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ORIGINAL ARTICLE

Compare the Effects of Infiltration of Bupivacaine in Liver Bed with Preperitoneal Nerve Block in Laparoscopic Cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy is now considered the preferred treatment for symptomatic gallstone diseases, establishing itself as the gold standard method. Nevertheless, pain remains the sole grievance responsible for delaying discharge.

Objective: To compare the effectiveness of bupivacaine infiltration into the liver bed and peritoneal cavity in reducing pain after laparoscopic cholecystectomy.

Material and Methods: This prospective comparative study was done at the Department of General Surgery of Akbar Niazi Teaching Hospital, Islamabad. The study included 100 patients who were admitted for elective laparoscopic cholecystectomy between June and November 2023.Patients were consecutively assigned to received either bupivacaine preperitoneal nerve block. After gallbladder was removed, 20 ml bupivacaine 0.5% was administered in liver bed. For preperitoneal nerve block bupivacaine 0.5% was infiltrated into port sites to block the preperitoneal nerves. Postoperative pain assessment was conducted at 1, 6, 12, and 24 hours utilizing the Visual Analog Scale (VAS).

Results: The mean patients ages were43.88±7.8 years. Postoperative mean VAS at 1, 6 and 12 hours were decreased in Bupivacaine compare to preperitoneal nerve block ($p \leq 0.05$). Postoperatively no difference was observed in VAS at 24 hours between the patients ($p \geq 0.05$). The total doses mean of SAID utilized in first 24 hours postoperatively were lower in Bupivacaine patients than in preperitoneal nerve block patients ($p \leq 0.05$).

Conclusion: The infiltration of bupivacaine in the liver bed following laparoscopic cholecystectomy effectively reduces pain as compare to preperitoneal nerve block. This straightforward, cost-effective technique should be adopted to diminish early postoperative pain in all elective cases.

Keywords: Bupivacaine; Cholecystectomy, Laparoscopic; Gallbladder; Gallstones; Pain.

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Introduction

Laparoscopic cholecystectomy (LC) is emerged as gold standard intervention for gallstone disease, with a majority of patients is discharged on day first postoperatively.[1]Several studies have demonstrated that LC can be safely and effectively performed as a day care procedure in appropriately designated

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patients.[2,3]Asignificant advantage of LC is the reduction in pain postoperatively. Conversely, open surgery often results in significant pain and discomfort due to a large incision of abdomen wall, which is severed sufficient to delay early discharge. However, achieving adequate relief in pain and ensuring patient comfort in the initial postoperative period remain challenges following LC, as unmanaged pain can still lead to delayed discharge.[4]

The pain experienced by a patient after LC can be categorized into three types.[5]Thevisceral pain following cholecystectomy is deep and originates from within the abdomen. Parietal pain is superficial and originating from the site of trocar, which is the incision, made for the insertion of trocar. Shoulder pain is a type of referred pain caused by the irritation of the diaphragm, typically due to the presence of pneumoperitoneum.[6]

Numerous methods are attempted to decrease pain postoperatively following LC. These methods included as follow; lower compression Pneumoperitoneum, gasless method, warmedCO_2, washing peritoneal with saline, local anesthetics in the site of tracer and local anesthetics instillation in sub diaphragmatic area, NSAIDs andsteroids.[7]

The peripheral utilization of local anesthetics for pain postoperatively management has gained popularity in numerous minor surgery operations and in laparoscopy surgery. This approach can improve early pain management and decrease the requirement of analgesic medications.[8]Bupivacaine typically has half-life of 2.5 to 3.5 hours and is noted pain relief for approximately 6 hours on average. Bupivacaine has a wide margin of safety for anesthesia. Up to an upper range of 2.5 mg bupivacaine/kg of body weight is safely utilized.[9]

The study aim was to compare the effectiveness of bupivacaine infiltration into the liver bed and preperitoneal nerve block in reducing pain after LC. Additionally, also determine which of these analgesic methods could reduce the postoperative requirement for NSAIDs.

Material and Method:

Study design: Prospective comparative study,

Setting and duration: Department of General Surgery of Akbar Niazi Teaching Hospital, Islamabad. The study involved 100 patients who were admitted for elective laparoscopic cholecystectomy between June and November 2023.

Inclusion criteria: All patients were provided with an explanation of the purpose of the study, and those individuals who ensured informed written consent were included. Qualified participants were of genders, ages 22-70 years, and American Society of Anesthesiologists (ASA) classification of class I (generally healthy individuals) or II (patient of systemic disease mild to moderate).

Exclusion criteria: Patients who were unwilling to join the study, acute Cholecystitis patients, required alteration to open surgery, or needed a drain insertion at end of surgery were excluded.

Process:50 patients were consecutively injected with 0.5% Bupivacainein the gallbladder bed, while other 50 patients was administered Preperitoneal nerve block at preperitoneal space.

Data collection procedure: Prior to surgery, patients underwent upper abdominal ultrasound, liver function tests, complete blood count, blood sugar assessment, and createnine measurement. Patients aged 40 years and older also underwent chest X-rays and ECGs. All patients were taken to the operating room without receiving any premedication.

A standard LC with four ports was performed on all patients. Pneumoperitoneum was established using a Verses needle through incision of sub-umbilical and was established at 12-14mmHg throughout the procedure. Following extraction of gallbladder after completion of cholecystectomy, infiltration of 20 ml bupivacaine 0.5% at liver bed. Subsequently irrigation, the gas, instruments, and the trocars were removed. While in Preperitoneal nerve block group20 ml bupivacaine 0.5% in equal doses was infiltrated in preperitoneal space at site of the ports.

Arrival time of patients in ward postoperatively was considered as 0 hour. Intensity of pain was assessed by Visual Analog Scale (VAS) at 1, 6, 12 hours, and 24 hours postoperatively. The analgesic prerequisite was documented for a period of 24 hours. Every patient received a 50 mg suppository of diclofenac every 12 hours as needed, and the total dose of diclofenac was documented. After 24 hours pain was not severe enough to require administration of diclofenac. Patients typically report mild pain at the ports site, which can be treated easily with oral paracetamol. All patients were briefed on how to use VAS before the operation. VAS represents varying pain intensities, with one ended as "no pain" and the other ended as "worse impossible".

The nature of the pain and postoperatively primary site of pain were also evaluated concurrently. Visceral pain was characterized as deep pain sensations localized in right hypochondrium or radiating to the shoulder. Parietal pain was described as incision pain localized at the site of trocar.

Statistical analysis: The data analysis was performed by SPSS version 25. The independent t-test and the chisquare were utilized for data analysis. The probability value ≤ 0.05 was deemed significantly.

Results:

100 patients met the inclusion criteria and were included in the study. The demographic details, including age, gender, ASA status, and surgery duration are shown in Table 1. No statistically differences were observed in the patients undergoing the procedure.

Table-I: Demographics statistics, n=100

Variables		Bupivacaine	Preperitoneal nerve block	p
Ages (year)	Mean	43.62±7.9	44.13±7.6	.463
Gender	Male	70% (n=35)	68% (n=34)	.257
	Female	30% (n=15)	32% (n=16)	
ASA	I	60% (n=30)	62% (n=31)	.451
	II	40% (n=20)	38% (n=19)	
Surgery duration (min)	Mean	45±4.8	42±2.5	.360

The pain intensity was evaluated at intervals of 1, 6, 12, and 24 hours postoperatively (Table 2).

Table-II: Comparison of VAS between the patients, n=100

Time intervals postop	Bupivacaine	Preperitoneal nerve block	P
1 hour	3.8±1.8	5.0±1.4	.0001
6 hours	3.4±1.6	4.7±1.2	.0001
12 hours	2.7±0.4	4.0±0.8	.0001
24 hours	1.8±0.3	2.5±0.5	.652

The VAS mean for Bupivacaine 0.5% was lower than Preperitoneal nerve block at 1, 6, and 12 hours ($p \leq 0.05$). However, no difference was seen in VAS between groups at 24 hours ($p \geq 0.05$).Primary site of pain at 6 hours postoperatively was documented (Table 3).

Table-III: Postoperative pain according to localization at 6 hourly, n=100

Pain site	Frequency	Percentage
Trocar	70	70.0
Visceral	25	25.0
Tip of shoulder	5	5.0

The pain of trocar site was the most prevalent, followed by visceral and tip of shoulder. The analgesic requirements following LC were documented (Table 4).

Table-IV: Requirement of analgesics in the patients, n=100

No. of doses of NSAID	Bupivacaine	Preperitoneal nerve block	p
1	40% (n=20)	20% (n=10)	.001
2	52% (n=26)	42% (n=21)	
≥ 3	8% (n=4)	38% (n=19)	

Discussion:

Laparoscopic cholecystectomy (LC) is gold standard for treating symptomatic gallstone disease, replacing open cholecystectomy except there are contraindications to the laparoscopic method.LC is a procedure with a short hospital stay, highlighting the importance of effective postoperative pain relief, making it an ideal choice for patients.[10]

Postoperative LC pain typically higher immediate after surgery and gradually lower within 24 hours postoperatively.[4]During this timeframe, the most frequent sites of pain are right upper quadrant, trocar insertion, and the right shoulder. The pain in LC is complex and has multiple causes. Incisions in the abdominal wall can cause parietal pain, while the presence of Pneumoperitoneum can lead to pain of shoulder tip. Visceral pain is primarily caused by the cholecystectomy itself, particularly in region of the liver bed. There is a debate regarding the primary source of pain following LC.[11]Certain authors suggest that the primary source of pain in LC is the insertion of the trocar through the abdominal wall. However, others argue that the majority of the pain stems from the Pneumoperitoneum and the removal of the gallbladder from the liver bed. Hence, pain management in this context should involve a multimodal approach. In this study, we compared the efficacy of bupivacaine infiltration at the ports site with its instillation into the liver bed and peritoneal cavity in reducing pain after laparoscopic cholecystectomy.

The mean pain score, as measured by VAS, were significant lower for patients receiving bupivacaine at the liver bed compared to those receiving bupivacaine at the preperitoneal site (Preperitoneal nerve block) at 1, 6, and 12 hours postoperatively ($p \leq 0.05$). However, no difference was foundin VAS at 24 hours between patients ($p \geq 0.05$). Therefore, findings of our study

indicate a notable reduction in pain following the administration of bupivacaine via port site infiltration and intraperitoneal instillation in the liver bed at 1 hour, 6 hours, and 12 hours after LC. However, no observed reduction in pain at 24 hours postoperatively. The absence of significant differences in pain levels between groups at 24 hours may be attributed to the relatively bupivacaine short half-life. Numerous studies have investigated the use of bupivacaine in ports site infiltration and intraperitoneal instillation in LC, and many have reported lower postoperative VAS score compare to findings of our study.[12,13]

In our study, primary site of pain 6 hours after surgery was the trocar site in 70%, followed by visceral in 25% of cases, and shoulder tip in 5% of cases. Lee et al highlighted that parietal and somatic pain are significant, if not more so, than visceral pain in initial 24-48 hours after surgery. This underscores the clear benefit of using local anesthetics to manage postoperative pain.[14]Sharma et al investigated the localization of pain in first 24 hours after surgery. They observed that the pain scores were higher significantly for pain of incisions compared to viscera and shoulder tip.[15]Our study shows, the occurrence of shoulder tip pain was 5%, which is notably lower than the occurrence reported in the literature.[16]This difference in incidence is attributed to fact that in our study, postoperatively localization pain was assessed in first 24 hours, whereas shoulder tip pain typically arises on second and third postoperative days.[17]

Numerous researches have demonstrated the infiltration of bupivacaine at ports site and intraperitoneal instillation following LC and have demonstrated a reduction in postoperative analgesic requirements.[18,19] This study shows, the total doses mean of NSAIDs were utilizedlowerin first 24 hours postoperatively in bupivacainepatients than in preperitoneal nerve block patients ($p \leq 0.05$).

Conclusion:

The infiltration of bupivacaine in the liver bed following LC effectively reduces pain as compare to preperitoneal nerve block. Therefore, this straightforward method can be routinely employed in all the elective LC procedures.

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