Original Research Article

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Attenuation of Stress Response during Intubation for Laparoscopic Procedures: A Comparative Study between Intravenous Dexmedetomidine and Lidocaine

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Abstract

Introduction: During laryngoscopy and endotracheal intubation, one of the most dreaded complications is hemodynamic instability which is a well-archived certainty and this response in most susceptible patients induces myocardial ischemia or infarction, left ventricular failure and cerebral hemorrhage due to the strong sympathetic response during the procedure. *The aim of the study:* This study was aimed to compare the effect of dexmedetomidine and lidocaine on hemodynamic response to laryngoscopy and endotracheal intubation in patients undergoing elective laparoscopic procedures under general anaesthesia. *Materials and Methods:* A total of sixty patients were selected and randomized into two groups of thirty patients each: dexmedetomidine-intervention group and lidocaine-control group. Inj. Dexmedetomidine by means of infusion pump was given prior to anesthetic induction, at a rate of 1 μg/kg IV over a period of 10 min, to all intervention group patients. Three minutes after the completion of infusion, patients were induced with general anaesthesia. As a standard procedure, plain preservative-free 2% lidocaine was given at a rate of 1.5 mg/kg IV bolus to all patients in the control group 1.5 minutes prior to laryngoscopy. Baseline parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial blood pressure (MAP), were recorded before administration of the drugs under study, at intubation, and at 1 min & 3 min after intubation. *Results:* The changes in mean heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure values were significantly lower in Dexmedetomidine group when compared to the lidocaine group. *Conclusions:* Dexmedetomidine when used as a pre-anesthetic medication significantly suppresses the sympathoadrenal response to laryngoscopy and endotracheal intubation without influencing intraoperative cardiovascular stability.

Keywords: Dexmedetomidine; Endotracheal Intubation; Hemodynamic Response; Laryngoscopy.

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Introduction

The word laparoscopy has its origin from the ancient Greek word *lapara* which literally means "flank or side". In this modern era, it has become the gold standard operating procedures for ovarian cystectomy, appendectomy, tubal ligation, and cholecystectomy [1]. Surgeons and patients prefer laparoscopic procedures over open procedures as they offer several advantages which include shorter hospitalization, can be carried out as a day care procedure, better cosmetics, faster recovery and reduced risk of postoperative adhesions. The method of laparoscopy basically includes creating a pneumoperitoneum utilizing carbon dioxide (CO_2) which is associated with different pathophysiological changes, especially involving

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the cardiovascular and respiratory systems. These changes manifest as an increase in heart rate, arterial pressure, systemic vascular resistance and abatement in both cardiac and urine output [2]. These changes are well tolerated by healthy adults but however can be detrimental in elderly and in patients with cardiorespiratory insufficiency. Subsequently, it is essential for the anesthesiologist to have an appropriate understanding of these changes for better preoperative assessment & preparation as well as perioperative management. One of the most dreaded complications during laryngoscopy and intubation is hemodynamic instability which is a well-archived certainty and these responses in most susceptible patients induce myocardial ischemia or infarction, left ventricular failure and cerebral hemorrhage [3,4]. Hence, in order to overcome these hemodynamic responses, various drugs like esmolol, lidocaine, nitroglycerine and clonidine, are being used to lessen the pressor response. All medications have a few contraindications and unfavorable events and need to be utilized with the precautionary measure. Dexmedetomidine, s-enantiomer of meditomidine, a highly selective alpha-2 adrenergic agonist, has many advantages like hypnotic, sedative, anxiolytic, sympatholytic, and opioid sparing, pain relieving properties without causing respiratory depression [5-8]. During the perioperative period, it can diminish both opioid analgesic and anaesthetic requirements [9,10]. Its sympatholytic property by diminishing norepinephrine release reduces mean arterial pressure (MAP) and heart rate (HR) and hence, improves hemodynamic stability during laparoscopy. [11, 12] These properties make dexmedetomidine a suitable medication to be utilized for reducing the pressor response to laryngoscopy & intubation and hence, it can serve as a useful anaesthetic adjunct. It has also been documented to decrease postoperative nausea and vomiting after laparoscopic surgery [13]. Hence, this study was undertaken to compare dexmedetomidine to lidocaine as regards to its efficacy on attenuation of intubation response.

Materials and Methodology

This study was conducted in the Department of Anaesthesiology, KarpagaVinayaga Institute of Medical Sciences, Madhurantagam, after obtaining approval by the Institutional Ethics Committee. A total of sixty patients, thirty in each group, aged between 20 and 45 years of either sex, scheduled for elective laparoscopic surgery, were considered for this study. Written informed consent was taken from all the patients.

Inclusion Criteria

1. Patients aged between 20 - 45 years
2. Patients scheduled for laparoscopic surgery belonging to American Society of Anesthesiologists Status I and II.

Exclusion Criteria

1. Patients who were not willing to give consent.
2. Patients with heart blocks, hypertensive patients on β blockers, morbid obesity, pregnant women & history of a psychiatric disorder were excluded from the study.
3. Patients with diabetes and renal disease were not included in the study.

Procedure

The preoperative and anesthetic procedures were explained to the patients. After obtaining informed consent, patients were kept nil per oral 8 hours prior to the surgery. All the patients received Tab Metoclopramide 10mg PO and Tab Pantoprazole 40 mg PO on the previous night and on the morning of the procedure. Inj Glycopyrrolate 0.2 mg IM was given as premedication an hour before the surgery. Intraoperative monitoring included pulse oximetry, noninvasive blood pressure (NIBP), ECG and capnography. Patients were assigned randomly into the dexmedetomidine-intervention group and lidocaine-control group. Inj. Dexmedetomidine, by means of an infusion pump, was given prior to anesthetic induction, at a rate of 1 μg/kg over a period of 10 min to all intervention group patients. As a standard procedure, plain, preservative-free, 2% lidocaine was given at a rate of 1.5 mg/kg IV bolus to all patients in the control group 1.5 minutes prior to laryngoscopy. All baseline parameters were recorded in the operation theatre. After preoxygenation with 100% oxygen for 3 minutes, Inj. Fentanyl 1.5 μg/kg IV was administered followed by Inj. Propofol, 2mg/kg IV, for induction of anaesthesia & Inj. Succinylcholine, 2 mg/kg IV. The patient was then subject to laryngoscopy and intubation with the appropriate endotracheal tube. For maintaining anaesthesia, nitrous oxide: oxygen in the ratio 2:1 was used while Inj. Vecuronium was used as muscle relaxant after intubation. Parameters like heart rate, systolic and

diastolic blood pressure were recorded pre-induction, during induction, during intubation, 1 min & 3 minutes after intubation. Inj. Neostigmine 0.05mg/kg and Inj. Glycopyrrolate 0.008mg/kg were used to reverse neuromuscular blockade at the end of the surgery. The patients were monitored post anesthesia after extubation for any side effects.

Statistical Analysis

Mann Whitney test was used. The statistical significance was taken as $p < 0.05$ Data were tabulated in MS-Excel and analyzed using SPSS software version 18.

Results

Patients were assigned randomly into the dexmedetomidine-intervention group and lidocaine-control group, thirty in each group.

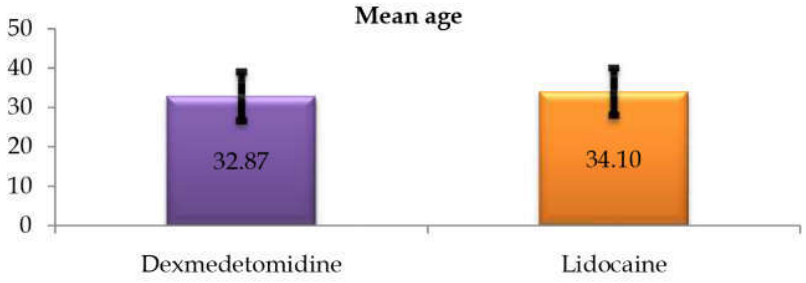

Fig. 1: Distribution of patients according to age

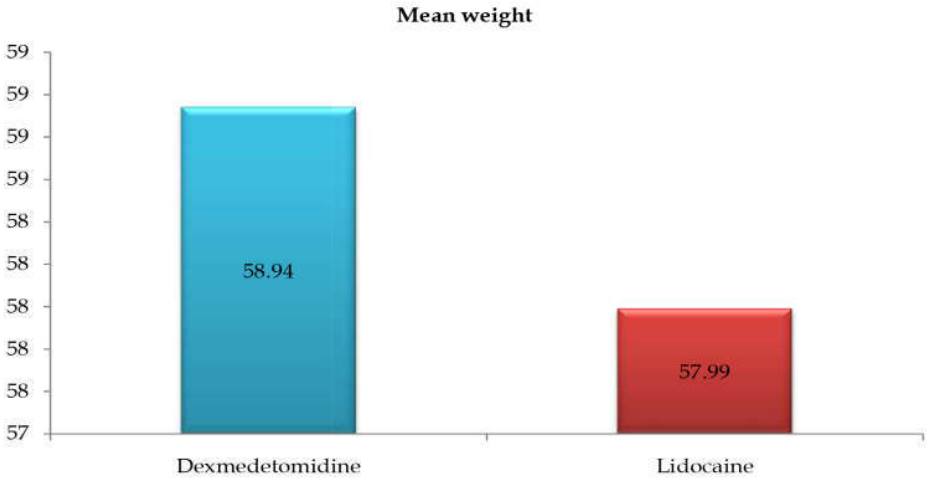

Fig. 2: Distribution of patients according to weight

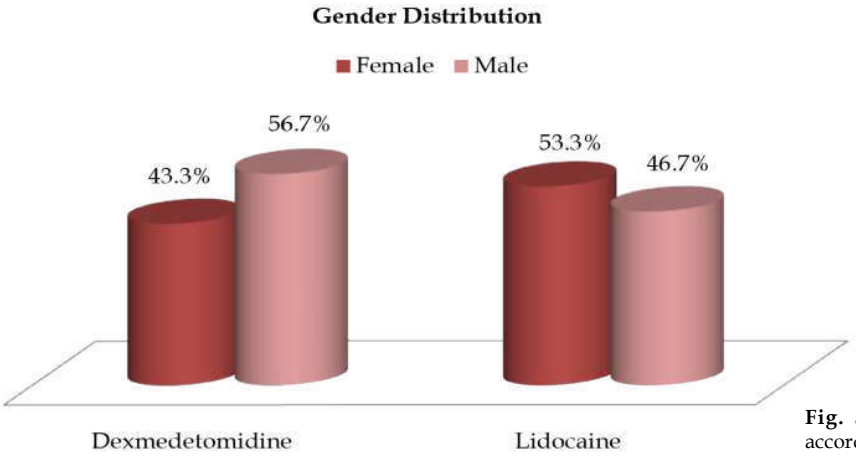

Fig. 3: Distribution of Patients according to Gender

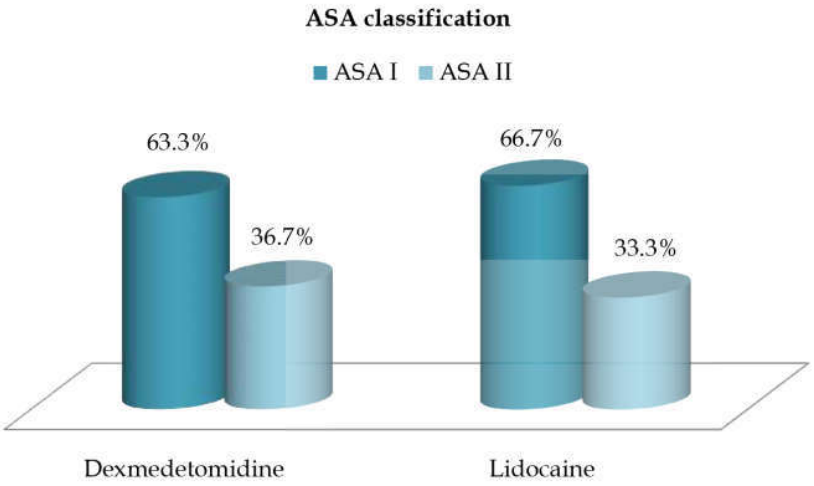

Fig. 4: Distribution of patients according to asa classification

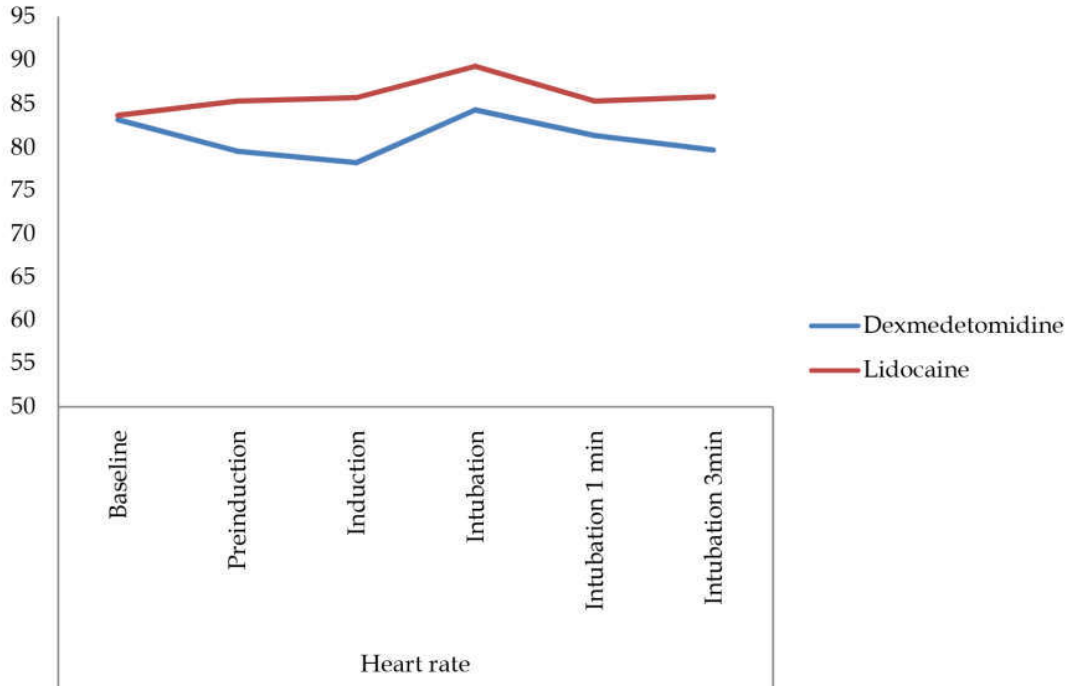

Fig. 5: Graph Showing Mean Heart Rate Variation

There was no difference in the baseline heart rate values. Statistically significant reduction in heart rate occurred in Dexmedetomidine group patients during pre-induction induction, intubation and 1min & 3min after intubation (p-value<0.05).

There was no variation in the baseline systolic blood pressure values. Statistically significant reduction in systolic blood pressure occurred in Dexmedetomidine group patients during pre-induction, induction, intubation and 1 min & 3 min after intubation (p-value<0.05).

There was no difference in the baseline diastolic blood pressure and preinduction diastolic BP values. Statistically significant reduction in diastolic blood pressure occurred in Dexmedetomidine group patients during induction, intubation and 1 min after intubation (p-value<0.05). However, no significant variation in diastolic BP at 3 min after intubation was observed.

There was no difference in the baseline Mean Arterial Pressure (MAP) values between the two groups.

Statistically significant reduction in mean arterial pressure occurred in Dexmedetomidine group

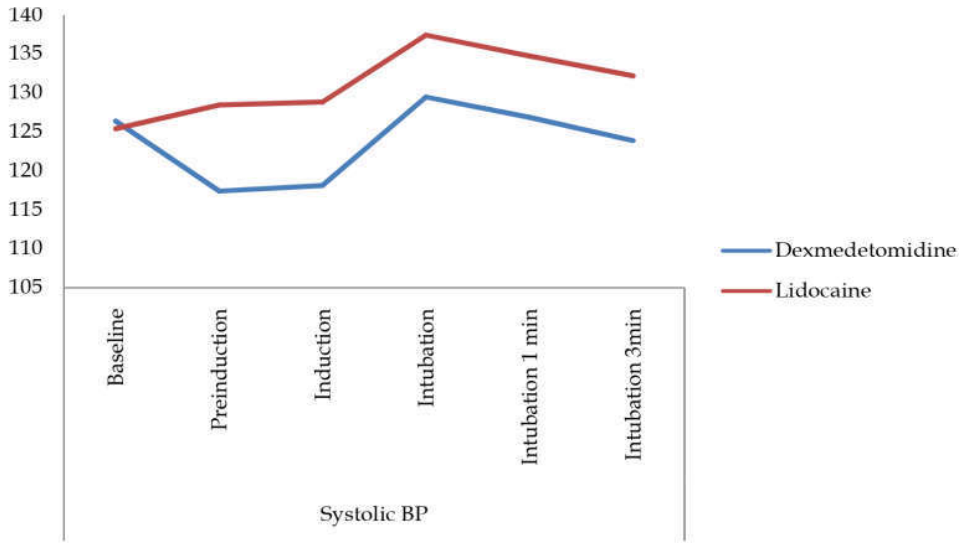

Fig. 6: Comparison of mean systolic blood pressure changes between groups at various intervals

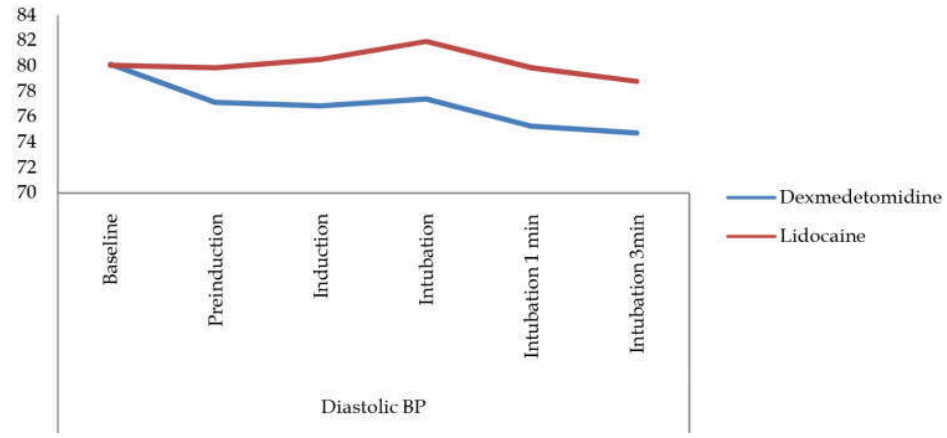

Fig. 7: Comparison of mean systolic blood pressure changes between groups at various intervals

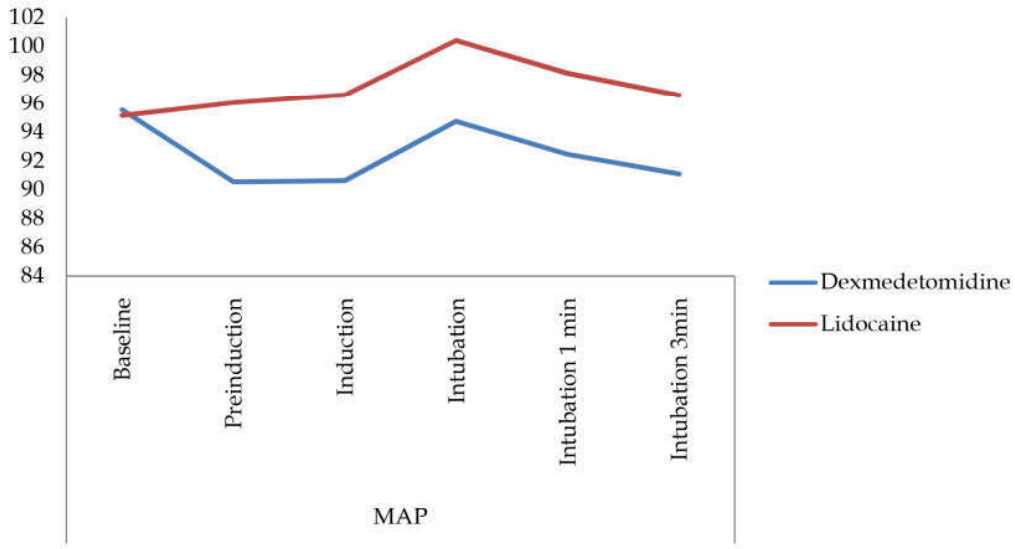

Fig. 8: Comparison of mean systolic blood pressure changes between groups at various intervals

patients during pre-induction, induction, intubation and at 1 min & 3 min after intubation (p-value<0.05).

Discussion

Laryngoscopy and endotracheal intubation are considered as the most crucial phenomenon in conducting general anesthesia [15]. They incite a transient and distinct sympathoadrenal response bringing about tachycardia and hypertension [16, 17]. Various strategies have been utilized to limit these reactions including inhalational anesthetic drugs, lignocaine, opioids, calcium channel blockers, and direct-acting vasodilators [18-20]. All these techniques have their own side effects, e.g. bradycardia, hypotension, sedation, and respiratory depression. In this manner, the search for a perfect agent is continuing. Beta blockers have been utilized for alleviating hemodynamic reaction to laryngoscopy and intubation. However, they limit the HR reaction better than blood pressure response. Calcium channel blockers may cause hypotension, inhibit autoregulation and dose-dependent cerebral vasodilatation. Alpha 2-adrenergic medications like clonidine or dexmedetomidine diminish these conceivably unsafe cardiovascular responses during induction of anesthesia. As of late, α-2 agonists, for example, clonidine and dexmedetomidine have been experimented for lessening the response to intubation without any adverse events. Dexmedetomidine is a direct acting, α-2 adrenergic agonist with sedative, anxiolytic, analgesic, and sympatholytic effects. It is superior to clonidine for decreasing the hemodynamic response to laryngoscopy and intubation as a result of higher selectivity to α-2 receptors than clonidine. Dexmedetomidine acts at the α-2 adrenergic receptors, thereby, diminishing the epinephrine and norepinephrine release. It also acts on the locus coeruleus and decreases central sympathetic outflow. Thus, Dexmedetomidine diminishes the hemodynamic response to intubation and minimizes the intraoperative opioid and anesthetic requirements. It also offers dose-dependent sedative property. Thus, the aforementioned aspects of the pharmacological profile of dexmedetomidine render it appropriate as an anaesthetic adjuvant. This randomized prospective study was conducted to find out the efficacy of dexmedetomidine, more recently introduced α2 - agonist, with additional advantageous properties, for example, sedation, anxiolysis, and sympatholysis, to reduce the hemodynamic response to laryngoscopy and endotracheal intubation. The study revealed that dexmedetomidine caused remarkable attenuation of heart rate and blood pressure response during laryngoscopy and intubation. A study done by Scheinin et al demonstrated that dexmedetomidine could not completely inhibit the pressor response to intubation but can significantly reduce it at a dosage of 0.6 μg/kg IV [20] . They also stated that the usage of thiopentone was lesser in the dexmedetomidine group compared to the control group. Lee et al stated that when used at 1a dose of 1 mcg/kg, dexmedetomidine suppressed the intubation response [21]. Bajwa et al. [22] used a similar dose of dexmedetomidine at 1 mcg/kg and found similar results. In a study done in neurosurgical patients, Srivastava et al. concluded similar results that dexmedetomidine was better [23]. Similar results were observed by Gupta and Vyas [24] and Selvaraj and Manoharan [25]. A study done by Lawrence et al revealed that 2 mcg/kg of dexmedetomidine when given as single dose before anesthesia induction decreased the hemodynamic response to intubation as well as to extubation. But they encountered bradycardia at the 1st and 5th min after administration. The reason might be due to a high bolus dose at administration [26]. Aantaa et al.[27] have already evaluated the various bolus dosages of dexmedetomidine for premedication. Attenuation in an increase in heart rate and blood pressure during intubation was also reported by Jaakola et al. [28]. Villela et al. [29] concluded that there was a decrease in anaesthetic needs in the dexmedetomidine group. A single dose of dexmedetomidine reduced opioid and anesthetic requirement when given as premedication by Yildiz M et al. [30]. The total dose of fentanyl and propofol were reduced for anesthesia maintainence when Tanuja et al. used dexmedetomidine was infused intravenously in the intraoperative period. They moreover concluded that there was better control in intra-operative & postoperative hemodynamic parameters and postoperative pain levels. Moreover, there was a better recovery inpatient profile when compared to placebo usage and they also reported a reduction in total dosage of morphine used [31]. In a study done to determine the efficacy of intravenous dexmedetomidine for attenuation of haemodynamic responses in patients having coronary artery disease, it reduced the sympathetic response in patients undergoing myocardial revascularization as stated by Sulaiman et al. [32].

The baseline heart rate value and blood pressure values were comparable in both groups in our study. Thus in our study pretreatment with

dexmedetomidine attenuated the cardiovascular response to tracheal intubation after anaesthesia induction but did not completely suppress the response when used at 1 mcg/kg over 10 minutes. To conclude, dexmedetomidine, as a pre-anesthetic medication, significantly weakens the sympathoadrenal response to laryngoscopy and endotracheal intubation without influencing intraoperative cardiovascular stability.

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