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RESEARCH ARTICLE
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ATTENUATION OF HAEMODYNAMIC RESPONSES TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION WITH INTRAVENOUS DEXMEDETOMIDINE BETWEEN TWO DOSES: A RANDOMIZED DOUBLE BLIND PROSPECTIVE STUDY

Dr. Chethan P.L.[1], Dr. N.S. Shruthi[2], Dr. Nikila Devarayasamudram Gopal[3], Dr. Shobha Devendrappa Yavagal[4*]

[1]Postgraduate, Department of Anaesthesia, SIMS & RC Bangalore, Karnataka, India.
[2]Assistant Professor, Department of Anaesthesia, SIMS & RC Bangalore, Karnataka, India.
[3]Associate professor, Department of Anaesthesia, SIMS & RC Bangalore, Karnataka, India.
[4*]Assistant Professor, Department of Anaesthesia, SIMS & RC Bangalore, Karnataka, India.

***Corresponding Author:** Dr. Shobha Devendrappa Yavagal
*Assistant Professor, Department of Anaesthesia, SIMS & RC Bangalore, Karnataka, India

ABSTRACT

Aim: The aim of the present study is to determine an optimal dose of IV dexmedetomidine by comparing different doses of the drug in terms of attenuation of haemodynamic stress response to laryngoscopy and endotracheal intubation.

Methods: This Randomized Double blind prospective clinical study was conducted at Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka for the period of 6 months. The sample size calculated in each group was 35.Group A: IV dexmedetomidine 0.3 µg/kg diluted to 20 ml with normal saline was given over 10 min.Group B: IV dexmedetomidine 0.5 µg/kg diluted to 20 ml with normal saline was given over 10 min.

Results: The mean age in group A and group B were 34.46±8.22 and 37.83±9.41 years respectively. 51.4% were males and 48.6% were females in both the groups. In both the groups, heart rate and SBP showed statistically significant result in 1 minute, 3 minutes and 5 minutes respectively.The sedation scores were more in Group B as compared to Group A.

Conclusion: The use of 0.5µg / kg dexmedetomidine as an intravenous infusion is associated with reduced postoperative pain and appropriate hemodynamic stability during surgery, and this dose seems to be effective in preventing acute postoperative pain.

Keywords: optimal dose of IV, dexmedetomidine, different doses, attenuation of haemodynamic stress, laryngoscopy, endotracheal intubation

INTRODUCTION

The heightened cardiovascular reflexes, characterized by increased heart rate (tachycardia) and elevated blood pressure (hypertension), caused by the unpleasant stimulation of laryngoscopy and intubation might be harmful for individuals with cardiovascular and cerebrovascular conditions.[1] Anaesthesiologists have experimented with various medicines and procedures to reduce the stress reaction during laryngoscopy and endotracheal intubation. Some studies have used α-2 agonists, such as clonidine and dexmedetomidine, to reduce the stress response to laryngoscopy. Only a small number of writers have administered dexmedetomidine at a dosage of 0.5 and 1 µg/kg and observed

its efficacy in reducing the stress reaction to laryngoscopy and endotracheal intubation.[2-4] While the researchers discovered encouraging outcomes, the administration of a larger dosage of 1 μg/kg was linked to a higher occurrence of cardiovascular issues, including hypotension and bradycardia.[3,4] Furthermore, it has been shown that there is a correlation between it and heightened sedation.[5]

Procedures such as direct laryngoscopy, tracheal intubation, and extubation cause intense sympathetic activation. In addition, the use of pneumoperitoneum and carbon dioxide insufflation, which are necessary in laparoscopic procedures, results in an elevation in plasma nor-epinephrine, epinephrine levels, and plasma renin activity.[6] The aforementioned alterations result in elevated heart rate, blood pressure, systemic and pulmonary vascular resistance, and diminished cardiac output. The reverse Trendelenburg position, which is necessary for surgery, results in decreased venous return and thus, a further decrease in cardiac output.[7] The alterations in blood flow dynamics make the heart muscle more susceptible to inadequate blood supply, which might potentially be fatal in a susceptible patient. Contemporary anesthesia procedures aim to limit the release of sympathetic activity and maintain stable blood flow throughout the perioperative period. Several medications, such as opioid analgesics, benzodiazepines, beta blockers, calcium channel blockers, and vasodilators, have been used to attain this goal with varying degrees of effectiveness. Recently, there has been a significant interest in using α2 agonists in anesthesia practice due to its ability to reduce anxiety, induce sedation, decrease sympathetic activity, and preserve analgesic effects.[8]

Dexmedetomidine, which was first developed for human usage in 1999, is a selective α2 agonist that has 8 times more affinity for α2 adrenergic receptors than clonidine. It exhibits all the features of an α2 agonist without causing respiratory depression.[9,10] The use of dexmedetomidine by intravenous route during the perioperative phase has been seen to reduce blood catecholamine levels by 90%.[11,12] The purpose of this intervention is to reduce the physiological reaction to laryngoscopy, tracheal intubation, pneumoperitoneum, and extubation. Additionally, it aims to induce drowsiness without causing respiratory depression and to lessen the amount of pain medication needed after surgery.[13]

The objective of this research is to establish the most effective dosage of intravenous dexmedetomidine by evaluating various dosages of the medication in terms of reducing the physiological stress response to laryngoscopy and endotracheal intubation.

MATERIALS AND METHODS

This Randomized Double blind prospective clinical study was conducted at Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka for the period of 6 months.

Inclusion criteria

- American Society of Anesthesiologists (ASA) Physical Status 1
- Age group of 18 –50 years of either sex
- Patient posted for elective surgeries under general anaesthesia

Exclusion criteria

- Patients who were physically dependent on narcotics, those with a history of bronchial asthma, drug or alcohol abuse, known drug allergy to either clonidine or dexmedetomidine
- Any predicted difficult airway

Methodology

After obtaining Institutional Ethical Committee clearance and written informed consent was obtained.The sample size in each group sample size calculated was 35. Patients scheduled for elective surgical procedures under general anaestheia in Sapthagiri institute of medical sciences and research centre.

Patients were randomly divided into two groups of thirty-five each.A day prior, pre-operative visit was made and through clinical evaluation was done.The double-blinding was done, in which the person administering the drug and the patient both were unaware as to which group the patient

belonged to.Patients were randomly allocated into either group A or Group B using computer generated table.

- Group A: IV dexmedetomidine 0.3 μg/kg diluted to 20 ml with normal saline was given over 10 min.
- Group B:IV dexmedetomidine 0.5 μg/kg diluted to 20 ml with normal saline was given over 10 min.

All patients are monitored with electrocardiography, pulse oximetry and non-invasive blood pressure.Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP) and oxygen saturation (SpO2) were measured.IV glycopyrrolate 0.2 mg and IV ondansetron 50 μg/kg were given half an hour before induction.After 10 min, study drug infusion was given over 10 min. Any hypotension (SBP fall >20% from the baseline) was treated with increments of IV mephentermine 3 mg, and incidence of bradycardia (HR<50 beats) was treated with IV atropine 0.6 mg. After completion of drug infusion, sedation was assessed at 2-, 5- and 10-min using Ramsay sedation score.After noting the sedation scores and monitoring the haemodynamics for 10 min, the anaesthetic procedure was initiated.All the patients were pre-oxygenated for 3 min. General anaesthesia technique is standardised for all the two groups.Then, patients are induced with IV propofol 2 mg/kg bodyweight with IV lignocaine (preservative free) in concentration of 0.1% (1 mg of lignocaine to 1 ml of propofol), IV fentanyl 2 μg/kg and IV Vecuronium 0.1mg/kg.Patients were mask ventilated for 3 mins.Following laryngoscopy and endotracheal intubation, the parameters recorded were HR, SBP, DBP and MAP at 1, 3 and 5 min after intubation.Anaesthesia was maintained with O2 and air and isoflurane to maintain MAC of 1.2 Muscle relaxation was maintained with IV vecuronium 0.1 mg/kg with top ups of 0.04 mg/kg. After surgery, reversal was achieved with IV neostigmine 0.05 mg/kg and IV glycopyrrolate 0.01 mg/kg. After adequate recovery, patients were shifted to post-anaesthesia care unit and monitored for 12 h and later shifted to ward.

Statistical Analysis

The data were entered in Microsoft Excel and analysis of the data was carried out with the help of SPSS version 22. Descriptive and inferential statistics was done accordingly.

RESULTS

Groups	Mean age (years) ±SD	Male	Female
GroupA	34.46±8.22	18 (51.4%)	17 (48.6%)
GroupB	37.83±9.41	18 (51.4%)	17 (48.6%)

Table 1: Demographic details

The mean age in group A and Group B were 34.46±8.22 and 37.83±9.41 years respectively. 51.4% were males and 48.6% were females in both the groups.

HR(beats/ min)	GroupA	GroupB	*P*
Baseline	80.38±5.65	82.48±6.34	0.634
1min	110.22±5.7	84.56±5.40	<0.001
3min	104.06±4.60	83.72±4.96	<0.001
5min	93.87±5.08	78.46±4.66	<0.001

Table 2: Comparison of heart rate

In both the groups, heart rate showed statistically significant result in 1 minute, 3 minutes and 5 minutes respectively.

SBP(mmHg)	GroupA	GroupB	*P*
Baseline	128.07±7.90	128.73±9.82	0.55
1min	160.13±6.08	134.60±9.74	<0.001
3min	148.33±5.87	129.87±9.75	<0.001
5min	139.60±4.94	126.07±9.78	<0.001

Table 3: Comparison of systolic blood pressure

In both the groups, SBP showed statistically significant result in 1 minute, 3 minutes and 5 minutes respectively.

DBP(mmHg)	GroupA	GroupB	*P*
Baseline	76.40±6.94	77.27±4.91	0.220
1min	91.27±6.02	81.67±4.52	<0.001
3min	88.13±5.63	76.67±4.62	<0.001
5min	84.67±5.21	74.33±4.52	<0.001

Table 4: Comparison of diastolic blood pressure

In both the groups, SBP showed statistically significant result in 1 minute, 3 minutes and 5 minutes respectively.

Sedation	GroupA			GroupB		
Score	2 min.	5 min.	10 min.	2 min.	5 min.	10 min.
1	7	5	2	0	0	0
2	26	27	30	20	17	14
3	2	3	3	15	17	21
4	0	0	0	0	2	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0

Table 5: Sedation Scores

The sedation scores were more in Group B as compared to Group A.

DISCUSSION

Intravenous anaesthesia is extensively used in spinal surgery.[14] Certain α2-adrenoreceptor agonists have been used as the only analgesic medication both during and after surgical procedures.[15] Dexmedetomidine is a potent agonist for the α2-adrenoreceptor that specifically targets and activates this receptor. It has sedative, anxiolytic, and analgesic qualities, while without causing any negative effects on respiratory function.[16,17] The relatively brief duration of it's effects (plasma half-life of around 2-3 hours) in comparison to clonidine, together with it's ability to sustain anaesthesia, has resulted in the use of dexmedetomidine as a supplementary agent in general anaesthesia.[18] Dexmedetomidine is often used as a supplementary agent for intravenous anaesthesia based on propofol.[19,20]

The average age in Group A and Group B was 34.46±8.22 and 37.83±9.41 years, respectively. 51.4% were males and 48.6% were females in both the groups. Heart rate and SBP exhibited statistically significant results at 1 minute, 3 minutes, and 5 minutes in both groups. Group B had higher sedation ratings in comparison to Group A. Smitha et al. allocated 90 patients eligible for surgery under general anaesthesia into three groups (30 patients in each group) using 0.5 μg / kg, 1 μg / kg dexmedetomidine, and normal saline. They then assessed the impact of these substances on the patients' haemodynamics during laryngoscopy. According to the findings of the research, the average blood pressure during systole, diastole, mean arterial pressure, and heart rate in the group that received 1 μg / kg dexmedetomidine was considerably lower compared to the other two groups. The research determined that administering 0.1 μg / kg of dexmedetomidine is more favourable than administering 0.5 μg / kg of dexmedetomidine for maintaining stable blood pressure during laryngoscopy.[21] Another research

done by Jarineshin et al. examined the impact of two dosages, 0.5 and 0.1 μg, of dexmedetomidine on the haemodynamics of patients undergoing laryngoscopy with a control group. In the research described, the average systolic, diastolic, and heart rate blood pressure was notably reduced in the group that got 1 μg / kg dexmedetomidine compared to the group that received 0.5 μg / kg dexmedetomidine and the control group.[22] Park et al[23] examined the impact of two different intravenous dosages of dexmedetomidine (0.5 and 0.1 μg / kg) on the haemodynamics of elderly individuals who had spinal anaesthesia surgery. Patients who were administered a dosage of 0.5 μg / kg dexmedetomidine had reduced postoperative pain intensity. However, there were no significant differences seen across the groups in terms of other postoperative problems such as nausea and vomiting. The research done by Momeni et al[24] examined the impact of administering 0.2 μg / kg dexmedetomidine on pain, postoperative complications, and haemodynamics in patients undergoing CABG. In the aforementioned research, including 40 patients in each group, there was a considerable disparity in the post-surgical morphine consumption between the two groups. Specifically, the dexmedetomidine group exhibited a considerably lower level of morphine consumption compared to the control group. The postoperative pain level in the dexmedetomidine group was markedly lower compared to the placebo group, and the extubation duration in the dexmedetomidine group was notably shorter than that in the placebo group.

CONCLUSION

The administration of 0.5 μg/kg of dexmedetomidine by intravenous infusion has been linked to a reduction in postoperative pain and the maintenance of optimal haemodynamic stability before, during, and after surgical procedures. Furthermore, this dosage seems to be useful in reducing acute postoperative discomfort.

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