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Original Research Article

Comparative Study of Ultrasound-Guided Quadratus Lumborum Block Versus Transversus Abdominis Plane Block for Postoperative Analgesia in Patients Undergoing Lower Abdominal Surgeries

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Abstract

Background: Effective postoperative pain management is crucial for early mobilization, reduced morbidity, and improved patient satisfaction. Ultrasound-guided truncal blocks such as the transversus abdominis plane (TAP) block and quadratus lumborum (QL) block are increasingly used as part of multimodal analgesia for lower abdominal surgeries.

Objective: To compare the efficacy of ultrasound-guided quadratus lumborum block versus transversus abdominis plane block for postoperative analgesia in patients undergoing elective lower abdominal surgeries.

Materials and Methods: This quasi-experimental study was conducted at a tertiary care teaching hospital between October 2022 and March 2024. Sixty patients aged 20–40 years with ASA physical status I–II undergoing elective lower abdominal surgeries under spinal anesthesia were enrolled. Patients were divided into two groups: Group Q (Quadratus Lumborum block, n=30) and Group T (Transversus Abdominis Plane block, n=30). Both groups received bilateral blocks using 0.125% bupivacaine at 0.3–0.4 ml/kg. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at predefined intervals up to 24 hours. Duration of analgesia, number of rescue analgesic doses, hemodynamic parameters, and adverse effects were recorded.

Results: Demographic variables, ASA status, type and duration of surgery, and hemodynamic parameters were comparable between groups ($p>0.05$). VAS scores were similar up to 4 hours postoperatively. From 8 hours onward, Group Q demonstrated significantly lower VAS scores compared to Group T ($p<0.05$). The mean duration of analgesia was significantly longer in Group Q (12.23 ± 1.94 hours) than in Group T (8.76 ± 0.81 hours; $p<0.0001$). Rescue analgesic requirement was significantly lower in Group Q ($p<0.0001$). No block-related complications or adverse effects were observed in either group.

Conclusion: Ultrasound-guided quadratus lumborum block provides superior and prolonged postoperative analgesia with reduced rescue analgesic requirements compared to transversus abdominis plane block in patients undergoing elective lower abdominal surgeries.

Keywords: Quadratus Lumborum Block, Transversus Abdominis Plane Block, Postoperative Analgesia, Ultrasound-Guided Nerve Block, Lower Abdominal Surgery.

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Introduction

Postoperative pain remains a significant clinical concern despite advances in surgical techniques and anesthetic management. [1] Inadequately controlled pain can lead to adverse physiological responses, delayed mobilization, prolonged hospital stay, and reduced patient satisfaction. [2]

Multimodal analgesia strategies aim to optimize pain control while minimizing opioid consumption and related adverse effects. [3] Nonopioid systemic analgesics, such as nonsteroid anti-inflammatory drugs (NSAIDs), antidepressants, and alpha-2 agonists, are used for preventive analgesia instead of opioids in some cases, and sometimes can be used as a component of multimodal analgesia. Regimen, especially together with opioids.[4]

Intraoperatively, lidocaine in the form of bolus or infusion, and preoperative gabapentin or pregabalin, can be used for preventive analgesia. [5] Together with the increasing use of ultrasound (US), various truncal blocks are performed under

US guidance to eliminate postoperative pain and reduce the need for opioids in patients undergoing lower abdominal surgeries. [6] Ultrasound-guided regional anesthesia techniques have gained prominence due to their precision, safety, and efficacy. [7] The transversus abdominis plane (TAP) block provides somatic analgesia to the anterior abdominal wall by blocking the intercostal, subcostal, iliohypogastric, and ilioinguinal nerves. However, its limitation lies in the lack of visceral analgesia. [8]

The TAP block can be used to manage postoperative analgesia after open and laparoscopic abdominal surgeries, as well as inpatient and outpatient surgical procedures. [9] Unilateral left- or right-sided blocks are used for unilateral surgical procedures such as cholecystectomy, appendectomy, nephrectomy, and transplantation of a kidney. [10] Bilateral TAP blocks, on the other hand, are utilized for midline and transverse abdominal incisions in procedures such as umbilical or ventral hernia repair, cesarean births, hysterectomy, and prostatectomy. [11] TAP blocks are used in multimodal pain management during abdominal procedures, providing analgesic relief to patients and lowering postoperative narcotic requirements. [12] TAP blocks are usually applied intraoperatively, either before the surgical incision or at the end of the procedure, before waking up from anesthesia. [13]

The quadratus lumborum (QL) block is a posterior abdominal wall block that involves deposition of local anesthetic in the thoracolumbar fascial plane. [14] Due to its potential spread to the paravertebral space, the QL block offers both somatic and visceral analgesia and has been suggested to provide more extensive and prolonged pain relief compared to TAP block. [15]

This study was undertaken to compare the postoperative analgesic efficacy of ultrasound-guided quadratus lumborum block and transversus abdominis plane block in patients undergoing elective lower abdominal surgeries.

Materials and Methods

A quasi-experimental study conducted at PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, from October 2022 to March 2024.

Study Population: Sixty patients aged 20–40 years, ASA physical status I–II, scheduled for elective lower abdominal surgeries under spinal anesthesia.

Inclusion Criteria

- Age 20–40 years
- ASA physical status I or II
- Elective lower abdominal surgeries
- Written informed consent

Exclusion Criteria

- Patient refusal
- Infection at injection site
- Coagulopathy
- Hepatic, renal, cardiovascular, respiratory disorders
- Neurological or psychiatric illness
- Allergy to local anesthetics

Group Allocation

- **Group Q (n=30):** Bilateral ultrasound-guided quadratus lumborum block with 0.125% bupivacaine (0.3–0.4 ml/kg)
- **Group T (n=30):** Bilateral ultrasound-guided transversus abdominis plane block with 0.125% bupivacaine (0.3–0.4 ml/kg)

Outcome Measures

- VAS scores at 0, 30 min, 2, 4, 8, 12, and 24 hours
- Duration of analgesia
- Number of rescue analgesic doses
- Hemodynamic parameters
- Adverse effects

Statistical Analysis: Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± SD and analyzed using Student's t-test. Categorical variables were analyzed using Chi-square test. A p-value <0.05 was considered statistically significant.

Results

Table 1: Comparison of Demographic Variables between Groups

Variable	Group Q (n=30) Mean ± SD	Group T (n=30) Mean ± SD	t-value	p-value	Significance
Age (years)	30.9 ± 7.8	32.3 ± 6.5	0.913	0.364	NS
Height (cm)	158.63 ± 5.82	158.36 ± 4.10	0.205	0.838	NS
Weight (kg)	63.30 ± 4.81	63.16 ± 3.70	0.120	0.905	NS

NS – Not Significant (p > 0.05)

In group Q the mean age is 30.9±7.8 yrs. and group T is 32.3±6.5, the p value is 0.3641 which is statistically insignificant. The mean height in group Q is 158.63±5.82 CMS and group T is 158.36 ±4.10, the p value is 0.8383 which is statistically insignificant. The mean weight in group Q is 63.3

±4.81 kgs and group T is 63.16±3.7 kgs, the p value is 0.9047 which is statistically insignificant.

Table 2: Gender Distribution between Groups

Gender	Group Q (n=30)	Group T (n=30)	χ^2 value	p-value	Significance
Male	12 (40.0%)	15 (50.0%)	0.606	0.436	NS
Female	18 (60.0%)	15 (50.0%)			
Total	**30 (100%)**	**30 (100%)**			

In Group Q among the 30 patients 12 patients were male (40%) and 18 patients (60%) were female. In Group T among 30 patients 15 patients were male (50%) and 15 patients (50%) were female, P value is 0.436 which is greater than 0.05.it is statistically in significant.

Table 3: ASA Physical Status Distribution

ASA Status	Group Q (n=30)	Group T (n=30)	χ^2 value	p-value	Significance
ASA I	14 (46.67%)	14 (46.67%)	0	1.00	NS
ASA II	16 (53.33%)	16 (53.33%)			
Total	**30 (100%)**	**30 (100%)**			

In Group Q among the 30 patients 14 patients (46.67%) were belong to ASA I and 16 patients (53.33%) were belong to ASA II. In Group T among 30 patients 14 patients (46.67%) were belong to ASA I and16 patients (53.33%) were belong to ASA II, P value is 1.00 which is greater than 0.05.it is statistically in significant.

Table 4: Type of Surgery Distribution

Type of Surgery	Group Q (n=30)	Group T (n=30)	χ^2 value	p-value	Significance
Bilateral Mesh Hernioplasty	13 (43.33%)	11 (36.67%)			
Elective LSCS	11 (36.67%)	12 (40.00%)	0.287	0.866	NS
Total Abdominal Hysterectomy	6 (20.00%)	7 (23.33%)			
Total	**30 (100%)**	**30 (100%)**			

In our study B/L mesh hernioplasty cases in group Q are 13 (43.33%) and group T are 11 (36.67%), Elective LSCS cases in group Q are 11 (36.7%) and group T are 12(40.0%), and TAH cases in group Q are 6 (20.00%) and group T are 7 (23.33%) the p value is 0.866 which is more than 0.05 which is statistically insignificant.

Table 5: Duration of Surgery (Minutes)

Variable	Group Q Mean ± SD	Group T Mean ± SD	t-value	p-value	Significance
Duration of Surgery (min)	78.46 ± 17.22	79.83 ± 17.42	0.306	0.761	NS

In group Q the mean duration of surgery is 78.46±17.22 min and in group T the mean duration of surgery is 79.83±17.42 min, the p value is 0.7611 which is more than 0.05 which is statistically insignificant.

Table 6: Comparison of VAS Scores between Groups

Time Interval	Group Q Mean ± SD	Group T Mean ± SD	t-value	p-value	Significance
0 hr	0	0	–	–	NS
30 min	0	0	–	–	NS
2 hr	0.43 ± 0.50	0.70 ± 0.59	1.87	0.066	NS
4 hr	1.49 ± 0.45	1.67 ± 0.48	1.48	0.146	NS
8 hr	2.20 ± 0.48	2.67 ± 1.03	2.25	**0.028**	**S**
12 hr	3.06 ± 0.45	3.50 ± 1.07	2.08	**0.042**	**S**
24 hr	4.16 ± 0.53	4.63 ± 1.06	2.17	**0.034**	**S**

In group Q the mean VAS score at 0 hr. and 30 min were 0, patient had no pain, at 2hr and 4hr the mean VAS scorer were 0.433±0.504 and 1.49±0.45 respectively, patient had minimal pain.at 8 hr. the mean VAS score were 2.2±0.481 the pain was gradually increasing.

At 12th hr the mean VAS score was 3.06±0.45 patient had moderate pain and first rescue analgesia was given. At 24 hr. the mean VAS score was 4.16±0.530. In group T the mean VAS score at 0 hr. and 30 min were 0, patient had no pain, at 2hr and 4hr the mean VAS scorer were 0.7±0.59 and 1.667±0.479 pain steadily increasing from 4th hr.

At 8hr the mean VAS score was 2.667±1.028 patient had moderate pain and first rescue analgesia was given. At 12th hr. the mean VAS score was 3.5±1.07.At 24 hr. the mean VAS score was 4.63±1.06.

Table 7: Duration of Analgesia

Variable	Group Q Mean ± SD (hrs)	Group T Mean ± SD (hrs)	t-value	p-value	Significance
Duration of Analgesia	12.23 ± 1.94	8.76 ± 0.82	9.01	**<0.0001**	**HS**

In group Q the mean duration of analgesia was 12.23±1.94 hrs. And in group T was 8.76±0.817 hrs, the p value was <0.0001* which are statistically highly significant.

Table 8: Rescue Analgesic Requirement in 24 Hours

Number of Rescue Doses	Group Q (n=30)	Group T (n=30)	χ^2 value	p-value	Significance
1 dose	24 (80.0%)	7 (23.33%)			
2 doses	6 (20.0%)	18 (60.0%)	20.32	**<0.0001**	**HS**
3 doses	0	5 (16.67%)			
Total	**30 (100%)**	**30 (100%)**			

Table 9: Adverse Effects

Adverse Effect	Group Q (n=30)	Group T (n=30)
Nausea	0	0
Vomiting	0	0
Hypotension	0	0
Bradycardia	0	0
Pruritus	0	0
Total	**0 (0%)**	**0 (0%)**

In group T(n=30) 7 patients (23.3%) received single dose of rescue analgesia and 18 patients (60%) received two doses of rescue analgesia and 5 patients (16.67%) received third dose of rescue analgesia. The p vale is <0.0001* which is highly significant.

Discussion

Effective postoperative pain management is a cornerstone of enhanced recovery after surgery, particularly in lower abdominal procedures where inadequate analgesia may delay mobilization and prolong hospital stay. Ultrasound-guided regional anesthesia techniques have gained popularity due to their ability to provide targeted analgesia while minimizing systemic opioid consumption. In the present study, we compared the postoperative analgesic efficacy of ultrasound-guided quadratus lumborum (QL) block and transversus abdominis plane (TAP) block in patients undergoing elective lower abdominal surgeries.

In both groups, the mean age did not differ statistically. Group Q's mean age was 30.9±7.8 years, while group T's mean age was 32.3±6.5 years. In group Q, there were more women than men, while in group T, there were equal numbers of men and women.

Group T's mean age was 59.9 (3.4) years, whereas group Q's mean age was 57.7 (3.5) years, according to a similar study by Gupta et al. [16] In both groups, they did not identify any statistically significant differences in age or gender. (p = 0.23). In the current study, 14 cases (46.66%) and 16 cases (53.33%) in both groups had ASA status I and II, respectively. In the present study B/L mesh hernioplasty cases in group Q are 13 (43.33%) and group T are 11 (36.67%), Elective LSCS cases in group Q are 11 (36.7%) and group T are 12(40.0%), and TAH cases in group Q are 6 (20.00%) and group T are 7 (23.33%) the p value is 0.866 which is more than 0.05 which is statistically insignificant. Kumar et al [18] conducted similar study comparing postoperative analgesic efficacy of QL and TAP block in patients undergoing elective lower abdominal surgeries, the results were concurrent with our study [19].

In the present study, Mean duration of surgery was 78.46±17.22 minutes in group Q and 79.83±17.42 minutes in group T. There was no difference in mean duration of surgery in both group. Similar findings were noted in study conducted by Kumar et al [18] with mean duration of surgery was 87.28±34.22 minutes in group T and 85±32.22 minutes in group Q with no significant difference. Baytar et al [20] found duration of surgery as 49.90 ± 16.79 minutes and 51.22 ± 17.2 minutes respectively in group T and group with no statistical significance. (p=0.73)

In present study, VAS score at 8 hours,12 hours and at 24 hours were significantly different in both groups (p<0.05) with higher values in TAP block group. Makhni et al., [21]. The study found that the VAS score in group TAP was high at 6 hours (3.54±0.90) and that the p value (p=0.00) was statistically significant. This means that rescue analgesia was administered much earlier in the TAP group than in the QL group, where it was administered at 10 hours (P< 0.001). Which bore similarities to the current investigation. The mean Duration of analgesia was 12.23±1.94 hrs in group Q and 8.76±0.817 hrs in group T. this was statistically highly significant difference in both

groups. (p<0.00001). According to Naaz et al[22] research, the mean duration of analgesia in patients undergoing TAH was shown to be longer in QL block (8.05 hours; 95%CI) than in TAP block (5.59 hours; 95%CI).

In present study, majority 24 (80.0%) of cases had 1 rescue analgesia in group Q and majority 18 (60.0%) cases in group T had 2 doses of rescue analgesia. Makhni et al [21] studied the effectiveness of QL Block and Tap Block as postoperative analgesics in patients having inguinal hernia surgery. The mean dose of rescue analgesia in the TAP group was (0.98 ± 0.12) in their study, while the QL group's mean dose was (0.72 ± 0.19). This difference was shown to be statistically significant (P < 0.001) deriving the equivalent conclusion that the TAP block required more rescue analgesia than the QL block did in our investigation.

In our present study none of the patients in either group Q or group T had experienced Nausea, Vomiting, Hypotension, Bradycardia, Dizziness, itching. Similarly, no side effects were seen in the study by Gupta et al. [16] Despite its strengths, the study has certain limitations, including a relatively small sample size and restriction to a single center. Additionally, opioid consumption was not quantitatively assessed, which could have further strengthened the evaluation of analgesic efficacy.

Conclusion

Ultrasound-guided quadratus lumborum block provides superior postoperative analgesia with prolonged duration, lower VAS scores, and reduced rescue analgesic requirements compared to transversus abdominis plane block in patients undergoing elective lower abdominal surgeries. QL block should be considered an effective component of multimodal analgesia in abdominal surgeries.

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