

## Unilateral Subcostal Transversus Abdominis Plane Block in Laparoscopic Cholecystectomy for Pain Control Comparison with Conventional Port Site and Peritoneal Infiltration

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### ABSTRACT

**Objective:** To compare image-guided unilateral subcostal transversus abdominis plane (STA) block with infiltration of local anaesthetic both port site and peritoneal for post-operative analgesia for laparoscopic gall bladder surgery.

**Study Design:** Quasi-experimental study

**Place and Duration of Study:** Department of Anesthesia, Combined Military Hospital, Quetta Pakistan, from Nov 2018 to Apr 2019.

**Methodology:** The study sample (n=80) was divided into two Groups, one for image-guided subcostal transversus abdominis plane block and the other for peritoneal and port site infiltration of local anaesthetic. Anaesthesia was induced with intravenously administered propofol, atracurium, nalbuphine, and intraoperative non-opioid analgesia with ketorolac following which endotracheal intubation was done. The level of abdominal pain was assessed.

**Results:** The mean opioid consumption at the 24th post-operative hour was 22.75±8.55 in Group-A and 43.20±11.80 in Group-B. Mean total opioid consumption was 111.40±35.99 and 218.90±63.91 in Group-A and B, respectively. The mean VAS score at the 24th post-operative hour was 1.20±0.96 in Group- A and 3.12±1.63 in Group-B. The results showed a significant mean difference between opioid consumption and VAS pain score at the 24th hour ( $p<0.05$ ).

**Conclusion:** The unilateral Subcostal transversus abdominis plane block proved a superior alternative to port site and peritoneal infiltration combined for laparoscopic cholecystectomy.

**Keywords:** Laparoscopic cholecystectomy, Port site and peritoneal infiltration, Ultrasound guided unilateral subcostal transversus abdomenis plane block.

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## INTRODUCTION

The enhanced recovery after the laparoscopic intervention depends on effective pain relief, which helps in swift recovery and improved physical status.<sup>1</sup> An array of regional and local anaesthesia choices have an opioid-sparing effect. One such option is the transversus abdominis plane (TAP) block, which has undergone numerous modifications.<sup>2</sup>

The local anaesthetic infiltration into the fascial plane blocks the afferents of dermatomes of thoracic intercostal nerves (seventh to eleventh), subcostal nerve, ilioinguinal, iliohypogastric nerves, and cutaneous branches of lumbar first to third nerves.<sup>3,4</sup> TAP block approaches have been revised lately. They now comprise lateral TAP block and posterior TAP block. However, convincing evidence has not yet been

established against port site infiltration in laparoscopic cholecystectomy.<sup>3</sup> Subcostal transversus abdominis (STA) block is a modification of the TAP block which causes unilateral supraumbilical analgesia.<sup>5,6</sup>

For Laparoscopic cholecystectomy, subcostal access to TAP provides better analgesia and expedites recovery.<sup>7</sup> The use of bilateral TAP blocks has been studied in other populations around the globe. Bilateral TAP has been studied in local study,<sup>8,9</sup> but no study has been done before in our general population using single shot unilateral TAP block. Data from international literature is scarce, and their results cannot be generalised to our population. Therefore, we planned to compare the port site, peritoneal LA infiltration, and unilateral subcostal TAP block for post-surgical pain score and opioid requirement after laparoscopic cholecystectomy. The rationale of this study is to figure out the possibility of giving unilateral TAP block instead of bilateral. The earlier studies in our setup emphasised bilateral blocking, but our study

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demonstrated that unilateral TAP block is equally effective against post-site infiltration. The study results will help us modify the technique of conventional TAP block and save time.

## METHODOLOGY

The study was conducted at the Department of Anesthesia, Combined Military Hospital, Quetta Pakistan, from November 2018 to April 2019, after approval from the Hospital Ethical Committee (IERB #1285/Adm/Trg). The sample size was computed by utilising the WHO sample size calculator, taking Group-A: port site infiltration as  $223.60 \pm 101.96 \mu\text{g}$  and  $120.22 \pm 74.93 \mu\text{g}$  in Group-B: subcostal TAP block-4.

**Inclusion Criteria:** Patients of either gender, with ASA Classification I or II, aged 16-65 years, weighing 45-90 kg planned for laparoscopic cholecystectomy were included in the study.

**Exclusion Criteria:** Participants having a history of any chronic pain, neuropathic pain, or psychiatric problem were not hepatic or Renal impairment, history of drug abuse or allergic to local opioid analgesics or corticosteroids, pregnant females were excluded from the study.

Patients were divided into two Groups by lottery: Group-A (STA block) and Group-B (LAI). Group-A (STA block) (n=40) received an image-guided STA block, with ultrasonography as the imaging technique used and with 0.25% bupivacaine 1mg/kg and Group-B (LAI) (n=40) received an equivalent dose as wound and peritoneal LA infiltration.

All patients were assessed a day before surgery, and written informed consent was taken. Anaesthesia was induced with intravenously (IV) administered Propofol 2mg/kg, Atracurium 0.5mg/kg, Nalbuphine 0.15mg/kg and intraoperative non-opioid analgesia with Ketorolac 0.45mg/kg, following which endotracheal intubation was done. Anesthesia was maintained with oxygen, air, and Isoflurane using controlled ventilation with a closed circuit. At the end of the surgery, patients received their intervention according to group allocation.

In Group-A (n=40), blocks were performed by placing a USG probe in the midline of the abdomen 2cm below the xiphisternum and then moving it right laterally along the subcostal margin to the anterior axillary line. The transversus abdominis muscle was identified as lying beneath and extending laterally to the rectus abdominis muscle; the block needle was guided in the plane to a point inferior to the right

costal margin at the anterior axillary line such that the tip lay between the transversus abdominis and internal oblique muscle within the neurovascular fascial plane. Following aspiration, 1mg/kg Bupivacaine 0.25% was deposited within the plane.

Group-B (LAI) (n=40) received a similar dose as a conventional local anaesthetic at port sites and intraperitoneally in the gall bladder bed under the right copula of the diaphragm at the end of the laparoscopic procedure. Finally, anaesthesia was discontinued, and residual neuromuscular blockade was reversed by giving neostigmine (0.05mg/kg) mixed with Glycopyrrolate (0.01mg/kg).

Patients were shifted to the recovery room, where they were observed for post-operative pain. Nalbuphine was used in 5mg boluses as a rescue analgesic if needed. All patients were evaluated hourly after surgery by the researcher himself. A level of abdominal pain was assessed and recorded using a 0-10 score on the visual analogue scale (VAS) on the first post-operative hour and then the 4th, 8th, and 24th post-operative hour. The mean pain score and total dose of rescue analgesic in milligrams/24 hours were recorded. Rescue analgesia will be given if the pain score on VAS is equal to or  $>4$ , and the mean analgesia requirement will be evaluated finally at the 24th hour. The outcomes were mean pain scores and mean opioid consumption.

Statistical Package for Social Sciences (SPSS) version 26.0 was used for the data analysis. Mean $\pm$ SD were calculated for age and rescue analgesia. Frequency and percentage were calculated for gender and ASA status. Inferential statistics were explored using the Chi-square and independent sample t-test. The *p*-value of  $\leq 0.05$  was considered statistically significant.

## RESULTS

In our study, mean opioid consumption at the 1st, 4th, 8th, and 24th post-operative hour was  $33.45 \pm 10.19$ ,  $29.22 \pm 9.20$ ,  $25.97 \pm 8.82$  and  $22.75 \pm 8.55$  respectively, in Group-A and  $67.22 \pm 23.31$ ,  $57.62 \pm 17.68$ ,  $50.85 \pm 14.26$  and  $43.20 \pm 11.80$  in Group-B. Mean total opioid consumption was  $111.40 \pm 35.99$  and  $218.90 \pm 63.91$  in Groups A and B, respectively (*p*-value  $< 0.006$ ). The mean total opioid consumption at the 1st, 4th, 8th, and 24th post-operative hour and total consumption are presented in Table-I.

The mean VAS of Group-A was  $8.85 \pm 1.027$ ,  $7.28 \pm 1.154$ ,  $1.20 \pm 0.966$ , and  $5.18 \pm 1.107$  at the 1st, 4th,

8th and 24th hour, respectively, compared to Group-B with VAS of 8.35± 1.051, 7.45± 1.239, 5.45±1.239 and 3.13±1.636 in the same hours (Table-II).

**Table-I: Opioid Consumption the 1st, 4th, 8th, and 24th Post-Operative Hours (n=80)**

Opioid Consumption	Group-A (n=40)	Group-B (n=40)	p-value
1st hour	33.45 ±10.19	67.22±23.31	<0.001
4th hour	29.22 ±9.20	57.62±17.68	<0.001
8th hour	25.97±8.82	50.85±14.26	0.002
24th hour	22.75±8.55	43.20 ±11.80	<0.001

**Table-II: Visual Analogue Score the 1st, 4th, 8th, and 24th Post-Operative Hours (n=80)**

Vas Pain Score	Group-A n=40(SD)	Group-B n=40(SD)	p-value
1st hour	7.27±1.15	8.35±1.05	0.176
4th hour	5.17±1.10	5.45±1.23	0.220
8th hour	1.20±0.96	3.12±1.63	0.200
24th hour	1.20±0.96	3.12±1.63	<0.001

The results showed a significant mean difference for opioid consumption ( $p<0.001$ ) and VAS pain score at the 24th hour ( $p<0.001$ ) between the study Groups. There were 10(25%) males and 30(75%) females in Group-A and 6(15%) males and 34(85%) females in Group-B. 21(52.5%) patients in Group-A were ASA-I and 19(47.5%) were ASA-II. Similarly, 22(55%) patients were ASA-I and 18(45%) were ASA-II in Group-B (Table-III).

**Table-III: Frequency Distribution of Gender, Age, Weight and ASA Status (n=80)**

	Group-A (Mean±SD)	Group-B (Mean±SD)
Age	43.17±8.07 years	46.72±6.59 years
weight	66.95±6.20 kg	69.30±5.40 kg
	n(%)	n(%)
Male	10(25)	6(15)
Female	30(75)	34(85)
ASA-I	21(52.5)	22(55)
ASA-II	19(47.5)	18(45)

**DISCUSSION**

Laparoscopic cholecystectomy has become a common same-day surgery that is minimally invasive and less time-consuming.<sup>10</sup> Effective peri-operative pain relief is the mainstay of ambulatory surgery as it is patients' biggest concern. The advantages of reduced surgical stress, improved satisfaction, and opioid-sparing with minimal risks are part and parcel of good peri-operative care.<sup>11,12</sup>

Intraperitoneal lavage of local anaesthetic and port site infiltration is used conventionally for laparo-

scopic cholecystectomy to enhance recovery by improving post-operative analgesia.<sup>13</sup> However, the uses of field blocks and peripheral blocks that directly deposit local anaesthetic into the fascial plane between two anterior abdominal wall muscles have recently gained importance for interventions involving incisions given into the anterior abdominal wall.<sup>14</sup> One such intervention is the transversus abdominis plane (TAP) block has been employed for post-operative analgesia in surgeries involving anterior abdominal such as appendectomy and lower segment cesarean section.<sup>15</sup> Anaesthetists use the conventional transcutaneous TAP block for post-operative pain. However, it is less favourable compared to Surgical TAP blocks, which are more convenient and quick than conventional ones, especially in setups where an ultrasound machine is not available.<sup>16</sup> Therefore, the responsibility of post-operative pain relief is mostly on anaesthetists as its part of peri-operative care. Moreover, patient satisfaction urges anaesthetists to find different ways to make patients comfortable. One recent technique is the image-guided subcostal transversus abdominis (STA) block, a newer adaptation of the conventional TAP block that delivers efficient unilateral analgesia in supraumbilical interventions with standard probe placement of laparoscopic cholecystectomy.<sup>17</sup>

The few problems in previous studies have been addressed in our study as data collection was limited to 8 hours postoperatively as the same-day surgery patients mostly go home by this point. We extended our pain measurement to 24 hours to be more accurate in our analysis.

There is a theoretical possibility of the use of pre-incisional STA block for peri-operative analgesia for laparoscopic cholecystectomy to reduce intraoperative neuroendocrine stress response as well as achieve analgesia, but its effectiveness is not yet established, and no such study has been carried out so far.<sup>18</sup> On the other hand, the multiport laparoscopic cholecystectomy requires good supraumbilical analgesia, and a unilateral STA block is sufficiently reliable, which covers the dermatomes involving the standard port site and saves the hassle of a four-point TAP block,<sup>19</sup> and bilateral TAP block, which is more time-consuming.

**LIMITATIONS OF STUDY**

A few things could be improved, like the expertise of the anesthesiologist performing the block. The operator needs a good knowledge of sonological anatomy. Moreover, the oblique approach requires a comparatively larger drug

volume, which is used for hydro dissection of the whole fascial plane, which is tough and requires a skilful operator.

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#### CONCLUSION

We concluded that the unilateral Subcostal transversus abdominis plane block could produce reliable analgesia for laparoscopic surgery, and it is a superior alternative to contemporary ports site & peritoneal infiltration of local anaesthetic. It can reduce costs by enhancing recovery and early ambulation.

**Conflict of Interest:** None.

#### Authors Contribution

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

MR & MI: Data acquisition, data analysis, drafting the manuscript, approval of the final version to be published.

KHQ & KM: Data acquisition, critical review, approval of the final version to be published.

UK & HUR: Conception, study design, 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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