Research Article

Peri-operative hemodynamic stability in patients undergoing laparoscopic procedures using dexmedetomidine

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Abstract

Introduction: In laparoscopic surgeries both pneumoperitoneum and carbon dioxide causes adverse cardiovascular effects. Some of these effects are related to carbon dioxide and some are due to increased intra abdominal pressure. Increased intra abdominal pressure can increase central venous pressure and in some cases the cardiac output is thus raised. Dexmedetomidine is an alpha adrenergic agonist. Its sympatholytic effects decreases mean arterial pressure and heart rate by decreasing norepinephrine release. **Aims and Objectives:** To evaluate the effects of dexmedetomidine in providing perioperative haemodynamic stability in patients undergoing laparoscopic procedures. **Material and Method:** In the present study total 60 patients posted for various laparoscopic surgeries were enrolled using precise inclusion and exclusion criteria. The patients were divided into two groups viz. group D (test group who received the drug Dexmedetomidine) and group C (control group). The haemodynamic parameters such as mean heart rate and mean blood pressure of both the group were recorded and compared. **Results:** It was observed that there was no significant difference in the preoperative heart rate between the dexmedetomidine and control groups (p= 0.96). While a significant difference between the two groups was noted at all time intervals thereafter. It was seen that there was no significant difference in the preoperative mean BP and the mean BP one minute after induction between the dexmedetomidine and control groups. While a significant difference between the two groups at all time intervals thereafter. **Conclusion:** The perioperative use of dexmedetomidine in patients undergoing laparoscopic procedures can produce a good hemodynamic stability i.e. stable mean BP and heart rate after intubation.

Keywords: dexmedetomidine, laparoscopic procedures, BP, heart rate.

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INTRODUCTION

Laparoscopy is usually performed under general anaesthesia and involves the deliberate production of a pneumoperitoneum with carbon dioxide in order to assist visualization of the abdominal viscera. Both pneumoperitoneum and carbon dioxide causes adverse cardiovascular effects. Some of these effects are related to carbon dioxide and some are due to increased intra abdominal pressure. Increased intra abdominal pressure can increase central venous pressure and in some cases the cardiac output is thus raised.[1] There can be a moderate fall in stroke volume and cardiac output during intraperitoneal insufflations of CO2, which is directly related to the gas used.[2] CO2 from the pneumoperitoneum can cause clinically relevant hypercapnia.[3] Immediately after pneumoperitoneum, plasma level of norepinephrine, epinephrine and renin increases. The renin – angiotensin – aldosterone system is also activated by the increased catecholamine level. All the changes come together to contribute to elevated arterial pressure, increased systemic and pulmonary vascular resistance and reduced cardiac output.[4] Also, reverse trendelenberg position, which may be adopted diminishes venous return and thereby cause further reduction in cardiac output. The combined effect of anaesthesia, head up tilt and peritoneal insufflations can produce a 50% decrease in cardiac

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index.[5] The pathophysiologic haemodynamic changes can be attenuated or prevented by optimizing preload before pneumoperitoneum and by vasodilating agents, alpha 2 adrenergic receptor agonists, high doses of opioids and beta blocking agents.[6] Dexmedetomidine is an alpha adrenergic agonist which has eight fold greater affinity for alpha 2 adrenergic receptors compared to clonidine and much less alpha 1 effects. Dexmedetomidine possesses hypnotic, sedative, anxiolytic, sympatholytic and analgesic properties, without producing significant respiratory depression. Its sympatholytic effects decreases mean arterial pressure and heart rate by decreasing norepinephrine release.[7] The intravenous administration of dexmedetomidine before induction of anaesthesia attenuates sympatho – adrenal responses to laryngoscopy and endotracheal intubation. It also provides improved haemodynamic stability during intraoperative period. Thus in the present study an attempt was done to evaluate the efficacy of dexmedetomidine in ensuring haemodynamic stability in patients undergoing laparoscopic procedures.

AIMS AND OBJECTIVES

To evaluate the effects of dexmedetomidine in providing perioperative haemodynamic stability in patients undergoing laparoscopic procedures.

MATERIAL AND METHOD

The present study was conducted in Academy of Medical Sciences, Pariyaram, Kannur Dist. Total 60 patients posted for various laparoscopic surgeries were enrolled in the study by using following inclusion and exclusion criteria.

Inclusion criteria

- Adults of both genders aged between 20 – 60 yrs
- Belonging to ASA grade I and II

Exclusion criteria

- Patients with ASA grade III and IV
- Unstable haemodynamics status in spite of adequate management.
- Patients with past history of allergy to dexmedetomidine.
- Morbidly obese patients
- Patients unwilling to undergo study.

After getting approval from the ethical and research committee for the study protocol and informed consent the study was started. All the patients were randomly assigned into two groups (Each containing 30 patients).

- Group D (dexmedetomidine group/ test group) and
- Group C (control group)

Routine monitoring i.e. ECG, heart rate, mean blood pressure and arterial oxygen saturation (Spo2) were recorded in all the patients on arrival to the operation theatre. In group D patients dexmedetomidine was started by intravenous infusion at a rate of 1 microgram per kg over 10 minutes as loading dose, followed by maintenance of 0.2 microgram per kg per hour intraoperatively. The study medication was prepared in identical 50 ml syringe. Dexmedetomidine 200 microgram (2ml) was added to 0.9% saline (48ml) making a total volume of 50ml. Group C patients received normal saline at the same rate. Patients were induced five minutes after starting the study drug, with IV Fentanyl 2 mcg/kg and IV Thiopentone sodium 5 mg/kg. Endotracheal intubation was facilitated by muscle relaxant IV Vecuronium 0.1mg/kg. Anaesthesia was maintained by oxygen, nitrous oxide (50:50), isoflurane at a concentration of 0.4 volume % and intermittent doses of IV Vecuronium. CO2 was insufflated into the peritoneal cavity at 2litre/minute to create pneumoperitoneum. Intra abdominal pressure was maintained at 12-14 mm Hg throughout the laparoscopic procedure. The patients were mechanically ventilated to keep ETCO2 between 35-40 mmHg. Monitoring of mean blood pressure, heart rate, ECG, ETCO2 and temperature were done. At the end of the operation, the infusion of study medication was stopped. Residual neuromuscular block was reversed by appropriate doses of neostigmine and glycopyrrolate and tracheal extubation was performed.

RESULTS

Table 1: Demographic distribution of subjects

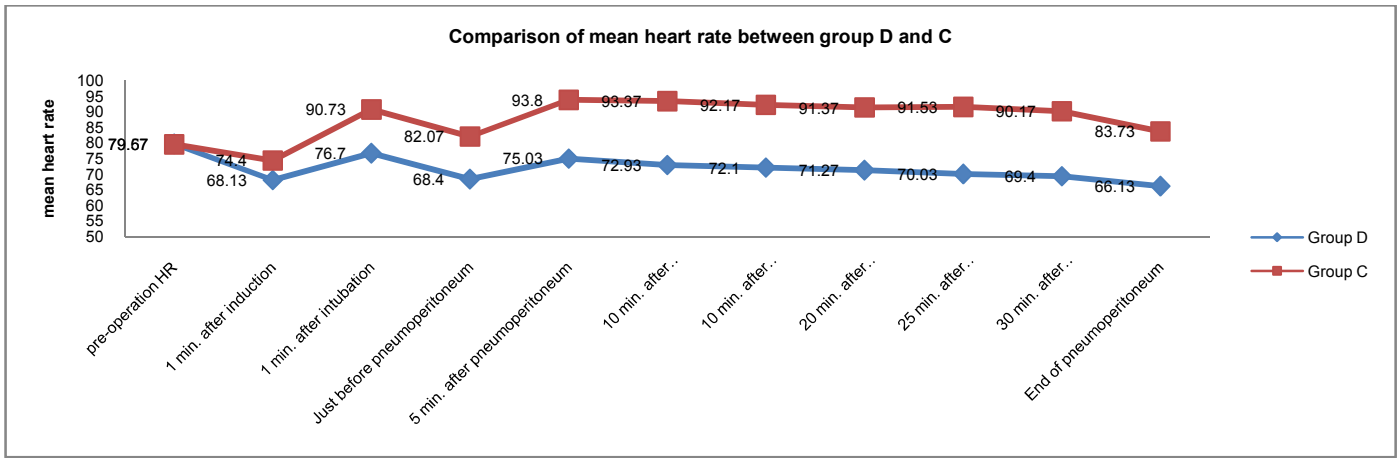
Variable		Group D (n=30)	Group C (n=30)
Age in years (Mean± S.D.)		36.90±7.71	36.17±9.00
Sex (F/M)		14/16	12/18
Weight in kg. (Mean± S.D.)		62.17±8.71	64.2±7.77
ASA status	ASA I	22(73.3%)	22(73.3%)
	ASA II	8(26.6%)	8(26.6%)
Type of Laparoscopic surgery	Cholecystectomy	22	23
	Hemicolectomy	4	3
	Anterior resection	2	2
	Appendicectomy	2	2

Characteristics of patients of both the groups such as weight, sex and age were recorded. It was observed that these characteristics showed no statistically significant differences between the two groups (P > 0.05). The ASA grading of patients was similar in both groups. The types of surgeries for which the patients were admitted were almost same in both the groups. Thus both the groups were identical and comparable.

Table 2: Comparison of mean heart rate between dexmedetomidine and control groups

Heart rate	Group D		Group C		p value
	Mean	SD	Mean	SD	
pre-operation HR	79.67	8.47	79.57	6.86	0.962
1 min. after induction	68.13	6.84	74.40	6.65	0.000*
1 min. after intubation	76.70	9.35	90.73	7.20	0.000*
Just before pneumoperitoneum	68.40	9.07	82.07	7.34	0.000*
5 min. after pneumoperitoneum	75.03	10.39	93.80	8.19	0.000*
10 min. after pneumoperitoneum	72.93	10.16	93.37	8.21	0.000*
10 min. after pneumoperitoneum	72.10	9.40	92.17	8.12	0.000*
20 min. after pneumoperitoneum	71.27	9.71	91.37	8.40	0.000*
25 min. after pneumoperitoneum	70.03	9.73	91.53	7.93	0.000*
30 min. after pneumoperitoneum	69.40	10.21	90.17	7.16	0.000*
End of pneumoperitoneum	66.13	9.01	83.73	6.35	0.000*

* Significant

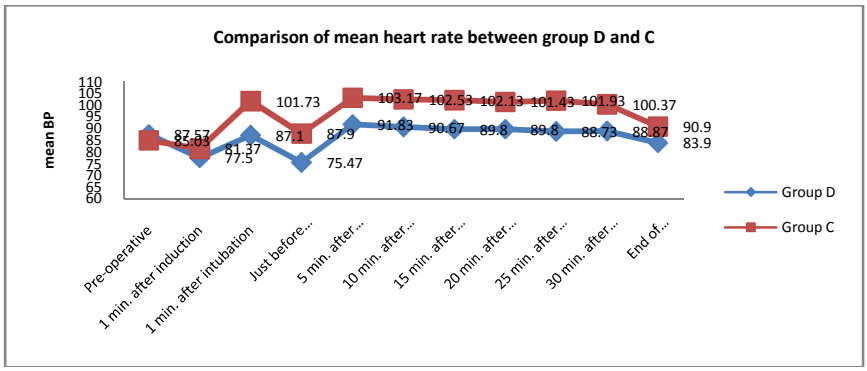


It was observed that there was no significant difference in the preoperative heart rate between the dexmedetomidine and control groups (p= 0.96).Whereas a statistically significant difference in heart rate was seen between the two groups at all time intervals thereafter.

Table 3: Comparison of mean BP between dexmedetomidine and control groups

Mean BP	Group D		Group C		p value
	Mean	SD	Mean	SD	
Pre-operative	87.57	12.07	85.03	7.73	0.335
1 min. after induction	77.50	11.64	81.37	7.95	0.138
1 min. after intubation	87.10	11.16	101.73	10.16	0.000*
Just before pneumoperitoneum	75.47	10.90	87.90	7.84	0.000*
5 min. after pneumoperitoneum	91.83	14.93	103.17	11.96	0.001*
10 min. after pneumoperitoneum	90.67	15.13	102.53	11.20	0.001*
15 min. after pneumoperitoneum	89.80	16.30	102.13	12.25	0.001*
20 min. after pneumoperitoneum	89.80	15.33	101.43	12.36	0.001*
25 min. after pneumoperitoneum	88.73	15.74	101.93	11.65	0.000*
30 min. after pneumoperitoneum	88.87	15.33	100.37	11.59	0.001*
End of pneumoperitoneum	83.90	14.45	90.90	10.35	0.035*

* Significant



It was seen that there was no significant difference in the preoperative mean BP and the mean BP one minute after induction between the dexmedetomidine and control groups. While a significant difference between the two groups was noted at all time intervals thereafter.

DISCUSSION

The present study was conducted with an attempt to examine whether administration of dexmedetomidine to patients undergoing laparoscopic procedures, ensures perioperative haemodynamic stability. The study was conducted on 60 patients who underwent various laparoscopic procedures. All the patients were divided in two group conating 30 patients each. Group D i.e. test group who received the drug Dexmedetomidine and Group C i.e. control group. Both groups were comparable with respect to their age, sex, weight, ASA grades and type of surgery. It was observed that the mean BP and heart rate was decreased in both test and control groups, after induction. The decrease was observed more in the test group, but this difference was not statistically significant. As for the heart rate, it increased significantly in the control group, whereas the test group showed a decrease in heart rate compared to baseline values. Heart rate showed a significant increase in the control group, whereas there was slight decrease from baseline in the test group. Heart rate increased significantly throughout the pneumoperitoneum for the control group, whereas heart rate was decreased throughout in the test group. After intubation, the mean BP increased significantly in the control group, while there was not much of an increase in mean BP in the test group. 5 minutes after pneumoperitoneum, both groups showed an increase in BP, but the increase was less in the test group and there was significant increase in the control group. Throughout the pneumoperitoneum, mean BP was increased in both the groups, but the increase was much less in test group. In a study, Dhurjoti *et al*[8] compared the effects of dexmedetomidine on haemodynamics in patients undergoing laparoscopic cholecystectomy. And the authors found that the mean BP values in groups which received dexmedetomidine were significantly lower after induction than in control group. In our study, though the mean BP decreased in both groups after induction, the decrease was not significant. They also found that the mean BP in dexmedetomidine group was significantly lower after intubation and pneumoperitoneum and remained lower throughout the pneumoperitoneum. In our study mean BP showed no much change during intubation for the dexmedetomidine group and during the pneumoperitoneum there was a slight increase in mean BP for the dexmedetomidine group, compared to the baseline preoperative values. A possible explanation for the lower mean BP after intubation in Dhurjoti's study could be the use of Propofol as the induction agent which is known to cause more fall in BP and heart rate than Thiopentone sodium which was the induction agent in our study. Dhurjoti found that in dexmedetomidine group, heart rate decreased significantly after intubation and pneumoperitoneum and remained lower throughout pneumoperitoneum compared to the control group. This was consistent with our study, where heart rate response to intubation showed a decrease in the dexmedetomidine group and the decrease in heart rate was also seen throughout the pneumoperitoneum. Reisli at al[9] studied the effect of dexmedetomidine on the haemodynamic response to laryngoscopy and intubation. They found that the mean blood pressure and heart rate increased after tracheal intubation, but the increase of both were significantly lower in the dexmedetomidine group than in the placebo group. This was similar to our study with respect to mean BP responses. Keniya *et al*[10] also observed similar finding in their study. Ferdi *et al*[11] compared the effect of dexmedetomidine on haemodynamic response to endotracheal intubation in patients undergoing fast track CABG. They found that the mean BP decreased in both groups after induction and the decrease was not statistically significant, which was consistent with our study. Aho *et al*[12] studied the effects of intravenously administered dexmedetomidine on perioperative haemodynamics in patients undergoing abdominal hysterectomy. They found that the mean BP

and heart rate increased in all the groups after tracheal intubation. However the increase in mean BP and heart rate was significantly less in the dexmedetomidine group than in the saline group.(p value<0.01).In our study ,the mean BP responses to tracheal intubation were similar i.e., no significant rise of BP, whereas the heart rate response showed a decrease from baseline value. The comparative increase in mean BP and heart rate in Aho's study could be because of a lower loading dose of dexmedetomidine used that is, 0.6 mcg/kg, compared to 1 mcg/kg used in our study. Peripheral α-adrenoceptors mediate vascular contraction by regulating calcium influx. After administration of dexmedetomidine, an initial pressor response is produced via vasoconstriction, followed by a secondary baroreflex-mediated decrease in heart rate. Systemic vascular resistance is increased and cardiac output is decreased. Bradycardia is subsequently produced mainly via diminished sympathetic[13,14,15] and/or augmented parasympathetic tone,[16] and blood pressure declines gradually to or beyond baseline level.[17] The site of central control of blood pressure is suggested to be the rostral ventrolateral medulla.[18] Despite later hypotension, heart rate does not increase, which suggests an inhibitory effect on the baroreflex or resetting of the baroreflex.[14] In humans, baroreflex sensitivity was unaffected while systemic sympathetic tone was reduced by dexmedetomidine.[15] The decrease in cardiac output after dexmedetomidine is caused mainly by a decrease in heart rate.

CONCLUSION

Thus we conclude that in patients undergoing laparoscopic procedures, the perioperative use of dexmedetomidine can produce a good hemodynamic stability i.e. stable mean BP and heart rate after intubation.

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