ANALGESIC EFFICACY OF ULTRASOUND GUIDED BILATERAL SUBCOSTAL TRANSVERSUS ABDOMINIS MUSCLE PLANE BLOCK AND PORT SITE INFILTRATION WITH BUPIVACAINE IN LAPAROSCOPIC CHOLECYSTECTOMY

Muhammad Ali✉, Syed Hafiz Majid Waseem, Sidra Khan, Abdullah, Zulfiqar Haider, Iftikhar Ali

Department of Anesthesia, Combined Military Hospital, Multan - Pakistan

Address for correspondence:
Muhammad Ali
Department of Anesthesia, Combined Military Hospital, Multan - Pakistan

E-mail:
dr.alirao@gmail.com

Date Received:
22nd May, 2022
Date Revised:
19th February, 2023
Date Accepted:
27th February, 2023

This article may be cited as

Ali M, Waseem SHM, Khan S, Abdullah, Haider Z, Ali I. Analgesic Efficacy of Ultrasound Guided Bilateral Subcostal Transversus Abdominis Muscle Plane Block and Port site Infiltration with Bupivacaine in Laparoscopic Cholecystectomy. J Postgrad Med Inst 2023;37(1): 17-21. http://doi.org/10.54079/jpmi.37.1.3106

ABSTRACT

Objective: To evaluate the postoperative analgesic efficacy of ultrasound-guided bilateral subcostal transversus abdominis plane block in comparison to port-site local anesthetic infiltration in patients undergoing elective laparoscopic cholecystectomy.

Methodology: It was a Quasi experimental study, conducted in Combined Military Hospital Rawalpindi, over 6 months, from April 2021 till October 2021. Patients numbering 92 of both genders fulfilling inclusion criteria were incorporated and placed into 2 groups equally. Group O (n=46) underwent ultrasound guided bilateral subcostal transversus abdominis plane block using 0.25% bupivacaine with volume dosage of 0.4ml/kg divided by 2, one part for each side. In Group-P (n=46) total dose of bupivacaine (0.25%, volume dose of 0.4ml/kg) was divided by total number of ports used and one portion was infiltrated at each port-site at the completion stage of surgery. Post-operative pain score, quantity of post-operative analgesia and patient satisfaction scores were calculated.

Results: Mean tramadol usage in Group-O was 109.56 ± 15.04 mg compared with 155.21 ± 22.18 mg of Group-P (p value <0.001 for both). Visual Analog pain scores were lesser in Group-O all the times. Patient satisfaction scores were 3.30 ± 0.66 and 2.71 ± 0.98 for Group-O and Group-P respectively.

Conclusion: Ultrasound guided subcostal Transversus abdominis plane block is effective in contributing to post-operative analgesia following laparoscopic cholecystectomy and is superior to port site infiltration. It decreases pain scores, post-operative analgesia requirement and increments patient satisfaction compared with port-site infiltration.

Keywords: Subcostal transversus abdominis plane block; Port site infiltration; Laparoscopic cholecystectomy; Analgesic efficacy

INTRODUCTION

Most of the patients undergoing surgeries confront acute post-operative pain and evidence advocates that almost half of them report inadequate relief in pain.[1] Newer guidelines suggest a multimodal approach for providing analgesia, comprising of different pharmacological modalities and block techniques resulting in an effective approach towards outcome.[1] Laparoscopic Cholecystectomy surgery is lesser invasive in nature. Although lesser invasive in nature and thought to be lesser painful but as of a recent study on 230745 patients by Rosero EB et al, 11.8 % of total readmission cases were due to postoperative pain, pain becoming the 3rd most common cause of readmissions.[2] Umbilical incision site after laparoscopic cholecystectomy remains the most painful and pain encountered in general is moderate to severe in intensity, its intensity is maximum during the 1st day of post-operative time and is due to activation of nociceptors in fascial plane linking the transversus abdominis and internal oblique muscles.[3,4] Different pre, intra and postoperative management strategies are in practice to control it. These include use of nonsteroidal anti-inflammatory drugs[5], opioids[6], dexamethasone[7], intraperitoneal instillation[8], local anesthetic infiltration and fascial plane blocks[9].

Transversus abdominis plane block (TAP) block is a well-known modality and its efficacy is known since long in providing post-operative pain relief in upper abdominal surgries.[10] Ultrasound lead subcostal transversus abdominis plane block includes TAP block through the subcostal approach this intervention is a relatively recent modification of TAP block.

This trial aimed at evaluating the analgesic efficacy of ultrasound-guided bilateral subcostal TAP plane block in comparison with usual port-site infiltration applying same drug in concentration and dose (i.e., 0.25%, 0.4ml/kg bupivacaine) in both scenarios. The end point of this trial was to find differences in pain scores on different points of time, total tramadol usage in first 24 hours post-operatively and patients satisfaction score among the two groups.

METHODOLOGY

The study is a prospective, quasi-experimental trial conducted at Combined Military Hospital Rawalpindi over a six-month period from April 2021 to October 2021. The study was approved by the hospital ethical committee (IRB 111/10/20). The study included patients aged 18 to 75 years with a BMI ≤30 and ASA status of I-II undergoing elective laparoscopic cholecystectomy. Patients with infection at the injection site, allergic to local anesthetics, advanced stage renal or hepatic disease, history of chronic pains, conversion of laparoscopic to open cholecystectomy, and any psychiatric or neurologic illness were excluded from the study. The study used a sample size of 92 patients calculated using OpenEpi software with a confidence interval of 95% and a power of 80%.

The patients were divided into two equal groups, Group-O (n=46) and Group-P (n=46). Group-O received subcostal TAP block, while Group-P received port-site infiltration. Patients and the anesthesiologist collecting postoperative data were blinded to the group status. Both groups received a standardized anesthetic regimen, which included Metoclopramide, Dexamethasone, Nalbuphine, Propofol, Atracurium, endotracheal intubation, and mechanical ventilation. Analgesia was augmented using ketorolac during the operation. Maintenance of general anesthesia was done using Isoflurane with boluses of atracurium. The level of muscle paralysis was monitored using TOF, and residual paralysis was reversed using Neostigmine and Glycopyrolate. Patients were extubated when TOF was 90% or more.

In Group-O, subcostal TAP block was performed bilaterally at the start of surgery using ultrasonography guidance. The total dose of bupivacaine (0.25%, 0.4ml/kg) was divided by two, and one part was administered to each side. In Group-P, port sites were marked and infiltration with local anesthetic bupivacaine (0.25%, 0.4ml/kg) was done at the start of surgery. The total dose of bupivacaine was divided by the number of port sites, and one part was administered to each port-site.

After the surgery, patients were shifted to the post anesthesia care unit (PACU) and kept there for at least one hour. After achieving Aldrete score of ≥ 9, they were shifted to the ward. Standard analgesia was provided using injection acetaminophen, and injection Tramadol was used as rescue analgesia. Pain scores were assessed at 1st, 2nd, 8th, and 24th hour postoperatively using Visual analog scale (VAS). Patient satisfaction was also assessed and classified as highly satisfied, satisfied, poorly satisfied, and unsatisfied. The data was analyzed using SPSS software version 25. Continuous variables with normal distribution were analyzed using independent sample t-test, while categorical data was analyzed using Chi-square test and presented as frequency or percentage.

RESULTS

In total, 92 patients completed the study, with 46 patients in each group (Group O and Group P). The male to female ratio was comparable in both groups. The age range of the patients was between 20 to 72 years, and there was no statistically significant difference in ages between the two groups (p-value 0.801). Similarly, the mean weight of patients in both groups did not differ significantly (p-value 0.762).

Further details are shown in Table 1. During the first 8 post-operative hours, pain scores measured using the Visual Analog Scale (VAS) were significantly lower in Group O (subcostal TAP group) compared to Group P (port-site infiltration) (p-value <0.001) at 1st, 2nd, and 8th hour assessments. However, pain scores in both groups were generally higher during the first 8 post-operative hours and decreased gradually afterward, likely due to the increased requirement for rescue analgesics as the effect of local anesthetics tapered off.

The requirement for rescue analgesics (tramadol) increased with time. However, the mean tramadol requirement was significantly less in Group O (109.57 ± 15.05, p-value <0.001) compared to Group P (155.22 ± 22.18, p-value <0.001), and this difference remained significant at all times, as shown in the data. These findings suggest that the use of subcostal TAP block (Group O) may provide better pain management compared to port-site infiltration (Group P) in the first 8 post-operative hours. Moreover, the lower requirement for rescue analgesics in Group O indicates that subcostal TAP block may be a more effective method for pain management in the post-operative period. However, further research is needed to determine the long-term effects and overall effectiveness of these two methods for pain management after surgery in figure-1.

During the initial time of the postoperative period, patients in Group-O were found to be more satisfied compared to Group-P based on the mean satisfaction score. However, this difference in satisfaction between the two groups decreased by the 24th hour of the postoperative period. The mean scores for both groups are presented in Table 2. It is important to note that two patients, one from each group, experienced postoperative nausea and vomiting, which was successfully

managed with the administration of ondansetron 8mg IV.

These findings suggest that Group O may provide a higher level of initial satisfaction for patients in the postoperative period. However, further research is needed to determine the long-term effects and overall effectiveness of Group O compared to Group P.

It is recommended that future studies include a larger sample size and longer follow-up periods to provide a more comprehensive analysis of the two groups' outcomes. Additionally, the use of standardized measures to assess patient satisfaction would allow for a more objective comparison between the two groups.

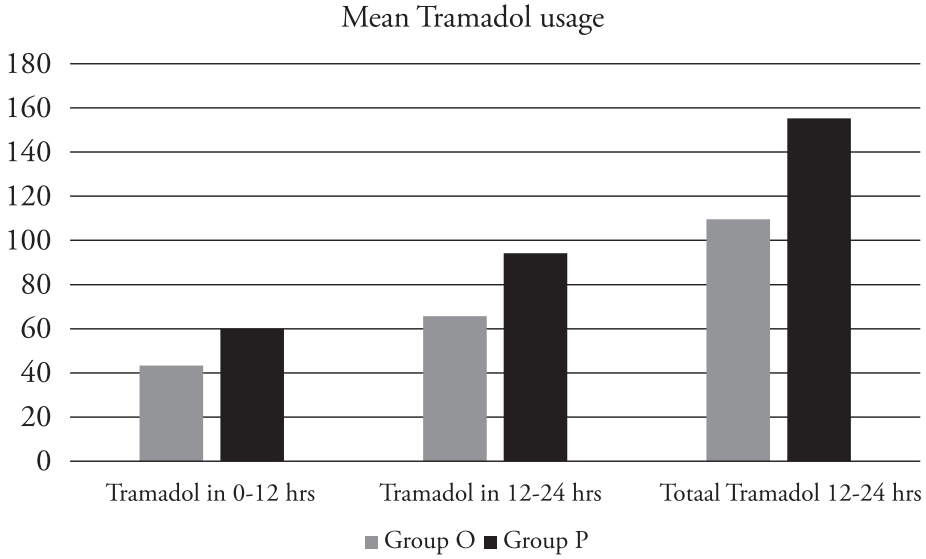

Figure 1: Comparison of mean tramadol requirement over time for groups o and p

Table 1: Comparison of patient characteristics between group-o (subcostal tap block) and group-p (port-site infiltration)

Variable	Group-O	Group-P	p-value
Male/Female	20/26	23/23	-
Mean Age (years)	48.37 ± 15.24	49.15 ± 14.40	0.801
Mean Weight (kg)	70.09 ± 7.04	69.65 ± 6.71	0.762
ASA Status (I/II)	27/19	28/18	-

Table 2: Comparison of mean vas scores and patient satisfaction scores between group-o and group-p

Time	Group-O (Mean VAS Scores)	Group-P (Mean VAS Scores)	p-value
VAS score at 1st hour	2.37 ± 0.83	3.91 ± 1.19	<0.001
VAS score at 2nd hour	3.00 ± 0.89	4.15 ± 0.84	<0.001
VAS score at 8th hour	3.34 ± 0.99	4.45 ± 0.98	<0.001
VAS score at 12th hour	1.69 ± 0.59	2.76 ± 0.85	<0.001
VAS score at 24th hour	1.11 ± 0.95	1.93 ± 0.45	<0.001
Average VAS score of 24 hours	2.58 ± 1.45	3.76 ± 0.74	<0.001
Patient satisfaction score	3.30 ± 0.66	2.71 ± 0.98	0.001

DISCUSSION

Cholecystectomy is a commonly performed surgery for various gall bladder diseases, such as cholelithiasis. However, post-operative pain is a major concern, and if left untreated, it may result in chronic pain. Local anesthetics, such as bupivacaine, have been shown to effectively relieve post-operative pain for many surgeries, including laparoscopic cholecystectomy.[12] The transversus abdominis plane (TAP) block and port-site infiltration are well-established modalities of a multimodal analgesia regimen for controlling pain after various abdominal surgeries, including laparoscopic cholecystectomy.[13,14] The study findings demonstrated that the subcostal approach of TAP block was effective in contributing to post-operative analgesia and was superior to port-site infiltration. This was evidenced by a decrease in pain scores, a decrease in post-operative analgesia requirement, and an increase in patient satisfaction. Janjua et al[15] compared unilateral subcostal TAP block (using port-site location modification) with port site infiltration with peritoneal instillation using 0.25% bupivacaine and found the analgesic superiority of even single sided subcostal TAP block where as in this analysis bilateral Subcostal TAP block was applied but no port site location modification was required.

Initially TAP block was practiced by landmarks technique method via petit triangle but it was not devoid of local complications[16] until recent times when use of ultrasound in regional blocks became a common practice. That is why in this study ultrasound was used to clearly identify the landmarks thus increasing the chances of successful block and reducing the need of drug volume.[17] TAP block efficacy, as multimodal pain relief technique for postoperative laparoscopic pain has long been proven.[18,19] However Ortiz et al claimed that TAP block has no superiority over traditional port site administration for providing postsurgical analgesia

after laparoscopic cholecystectomy.[20] These nontraditional results may find an explanation due to differences in study settings like approach of block (anterior or posterior), time of block (pre or post-operative), type of drug and dosage used.

In this study subcostal approach was used which reportedly provides better analgesia when compared with classical approach of TAP block.[21,22] This subcostal TAP block was compared with port site infiltration technique. Bupivacaine (0.25%, 0.4ml/kg) was used in both groups. The results of this study on account of patient profiles, post-surgical pain score along with total postoperative analgesic requirement have coherence with the results of randomized clinical trial done by Suseela et al.[23] They compared ultrasound guided subcostal transversus abdominis plane block with port site infiltration applying 0.25% bupivacaine in 80 patients. It was summarized that subcostal TAP block provided greater pain relief in comparison to port site infiltration, patients in subcostal TAP group required 1st rescue analgesic dose at a comparatively delayed point of time, NRS (Numerical rating scale) pain scores were lesser in this group and so was the case with total tramadol usage (48.69 ± 36.14 mg and 141.8 ± 60.01 mg in subcostal TAP and port-site infiltration group respectively, p-value 0.001 for both). The difference in both studies regarding rescue analgesic quantity (tramadol usage mean) in counterpart subcostal TAP block groups is explainable as in this study block was performed at the start of surgery whereas Suseela et al performed this intervention towards the end of the surgery with respect to time.[23] Baeriswyl et al[24] found the superiority of TAP block in regard to pain control following laparoscopic abdominal surgeries. In their study, minimal analgesic efficacy remained unrelated to the approach of the TAP block used. Randomization of patients was not done and blinding of the groups required a better technique.

CONCLUSION

The ultrasound-guided subcostal Transversus abdominis plane block is an effective method for providing post-operative analgesia following laparoscopic cholecystectomy. This technique has been found to be superior to port site infiltration, as it reduces pain scores, post-operative analgesic requirements, and increases patient satisfaction. However, to obtain more dependable results, randomized controlled trials with proper randomization techniques and blinding are recommended.

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Author's Contribution

MA conceived the idea for the study and assisted with data collection, as well as drafting the manuscript. SHMW, ZH, and A provided valuable input and assistance with manuscript writing. SK contributed to data analysis. IA aided in data collection. 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.

Conflict of Interest

Authors declared no conflict of interest

Grant Support and Financial Disclosure

None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.