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Efficacy of Dexmedetomidine on Pressor Response in Patients Undergoing Elective Laparoscopic Hernia Repair. A Prospective Observational Study

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ABSTRACT

Background: Dexmedetomidine is a α2 agonist drugs which acts at both supraspinal and spinal level and modulate the transmission of nociceptive signals in the central nervous system. This drug has become an ideal adjuvant during general anesthesia, especially when stress is expected. The aim of this study was to see the efficiency of low dose of dexmedetomidine infusion on haemodynamic response during laryngoscopy, endotracheal intubation, creation of pneumoperitoneum and extubation in patients undergoing laparoscopic hernia repair. **Methods:** Sixty patients of American Society of Anesthesiologists (ASA) physical status I and II undergoing laparoscopic hernia repair were divided into two groups of 30 patients each. Group X received 50 ml NS and Group Y received Dexmedetomidine 0.6mcg/kg/hr (0.5 ml in normal saline 50ml/hr). All the patients were observed for vitals like HR, MAP, oxygen saturation at regular intervals including before starting the infusion, 10 minutes after starting the infusion, after induction, after intubation, after creation of pneumoperitoneum and after extubation.Patients were also observed for post-operative sedation and analgesia requirements. **Results:** In Group NS, after starting the infusion there was no significant change in HR and MAP but these increased significantly above the baseline values after intubation and extubation ($p<0.01$) and significantlyafter pneumoperitoneum ($p<0.05$). While as in Dexmedetomidine groups, after starting the infusion, HR decreased significantly below the baseline value and MAP also decreased highly significantly among the patients who received dexmedetomidine infusion. Pneumoperitoneum did not produce significant effect in dexmedetomidine group. **Conclusion:** Infusion dose of 0.6mcg/kg/hr without any bolus dose serves very good adjuvant to control haemodynamic pressor response to intubation, pneumoperitoneum and extubation in patients undergoing laparoscopic hernia repair.

Keywords: Dexmedetomidine, haemodynamic pressor response, laparoscopic hernia repair.

INTRODUCTION

Laparoscopy is getting more popular these days because of early mobilization and shorter hospital stay of patients; as painful surgical incisions are avoided, as less tissue trauma, reduces wound size, less postoperative pain.

Laryngoscopy and endotracheal intubation is a vital part in general anaesthesia and in ACLS. Endotracheal intubation is an itself a stressful stimulus which leads to increased response in cardiovascular, respiratory, physiological system.[1] severe sympathetic response is usually seen during laryngoscopy which is due to increase in catecholamine release causing hemodynamic pressor response.[2-4]

Various Anesthetic agents like benzodiazepine, lignocaine, β-blockers, Ca channel blockers, opioids, have been used till now with different success rates. Dexmedetomidine highly selective α2 agonist centrally acting that has sedative and anesthetic properties by activating G-proteins in brain stem, which results in inhibition of nor epinephrine release. It has half-life of 6 min.

The aim of this study was to see the efficiency of low dose of dexmedetomidine infusion on haemodynamic response during laryngoscopy, endotracheal intubation, creation of pneumoperitoneum and extubation in patients undergoing laparoscopic hernia repair.

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MATERIALS AND METHODS

This study was done in tertiary care hospital in Govt. Medical college, and written informed consent of the patients were taken. It was a prospective, observational study. Sixty ASA physical status I,II aged between 18 to 50 years of either sex, posted for laparoscopic hernia repair under general anesthesia were included in this study. Patients excluded from study were patients with ischemic heart disease, valvular heart disease, elderly and pregnant women. Patients taking drugs like clonidine, methyldopa, β-Blockers, and calcium channel blockers were also excluded from the study.

The patients were divided by senior Consultant Anesthesia incharge operation theatre based on his valuable experience and total discretion, into 2 equal groups [n=30], Group X received 50 ml NS and Group Y received Dexmedetomidine 0.6mcg/kg (0.5 ml in normal saline 50ml/hr). Total volume of the drug was adjusted to 50ml and administered over a period of 15 minutes before induction. Dexmedetomidine infusion or normal saline infusion was given though syringe infusion pump. Depending upon the weight of the patient, the pump was set so as to deliver the targeted infusion rate.

On arrival in operating room two large bore 18 G cannula was inserted for giving i.v fluids, anesthetic drugs and for infusion pump respectively. Multichannel monitor was attached and baseline parameters like heart rate, mean arterial pressure [MAP], oxygen saturation were noted. All patients received injection pantoprazole 40mg intravenously, injection tramadol 1.0mg/kg intravenously over the next 15 minutes, study drugs were given through syringe infusion pump. Subsequently, vital parameters like HR, MAP were recorded again. After pre-oxygenation for 3 minutes, general anesthesia was induced using injection propofol 2mg/kg intravenously followed by injection atracurium 0.5mg/kg intravenously. Endotracheal intubation done with a proper sized cuffed endotracheal tube. Anesthesia was maintained with 02:N2O (50:50) Isoflurane and injection atracurium [0.1mg/kg] as a muscle relaxant. Injection paracetamol 1gm i.v infusion was also given intraoperatively. Pressure was maintained at 12-14 mmHg throughout the laparoscopic procedure. The patients were mechanically ventilated to keep EtCO2 between 35-45mmHg. Drug infusion and anesthetic agents were stopped at the end of surgery. Reversal was done with injection neostigmine and injection glycopyrrolate.

All the patients were observed for vitals like HR, MAP, oxygen saturation at regular intervals including before starting the infusion, 10 minutes after starting the infusion, after induction, after intubation, after creating of pneumoperitoneum and after extubation. Throughout the study patients were observed for any change in vitals like Bradycardia/tachycardia (PR <20% and >20%) respectively of baseline value on two consecutive readings. Hypotension/Hypertension (MAP<20% and >20%) of baseline value on two consecutive readings.

RESULTS

The results were statistically done using spss (statistical package for social sciences) software version 15.0.Quantitative data was achieved with the help of mean, standard deviation (SD) and median. Qualitative data was done using chi-square test for Gender, HR, SBP, and DBP. P value< 0.05 was considered statistically significant.

Both groups under study were comparable to each other with respect to age, sex, weight, height, ASA physical status class and duration of surgery [Table 1]. There was no significant difference between the groups in reference to the baseline HR and MAP.

Table1: Comparison of demographic profiles between the study groups

Parameters	Group X	Group Y	P value
Age (yrs)	33.6±9.08	34.1±8.61	0.496
Sex Male/female	19/11	23/7	0.495
Weight (kg)	68.2±8.71	69.0±9.25	0.465
Height (cms)	165.8±5.72	167.9±5.36	0.164
ASAI/II	26/4	28/2	0.690
Duration of surgery	57±21.34	62±30.56	0.881

After starting the infusion there was no significant change in HR but it increased significantly above the baseline values after intubation and extubation ($p<0.01$) and significantly after pneumoperitoneum in Group X as compared to Group Y ($p<0.05$) [Table2].

Table 2: Changes in HR (beats per minute) (mean±SD)

Time	Group X	Group Y	P value
Before starting infusion	72±2.5	74±2.8	0.658
10 minutes after infusion	70±1.9	70±1.7	0.879
1 minute after intubation	69±3.7	64±4.9	0.521
After laryngoscopy & intubation	94±14.5	68±17.6	0.002
After pneumoperitoneum			
10 minutes	110±16.7	72±11.4	0.001
20 minutes	102±14.9	66±12.6	0.003
30 minutes	102±17.5	62±13.8	0.001
After extubation 1 minute	101±22.6	73±21.4	0.001

SD – Standard deviation, HR- Heart rate.

In Group Y MAP decreased highly significantly below baseline, even after intubation, in pneumoperitoneum, and extubation ($p <0.05$) as compared to Group X [Table 3].

Table 3: Changes in MAP (mm of Hg) (mean±SD)

Time	Group X	Group Y	P value
Before starting infusion	96±3.5	92±3.8	0.472
10 minutes after infusion	90±3.5	94±2.9	0.561
1 minute after intubation	95±16.4	82±13.8	0.012
After laryngoscopy & intubation	115±13.3	86±19.8	0.001
After pneumoperitoneum			
10 minutes	101±18.9	88±21.4	0.013
20 minutes	95±12.7	84±16.6	0.021
30 minutes	94±13.5	82±15.6	0.001
After extubation	106±16.4	90±13.9	0.015

SD – Standard deviation, MAP – Mean arterial pressure

The mean sedation scores [Figure 1] were more in dexmedetomidine groups compared to normal saline group patients. Dexmedetomidine 0.6 group patients

had better sedation than NS group patients. None of the patients in dexmedetomidine groups developed significant sedation levels and the patients were cooperative, oriented and tranquil all the time. In group NS sedation score, which was less initially, improved subsequently due to early requirement of analgesia in this group.

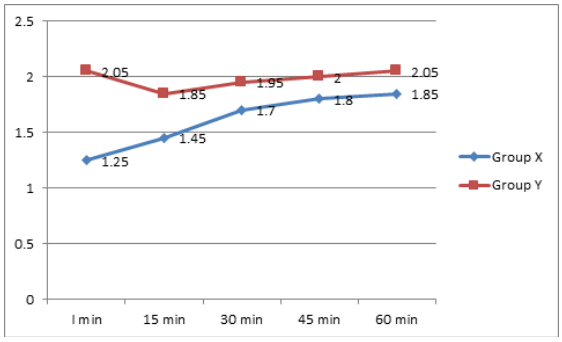

Figure 1: Mean sedation scores

DISCUSSION

Dexmedetomidine is highly selective α2 agonist. It acts through α2A, α2B, α2C receptors, situated in brain and spinal cord.It leads to hypotension and Bradycardia. α2A and α2C causes sedation. α2A, α2C also reduces pain transmission. With dose infusion 0.6mcg/kg/hr results in 10-15% fall in mean arterial pressure and Heart Rate.

Looking at these pharmacological properties, it has been evaluated in the past to assess its effect on haemodynamic responses in patients undergoing laparoscopic surgeries. The molecule has been used in infusion form with or without bolus dose. Infusion rates varying from 0.1 to 10 mcg/kg/h have been studied.[9-11] However, with higher dose infusion of dexmedetomidine, high incidence of adverse cardiac effects have been observed.[11] A biphasic response on blood pressure occurs with a bolus dose.[6] Initially, there occurs hypertension followed by fall in blood pressure. This response is seen often more in young and healthy patients.[12] Stimulation of α2 B receptors in vascular smooth muscles is said to be responsible for this.

Low dose infusion of 0.25–0.5 mcg/kg/h results in a monophasic response of 10–15% fall in mean arterial blood pressure and HR.[6] Furthermore, in low dose, dexmedetomidine exhibits linear kinetics, meaning that a constant amount of drug is eliminated per hour rather than a constant fraction of drug.

Our study confirms pressor response to laryngoscopy and intubation, pneumoperitoneum, extubation. There was increase in MAP and HR among the patients undergoing laparoscopic hernia repair as seen in Group X. Dexmedetomidine attenuates this sympathetic response and provides haemodynamic stability. The effective attenuation dose in our study was 0.6 mcg/kg /hr.

The two groups under study were comparable to each other with respect to age, gender, and weight, duration of surgery, and anesthesia. The results of our study show that, in NS group, there was a significant rise in Heart Rate, SBP, DBP, and MAP following laryngoscopy, intubation, pneumoperitoneum, and after extubation. These results are in consistent with the study conducted by authors Bhattacharjee et al., Keniya et al., and Tufanogullari et al.[5,8,13] The suppression of the sympathoadrenal response was seen in dexmedetomidine group as it was observed in a study conducted by Scheinin et al.[9]

The hemodynamic alterations due to intense sympathetic stimulation accompanying laparoscopic surgery comprising of elevation in heart rate and rise in mean arterial pressure are well known. The potential for life-threatening complications associated with such a response is also well documented. There exists a strong relationship of both perioperative myocardial ischemia and postoperative myocardial infarction with anesthetic and surgical events known to produce intense sympathetic stimulation, with or without hemodynamic abnormalities.[21] Thus, it is logical to look for methods to reduce sympathetic stimulation.

Various drugs and methods had been studied to prevent hemodynamic alterations due to stress of surgery and anesthesia. Dexmedetomidine, a highly selective α2-agonist, has also been evaluated in the past for attenuation of hemodynamic responses in various doses and along with various anesthetic regimens for various types of surgeries.[11,15,19] Gynecologic diagnostic laparoscopy was the first laparoscopic procedure in which the effects of dexmedetomidine were studied with encouraging results.[22] Since then, the molecule has been widely used to assess its effect on hemodynamic responses in patients undergoing various types of laparoscopic surgeries, including laparoscopic cholecystectomy.[14,23-31]

Our study confirms the fact that stressful events such as laryngoscopy and endotracheal intubation, pneumoperitoneum, and extubation do lead to significant increase in HR and MAP in patients undergoing laparoscopic cholecystectomy as seen in normal saline group.[4,26,29-32] This sympathoadrenal response is effectively attenuated by used doses of dexmedetomidine providing intraoperative hemodynamic stability as seen in dexmedetomidine group.[14,26,29-32] Although there was significant decrease in HR from baseline in dexmedetomidine group, significant bradycardia was not noted in any case.

CONCLUSION

Infusion dose of 0.6mcg/kg/hr without any bolus dose serves very good adjuvant to control haemodynamic pressor response to laryngoscopy, intubation,

pneumoperitoneum and extubation in patients undergoing laparoscopic hernia repair.

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