ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4

Journal of Coastal Life Medicine

A Comparative Study to See the Effects of Perioperative Infusion of Lidocaine vs Dexmedetomidine on Hemodynamic Parameters in Patients Undergoing Laparoscopic Cholecystectomy Surgery

Received: 17 August 2022, **Revised:** 13 September 2022, **Accepted:** 15 October 2022

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Keywords

dexmedetomidine, hemodynamic, perioperative, laparoscopic cholecystectomy, surgery, QoR (Quality of Recovery).

Abstract

Background: Laparoscopic cholecystectomy is also found to be attributing to stress response and significant alteration of hemodynamics due to effects of pneumoperitoneum, patient's position, and hypercapnia by absorption of CO2 as a result of pneumoperitoneum. It is also important to have good postoperative pain control for early recovery after laparoscopic cholecystectomy (LC). Intravenous lidocaine has anti-hyperalgesic, anti-inflammatory and analgesic effects while dexmedetomidine provides anti-nociception, analgesic, sedative and sympatholytic effects. Both these drugs can be used as adjuvants to improve recovery after LC.

Aim and Objective: To see the effects of perioperative infusion of Lidocaine vs dexmedetomidine on hemodynamic parameters during perioperative period in patients undergoing laparoscopic cholecystectomy surgery.

Methodology: The study, a non-randomized controlled trial conducted in a hospital setting, took place from 2019 to 2020 in the department of anesthesia at Santosh Medical College and Hospital in Ghaziabad, India. In this study, patients of either gender between the ages of 18yrs and 60yrs were scheduled for laparoscopic cholecystectomy. To perform a laparoscopic cholecystectomy, 70 adult patients of either sex who had ASA grades I or II were admitted. They were randomly split into two groups of 35 patients each.

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Result: The most frequent side effect in group D was bradycardia, which was followed by dry mouth (23.9%), hypotension (8.6%), and hypotension (37.1%). In contrast, side effects in group L included dry mouth (14.3%) and bradycardia (11.4%). Any patient receiving lignocaine did not experience hypotension.

Conclusion: Lidocaine and dexmedetomidine perioperative infusions improved recovery following LC and were both reliable and safe adjuvants. But with dexmedetomidine infusion, the postoperative recovery profile was better, and it might be regarded as the best adjuvant in outpatient laparoscopic surgery.

1. Introduction

In modern times, laparoscopic cholecystectomy is one of the procedures most often performed. The preferred course of care for symptomatic cholelithiasis is likewise thought to be laparoscopic cholecystectomy [1]. It has many benefits over an open cholecystectomy, including less post-operative pain, a smaller incision, less blood loss, a shorter hospital stay, quicker functional recovery, and an earlier return to preoperative activity and employment [2-4]. Even while one benefit of laparoscopic surgery over open surgery is that postoperative pain is less intense, it is still significant and does not go away entirely [5]. Pain is a frequent factor in prolonged hospital stays following laparoscopic cholecystectomy and may increase morbidity [6, 7]. The most prevalent complaints from patients are back pain, shoulder pain, and discomfort from port site incisions [8], with shoulder and sub-diaphragmatic pain being recorded in 12% to 60% of cases [9]. The first few postoperative hours have the highest pain intensity, which often starts to subside after two or three days [10].

The peritoneal insufflation of CO2 to produce the pneumoperitoneum required for laparoscopy also causes intraoperative hemodynamic [4-6,9,10] and ventilatory [4-8] changes that complicate laparoscopic anaesthesia management. These alterations are also influenced by the patient's position, which must be either head-down or head-up throughout these treatments.

Pain, physiological endpoints, the frequency of adverse events, and changes in psychological status are just a few of the consequences that can occur during the complicated postoperative recovery process. For pain management and to reduce opioid-related adverse effects, multimodal analgesia has been suggested. However, there are other aspects that affect recovery quality as well, including as nausea and vomiting, the length of the ileus, achieving physical comfort and independence, and early ambulation. Systemic lidocaine is a useful supplement to lessen postoperative discomfort, nauseousness, and vomiting, as well as the length of ileus and hospital stay [11–13]. By preventing the onset of central hyperalgesia and enhancing the quality of postoperative recovery, it is hypothesised that lidocaine offers real preventive analgesia. Dexmedetomidine is a highly selective -2 adrenoceptor agonist that induces sleepiness, analgesia, and sympatholysis. An earlier postoperative recovery is made possible by perioperative administration, which enhances hemodynamic stability and reduces the need for postoperative analgesics, nausea, vomiting, and respiratory depression [14,15].

Yong Hong Bi et al also carried out another study with the aim to assess effects of dexmedetomidine on postoperative analgesia, somato-visceral sensory block characteristics as well as on the stress response of intrathecal bupivacaine administration among women undergoing caesarean section [17]. In total, 60 eligible parturient undergoing caesarean section were included in the study and were given intrathecal bupivacaine alone as well as in combination with dexmedetomidine. It was found that addition of dexmedetomidine enhanced the time duration of motor and sensory block and reduced the requirement of supplemental dose of lignocaine and fentanyl. This study concluded that addition of dexmedetomidine to bupivacaine provided better somato-visceral sensory block characteristics intraoperatively and analgesia postoperatively without any influence on Apgar scores, side effects and stress response. Although various studies have been conducted to evaluate efficacy of lignocaine and dexmedetomidine individually but comparative

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study between lignocaine and dexmedetomidine are very few.

The Global QoR-40 questionnaire has been used to evaluate the QoR (Quality of Recovery) [16]. A multitude of studies show that intravenous lidocaine enhances the QoR after laparoscopic cholecystectomy. Dexmedetomidine provides haemodynamic stability and has analgesic and anesthetic sparing properties. Several studies have summarised that improved postoperative recovery is due to a lowering of opioid consumption. Keeping this in mind we hypothesised that dexmedetomidine may provide a superior quality of recovery during laparoscopic surgeries and decided to evaluate the effects of intraoperative intravenous infusions of lidocaine and dexmedetomidine in reducing postoperative pain and improving the recovery profile in patients undergoing laparoscopic cholecystectomy using the Global QoR-40 questionnaire.

We are proposing to use lignocaine and dexmedetomidine to compare their effects on haemodynamic response and postoperative analgesia in place of opioids in patients undergoing laparoscopic cholecystectomy.

2. Materials and Methods

The study was a "hospital based non-randomized controlled trial" and carried out in "Department of Anaesthesiology of Santosh Medical College and Hospital, Ghaziabad, India" over a period of 12 months from 2019 to 2020. In this study patients planned for Laparoscopic Cholecystectomy between age 18 to 60 years of either gender. There were 70 adult patients of either sex with either "ASA grade I or grade II admitted for Laparoscopic Cholecystectomy" were randomly divided into 2 groups 35 each.

"After obtaining approval from institutional ethical committee 70 adult patients of either sex with ASA grade I or II admitted to Santosh Medical College, Ghaziabad, for Laparoscopic Cholecystectomy were randomly divided into 2 groups 35 each. After taking informed written consent from patients, all 70 patients were assigned to 2 groups, 1 group receiving 2% intravenous preservative free Lidocaine (bolus followed by infusion) and other group receiving Dexmedetomidine (bolus followed by infusion)".

The gathered information was changed into variables, coded, and entered into Microsoft Excel. "SPSS-PC-21" was used to analyse and statistically evaluate the data.

3. Results

It was a hospital based randomized controlled trial conducted in "Department of Anaesthesiology of Santosh Medical College and Hospital, Ghaziabad, India" enrolling 70 adult patients of either sex with either ASA grade I or grade II admitted for Laparoscopic Cholecystectomy were randomly divided into 2 groups 35 each. Group L received 2% intravenous preservative free Lidocaine (bolus followed by infusion) and Group D received Dexmedetomidine (bolus followed by infusion).

Table 1: Demographic data distribution of study subject and comparison between both groups.

Demographic Distribution		**Number (Percentage)**	
		Group D (n=35)	**Group L (n=35)**
Gender	Male	24 (68.6)	26 (74.3)
	Female	11 (31.4)	9 (25.7)
ASA Grade	Grade I	1 (88.6)	32 (91.4)
	Grade II	4 (11.4)	3 (8.6)

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Mean age in years	38.89±10.66	38.0±9.51
Weight (Kgs)	59.59±8.18	58.66±5.29

Table1 shows that the mean age in group D was 38.89±10.66 years while the mean age in group lignocaine was 38.0±9.51 years. Mean weight in group Dexmedetomidine was 59.59±8.18 kgs and mean weight in group lignocaine was 58.66±5.29 kgs. Both the groups were comparable in term of demographic distribution. In Dexmedetomidine group, 24 (68.6%) were males and 11(31.4%) were females whereas in the lignocaine group, 26 (74.3%) were male and 9 (25.7%) were female. In Dexmedetomidine group, 31 (88.6%) patients were in grade I and 4 (11.4%) were in grade II whereas in the lignocaine group, 32 (91.4%) were in grade I and 3 (8.6%) were ASA grade II category

Table 2: SBP (mm Hg) and MAP (mm Hg) at different interval in both groups.

		Group D (n=35)	**Group L (n=35)**	**P value**
		Mean±SD	**Mean±SD**	
SBP (mm Hg)	Preoperative	121.01±11.79	120.09±8.96	0.71
	After bolus drug	118.0±7.72	118.34±6.25	0.83
	After induction	121.26±7.26	122.46±7.25	0.49
	After intubation	119.14±8.04	121.17±7.01	0.26
	After pneumo-peritoneum 1min	116.17±10.08	124.91±7.82	<0.001
	After pneumo-peritoneum 15 min	121.27±6.31	129.63±6.22	<0.001
	After pneumo-peritoneum 30 min	114.69±11.32	124.63±5.45	<0.001
	After pneumo-peritoneum 45 min	110.57±12.44	122.20±7.82	<0.001
	After pneumo-peritoneum 60 min	111.0±10.03	118.80±6.38	<0.001
	Post release pneumo-peritoneum	108.77±10.55	117.80±7.65	<0.001
	Post extubation	120.83±7.39	120.20±6.41	0.71
MAP (mm	Preoperative	89.80±7.36	89.31±6.58	0.77

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Hg)	After bolus drug	88.09±6.18	90.86±6.07	0.06
	After induction	91.83±5.88	94.86±7.98	0.07
	After intubation	87.74±6.75	93.66±8.51	<0.01
	After pneumo-peritoneum 1min	87.89±7.28	94.63±6.36	<0.001
	After pneumo-peritoneum 15 min	92.09±3.95	96.89±6.78	<0.01
	After pneumo-peritoneum 30 min	87.69±8.12	93.11±7.81	<0.01
	After pneumo-peritoneum 45 min	86.01±7.13	91.03±5.87	<0.01
	After pneumo-peritoneum 60 min	84.71±6.75	88.09±4.75	0.01
	Post release pneumo-peritoneum	81.83±8.17	87.23±6.34	<0.01
	Post extubation	87.23±5.46	91.09±5.50	<0.01

In Table 2, it shows that the mean systolic blood pressure at baseline was comparable in both the groups (121.01±11.79 mm Hg in group D & 120.09±8.96 mm Hg in group L). After intubation there was an increase in systolic blood pressure in both the groups but there was more control of increase of systolic blood pressure response in Dexmedetomidine group compare to lignocaine group and this difference was statistically significant which was seen till 60 minutes post intubation between both groups. Post-extubation systolic blood pressure comes to baseline range in both the groups but mean arterial pressure was more controlled in group D. Also, after bolus drug along with infusion no significant difference was observed in mean arterial pressure between both groups but after intubation, there was more control of increase of mean arterial pressure in Dexmedetomidine group as compared to lignocaine group, with significant statistical difference ($p<0.05$) between both the groups and this control was continued till post extubating.

Table 3: Pulse rate and SPO2 at different interval in both groups.

Pulse rate and sPO_2		**Group D (n=35)**	**Group L (n=35)**	**P value**
		Mean±SD	**Mean±SD**	
Pulse rate	Preoperative	76.60±9.83	77.80±7.51	0.52
	After bolus drug	77.77±12.12	76.43±7.30	0.83
	After induction	79.23±11.55	80.69±13.93	0.69
	After intubation	81.66±7.80	86.46±11.67	0.09
	After pneumo-peritoneum 1min	76.91±8.01	87.03±8.07	<0.01

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	After pneumo-peritoneum 15 min	77.03±10.13	85.14±10.73	<0.01
	After pneumo-peritoneum 30 min	74.57±9.95	84.17±9.80	<0.01
	After pneumo-peritoneum 45 min	73.77±10.38	85.17±9.44	<0.001
	After pneumo-peritoneum 60 min	71.83±6.56	83.34±11.28	<0.001
	Post release pneumo-peritoneum	71.63±7.94	79.51±12.30	<0.01
	Post extubation	78.69±12.18	85.43±13.12	<0.01
SPO_2	Preoperative	99.26±0.88	99.49±0.82	0.26
	After bolus drug	99.43±1.01	99.54±0.61	0.56
	After induction	99.71±0.52	99.66±0.48	0.63
	After intubation	99.71±0.46	99.63±0.69	0.54
	After pneumo-peritoneum 1min	99.69±0.53	99.63±0.55	0.65
	After pneumo-peritoneum 15 min	99.63±0.59	99.57±0.55	0.68
	After pneumo-peritoneum 30 min	99.63±0.69	99.43±0.61	0.2
	After pneumo-peritoneum 45 min	99.46±0.82	99.49±0.56	0.86

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	After pneumo-peritoneum 60 min	99.40±0.77	99.43±0.61	0.86
	Post release pneumo-peritoneum	99.54±0.61	99.65±0.61	1
	Post extubation	99.63±0.55	99.57±0.55	0.66

Prior to intubation, for the changes in Pulse Rate, both the groups "lignocaine and dexmedetomidine" with values ("p value> 0.05") were comparable (In group D pulse rate during preoperative period was 76.60±9.83, after bolus drug administration was 77.77±12.12 and after induction was 79.23±11.55 while in group L, pulse rate during preoperative period was 77.80±7.51, after bolus drug administration was 76.43±7.30 and after induction was 80.69±13.93. The pulse rate in the lignocaine group continuously increased in comparison to the pre-intubation values, which served as the baseline. The pulse rate was elevated from pre-intubation values in the Dexmedetomidine group as well. But the increase in pulse rate was significantly lesser than that of the increase in lignocaine group ($p<0.01$). This difference between dexmedetomidine group and lignocaine group was statistically significant ($p<0.01$). The reaction of the Pulse Rate to extubation was attenuated by both lignocaine and dexmedetomidine. With Inj Dexmedetomidine, however, as opposed to Inj Lignocaine, the mean pulse rate was much lower following extubation. Mean SPO_2 level in both the group were comparable in both the groups. In group D Mean SPO_2 level after induction, after intubation, at 1 minute, 15-minute, 30-minute, 45 minute and 60 minute was 99.71±0.52, 99.71±0.46, 99.69±0.53, 99.63±0.59, 99.63±0.69, 99.46±0.82 and 99.40±0.77 respectively while in group L Mean SPO_2 level after induction, after intubation, at 1 minute, 15-minute, 30 minute, 45 minute and 60 minute was 99.66±0.48, 99.63±0.69, 99.63±0.55,99.57±0.55, 99.43±0.61, 99.49±0.56 and 99.43±0.61 respectively.

Table 4: Side effects in both groups.

Side effects	**No. (Percentage)**		**P value**
	Group D (n=35)	**Group L (n=35)**	
Hypotension	3 (8.6)	0 (0.0)	0.23
Hypertension	0 (0.0)	0 (0.0)	0
Bradycardia	13 (37.1)	4 (11.4)	0.02
Tachycardia	0 (0.0)	0 (0.0)	0
Respiratory depression	0 (0.0)	0 (0.0)	0
Dryness of mouth	8 (22.9)	5 (14.3)	0.35
Fever	0 (0.0)	0 (0.0)	0
Other	5 (14.3)	3 (8.6)	0.71

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ISSN: 2309-6152 (Online)
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In Table 4, it shows that group D most common side effect observed was bradycardia (37.1%) followed by dryness of mouth (22.9%) and hypotension (8.6%) while in group L dryness of mouth (14.3%) and bradycardia (11.4%) were side effects. Hypotension was not observed in any patients receiving lignocaine.

4. Discussion

During laryngoscopy and endotracheal intubation, haemodynamic response has been seen since 1940. It was Burstein CL et al who initially identified these haemodynamic changes during intubation and laryngoscopy in 1940. [50] Burstein CL et al [50] also identified the reason behind this haemodynamic response and stated that this haemodynamic response was due to increased sympathetic response which is due to stimulation of laryngopharynx and epipharynx. Prys-Roberts also later confirmed these findings that T1-4 provides efferent sympathetic outflow to the heart while T3-L3 provides sympathetic outflow to adrenal medulla.

Dexmedetomidine was 38.89±10.66 years and the mean age in group lignocaine was 38.0±9.51 years. Mean weight in group Dexmedetomidine was 59.59±8.18 kgs and mean weight in group lignocaine was 58.66±5.29 kgs. Both the groups were comparable in term of demographic distribution. In Dexmedetomidine group, 24 (68.6%) were males and 11(31.4%) were females whereas in the lignocaine group, 26 (74.3%) were male and 9 (25.7%) were females.

In our study, "Mean VAS score in group D at 0 hrs, 2 hrs, 4 hrs, 6 hrs, 12 hrs and at 24 hrs was 0.23±0.64, 1.06±1.58, 1.63±1.69, 1.17±1.27, 1.77±1.45, 1.74±1.44 respectively while in group L mean VAS score at 0 hrs, 2 hrs, 4 hrs, 6 hrs, 12 hrs and at 24 hrs was 0.09±0.37, 0.69±1.45, 0.71±1.27, 0.66±0.94, 1.34±1.63 and 1.51±1.65 respectively". The mean VAS score was therefore greater in group D than in group L, but no other significant difference was found between the two groups until after 4 hours. Only 24 hours after surgery was it possible to study the analgesic action, and it was discovered that IV lignocaine was important. Significant analgesic activity has been documented in other studies between 2 and 48 hours after surgery. [18-20] Kim YS et al. [21] investigated the ideal dose of dexmedetomidine to prevent post-anesthesia shivering in patients undergoing elective laparoscopic total hysterectomy, and they came to the conclusion that 0.75 g/kg or 1 g/kg of dexmedetomidine provides both an analgesic and effective prophylaxis against post-operative shivering.

Laparoscopic cholecystectomy is one of the most commonly practiced surgery nowadays. Laparoscopic cholecystectomy is also considered as the treatment of choice for symptomatic cholelithiasis. It has lot of advantages over open cholecystectomy like less post-operative pain, smaller incision, reduced blood loss, shorter hospitalization and faster functional recovery and earlier return to preoperative activity and work. Although reduced postoperative pain is one of the advantages of laparoscopic surgery as compared to open surgery but it does not completely disappear and is still considerable. The study was aimed to use lignocaine and dexmedetomidine and to compare their effects on haemodynamic response and postoperative analgesia in place of opioids in patients undergoing laparoscopic cholecystectomy.

5. Conclusion

To conclude, perioperative infusions of lidocaine and dexmedetomidine had similar effect on postoperative pain relief and reduction in analgesic consumptions. However, the postoperative recovery profile was better with dexmedetomidine infusion. So, we suggest the use of perioperative dexmedetomidine in laparoscopic cholecystectomy for postoperative pain relief as it reduces opioid consumption and provides early recovery. This study was conducted in 35 patients belonging to ASA I and II, between the age group of 18 to 60 years of age who were posted for laparoscopic cholecystectomy surgeries.

The study concluded that Dexmedetomidine is better drug in compare to Lignocaine in controlling pressor response and the most correct time of administration based on our study is around 10 min prior to intubation. However, Lignocaine is superior to Dexmedetomidine for the increased pain-free period and better postoperative analgesia with lesser side effects in patients undergoing laparoscopic cholecystectomy.

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ISSN: 2309-6152 (Online)
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ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
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