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ORIGINAL RESEARCH

Evaluating the effect of low dose dexmedetomidine infusion on hemodynamic response in patients undergoing laparoscopic cholecystectomy

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ABSTRACT

Background: The key element in laparoscopic surgery is creation of pneumoperitoneum and carbon dioxide is commonly used for insufflation. The present study was conducted to assess the effect of low dose dexmedetomidine infusion on hemodynamic response in patients undergoing laparoscopic cholecystectomy. **Materials & Methods:** 120 patients were randomly allocated into two groups, 60 patients in each group, Group A (patients receiving normal saline 0.9% infusion) & group B (patients receiving dexmedetomidine infusion at the rate of 0.4 mcg/kg/hour). **Results:** There was no significant difference in mean BMI, systolic blood pressure, diastolic blood pressure, heart rate, MAP and SpO_2 at baseline between Group A and Group B. The mean heart rate at 1 minute after induction, after laryngoscopy & intubation, after pneumoperitoneum, after release of pneumoperitoneum and after 1 min of extubation was significantly more among Group A and Group B. There was no significant difference in distribution of males and females between Group A and Group B. Ramsay Sedation Score 5 1 minute after extubation and 15 minutes after extubation was significantly more among Group B. Ramsay Sedation Score at 60 mins after extubation and score 3 at 120 minutes after extubation was significantly more among Group B. The mean duration of surgery was significantly more among Group A as compared to Group B. **Conclusion:** There was attenuation of hemodynamic changes during laryngoscopy, endotracheal intubation, pneumoperitoneum and extubation during laparoscopic cholecystectomy surgeries with infusion of Dexmedetomidine at the dose of 0.4 µg/kg/hr.

Keywords: endotracheal intubation, pneumoperitoneum, laparoscopic cholecystectomy

INTRODUCTION

Laparoscopic cholecystectomy, first performed by Dr. Philippe Mouret (1987) has made a revolution in gastro intestinal surgery in recent years. It has become the gold standard for surgical treatment of benign gallbladder disease. This minimal access procedure has gained popularity over the conventional method due to wide spectrum of advantages, namely lesser blood loss, minimal post- operative pain, shorter hospital stay, early mobilization and good cosmetic outcome.[1]

The key element in laparoscopic surgery is creation of pneumoperitoneum and carbon dioxide is commonly used for insufflation. This pneumoperitoneum perils the normal cardiopulmonary system to a considerable extent. The CO2 induced pneumoperitoneum (carbo-peritoneum) exerts its physiological effect via two different mechanism chemical effect of CO2 due to its diffusion into blood. Mechanical effect related to increased intra-abdominal pressure.[2] On cardiovascular system carbo-peritoneum may lead to hypercarbia leading to activation of sympathetic nervous system consequently resulting in tachycardia, hypertension and incidence of dysrhythmias. Increased intra-abdominal pressure can cause venous compression leading to decrease preload, hence hypotension. Stretching of the peritoneum can disturb the cardiac rhythm due to intense vagal stimulation.

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Physiological changes in pulmonary system includes decrease lung volume and capacity, increase peak airway pressure, cephalad movement of diaphragm and reduced excursion, increased incidence of ventilation perfusion mismatch, pneumothorax and pneumomediastinum. Surgery represents a form of premeditated injury to the body. The stimulation of the free nerve endings and nociceptors occur due to the incision, traction and cutting of the tissues, resulting in the post-operative pain. This acute pain results in the adverse effects on the morale of the patient along with body's physiologic functions.[3]

CO2 causes sympathetic stimulation. So does pain. The signs and symptoms of stimulation are detrimental to recovery. Untreated post-operative pain consequently results in detrimental acute and chronic effects. The attenuation of complex pathophysiology of perioperative pain associated with surgery thereby decreasing nociceptive input to the CNS might result in reduced complications and aid in holistic recovery in the immediate post-operative period and early discharge from the hospital. Adequate post-operative pain management especially with appropriate analgesic regimens, might result in lesser peri-operative morbidity and mortality.[4]

Thus, this study has been modulated as dexmedetomidine could be an important part of the anaesthesiologist's armamentarium to achieve desirable control of the hemodynamics of the patient during laryngoscopy, endotracheal intubation, creation of pneumoperitoneum and extubation in patients undergoing laparoscopic cholecystectomy.[5] The present study was conducted to assess the effect of low dose dexmedetomidine infusion on hemodynamic response in patients undergoing laparoscopic cholecystectomy.

MATERIALS & METHODS

The present study was conducted on 120 patients aged ranging between 18 to 60 years of American Society of Anesthesiologists (ASA) physical status I & II, scheduled for elective laparoscopic cholecystectomy under general anaesthesia. Informed written consents were taken from all patients in the preanesthetic checkup room one day before surgery.

Data such as name, age, gender etc. was recorded. Patients were randomly allocated into two groups by computer generated randomization, 60 patients in each group, Group A (patients receiving normal saline 0.9% infusion) & group B (patients receiving dexmedetomidine infusion at the rate of 0.4 mcg/kg/hour). Infusion was prepared according to the group allotted by the computer, by the anaesthesiologist posted in the pre operative room. All the patients were observed for vital parameters like pulse rate, systolic and diastolic blood pressure, mean arterial pressure (MAP) & oxygen saturation of arterial blood at regular intervals including before starting the infusion, 15 min after starting the infusion, after induction, after intubation, after creation and release of pneumoperitoneum and after extubation. Patients were also observed for post-operative sedation levels at 1minute, 15 minutes, 30 minutes, 60 minutes to 120 minutes post-operatively using Ramsay sedation score (RSS) in the post-operative room, time to first rescue analgesic requirement (analgesic in the form of Injection Diclofenac sodium 1.5 mg/kg was administered when pain was reported by patient ≥ 4 on visual analogue scale [VAS]) and the adverse effects like nausea, vomiting, allergic reactions were recorded. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I B**aseline parameters**

Baseline	Group A		Group B		Mean Difference	t-test value	p-value
	Mean	SD	Mean	SD			
BMI	27.21	1.62	27.58	1.44	-0.36	-1.300	0.196
SBP	121.52	20.02	119.18	13.43	2.33	0.750	0.455
DBP	75.13	9.20	74.72	8.03	0.42	0.264	0.792
HR	76.58	8.03	78.07	12.25	-1.48	-1.572	0.155
MAP	92.78	12.17	90.12	9.95	2.67	1.314	0.191
SPO^2	99.43	0.93	98.92	0.89	0.52	1.116	0.072

There was no significant difference in mean BMI, systolic blood pressure, diastolic blood pressure, heart rate, MAP and SpO_2 at baseline between Group A and Group B.

Table II Assessment of heart rate

Heart rate	Group A		Group B		Mean Difference	t-test value	p-value
	Mean	SD	Mean	SD			
Baseline	76.58	8.03	78.07	12.25	-1.48	-1.572	0.155
Pre-infusion	76.72	8.16	78.07	12.25	-1.35	-1.972	0.101
15 mins post infusion	81.70	12.15	78.32	11.18	3.38	1.587	0.115
1 min after induction	80.35	12.82	72.77	9.92	7.58	3.625	0.001*
After laryngoscopy & intubation	92.82	9.91	84.67	11.50	8.15	4.159	0.001*
After pneumoperitoneum	90.45	10.82	82.52	11.15	7.93	3.955	0.001*

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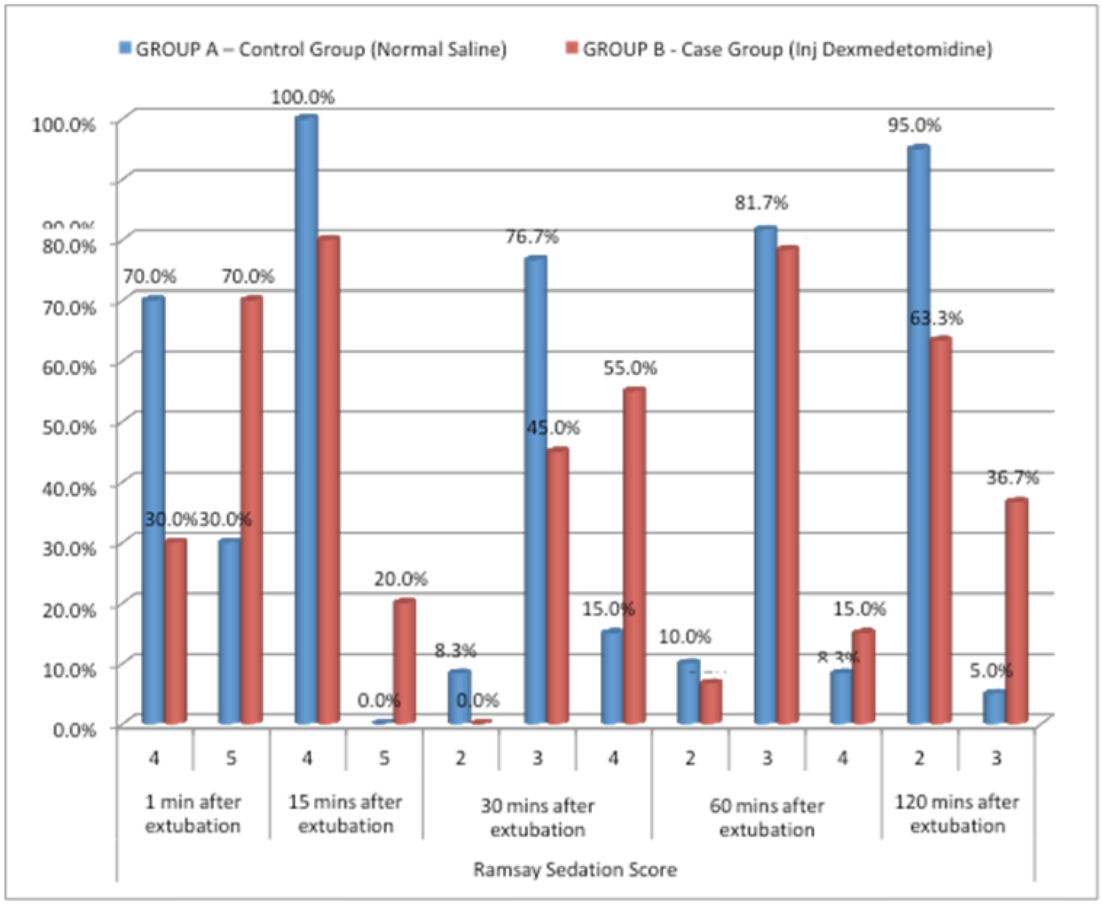
30 mins after pneumoperitoneum	85.85	13.19	84.27	12.96	1.58	0.663	0.509
After release of pneumoperitoneum	86.08	7.82	79.82	10.25	6.27	3.766	0.001*
After 1 min of extubation	95.28	8.68	85.92	8.81	9.37	5.866	0.001*

The mean heart rate at baseline, pre-infusion, 15 mins post-infusion, 1 min after induction, after laryngoscopy & intubation, after pneumoperitoneum, 30 mins after pneumoperitoneum, after release of pneumoperitoneum and after 1 minute of extubation was compared between Group A and Group B using the unpaired t-test. The mean heart rate at 1 minute after induction, after laryngoscopy & intubation, after pneumoperitoneum, after release of pneumoperitoneum and after 1 min of extubation was significantly more among Group A and Group B.

Graph I Ramsay sedation score



The distribution of Ramsay Sedation Score 1 minute after extubation, 15 minutes after extubation, 30 minutes after extubation, 60 minutes after extubation and 120 minutes after extubation was compared between Group A and Group B using the chi-square test. There was no significant difference in distribution of males and females between Group A and Group B. Ramsay Sedation Score 5 1 minute after extubation and 15 minutes after extubation was significantly more among Group B. Ramsay Sedation Score 4 at 60 mins after extubation and score 3 at 120 minutes after extubation was significantly more among Group B.

Table III Duration of Surgery

	Duration of surgery				
Groups	**Mean**	**Std. Deviation**	**Mean Difference**	**t-test value**	**p-value**
Group A	65.08	15.82	9.67	3.818	0.001*
Group B	55.42	11.58			

The mean duration of surgery was compared between Group A and Group B using the unpaired t-test. The mean duration of surgery was significantly more among Group A as compared to Group B.

DISCUSSION

Acute pain post-operatively leads to the activation of the sympathetic nervous system contributing to the morbidity or even mortality. Sympathetic activation may increase myocardial oxygen consumption, which may be important in the development of myocardial ischemia and infarction, and may decrease myocardial oxygen supply through coronary vasoconstriction and attenuation of local metabolic coronary vasodilation. Post-operative pain relief is the greatest challenge for

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the anaesthesiologists and multimodal analgesic regimen is the need of the hour to achieve best post-operative experience thereby making surgery a comfortable assertion for the surgical patients.[6]

Laparoscopic cholecystectomy is performed under general anaesthesia during which the surgery itself, along with laryngoscopy, tracheal intubation and extubation and other critical events like creation of pneumoperitoneum, increases surgical stress response leading to endocrinological changes.[7] It increases secretion of many catabolic and anabolic hormones resulting in increased metabolic rate, for example, cortisol, catecholamines, glucagon, aldosterone, anti-diuretic hormone, thyroid hormone and growth hormone. Despite laparoscopy being minimally invasive, the classical stress responses (catecholamines, cortisol and glucose) are not greatly altered in comparison to open cholecystectomy, hence, stress attenuation is of high relevance to achieve good outcome. Stress response can be attenuated by various pre-medications and anaesthetic techniques. Pharmacological agents are used to improve outcome and decrease surgical stress. Various pharmacological agents like opioids, dexmedetomidine, magnesium sulphate, clonidine, and deeper planes of anaesthesia are used to achieve this goal.[8]

Dexmedetomidine is the S-enantiomer of medetomidine having more specificity for the α2-adrenoreceptor than Clonidine. Since then, it has been investigated as the anxiolytic, sympatholytic, and analgesic properties related to α2-adrenoceptor binding, and it is now being used as a co-analgesic drug.[9] In the form of the adjuvant, the most suitable route is the neuraxial administration as the analgesic effect of α2-agonists is mainly at the spinal level, and the high lipophilicity helps in the facilitation of the fast absorption into the cerebrospinal fluid and binds to α2-adrenoreceptor of the spinal cord.[10]

We found that there was no significant difference in mean BMI, systolic blood pressure, diastolic blood pressure, heart rate, MAP and SpO_2 at baseline between Group A and Group B. 55. Laxmi Narsaiah et al[11] stated that comparing group D (Inj Dexmedetomidine) with group S (Normal Saline), a highly significant ($P < 0.001$) fall in mean heart rate was seen during laryngoscopy and intubation and remained so till after 1 minute of intubation and became statistically significant after 15 minutes of pneumoperitoneum and throughout rest of the study.

We observed that the mean heart rate at 1 minute after induction, after laryngoscopy & intubation, after pneumoperitoneum, after release of pneumoperitoneum and after 1 min of extubation was significantly more among Group A and Group B. We found that there was no significant difference in distribution of males and females between Group A and Group B. Ramsay Sedation Score 1 minute after extubation and 15 minutes after extubation was significantly more among Group B. Ramsay Sedation Score at 60 mins after extubation and score 3 at 120 minutes after extubation was significantly more among Group B. The mean duration of surgery was significantly more among Group A as compared to Group B. Manne GR et al[12] assessed the impacts of low measurements of dexmedetomidine on haemodynamic reaction to laryngoscopy, endotracheal intubation, production of pneumoperitoneum and extubation in patients experiencing laparoscopic cholecystectomy. There was significant attenuation of the hemodynamic response was seen in both the dexmedetomidine groups.

CONCLUSION

Authors found that there was attenuation of hemodynamic changes during laryngoscopy, endotracheal intubation, pneumoperitoneum and extubation during laparoscopic cholecystectomy surgeries with infusion of Dexmedetomidine at the dose of 0.4 µg/kg/hr.

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