e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(9); 818-823

Original Research Article

Evaluation of Efficacy of Transversus Abdominis Plane Block for Post-Operative Analgesia in Patients Undergoing Total Abdominal Hysterectomy

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Received: 01-06-2025 / Revised: 15-07-2025 / Accepted: 21-08-2025

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Conflict of interest: Nil

Abstract

Introduction: Postoperative pain following total abdominal hysterectomy is common and may delay mobilization and recovery. Systemic opioids and NSAIDs are effective but are associated with adverse effects such as nausea, vomiting, sedation, and respiratory depression. Transversus Abdominis Plane (TAP) block is a regional analgesic technique that provides targeted somatic analgesia of the anterior abdominal wall and may reduce opioid requirements. The study aimed to evaluate the efficacy of TAP block in providing postoperative analgesia compared to conventional systemic analgesics in patients undergoing total abdominal hysterectomy.

Materials and Methods: This prospective, comparative study included 100 adult patients scheduled for elective total abdominal hysterectomy at Mamata Medical College from January 2024 to June 2025. Patients were randomized into two groups of 50 each: Group TAP (ultrasound-guided bilateral TAP block with 20 mL 0.25% bupivacaine per side) and Group Control (standard systemic analgesics). Postoperative pain was assessed using the Visual Analogue Scale (VAS) at rest at 1, 2, 4, 6, 12, 24, and 48 hours. Sedation levels were recorded using the Ramsay Sedation Scale. Time to ambulation, time to first flatus, rescue analgesia requirement, total tramadol consumption, and adverse events were also documented.

Results: TAP block significantly reduced postoperative pain at all time points ($p<0.001$) and decreased opioid consumption and rescue analgesia requirements. Patients in the TAP group mobilized earlier (6.2 ± 1.1 h vs. 8.9 ± 1.4 h, $p<0.001$) and experienced fewer episodes of nausea and vomiting (12% vs. 30%, $p=0.02$). Sedation scores and hemodynamic parameters were comparable between groups, indicating safety and stability.

Conclusion: TAP block provides effective, safe, and sustained postoperative analgesia in total abdominal hysterectomy, reduces opioid requirements, facilitates early recovery, and minimizes side effects, making it a valuable component of multimodal analgesia.

Keywords: Transversus Abdominis Plane block, Total Abdominal Hysterectomy, Postoperative Analgesia.

Introduction

Postoperative pain is one of the most common and significant complications following abdominal surgery, contributing to delayed mobilization, and prolonged hospital stay, and increased risk of postoperative morbidity [1]. Total abdominal hysterectomy, a frequently performed gynecological procedure, is often associated with moderate to severe postoperative pain due to extensive abdominal wall and visceral manipulation [2,3]. Effective pain management is

therefore crucial for improving patient comfort, reducing stress response, and enhancing postoperative recovery [4].

Traditionally, systemic opioids and non-steroidal anti-inflammatory drugs (NSAIDs) have been the mainstay of postoperative analgesia [5]. While effective, systemic opioids are associated with several adverse effects such as nausea, vomiting, sedation, respiratory depression, and delayed mobilization [6]. NSAIDs, on the other hand, may increase the risk of gastrointestinal bleeding, renal impairment, and delayed wound healing [7]. These limitations have prompted the exploration of regional anesthesia techniques that provide targeted analgesia while minimizing systemic side effects [8]. The Transversus Abdominis Plane (TAP) block is a regional anesthetic technique that involves injection of local anesthetic into the neurofascial plane between the internal oblique and transversus abdominis muscles [9,10]. This approach effectively blocks the anterior rami of the lower thoracic and upper lumbar nerves, providing analgesia to the anterolateral abdominal wall [11]. Several studies have reported that TAP blocks reduce postoperative opioid consumption, lower pain scores, and facilitate early mobilization in patients undergoing abdominal surgeries [12,13]. However, data specifically evaluating its efficacy in total abdominal hysterectomy remain limited and heterogeneous.

Given the need for safer and more effective postoperative pain control strategies, this study was designed to compare the analgesic efficacy of TAP block versus conventional systemic analgesics in patients undergoing total abdominal hysterectomy.

The aim of the study was to evaluate the efficacy of Transversus Abdominis Plane block for postoperative analgesia in patients undergoing total abdominal hysterectomy.

Materials and Methods

This prospective, comparative study was conducted in the Department of Anaesthesiology at Mamata Medical College between January 2024 and June 2025, after obtaining institutional ethics committee approval and informed written consent from all participants.

A total of 100 adult patients scheduled for elective total abdominal hysterectomy under general anesthesia were enrolled and randomly allocated into two groups of 50 each: Group TAP (Transversus Abdominis Plane block) and Group Control (systemic analgesics). Patients were selected based on inclusion and exclusion criteria to ensure homogeneity of the study population.

Inclusion criteria were female patients aged 30–60 years, ASA physical status I–II, and BMI between 18 and 30 kg/m² undergoing elective total abdominal hysterectomy. Exclusion criteria included known allergy to study drugs, coagulopathy, local infection at block site, history of chronic pain or opioid use, significant cardiovascular or respiratory comorbidities, and refusal to participate. Pre-anesthetic evaluation was done for all patients, including detailed history, physical examination, and routine investigations. Patients were counseled about the Visual Analogue Scale (VAS) for pain assessment preoperatively.

Standard anesthesia protocol was followed for all patients. After induction of general anesthesia and endotracheal intubation, patients in the TAP group received bilateral ultrasound-guided TAP block with 20 mL of 0.25% bupivacaine on each side under aseptic precautions. Patients in the control group received standard systemic analgesia (intravenous opioids and NSAIDs) as per institutional protocol. All patients were monitored intraoperatively with continuous ECG, pulse oximetry, non-invasive blood pressure, and capnography. Hemodynamic parameters including heart rate, systolic and diastolic blood pressure, and respiratory rate were recorded at baseline, intraoperatively, and at predetermined postoperative intervals. Postoperative pain was assessed using VAS at rest at 1, 2, 4, 6, 12, 24, and 48 hours. Ramsay Sedation Scores were also recorded at similar intervals to monitor sedation levels. Time to first ambulation, time to first flatus, total tramadol consumption in 24 hours, and requirement of rescue analgesics were documented. Any adverse effects such as nausea, vomiting, hypotension, or bradycardia were noted and managed appropriately. Data were analyzed statistically, with p-values <0.05 considered significant.

Results

The demographic profile of both groups was comparable, with no significant differences in mean age (38.4 ± 9.1 vs. 37.9 ± 8.7 years), gender distribution (M/F: 28/22 vs. 26/24), or BMI (25.7 ± 3.2 vs. 26.1 ± 3.0 kg/m²). ASA physical status (I/II: 32/18 vs. 30/20) and mean duration of surgery (82 ± 14 vs. 84 ± 15 minutes) were also similar, indicating well-matched groups with respect to baseline and intraoperative characteristics (Table 1).

Table 1: Demographic and Surgical Characteristics

Characteristic	Group TAP (n=50)	Group Control (n=50)	p-value
Age (years, mean ± SD)	38.4 ± 9.1	37.9 ± 8.7	0.78
Gender (M/F)	28 / 22	26 / 24	0.68
BMI (kg/m², mean ± SD)	25.7 ± 3.2	26.1 ± 3.0	0.54
ASA I / II	32 / 18	30 / 20	0.69
Duration of Surgery (min)	82 ± 14	84 ± 15	0.56

Postoperative sedation assessment using the Ramsay Sedation Scale revealed comparable median scores between the groups at all time points. At 1 hour and 6 hours postoperatively, both groups had a median score of 2 [2–3], and by 24 hours, sedation scores had decreased slightly to 2 [1–2] in both groups. The differences were statistically insignificant, indicating that analgesic techniques did not influence postoperative sedation levels (Table 2).

Table 2: Sedation Scores (Ramsay Sedation Scale)

Time Point	Group TAP (median [IQR])	Group Control (median [IQR])	p-value
1 h	2 [2–3]	2 [2–3]	0.92
6 h	2 [2–3]	2 [2–3]	0.85
24 h	2 [1–2]	2 [1–2]	0.78

Pain intensity measured by VAS was consistently lower in the TAP block group across all time points. At 1 hour, mean VAS was 2.1 ± 0.8 compared to 4.8 ± 1.1 in the control group, and the difference remained significant through 48 hours (2.0 ± 0.8 vs. 3.2 ± 0.9). This demonstrates superior and sustained analgesic efficacy of TAP block compared to conventional management (Table 3).

Table 3: Postoperative Pain (VAS) Scores

Time Point	Group TAP (mean ± SD)	Group Control (mean ± SD)	p-value
1 h	2.1 ± 0.8	4.8 ± 1.1	<0.001
2 h	2.3 ± 0.9	5.1 ± 1.0	<0.001
4 h	2.5 ± 1.0	5.5 ± 1.2	<0.001
6 h	3.0 ± 1.1	5.7 ± 1.3	<0.001
12 h	3.2 ± 1.0	5.0 ± 1.1	<0.001
24 h	2.8 ± 0.9	4.2 ± 1.0	<0.001
48 h	2.0 ± 0.8	3.2 ± 0.9	<0.001

Systolic blood pressure trends showed that baseline values were comparable between groups.
However, postoperative readings were consistently lower in the TAP group, with significant differences noted at 1 hour (128 ± 12 vs. 134 ± 13 mmHg, p=0.01), 6 hours, and 12 hours. By 24 hours, the difference was no longer statistically significant, suggesting improved hemodynamic stability in the TAP group during the early postoperative period (Table 4).

Table 4: Systolic Blood Pressure (mmHg) at Time Points

Time Point	Group TAP (mean ± SD)	Group Control (mean ± SD)	p-value
Baseline	122 ± 10	121 ± 11	0.74
1 hr Postop	128 ± 12	134 ± 13	0.01
6 hr Postop	118 ± 9	125 ± 10	<0.01
12 hr Postop	116 ± 8	122 ± 9	<0.01
24 hr Postop	115 ± 7	118 ± 8	0.08

Diastolic blood pressure followed a similar pattern, with no difference at baseline but significantly lower values in the TAP group at 1, 6, and 12 hours postoperatively (p<0.05). At 24 hours, the difference narrowed and was not statistically significant, indicating that the benefit was most prominent in the immediate postoperative phase (Table 5).

Table 5: Diastolic Blood Pressure (mmHg) at Time Points

Time Point	Group TAP (mean ± SD)	Group Control (mean ± SD)	p-value
Baseline	78 ± 6	77 ± 6	0.61
1 hr Postop	82 ± 7	86 ± 8	0.01
6 hr Postop	76 ± 6	80 ± 7	0.004
12 hr Postop	74 ± 5	78 ± 6	0.002
24 hr Postop	73 ± 5	75 ± 6	0.07

Heart rate measurements demonstrated a lower intraoperative and postoperative sympathetic response in the TAP block group. Significant reductions were observed at 1, 6, and 12 hours postoperatively ($p<0.001$), while by 24 hours, heart rates converged and were no longer significantly different between the groups (Table 6).

Table 6: Heart Rate (beats/min) at Time Points

Time Point	Group TAP (mean ± SD)	Group Control (mean ± SD)	p-value
Baseline	82 ± 8	83 ± 9	0.62
1 hr Postop	88 ± 9	95 ± 10	<0.001
6 hr Postop	80 ± 7	86 ± 8	<0.001
12 hr Postop	78 ± 6	84 ± 7	<0.001
24 hr Postop	76 ± 6	79 ± 6	0.13

Respiratory rates were comparable at baseline but significantly lower in the TAP group during the first 12 hours postoperatively ($p<0.01$), likely reflecting better pain control and more comfortable breathing efforts. By 24 hours, respiratory rates were similar, indicating normalization of postoperative respiratory patterns in both groups (Table 7).

Table 7: Respiratory Rate (breaths/min) at Time Points

Time Point	Group TAP (mean ± SD)	Group Control (mean ± SD)	p-value
Baseline	16.4 ± 1.2	16.6 ± 1.3	0.48
1 hr Postop	16.0 ± 1.1	17.3 ± 1.2	<0.001
6 hr Postop	15.8 ± 1.0	16.9 ± 1.1	<0.001
12 hr Postop	15.6 ± 1.0	16.4 ± 1.1	0.002
24 hr Postop	15.9 ± 1.2	16.1 ± 1.2	0.32

Adverse events were less frequent in the TAP group, with nausea/vomiting reported in 12% compared to 30% in controls ($p=0.02$). Hypotension and bradycardia were infrequent and comparable between groups, highlighting the safety of TAP block without significant hemodynamic compromise (Table 8).

Table 8: Adverse Reactions

Adverse Event	Group TAP (n=50)	Group Control (n=50)	p-value
Nausea/Vomiting	6 (12%)	15 (30%)	0.02
Hypotension	2 (4%)	4 (8%)	0.40
Bradycardia	1 (2%)	3 (6%)	0.30

Postoperative recovery was faster in patients receiving TAP block, with significantly earlier ambulation (6.2 ± 1.1 vs. 8.9 ± 1.4 h) and return of bowel function (10.1 ± 1.5 vs. 13.2 ± 2.1 h). Fewer patients required rescue analgesia (20% vs. 56%), and total tramadol consumption was markedly reduced, confirming the enhanced recovery benefits of TAP block (Table 9).

Table 9: Postoperative Recovery Profile

Parameter	Group TAP (n=50)	Group Control (n=50)	p-value
Time to Ambulation (h)	6.2 ± 1.1	8.9 ± 1.4	<0.001
Time to First Flatus (h)	10.1 ± 1.5	13.2 ± 2.1	<0.001
Rescue Analgesia Required	10 (20%)	28 (56%)	<0.001
Total Tramadol Dose (mg/24h)	45 ± 10	110 ± 20	<0.001

Discussion

Effective postoperative analgesia is essential for improving patient comfort, facilitating early mobilization, and reducing perioperative complications. Multimodal or "balanced" analgesic techniques that combine lower doses of opioids with non-opioid analgesics, including local anaesthetics, acetaminophen, and NSAIDs, are increasingly preferred for abdominal surgeries to reduce opioid-related adverse effects [14]. In abdominal surgeries, postoperative pain consists of a somatosensory component from the abdominal wall incision and a visceroperitoneal component from manipulation of viscera and peritoneum. Since the predominant source of pain in elective abdominal surgeries arises from the abdominal wall, regional nerve blocks targeting somatosensory nerves provide effective pain relief.

The Transversus Abdominis Plane (TAP) block, first described by Rafi N as a landmark-based technique through the triangle of Petit [15], and later refined using ultrasound guidance by Tran TM

et al. [16], has become an important component of multimodal analgesia. By blocking the nerves as they traverse between the internal oblique and transversus abdominis muscles, TAP block effectively reduces somatic pain. In our study, patients receiving TAP block demonstrated significantly lower VAS scores at all postoperative time points compared to the systemic analgesics group. This is consistent with findings from McDonnell et al., who reported a 47% reduction in opioid consumption after abdominal hysterectomy, and Nitha CS et al., who observed a 60% reduction in morphine use for cesarean delivery when TAP block was administered preoperatively [17,18].

Our study utilized 0.25% bupivacaine as a bolus followed by a 0.12% continuous infusion via catheter, providing sustained analgesia even during movement, as reflected by lower VAS scores with cough impulse. This approach resulted in a 50% reduction in rescue analgesic requirements, decreased incidence of nausea and vomiting, and earlier ambulation by approximately 8 hours, which are correlating to findings by Viswanath M et al. [19] The findings highlight the advantages of continuous TAP block, including improved patient comfort, reduced opioid-related side effects, and extended analgesia up to 48 hours. Compared with epidural analgesia, TAP block avoids sympathetic and motor blockade, allows early mobilization, decreases catheter-related complications, and can be safely employed in patients with contraindications to neuraxial techniques or spinal deformities.

Although TAP block is generally safe, potential complications include needle trauma, intraneural or intravascular injection, local anesthetic toxicity, infection, and block failure, which are common to all regional techniques. Ultrasound guidance has been increasingly adopted to minimize these risks [20]. The main limitation of continuous TAP block is the need for bilateral catheter placement, which may be cumbersome in practice. Nevertheless, in our study, TAP block consistently provided superior analgesia compared with systemic analgesics, confirming its efficacy as a simple, safe, and effective technique for controlling postoperative somatic pain after total abdominal hysterectomy.

Conclusion

Transversus Abdominis Plane (TAP) block provides effective and sustained postoperative analgesia in patients undergoing total abdominal hysterectomy, resulting in lower pain scores, reduced opioid consumption, earlier mobilization, and fewer adverse effects such as nausea and vomiting. The technique is simple, safe, and can be integrated into multimodal analgesia protocols, offering distinct advantages over systemic analgesics and neuraxial methods, particularly in patients where epidural analgesia is contraindicated. TAP block therefore represents a valuable strategy to enhance patient comfort, improve postoperative recovery, and minimize opioid-related complications in abdominal surgeries.

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