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Comparison of Pain Intensity After Laparoscopic Cholecystectomy Between Patients with and Without Periportal Lidocaine Infiltration

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ABSTRACT

Early postoperative pain after laparoscopic cholecystectomy (LC) is largely related to port-site trauma. Peri-portal lidocaine infiltration is a simple technique used to reduce this discomfort, but evidence from local clinical settings remains limited. **Objectives:** To compare postoperative pain intensity between patients receiving peri-portal lidocaine infiltration and those undergoing LC without local anesthesia at a tertiary hospital in Karachi, Pakistan. **Methods:** This prospective cohort included 148 adults undergoing elective LC who were allocated to receive either periportal infiltration of 10 mL 2 % lidocaine (n=74) or no local anaesthetic (n=74). Pain at rest was assessed on a 10-cm visual analogue scale immediately post extubating and at 3, 6, 12, and 24 h. Secondary outcomes were time to ambulation, time to oral intake, and length of hospital stay. SPSS version 23.0 was used to analyze the data. **Results:** Pain scores were significantly lower in the lidocaine group at the immediate (3.42 ± 0.64 vs 4.38 ± 0.85, p=0.001), 3-hour (2.83 ± 0.63 vs 3.76 ± 0.63, p=0.001), and 6-hour assessments (1.95 ± 0.67 vs 2.53 ± 0.92, p=0.001). Patients receiving lidocaine mobilized earlier (4.43 ± 1.57 h vs 6.32 ± 2.37 h, p=0.001), resumed oral intake sooner (6.18 ± 1.52 h vs 7.70 ± 1.84 h, p=0.001), and had a slightly shorter postoperative stay (9.31 ± 1.57 h vs 9.99 ± 0.07 h, p=0.001). **Conclusion:** Peri-portal lidocaine infiltration effectively reduces early postoperative pain after LC.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the procedure of choice for symptomatic cholelithiasis, offering distinct advantages over open cholecystectomy, such as smaller incisions, reduced blood loss, earlier ambulation, and shorter hospital stay [1-3]. LC, introduced in the mid-1980s, has become the standard surgical approach for symptomatic gallstone disease because it offers clear advantages over open surgery [4]. Even though LC is less invasive, it doesn't prevent postoperative complications, and pain is reported very frequently [1]. Parietal pain arises from the port-site incisions, visceral pain occurs from peritoneal irritation and dissection of the gallbladder from the hepatic bed, and referred shoulder pain arises in several patients because of phrenic nerve irritation due to residual carbon dioxide used during pneumoperitoneum [4-6]. This often results in a wide spectrum regarding the

intensity of pain [1, 5]. In one study, Zedan et al. reported VAS scores ranging from 2 to 9 at 24 hours, underlining how patient experience can vary depending on operative technique and perioperative analgesia [7]. Nonsteroidal anti-inflammatory drugs, opioids, intraperitoneal local anesthetics instillation, transverse abdominal plane block, and subhepatic drainage are some analgesic maneuvers that have been utilized in the process to reduce this pain [7-10]. However, one or more of these methods may be limited by their side effects, inconsistent efficacy, or resource issues, especially in low- and middle-income countries (LMICs). Among them, infiltration with local anesthetics like lidocaine at the periportal site has gained attention as an easy, less expensive technique that can directly target parietal pain at port sites [4, 10]. This randomized trial, by Kiany et al. showed subcutaneous lidocaine injection at port sites was associated with a measurable reduction in postoperative opioid use when compared to instillation at the gallbladder bed [4]. Similarly, patients receiving 0.25% bupivacaine at port sites demonstrated significantly lower mean pain scores at 12 hours postoperatively (4.1 ± 1.21) compared to controls (7.95 ± 0.6) and thus described the clinical efficacy of local infiltration techniques [2]. Although promising in the international literature, there is a paucity of evidence from Pakistan that assesses the role of periportal lidocaine in enhancing postoperative pain and recovery in LC. Locally, Asad et al. compared day-case with conventional LC and demonstrated no difference in the intensity of pain on VAS; however, they identified early resumption of activity. The use of local anesthetics was not explored in this study [11].

This study among a Pakistani population will also test the feasibility and effectiveness of lidocaine use in public sector hospitals, where resource limitations are an important reason for pragmatic yet evidence-based interventions. This study aimed to identify the difference in postoperative pain intensity measured on the VAS in patients with and without periportal lidocaine infiltration after undergoing laparoscopic cholecystectomy.

METHODS

This was a prospective cohort study conducted at the Department of General Surgery in a tertiary care teaching hospital in Pakistan over a period of six months (June to December 2024). Ethical approval was obtained from the Institutional Review Board (IRB) of the respective institution, and the study was conducted in accordance with the Declaration of Helsinki (3507). The sample size of 74 participants per group (148 total) was calculated using the WHO sample size calculator, by considering 95% confidence interval, 80% power, pain score at 12 hours in the instillation group as 1.18 ± 0.39 and the infiltration group as 1.05 ± 0.22 post-laparoscopic cholecystectomy [4].

Eligible participants included adult patients aged 18–60 years scheduled for elective laparoscopic cholecystectomy for uncomplicated symptomatic cholelithiasis. All patients were classified as American Society of Anesthesiologists (ASA) physical status I or II. Exclusion criteria included patients with acute cholecystitis, gallbladder perforation, common bile duct stones, conversion to open cholecystectomy, allergy to lidocaine, coagulopathy, or significant comorbidities such as uncontrolled diabetes, cardiovascular disease, or renal or hepatic insufficiency. Written informed consent was taken. Samples were selected using a non-probability consecutive sampling technique. Patients were divided into two groups based on the anesthetic plan at the discretion of the attending surgeon. Group A (Intervention Group): Received periportal infiltration of 5 mL of 2% lidocaine at each port site immediately after creation of pneumoperitoneum, before trocar insertion. Group B (Control Group): Did not receive any local anesthetic at the port sites. All procedures were performed by consultant general surgeons with a standardized technique using four ports under general anesthesia. Pneumoperitoneum was established with CO_2, maintaining intra-abdominal pressure between 12 and 14 mmHg. No intraperitoneal or intramuscular analgesics were administered intraoperatively apart from standardized anesthesia. Postoperative pain intensity was assessed using the Visual Analogue Scale (VAS), with scores ranging from 0 (no pain) to 10 (worst imaginable pain). VAS scores were recorded at 3, 6, 12, and 24 hours postoperatively by nursing staff who were not involved in the surgical procedure and were unaware of group allocation. The lidocaine infiltration was conducted before the observer entered the operating area, and postoperative charts did not indicate intervention status. This approach ensured single-blind outcome assessment to minimize observer bias. Analgesic consumption was also recorded within the first 24 hours. Rescue analgesia in the form of intravenous diclofenac sodium (75 mg) was administered on the patient's request [12], and the total number of doses required within the first 24 hours was documented. Time to ambulation, time to oral intake, and total length of hospital stay were also recorded. Data were analyzed using SPSS version 23.0. Normality of continuous variables was assessed using the Shapiro–Wilk test, and homogeneity of variances was evaluated with Levene's test. As assumptions were met, continuous variables were summarized as mean ± standard deviation and compared between groups using the independent t-test. Repeated-measures ANOVA was applied to evaluate changes in pain scores over time and interaction effects between time and group. Categorical variables were compared with the chi-square test. Effect sizes and 95%

confidence intervals were calculated for between-group mean differences. A p-value <0.05 was considered statistically significant.

RESULTS

Out of 148, the mean age was 39.76±11.73 years, and the mean BMI was 26.09 ± 3.45 kg/m^2. About 97 (65.5%) were female, and 51 (34.5%) were male. ASA class II was reported in 89 (60.1%) participants. Hypertension was present in 36 (24.3%) participants, diabetes mellitus was present in 27 (18.2%) participants, and 13 (8.8%) participants had both conditions. Group-wise distribution of baseline characteristics is displayed in table 1.

Table 1: Baseline Characteristics of Study Participants (n=148)

Variables	Overall (n=148)	Lidocaine (n=74)	Control (n=74)	p-value
Age				
Years	39.76 (11.73%)	39.23 (11.41%)	40.30 (12.09%)	0.582
BMI (kg/m^2)	26.09 (3.45%)	25.88 (3.69%)	26.31 (3.20%)	0.458
Gender				
Male	51 (34.5%)	27 (52.9%)	24 (47.1%)	0.604
Female	97 (65.5%)	47 (48.5%)	50 (51.5%)	
ASA Status				
I	59 (39.9%)	25 (42.4%)	34 (57.6%)	0.131
II	89 (60.1%)	49 (55.1%)	40 (44.9%)	
Comorbid				
Hypertension	36 (24.3%)	19 (54.3%)	17 (47.2%)	0.755
Diabetes	27 (18.2%)	15 (55.6%)	12 (44.4%)	
Both	13 (8.8%)	5 (38.5%)	8 (61.5%)	
None	72 (48.6%)	35 (48.6%)	37 (51.4%)	

Data presented as Mean (SD) or n (%), BMI=Body Mass Index

Immediately after surgery, the lidocaine group reported a lower mean VAS score than controls (3.42 ± 0.64 vs 4.38 ± 0.85), with a mean difference of –0.95 (95% CI: –1.20 to –0.71; p=0.001). At 3 hours, pain remained lower in the lidocaine group (2.83 ± 0.63 vs 3.76 ± 0.64), corresponding to a mean difference of –0.93 (95% CI: –1.14 to –0.72; p=0.001). This difference persisted at 6 hours (1.95 ± 0.68 vs 2.53 ± 0.92), with a mean difference of –0.58 (95% CI: –0.85 to –0.32; p=0.001). By 12 hours, VAS scores had converged between groups (1.08 ± 0.47 vs 1.14 ± 0.32), with a non-significant mean difference of –0.05 (95% CI: –0.18 to 0.08; p=0.409). At 24 hours, pain levels were similarly low in both groups (0.99 ± 0.39 vs 0.95 ± 0.37), with a mean difference of 0.05 (95% CI: –0.08 to 0.17; p=0.463). A repeated-measures ANOVA demonstrated a significant overall within-subjects effect of time (p=0.001), indicating a steady decline in postoperative pain across all assessment points. Trend analysis showed a strong linear effect (p=0.001), consistent with progressive pain reduction throughout the first 24 hours. The between-subjects effect was also significant (p=0.001), confirming that, across all timepoints, patients who received lidocaine experienced lower overall pain

scores than those in the control group. Postoperative pain scores were assessed at five predefined intervals and are illustrated in figure 1.
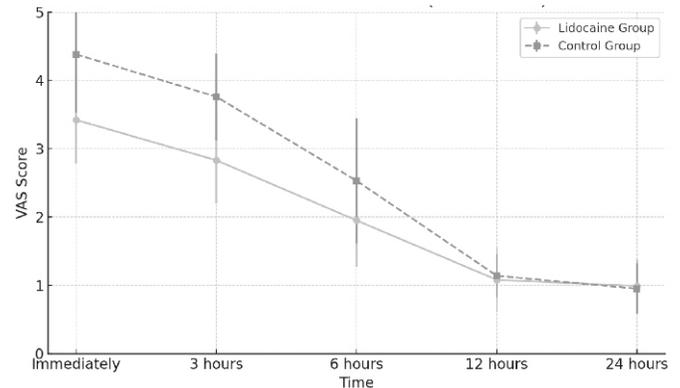

Figure 1: Comparison of Pain Scores at Five Time Points Between Both Groups (n=148)

Mean time to ambulation was 4.43 ± 1.57 hours in the lidocaine group and 6.32 ± 2.37 hours in the control group (p=0.001). Time to oral intake was 6.18 ± 1.52 hours in the lidocaine group compared to 7.70 ± 1.84 hours in the control group (p=0.001). Mean hospital stay was 9.31 ± 1.57 hours in the lidocaine group and 9.99 ± 0.07 hours in the control group (p=0.001), as shown in table 2.

Table 2: Comparison of Time to Ambulation and Oral Intake and Hospital Stay Between Both Groups (n=148)

Variables	Group	Mean ± SD	p-value
Time To Ambulation (Hours)	Lidocaine	4.43 ± 1.57	0.001*
	Control	6.32 ± 2.37	
Time To Oral Intake (Hours)	Lidocaine	6.18 ± 1.52	0.001*
	Control	7.70 ± 1.84	
Hospital Stay (Hours)	Lidocaine	9.31 ± 1.57	0.001*
	Control	9.99 ± 0.07	

*Significant at 5% level of significance

DISCUSSION

This cohort demonstrates that subcutaneous peri-portal infiltration of 2% lidocaine provides an early but time-limited analgesic benefit after laparoscopic cholecystectomy. Pain scores were significantly lower in the lidocaine group during the immediate (Δ=0.96) and 3-hour (Δ=0.93) assessments (both p=0.001). By 9 hours, differences between groups had narrowed substantially, and no significant advantages were observed at 12 or 24 hours. Despite the short pharmacologic duration of lidocaine, the reduction in early parietal pain was sufficient to produce clinically relevant functional gains, including earlier ambulation by nearly two hours, faster resumption of oral intake, and a modest reduction in postoperative stay. These improvements may be particularly valuable for enhancing patient turnover in resource-constrained public hospitals. The pattern observed here aligns with findings

from a recent double-blind Iranian randomized trial in which subcutaneous lidocaine improved early pain scores without affecting 24-hour outcomes [4]. Studies evaluating longer-acting local anesthetics show a more prolonged effect. A Bangladeshi study using 0.25% bupivacaine reported significantly lower pain scores up to 12 hours [13], while a Turkish cohort demonstrated reduced pain at one hour but no advantage beyond 12 hours when bupivacaine was used at port sites [14]. Combined parietal–visceral techniques appear to extend analgesic duration. Ahmed *et al.* reported greater pain reduction when bupivacaine infiltration was paired with intraperitoneal irrigation of the gallbladder bed [15], and Egyptian data indicate that gall-bladder-bed lidocaine can effectively reduce visceral discomfort throughout the first postoperative day [16]. Collectively, these studies support the concept that addressing both somatic and visceral nociception may provide broader analgesic coverage than port-site infiltration alone. Our functional gains mirror systemic-lidocaine data. A Pakistani randomized trial of perioperative intravenous lidocaine recorded VAS 2.0 ± 0.49 versus 3.93 ± 0.94 at 12 h (p=0.001) and 0.73 ± 0.82 versus 2.2 ± 0.61 at 24 h (p<0.001) and earlier ambulation (5.57 ± 1.55 h vs 7.30 ± 1.90 h; p=0.001) [17]. Local infiltration avoids infusion pumps and monitoring, therefore offering a low-cost alternative that aligns with enhanced-recovery targets [18-21]. Adjunct modalities could further prolong analgesia: reducing pneumoperitoneum pressure to 7–8 mm Hg halved postoperative opioid demand and lowered pain intensity in a 100-patient double-blind study [5], and sodium-bicarbonate peritoneal lavage decreased 24-h VAS by more than two units in a controlled study [7]. This study has several strengths. Its prospective design reduced recall bias, pain assessment was conducted by blinded nursing staff, and all procedures followed a uniform four-port technique performed by the same surgical team, minimizing operative variability. Baseline demographic and clinical variables were balanced between groups, enhancing comparability. Moreover, the inclusion of functional outcomes like ambulation time, oral intake, and length of stay provides a more comprehensive picture of postoperative recovery than pain scores alone. The setting of a high-volume government hospital increases the applicability of these findings to similar environments, where simple, low-cost analgesic strategies are particularly valuable. Future research should prioritize randomized controlled designs to reduce allocation bias and strengthen causal interpretation. Exploration of combined parietal–visceral blocks, such as port-site infiltration plus gall-bladder-bed instillation, may yield more sustained analgesia. Trials comparing lidocaine with longer-acting agents (e.g., bupivacaine, ropivacaine, or liposomal formulations) or adjuncts like dexamethasone would clarify whether extended coverage enhances functional recovery. Incorporating dynamic pain assessments, opioid usage, and patient-reported outcomes could offer a broader view of postoperative comfort. Finally, dedicated health-economic analyses are needed to determine whether improvements in early mobility and oral intake translate into meaningful cost savings in high-volume public-sector hospitals.

CONCLUSIONS

Peri-portal lidocaine infiltration provides meaningful early analgesic benefit after LC and contributes to faster immediate recovery milestones. Although its effect is time-limited, its simplicity, low cost, and ease of integration into routine surgical practice make it a useful component of postoperative pain management, particularly in resource-limited settings.

Authors' Contribution

Conceptualization: WNZ, MG
Methodology: WNZ, MG, MA, MDH
Formal analysis: WNZ
Writing and Drafting: WNZ, MA, ZS, MZ, MDH
Review and Editing: WNZ, MG, MA, ZS, MZ, MDH

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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