

Comparison of Postoperative Pain Scores in Laparoscopic Cholecystectomy with Infiltration of Intraperitoneal Bupivacaine and Bupivacaine Plus Hydrocortisone"

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ABSTRACT

Objective: To compare postoperative pain scores in patients who underwent laparoscopic cholecystectomy (LC) with infiltration of intraperitoneal Bupivacaine vs Bupivacaine plus Hydrocortisone.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of General Surgery, Pak Emirates Military Hospital Rawalpindi, Pakistan from Nov 2024 to Jun 2025.

Methodology: Ninety (n=90) patients underwent LC under general anesthesia. Participants were segregated into two groups. In Group-A, intraperitoneal instillation of Bupivacaine was done and in Group-B, intraperitoneal instillation of Bupivacaine plus Hydrocortisone was done. After the surgery, abdominal pain was compared between the two groups. Statistical Package for Social Sciences 23 was utilized to assess data.

Results: Ninety (n=90) patients were included in the study and equally segregated into two groups. In Group-A, at 02 hours posts surgery significant pain was present in 7(15.55%) patients and in Group-B, in 3(6.66%) patients (p-value:0.18). In Group-A, at 06 hours posts surgery significant pain was present in 5(11.11%) patients and in Group-B in 2(4.44%) patients, (p-value:0.23). In Group-A, at 12 hours posts surgery significant pain was present in 2(4.44%) patients and in Group-B in 3(6.66%) patients, (p-value:0.64). In Group-A, at 24 hours posts surgery significant pain was present in 4 (8.88%) patients and in Group-B in 1(2.22%) patient, (p-value:0.16).

Conclusion: No significant difference was found between instillation of intraperitoneal Bupivacaine vs Bupivacaine plus Hydrocortisone in terms of post-operative abdominal pain.

Keywords: Bupivacaine, Cholecystectomy, Hydrocortisone, Laparoscopic, Postoperative Pain

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INTRODUCTION

The world-wide prevalence of gallstones (GS) is estimated to be 10% to 15%.¹ In our country the estimated prevalence is approximately 10.2%.² LC is the gold standard surgical treatment for symptomatic GS.³ LC is the minimally invasive surgery which is associated with less morbidity and results in less postoperative pain and early recovery after surgery as compared to the open surgery.⁴ Due to its less invasive nature, it has replaced the invasive open surgery and is now practiced in routine to achieve better post-operative results. To further reduce post-operative pain after LC, surgeons have tried and adopted various modified practices. Many of these practices have not been yet supported by evidence-based knowledge in available literature and hence there is difference of opinion about their efficacy and

superiority over each other.

A study conducted in United Kingdom documented that instillation of local anesthesia within peritoneal cavity through laparoscopic ports provide better post-operative pain control and reduced length of stay (LOS) in hospital.⁵ A clinical trial conducted in Egypt concluded that instillation of Lignocaine along Tenoxicam resulted in better pain relief as compared to Lignocaine alone.⁶ Another randomized controlled trial conducted in Norway documented that corticosteroid prophylaxis reduces post-operative nausea and pain and provides better patient's satisfaction.⁷ A double-blind clinical trial conducted in Iran documented that efficacy of intraperitoneal Hydrocortisone is similar to Bupivacaine for pain relief after LC and no significant difference was observed between these two methods.⁸

In our country, surgeons have adopted various similar practices of intraperitoneal instillation of local anesthesia with or without corticosteroids while performing LC. The goal of these practices is to

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achieve better post-operative pain relief and reduce the LOS in hospital, which will not only increase the over-all patient's satisfaction but will also reduce the financial burden and total expenses of the health care systems. Majority of these practices depends upon the personal preferences and departmental guidelines and vary from surgeon to surgeon. To the best of our knowledge, no large-scale study has yet been conducted upon the local population of our country, comparing the effectiveness of local anesthesia with or without corticosteroid to reduce the post-operative pain after LC. A study hence needed to be conducted to compare the efficacy of intraperitoneal Bupivacaine alone vs combination of Bupivacaine and Hydrocortisone in terms of post-surgery analgesia, incidence of nausea/vomiting, time of mobility out of the bed and LOS in hospital.

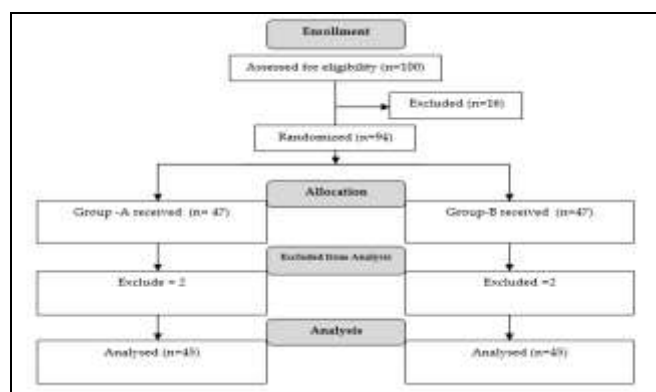


Figure : Patient flow diagram (n = 90)

METHODOLOGY

Quasi-experimental research was carried out at the Department of General Surgery of Pak Emirates Military Hospital Rawalpindi, Pakistan from November 2024 to June 2025. The ethical review board's approval (ERC letter no: A/28/ERC/165/25) was acquired. To calculate sample size, the WHO Sample Size calculator was utilized, with the following parameters: 90% power of the test, 5% level of significance, pain in Bupivacaine group 2.53 ± 0.57 and pain in Hydrocortisone group $2.26 \pm 0.58.8$. Based on these, the total sample size of 94 patients was calculated (47 patients in each group). During the surgery 2 patients from each group was excluded, making the final sample size of 90 patients (45 patients in each group). (Figure)

Inclusion Criteria: The study included patients between 20 and 60 years of age, of either gender, having American Society of Anesthesiologists (ASA)

grade I/II and III, who underwent elective LC for symptomatic GS.

Exclusion Criteria: Patients with empyema gallbladder, mucocele or gallbladder perforation. Patients with chronic pain, neuromuscular disorder or any other psychological problem were excluded. Patients having chronic medical illness like chronic liver disease, chronic renal failure, cardiopulmonary dysfunction, neurological disorder having any absolute/relative contraindication for the LC, and those who didn't provide consent were also eliminated from the research. Patients with any known drug allergy to Bupivacaine or Hydrocortisone and those who developed any complication during the surgery were also removed.

The purpose of study was explained to the patients in detail and informed written consent was obtained before inclusion in the research. Age, gender and body mass index (BMI) was recorded in a predesigned proforma. Participants were divided into two groups consecutively as per order of admission. All surgeries were performed under general anesthesia by the laparoscopic surgeons from the same department following the same surgical principles. After removal of the gallbladder, in Group-A, intraperitoneal instillation of 100mg Bupivacaine in 20 ml solution was given via 10mm epigastric laparoscopic port. In Group-B, intraperitoneal instillation of 100mg Bupivacaine along with 100 ml Hydrocortisone in 20ml solution was given via 10mm epigastric laparoscopic port, ensuring the equal intraperitoneal volume in both groups. After that, intraperitoneal carbon dioxide gas was evacuated. Routine placement of abdominal drain was avoided unless there was some complication during the surgery and expected bile leak, which resulted in removal of patients from the study. After recovery from anesthesia, patients were shifted to the ward. For post-operative analgesia injection Ketorolac Tromethamine 30mg in 100ml normal saline was advised 08 hourly. Primary endpoint of the study was comparison of abdominal pain between two groups which was assessed at 2hrs, 6hrs, 12hrs and 24hrs post-surgery. Pain assessment was done using a visual analogue scale (VAS), which consisted of a straight horizontal line of 10cm size, with the left endpoint representing "no pain" (score 0) - the right endpoint representing "worst imaginable pain" (score 10).⁹ Each patient marked the point that best reflected the pain intensity. Significant pain was defined as VAS ≥ 4 .

Moreover, assessment of pain was done by a doctor who remained unaware of the group of the patient. Secondary endpoints were incidence of nausea/vomiting during hospital stay, time of unassisted mobilization out of bed in hours and Length of stay (LOS) in hospital.

The Statistical Package for Social Sciences (SPSS) version 23 was used to assess the data. Categorical variables (gender, VAS ≥ 4 , nausea/vomiting) were represented as percentages, and the Chi-Square Test compared categorical variables. The Shapiro-Wilk test assessed the normal distribution of quantitative data (age, BMI, time for unassisted mobilization, LOS). Data that was not normally distributed was assessed using the Mann-Whitney U test. A significant p -value was defined as < 0.05 .

RESULTS

In Group-A, age of patients was 45 years (median), with Interquartile range (IQR): 1.50 and in Group-B age was 45 years (median) with IQR: 2.50 (p -value: 1.00). 85 (94.4%) patients were female and 5 (5.6%) were male. In Group-A, BMI was 27.0 (median, IQR: 1.50) and in Group-B, BMI was 28.0 (median, IQR: 2.00, p -value: 0.62). This comparison of demographic characteristics is shown in Table-I.

Table-I: Comparison of Demographic Characteristics (n = 90)

Parameter(s)	Study Groups		p value
	Group-A (n=45)	Group-B (n=45)	
Age in years (median, IQR)	45 (IQR: 1.50)	45 (IQR: 2.50)	1.00
Gender, (%)	Male 03 (6.66%)	02 (4.44%)	0.64
	Female 42 (93.33%)	43 (95.55%)	
Body Mass Index (median, IQR)	27.0 (IQR: 1.50)	28 (IQR: 2.00)	0.62

Qualitative values are expressed as frequency (percentage), and chi-square test was applied. Quantitative values are expressed as median (interquartile range: IQR). Mann-Whitney U test was applied.

In Group-A, at 02 hours posts surgery significant pain (VAS ≥ 4) was present in 7 (15.55%) patients whereas in Group-B, 3 (6.66%) patients. In Group-A, at 06 hours posts surgery significant pain (VAS ≥ 4) was present in 5 (11.11%) patients and in Group-B in 2 (4.44%) patients (p -value: 0.23). In Group-A, at 12 hours post-surgery significant pain (VAS ≥ 4) was present in 2 (4.44%) patients and in Group-B in 3 (6.66%) patients, (p -value: 0.64). In Group-A, at 24 hours post-surgery significant pain (VAS ≥ 4) was present in 4 (8.88%) patients and in Group-B in 1 (2.22%) patient (p -value: 0.16). Table-II shows the comparison among groups.

In Group-A, at 02 hours posts surgery VAS was median: 3.00 and interquartile range (IQR): 1.00 and in Group-B, median was 3.00 and IQR 1.00 (p -value: 0.07). In Group-A, at 06 hours posts surgery VAS was median: 2.00 and IQR: 0.00 and in Group-B, median was 2.00 and IQR 1.00 (p -value: 0.15). In Group-A, at 12 hours posts surgery VAS was median: 3.00 and IQR: 1.00 and in Group-B, median was 3.00 and IQR 1.00 (p -value: 0.92). In Group-A, at 24 hours posts surgery VAS was median: 3.00 and IQR: 1.00 and in Group-B, median was 3.00 and IQR 0.50 (p -value: 0.71). Table-III shows this comparison.

Table-II: Comparison of Significant Pain (VAS ≥ 4) among Groups (n = 90)

Significant pain (VAS ≥ 4)	Group-A (n=45)	Group-B (n=45)	p-value
At 02 hours, n(%)	7 (15.55%)	3 (6.66%)	0.18
At 06 hours, n(%)	5 (11.11%)	2 (4.44%)	0.23
At 12 hours, n(%)	2 (4.44%)	3 (6.66%)	0.64
At 24 hours, n(%)	4 (8.88%)	1 (2.22%)	0.16

Qualitative values are expressed as frequency (percentage), and chi-square test was applied.

Table-III: Comparison of Pain according to VAS (n = 90)

Pain as per VAS	Group-A (n=45)	Group-B (n=45)	p-value
VAS at 02 hours, (median, IQR)	3 (IQR: 1.00)	3 (IQR: 1.00)	0.07
VAS at 06 hours, (median, IQR)	2 (IQR: 0.00)	2 (IQR: 1.00)	0.15
VAS at 12 hours, (median, IQR)	3 (IQR: 1.00)	3 (IQR: 1.00)	0.92
VAS at 24 hours, (median, IQR)	3 (IQR: 1.00)	3 (IQR: 0.50)	0.71

Quantitative values are expressed as median (interquartile range). Mann-Whitney U test was applied, VAS: Visual Analogue Scale

In Group-A, unassisted mobility out of bed occurred at 13 hrs (median, IQR: 2.00), and in Group-B, at 13 hrs (median, IQR: 4.00) with p -value: 0.81. In Group-A, nausea/vomiting was present in 2 (4.44%) patients and in Group-B in 3 (6.66%) patients (p -value: 0.64). In Group-A, LOS in hospital was 01 day (median, IQR: 0.00), and in Group-B, it was also 01 day (median, IQR: 0.00), with p -value: 0.57. This comparison is demonstrated below in Table-IV.

Table-IV: Comparison of Other Postoperative Parameters (n = 90)

Outcome(s)	Group-A (n=45)	Group-B (n=45)	p-value
Mobility out of bed (median, IQR)	13 (IQR: 2.00)	13 (IQR: 4.00)	0.18
Nausea/vomiting, n(%)	2 (4.44%)	3 (6.66%)	0.64
Length of Stay (days) (median, IQR)	1 (IQR: 0.00)	1 (IQR: 0.00)	0.57

Quantitative values are expressed as median (interquartile range). Mann-Whitney U test was applied.

DISCUSSION

We conducted a prospective study and included ninety patients who underwent elective LC. 94.4% of our participants were of female gender and 4.44%

were of male gender. Matsushima et al studied gender specific analysis of patients undergoing LC and documented that 73.4% of their patients who underwent LC were female, which shows a clear female gender predominance in cases undergoing LC for symptomatic GS.¹⁰ Jadoon et al conducted a descriptive study upon local population of Pakistan and documented that 88% of patients with GS were found to be females while only 11.8% were males.¹¹ The results of our study as well as other previous studies reveal that GS are more common in female population as compared to the male counterpart. Mean age of our participants was 44.88 ± 4.13 years. Lillemoe et al. documented that mean age of patients who underwent LC was 47.1 years which align with the results of our study.¹² Ng et al. also documented that majority of the patients with acute cholecystitis who underwent LC were aged between 18-49 years.¹³ In our study mean BMI of participants was 27.76. Kiani et al. conducted a case control study in Islamabad and found that mean BMI of patients with GS disease was 27.576, which also aligns with the findings of our study.¹⁴ Parra-Landazury et al. also mentioned that GS disease is more common in patients with increased BMI.¹⁵ In our study, we measured post-operative abdominal pain in patients using VAS at the various post-operative intervals of 2,6,12 and 24 hours and found no statistically significant difference between two group in terms of better post-operative pain relief. Moreover, we also compared the two study groups group in terms of incidence of post-operative nausea and vomiting, unassisted mobility out of the bed and LOS in the hospital. This study also didn't find any statistically significant difference between the two groups in terms of these above mentioned post-operative parameters. Amini et al. conducted a clinical trial and compared the efficacy of intraperitoneal Bupivacaine vs Hydrocortisone after LC.⁸ They found no difference between the two groups in terms of abdominal pain and shoulder tip pain. They also didn't find any difference in the requirement of additional analgesia between the two groups during post-operative period. There was also no significant difference in terms of frequency of nausea and vomiting between the two groups, which aligns with the findings of our study. Jadav et al. in a similar study found that addition of corticosteroid with local anesthetic drug enhances the efficacy of analgesia and provides better post-surgery pain relief and cause less incidence of nausea and vomiting, which contradicts our findings.¹⁶ Alansary et

al. mentioned that addition of Dexamethasone to Bupivacaine lowers the consumption of opioid and provides prolong analgesia free period.¹⁷ Amer et al. conducted another study and compared the analgesic properties of Bupivacaine vs Bupivacaine plus Hydrocortisone after laparoscopic bariatric surgery.¹⁸ They found no significant difference between these two techniques at 02hrs (median VAS 3 vs 3, p -value 0.85) and at 24hrs (median VAS 4 vs 4, p -value 0.609) post-surgery which matches the results of our study. However, at 4hrs (median VAS 3 vs 2, p -value 0.006), at 6hrs (median VAS 3 vs 2, p -value 0.02) and at 12hrs (median VAS 4 vs 2, p -value 0.03) post-surgery combination of Bupivacaine and Hydrocortisone resulted in significantly reduced pain which contradicts the results of our study. Vandana et al. conducted a randomized controlled trial and found that VAS score was significantly lower with Bupivacaine plus Dexamethasone as compared to the Bupivacaine alone till 02hrs after surgery (mean difference: -1.0 and P -value < 0.001).¹⁹ However from there onwards at the interval of 4hrs, 8hrs, 12hrs, 16hrs, and 24hrs post-surgery no significant difference was found between these two groups which aligns with our findings. Kshirsagar et al. found that intraperitoneal Hydrocortisone resulted in better analgesia as compared to Bupivacaine (VAS 2.17 ± 0.47 vs 3.51 ± 1.10 , p -value 0.01) however they did not measure the efficacy of combination of bupivacaine plus hydrocortisone like we did in our work.²⁰ Sarvestani et al. documented that hydrocortisone provided better analgesia after LC as compared to bupivacaine (10.95 vs 12.95; $p < 0.01$).²¹

Better pain control after surgery plays a primary role to reduce overall morbidity and promotes early out of bed mobility of the patients. It not only increases the overall patient's satisfaction but also reduces the LOS in hospital and helps the patients to resume their routine life activities after surgery. Importance of good analgesia in post-surgery period also depends upon the fact that it is associated with reduced overall financial burden health care cost. These facts, encourages the surgeons to adopt certain measures for providing better analgesia. However, many of these practices are not supported by real evidence-based knowledge and some may not be associated with any significant benefit and may even result to be hazardous for the patients. We recommend that further large-scale studies need to be conducted to assess the efficacy of intraperitoneal

bupivacaine vs bupivacaine plus hydrocortisone after LC for better post-operative analgesia.

CONCLUSION

No significant difference was found between instillation of intraperitoneal Bupivacaine vs Bupivacaine plus Hydrocortisone in terms of post-operative abdominal pain, nausea/vomiting, time of unassisted mobility out of bed and LOS in the hospital.

LIMITATION OF STUDY

The study was conducted in a single-center with a limited follow-up period so only short-term effects could be compared between the participants and no insight has been provided over the long-term results. The study was conducted in hospital where majority of the entitled patients are female. This could have resulted in gender bias.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SZT & FK: Data acquisition, data analysis, critical review, approval of the final version to be published.

WAK & MMAN: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

HK & MG: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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