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Original Research Article

Comparison of Subcutaneous Infiltration With Intraperitoneal Instillation of Bupivacaine in Reduction of Early Postoperative Pain After Laparoscopic Cholecystectomy

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Abstract: *Postoperative pain remains a significant concern following laparoscopic cholecystectomy. Bupivacaine, a long-acting local anesthetic, is commonly used through different administration routes to reduce early postoperative pain. Determining the most effective delivery method may enhance recovery and improve patient comfort.* ***Objective:*** *To compare the effectiveness of subcutaneous infiltration versus intraperitoneal instillation of bupivacaine in reducing early postoperative pain following laparoscopic cholecystectomy.* ***Methods:*** *A quasi-experimental study was conducted at the Department of General Surgery, Qazi Hussain Ahmad Medical Complex, Nowshera, from December 2022 to June 2023. Sixty-two patients meeting the inclusion criteria were randomly assigned to two equal groups. Group A received 20 ml of 0.25% bupivacaine via subcutaneous infiltration at port sites, while Group B received the same dose intraperitoneally before the completion of the procedure. Pain intensity was assessed at 1, 4, 8, 12, and 24 hours postoperatively using the Visual Analogue Scale (VAS). Data were analyzed using SPSS Version 25, with p-values ≤0.05 considered statistically significant.* ***Results:*** *The mean age of participants was 45.92 ± 8.73 years. Gender distribution included 30 (51.6%) males and 32 (48.4%) females. No significant differences in age (p = 0.31) or gender (p = 0.22) were observed between groups. At 1 hour postoperatively, Group A had a higher mean VAS score (7.45 ± 0.89) compared to Group B (5.64 ± 0.84) (p = 0.00). At 24 hours, pain scores remained significantly lower in Group B (1.65 ± 0.61) compared to Group A (2.29 ± 0.86) (p = 0.00).* ***Conclusion:*** *Both subcutaneous infiltration and intraperitoneal instillation of bupivacaine effectively reduce early postoperative pain following laparoscopic cholecystectomy. However, intraperitoneal instillation provides significantly superior pain control at both early and later postoperative periods.*

Keywords: Subcutaneous infiltration, intraperitoneal instillation, Postoperative pain

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Introduction

Laparoscopic cholecystectomy is a widely performed procedure for the treatment of gallbladder diseases, offering benefits such as reduced postoperative pain, quicker recovery, and shorter hospital stays compared to traditional open surgery.(1) Despite these advantages, postoperative pain remains a common concern, especially during the early hours following surgery.(2) Effective pain management is essential for improving patient outcomes and ensuring smooth recovery.(3)

Various techniques have been explored to reduce postoperative pain, with local anesthetics being a popular choice.(4) Among these, bupivacaine, a long-acting local anesthetic, has demonstrated significant efficacy in controlling postoperative pain.(5) Traditionally, bupivacaine has been administered through subcutaneous infiltration at the port sites.(6) However, the alternative approach of intraperitoneal instillation of bupivacaine has gained attention due to its potential for more effective pain control by directly targeting the peritoneal cavity.(7) Parietal discomfort is a common and well-known issue in traditional cholecystectomy, where the incision site causes direct somatic pain.(8) In the case of laparoscopic cholecystectomy, which is generally considered less invasive, pain still arises from several different sources. These include somatic pain resulting from the small incisions made for the insertion of laparoscopic instruments, visceral pain, which is deep intra-abdominal pain caused by the manipulation of organs during surgery, and referred pain, notably shoulder pain, which is caused by irritation of the diaphragm and phrenic nerve due to carbon dioxide insufflation used to create the pneumoperitoneum.

Research indicates that pain is a significant factor contributing to prolonged hospital stays, with 17% to 41% of patients undergoing day-care surgery experiencing delays in discharge due to pain. Furthermore, pain after laparoscopic surgery is often a major contributor to extended recovery times, with many patients reporting significant discomfort even after the procedure. Despite laparoscopic surgery's benefits, such as smaller incisions and faster recovery compared to traditional methods, the persistence of pain remains a substantial challenge. This underscores the importance of developing and implementing effective pain management strategies.

This study aims to compare the effectiveness of subcutaneous infiltration and intraperitoneal instillation of bupivacaine in reducing early postoperative pain after laparoscopic cholecystectomy. By evaluating pain intensity using the Visual Analogue Scale (VAS) at multiple postoperative time points, this study seeks to determine which method provides superior pain relief, ultimately contributing to enhanced patient care and faster recovery following laparoscopic surgery.

Objective:

To compare the effectiveness of subcutaneous infiltration versus intraperitoneal instillation of bupivacaine in reducing early postoperative pain following laparoscopic cholecystectomy.

Methodology

Randomized controlled trial (RCT).Department of General Surgery, Qazi Hussain Ahmad Medical Complex, Nowshera. The study duration was 6 months (20 Dec 2022 to 20 June 2023). Non-probability Consecutive

sampling was used to recruit patients. Patients with symptomatic gallstone disease. Patients ASA physical status I-II.Both genders. Patients aged 18-60 years. Patients with a BMI ≤ 30 kg/m².Patients with a known allergy or hypersensitivity to bupivacaine. Patients with hepatic or renal impairment may experience effects on drug metabolism and excretion, and patients with arrhythmias, ischemic heart disease, or heart failure. Patients with a history of chronic pain syndromes or long-term opioid use may have altered pain perception. Pregnant or lactating women. After obtaining approval from the ethical committee of Qazi Hussain Ahmad Medical Complex, Nowshera, patients who fulfilled the selection criteria were enrolled in the study. Written informed consent was obtained from each patient. A total of 62 patients were included in the study. Patients were divided into two groups. Group A patients were treated with a 20ml solution of 0.25% Bupivacaine, administered via subcutaneous infiltration at the port sites. In contrast, group B patients were treated with Bupivacaine, instilled intraperitoneally before completing the procedure. All patients were preoperatively informed about using the Visual Analogue Scale (VAS) for pain assessment. Postoperatively, pain intensity was evaluated at 1, 4, 8, 12, and 24 hours following surgery, with comprehensive recording of the total pain intensity at each interval. The gathered data was entered and analyzed using the computer software Statistical Package for Social Sciences (SPSS) Version 25.

Results

The mean age of the study participants was 45.92 ± 8.73 years. Age distribution showed that 3 (4.8%) patients were between 18 and 30 years, 15 (24.2%) were in the 31-40 years age group, 21 (33.9%) were aged 41-50 years, and 23 (37.1%) were older than 50 years. Regarding gender distribution, 30 (51.6%) participants were male, while 32 (48.4%) were female. The age distribution in Group A and Group B showed that 3 (9.7%) patients in Group A were aged 18-30 years, while none were in this age group in Group B. Among those aged 31-40 years, there were 7 (22.6%) patients in Group A and 8 (25.8%) in Group B. In the 41-50 years category, 9 (29.0%) patients were in Group A, compared to 12 (38.7%) in Group B. For those aged above 50 years, Group A had 12 (38.7%) patients, while Group B had 11 (35.5%) ($p = 0.31$). Regarding gender distribution, 18 (58.1%) patients in Group A were male, compared to 14 (45.2%) in Group B, while 13 (41.9%) in Group A and 17 (54.8%) in Group B were female ($p = 0.22$), indicating no statistically significant difference between the groups in terms of age or gender. The comparison of VAS scores at 1 hour and 24 hours postoperatively between Group A and Group B ($n = 62$) revealed significant differences. At 1 hour, the mean VAS score in Group A was 7.451 ± 0.888; in Group B, it was lower at 5.645 ± 0.838. At 24 hours, the VAS score decreased in both groups, with Group A reporting 2.290 ± 0.863 and Group B showing a lower score of 1.645 ± 0.608. The p-value for both time points was 0.00, indicating a statistically significant reduction in pain in both groups.

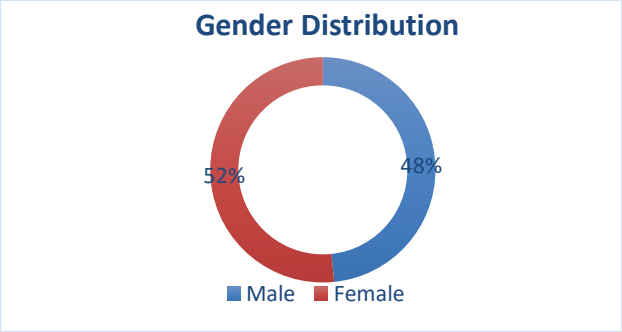

Figure 1: Frequency of patients based on gender.

Table 1: Descriptive Statistics for Quantitative Variables of all enrolled patients (*n=62)*

Variables	Mean±SD/ n (%)
Age	45.92±8.73
Age Groups	
18-30 years	3(4.8%)
31-40 years	15(24.2%)
41-50 years	21(33.9%)
>50 years	23(37.1%)
Gender	
Male	30(51.6%)
Female	32(48.4%)

Table 2: Comparison of Age Groups and Gender Distribution between Group A and Group B

	Groups		p-value
	Group A	Group B	
Age groups			
18-30 years	3(9.7%)	0(0.0%)	0.31
31-40 years	7(22.6%)	8(25.8%)	
41-50 years	9(29.0%)	12(38.7%)	
>50 years	12(38.7%)	11(35.5%)	
Gender			
Male	18(58.1%)	14(45.2%)	0.22
Female	13(41.9%)	17(54.8%)	

Table 3: Comparison of VAS Scores at 1 Hour and 24 Hours between Group A and Group B (n=62)

	VAS Score		p-value
	At 1 Hour, At 24 Hours		
Group A	7.451±0.888	2.290±0.863	0.00
Group B	5.645±0.838	1.645±0.608	0.00

Table 4: Paired Sample t-Test for Reduction in Postoperative Pain (VAS Scores) in Both Groups

Group			Paired Differences					t	df	P-value
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
						Lower	Upper			
A	Pair 1	VAS1 - VAS24	5.16129	1.21372	.21799	4.71609	5.60649	23.677	30	.000

Discussion

Laparoscopic cholecystectomy, although considered a minimally invasive procedure, is frequently associated with varying degrees of postoperative pain, particularly in the early postoperative period.(9) This pain, though less than that experienced in open surgery, may significantly affect patient comfort and delay early ambulation and discharge. Effective pain management strategies are, therefore, crucial to enhancing postoperative recovery. Laparoscopic cholecystectomy, recognized as the gold standard for managing gallstone disease, is the most commonly performed laparoscopic surgery worldwide. It has largely replaced open cholecystectomy in the treatment of gallbladder disorders. Most patients undergoing this procedure are discharged on the same day or by the first postoperative day.(10) However, pain remains a key factor contributing to overnight hospital stays in approximately 17% to 41% of cases.(11) Additionally, 58% to 70% of patients require injectable analgesics to manage postoperative pain. This pain can be transient or persist for up to three days after surgery.(12)

In the present study, we compared the efficacy of subcutaneous infiltration versus intraperitoneal instillation of Bupivacaine in reducing early postoperative pain after laparoscopic cholecystectomy. The present study's findings demonstrated that intraperitoneal instillation of Bupivacaine significantly reduced pain scores at 1 hour and 24 hours postoperatively compared to subcutaneous infiltration, suggesting it to be a more effective method for postoperative analgesia in this context. Our findings align with those of a previous study. (13) They have also reported the superiority of intraperitoneal local anesthetic administration over subcutaneous infiltration in controlling visceral pain, which is believed to be a major component of discomfort after laparoscopic procedures. The observed pain reduction in the intraperitoneal group may be attributed to the direct action of Bupivacaine on the peritoneal surfaces and visceral afferent nerves, particularly around the gallbladder bed and under the diaphragm, common sites of pain due to peritoneal irritation and residual carbon dioxide gas.(10) In contrast, subcutaneous infiltration primarily addresses somatic pain originating from trocar insertion sites and may not sufficiently alleviate visceral pain, which is the predominant component after laparoscopic surgery.(14) This may explain the higher pain scores observed in the subcutaneous group, particularly in the early postoperative hours. The statistical analysis showed that the differences in pain scores at 1 hour and 24 hours were highly significant ($p = 0.00$), highlighting the clinical relevance of intraperitoneal Bupivacaine instillation in pain control. Furthermore, the demographic variables, including age and gender, were comparable between the two groups, with no statistically significant differences, ensuring that confounding factors did not influence the outcomes. It is also important to note that both techniques are simple, safe, and cost-effective, requiring minimal additional time during surgery. However, the clear advantage seen with intraperitoneal instillation supports its routine use in clinical practice for better pain management after laparoscopic cholecystectomy. Despite these positive findings, the study has some limitations. The sample size was small, and the follow-up was limited to the first 24 hours postoperatively. Long-term pain outcomes and additional factors such as opioid consumption, return to normal activity, and patient satisfaction were not assessed. Future studies with larger populations, longer follow-up periods, and inclusion of additional outcome measures are recommended to validate these results further.

Conclusion

The study findings indicate that both subcutaneous infiltration and intraperitoneal instillation of bupivacaine significantly reduce early postoperative pain following laparoscopic cholecystectomy. However, patients in Group B (intraperitoneal instillation) experienced lower VAS scores at both 1 hour and 24 hours postoperatively, suggesting that this method provides more effective pain control.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMN-22)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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