects of low dose dexmedetomidine infusion on haemodynamic stress response, sedation and post-operative analgesia requirement in patients undergoing laparoscopic cholecystectomy. *Indian J Anaesth.* 2014;58:726–31.
12. Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous dexmedetomidine in humans. II. Hemodynamic changes. Anesthesiology 1992;77:1134-42.
13. Abdel-Ghaffar HS, Kamal SM, El Sherif FA, Mohamed SA. Comparison of nebuliseddexmedetomidine, ketamine, or midazolam for premedication in preschool children undergoing bone marrow biopsy. *Br J Anesth.* 2018;121:445–52.
14. Surendar MN, Pandey RK, Saksena AK, Kumar R, Chandra G. A comparative evaluation of intranasal dexmedetomidine, midazolam and ketamine for their sedative and analgesic properties: A triple blind randomized study. *J ClinPediatr Dent.* 2014;38:255–61.
15. Sale HK, Shendage VJ. Lignocaine and dexmedetomidine in attenuation of pressor response to laryngoscopy and intubation: A prospective study. *Int J Sci Study*. 2015;3:155–60.
16. Anttila M, Penttilä J, Helminen A, Vuorilehto L, Scheinin H. Bioavailability of dexmedetomidine after extravascular doses in healthy subjects. Br J ClinPharmacol. 2003 ;56(6):691-3.
17. Paranjpe, Jyotsna S.. Dexmedetomidine: Expanding role in anesthesia. Medical Journal of Dr. D.Y. Patil University 6(1):p 5-13, 2013.