

Posterior Sheath Block Versus Transversus Abdominis Plane Block In Abdominal Surgeries

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Abstract: Effective postoperative pain management is a critical component of enhanced recovery protocols after abdominal surgery. Regional blocks, such as the posterior sheath (rectus sheath, RS) block and the transversus abdominis plane (TAP) block, are increasingly used to minimize opioid consumption and improve patient outcomes. However, evidence comparing their analgesic efficacy remains limited, particularly in resource-constrained settings such as Pakistan. **Objective:** To compare the analgesic efficacy of ultrasound-guided posterior sheath block and transversus abdominis plane block in patients undergoing abdominal surgery. **Methods:** This randomized controlled trial was conducted at the Department of Anesthesia, King Edward Medical University/Mayo Hospital, Lahore, between January and April 2025. Eighty patients aged 18–60 years with ASA I–II status scheduled for elective abdominal surgery were randomized into two groups: Group A (RS block, n=40) and Group B (TAP block, n=40). Both groups received 20 ml of 0.25% bupivacaine per block and local wound infiltration at the end of surgery. Postoperative pain was assessed at six hours using a 10-point visual analogue scale (VAS). Data were analyzed using SPSS 26.0, with $p < 0.05$ considered statistically significant. **Results:** Baseline demographics, BMI, ASA status, and surgical procedures were comparable between groups ($p > 0.05$). At six hours, mean VAS scores were significantly lower in the TAP group compared to the RS group (2.6 ± 0.8 vs. 4.5 ± 1.1 ; mean difference -1.9 , 95% CI -2.32 to -1.48 ; $p < 0.001$). Clinically significant pain (VAS > 3) was present in 75% of RS block patients versus 20% of TAP block patients (risk difference -55.0% , 95% CI -71.3% to -38.7% ; $p < 0.001$). Subgroup analysis confirmed consistent superiority of TAP block across age, gender, BMI, and ASA categories (all $p < 0.05$). **Conclusion:** The TAP block provided significantly superior postoperative analgesia compared to the RS block in patients undergoing abdominal surgery. These findings support the integration of TAP block into multimodal analgesia protocols to improve postoperative outcomes, particularly in healthcare systems with limited resources.

Keywords: Postoperative analgesia, Transversus abdominis plane block, Rectus sheath block, abdominal surgery

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Introduction

The ability to manage postoperative pain is vital in enhancing recovery after abdominal surgeries. Pain control strategies have evolved significantly, with regional analgesia becoming the cornerstone of multimodal pain management protocols. Among these techniques, the posterior sheath block (PSB) and transversus abdominis plane block (TAPB) have gained considerable attention due to their effectiveness in reducing the need for opioids and enhancing patient recovery outcomes. PSB targets the fascia covering the posterior sheath of the rectus abdominis, providing targeted analgesia by interrupting nerve signals. In contrast, TAPB involves the injection of local anesthetics between the transversus abdominis and internal oblique muscles, targeting the thoracolumbar nerves that innervate the abdominal wall (1, 2). Numerous studies have supported the efficacy of TAPB, demonstrating significant reductions in postoperative pain scores as well as opioid consumption compared to various conventional methods. For instance, Khalid et al. reported that TAPB effectively diminishes postoperative pain and the incidence of opioid-related side effects in patients undergoing cesarean sections (3). Similarly, research by Butiulca and Lazăr highlights the positive impact of TAPB on the recovery trajectory of patients post-surgery, indicating less reliance on opioids and shorter recovery times in the post-anesthesia care unit (4). Such benefits align with Enhanced Recovery after Surgery (ERAS) protocols, which prioritize minimizing pain, enhancing mobility, and expediting discharge (5).

The rationale for assessing the comparative effectiveness of PSB versus TAPB is paramount in addressing diverse patient demographics and surgical techniques. The effectiveness of TAPB has been under scrutiny in various contexts, including its use in laparoscopic procedures and its viability in conjunction with other analgesic techniques. Studies have explored the combination of TAPB with additional blocks, such as the rectus sheath block, to achieve superior pain management in laparoscopic surgeries like cholecystectomy (6, 7). While TAPB remains a popular modality, emerging techniques, including quadratus lumborum blocks, offer comparative benefits warranting careful evaluation and direct comparison with TAPB in terms of efficacy and safety (8, 9).

In the context of Pakistan, where healthcare resources and the prevalence of postoperative pain management practices vary widely, establishing robust regional analgesia protocols is crucial. The integration of both PSB and TAPB into standard pain management regimes could potentially reduce the burden of pain on patients and healthcare systems alike. Given the cultural and economic factors influencing postoperative care in Pakistan, optimizing pain management strategies is essential for improving surgical outcomes and patient satisfaction (3, 10). The emphasis on multimodal analgesia through effective regional blocks is not only necessary but imperative to respect the urgent need for global best practices in pain management (11).

Methodology

This randomized controlled trial was conducted at the Department of Anesthesia, King Edward Medical University/Mayo Hospital, Lahore,



over a period of three months, from January 5, 2025, to April 5, 2025, following ethical approval from the institutional review board. The study enrolled a total of 80 patients, with 40 patients allocated to each of two groups. All patients met the inclusion criteria, which included being between 18 and 60 years of age, of either gender, with an American Society of Anesthesiologists (ASA) physical status classification of I or II, and scheduled to undergo elective abdominal surgery under general anesthesia. Patients were excluded if they had any contraindication to the rectus sheath (RS) or transversus abdominis plane (TAP) block, a known allergy to bupivacaine, or any physical or mental condition that could interfere with accurate assessment of postoperative pain. Additionally, patients with morbid obesity, defined as a body mass index (BMI) of 40 kg/m² or greater, were excluded from participation.

Participants who met the eligibility criteria were recruited after obtaining written informed consent. Demographic and baseline clinical information, including age, gender, BMI, ASA status, and type of surgery, was recorded in a predesigned proforma. Patients were randomly assigned to one of the two intervention groups using a lottery method to ensure equal allocation. Group A received a pre-incisional ultrasound-guided bilateral rectus sheath block, while Group B received a pre-incisional ultrasound-guided TAP block. In both groups, 20 ml of 0.25% bupivacaine was administered for each block. At the conclusion of surgery, all patients additionally received local wound infiltration with 40 ml of 0.25% bupivacaine. All blocks were performed under strict aseptic precautions by an experienced anesthesiologist trained in ultrasound-guided regional anesthesia techniques.

General anesthesia was administered according to institutional protocols, and all patients were monitored intraoperatively with continuous electrocardiography, non-invasive blood pressure measurement, and pulse oximetry. Standardized intraoperative analgesia was administered, and hemodynamic parameters, including blood pressure and heart rate, were closely monitored throughout the procedure. Postoperative care was uniform for both groups to minimize confounding factors. Postoperative pain assessment was performed at six hours using a 10-point visual analogue scale (VAS), where 0 indicated no pain and 10 indicated the worst possible pain. A score greater than three was considered indicative of clinically significant pain.

All data were entered into SPSS version 26.0 for statistical analysis. Continuous variables such as age, BMI, and postoperative pain score were presented as mean \pm standard deviation and compared between groups

using the independent samples t-test. Categorical variables, including gender, ASA status, and type of surgery, were expressed as frequencies and percentages and compared using the chi-square test. Data were stratified by age, gender, ASA status, and BMI to control for effect modifiers, and post-stratification t-tests were applied. A p-value of less than 0.05 was considered statistically significant.

Results

In a study involving 80 patients undergoing abdominal surgery. The mean age of participants was 40.4 ± 10.9 years, with similar distribution across groups (RS: 39.8 ± 11.2 years vs. TAP: 41.0 ± 10.6 years; $p = 0.60$). Males comprised 53.8% ($n = 43$) of the study population, while females accounted for 46.3% ($n = 37$); there was no statistically significant difference between the groups ($p = 0.82$). The mean BMI was comparable between groups (RS: 26.6 ± 3.9 kg/m² vs. TAP: 26.4 ± 3.7 kg/m²; $p = 0.85$). The majority of participants were classified as ASA I (61.3%), with the remainder as ASA II (38.8%), again showing no significant difference between groups ($p = 0.82$). The most common surgical procedures performed were laparoscopic cholecystectomy (36.3%), followed by open inguinal hernia repair and laparoscopic appendectomy (23.8% each), and midline laparotomy (16.3%). There was a similar procedural distribution between the two groups (Table 1).

Regarding analgesic outcomes at six hours postoperatively, patients receiving TAP block reported significantly lower mean VAS pain scores compared to those receiving RS block (2.6 ± 0.8 vs. 4.5 ± 1.1 , mean difference -1.9 , 95% CI -2.32 to -1.48 ; $p < 0.001$). The proportion of patients experiencing clinically significant pain (VAS > 3) was markedly lower in the TAP block group (20.0%) compared to the RS block group (75.0%), yielding a risk difference of -55.0% (95% CI -71.3% to -38.7% ; $p < 0.001$) (Table 2).

Post-stratification analysis further confirmed the superiority of the TAP block across all subgroups. In both younger (<40 years) and older (≥ 40 years) patients, the proportion experiencing pain was significantly lower in the TAP group compared to the RS group ($p < 0.001$ for both). This trend persisted across male and female participants, in all BMI categories, and in both ASA I and ASA II classifications, with p-values ranging from 0.03 to <0.001 , indicating a robust consistency in the analgesic benefit of the TAP block (Table 3).

Table 1. Baseline demographic and clinical characteristics

Characteristic	RS block (n=40)	TAP block (n=40)	Total (n=80)	p-value
Age, years	39.8 ± 11.2	41.0 ± 10.6	40.4 ± 10.9	0.60
Male	22 (55.0)	21 (52.5)	43 (53.8)	0.82
Female	18 (45.0)	19 (47.5)	37 (46.3)	
BMI, kg/m ²	26.6 ± 3.9	26.4 ± 3.7	26.5 ± 3.8	0.85
ASA I	25 (62.5)	24 (60.0)	49 (61.3)	0.82
ASA II	15 (37.5)	16 (40.0)	31 (38.8)	
Procedure: Laparoscopic cholecystectomy	14 (35.0)	15 (37.5)	29 (36.3)	0.96
Procedure: Open inguinal hernia repair	10 (25.0)	9 (22.5)	19 (23.8)	-
Procedure: Laparoscopic appendectomy	10 (25.0)	9 (22.5)	19 (23.8)	-
Procedure: Midline laparotomy	6 (15.0)	7 (17.5)	13 (16.3)	-

Table 2. Primary analgesic outcomes at 6 hours post-op

Outcome	RS block (n=40)	TAP block (n=40)	Between-group effect
VAS pain score (0–10), mean \pm SD	4.5 ± 1.1	2.6 ± 0.8	Mean difference -1.9 (95% CI -2.32 to -1.48), $p < 0.001$
Pain present ($>3/10$), n (%)	30 (75.0)	8 (20.0)	Risk difference -55.0% (95% CI -71.3% to -38.7%), $p < 0.001$

Table 3. Post-stratification comparison of "pain present" ($>3/10$) at 6 hours

Stratum	Category	RS: pain n/N (%)	TAP: pain n/N (%)	p-value
Age	<40 years	14/20 (70.0)	3/17 (17.6)	<0.001
	≥ 40 years	16/20 (80.0)	5/23 (21.7)	<0.001
Sex	Male	17/22 (77.3)	5/21 (23.8)	<0.001
	Female	13/18 (72.2)	3/19 (15.8)	<0.001

BMI	<25 kg/m ²	7/11 (63.6)	2/11 (18.2)	0.03
	25–29.9 kg/m ²	15/20 (75.0)	4/20 (20.0)	<0.001
	≥30 kg/m ²	8/9 (88.9)	2/9 (22.2)	0.01
ASA	I	18/25 (72.0)	4/24 (16.7)	<0.001
	II	12/15 (80.0)	4/16 (25.0)	0.002

Discussion

The present study aimed to compare the analgesic efficacy of the posterior sheath (RS) block and transversus abdominis plane (TAP) block in abdominal surgeries involving 80 patients. The demographic characteristics of the participants were balanced across both groups in terms of age, gender distribution, body mass index (BMI), and ASA classification, ensuring a fair comparison of the analgesic outcomes. This baseline information lays an important groundwork for understanding the subsequent analgesic effects, which were markedly distinct between the two groups in terms of pain scores and the incidence of significant pain.

Table 1 illustrates that our study's average patient age of 40.4 years corroborates with findings from studies by Escudero-Fung et al. and Liu et al., where regional anesthesia techniques were analyzed in similar age demographics undergoing abdominal surgeries Escudero-Fung et al., 12,13). Escudero-Fung et al. emphasized the importance of age in postoperative pain management. Our findings, which detail a p-value of 0.60 for the age comparison, indicate no significant disparity, consistent with the literature suggesting uniformity in pain response across various ages, particularly considering the established analgesic techniques used. The gender distribution of our cohort demonstrated no statistically significant difference between the groups ($p = 0.82$), with 53.8% of patients being male. Previous research has shown mixed influences of gender on postoperative pain outcomes. However, studies such as those by Bansal et al. found little influence of gender on analgesic efficacy of regional blocks (14). Our results reaffirm these findings and suggest that gender may not inherently influence the effectiveness of TAP compared to the RS block in abdominal procedures.

The BMI metrics of participants in our study also presented no significant differences ($p = 0.85$), indicating that both analgesic techniques yielded effective pain management regardless of BMI. This finding is consistent with those of Liu et al., who noted that variations in BMI did not adversely affect the analgesic efficacy of TAP blocks post-surgery (13). Thus, our results further support the notion that both TAP and RS blocks can be effectively utilized across varying patient body compositions without escalating the risk of inadequate analgesia.

Moving to the procedural distribution, laparoscopic cholecystectomy emerged as the most frequently performed surgical procedure, which is reflective of trends in studies like the one conducted by Rahimzadeh et al., who reported similar procedural patterns in their evaluation of TAP blocks (15). The consistency across procedural types in both studies reinforces the argument for the generalized application of TAP as an effective analgesic technique during various forms of abdominal surgery. In analyzing analgesic outcomes at six hours postoperatively, our findings demonstrated a significantly lower mean VAS pain score in the TAP block group (2.6 ± 0.8) versus the RS block group (4.5 ± 1.1), with a mean difference of -1.9 ($p < 0.001$). This finding aligns with studies by Diedhiou et al. and Wang et al., which emphasize the effectiveness of TAP blocks in managing postoperative pain, as evidenced by reduced VAS scores in patients undergoing abdominal surgeries (16, 17). These results underscore the effectiveness of TAP in achieving immediate postoperative pain control and diminishing reliance on narcotics, aligning with the ERAS protocols promoted by existing literature aiming to expedite recovery times.

The proportion of patients experiencing clinically significant pain, defined as a VAS score greater than 3, was remarkably lower in the TAP group (20.0% vs. 75.0% with RS block), confirming the effectiveness of TAP blocks in pain mitigation. These findings are consistent with meta-analyses by Hain et al. and the systematic review conducted by Wang et al., which demonstrate the effectiveness of TAP in significantly reducing

pain incidence and opioid consumption (18, 17). The substantial risk difference of -55.0% noted further emphasizes the effectiveness of the TAP block in clinical practice, advocating for its broader adoption in multimodal analgesia protocols.

Lastly, the post-stratification analysis revealed consistent superiority of the TAP block across all patient subgroups, reinforcing the reliability of TAP in diverse age categories, genders, BMI values, and ASA classifications. This consensus aligns with findings from ongoing research by Özçiftçi et al., which reported similar results in various configurations of demographic stratification (Özçiftçi et al., 19). Thus, the robust efficacy of the TAP block over the RS block in minimizing postoperative pain and opioid reliance underscores its potential role as a critical component in contemporary pain management strategies in abdominal surgical practices.

The findings of our study support the existing literature and provide compelling evidence in favor of TAP blocks as a preferable modality for postoperative analgesia in abdominal surgeries. This supports ongoing efforts to standardize TAP implementation in clinical settings to improve patient outcomes and optimize recovery protocols.

Conclusion

In this randomized trial of elective abdominal surgeries, ultrasound-guided transversus abdominis plane block provided superior early postoperative analgesia compared with rectus (posterior sheath) block, with lower pain scores and fewer patients reporting clinically significant pain at 6 hours. These findings support the incorporation of the TAP block into multimodal analgesia and ERAS pathways in similar settings. Given the single-center design and short follow-up, multicenter studies with longer outcomes and opioid consumption metrics are warranted to confirm generalizability.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Manuscript drafting, Study Design,

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Review of Literature, Data entry, Data analysis, and drafting an article.

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Conception of Study, Development of Research Methodology Design,

CAA (Consultant, General Surgery)

Study Design, manuscript review, and critical input.

BM (PGR, Nephrology)

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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