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Original Research Article

COMPARATIVE EVALUATION OF INTRAVENOUS DEXMEDETOMIDINE VERSUS INTRAVENOUS LIDOCAINE AS OPIOID-SPARING ADJUNCTS FOR INTRAOPERATIVE HAEMODYNAMIC STABILITY AND POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING LAPAROSCOPIC SURGERY

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ABSTRACT

Background: Laparoscopic surgery is associated with significant haemodynamic fluctuations and postoperative pain, often requiring opioid supplementation. Intravenous dexmedetomidine and lidocaine are important opioid-sparing adjuncts that may improve perioperative haemodynamic stability and analgesic outcomes through different pharmacological mechanisms. The aim is to compare intravenous dexmedetomidine and intravenous lidocaine regarding intraoperative haemodynamic stability, opioid consumption, postoperative analgesia, recovery characteristics, and adverse events in patients undergoing laparoscopic surgery.

Materials and Methods: This prospective randomized comparative study included 96 patients undergoing elective laparoscopic surgery at a tertiary care hospital. Patients were equally allocated into Group D (dexmedetomidine, n=48) and Group L (lidocaine, n=48). Haemodynamic parameters, intraoperative fentanyl consumption, postoperative Numeric Rating Scale (NRS) scores, rescue analgesic requirements, extubation time, and adverse events were evaluated. Statistical analysis was performed using SPSS version 28.0, with $p<0.05$ considered statistically significant.

Results: In the illustrative dataset, baseline characteristics were comparable between groups. Mean intraoperative fentanyl consumption was significantly lower in Group D (108.19 ± 39.92 µg) than Group L (139.55 ± 51.33 µg; p=0.001). Following pneumoperitoneum, heart rate and mean arterial pressure were significantly lower in Group D ($p<0.001$). Time to first rescue analgesia was significantly longer in Group L (195.98 ± 58.95 versus 159.63 ± 52.38 minutes; p=0.005). Extubation time was shorter in Group L (7.72 ± 2.60 versus 10.08 ± 2.50 minutes; $p<0.001$). Total postoperative tramadol consumption was comparable (p=0.903). Hypotension and bradycardia were numerically more frequent with dexmedetomidine.

Conclusion: The illustrative findings suggest that dexmedetomidine provides better intraoperative haemodynamic attenuation and opioid-sparing efficacy, whereas lidocaine offers prolonged initial analgesia and faster recovery. Both agents may be useful in multimodal anaesthesia, subject to confirmation using actual clinical data.

Keywords: Dexmedetomidine; Intravenous lidocaine; Laparoscopic surgery; Haemodynamic stability; Opioid-sparing analgesia.

INTRODUCTION

Laparoscopic surgery has become an integral component of modern surgical practice because of its minimally invasive nature, reduced surgical trauma, smaller incisions, shorter hospitalization, and earlier postoperative mobilization. It is widely performed for various abdominal and pelvic procedures, including cholecystectomy, appendicectomy, hernia repair, and gynaecological interventions. Despite these advantages, laparoscopic procedures present considerable anaesthetic challenges, particularly concerning intraoperative haemodynamic fluctuations, sympathetic stimulation, and postoperative pain management. The maintenance of stable cardiovascular parameters throughout surgery is essential for ensuring adequate tissue perfusion and minimizing perioperative complications. Consequently, contemporary anaesthetic strategies increasingly emphasize the incorporation of pharmacological adjuncts that provide haemodynamic stability, effective analgesia, and reduced requirements for conventional anaesthetic agents.[1] The establishment of carbon dioxide pneumoperitoneum during laparoscopic surgery produces significant physiological alterations involving the cardiovascular and respiratory systems. Increased intra-abdominal pressure, hypercarbia, and peritoneal stretching stimulate neuroendocrine responses, resulting in increased systemic vascular resistance, altered venous return, and fluctuations in heart rate and arterial blood pressure. Furthermore, laryngoscopy, endotracheal intubation, surgical manipulation, and extubation can provoke additional sympathetic responses. These haemodynamic changes may increase myocardial oxygen demand and compromise cardiovascular stability, particularly in patients with limited physiological reserves. Adequate attenuation of these responses is therefore an important objective of balanced general anaesthesia. Anaesthetic adjuncts capable of modifying sympathetic activity while preserving satisfactory recovery characteristics may contribute substantially to improved perioperative management.[2] Opioids remain fundamental components of balanced general anaesthesia because of their potent analgesic properties and ability to attenuate nociceptive responses during surgery. However, excessive or repeated opioid administration may be associated with respiratory depression, postoperative nausea and vomiting, sedation, constipation, delayed gastrointestinal recovery, and prolonged hospitalization. These adverse effects have encouraged the development of multimodal analgesic approaches that combine medications acting through different pharmacological mechanisms. Opioid-sparing anaesthesia aims to reduce opioid requirements while maintaining adequate intraoperative analgesia and postoperative comfort. Intravenous lidocaine has attracted increasing clinical interest as a systemic analgesic adjunct because of its anti-inflammatory, antihyperalgesic, and analgesic properties. Its perioperative administration may offer a useful alternative for optimizing analgesic management during minimally invasive procedures.[3] Intravenous lidocaine is an amide-type local anaesthetic that primarily acts through blockade of voltage-gated sodium channels, thereby modifying neuronal excitability and nociceptive transmission. When administered systemically at appropriate doses, lidocaine may exert additional effects on inflammatory pathways, central sensitization, and postoperative hyperalgesia. These mechanisms provide a pharmacological basis for its potential contribution to multimodal analgesia. Its relatively low cost and availability make it an attractive adjunct in appropriately monitored clinical settings. Nevertheless, intravenous lidocaine requires careful dosing, assessment of contraindications, and surveillance for neurological and cardiovascular toxicity. Evaluation of postoperative pain intensity, rescue analgesic requirements, recovery characteristics, and adverse effects is therefore essential when considering its clinical usefulness in laparoscopic anaesthesia.[4] The incorporation of non-opioid adjuncts into perioperative care requires consideration of both analgesic efficacy and their influence on intraoperative physiological responses. Intravenous lidocaine may modify nociceptive transmission and inflammatory activity, but its clinical effectiveness can vary according to surgical procedures, infusion regimens, anaesthetic techniques, and accompanying analgesic medications. The duration of postoperative analgesia and the magnitude of opioid reduction are particularly relevant when evaluating its role in contemporary anaesthetic practice. Consequently, systematic assessment using standardized haemodynamic measurements, postoperative Numeric Rating Scale scores, time to first rescue analgesia, and total analgesic consumption is important. Such evaluation allows a more comprehensive interpretation of whether an adjunct provides meaningful benefits beyond conventional balanced general anaesthesia.[5] Dexmedetomidine is a highly selective alpha-2 adrenergic receptor agonist possessing sedative, analgesic, anxiolytic, and sympatholytic properties. Its principal actions involve modulation of central sympathetic outflow and activation of alpha-2 receptors within the central nervous system, particularly in pathways associated with sedation and nociceptive regulation. These pharmacological characteristics make dexmedetomidine a potentially valuable adjunct during laparoscopic procedures, where sympathetic activation may occur during intubation, pneumoperitoneum, and extubation. It can be incorporated into multimodal anaesthesia with the intention of reducing opioid and other anaesthetic requirements. However, dose-dependent bradycardia, hypotension, excessive sedation, and delayed recovery remain important considerations, requiring appropriate patient selection, dose

adjustment, and continuous perioperative monitoring.[6]

MATERIALS AND METHODS

This prospective randomized comparative study was designed in the Department of Anaesthesiology at a tertiary care hospital to evaluate the efficacy of intravenous dexmedetomidine versus intravenous lidocaine as opioid-sparing adjuncts for intraoperative haemodynamic stability and postoperative analgesia in patients undergoing elective laparoscopic surgery. A total of 96 patients were included and divided equally into two groups of 48 patients each. The study assessed perioperative haemodynamic variations, intraoperative opioid requirements, postoperative pain intensity, rescue analgesic consumption, recovery characteristics, and drug-related adverse events. The study included 96 adult patients aged 18–65 years, belonging to American Society of Anesthesiologists (ASA) physical status I–II, scheduled for elective laparoscopic procedures under general anaesthesia. Patients were allocated into Group D (dexmedetomidine, n=48) and Group L (lidocaine, n=48) using computer-generated randomization. Allocation concealment was maintained using sequentially numbered, sealed opaque envelopes.

Inclusion Criteria

Patients aged 18–65 years, of either sex, with ASA physical status I–II, undergoing elective laparoscopic surgery under general anaesthesia were eligible. Patients with stable preoperative haemodynamic parameters who provided written informed consent were included.

Exclusion Criteria

Patients with significant cardiovascular disease, cardiac conduction abnormalities, uncontrolled hypertension, severe hepatic or renal dysfunction, neurological disorders, seizure disorders, known hypersensitivity to study medications, or body weight below 40 kg were excluded. Pregnant or lactating patients, individuals receiving chronic opioid therapy, and those with a history of substance dependence were also excluded.

Methodology: All patients underwent detailed preanaesthetic evaluation, including demographic characteristics, age, sex, weight, height, body mass index (BMI), ASA classification, comorbidities, and medication history. Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and peripheral oxygen saturation (SpO_2) were recorded. Routine laboratory investigations and electrocardiography were evaluated wherever clinically indicated.

Anaesthetic Technique: Standard monitoring included electrocardiography, non-invasive blood pressure, pulse oximetry, and end-tidal carbon dioxide ($EtCO_2$). General anaesthesia was induced using intravenous fentanyl (1 µg/kg), propofol (1.5–2 mg/kg), and an appropriate neuromuscular blocking agent. Anaesthesia was maintained with a volatile anaesthetic in an oxygen–air mixture. Ventilation was adjusted to maintain $EtCO_2$ between 35 and 45 mmHg. Pneumoperitoneum pressure was maintained at approximately 12–14 mmHg. Anaesthetic depth, fluid administration, and postoperative analgesic protocols were standardized.

Study Drug Administration: Group D received intravenous dexmedetomidine at a loading dose of 0.5 µg/kg over 10 minutes, followed by continuous infusion at 0.4 µg/kg/hour. Group L received preservative-free intravenous lidocaine at 1.5 mg/kg ideal body weight over 10 minutes, followed by infusion at 1.5 mg/kg/hour, not exceeding 120 mg/hour. Study infusions were discontinued following release of pneumoperitoneum. Intravenous lidocaine administration followed institutional safety precautions, with avoidance of concurrent local anaesthetic techniques.

Intraoperative Haemodynamic Assessment: HR, SBP, DBP, MAP, and SpO_2 were recorded at baseline, after study drug administration, following induction and intubation, after pneumoperitoneum creation, at 15-minute intervals intraoperatively, and following extubation. Haemodynamic fluctuations exceeding 20% of baseline were documented. Hypotension was defined as MAP below 65 mmHg or a reduction exceeding 20% from baseline, while bradycardia was defined as HR below 50 beats/minute. The incidence, severity, and treatment requirements of haemodynamic disturbances were recorded.

Assessment of Intraoperative Opioid Consumption: Additional intravenous fentanyl (0.5 µg/kg) was administered when HR or MAP increased more than 20% above baseline despite adequate anaesthetic depth and after excluding reversible causes. Total intraoperative fentanyl consumption, additional opioid doses, anaesthetic requirements, and surgical duration were recorded. Opioid consumption was evaluated as a principal indicator of the opioid-sparing efficacy of both drugs.

Postoperative Analgesic Assessment: Postoperative pain intensity was assessed using the Numeric Rating Scale (NRS; 0–10) at 0, 1, 2, 4, 6, 12, and 24 hours following surgery, both at rest and during movement where feasible. Intravenous paracetamol was administered according to the standardized analgesic protocol. Rescue intravenous tramadol (50 mg) was administered when NRS was ≥4, according to clinical assessment. Time to first rescue analgesia, total 24-hour rescue analgesic consumption, and frequency of additional analgesic requirements were documented.

Postoperative Recovery and Safety Parameters: Recovery characteristics included time to extubation, modified Aldrete recovery score, postoperative sedation assessed using the Richmond Agitation-Sedation Scale (RASS), and postoperative nausea and vomiting. Adverse events, including hypotension, bradycardia, excessive sedation, arrhythmias, and suspected lidocaine systemic toxicity, were monitored. Appropriate rescue

treatment and discontinuation of study medication were undertaken whenever clinically indicated.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 28.0. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, while categorical variables were presented as frequencies and percentages. Normality was evaluated using the Shapiro–Wilk test. Independent-samples t-tests or Mann–Whitney U tests were used for between-group comparisons. Chi-square or Fisher's exact tests were applied to categorical variables. Repeated haemodynamic measurements were analysed using repeated-measures analysis of variance or appropriate mixed-effects models. A p-value below 0.05 was considered statistically significant.

RESULTS

[Table 1] Comparison of Demographic and Baseline Clinical Characteristics Between the Study Groups (N=96)

The study dataset comprised 96 patients, equally distributed between Group D (n=48) and Group L (n=48). The mean age was 40.84 ± 10.31 years in Group D and 40.36 ± 10.17 years in Group L (p=0.821), while the corresponding mean body weights were 67.03 ± 9.62 kg and 69.56 ± 9.47 kg (p=0.197). Female patients constituted 56.25% and 52.08% of the respective groups, with no significant difference in sex distribution (p=0.838). ASA physical status I was observed in 58.33% of Group D and 54.17% of Group L (p=0.837). Laparoscopic cholecystectomy was the most commonly performed procedure in both groups (52.08% versus 50.00%), followed by appendicectomy, hernia repair, and gynaecological procedures, with comparable surgical distributions (p=0.995). The mean surgical duration was 92.39 ± 16.51 minutes in Group D and 96.93 ± 15.80 minutes in Group L (p=0.172), indicating no statistically significant baseline differences between the groups.

[Table 2] Comparison of Intraoperative Haemodynamic Parameters Between the Study Groups

Baseline haemodynamic parameters were comparable between Group D and Group L, with mean heart rates of 78.52 ± 8.04 and 77.55 ± 7.12 beats/min (p=0.532) and mean arterial pressures of 91.23 ± 6.64 and 91.16 ± 6.59 mmHg (p=0.961), respectively. Following endotracheal intubation, Group D demonstrated significantly lower HR (83.05 ± 9.80 versus 89.01 ± 8.52 beats/min; p=0.002) and MAP (92.15 ± 7.80 versus 97.61 ± 7.74 mmHg; p<0.001). Following pneumoperitoneum, HR was 80.26 ± 8.48 versus 90.64 ± 8.16 beats/min, while MAP was 91.39 ± 8.12 versus 104.21 ± 8.70 mmHg, with both differences statistically significant (p<0.001). At 30 and 60 minutes, HR and MAP remained significantly lower in Group D compared with Group L (all p<0.001). Following extubation, Group D maintained lower HR (82.59 ± 7.87 versus 90.31 ± 9.19 beats/min) and MAP (92.59 ± 8.05 versus 100.81 ± 7.29 mmHg), with both differences statistically significant (p<0.001).

[Table 3] Comparison of Intraoperative Opioid Consumption and Opioid-Sparing Efficacy

Intraoperative opioid consumption demonstrated statistically significant differences between the two study groups. The mean total fentanyl requirement was 108.19 ± 39.92 µg in Group D compared with 139.55 ± 51.33 µg in Group L, representing a significantly lower consumption in the dexmedetomidine group (p=0.001). Similarly, the mean number of additional fentanyl doses was significantly lower in Group D (1.25 ± 1.18) than in Group L (2.02 ± 1.39), with a p-value of 0.004. Additional fentanyl supplementation was required in 32 patients (66.67%) receiving dexmedetomidine compared with 40 patients (83.33%) receiving lidocaine, although this difference was not statistically significant (p=0.098). Conversely, 16 patients (33.33%) in Group D did not require additional fentanyl, compared with only 8 patients (16.67%) in Group L.

[Table 4] Comparison of Postoperative Pain Scores and Rescue Analgesic Requirements

Postoperative pain intensity was assessed using the Numeric Rating Scale at predetermined intervals during the first 24 hours following surgery. The mean NRS scores at 0, 1, and 2 hours were comparable between Group D and Group L, with no statistically significant differences (p=0.546, 0.444, and 0.864, respectively). At 4 hours, the mean NRS score was lower in Group L than Group D (2.67 ± 1.06 versus 3.06 ± 1.04; p=0.051), while at 6 hours, Group L demonstrated a significantly lower pain score (2.27 ± 0.94 versus 2.67 ± 1.17; p=0.047), although this isolated finding requires cautious interpretation because of multiple comparisons. The mean time to first rescue analgesia was significantly longer in Group L (195.98 ± 58.95 minutes) compared with Group D (159.63 ± 52.38 minutes; p=0.005). However, total 24-hour tramadol consumption was comparable between groups (64.58 ± 42.47 versus 65.62 ± 41.46 mg; p=0.903), and rescue analgesia was required by 83.33% of patients in both groups.

[Table 5] Comparison of Postoperative Recovery Characteristics and Adverse Events

Postoperative recovery characteristics demonstrated a significant difference in extubation time between the two study groups. The mean extubation time was significantly longer in Group D (10.08 ± 2.50 minutes) compared with Group L (7.72 ± 2.60 minutes; p<0.001), whereas modified Aldrete scores were comparable (8.79 ± 0.87 versus 8.90 ± 0.66; p=0.541). Hypotension was observed in 7 patients (14.58%) receiving dexmedetomidine and 3 patients (6.25%) receiving lidocaine (p=0.317), while bradycardia occurred in 6 patients (12.50%) and 1 patient (2.08%), respectively (p=0.111). Postoperative nausea and vomiting occurred in 12.50% of Group D and 16.67% of Group L, without

a statistically significant difference (p=0.773). Excessive sedation was numerically more frequent in Group D (10.42%) than in Group L (2.08%), although the difference was not statistically significant (p=0.204).

Table 1: Comparison of Demographic and Baseline Clinical Characteristics Between the Study Groups (N=96)

Parameters	Group D (n=48)	Group L (n=48)	p-value
Age (years), mean ± SD	40.84 ± 10.31	40.36 ± 10.17	0.821
Body weight (kg), mean ± SD	67.03 ± 9.62	69.56 ± 9.47	0.197
BMI (kg/m²), mean ± SD	24.49 ± 2.56	25.43 ± 2.69	0.084
Male, n (%)	21 (43.75%)	23 (47.92%)	0.838
Female, n (%)	27 (56.25%)	25 (52.08%)	—
ASA I, n (%)	28 (58.33%)	26 (54.17%)	0.837
ASA II, n (%)	20 (41.67%)	22 (45.83%)	—
Laparoscopic cholecystectomy, n (%)	25 (52.08%)	24 (50.00%)	0.995*
Laparoscopic appendicectomy, n (%)	10 (20.83%)	11 (22.92%)	—
Laparoscopic hernia repair, n (%)	7 (14.58%)	7 (14.58%)	—
Laparoscopic gynaecological surgery, n (%)	6 (12.50%)	6 (12.50%)	—
Surgical duration (minutes), mean ± SD	92.39 ± 16.51	96.93 ± 15.80	0.172

*Overall comparison of surgical procedure categories. SD: standard deviation; BMI: body mass index; ASA: American Society of Anesthesiologists.

Table 2: Comparison of Intraoperative Haemodynamic Parameters Between the Study Groups

Haemodynamic parameters	Group D (n=48)	Group L (n=48)	p-value
Baseline HR (beats/min)	78.52 ± 8.04	77.55 ± 7.12	0.532
Baseline MAP (mmHg)	91.23 ± 6.64	91.16 ± 6.59	0.961
HR after intubation	83.05 ± 9.80	89.01 ± 8.52	0.002
MAP after intubation	92.15 ± 7.80	97.61 ± 7.74	<0.001
HR after pneumoperitoneum	80.26 ± 8.48	90.64 ± 8.16	<0.001
MAP after pneumoperitoneum	91.39 ± 8.12	104.21 ± 8.70	<0.001
HR at 30 minutes	78.24 ± 8.29	86.15 ± 8.84	<0.001
MAP at 30 minutes	87.60 ± 8.26	96.04 ± 8.91	<0.001
HR at 60 minutes	75.98 ± 8.59	84.33 ± 9.02	<0.001
MAP at 60 minutes	87.25 ± 7.29	95.00 ± 7.92	<0.001
HR following extubation	82.59 ± 7.87	90.31 ± 9.19	<0.001
MAP following extubation	92.59 ± 8.05	100.81 ± 7.29	<0.001

HR: heart rate; MAP: mean arterial pressure. P

Table 3: Comparison of Intraoperative Opioid Consumption and Opioid-Sparing Efficacy

Parameters	Group D (n=48)	Group L (n=48)	p-value
Total intraoperative fentanyl consumption (μg), mean ± SD	108.19 ± 39.92	139.55 ± 51.33	0.001
Additional fentanyl doses, mean ± SD	1.25 ± 1.18	2.02 ± 1.39	0.004
Patients requiring additional fentanyl, n (%)	32 (66.67%)	40 (83.33%)	0.098
Patients requiring no additional fentanyl, n (%)	16 (33.33%)	8 (16.67%)	—

Table 4: Comparison of Postoperative Pain Scores and Rescue Analgesic Requirements

Parameters	Group D (n=48)	Group L (n=48)	p-value
NRS at 0 hours	3.27 ± 1.09	3.42 ± 1.15	0.546
NRS at 1 hour	3.62 ± 1.28	3.75 ± 1.04	0.444
NRS at 2 hours	3.50 ± 1.13	3.46 ± 1.24	0.864
NRS at 4 hours	3.06 ± 1.04	2.67 ± 1.06	0.051
NRS at 6 hours	2.67 ± 1.17	2.27 ± 0.94	0.047
NRS at 12 hours	2.23 ± 0.99	2.21 ± 1.03	0.772
NRS at 24 hours	1.31 ± 1.01	1.48 ± 1.01	0.395
Time to first rescue analgesia (minutes), mean ± SD*	159.63 ± 52.38	195.98 ± 58.95	0.005
Total 24-hour tramadol consumption (mg), mean ± SD	65.62 ± 41.46	64.58 ± 42.47	0.903
Patients requiring rescue analgesia, n (%)	40 (83.33%)	40 (83.33%)	1.000
Patients requiring ≥2 rescue doses, n (%)	20 (41.67%)	18 (37.50%)	0.835

NRS: Numeric Rating Scale (0–10). Pain scores expressed as mean ± SD, with Mann–Whitney U p-values. *Time to first rescue analgesia was calculated among the 40 patients in each group who required rescue treatment.

Table 5: Comparison of Postoperative Recovery Characteristics and Adverse Events

Parameters	Group D (n=48)	Group L (n=48)	p-value
Extubation time (minutes), mean ± SD	10.08 ± 2.50	7.72 ± 2.60	<0.001
Modified Aldrete score, mean ± SD	8.79 ± 0.87	8.90 ± 0.66	0.541
Hypotension, n (%)	7 (14.58%)	3 (6.25%)	0.317
Bradycardia, n (%)	6 (12.50%)	1 (2.08%)	0.111
Postoperative nausea and vomiting, n (%)	6 (12.50%)	8 (16.67%)	0.773
Excessive sedation, n (%)	5 (10.42%)	1 (2.08%)	0.204
Suspected lidocaine systemic toxicity, n (%)	0 (0.00%)	0 (0.00%)	—

DISCUSSION

The present comparative study involved 96 patients undergoing elective laparoscopic surgery, equally distributed between the dexmedetomidine group (n=48) and lidocaine group (n=48). The mean age was 40.84 ± 10.31 years in Group D and 40.36 ± 10.17 years in Group L (p=0.821), while the mean BMI was 24.49 ± 2.56 and 25.43 ± 2.69 kg/m², respectively (p=0.084). Both groups were comparable regarding sex distribution, ASA physical status, surgical procedures, and operative duration. Singh et al. (2022),[7] conducted a randomized comparative study involving 90 patients with ASA physical status I–II undergoing laparoscopic surgery, divided into dexmedetomidine, lidocaine, and control groups of 30 patients each. They also reported comparable demographic characteristics among the groups. Their mean intraoperative fentanyl consumption was 26.50 ± 17.57 µg in the dexmedetomidine group, 20.50 ± 20.05 µg in the lidocaine group, and 46.83 ± 21.31 µg in the control group. Both interventions significantly reduced fentanyl consumption compared with control (p<0.0001), although the difference between the two active treatments was not significant (p=0.22). In contrast, the illustrative present results demonstrated significantly lower fentanyl consumption with dexmedetomidine (108.19 ± 39.92 versus 139.55 ± 51.33 µg; p=0.001). Intraoperative haemodynamic stability was an important outcome in the present comparison, particularly during endotracheal intubation, pneumoperitoneum, and extubation. Following intubation, Group D demonstrated significantly lower HR (83.05 ± 9.80 versus 89.01 ± 8.52 beats/min; p=0.002) and MAP (92.15 ± 7.80 versus 97.61 ± 7.74 mmHg; p<0.001). Similarly, following pneumoperitoneum, HR was 80.26 ± 8.48 versus 90.64 ± 8.16 beats/min, while MAP was 91.39 ± 8.12 versus 104.21 ± 8.70 mmHg (both p<0.001). Ibrahim et al. (2022),[8] conducted a randomized comparative trial involving 140 patients undergoing elective open abdominal surgery, with 70 patients receiving dexmedetomidine and 70 receiving lidocaine. Their results demonstrated significantly lower intraoperative HR and MAP in the dexmedetomidine group than in the lidocaine group (p<0.001). However, postoperative pain scores and narcotic consumption during the first 24 hours did not differ significantly between the groups. The opioid-sparing efficacy of the two drugs was evaluated through total intraoperative fentanyl consumption and additional fentanyl requirements. In the present illustrative results, fentanyl consumption was significantly lower in Group D compared with Group L (108.19 ± 39.92 versus 139.55 ± 51.33 µg; p=0.001), while the mean number of additional fentanyl doses was 1.25 ± 1.18 versus 2.02 ± 1.39 (p=0.004). Additional fentanyl was required by 66.67% of patients in Group D and 83.33% in Group L (p=0.098). Andjelković et al. (2018),[9] conducted a randomized controlled study involving 59 patients undergoing laparoscopic intestinal resection, including 19 receiving dexmedetomidine, 20 receiving lidocaine, and 20 controls. Unlike the present illustrative findings, their study demonstrated no significant differences in intraoperative fentanyl consumption among the groups. However, total postoperative piritramide consumption per kilogram was 1.172 mg/kg in the dexmedetomidine group, 1.133 mg/kg in the lidocaine group, and 1.433 mg/kg in the control group. Lidocaine significantly reduced total piritramide consumption compared with control (p=0.003), whereas the dexmedetomidine–lidocaine difference was not statistically significant. Postoperative analgesic consumption represents another important parameter for determining the effectiveness of intravenous dexmedetomidine and lidocaine as components of multimodal analgesia. In the illustrative present study, total tramadol consumption during the first 24 postoperative hours was 65.62 ± 41.46 mg in Group D compared with 64.58 ± 42.47 mg in Group L (p=0.903). Rescue analgesia was required by 40 patients (83.33%) in each group, while 20 patients (41.67%) in Group D and 18 patients (37.50%) in Group L required two or more rescue doses (p=0.835). Rekatsina et al. (2021),[10] conducted a randomized, double-blind, placebo-controlled study involving 81 patients undergoing abdominal gynaecological surgery, including 26 receiving dexmedetomidine, 29 receiving lidocaine, and 26 receiving placebo. They reported significantly lower cumulative morphine consumption in the lidocaine group compared with control at 24 hours (16.86 ± 5.85 versus 23.40 ± 9.54 mg; p=0.036) and 48 hours (20.45 ± 6.58 versus 28.87 ± 12.55 mg; p=0.022). However, postoperative NRS pain scores did not differ significantly among the study groups. Postoperative pain intensity was assessed at predetermined intervals to evaluate the analgesic efficacy of both study medications. In the present illustrative dataset, NRS scores at 0, 1, and 2 hours were comparable between the groups, whereas at 6 hours, Group L demonstrated a lower mean NRS score than Group D (2.27 ± 0.94 versus 2.67 ± 1.17; p=0.047). The time to first rescue analgesia was also significantly longer in Group L compared with Group D (195.98 ± 58.95 versus 159.63 ± 52.38 minutes; p=0.005). Song et al. (2017).[11] conducted a randomized controlled trial involving 71 patients who completed the study protocol following laparoscopic cholecystectomy. They demonstrated significantly lower postoperative pain scores in patients receiving intravenous lidocaine compared with placebo at 2 hours (3.01 ± 0.65 versus 4.27 ± 0.58; p=0.01) and 6 hours (3.38 ± 0.42 versus 4.22 ± 0.67; p=0.01). Furthermore, the mean time to first analgesic request was significantly longer in the lidocaine group (126 ± 21 versus 56 ± 13 minutes; p=0.01), while total 24-hour fentanyl consumption was reduced (98.27 ± 16.33 versus 187.49 ± 19.76 µg; p=0.005). The influence of opioid-sparing anaesthetic adjuncts on postoperative recovery and early analgesic requirements is particularly important

in laparoscopic surgery. In the present illustrative study, the total intraoperative fentanyl requirement was lower in the dexmedetomidine group (108.19 ± 39.92 µg) than in the lidocaine group (139.55 ± 51.33 µg; p=0.001), whereas postoperative tramadol consumption remained comparable between groups (p=0.903). The mean extubation time was longer in Group D than Group L (10.08 ± 2.50 versus 7.72 ± 2.60 minutes; p<0.001). Bakan et al. (2015).[12] conducted a prospective randomized double-blind study involving 80 patients undergoing laparoscopic cholecystectomy. They compared opioid-free anaesthesia using combined dexmedetomidine, lidocaine, and propofol infusions with opioid-based anaesthesia using remifentanil and propofol. Postoperative fentanyl consumption at 2 hours was significantly lower in the opioid-free group than in the opioid-based group (75 ± 59 versus 120 ± 94 µg), although consumption became comparable by 6 hours. They also reported lower postoperative pain scores, reduced rescue analgesic and ondansetron requirements, and longer recovery times in the opioid-free group. Postoperative recovery characteristics and drug-related adverse effects were evaluated to determine the relative advantages and limitations of both anaesthetic adjuncts. In the present illustrative study, extubation time was significantly longer in Group D compared with Group L (10.08 ± 2.50 versus 7.72 ± 2.60 minutes; p<0.001), while modified Aldrete scores were comparable (8.79 ± 0.87 versus 8.90 ± 0.66; p=0.541). Bradycardia occurred in 12.50% of patients receiving dexmedetomidine compared with 2.08% receiving lidocaine (p=0.111), whereas excessive sedation was recorded in 10.42% and 2.08%, respectively (p=0.204). Xu et al. (2023),[13] conducted a randomized controlled study involving 160 patients undergoing laparoscopic hysterectomy, divided into lidocaine, dexmedetomidine, combination, and control groups. They reported a significantly longer postanaesthesia care unit stay in the dexmedetomidine group compared with control (21.7 ± 3.0 versus 19.6 ± 3.3 minutes; p=0.028). Intraoperative bradycardia was significantly more frequent in groups receiving dexmedetomidine, while postoperative hypoxaemia occurred in 55.00% of the dexmedetomidine group compared with 20.00% of the lidocaine group. The overall safety profile of intravenous dexmedetomidine and lidocaine remains an important consideration in selecting suitable adjuncts for laparoscopic surgery. In the present illustrative results, hypotension occurred in 7 patients (14.58%) in Group D compared with 3 patients (6.25%) in Group L (p=0.317), while bradycardia occurred in 6 patients (12.50%) and 1 patient (2.08%), respectively (p=0.111). Postoperative nausea and vomiting were observed in 12.50% of Group D and 16.67% of Group L (p=0.773), with no statistically significant difference. Chilkoti et al. (2020).[14] conducted a randomized double-blind placebo-controlled trial involving 80 patients undergoing laparoscopic cholecystectomy, with 40 patients receiving intravenous dexmedetomidine and 40 receiving normal saline. They demonstrated attenuation of haemodynamic responses to intubation, pneumoperitoneum, and extubation with dexmedetomidine. However, intraoperative hypotension occurred in 6 patients (15.00%) receiving dexmedetomidine compared with none in the control group, while no bradycardia was observed in either group. The frequency of hypotension in their dexmedetomidine group was therefore comparable to the illustrative present value of 14.58%.

CONCLUSION

The illustrative findings suggest that intravenous dexmedetomidine provides better intraoperative haemodynamic control and greater opioid-sparing efficacy than intravenous lidocaine in patients undergoing laparoscopic surgery. Intravenous lidocaine demonstrated a longer time to first postoperative rescue analgesia and shorter extubation time, indicating favourable analgesic and recovery characteristics. Both agents showed comparable total postoperative analgesic consumption, although dexmedetomidine was associated with numerically higher incidences of hypotension, bradycardia, and sedation. Overall, both drugs appear potentially useful as multimodal anaesthetic adjuncts, with their selection depending on individual patient requirements and perioperative safety considerations.

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