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Original Research Article

A Comparative Study of Intraoperative Intravenous Paracetamol vs. Intravenous Dexmedetomidine for Postoperative Analgesia in Patients Undergoing Laparoscopic Cholecystectomy

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Conflict of interest: Nil

Abstract

Objectives: Efficient post-operative pain management is pivotal in healthcare. The primary aim of this study is to evaluate the duration and efficacy of post-operative pain relief achieved by intravenous Paracetamol and Dexmedetomidine. Secondary objectives encompassed the assessment of haemodynamic changes, adverse effects, and complications associated with these agents.

Methods: Ethical approval was obtained for this prospective randomized study, involving 60 enrolled patients. Participants were randomly assigned to two groups: Group P received intravenous Paracetamol (15 mg/kg), and Group D received intravenous Dexmedetomidine (1 µg/kg) followed by continuous infusion. Pain intensity was gauged through the Visual Analogue Scale (VAS). Recorded parameters included time to initial rescue analgesia, overall analgesic consumption, vital signs, Ramsay Sedation Scores, and adverse reactions. Statistical analysis employed t-tests, Chi-square tests, and p-values.

Results: Both groups displayed comparable age, gender distribution, and ASA physical status. Dexmedetomidine correlated with reduced mean heart rates, systolic and diastolic blood pressures at diverse postoperative intervals ($p < 0.05$). No significant variations were observed in mean oxygen saturation percentages. Dexmedetomidine exhibited significantly lower pain scores at 1 and 1.5 hours postoperatively compared to Paracetamol ($p < 0.0001$). Time to administer first rescue analgesia was notably extended in the Dexmedetomidine group ($p < 0.0001$), while Group P had heightened total analgesic consumption ($p < 0.0001$). The Dexmedetomidine group demonstrated higher Ramsay Sedation Scores, whereas paracetamol group exhibited increased frequency of nausea and vomiting ($p < 0.05$).

Conclusions: This study demonstrates that Dexmedetomidine provides superior post-operative pain relief compared to Paracetamol, as indicated by lower pain scores, delayed need for rescue analgesia, and reduced analgesic consumption in post-laparoscopic cholecystectomy patients.
Keywords: Post-operative pain management, intravenous Paracetamol, Dexmedetomidine, pain relief, analgesic efficacy.

Introduction

Pain, described as an uncomfortable feeling linked to potential or actual tissue damage, is a well-known challenge in healthcare, acknowledged by professionals worldwide [1]. Despite advancements in surgical techniques, pain management continues to be a crucial aspect of patient care. Minimally invasive procedures like laparoscopic cholecystectomy, which replaced traditional open methods for gallbladder removal, have improved patient outcomes [2]. This technique is recommended for various conditions, such as cholecystitis, gallstone-related problems, and more [3]. Although laparoscopic surgery offers benefits like reduced pain and quicker recovery, many patients still experience significant pain within the first 24 hours after the procedure [4]. This post-operative pain, affecting over 80% of surgical patients, can have a severe impact on well-being. It not only increases patient discomfort but also burdens healthcare systems emotionally and financially [5]. The consequences of uncontrolled pain extend across multiple body systems, including respiratory, cardiovascular, genitourinary, gastrointestinal, musculoskeletal, psychological, and neuroendocrine systems [6]. The term "perioperative physician" is emerging to describe healthcare professionals, like anesthesiologists, responsible for post-operative pain management, aimed at patient comfort and well-being. The objectives of this pain management are clear: to reduce the physical stress response to pain, provide effective pain control for quicker recovery, minimize side effects, and prevent chronic pain [7]. Numerous methods, both pharmacological and non-pharmacological, have been used to manage pain, with varying success. Despite efforts, many methods fall short in either effectiveness or unwanted side effects. In this context, dexmedetomidine, an alpha-2 adrenoceptor agonist, has gained attention for its sedative and analgesic properties [8]. Another option is paracetamol, widely prescribed for acute pain relief due to its safety profile. While oral paracetamol takes time to work, intravenous administration offers faster relief [9].

So, we conducted a prospective randomized study to compare the post-operative analgesia provided by intravenous paracetamol and dexmedetomidine in terms of duration and efficacy in patients posted for laparoscopic cholecystectomy.

Materials and Methods

Study Approval, Ethical Considerations, and Participant Selection: This is the prospective randomised study approved by the institute ethics committee at Rajendra Institute of Medical sciences, Ranchi, Jharkhand, and protocols followed were in accordance with the ethical standards formulated in the Helsinki Declaration. Patients were informed in detail and voluntary written informed consent was obtained from each patient before recruitment. A thorough pre-anaesthetic evaluation was done including airway assessment, clinical history, general and systemic examination, routine biochemical investigation, chest X-ray and electrocardiography. The previous anaesthetic exposure and drug sensitivity were enquired. The subjects were included

based on the following criteria during screening of the study. (a) age group of 18-60 yrs. (inclusive of both genders). (b) American Society of Anaesthesiologists (ASA) physical status I and II (c) Patients posted for laparoscopic cholecystectomy surgery. The exclusion criteria were based on (a) ASA physical status III and IV (b) Patients with known hypersensitivity to paracetamol or dexmedetomidine (c) Presence of co-morbidities like diabetes mellitus, asthma, hypertension, cardiac disease, haematological disease, psychiatric illness etc (d) Patient with opioid or alcohol addiction (e) Patients taking nonsteroidal anti-inflammatory or any other analgesic drug.

Procedures

In this study, a total of 60 patients were enrolled and randomly allocated into two groups: Group D (n=30) and Group P (n=30). The allocation was accomplished using the "closed envelope method.

Preoperative Preparation, Induction, Anesthesia Maintenance and Controlled Ventilation: Upon patients' transfer to the Operation Room, meticulous monitoring was commenced, including ECG, NIBP, and pulse oximetry for haemodynamic assessment. Preoxygenation was executed with 100% oxygen for 3 minutes. Patients received inj. Propofol 2 mg/kg IV, inj. fentanyl 2 mcg/kg IV, and Inj. Succinylcholine 2 mg/kg IV for tracheal intubation as the induction process. Further, anesthesia was maintained with N_2O:O_2 2:1, Isoflurane 0.6-1.2%, and inj. Atracurium 0.5 mg/kg IV loading dose, alongside 0.1 mg/kg boluses for relaxation. The controlled ventilation was employed using a closed circuit. Tidal volume was set at 8-10 ml/kg, respiratory rate at 12-16/min, and minimal PEEP was used to maintain EtCO2 at 35-45 mm Hg.

Administration of Study Drugs: After induction, study drugs were administered according to group allocation:

Group D (n=30): Patients in this group received an intravenous injection of Dexmedetomidine at a dose of 1 mcg/kg over a duration of 15 minutes, followed by a continuous infusion of 0.5 mcg/kg/hr through a syringe infusion pump.

Group P (n=30): Patients in this group were administered an intravenous injection of Paracetamol at a dose of 15 mg/kg over a 15-minute period, followed by a volume-matched infusion of 0.9% normal saline via a syringe infusion pump.

Surgical Procedure: The surgical procedure involved an 11mm trocar through the umbilical port, abdomen inflation with CO_2 (1-2 litres/min, 12-14 mmHg), and post-procedure abdominal cleansing with saline. Residual CO_2 release was facilitated by abdomen compression pre-port closure.

Neuromuscular Blockade Reversal, Extubation and Postoperative Monitoring: Neuromuscular blockade was reversed with inj. Neostigmine (0.05 mg/kg) and inj. Glycopyrrolate (0.01 mg/kg), leading to extubation upon spontaneous breathing return. Post-operatively, patients were monitored for 2 hours in the post-anaesthetic care unit, with parameters recorded every 30 minutes. Monitoring continued in the ward at 4th, 12th, and 24th hours.

Analgesia, Hemodynamic Management and Side Effects Management: During the postoperative phase, the administration of analgesia was initiated when the Visual Analogue Scale (VAS) indicated pain intensity greater than 4, leading to the administration of Inj. Tramadol. In cases of hypotension, a dose of Inj. Mephentermine 6 mg was administered to address the condition effectively. Similarly, the management of bradycardia was achieved through the administration of Inj. Atropine 0.6 mg IV. Any potential side effects that arose were vigilantly identified and managed in accordance with appropriate

measures, ensuring patient safety and well-being throughout the study period

Study Objectives and Methodology: The primary objective of this study is to perform a comprehensive comparison of the quality and duration of post-operative analgesia achieved through the intravenous administration of Paracetamol and Dexmedetomidine. The secondary objectives of this study encompass the evaluation of haemodynamic changes occurring within all participant groups and an in-depth investigation into the potential side effects and complications arising from the administration of these analgesic agents.

To achieve this, we employed the following methodology:

Vital Parameter Monitoring: All vital parameters, including heart rate, blood pressure, mean arterial pressure, and oxygen saturation, were diligently recorded every 15 minutes during the intraoperative period until the completion of surgery. Following surgery, these parameters were documented every 30 minutes for the first 2 hours in the ward, and subsequently at the 4th, 12th, and 24th hour postoperatively.

Pain Assessment: Pain intensity was evaluated using the Visual Analogue Scale (VAS), which employs a 0-10cm scale, with higher values indicating greater pain. Alternatively, the Numeric Pain Rating Scale was utilized for pain assessment.

Rescue Analgesia: The time of administration for the first rescue analgesia dose and the total amount of rescue analgesia required within a 24-hour timeframe were meticulously recorded.

Ramsay Sedation Score: The Ramsay Sedation Score, a standardized scale to assess sedation levels, was measured at the 1-hour mark postoperatively.

Side Effect Monitoring: Potential side effects such as nausea, vomiting, hypotension, bradycardia, tachycardia, or any other significant observations were noted and managed accordingly throughout the study period.

Statistical analysis: Demographic information including age and sex, along with baseline data, was presented using appropriate descriptors such as mean and standard deviation, or frequency and percentage, depending on the type of variable. Numerical variables were compared between groups using the student's t-test. Categorical variables, such as ASA status, sex, postoperative analgesic requirement, and adverse effects, were compared between groups using the Chi-square test. All values were expressed as Mean ± Standard deviation. Statistical comparisons were performed using student's t-test for numerical variables and the Chi-square test for categorical variables. $p < 0.05$ is considered as statistically significant.

Results

Demographic and ASA distribution characteristics of study participants: In both Group P and Group D, the highest patient distribution occurred in the 18-30 age range, with each group constituting 43.3%. The age distribution similarity was confirmed with a p-value of 0.95 (>0.05). Gender distribution in Group P consisted of 36.67% males and 63.33% females, while Group D had 40% males and 60% females, with a p-value of 0.7906, indicating similarity. ASA physical status distribution showed that in Group P, 26 patients were ASA physical status I and 4 were ASA physical status II, while in Group D, 28 were ASA physical status I and 2 were ASA physical status II. The p-value of 0.3894 demonstrated comparable ASA grade distributions as shown in table 1. The average body weight was 71.4 kg in Group P and 70.77 kg in Group D, with no statistical difference (p value = 0.7381, p value > 0.05). The mean height of Group P was 161.87±8.94 cm and that of Group D was 165.2±9.71 cm, with both groups being comparable (p-value > 0.05).

Table 1: Patients clinical characteristics, n=60 (Group P, n=30 and Group D, n=30)

Parameters	Group P N (%)	Group D N (%)	P value
Age			
18-30	13(43.3%)	13(43.3%)	0.95
31-40	5(16.7%)	6(20%)	
41-50	9(30%)	8(26.7%)	
51-60	3(10%)	3(10%)	
Gender			
Male	11(36.67%)	12(40%)	0.7906
Female	19(63.33%)	18(60%)	
ASA Grade			
ASA Grade I	26 (86.6%)	28(93.3%)	0.3894
ASA Grade II	4 (13.3%)	2(6.6%)	

Vital Parameter Outcomes: In Group P, the mean heart rate was 79.38, while in Group D, it was 79.13 ($p = 0.9143$) as shown in table 2. Statistically significant differences were noted at 15, 30, 45, and 60 minutes ($p < 0.05$), with lower heart rates observed in Group D. Postoperatively, Dexmedetomidine led to reductions of 3.16%, 8.34%, 6.27%, and 5.4% in heart rate at 15, 30, 45, and 60 minutes, respectively. Mean systolic blood pressure was 122.03 mmHg in Group P and 121.53 mmHg in Group D ($p = 0.7998$). Significant differences appeared at 15, 30, 45, and 60 minutes ($p < 0.05$), showing lower systolic pressures in Group D. The mean diastolic blood pressure in Group P was 80.6 mmHg and 78.37 mmHg in Group D ($p = 0.1289$), with lower diastolic pressures in Group D at 15, 30, 45, and 60 minutes ($p < 0.05$). Conversely, Group P showed increases of 2.32%, 1.65%, 0.96%, and 0.87% from baseline. No statistical differences emerged in mean oxygen saturation percentages at various intervals between the two groups ($p > 0.05$). Furthermore, postoperative vital parameters exhibited statistical significance (p-value < 0.05) in mean heart rates at 0, 1, and 1.5 hours, indicating higher heart rates in the paracetamol group compared to the dexmedetomidine group.

Dexmedetomidine also yielded lower mean values of systolic blood pressure (SBP) with statistical significance at 0, 0.5, 1, and 1.5 hours, while statistical significance was not observed across other time intervals. Regarding mean diastolic blood pressure (DBP), statistical differences were noted at 0, 0.5, 1, 1.5, 4, 12, and 24 hours, favoring lower means in the dexmedetomidine group. Mean arterial pressures showed statistically lower values at 0, 0.5, 1, 1.5, 4, and 24 hours postoperatively in the dexmedetomidine group. No significant differences were identified in mean oxygen saturation percentages between the two groups at various time intervals as shown in table 3.

Table 2: Intraoperative vital parameter observations at different time intervals

TIME (Mins)	Mean Heart Rate			Intraoperative Systolic Blood Pressure (mm Hg)			Intraoperative Diastolic Blood Pressure (mmHg)			Mean Arterial Pressures (mmHg)			Mean Oxygen Saturation (%)		
	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value
BASELINE	79.4± 8.7	79.1± 8.0	0.9	122±7. 7	121.5± 7.6	0.8	80.6± 6.0	78.4± 5.2	0.1	94.4± 5.1	92.8± 4.8	0.2	99.9± 0.2	99.9± 0.2	0.6
0 min	79.4± 8.5	78.8± 7.7	0.2	122±8. 1	121.3± 5.6	0.7	81±6. 1	78.5± 4.7	**0.08***	94.6± 5.4	92.8± 4.4	0.2	99.8± 0.2	99.8± 0.2	0.8
15 mins	82.2± 9	76.6± 7.7	**<0.00 01***	127.1± 10.1	112.6± 13.7	**< 0.00 01***	82.4± 6.3	73.7± 7.2	**<0.00 01***	97.4± 6.1	86.7± 8.4	**<0.00 01***	99.8± 0.2	99.9± 0.2	**0.0 8***
30 mins	81.6± 7.4	76.6± 6.8	**<0.00 01***	125.3± 7	117.1± 5.4	**< 0.00 01***	81.9± 6.1	76.3± 6.5	**0.001 ***	96.4± 5.3	89.9± 5.3	**<0.00 01***	99.9± 0.2	99.9± 0.2	0.6
45 mins	82.3± 6.2	76.6± 8	**<0.00 01***	124.3± 7.3	117.9± 5.4	**0.00 03***	81.4± 6.1	76.6± 4.6	**0.001 ***	95.7± 4.5	90.3± 3.9	**<0.00 01***	99.8± 0.2	99.8± 0.2	0.8
60 mins	79.4± 8.4	76.6± 7.8	**0.005 5***	124.1± 7	119±4. 3	**0.00 1***	81.3± 6.2	76.6± 7.6	**0.01***	95.6± 5.7	90.8± 5.9	**0.002 2***	99.9± 0.2	99.9± 0.2	0.3

*Significant, p<0.05

Table 3: Post operative vital parameters observation at different time intervals

TIME (Mins)	Mean Heart Rate			Intraoperative Systolic Blood Pressure (mm Hg)			Intraoperative Diastolic Blood Pressure (mmHg)			Mean Arterial Pressures (mmHg)			Mean Oxygen Saturation (%)		
	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value	GROUP-P (Mean±SD)	GROUP-D (Mean±SD)	P value
0 Hrs	79.4± 8.4	75±8. 4	**0.04 ***	124.2 ±6.9	118.8 ±6.9	**0.00 4***	81.3± 6	76.7± 6.2	**0.00 5***	95.6± 5.2	90.7± 5.1	**0.000 5***	99.4± 0.6	99.8± 0.4	0.1
0.5 Hrs	79.9± 8.9	75.7± 7.9	**0.05 ***	126.1 ±7.6	119.1 ±6.9	**0.00 04***	81.5± 5.9	76.8± 6.7	**0.00 6***	96.4± 5.3	90.9± 5.4	**0.000 2***	99.9± 0.3	99.9± 0.2	0.6
1 Hrs	86.3± 7.4	76.7± 7.6	**< 0.00 01***	134.5 ±5.1	120.1 ±7.1	**< 0.00 01***	81.4± 5.2	76.9± 6.5	**0.00 4***	99.1± 3.5	91.3± 5.8	**<0.00 01***	99.7± 0.5	99.9± 0.3	**0.0 9***
1.5 Hrs	84.3± 6.7	80.3± 7	0.02	127.6 ±6.2	123.5 ±7.3	**0.02 ***	81.7± 3.9	77.8± 5.8	**0.00 4***	96.9± 3.8	93.1± 5.3	**0.001 8***	99.8± 0.5	99.9± 0.3	0.2
2 Hrs	84.3± 7.5	83.7± 7.9	0.8	126.9 ±6.3	125.9 ±6.6	0.54	82.2± 4.5	79.8± 6.7	0.1	97.1± 3.9	95.2± 5.6	0.13	99.7± 0.5	99.8± 0.4	0.4
4 Hrs	83.2± 6.8	81.6± 6.6	0.4	124.6 ±3.9	123.1 ±3.6	0.12	81.6± 4.2	79.5± 4.2	**0.05 ***	95.9± 3.2	94±3. 0	**0.019 ***	99.8± 0.4	99.9± 0.2	0.1 2

12 Hrs	81.1± 7.8	80.1± 4.6	0.5	123.1 ±5.3	122.3 ±5.8	0.62	80.8± 4.8	78.2± 5.2	**0.05 ***	94.9± 4.1	92.9± 4.5	**0.08***	99.9± 0.2	99.9± 0.2	0.6
24 Hrs	78.5± 6.5	78.6± 7.7	0.9	122.8 ±5.9	121.9 ±3.7	0.44	80.6± 4.9	78.2± 4.7	**0.05 ***	94.7± 3.9	92.7± 3.7	**0.05***	99.9± 0.3	99.9± 0.2	0.3

Pain Assessment outcomes: The comparison of mean Visual Analogue Scale (VAS) scores at postoperative intervals revealed statistically significant differences at 1 and 1.5 hours ($p<0.0001$). At 1 hour, Group P exhibited a mean VAS score of 4.87, whereas Group D had a lower score of 2.67. Similarly, at 1.5 hours, Group P mean VAS score was 4.57 compared to Group D 3.07. Although mean VAS scores were higher in Group P than Group D at 0.5, 2, 4, 12, and 24 hours postoperatively, these differences were not statistically significant (>0.05).

Table 4: Mean VAS score in the postoperative period

Time in Hours	Group P	Group D	P value
	Mean± SD	Mean±SD	
0.5 Hours	2.5±0.5	2.3±0.5	0.13
1 Hours	4.9±0.9	2.67±0.5	**<0.0001***
1.5 Hours	4.6±0.9	3.07±0.5	**<0.0001***
2 Hours	4.5±0.9	4.2±0.9	0.3
4 Hours	3.4±0.8	3.1±0.96	0.3
12 Hours	2.2±0.8	2.1±0.6	0.9
24 Hours	1.1±0.3	1.1±0.3	0.7

***p* <0.05**

Rescue Analgesia outcomes: In Group D, the average time to administer the first rescue analgesia was significantly longer at 137.97 minutes compared to Group P 53.1 minutes ($p < 0.0001$). Additionally, Group P exhibited higher total analgesic consumption than Group D, a statistically significant difference with a p-value < 0.0001.

Table 5: Rescue Analgesia of study participants

	Group P	Group D	P value
	Mean± SD	Mean± SD	
Time of 1st rescue analgesia (minutes)	53.1±9.9	137.9±11.2	**< 0.0001***
Total analgesic consumed in 24 hours (mg)	201.3±28.8	105.5±35.5	**<0.0001***

Ramsay Sedation Score and side effect outcome: In terms of the Ramsay Sedation Score at the 1-hour mark, the average sedation score was notably higher in Group D compared to Group P. Additionally, there was a higher incidence of nausea and vomiting in the PCM group (8%) compared to the dexmedetomidine group (6.67%), and this difference was statistically significant as shown in figure 1.

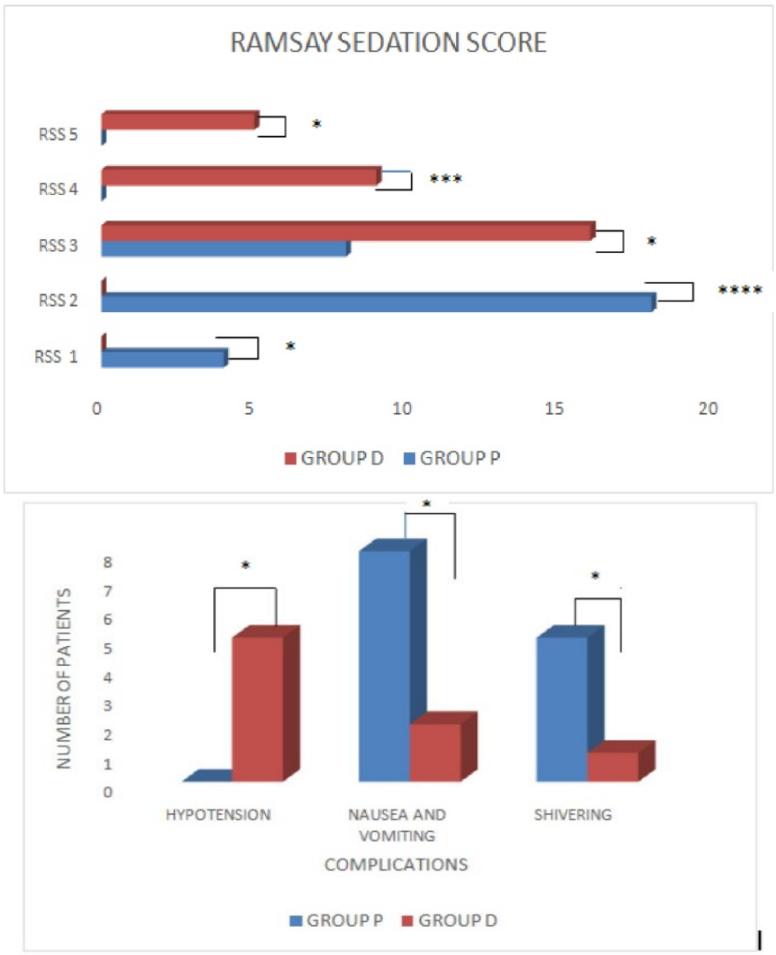

Figure 1 (a): The Ramsay Sedation Score, a standardized scale to assess sedation levels, was measured at the 1-hour mark postoperatively, (b) side effects observed in study participants, *p<0.05, **p<0.01, ***p<0.001

Discussion

Pain is a common issue after laparoscopic cholecystectomy, often appearing at a moderate to severe level during the initial 24 hours post-surgery. In our investigation, we assessed pain and hemodynamic changes during the surgery and in the postoperative phase through various parameters. In our study, significant differences in VAS scores were observed only at the 1-hour and 1.5-hour postoperative intervals as depicted in Table 2. The initial rescue analgesia dose administration time was notably prolonged in the dexmedetomidine group (mean 137.97±11.214 mins), contrasting with the paracetamol group (mean 53.1±9.914 mins). Additionally, the 24-hour cumulative rescue analgesic consumption (IV tramadol) was significantly lower in the dexmedetomidine group (mean 105.47±35.503 mg) compared to the paracetamol group (mean 201.33 ± 28.756 mg) as shown in Table 5. Our study findings are consistent with Sharma R et al., [10], who examined intravenous paracetamol and dexmedetomidine for postoperative analgesia in laparoscopic cholecystectomy surgeries. Their results showed higher mean VAS scores in the paracetamol group (4.86) compared to the dexmedetomidine group at the 1-hour postoperative mark, in line with our observation of VAS scores of 4.87 and 2.67 in the respective groups at the same interval. Additionally, the first administration of rescue analgesia occurred earlier in the paracetamol group

(79.25±50.85 mins), mirroring our findings of 53.1±9.914 mins and 137±11.214 mins in the paracetamol and dexmedetomidine groups, respectively. Moreover, the total rescue analgesia dosage was notably higher in the paracetamol group (236±106.44 mg), akin to our study's value of 201.33±28.75 mg, while the dexmedetomidine group required a significantly lower dosage of 80 ± 69.98 mg, consistent with our study's value of 105.47±35.50 mg. Similarly another study, Bielka K et al.,[11] identified a reduced incidence of pain in the dexmedetomidine group and the time to first rescue analgesia administration was 180 minutes (range 130-210 minutes) in the dexmedetomidine group, mirroring our results.

In contrast to our study, one study Sarkar M et al., [12] showed lower VAS scores and an extended time to first rescue analgesia (134 ±12.67 mins) in paracetamol group as compared to dexmedetomidine group (82.76±9.38 mins) in laparoscopic cholecystectomy patients, ultimately favoring paracetamol's efficacy over dexmedetomidine as an analgesic. Another study, Swaika S [13] also reported lower VAS scores in the Paracetamol group compared to the Dexmedetomidine group.

In the study by Salihoglu Z et al., [14] administration of paracetamol 1g over 15 minutes after intubation mirrored our approach. Their reported VAS scores at 0.5 and 1 hour postoperatively were 2.1±1.4 and 1.9±1.5, respectively. Our study observed slightly different mean VAS scores for those time intervals (2.5±0.5 and 4.87±0.92). Moreover, their time to the first rescue analgesia dose was significantly shorter (15±5 minutes) compared to our observation of 53.1±9.914 minutes. Furthermore, Panchgar V et al.,[15] study reported a significant decrease in mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) following dexmedetomidine infusion, consistent with our study. Our findings align with the study, revealing a higher incidence of hypotension in the dexmedetomidine group compared to paracetamol (20% vs. 3.3%). Nausea and vomiting were more frequent in the PCM group (8%) than the dexmedetomidine group (6.67%), with statistically significant differences.

However, our study's limitations include a small sample size of 60 patients and absence of a control group. Variations in drug administration methods among previous studies add complexity to comparisons. Multicentric trials are needed to confirm findings and establish optimal dosing and timing for dexmedetomidine. Future research in this area holds promise for further advancements.

Conclusion

In conclusion, our study strongly favours dexmedetomidine over paracetamol for postoperative pain relief following laparoscopic cholecystectomy. Dexmedetomidine consistently outperformed paracetamol in terms of lower pain scores, delayed need for rescue analgesia, and reduced analgesic consumption, highlighting its superior efficacy in enhancing patient comfort and recovery. This research underscores the clinical value of prioritizing dexmedetomidine in postoperative pain management strategies.

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