Original Research Article

A comparative study to evaluate the efficacy of dexmedetomidine with normal saline in attenuating sympathoadrenal response to laryngoscopy and tracheal intubation

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Abstract

Introduction: Laryngoscopy and endotracheal intubation often provoke an undesirable increase in arterial blood pressure and/or heart rate[1,2,3]. Alpha 2-adrenergic agonists like dexmedetomidine have been extensively used to suppress the hemodynamic response to laryngoscopy and endotracheal intubation.
Methods: The study was conducted among 60 ASA grade I and II patients between 18-60 years of age, scheduled for elective surgeries under general anaesthesia. The study population was subdivided randomly into 2 groups each consisting 30 patients. Group D received Dexmedetomidine 0.5mcg/kg IV diluted to 10 ml with normal saline. Group S received Normal saline 10 ml IV.
Results: There was a significant fall in HR in group D at 5 and 10 minutes after drug administration. The mean HR increase observed at 1, 3, 5 and 10 minutes after intubation in group NS was statistically significant. The mean SBP values at 5 and 10 minutes after drug administration were significantly low in group D. The increase in SBP in group NS at 1, 3, 5 and 10 minutes after intubation was statistically significant. The mean DBP values at 5 and 10 minutes after drug administration were significantly low in group D. The increase in DBP in group NS at 1, 3, 5 and 10 minutes after intubation was statistically significant. There was a significant difference in MAP values at 5 and 10 minutes after drug administration which was statistically significant. The increase in MAP in group NS was statistically significant at 1, 3, 5 and 10 minutes after intubation.
Conclusion: We conclude that Dexmedetomidine 0.5 µg/kg before laryngoscopy and endotracheal intubation effectively attenuates the hemodynamic response as compared to normal saline without major adverse effects.

Keywords: Dexmedetomidine, laryngoscopy, endotracheal intubation, sympathoadrenal response

Introduction

Laryngoscopy and endotracheal intubation induce a sympathetic response resulting in a rise in serum catecholamines [1]. Laryngoscopy and tracheal intubation often provoke an undesirable increase in arterial blood pressure (BP) and/or heart rate (HR) [2, 3]. The hemodynamic response is exaggerated in hypertensive patients even though rendered normotensive pre-operatively by antihypertensive medication [4]. Intravenous anaesthetic induction agents do not adequately or predictably suppress the hemodynamic responses induced by laryngoscopy and tracheal intubation [5]. The alpha 2-adrenergic agonists provide sedation, anxiolysis, hypnosis, analgesia and sympatholysis [6]. This highly selective alpha 2 agonist has a set of unique effects that include titratable sedation, sympatholysis and analgesia without significant respiratory depression [7]. Originally approved as a sedative in the intensive care unit (ICU), it has found many off-label applications in the ICU, the operating room and perioperative environment [8]. The aim of the study was to assess the efficacy of dexmedetomidine in attenuating sympathoadrenal response to laryngoscopy and tracheal intubation.

Objectives

To assess the efficacy of dexmedetomidine in attenuating sympathoadrenal response to laryngoscopy and tracheal intubation.

Methodology

A comparative, randomised, double blinded study was carried out on 60 ASA physical status grade I and II patients of either sex between 18-60 years of age, scheduled for elective surgeries under general anaesthesia. The study was conducted in department of Anaesthesiology, BMCH, Chitradurga. After the approval by the Institutional Ethical Committee on 16th January 2021 numbered 2020-2021/97, written informed consent was obtained from all the patients before being included in the study. Sampling was done by Simple Random Sampling using computer generated table. Sample size was calculated using OPEN EPI software (AG Dean, KM Sullivan, MM Soe-3.03/September 22, 2014) with Significance level of 95%, Power of 80% Allocation ratio of 1 and Odds ratio of 4. Percentage of normal saline group effectiveness was 15% [10]. Therefore, a sample size of 30 in each group was considered. Patient's willing to participate in the study aged between 18 to 60 years of either sex with ASA I or ASA II scheduled for elective surgical procedures under general anaesthesia and Mallampati grade I and II were included in the study. Patients not willing to participate in the study, pregnant and lactating mother, patient's with morbid obesity, heart block, hypertensive, diabetes mellitus, hepato-renal disturbances, patient's with known allergic reaction to any of the study medications, patient's recently using sedatives or analgesics, patient's with significant laboratory abnormalities, patients with anticipated difficult intubation were excluded from the study.

The study population was subdivided randomly into 2 groups each consisting 30 patients. Group D each consisting of 30 patients received Inj. Dexmedetomidine 0.5mcg/kg IV diluted to 10 ml with normal saline. Group S each consisting of 30 patients received Normal saline 10 ml IV. Both the drugs administered 10 minutes before intubation. Statistical Analysis was done using Statistical package for social sciences (SPSS) software version 20. Results of categorical variables was presented using proportions and analysed using Chi square test or Fisher's exact test as appropriate. Results of continuous variables was presented as means and analysed using t-test or Mann Whitney test.

Pre-anesthetic evaluation was done a day prior to surgery. Routine investigations will be done

in patients as required. Patient was kept nil per oral 8 hours before the surgery.

Patient shifted on to OT table, connected to multi parameter monitor with HR, noninvasive measurements of systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), temperature probe and continuous ECG monitoring and oxygen saturation. Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), oxygen saturation (SpO2), were recorded after 5 minutes by an anaesthesiologist who was blinded for the study. After securing an 18G intravenous (IV) cannula, patients were randomly assigned by computer generated random table number to receive either, dexmedetomidine 0.5mcg/kg IV in 0.9% normal saline to a total volume of 10ml (Group D) or 10ml of 0.9% normal saline (NS) IV (Group S). Both the drugs were prepared by an anaesthesiologist who are not involved in the study and observer was blinded for the study and syringes were labelled as study drug. All the study vital parameters required were recorded at an interval of 1 minute upto 10 minutes before intubation followed by each minute monitoring upto 20 minutes and every 2 minutes monitoring upto 30 minutes after intubation. All patients were premedicated with Inj. Fentanyl 2mcg/kg IV; Inj. Ondansetron 0.08mg/kg IV; Inj. Ranitidine 40mg IV; Inj. Glycopyrrolate 0.005 mg/kg IV and pre-oxygenated with 100% oxygen for 3 minutes before induction. After 10 minutes of the administration of the study drug, anaesthesia was induced with Inj. Propofol 1% solution and the dose sufficient to abolish eyelash reflex was recorded, followed by Inj. Succinyl choline 2mcg/kg IV was administered to facilitate intubation and produce muscle relaxation. After achieving adequate neuro muscular relaxation (after attaining Gudel's stage 3), intubation was done. Intubation was carried out with an appropriate sized disposable, high volume low pressure cuffed PVC endotracheal tube. After confirmation of the tracheal intubation with auscultation of the chest for bilateral air entry and using $ETCO_2$, the tube was secured and connected to closed circuit and anaesthesia was maintained with 66% nitrous oxide, 34% oxygen and Isoflurane 0.6%, maintenance dose of Vecuronium with a tidal volume of 8-10ml/kg and a respiratory rate of 10-12 breaths per min. At the end of the surgery, the patients were reversed with Inj. Neostigmine 0.05mg/kg and Inj. Glycopyrrolate 0.01 mg/kg IV. The patients were extubated after attainment of extubation criteria and shifted to the recovery. Any adverse effects related to the drug and anaesthesia was noted and attended to appropriately with necessary drugs.

Adverse effects

Hypotension was defined as MAP/SBP $</= 30\%$ of the baseline value, was treated with simultaneous fluid bolus and vasopressors like phenylephrine (100μg) or Mephentermine (6 mg) bolus and repeated as necessary. Hypertension-defined as MAP/SBP $>/= 30\%$ of the baseline value, was treated after checking for the depth of anaesthesia, if inadequate was treated with beta blockers (i.e., IV Metaprolol 0.5mg/kg) and repeated as necessary. Tachycardia-defined as HR $>/= 25\%$ of the baseline value. Bradycardia-defined as HR $<$ 60bpm was treated with IV atropine 0.6 mg bolus dose and repeated as necessary. Arrhythmia -defined as supra ventricular or a ventricular beats $> 3/min$ or a rhythm other than sinus. Patients were followed up post-operatively on an hourly basis for 6 hours from drug administration.

Complications

Any airway complications caused by intubation like laryngospasm, bronchospasm, presence of blood in the oral cavity, lip and dental injury, any aspiration were recorded throughout the surgery and after extubation. Each patient was questioned to determine any of the following complications (in recovery room and 24 hours postoperatively) like sore throat (constant pain,

independent of swallowing), dysphagia (difficulty or pain with swallowing), dysphonia (difficulty or pain with speaking), numbness of the tongue or the oropharynx.
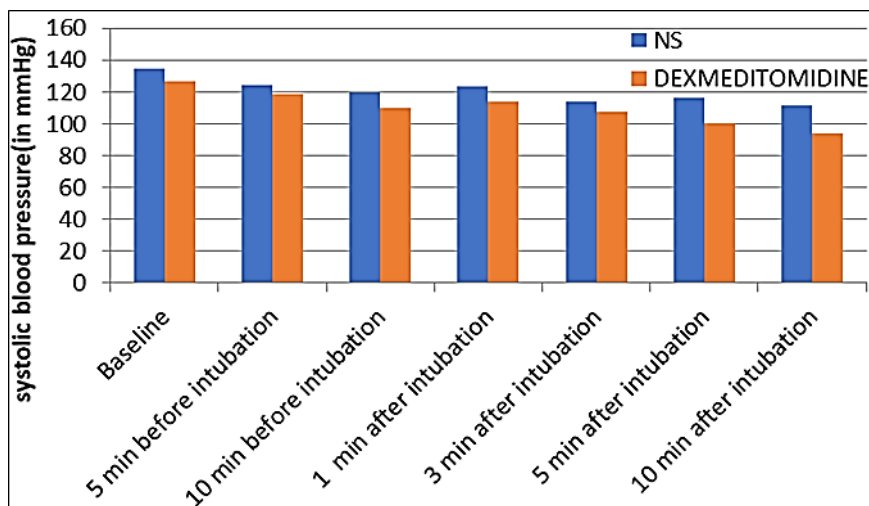
Results

The basal HR was comparable in both groups (p=0.045). There was a significant fall in HR in group D at 5 and 10 minutes after drug administration when compared to group NS. The mean HR increase observed at 1, 3, 5 and 10 minutes after intubation in group NS was statistically highly significant compared to group D (p=0.000).
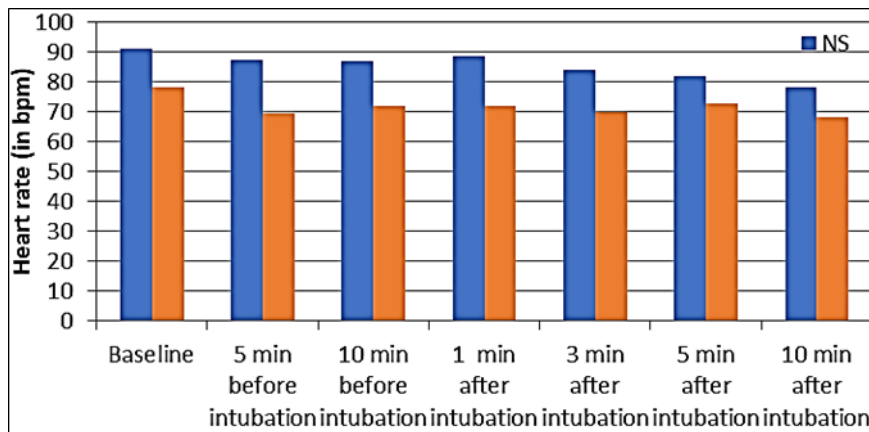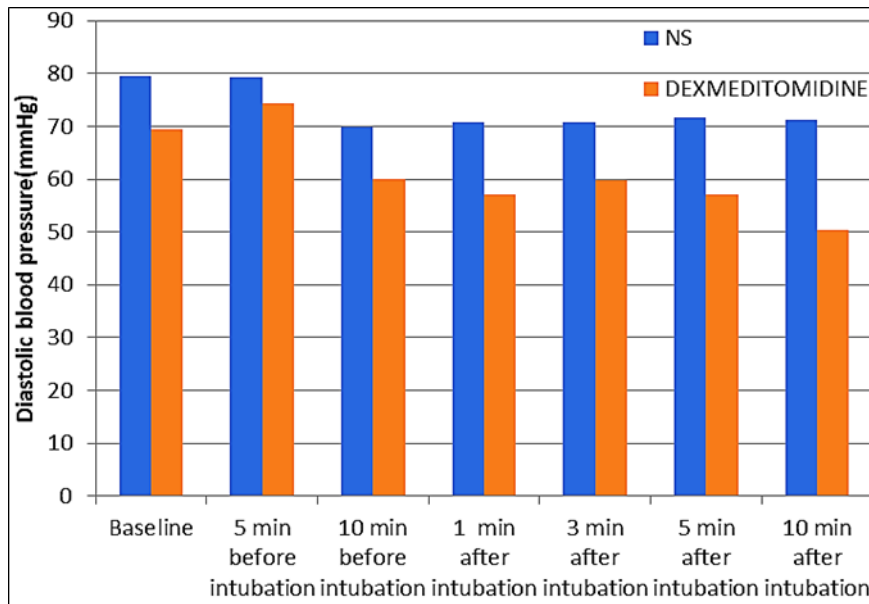

Graph 1: Comparison of basal HR between the two groups

The mean SBP were comparable in both groups (p=0.207). The mean SBP values at 5 and 10 minutes after drug administration were significantly low in group D (p=0.000) compared to group NS. The increase in SBP in group NS at 1, 3, 5 and 10 minutes after intubation was statistically highly significant (p=0.000) compared to group D.


Graph 2: Comparison of Systolic blood pressure between two groups

The mean basal DBP were comparable in both groups (p=0.9614). The mean DBP values at 5 and 10 minutes after drug administration were significantly low in group D (p=0.000) compared to group NS. The increase in DBP in group NS at 1, 3, 5 and 10 minutes after intubation was statistically highly significant (p=0.000) compared to group D.

Graph 3: Comparison of Diastolic blood pressure between the two groups

The mean basal MAP were comparable in both groups (p=0.003). There was a significant difference in MAP values at 5 and 10 minutes after drug administration which was statistically highly significant (p=0.000). The increase in MAP in group NS was statistically highly significant at 1, 3, 5 and 10 minutes after intubation (p=0.000) compared to group D.
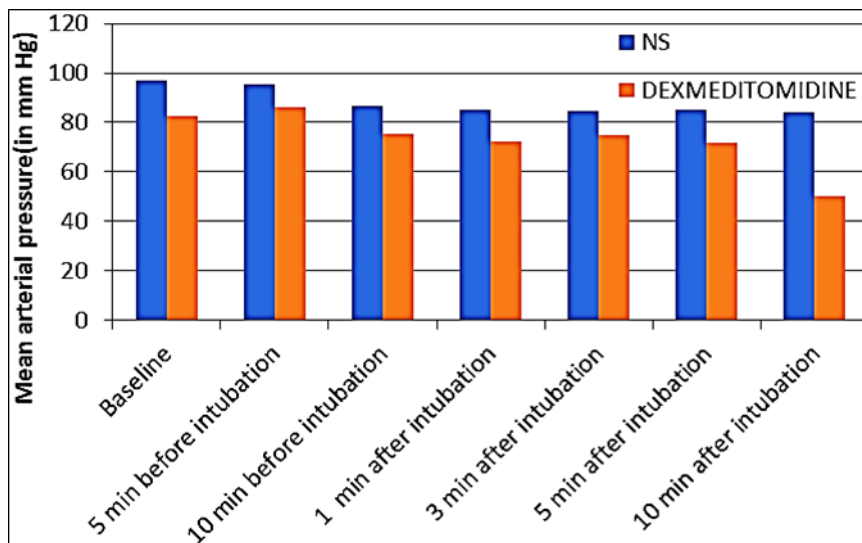
Graph 4: Comparison of Mean arterial blood pressure between the two groups

Discussion

Immediately after laryngoscopy and intubation, there was an increase in mean HR measuring 71.66/min in Group D and 85.35/min in Group NS. The increase was more in group NS than group D. Similarly, increase in mean SBP measuring 110.15 mm Hg and 120.50 mm Hg in Group D and NS respectively. Increase in SBP was more in NS group than in Dexmedetomidine group. It was statistically significant. DBP also showed a increase to a mean value of 61.11mm Hg in Group D and 73.30 mm Hg in Group NS. The rise in DBP was more in the NS group. MAP also showed a increase to a mean value of 73.15 mm Hg in Group D and 88.17 mm Hg in Group NS. The rise in MAP was more in the NS group. The results of the present study show that the preinduction administration of single dose of

dexmedetomidine of 0.5mcg/kg IV resulted in significant attenuation of cardiovascular responses to laryngoscopy and endotracheal intubation. In contrast to the previous studies where dexmedetomidine in a dose range of 1-2 mcg/kg was used, we decided to use 0.5 mcg/kg because, in preliminary study using a dose of 1 mcg/kg, we observed significant bradycardia and hypotension requiring pharmacological intervention in the majority of our patients. A search of available literature revealed few studies evaluating the role of lower doses of dexmedetomidine (0.5-0.6 mcg/kg) in attenuation of pressor responses.

Gerlach AT *et al*. concluded that intravenous dose of Dexmedetomidine 1 µg/kg significantly blunted the heart rate and blood pressure response at 1 min, 2 min and 5 min after laryngoscopy and endotracheal intubation when comparing with control group while in our study same results were found at 1, 3, 5 and 10 min after laryngoscopy and endotracheal intubation at a low dose of Dexmedetomidine 0.5 µg/ kg without any adverse side effects [9].

Madhusudhan *et al*. in 2016 selected 60 patients scheduled for elective surgery under general anaesthesia. Authors concluded that Dexmedetomidine 1mcg/kg is more effective in attenuating hemodynamic pressure responses to laryngoscopy and intubation than 2mcg/kg fentanyl when given as premedication which in our study similar results were obtained with a Dexmedetomidine dose of 0.5 mcg/kg I.V [10].

Conclusion

Our present study concludes that Dexmedetomidine in a dose of 0.5 µg/kg before laryngoscopy and endotracheal intubation effectively attenuates the hemodynamic response as compared to placebo (normal saline) without major adverse effect in ASA physical status I and II of aged 18-65 years patient undergoing general anaesthesia for different elective surgical procedures.

References

1. Reid LC, Brace DE. Irritation of the respiratory tract and its reflex effect upon heart. Surg. Gynaec & Obst. 1940;70:157-62.
2. Fox EJ, Sklar GS, Hill CH. Complications related to pressor response to endotracheal intubation. Anaesthesiology. 1977;47:524-5.
3. Chraemmer-Jorgensen B, Hertel S, Strom J, Hoilund-Carlsen PF, Bjerre-Jepsen K. Catecholamine response to laryngoscopy and intubation. Anaesthesia. 1992;47:750-6.
4. Prys-Roberts C. Anaesthesia and hypertension. Br J Anaesth. 1984;56:711-24.
5. Atlee JL, Dhamee MS, Olund TL, Georrge V. The use of esmolol, nicardipine, or their combination to blunt hemodynamic changes after laryngoscopy and tracheal intubation. Anesth Analg. 2000;90:280.
6. Bhana N, Goa KL, McClellan KJ. Dexmedetomidine. Drugs. 2000;59:263-8.
7. Virtanen R, Savola JM, Saano V, Nyman L. Characterization of the selectivity, specificity and potency of medetomidine as an alpha 2 adrenoceptor agonist. Eur J Pharmacol. 1988;150:9-14.
8. Tobias JD. Dexmedetomidine: applications in pediatric critical care and pediatric anesthesiology. Pediatr Crit Care Med. 2007;8:115-31.
9. Gerlach AT, Dasta JF. Dexmedetomidine: an updated review. Ann Pharmacother. 2007;41:245-52.
10. Madhusudan M, Lavakumar A, Rao MH, Samantaray A, Charupalli K. Effect of intravenous dexmedetomidine on haemodynamic responses to laryngoscopy, tracheal intubation and anaesthetic and analgesic requirements: a randomized double-blind clinical efficacy study. J Clin Sci Rez. 2016;5:205-13.