ORIGINAL RESEARCH

Ultrasound-guided transversus abdominis plane block versus systemic lidocaine for postoperative analgesia in patients undergoing colorectal surgery

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ABSTRACT

Background: Colorectal surgery is associated with significant postoperative pain which are associated with significant side effects. **Objective:** To investigate the effect of intravenous infusion of lidocaine compared with ultrasound-guided transverse abdominal plane (TAP) block on the quality of postoperative recovery and analgesic effect in patients undergoing colorectal surgery. **Methods:** In this prospective study, patients who chose to have colorectal operations for a variety of reasons are included. Patients were split into two groups and given either a transverse abdominal plane block (TAP) using ultrasound-guided bilateral administration of 0.25% ropivacaine or lidocaine (LIDO, a loading dose of 1.5 mg/kg). At 24 hours following surgery, the Quality of Recovery-40 (QoR-40) was evaluated. Use of remedial analgesics within 24 hours after surgery, consumption of propofol and remifentanil, numeric rating scale (NRS) pain scores at rest at 0 to 24 h postoperatively, and adverse events were also noted. **Results:** These two groups' demographic profiles were equivalent. The QoR-40's numerous components did not differ between the LIDO and TAP groups. In comparison to the TAP group, the patient in the lidocaine group had a decreased resting NRS score evaluated at 1 h, 2 h, and 4 h postoperatively, but not at 8 and 24 h (P 0.05). **Conclusion:** For patients who underwent colorectal surgery, intravenous infusion of lidocaine and ultrasound-guided TAP block both offered satisfactory postoperative recovery and postoperative analgesia, although intravenous infusion of lidocaine was superior to TAP block at 12 and 24 hours after surgery.

Key words: ultrasound-guided transverse abdominal plane, Systemic lidocaine, Colorectal surgery, Post-operative pain, Numeric rating scale

INTRODUCTION

The primary gold standard surgical technique in colorectal resection for benign and malignant illness is presently laparoscopic bariatric surgery [1]. Reduced postoperative pain and opiate use, lower morbidity, a quicker recovery, and a shorter hospital stay are all benefits of laparoscopic surgery. However, methods for managing postoperative pain following laparoscopic surgery are primarily based on ideas that have been shown effective for open surgical procedures [2]. Opioids continue to be the primary analgesics used during and after surgery. However, postoperative complications like respiratory depression, nausea, and vomiting can easily happen. Additionally, they can cause increased blood pressure, which can result in postoperative bleeding. Nausea and vomiting can also cause an increase in intragastric pressure, one of the causes of anastomotic fistula [3].

The use of epidural analgesia after laparoscopic colorectal surgery has been demonstrated to cause a

prolonged time to mobilisation, an increase in hospital costs, lengthier hospital stays, and a higher incidence of uti [1,4]. Modern multimodal analgesia approaches have been shown to give postoperative analgesia in patients following laparoscopic colorectal surgery that is just as effective as epidural analgesia and opioids [5]. As a result, EA is no longer advised as conventional treatment for pain management following laparoscopic colorectal surgery, according to recently published UK guidelines [6]. For patients undergoing laparoscopic colorectal surgery, effective and efficient options to postoperative analgesia are sought after.

The transversus abdominis plane (TAP) block is a relatively new regional anaesthesia technique that provides analgesia of the parietal peritoneum, the anterior abdominal wall, and the skin [7]. Performed under ultrasound guidance, the block has been shown to be straightforward and safe [7]. Additionally, the use of TAP blocks causes a reduction in the total amount of opioids consumed in the first 24 postoperative hours [8].

The use of systemic lidocaine as a co-analgesic for the management of acute postoperative pain has attracted growing interest in recent years. A local anaesthetic amide with anti-inflammatory, analgesic, and anti-hyperalgesic effects is lidocaine [9]. There are conflicting reports on the effectiveness of systemic lidocaine administration during surgery [9]. The use of anaesthetics and postoperative analgesics is greatly decreased after abdominal surgery when lidocaine is used, according to studies [10].

The usage of opioids can be decreased by giving patients a continuous intraoperative infusion of lidocaine or TAP block, both of which have some analgesic effects. No randomised studies contrasting the role of TAP block against systemic lidocaine are available [11–12], despite the fact that both the TAP block and systemically administered lidocaine have been shown to effectively relieve pain during laparoscopic colorectal surgery.

In order to generate new ideas for multimodal analgesic strategies and enhance the quality of postoperative recovery in patients undergoing perioperative gastric decompression, this study focused on the differences in the quality of postoperative recovery and analgesic effects between the two methods in patients undergoing gastric decompression by intravenous infusion of lidocaine or ultrasound-guided transverse abdominal plane block.

MATERIALS AND METHODS

STUDY DESIGN

This study is a single-center, prospective, randomized, double-blind, controlled trial.

SUBJECTS

All consecutive patients scheduled for elective laparoscopic resection and candidates for enhanced recoveryafter surgery were included in the study after informedconsent has been obtained.

RANDOMIZATION

Using a computer-generated list, patients were randomly assigned to undergo a TAP block with ropivacaine 0.375% at the conclusion of surgery (TAP group, n = 32) or perioperative intravenous lidocaine (LIDO group, n = 33). Researchers who remained ignorant to the nature of the intervention throughout the study evaluated postoperative outcomes.

INCLUSION AND EXCLUSION CRITERIA

Patients who met the following requirements were included in the study: (1) between the ages of 18 and 75; (2) elective laparoscopic colorectal surgery; and (3) risk category IV according to the American Society of Anesthesiologists.

The exclusion criteria include: (1) refusal of the patient, (2) known hypersensitivity to study medications, (3) chronic opioid use, (4) liver insufficiency (defined as a serum bilirubin ≥2 mg/dl), (5) renal insufficiency (defined by estimated glomerular filtration rate ≤60 ml/min/1.73 m2), (6) epilepsy, (7) psychomotoric retardation, (8) morbid obesity (defined as a body mass index >40), (9) obstructive sleep apnea syndrome, (10) cardiac rhythm disorders.

COLORECTAL SURGERY: INDUCTION AND MAINTENANCE OF ANESTHESIA

A bolus injection of propofol (2 mg/kg) and an intravenous infusion of remifentanil (4–5 ng/ml) were used to produce anaesthesia after preoxygenation. Cisatracurium (0.15 mg/kg) will make it easier to intubate the trachea. Sevoflurane will be used to maintain general anaesthesia. All patients will get standard monitoring recommended by the American Society of Anesthesiologists, including ECG, pulse oximetry, capnography, and temperature readings. Patients will also be observed utilising relaxometry, invasive arterial and central venous pressure measures, and bispectral index.

INTERVENTIONAL TREATMENT

TAP group: At the end of surgery, a bilateral single shot TAP block was performed under ultrasound guidance. At each side, 20 ml ropivacaine 0.375% and clonidine 0.5 μg/kg were injected into the “triangle of Petit”, which is located between the internal oblique muscle and the transverse abdominal muscle.

LIDO group: A bolus of 1.5 mg/kg of intravenous lidocaine was administered after induction of anesthesia, followed by a continuous infusion of intravenous lidocaine at 1.5 mg/kg per hour. The lidocaine infusion was stopped 4 hours after arrival in the postoperative anesthesia care unit (PACU).

POSTOPERATIVE ANALGESIA

Irrespective of group allocation, all patients received a combination of intravenous analgesics 30 minutes before the end of the surgery: paracetamol 15 mg/kg, ketorolac 0.5 mg/kg (maximum 30 mg), 0.2 mg/kg morphine.

POSTOPERATIVE CARE UNIT

For ongoing vital sign monitoring, patients were sent to the postanesthesia care unit (PACU). The Aldrete rating was noted. In the PACU, the intensity of pain was measured using a numeric rating scale (0 = no pain, 10 = the worst agony imaginable) both while the patient was at rest and when coughing. Patients were administered 1 mg of intravenous morphine whenever the numeric rating scale score reached or exceeded 3. Throughout the first two hours of the PACU stay and for the final two hours, the intensity of the patient's pain was assessed every 15 minutes. Patients must stay in the PACU for at least 4 hours before being discharged, and only once their Aldrete scores reach 9 and there is no sign of pain.

PRIMARY ENDPOINT

The Quality of Recovery-40 (QoR-40) questionnaire, which was completed 24 hours following surgery, served as this study's major end measure [3]. Physical comfort, physical independence, emotional state, psychological support, and pain are the five recovery components that the QoR-40 questionnaire measures throughout 40 items. Each item is given a number between 1 and 5, with 200 being the highest possible score (greatest quality). The smallest clinically significant difference for the QoR-40 scale scores is 4.8 [4].

SECONDARY ENDPOINT

Scores on the Visual Analogue Scale were evaluated at 0, 2, 4, 8, 12, and 24 hours after surgery. The length of the procedure, the time spent extubating, the time spent in the PACU, the amount of propofol and remifentanil consumed during the procedure, the use of vasoactive medications, blood loss, the amount of diazoxide consumed within 24 hours after the procedure, adverse reactions, the amount of postoperative bowel movements before discharge, and the length of hospital stays were also noted. A VAS score was used to gauge the severity of the pain (0 being no pain and 10 being the most agonising agony). The time between the conclusion of operation and the onset of the first farts was used to define the time to first exhaust.

STATISTICAL ANALYSIS

For statistical data analysis, SPSS statistical software (version 26.0; SPSS Inc., IBM, Chicago, IL, USA) was used. The measurement data used the Shapiro-Wilk test to determine the normality of the data distribution. Data are expressed as the mean (SD) for parametric continuous variables and as the median (interquartile range [IQR]) for nonparametric distributions. Categorical data are expressed as a number (percentage). When necessary, categorical variables were compared using the chi-square test or Fisher exact test with Yates adjustment. Continuous nonparametric variables were compared using the Kruskal-Wallis test, while continuous parametric variables were compared using analysis of variance. In the event that there were differences between multiple groups that were statistically significant, post hoc analysis was carried out using the Bonferroni adjustment. Statistical significance was determined by a two-sided P value of 0.05.

RESULTS

DEMOGRAPHICS

Seven patients were disqualified from the experiment out of a total of 70 patients that underwent screening. Due to a temporary cancellation of surgery, one of these patients was disqualified, while another had a history of postoperative nausea. Five more patients were added, but only two were kept since their surgeries took longer than three hours, one was converted to open surgery, and one withdrew halfway through. 63 patients in all were included in the statistical evaluation. Regarding baseline characteristics, there were no discernible changes between the two groups (Table 1).

1: Demographic characteristics

	Group I (TAP)	**Group II (LIDO)**	**P value**
N	32	33	
Gender (M/F)	19/13	18/15	0.091
Age (yr)	41.74±7.72	43.14±6.89	0.098
Height (m)	1.67±0.17	1.67±0.78	0.584
Weight (kg)	72.51±7.16	74.30±8.21	0.064
Body mass index (kg/m2)	23.65±2.81	23.73±3.35	0.612
ASA physical status (II/III)	17/15	17/16	0.372
Hypertension	7 (21.88%)	9 (27.27%)	0.593
Diabetes mellitus	9 (28.13%)	11 (33.33%)	0.071
Obstructive sleep apnea-hypopnea syndrome	11 (34.38%)	13 (39.39%)	0.092
Surgical procedure			
Ambulatory hemorrhoidal surgery	4	3	
Hemorrhoidal banding	4	2	

Hemorrhoidal excision	3	4	
High Resolution Anoscopy	2	2	
Internal-lateral sphincterotomy	2	3	
Repair of fistula and fissure	6	4	
Laparoscopic or open rectal prolapse repair	4	4	
Treatment of proctitis	2	4	
Tumour removal	5	7	
Surgical duration (minutes)	110 (90–140)	115 (85–135)	0.144
Intravenous fluid (mL)	1250 (800–1500)	1325 (850–1300)	0.203

EFFECT ON QUALITY OF RECOVERY-40

The median (IQR) QoR-40 scores for the TAP group were 157 and for the LIDO group, 162. At 24 hours after surgery, the total QoR-40 scores of LIDO and TAP were comparable, and the difference was not statistically significant. At 24 hours following surgery, Group LIDO showed a statistically significant increase in physical comfort, physical independence, and pain compared to Group C (P 0.001). Additionally, Group T performed much better in these three categories than did Group C (P=0.001, P=0.003, and P=0.014, respectively). In addition, Group L scored better on the pain perception scale than did Group T (P = 0.008, Table 2).

Table 2: Effect of analgesics on Quality of Recovery-40 parameters

	Group I (TAP)	**Group II (LIDO)**
Emotional state	35	34
Physical comfort	45	45
Physical independence	21	24
Psychological support	27	28
Pain	29	31
Total	**157**	**162**

NUMERIC RATING SCALE FOR PAIN (NRS)

The patient in the lidocaine group had lower resting NRS score measured at 1 h, 2 h and 4 h but not at 8 and 24 h ($P < 0.05$) postoperatively than in TAP group [Table 2].

Table 3: Visual analogue scores

NRS Score	**Median/IQR (Range)**		***P***
	LIDO	**TAP**	
1 h	2.39/1.12 (2, 9)	2.99/1.81 (2, 7)	0.02
2 h	2.67/1.09 (2, 7)	3.00 1.90 (2, 6)	0.01
4 h	3.67/2.23 (2, 5)	3.89/2.25 (2, 5)	0.03
8 h	2.30/2.02 (2, 4)	3.10/1.50 (2, 5)	0.067
24 h	1.50/1.25 (1, 2)	1.80/2.20 (1, 3)	0.35

After extubation, the mean amount of time needed for the initial dose of rescue analgesia was longer in the lidocaine group than in the TAP group (P 0.01). Lidocaine group had a lower overall 24-hour fentanyl requirement than TAP group. At 1 hour, 2 hours, 4 hours, 8 hours, and 24 hours following surgery, the difference was discovered to be extremely statistically significant (P 0.001). Both groups consumed less remifentanil throughout the procedure. There was no significant difference in intraoperative propofol intake, use of vasoactive medications, extubation time, PACU stay time, first postoperative defecation, or hospital stay duration between the groups. However, time to first leave bed and time to first exhaust were faster in both groups.

DISCUSSION

The efficient strategy for treating morbid or complicated obesity is laparoscopic colorectal surgery [13]. The perioperative outcome and recovery of patients who have undergone bariatric surgery may be hampered by a number of major obstacles and variables [14]. Postoperative discomfort may negatively affect healing, mobility, gastrointestinal health, and hospital stay. Additionally, using opioid analgesics in patients is linked to major side effects include apnea, hypoxemia, sleepiness, intestinal obstruction, vomiting, delayed activity, and mortality [15]. In order to reduce opioid-related adverse effects and enhance postoperative recovery in bariatric surgery patients, it is extremely desired to adopt multimodal techniques.

The QoR-40 scale [16] offers a thorough evaluation of the quality of recovery in terms of five dimensions: emotional state, physical comfort, psychological support, self-care, and pain perception. It also contains a final score. The quality of postoperative recovery increases with the postoperative QoR-40 score. The QoR-40 questionnaire can be used to quickly evaluate how well patients are recovering from surgery, according to a number of studies.

Although its effectiveness is still debatable, intravenous lidocaine and TAP block have become

more often utilised for postoperative analgesia in recent years. According to research, intravenous infusions of lidocaine and TAP block can reduce the need for opioids, treat acute postoperative pain, and enhance postoperative comfort [17]. Intravenous lidocaine, according to G. Dewinter's research, could not speed up postoperative recovery or reduce the amount of morphine given to patients undergoing posterior spinal fusion [18]. After laparoscopic hysterectomy, TAP block did not increase the QOR-40 score or decrease the need for narcotic analgesics [19].

According to our study, ultrasound-guided TAP block or intravenous lidocaine infusion might both raise postoperative recovery quality scores; however, there was no discernible difference between the two treatments. Wang's finding [20] that intravenous lidocaine could enhance the postoperative recovery quality of patients undergoing thoracoscopic lung cancer was consistent with the improvement in the overall score, which was primarily reflected in the three areas of physical comfort, self-care capability, and pain perception.

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