Original article

Reduction of postoperative pain after infiltration of local anesthetic at the port site and subdiaphragmatic space in laparoscopic cholecystectomy: A cross-sectional study

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Abstract

Introduction: Port site and subdiaphragmatic infiltration of local anesthetics during laparoscopic cholecystectomy (LC) is preferred by surgeons to decrease postoperative pain. LC with local anesthetics infiltration as well as without any local anesthetic both have been standard surgical practice. However, the difference in the reduction of postoperative pain in these two groups is not well known. The objective of the study was to compare the postoperative pain with and without infiltration of local anesthetic at the port site and subdiaphragmatic space in LC.

Methods: A hospital-based cross-sectional study was conducted from 25 April 2021 to 25 October 2021 among 60 patients who underwent elective LC. The patients were divided into two equal groups. The study group received infiltration of 20 ml of bupivacaine (0.5%) at the port site and the subdiaphragmatic space, while the control group did not receive any local anesthetic. The primary outcome measure was the visual analog pain score at 6, 12, 24 and 48hrs postoperatively.

Results: Among 60 patients, the majority were female- 40(66.7%); and 40-50 years age group. The two groups were comparable in terms of age, sex, ASA, BMI and duration of pneumoperitoneum and surgery. Infiltration of a local anesthetic agent produced effective postoperative analgesia in the immediate postoperative hours (6, 12 and 24 hours) and was found to be statistically significant when compared to the no-local anesthesia group.

Conclusion: The intraoperative port site and subdiaphragmatic local infiltration is effective at reducing postoperative pain in the first 12 hours without any adverse events.

Keywords: Anesthetics; Bupivacaine; laparoscopic cholecystectomy; postoperative pain; VAS.

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Introduction

Laparoscopic cholecystectomy (LC) has established itself as the gold standard for treatment of symptomatic cholelithiasis. Gallstone disease (GSD) is a chronic disease that consumes a lot of financial resources. It affects patients with potential risks of the development of cholecystitis, pancreatitis, biliary tract obstruction and gallbladder cancer.[1,2] Gallstone disease is common in the world population with the incidence ranging from 10% to 20%. In our hospital, it is the most frequently performed minimally invasive procedure, with approximately 1,200 procedures per year. Early recovery and shorter hospital stay are the benefits of LC. There is a very less complication rate of this surgery. Even though there are many benefits of the laparoscopic approach, postoperative pain still remains the most important complaint of patients.[3] Instillation of local anesthesia helps to decrease the postoperative pain and minimize the need for opioids. Neural impulse in the afferent nerve is blocked by the use of local anesthesia (bupivacaine).[4,5]

The pain in LC can be divided into two components: visceral and parietal pain. The visceral and parietal pain seems to be important during the first 24-48 hours after surgery. In the first 24-48 hours post-operative pain is effectively prevented by local tissue infiltration of local anesthesia. Safety, simplicity, low cost and efficacy are the most identified characters of local tissue infiltration. Bupivacaine is a safe drug with half-life of 2.5-3.5 hours. It provides pain control for 8 hours and has a wide range of safety. At the upper limit of 2.5 mg of bupivacaine per kilogram body weight, 100 mg of the drug can be used safely in a patient with a lean body mass of 40 kgs.[6-8] Reduction of postoperative pain after infiltration of local anesthetic Bupivacaine at the port site and subdiaphragmatic space in LC has not been studied in our hospital setting.

The aim of our prospective, cross-sectional study was to evaluate the efficacy and intensity of the postoperative pain after peri-trocal injection and subdiaphragmatic instillation of bupivacaine in LC.

Methods

A hospital-based cross-sectional study was conducted from 25 April 2021 to 25 Oct 2021 among 60 patients who underwent elective LC at the Department of Surgery of Birat Medical College Teaching Hospital. There were 60 patients allocated for the study. Equal number of patients were divided into bupivacaine group (study group), where the patient received LA infiltration at the port site and subdiaphragmatic space, and non-bupivacaine (control group). Ethical clearance was taken from the institutional review committee (Ref: IRC-PA-109/2077-78) and informed written consent was taken from each study participant. All the patients having American Society of Anesthesiology (ASA) class 1 (a normally healthy individual) and class 2 (a patient with mild to moderate disease) who were above 16 years were included. Patients with choledocholithiasis, placement of drain intraoperatively and any previous upper abdominal surgery, patients with alcohol or drug abuse, open conversion were excluded. Visual Analogue scale (VAS) was employed for marking of pain in this study.

LC was performed with the standard four ports. Infraumbilical port was used for the access of the peritoneal cavity. Direct trocar insertion method was used with CO_2 insufflation gas pressure of 12 mm Hg. A 10 mm umbilical port, another 10 mm port in the epigastrium and other two 5 mm ports in the right upper quadrant were used. Retrieval of the specimen was done from the epigastric port. Retrieval bag was only used in case of intraoperative gall bladder perforation. After the procedure the umbilical port was closed with polyglactin no. 1 and the entire incision site closed with skin stapler. The dominant site of postoperative pain, and analgesics requirements were also noted. Patients were allotted into each group on alternate basis (non-randomised). In the bupivacaine group, 20 ml of bupivacaine (0.5%) was infiltrated in the liver bed after extraction of gall bladder and 20 ml of bupivacaine was locally injected at all the port sites. The CO_2 was carefully evacuated at the end of operation by manual compression of the abdomen with open trocars.

Before the induction of anesthesia, patients were instructed about the use of a 10-cm visual analog scale (VAS: with endpoints 'no pain' and 'worst pain') for the measurement of pain and nausea. Postoperative pain was rated on a VAS at rest. The time of arrival in the postoperative recovery room was defined as zero hour postoperatively. The pain scoring of the visual analogue scale was taken as 6 hours, 12 hours, 24 hours and 48 hours. The visual analogue scale ranged from 0-10 with 1 being the mildest pain the patient ever had and 10 being the most severe pain, zero counts for no pain. On emergence, patients were asked, "Do you have any pain?" and given bolus IV ketorolac in 30 mg doses if they answered "yes", followed by an additional ketorolac 30 mg if requested by the patient. For postoperative analgesia, all patients received the following analgesia treatment: intramuscular ketorolac (30 mg) at eight-hour intervals for 48 hrs. The VAS score was recorded by the trained anesthetics.

The variables that were studied were age, gender, the ASA physical status, body mass index (BMI), duration of anesthesia, and the duration of operation in both the groups. The anonymity and confidentiality of data were maintained. Collected data was entered in microsoft excel 2016 and analyzed by SPSS software version 25. Data were expressed as the mean (standard deviation), or the number (percentage). Continuous variables were compared for statistical differences using 2-sample Student t tests. Categorical variables were tested for significance using Chi square test or Fisher exact test, as appropriate. Differences were considered significant at a probability level less than 0.05.

Results

The majority of the study participants were female; n=40 (66.7%). The most common age group was 40-50 years (46.7%). Six patients were excluded from the study at the conclusion of the operation due to open conversion, drain placement and extension of the epigastric incision for large stone extraction. Subsequently, these exclusion patients were replaced by other six patients who fit our inclusion criteria.

There were no significant differences between the study and control groups with respect to age, sex, ASA grade, body mass index, duration of pneumoperitoneum and operation (**Table 1**).

Table1. Baseline Characteristics-Comparisons between the two groups

	Study group (n=30)	Control group (n=30)	P Value
Age (mean), years	42.85±15.78	52.35±14.60	0.866
Gender (M/F)	11/19	12/18	0.946
Body mass index (BMI), mean, kg/m2	20.35±10.54	19.45±12.71	0.387
ASA grade (I/II)	12/18	13/17	0.877
Pneumoperitoneum time (minutes)	38.55±12.90	43.36±10.62	0.471
Operating time (minutes)	50.35±14.54	59.75±12.39	0.256

The postoperative pain as measured by VAS scale at 6 hour, 12 hour and 24 hour was found to be statistically significant. However, there was no statistically significant pain difference at 48 hrs between the two groups (**Table 2**).

Table2. Comparisons of postoperative pain score (VAS) at different times (Total patients, n=60)

Post-operative Pain Score (VAS)	Study group (n=30)	Control group (n=30)	t-test	p-value
6 hours	5.23±0.86	7.7±1.1	9.932	<0.001
12 hours	4.23±0.86	6.43±0.89	9.702	<0.001
24 hours	3.67±0.92	2.9±0.88	-3.286	0.002
48 hours	2.0±0.74	1.97±0.76	-0.17	0.865

There were no significant differences between the groups with respect to nausea, vomiting, and shoulder tip pain. Further, there was no morbidity that was directly related to bupivacaine injection.

Discussion

The popular minimal access surgery (Laparoscopic cholecystectomy) is not free of pain. Bupivacaine as intraperitoneal and peri-trocar infiltration is widely used for pain reduction among patients with LC.[9] Identifying the source of pain after LC is still an ongoing study. The site of placement of trocars through the abdominal wall is considered as the primary source of pain. Further, some clinicians thought that it arises from the intraperitoneal dissection and carbon dioxide insufflations that results in abdominal wall distension and prolonged stretching of the diaphragm.[10,11] But the pain seems to be multifactorial which includes different pain components secondary to surgical trauma to the abdominal wall from the port insertion, intraabdominal trauma due to the gall bladder bed dissection, and abdominal distension due to the pneumoperitoneum using carbon dioxide.[7] At many institutes, LC is performed as a day care procedure, and in the present study, use of Bupivacaine showed significant postoperative pain reduction till 24 hrs compared to the control group (non-bupivacaine) suggesting its routine use in the procedure. This drug use is a simple a simple analgesic technique without much side-effect, and can be practiced routinely in all elective LC.

In the present study, the postoperative pain at 6 hour, 12 hour and 24 hour was found to be statistically significant, but no statistically significant difference was observed at 48 hours. It provided significant reduction in pain during the first 12 hour, however at 24 hour onwards no significant pain reduction was found in the bupivacaine group. At 24 hour, the pain appeared more with significantly higher VAS score compared to the control group and was negatively correlated. In a study by Alam et al, the use of local anesthetics in postoperative pain reduction was found to be significant only at six and 12 hour. At 24 and 48 hours no statistically significant different was found.[12] Another study reported statistically significant differences in VAS scores between Bupivacaine group and no bupivacaine group at all postoperative time points - 1hr,4 hr,8 hr,12hr and 24hr ($p < 0.00001$). Mean pain scores at 6 hours postoperatively in treatment group was less than that of the control group (4.5 and 7.6) ($p<0.05$).[13] These findings supported that bupivacaine has contribution to reduce the postoperative pain after LC.

In the present study, there was not a single patient having bupivacaine toxicity. Other researchers also observed that bupivacaine administration at local and subdiaphragmatic site has no signs and symptoms of toxicity.[14] Further, another study by Ali et al, found a significant difference in mean postoperative pain scores at 2 and 6 hours after surgery between Bupivacaine local infiltration group and non-Bupivacaine group. Pain scores at 2 and 6 hours after surgery were 3.97 +1.327 and 3.02 ±1.08 vs. 4.65 +1.448 and 4.72 ±1.277 respectively with p-values of 0.008 and 0.005. There was no significant difference in mean postoperative pain scores at 12 and 24 hours between the groups.[15] In a study from Mexico, it was reported that a significant difference ($p= 0.018$) was observed in pain levels between Bupivacaine local infiltration group and non-Bupivacaine groups at 6 hours postoperatively. At 24

hours of pain assessment, it was observed that bupivacaine provided a substantial reduction of pain intensity up to 24 hours postoperatively.[16] In contrast to other studies, a study reported that Bupivacaine local infiltration group and non-Bupivacaine group has no statistical significant difference ($p>0.05$) in postoperative pain. However, rescue analgesic requirement was significantly less in Bupivacaine local infiltration group.[5] In a similar study from UK, postoperative pain was assessed with a visual analogue pain scale, and the site of pain was recorded. Patients in the bupivacaine group had less pain in the early postoperative period and a lower incidence of pain in the right hypochondrium. They suggested intraperitoneal bupivacaine use is a simple and effective treatment for postoperative pain after LC.[17]

Study done by Barczynski et al, came to a conclusion that preemptive analgesia with intraperitoneal instillation of bupivacaine mixed to saline before the creation of pneumoperitoneum has improved the surgical outcome after LC in terms of significantly diminished total abdominal pain, complete elimination of shoulder tip pain and decreased analgesia request and analgesic consumption.[18]

This study has several limitations worth noting. This study was performed in a single institution and surgeries were performed by multiple surgeon (with variable capabilities), which may limit the generalizability of the findings. As pain is a subjective finding, patient self-reporting is the best indicator of pain. Thus, this study deliberately used individual patients' pain assessment to act as their own control, which also served to control confounding variables. Another limitation of the present study is small sample size, comparision of treatment vs no treatment and its non-randomized study design.

Conclusion

The intraoperative port site and subdiaphragmatic local infiltration of 20 ml of 0.5% Bupivacaine is effective at reducing postoperative pain in the first 12 hour with no risk of its side effects. As the drug is free if its adverse effects with its positive benefit, it should be routinely used in LC to decrease postoperative pain. Further, randomized study is required in our set up to prove its real benefit.

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References

1. Sain AH. Laparoscopic cholecystectomy is the current "gold standard" for the treatment of gallstone disease. Ann Surg. 1996;224(5):689-90.
2. Portincasa P, Di Ciaula A, de Bari O, Garruti G, Palmieri VO, Wang DQ. Management of gallstones and its related complications. Expert Rev Gastroenterol Hepatol. 2016;10(1):93-112.
3. Gan TJ. Poorly controlled postoperative pain: prevalence, consequences, and prevention. J Pain Res. 2017;10:2287-98.
4. Hilvering B, Draaisma WA, van der Bilt JD, Valk RM, Kofman KE, Consten EC. Randomized clinical trial of combined preincisional infiltration and intraperitoneal instillation of levobupivacaine for postoperative pain after laparoscopic cholecystectomy. Br J Surg. 2011 Jun;98(6):784-9.
5. Maharjan SK, Shrestha S. Intraperitoneal and periportal injection of bupivacaine for pain after laparoscopic cholecystectomy. Kathmandu Univ Med J (KUMJ). 2009 Jan-Mar;7(25):50-3.
6. Akter MB, Bahar MAA, Ahmed J, Islam MT, Alam KZ, Rahman MM, et al. Port-site infiltration of bupivacaine in reduction of postoperative pain after laparoscopic cholecystectomy. Int J Surg Sci 2021;5(2):135-8.
7. Cha SM, Kang H, Baek CW, Jung YH, Koo GH, Kim BG, et al. Peritrocal and intraperitoneal ropivacaine for laparoscopic cholecystectomy: a prospective, randomized, double-blind controlled trial. J Surg Res. 2012 Jun 15;175(2):251-8.
8. Paudel B, Paudel S, Rai P, Dahal S, Pokhrel A. Comparison of Ultrasound Guided Bilateral Subcostal Transversus Abdominis Plane Block Versus Local Infiltration of Port Site With Bupivacaine in Patients Undergoing Laparoscopic Cholecystectomy under General Anesthesia. Birat J. Health Sci. 2021; 6:1642-46.
9. Rutherford D, Massie EM, Worsley C, Wilson MSJ. Intraperitoneal local anaesthetic instillation versus no intraperitoneal local anaesthetic instillation for laparoscopic cholecystectomy. Cochrane Database Syst Rev. 2021;10(10):CD007337.
10. Ekstein P, Szold A, Sagie B, Werbin N, Klausner JM, Weinbroum AA. Laparoscopic surgery may be associated with severe pain and high analgesia requirements in the immediate postoperative period. Ann Surg. 2006 Jan;243(1):41–6.
11. Goldstein A, Grimault P, Henique A, Keller M, Fortin A, Darai E. Preventing postoperative pain by local anesthetic instillation after laparoscopic gynecologic surgery: a placebo-controlled comparison of bupivacaine and ropivacaine. Anesth Analg. 2000 Aug;91(2):403–7.
12. Alam, M. S.; Hoque, H. W.; Saifullah, M.; Ali, M. O. Port Site and Intraperitoneal Infiltration of Local Anesthetics in Reduction of Postoperative Pain After Laparoscopic Cholecystectomy. Med. Today 2010; 22: 24-8.
13. Toleska M, Kartalov A, Kuzmanovska B, Panovski M, Shosholcheva M, Dimitrovski A, Cholanchevski R, Toleska N, Zdravkovska M. Efficacy of

Intraperitoneal Bupivacaine on Pain Relief After Laparoscopic Cholecystectomy. PRILOZI. 2018;39(1): 123-129.
14. Deans GT, Richardson T, Wilson MS, Brough WA. Absorption of bupivacaine from the pre-peritoneal space in laparoscopic hernia repair. Minimally Invasive Therapy.1995;4(3):175-177.
15. Ali S, Zarin M, Jan Z, Maroof A. Effect of Bupivacaine on Postoperative Pain after Laparoscopic Cholecystectomy. J Coll Physicians Surg Pak. 2018 Sep;28(9):663–66.
16. Castillo-Garza G, Díaz-Elizondo JA, Cuello-García CA, Villegas-Cabello O. Irrigation with Bupivacaine at the Surgical Bed for Postoperative Pain Relief After Laparoscopic Cholecystectomy. JSLS. 2012;16(1):105
17. Chundrigar T, Hedges AR, Morris R, Stamatakis JD. Intraperitoneal bupivacaine for effective pain relief after laparoscopic cholecystectomy. Ann R Coll Surg Engl. 1993;75(6):437-439.
18. Barczyński M, Konturek A, Herman RM. Superiority of preemptive analgesia with intraperitoneal instillation of bupivacaine before rather than after the creation of pneumoperitoneum for laparoscopic cholecystectomy: a randomized, double-blind, placebo-controlled study. Surg Endosc. 2006 Jul;20(7):1088-93.