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Original Research Article

Intraoperative Lidocaine Infusion Reduces Analgesic and Anesthetic Requirements in Patients with High Body Mass Index Undergoing Laparoscopic Cholecystectomy

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Abstract:

Background: The administration of lidocaine by intravenous (IV) means has been found to possess analgesic, antihyperalgesic, and anti-inflammatory characteristics. The utilization of lidocaine infusion during laparoscopic cholecystectomy procedures has been shown to decrease the need for analgesics and anesthetics.

Aims and Objectives: The objective of this study was to examine the impact of administering lidocaine during surgery on the need for opioids, anesthetics, and neuromuscular agents, as well as the occurrence of adverse effects in individuals with a high body mass index who are undergoing laparoscopic cholecystectomy.

Materials and Methods: The present study is a prospective, randomized, double-blinded investigation carried out in a tertiary hospital. Out of the initial cohort of 38 participants who were recruited in the research, a total of 33 individuals successfully concluded the study. This reduction in sample size was mostly due to cancellations and conversions to open surgery. The remaining participants were divided into two groups: the control group (C) consisting of 16 individuals, and the lidocaine group (L) consisting of 17 individuals. Patients from both groups were administered the test medication, either lidocaine or normal saline, as a bolus of 2 mg/kg during the induction phase. This administration was followed by a continuous infusion at a rate of 2 mg/kg/h throughout the surgical procedure, which concluded 30 minutes after extubation. The study involved an analysis of the patients' perioperative analgesic, anaesthetic, muscle relaxant need, and side effects.

Results: The average visual analogue scale (VAS) score during the first- and second-hour following surgery was lower in the group that received intravenous lidocaine infusion compared to the control group. Specifically, the VAS scores were 7.5 ± 7.8 and 10.5 ± 11.8 in the lidocaine group, and 12.5 ± 8.1 and 23 ± 24.6 in the control group, respectively. The lidocaine group exhibited a reduction of 43% in the intraoperative opioid need. The lidocaine group had a 53% reduction in the cumulative dosage of rocuronium. There was no discernible disparity observed in the sedation ratings between the two groups, and no untoward effects were reported in either cohort.

Conclusion: The study presents evidence supporting the efficacy of intravenous lidocaine infusion as a supplementary method for administering anaesthesia, resulting in reduced requirements of opioid, anaesthetic, and neuromuscular blocking drugs.

Keywords: Body mass index; Laparoscopic cholecystectomy; Lidocaine infusion; Opioids; Rocuronium.

Introduction

The association between high body mass index (BMI) and the development of gallstones is widely recognized in the medical field. Individuals who have surgery for gallstone disease are predominantly classified as overweight (BMI 25–29 kg/m2), obese (BMI 30–39 kg/m2), or severely obese (BMI 40 kg/m2). [1] A significant fraction of individuals in need of a cholecystectomy due to symptomatic cholelithiasis belong to the overweight, obese, as well as morbidly obese categories.

Laparoscopic cholecystectomy has emerged as the preferred method for managing symptomatic gallstones, since it has advantages such as

decreased duration of hospitalization and alleviation of postoperative discomfort.

The postoperative pain experienced following a laparoscopic cholecystectomy is characterized by its multifaceted nature and distinct attributes when compared to other laparoscopic surgical interventions. [2] Opioid analgesics are commonly utilized to give intraoperative analgesia. Nevertheless, the use of opioids has been linked to a heightened occurrence of postoperative problems, including respiratory depression, drowsiness, and postoperative nausea and vomiting, ileus, and urine retention. [3] Certain adverse effects have the potential to impede the process of recuperation and result in an extended duration of hospitalization. Hence, it is advisable to mitigate these adverse effects by the use of multimodal analgesic approaches or the incorporation of adjuvant treatments, with the aim of diminishing the required opioid dosages. [4]

One potential strategy for decreasing the amount of analgesics needed during the perioperative period and promoting faster postoperative recovery involves the use of intravenous (IV) lidocaine. This particular intervention possesses analgesic, antihyperalgesic, and anti-inflammatory characteristics. [5] Furthermore, intravenous lidocaine is a cost-effective intervention that may be easily administered and is considered to have a favorable safety profile. Therefore, this intervention possesses considerable appeal and has the potential for broad use. Consequently, we conducted an experiment to examine the proposition that the administration of systemic lidocaine infusion diminishes the perioperative need for analgesics and anesthetics in the context of laparoscopic cholecystectomy procedures.

Aims and objectives

The purpose of this study was to examine the impact of intraoperative administration of lidocaine on the usage of perioperative opioids, anesthetics, and neuromuscular agents, as well as the occurrence of adverse effects in patients with a high body mass index (BMI) who were undergoing laparoscopic cholecystectomy.

Materials and Methods

After obtaining approval from the Institutional Ethics Committee and obtaining written informed consent from each participant, we recruited a total of 38 patients who were members of the American Society of Anesthesiologists (ASA) and had a physical status of I-II. These patients were between the ages of 18 and 65 and had a body mass index (BMI) greater than 25 kg/m2. They were scheduled for an elective laparoscopic cholecystectomy for nonmalignant disease at a tertiary medical centre located in India from June 2022 to May 2023.

Patients who were excluded from the study were those with ASA Physical Status III and higher, a history of hepatic, renal, or cardiac failure, organ transplant, seizure condition, pregnancy or lactation, allergy to local anesthetics, or an inability to understand pain evaluation.

Out of the total cohort of 38 participants, three individuals were eliminated from the research due to the cancellation of their scheduled surgeries. A total of 35 patients were subjected to randomization, with 17 individuals assigned to the control group (C) and 18 individuals assigned to the lidocaine group (L). One participant from each group was excluded from the study due to the conversion of laparoscopy to open surgery. A total of 33 participants were included in the study, with 16 assigned to the control group and 17 assigned to the lidocaine group. The data collected from these individuals were utilized for the subsequent analysis.

During the preanesthetic checkup visit, patients were provided with a comprehensive explanation and introduction to the research, which included the use of a visual analogue scale ranging from 0 to 100 mm for pain evaluation. On this scale, 0 represented the absence of pain, while 100 denoted the highest level of discomfort possible.

Prior to surgery, all patients were administered a premedication of oral diazepam at a dosage of 0.2 mg/kg, both the night before and 2 hours prior to the surgical procedure. Upon arrival in the operating theatre on the day of surgery, peripheral venous access was established in all patients using an 18G intravenous cannula placed on the dorsum of the left hand. The patients were linked to the patient monitor in order to measure their electrocardiogram (ECG), pulse rate, noninvasive blood pressure (NIBP), and pulse oximeter.

The participants were assigned to two groups by a random allocation process, utilizing computer-generated codes that were stored in sequentially numbered opaque envelopes. The lead investigator unsealed the allocation envelopes and thereafter produced either preservative-free 2% Lidocaine or saline in 50-ml syringes that were labelled as "TEST drug." The anesthesiologist responsible for the case was not informed of the patient's group allocation, ensuring the study's complete double-blinding. In accordance with the literature, the medication dosages for the trial participants are determined by considering their ideal and adjusted body weight (ABW) in order to prevent the occurrence of overdose. This approach is used due to the participants' enrollment criteria, which specify a body mass index (BMI) more than 25 kg/m2. The bolus dosage of lidocaine and all fentanyl dosages were determined via adjusted body weight (ABW). The computation of boluses

and infusions for all the other medications involved the utilization of the concept of ideal body weight (IBW). [6,7]

Anaesthesia was administered to all patients by means of an intravenous injection of propofol at a dosage of 2.0 mg/kg, fentanyl at a dosage of 2.0 µg/kg, and subsequently rocuronium at a dosage of 0.6 mg/kg. This was done to assist the process of laryngoscopy and endotracheal intubation. The test medication was supplied at a dosage of 2 mg/kg as a bolus, 30 seconds after the administration of rocuronium. The intubation procedure was performed 90 seconds following the administration of the test medication bolus. Prior to intubation, the patients received mask ventilation. Following the procedure of tracheal intubation, the administration of anaesthesia was sustained with the use of isoflurane.

The administration of the TEST medication infusion was maintained at a constant rate of 2 mg/kg/h throughout the duration of the surgical procedure and ceased 30 minutes following the removal of the endotracheal tube. During the maintenance of anaesthesia, supplemental analgesia was administered with intravenous boluses of fentanyl, up to a maximum dosage of 5µg/kg, or morphine, up to a maximum dosage of 0.2 mg/kg. Additionally, neuromuscular blocking with rocuronium was administered as required in both groups. The patient was subjected to mechanical ventilation using a blend of oxygen and air, with minute ventilation being carefully regulated to sustain normocarbia, characterized by a carbon dioxide level within the range of 35 to 40 mmHg. For the purpose of maintaining intraoperative normothermia, forced air warming blankets were strategically placed over the exposed regions of the body. Following the procedure of intubation, an intravenous infusion of paracetamol at a dosage of 30 mg/kg was supplied for a duration of 15 minutes. Additionally, an intravenous bolus of morphine at a dosage of 0.05 mg/kg and intravenous dexamethasone at a dosage of 0.1 mg/kg were administered. Instances of intraoperative hypotension, characterized by a mean arterial blood pressure below 60 mmHg, are managed with the administration of intravenous boluses containing 5 mg of ephedrine or 50-100 µg of phenylephrine. The administration of isoflurane was ceased following the last skin suture, and subsequent to the conclusion of the surgical procedure, the remaining neuromuscular blockade was counteracted with the administration of a combination of intravenous neostigmine at a dosage of 0.05 mg/kg and glycopyrrolate at a dosage of 0.01 mg/kg. Upon the patient's restoration of awareness, the trachea was extubated, and subsequently, the patients were relocated to the post-anesthesia care unit (PACU). During this transition, the infusion was sustained for an additional duration of 30 minutes. During the post-anesthesia care unit (PACU) phase, healthcare professionals, namely nurses, diligently watched and documented vital signs such as blood pressure, pulse rate, respiration rate, and body temperature. It is important to note that these nurses were unaware of the randomization procedure, ensuring unbiased data collection. The investigator, who was blinded to the study drug administered, conducted evaluations of the patient in both the Post-Anesthesia Care Unit (PACU) and the postoperative ward.

The pain intensity and potential systemic toxicity of lidocaine were assessed every 15 minutes for duration of 2 hours during the immediate postoperative period. The assessment of pain intensity involved requesting the patient to indicate on a Visual Analogue Scale ranging from 0 to 100 mm the specific point that aligned with their perceived degree of pain intensity.

Study Parameters

The main focus of the study was the evaluation of perioperative analgesia. Intraoperative analgesia was assessed by monitoring changes in hemodynamic parameters, including heart rate and blood pressure, in response to different stimuli throughout various time intervals. Postoperative analgesia was examined using a horizontal Visual Analogue Scale ranging from 0 to 100 mm.

Secondary outcome measures were as follows:

1. Peri-operative requirement of anesthetic agents, analgesic drugs, and neuromuscular blocking agents.
2. Complications documented at any point when they occur.

Statistical Analysis

The determination of the sample size was conducted using the major outcome measure, specifically the Visual Analogue Scale (VAS) score. According to previous research [8], it is necessary to have a minimum of 15 patients in each group in order to detect a mean difference of 8.6 units in visual analogue scores (VAS) between the intervention group (lidocaine) and the control group (saline). The control group would yield a standard deviation of 7 units, an 80% power, and a significance level of 5%. The calculation of the sample size was performed using the following formula:

(Non-inferiority - Two Groups - Parallel - Two proportions - Equal Allocation).

The main objective of the study was to evaluate the level of pain experienced by patients throughout the perioperative period. Hemodynamic measures

were utilized as proxies to evaluate intraoperative discomfort. A two-sample t-test was utilized to determine the statistical significance of the differences in hemodynamic parameters between the two arms.The evaluation of postoperative pain was conducted with the visual analogue score, which ranges from 0 to 100. The statistical significance of the data was assessed using the Wilcoxon rank sum test, often known as the Mann-Whitney test. Two independent samples were analyzed using this technique. The median values and interquartile range were employed due to the non-normal distribution and skewness of the data.

Results

Table 1 provides a comparison of the overall characteristics of the study population in both groups.

There were no statistically significant differences identified in the age, body mass index (BMI), ideal body weight (IBW), ASA physical status, gender ratio, mean duration of surgery, basal heart rate, and mean blood pressure among the groups. After the administration of anaesthesia and the insertion of an endotracheal tube into the patient, as outlined in the methods section, the researchers collected and analyzed data related to hemodynamic parameters and the level of anaesthesia. The variables were obtained at distinct time intervals.

Table 1: Demographic variables

Demographic variables	Group L (n=17) (Mean±SD)	Group C (n=16) (Mean±SD)	P- value
Gender (M:F)	4:13	4:12	-
ASA (I/II)	6/11	10/6	-
Age (years)	42.1±14.45	45.4±13.63	0.505 **(NS)**
BMI	28.6±2.37	27.8±3.24	0.422 **(NS)**
Ideal body weight	52.1±8.9	52.0±7.47	0.995 **(NS)**
Duration of surgery	147.2±31.6	139.2±36.1	0.502 **(NS)**

NS- Non-Significant ($p>0.05$)

Heart rate and blood pressure

The heart rate & mean blood pressure measurements were documented at various time intervals during the surgical procedure, as indicated in Table 2. The recordings were conducted at several stages: (a) prior to induction as a baseline measurement, (b) after intubation, (c) after insufflation of the peritoneum with carbon dioxide, (d) during the time between insufflation and ex-sufflation, (e) during extubation, and (f) after extubation. The average overall heart rate and average blood pressure in both groups during different intraoperative events showed no significant differences, except for two instances. Following intubation, the mean blood pressure in the lidocaine group (87 ± 12) was statistically significantly lower than that in the saline group (100 ± 23) with a p-value of 0.049.

Similarly, following insufflations, the mean blood pressure in the lidocaine group (79.8 ± 8.3) was significantly lower than that in the saline group (93.9 ± 13.5) with a p-value of 0.001.

Table 2: Differences in haemodynamic variables

Time frame	Heart rate / min			MBP (mmHg)		
	Group L (Mean±SD)	Group C (Mean±SD)	P-value	Group L (Mean±SD)	Group LC (Mean±SD)	P-value
Baseline	85.9±10.6	90.1±16.7	0.392(NS)	95.4±10.3	99.3±15.2	0.392(NS)
Following intubation	84.6±13.1	93.0±16.1	0.109(NS)	87.0±12.0	100.0±23.0	0.049**(S)**
Following insufflations	77.4±13.1	84.8±14.9	0.139(NS)	79.8±8.3	93.9±13.5	0.001**(S)**
Insufflation to ex-sufflation	76.7±9.6	82.4±10.1	0.106(NS)	83.1±8.2	91.4±13.3	0.376(NS)
During extubation	91.4±9.1	94.4±10.8	0.393(NS)	87.5±7.0	93.8±12.6	0.083(NS)
Post-extubation	80.7±9.2	81.4±10.6	0.840(NS)	95.5±10.4	99.4±15.2	0.393(NS)

S- Statistically Significant ($p<0.05$), NS- Non-Significant

VAS scores

The pain intensity ratings, as measured by the 0-100 mm Visual Analogue Scale (VAS), during the first hour following extubation were 7.5 and 10.5 in the intervention (lidocaine) and control (saline) groups, respectively. In the second hour post-extubation, the values were 12.5 and 23 for the intervention and control groups, respectively. However, these differences were not found to be statistically significant [Table 3].

Table 3: Pain scores

Cumulative pain scores (0-100 VAS)	Group L (Mean±SD)	Group C (Mean±SD)	P-value
In the 1st hour post-extubation	7.5±7.8	10.5±11.8	0.392 (NS)
In the 2nd hour post-extubation	12.5±8.1	23.0±24.6	0.105 (NS)

NS- Non-Significant (p>0.05)

Drug consumption

The administration of fentanyl, morphine, propofol, rocuronium, ephedrine, and phenylephrine, which were employed during the surgical procedure, was recorded at four distinct intervals. The sequence of events in the surgical procedure may be outlined as follows: (1) Induction, (2) Transitioning from induction to the insufflation of the peritoneum with carbon dioxide, (3) Insufflation of the peritoneum with carbon dioxide till the point of extubation, (4) Monitoring and managing the patient for a period of 2 hours following extubation, with the exception of the administration of rocuronium.

The administration of medication doses was split by the duration of the surgical procedure and subsequently analyzed. This was done in order to account for the potential need for higher amounts of anaesthetic medicines during longer procedures, which may be indicative of increased surgical complexity and greater pain experienced by the patient.

Opioids

The quantity of fentanyl provided in the intervention group (lidocaine) and control group (saline) was 133.8 and 208.4 µg, respectively. This difference in dosage was shown to be statistically significant, with a p-value of 0.000. The fentanyl dosage supplied per minute throughout the surgical procedure was determined by dividing the total amount of fentanyl administered by the length of the surgery. The resulting values were 0.79 and 1.3 µg/min, respectively. This difference in dosage was found to be statistically significant, with a p-value of 0.000. The quantity of morphine delivered in the intervention group (lidocaine) compared to the control group (saline) was 3.1 and 7.9 mg, respectively. This difference was shown to be statistically significant (P=0.000). The intervention group (lidocaine) received a total morphine dose of 20µg/min during surgery, whereas the control group (saline) received a dose of 50µg/min. This difference in dosage was shown to be statistically significant (P=0.000). The calculation of the time-weighted total opioid supplied per minute of surgery involved dividing the total dosage of fentanyl by the potency conversion factor of 7.5. This result was then added to the total dose of morphine and divided by the length of the operation, as shown in Table 4. The participants in the intervention group, who got lidocaine, had a mean respiratory rate of 17.9 breaths per minute, whereas those in the control group, who received saline, had a mean respiratory rate of 27.8 breaths per minute. This difference in respiratory rates between the two groups was found to be statistically significant, with a p-value of 0.000.

Table 4: Opioid consumption

Opioid consumption	Group L (Mean±SD)	Group C (Mean±SD)	% difference	P-value
Total fentanyl administered (mcg)	133.8±55.64	208.4±44.11	43.6	0.000 **(S)**
Total fentanyl administered/min of surgery (mcg/min)	0.79±0.4	1.3±0.36	48.8	0.001**(S)**
Total morphine administered (mg)	3.1±1.4	7.9±2.1	87.2	0.000 **(S)**
Total morphine administered /min of surgery (mg/min)	20.0±10.0	50.0±20.0	85.7	0.000 **(S)**
Time weighted total opioids administered [{(total fentanyl/7.5)+(total morphine)}÷(total time)]	17.9±7.4	27.8±5.9	43.33	0.000 **(S)**

S- Statistically Significant (p<0.05)

Propofol

The amount of propofol delivered throughout the period from induction until insufflation of the peritoneum with carbon dioxide was 52.5 mg in the intervention group (lidocaine) and 86.9 mg in the control group (saline), with a statistically significant difference (P=0.000). The quantity of propofol delivered in the intervention group (lidocaine) compared to the control group (saline) was 108 and 173.8 mg, respectively. This difference was shown to be statistically significant (P=0.000).

The calculation of the propofol infusion rate during surgery involved dividing the total amount of propofol provided by the length of the surgical procedure, as shown in Table 5. The

interventional group, which got lidocaine, and the control group, which received saline, was administered doses of 0.63 and 0.86 mg/min, respectively. This difference in dosage was shown to be statistically significant.

Table 5: Requirement of propofol

Propofol requirement	Group L (Mean±SD)	Group C (Mean±SD)	% difference	P-value
From induction to insufflation (mg)	52.5±11.8	86.9±15.4	44.6	0.000 **(S)**
Total propofol administered (mg)	108.0±26.0	173.8±30.74	46.6	0.000 **(S)**

S- Statistically Significant ($p<0.05$)

Rocuronium

The intervention group (lidocaine) received a total median rocuronium dose of 35 mg, whereas the control group (saline) received a total median rocuronium dose of 62 mg. This difference in dosage between the two groups was shown to be statistically significant, as seen in Table 6. The calculation of the rocuronium administration rate during the surgical procedure involved dividing the total rocuronium dose by the time of the surgery. The experimental group, which got lidocaine, and the control group, which received saline, was administered doses of 0.21 and 0.37 mg/min, respectively. This difference in dosage was shown to be statistically significant, with a p-value of 0.000. During the surgical procedure, the administration rate of rocuronium was 0.41mcg/kg/min in the lidocaine group and 0.71mcg/kg/min in the saline group. The obtained result exhibits statistical significance, as indicated by a p-value of 0.000. The lidocaine group received a 53% lower dosage of rocuronium.

Table 6: Requirement of rocuronium

Rocuronium requirement	Group L (Mean±SD)	Group C (Mean±SD)	% difference	P-value
In mg/min	0.21 (0.18-0.26)	0.37 (0.28-0.48)	55.0	0.000 **(S)**
In mg/kg/min	0.41 (0.34-0.5)	0.7 (0.54-0.92)	53.5	0.000 **(S)**

S- Statistically Significant ($p<0.05$)

Vasopressor requirement

Boluses of either ephedrine or phenylephrine were administered to manage intraoperative hypotensive episodes, as shown in Table 7. The vasopressor needs in both groups exhibited identical and similar patterns; however no statistical significance was seen.

Table 7: Requirement of vasopressors

Vasopressors requirement		Group L (Mean±SD)	Group C (Mean±SD)	P-value
Induction to insufflations	Ephedrine (mg)	3.59±5.67	1.72±3.5	0.267 (NS)
	Phenylephrine (mcg)	12.5±8.1	23.0±24.6	0.105 (NS)

NS- Non-Significant ($p>0.05$)

Discussion

The findings of this study indicate that the administration of lidocaine by intravenous infusion during the perioperative period resulted in enhanced pain relief after surgery. Additionally, it led to a decrease in the amount of opioids and anesthetics required during the perioperative period in patients with a high body mass index who underwent laparoscopic cholecystectomy. Notably, no major negative effects were observed as a result of this intervention. The alleviation of pain during the perioperative period has always posed difficulties in patients with a high body mass index (BMI) as a result of the physiological and pharmacokinetic changes associated with their condition. [9,10] Due to the elevated prevalence of concurrent medical conditions within this specific group of patients, the use of conventional pain treatment strategies that primarily rely on opioids can frequently lead to respiratory impairment caused by opioids and subsequently contribute to heightened morbidity and/or fatality rates. The use of multimodal analgesia techniques, which prioritize minimizing the use of opioids, has demonstrated the potential to enhance patient safety and improve outcomes. In this regard, the perioperative administration of lidocaine infusion has emerged as an appealing choice for minimizing the need for analgesics during the perioperative period. Intravenous administration of lidocaine has been shown to possess analgesic, antihyperalgesic, and anti-inflammatory characteristics, as supported by previous studies [11-13]. Additionally, it has been seen to effectively decrease the need for analgesic medication both during and after surgical

procedures. The aforementioned characteristics are influenced by a range of processes, such as the blocking of sodium channels [5], as well as the inhibition of G-protein coupled receptors [5,14] and N-methyl-D-aspartate receptors.[15] Intravenous administration of lidocaine has been seen to induce a decrease in spike activity, amplitude, and conduction time in both myelinated A fibers and unmyelinated C fibers. [16,17] The proposed mechanism by which lidocaine improves perioperative pain may involve its anti-inflammatory effect, which might result in the reduction of cytokine production and neutrophil activation. [18] The anaesthetic drugs exhibit voltage-dependent suppression of sodium (Na+) channels in the central nervous system (CNS). [19] The mechanism of action of lidocaine encompasses the blockage of sodium (Na+) channels in both the peripheral and central nervous systems (CNS). Therefore, it may be inferred that both inhalant anesthetics and lidocaine exert their actions on voltage-gated Na+ channels in the central nervous system (CNS). Consequently, their impact during general anaesthesia may exhibit an additive nature. [20]

The findings of our study align with other research, which has demonstrated that intravenous lidocaine infusion effectively decreases the need for intraoperative opioid administration. In our research, we successfully established evidence of an opioid-sparing impact during the intraoperative phase among participants in the lidocaine group. This effect was observed through a notable reduction in the need for opioids (namely fentanyl and morphine), amounting to a drop of 43%. The research conducted by Saadawy et al. examined the impact of lidocaine on fentanyl consumption in patients having laparoscopic cholecystectomy. The study revealed a statistically significant reduction of 34% in total fentanyl consumption among individuals in the lidocaine group. The observed values for the lignocaine and control groups were 242 ± 48.5 µg and 323 ± 70.8 µg, respectively. [21] In their study, Kaba et al. observed a substantial reduction in the total dosage of sufentanil administered to patients undergoing laparoscopic colectomy in the lidocaine group compared to the control group. Specifically, the total dose in the lidocaine group was found to be 22% lower (13.0 ± 3.7 µg) than that in the control group (16.3 ± 3.6 µg). [8] A comparable outcome was observed in the context of ambulatory surgery, wherein the administration of lidocaine resulted in a noteworthy 30% decrease in the use of intraoperative opioids. [22]

The individuals who took part in our study had a body mass index (BMI) over 25 kg/m2, and it is plausible that these particular patients possess a heightened susceptibility to the respiratory depressive properties associated with opioids. De Oliveira et al. conducted a study on patients after bariatric surgery, whereby they demonstrated that the administration of lidocaine infusion resulted in a reduction of 24-hour opioid consumption by 10 mg morphine equivalents when compared to a placebo. This reduction in opioid consumption was shown to be positively associated with higher scores on quality of recovery assessments. [23]

In our investigation, we observed that the levels of postoperative pain experienced during the initial and second hour after extubation, as assessed by the Visual Analogue Scale (VAS), were found to be greater in the saline group by 3 and 10.5 points, respectively. While the clinical significance of these findings may be noteworthy, it is important to note that they did not reach statistical significance. This lack of statistical significance might perhaps be attributed to the lower sample size and the larger dosage of opioids required in the saline group to achieve analgesia, resulting in a reduction in pain levels.

The study conducted by Altermatt et al. revealed a noteworthy decrease in propofol dosage required during the maintenance phase of total intravenous anaesthesia (TIVA) for elective laparoscopic cholecystectomies following the administration of intravenous lidocaine. [24] Furthermore, the control group, which received saline, had a substantially greater intraoperative demand, amounting to a 45% increase.

The study conducted by our research team saw a much lower cumulative dose of rocuronium administered during surgery in the lidocaine group compared to the control group. Specifically, the lidocaine group exhibited a reduction of 53% in rocuronium dosage, which is notably higher than the 15% decrease reported in a previous study conducted by Omar. [25] The likely reason for the reduced need of rocuronium in the lidocaine group can be attributed to the capacity of lidocaine to attenuate the reflexes of the cough airway in response to the endotracheal tube. The findings of this study offer potential support for the utilization of lidocaine infusion during general anaesthesia as a means to reduce the required dosages of neuromuscular blocking drugs (NMBDs) in settings where quantitative neuromuscular monitors are not readily available.

Nevertheless, the cautious use of neuromuscular blocking drugs (NMBDs) may not be suitable in surgical procedures that need profound muscle relaxation. The study conducted by Cardoso et al. shown that the administration of intravenous lidocaine prior to rocuronium did not result in a reduction in its start time. However, it did lead to an extension in the pharmacological duration of rocuronium without affecting the overall recovery

of neuromuscular function. [26] The literature extensively documents the reduction of sympathetic response during laryngoscopy and endotracheal intubation with the use of Lidocaine. [27,28] In the present study, it was observed that the heart rate and mean blood pressures exhibited greater values in the saline group during the processes of intubation, insufflation, and surgery. This observation demonstrates the capacity of lidocaine to regulate the hemodynamic response not only in the context of intubation, but also during pneumoperitoneum and surgical procedures.

Furthermore, a statistically significant disparity was noted in peritoneal insufflations, wherein the mean arterial pressure (MAP) in the lidocaine group was found to be lower compared to the control group (79.8 ± 8.3 vs. 93.9 ± 13.5, $P = 0.001$). The study conducted by Weinberg et al. examined the impact of intraoperative lidocaine infusion on hemodynamic alterations in individuals having open radical prostatectomy. [29]

In the present investigation, we employed the administration of lidocaine at a dosage of 2 mg/kg by a gradual intravenous bolus injection. This was subsequently followed by a continuous infusion of 2 mg/kg/h throughout the surgical procedure, concluding 30 minutes after extubation. Due to the administration of lidocaine infusion for a duration of 30 minutes following the surgical procedure, it is uncertain whether extending the duration of the lidocaine infusion would have resulted in enhanced analgesic effects.

While the continuous infusion of lidocaine raises concerns over its buildup, prior research have demonstrated that the dosages employed in these investigations result in plasma concentrations that stay much below the lethal threshold (5 μg/ml) even after a 24-hour period. [8,11]. The occurrence of toxicity resulting from perioperative lidocaine infusion is quite uncommon [30,31]. However, it can manifest through symptoms like as tinnitus, perioral numbness, and cardiac dysrhythmias. In the present investigation, no detrimental effects were seen in any of the experimental groups.

The consideration of monitoring plasma lidocaine levels may be warranted in patients who are at a heightened risk for lidocaine toxicity, such as individuals with impaired liver or kidney function.

Limitations of the study

The limited size of the sample is a significant constraint in our investigation. On the contrary, employing a larger sample size would have yielded enhanced statistical significance and a deeper understanding of the secondary objectives.

The study did not take into account surgical and anaesthetic experiences, as the surgical anaesthetic team engaged was diverse. The study did not take into account previous abdominal operations, which might potentially contribute to increased surgical technical difficulties and higher pain levels. The patients were observed for a duration of just 2 hours post-surgery. If a longer follow-up period had been used, it would have allowed for the analysis of additional information, such as the occurrence of bowel movement, the need for more analgesics, as well as the time required for mobility and discharge.

Conclusion

The intravenous administration of Lidocaine infusion serves as a valuable supplementary measure for anaesthesia provision. Furthermore, it is noteworthy that the dosages employed in the study never result in adverse effects. The potential impact of systemic lidocaine on the requirements of opioids, anesthetics, and neuromuscular blocking agents is highly significant in patients with a body mass index (BMI) exceeding 25.

This effect is particularly noteworthy due to its association with improved lung function and airway patency in the postoperative period, reduced likelihood of residual neuromuscular blockade, and, most importantly, decreased perioperative pain. These benefits collectively contribute to decreased morbidity rates and shorter hospital stays.

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