Original Research Article

Study of intravenously administered dexmedetomidine on isoflurane requirement and perioperative haemodynamic stability in elective surgery

Hemlata N Chaudhary*, Bansari M Shah**, Bharti R Rajani***

[1]Assistant Professor, **Senior Resident, ***Associate Professor, Department of Anaesthesiology, GMERS Medical College, Gandhinagar, Gujarat, INDIA.
Email: raviagrawal2121983@gmail.com , bansarimshah11@gmail.com , ramesh.rajani@ril.com

Abstract

Background and Aims: In this study we observe the effect of dexmedetomidine as an adjuvant to general anesthesia on cardiovascular response to intubation and extubation, hemodynamic stability, requirement of Isoflurane concentration, postoperative recovery and sedation. **Material and Methods:** 60 patients were divided into 2 groups with 30 patients in each, undergoing elective surgical procedure. Group D patients received l µg/kg Dexmedetomidine i.v. over 10 min before induction, followed by 0.6µg/kg/hour infusion till end of surgery and Group S received normal saline intravenously at the same rate. A standardized anesthetic protocol was used. Monitoring of Hemodynamic parameters, Recovery Time, Sedation Score and end tidal concentration of Isoflurane were assessed. Statistical analysis was performed using 'p' value obtained from Student't' test. **Results:** Hemodynamic response to intubation and Extubation, sedation score and recovery time were statistically different in both groups. End expiratory concentration of isoflurane required during anesthesia maintenance was 24.28% less in Group D in comparison to Group S($P<0.05$). There was increase in heart rate and blood pressure in response to Extubation but in Group D patients this response in blunted by Dexmedetomidine. **Conclusion:** Dexmedetomidine maintains hemodynamic stability during surgery and reduce requirements of isoflurane without causing significant sedation.
Key Word: Dexmedetomidine, Isoflurane requirement, hemodynamic stability

Address for Correspondence:
Dr. Bansari Shah, Senior Resident, Department of Anaesthesiology, GMERS Medical College and civil hospital, Opp. Pathikashram, Sector - 12 Gandhinagar -382012 Gujarat, INDIA.
Email: bansarimshah11@gmail.com
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INTRODUCTION

The perioperative course of patient undergoing surgery is complicated by tachycardia and hypertensive episode. Dexmetomedine is highly selective and potent alpha $(\alpha)_2$ - adrenoceptor agonists has sedative and analgesic, anxiolytic and sympatholytic properties that blunt many of the cardiovascular responses in the perioperative period. This drug improves hemodynamic stability during endotracheal intubation and surgical stress by its central sympatholytic action and thus reduces anaesthetic and opioids requirements[1]. These properties render Dexmedetomidine suitable for sedation and analgesia during the whole perioperative period: as premedication, as an anaesthetic adjunct for general and regional anaesthesia, and as postoperative sedative and analgesia. Dexmedetomidine also has minimum alveolar anaesthetic concentration (MAC) sparing properties. In addition, it has been shown to induce a centrally mediated reduction of sympathetic nervous system activity and decrease hemodynamic and plasma catecholamine response to

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stressful events[2,3,4] and [5]. Effective attenuation of the sympatheticoadrenal stress responses is an important goal in anesthesiology.

The primary objective of our study was to assess the effect of loading dose followed by continuous infusion of dexmedetomidine on haemodynamic parameters and requirement of isoflurane during general anaesthesia and post-operative recovery in elective surgery.

MATERIAL AND METHODS

Sixty patients aged between 18 years and 55 years of either sex belonging to ASA class I and class II posted for various elective surgeries at our institute were randomly selected for the study. They were randomly divided into 2 groups with 30 patients in each. Group D: Patients received l µg/kg of Dexmedetomidine infusion intravenously over 10 min before induction, followed by 0.6 µg/kg/hour infusion during surgery till end of surgery. Group S: normal saline intravenously at the same rate. Maintenance of anesthesia was with O_2, N_2O, Isoflurane and Vecuronium in both groups. Patients with history of Allergy to drug, hypertension, cardiac, renal, hepatic and cerebral diseases, difficult airway, alcohol or drug abuse, Obesity and pregnancy were excluded from the study All the patients underwent a detailed pre anaesthetic check-up before surgery and all the routine and specific investigations were noted. The patients were electively kept nil per oral for 6 hours before surgery and prior to operation patients were explained about the procedure. On arrival in the operating room, standard monitors like ECG, NIBP, and pulse oximetry were applied. Intravenous line secured with one 18 gauge cannula and another 20 gauge for infusion of study drug in all the patients and intravenous fluid was started. The study drug was prepared in infusion pump as Dexmedetomidine 100 µg/ ml was added to 0.9% normal saline (99ml) to make a total volume of 100 ml (resulting concentration 1µg/ml). After 5 min of monitoring period patient's baseline parameters like pulse, blood pressure, respiratory rate, Spo_2 were recorded Inj. Ondansetron 0.15 mg/kg, Inj. Glycopyrrolate 0.004 mg/kg given as a premedication in both the groups. Loading dose of study drug Dexmedetomidine 1 µg /kg dose is given over 10 min intravenously before induction followed by continuous infusion of 0.6µg/kg/min during surgery till end of surgery. In both groups patients two minutes prior to induction Fentanyl 2µg/kg IV infused slowly. All patients were preoxygenated with 100% oxygen for 5 minutes and induced 10 minutes after starting the infusion of the study drug with inj. Thiopental sodium 6mg/kg and Inj. Succinylcholine 2 mg/kg and Endotracheal intubation done using an appropriate size of ET tube. Positive pressure ventilation and Etco2 monitoring was started. Anaesthesia was maintained using oxygen (50%), nitrous oxide (50%), inhalational agent Isoflurane and loading as well as intermittent dose of Inj. vecuronium. Anaesthesia was maintained with isoflurane using the lowest possible concentration necessary to keep blood pressure and heart rate within 20% limits of the patient's pre- operative baseline value. Isoflurane administration and nitrous oxide was discontinued after skin closure and dexmedetomidine infusion was also switched off at the same time. Pulse rate, blood pressure, oxygen saturation values were noted after starting loading infusion of drug at l,3,5 and 10min and then after induction and intubation at 1, 3, 5, 10, 15 min and then at regular intervals of 15 min throughout the surgery. Monitoring of end tidal concentration of isoflurane and EtCo2 started after intubation. End tidal isoflurane concentration noted after every 15 min and also whenever concentration was changed to maintain the haemodynamic parameters within 20% of baseline value. All patients were reversed using Inj. Glycopyrrolate 0.008 mg/kg and Inj. Neostigmine 0.05 mg/kg. After thorough oral and endotracheal suction patients were extubated after they satisfied the criteria for extubation. Time between stopping of anaesthesia and eye opening on verbal command also noted for Recovery Time**.** All patients were then shifted to the post-operative room and observed for sedation and any postoperative complications for a period of 3 hours. Any post-operative complications were noted and treated accordingly. Post-operative sedation was assessed at 5, 30, 60, 120 and 180 postoperatively using Ramsay Sedation Scale. All the observations were recorded and all the results were analyzed. Statistically data were presented as mean ± S.D. The results of the intended study between two groups were compared statistically using 'p' value obtained from Student‘t’ test. A value of $P<0.05$ was considered as statistically significant difference.

RESULTS

Both groups were comparable with respect to age, weight, and duration of surgery. Hemodynamic parameters like PR and BP were significantly under control in dexmedetomidine group. There was significant difference in end tidal isoflurane concentration in both groups (Table 1). Requirement of isoflurane in group D is 41.46% less in comparison to Group S (Figure 1). And recovery time from anesthesia and sedation score in both groups was comparable (Table 2).

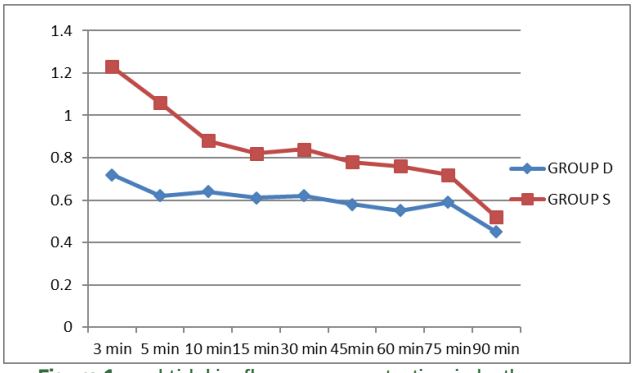

Figure 1: end tidal isoflurane concentration in both groups

Table 1: end tidal isoflurane concentration in both groups

End tidal isoflurane concentration			
Time	**Group d**	**Group s**	**% difference**
3 min	0.72	1.23	41.46
5 min	0.62	1.06	41.50
10 min	0.64	0.88	29.54
15 min	0.61	0.82	25.60
30 min	0.62	0.84	25.88
45min	0.58	0.78	27.77
60 min	0.55	0.76	27.63
75 min	0.59	0.72	18.05
90 min	0.45	0.52	13.46
Over all conc.	0.37	0.49	24.48

Table 2: sedation time in both groups

Sedation time		
Time	**Group d**	**Group s**
5 min	4.1	3.87
30 min	2.93	2.43
60 min	1.70	1.57
120 min	1.53	1.37
180 min	1.27	1.23

DISCUSSION

General inhalational anesthesia associated with adjuvant intravenous agents provides better sedation, hypnosis and analgesia[2]. The centrally acting alpha 2-adrenergic agonists including Dexmedetomidine activate receptors in the medullary vasomotor Centre, reducing norepinephrine turnover and decreasing central sympathetic outflow, resulting in alterations in sympathetic function. The activation of $\alpha_2$adrenergic receptors in the dorsal horn of the spinal cord inhibits the release of substance P, a nociceptive mediator resulting in primary analgesic effects as well as potentiating of opioid-induced analgesia. α_2 adrenergic receptor agonist like Dexmedetomidine provides better hemodynamic and adrenergic stability via sympatholytic action, sedation, anxiolysis, decreased anaesthetic and analgesic consumption and attenuation of opioid-induced muscle stiffness, without marked ventilator depressing effects. Dexmedetomidine in anaesthesia has been related to preanaesthetic medication, general anaesthesia adjuvant and postoperative medication[3,6,7.]As preanaesthetic medication and general anaesthesia adjuvant, dexmedetomidine decreases the need for anaesthetic agents including inhalation and an analgesic administered for anaesthetic induction and maintenance, as well as attenuates adrenergic response to tracheal intubation[3, 7] This randomized controlled study was conducted to evaluate the effect of perioperative dexmedetomidine infusion on haemodynamic stability and isoflurane requirements during general anaesthesia. Based on observation of various previous studies we have given the loading dose of 1µg/kg over 10 min and then 0.6 µg/min continuous infusion. Patients in both the groups were demographically comparable. There was no statistically significant difference in age, weight, gender distribution and duration of surgery between the groups. Laryngoscopy and intubation induces an increase in arterial blood pressure and Pulse rate in both the study group. After a maximum increase during 1-3 min post intubation, pulse rate and mean blood pressure began to fall in both the groups. But this increase is significantly less in Dexmedetomidine group. Thus Dexmedetomidine substantially blunted the increase in pulse rate and blood pressure in response to laryngoscopy and intubation. Intra-operatively at 15 min post intubation pulse rate and mean blood pressure are significantly lower in Group D (68.4/min and 83.2 mm of hg) in comparison to Group S (90.6/min and 96.5 mm of hg). The same trend was observed throughout intraoperative period. Again during extubation pulse rate and blood pressure values were increased in both groups but this rise in pulse rate and arterial blood pressure response was significantly less in Group D in Comparison to Group S. Post-operatively, the pulse rate was noted at regular intervals in both the groups. When compared, at l min and 5 min post extubation pulse rate was significantly higher in Group S and at 10 min post extubation pulse rate was comparable in both the group. The mean isoflurane concentration required to maintain the pulse rate and blood pressure within 20 % limit of preoperative values is significantly lesser in group D. The overall mean end expiratory concentration of isoflurane required during anesthetic maintenance was 24.48% less in Group D as compared to Group S. Difference in isoflurane requirement is maximum during first 10-15 min after intubation (41.50% less in Group D). Time to eye opening on verbal commands was similar in both the groups. The post-operative sedation score was assessed at regular intervals using Ramsay Sedation Scale. Dexmedetomidine did not cause any delay in recovery of the patient from anesthesia.

CONCLUSION

Exmedetomidine, a newer highly selective alpha 2 agonist, when given as an infusion at a dose of 1 µg/kg over 10 min followed by 0.6µg/kg/min reduces the intraoperative requirement of isoflurane, maintains stable haemodynamics during intra operative period, attenuates the sympathetic hemodynamic response to both laryngoscopy, intubation and extubation, produces some amount of sedation in the patients but the sedation was not significant enough to delay recovery from anaesthesia without any complications.

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