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# ORIGINAL ARTICLE

## Ultrasound Guided Transversalis Fascia Plane Block Versus Transversus Abdominis Plane Block for Postoperative Pain Management in Patients after Cesarean Section under Spinal Anesthesia: A Prospective Randomized Comparative Clinical Trial

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**Background** The frequent presentation of postoperative pain constitutes a significant clinical concern, especially after cesarean deliveries. Effective management is crucial to avoid negative consequences. This study aimed to improve postoperative pain management after cesarean delivery by assessing the effectiveness of ultrasound guided transversalis fascia plane block in comparison to transversus abdominis plane block.

**Methods** This prospective, randomized investigation recruited 74 pregnant patients, aged 20-40 years. They were assigned randomly to either transversalis fascia plane block (TFPB) group or transversus abdominis plane block (TAPB) group, each receiving 20ml of 0.25% bupivacaine on each side.

**Results** The mean visual analogue scale was significantly lower among the TFPB group than the TAPB group (*P* value <0.001). The time for first morphine request was significantly delayed among the TFPB group than the other group (12.7±2.2 vs 10.2±2.1, respectively with a *p* value <0.001). The total morphine dose required in the TFPB group was 2.9±0.8 and in the TAPB group was 3.8±1.5 (*P* value <0.001).

**Conclusions** The TFPB provided longer pain relief, delaying the need for additional analgesics compared to the TAPB, highlighting its superior effect in postoperative pain management.

**Keywords** Cesarean Section, Postoperative Pain Management, Spinal Anesthesia, Transversalis Fascia Plane Block, Transversus Abdominis Plane Block.
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## INTRODUCTION

Cesarean section (CS) is one of the most conducted surgeries involving the lower abdomen. Regional anesthesia methods are commonly employed for postoperative pain relief following CS [1]. Insufficient pain management after surgical intervention is associated with the potential for depressive symptoms, prolonged pain, and delayed establishment of maternal-infant attachment. Thus, the goal of postpartum care is to provide a pain-free recovery, promote early mobilization, and ensure high-quality neonatal care [2].

Various methods are employed to manage postoperative pain. Opioids can be delivered intravenously (IV), through neuraxial administration, or a combination

of both. Notwithstanding the efficacy of opioids in analgesia, their administration is often accompanied by adverse reactions, encompassing respiratory and urinary dysfunction, and emesis. Consequently, the adoption of regional anesthetic techniques has witnessed a surge in prevalence, aimed at minimizing opioid consumption and augmenting the efficacy of postoperative pain management [3].

Post-surgical pain alleviation, subsequent to lower abdominal surgeries, is achieved through different abdominal wall blocks such as TAPB, quadratus lumborum block (QLB), and TFPB [4].

Targeting the proximal branches of the T12 and L1 nerves, the TFPB, as originally described by Hebbard, is administered within the anatomical plane defined by the transversus abdominis muscle (TAM) and the transversalis fascia (TF) [5]. Published evidence supports the utility of the TFPB in procedures such as inguinal herniorrhaphy and CS [6,7].

By anesthetizing the sensory afferent nerves innervating the anterior abdominal wall, the TAPB achieves its analgesic effect. Specifically, sensory nerves originating from T9 to T12 are targeted within the neuro-fascial plane located between the internal oblique muscle (IOM) and TAM, utilizing the triangle of Petit as the point of entry. The widespread clinical adoption of TAPBs for pain management following non-obstetric abdominal surgeries is well documented [8].

As per our current awareness, the comparative efficiency of TFPB and TAPB in the post-operative pain in pregnant underwent CS has been addressed by a paucity of prior scholarly publications.

## PATIENTS AND METHODS

This prospective randomized trial was conducted at the operative theatre at Suez Canal university hospital from January 2023 to March 2024. It recruited 74 pregnant who underwent elective CS with spinal anesthesia, aged from 20 to 40 years old, body mass index (BMI) between 18 to 35kg/m$^2$, and American Society of Anesthesiologists (ASA) physical status II. Written documentation of the patient's informed consent was obtained. The trial was started at the elective surgical theatres in Suez Canal University hospitals in Ismailia after approval of the Ethical Committee in Suez Canal university (approval code:5405).

Exclusion criteria were patients requiring emergency procedures, patients refusing spinal anesthesia, patients who have infection or skin lesion at the site of puncture for local anesthetic (LA) injection, who have bleeding disorders, and history of allergy to LA.

**Randomization and grouping:**

Utilizing a computerized system, cases were randomly assigned to treatment groups. The randomization schedule was sequestered within sealed, sequentially numbered envelopes. The envelopes were opened in an ascending numerical order by the main researcher after the CS was done. Cases were randomly allocated using computer generated randomization tables into two equal groups: Group A received TFPB, and Group B received TAPB, each receiving 20ml of 0.25% bupivacaine on each side. Patients, other researchers, and outcome assessors were blinded to patient allocation.

All cases were subjected to full history taking (Age, medical history, and history of previous operations, obstetric history), and describe pain on the visual analogue score (VAS), medical history History of systemic medical diseases to assess ASA physical status, - any medical disorders during pregnancy, bleeding disorders, anticoagulants, family history, past anesthetic history with impact on previous airway problems, hypersensitivity to anesthetic drugs and any postoperative problems that may be linked to anesthesia, past history of operations]. A comprehensive physical assessment was conducted, encompassing the evaluation of vital parameters (heart rate [HR], blood pressure [BP], and temperature), and cardiovascular examinations. Laboratory investigations included a complete blood count and coagulation studies.

**Pre-operative at the operation room:**

All anesthetic procedures and the regional block technique were executed by a single, experienced anesthesiologist. IV access was established utilizing an 18-gauge catheter, and all participants received a 1000mL crystalloid co-load of lactated Ringer's solution. Subarachnoid puncture was performed with a 25-gauge Quincke spinal needle at the L3-4 or L4-5 interspace, with cases in a seated position. A 2.4mL solution, comprising 2mL of hyperbaric bupivacaine and 20mcg of fentanyl, was injected using a 3mL syringe. Post-injection, patients were immediately placed in a supine position with a 20-degree left lateral tilt. HR, BP and SpO2 were monitored intraoperative and recorded every 5 minutes till the end of surgery. After spinal anesthesia (SA), Sensory blockade progression, specifically the cephalad extension of SA to the T4 dermatome, was determined via repetitive cold sensation assessments conducted every five minutes until stabilization was observed across three successive assessments. The time from SA administration to peak sensory level was documented. Motor block characteristics, including onset and duration, were appraised utilizing the Bromage scale [9].

Motor block onset was quantified as the time to attain a Bromage score of 3, and motor block duration was

described as the time needed to return to a Bromage score of 0. After SA, if the BP decreased to 20% or more of its base a dose of 5mg ephedrine was given IV and titrate till the BP rises again as well as if HR decrease less than 60 beat per minute, atropine 1mg I.V was given. After Delivery of the baby 5 IU Oxytocin was given intravenously to decrease postpartum hemorrhage by uterine contraction.

**Procedure for post-operative pain management:**

For participants in Group A, bilateral ultrasound guided TFPB, was performed with cases lying supine, while the Sonosite M-Turbo-C apparatus was placed on the operator opposite side. Under strict aseptic conditions, a high-frequency linear probe (6–13 MHz) was applied to the lateral abdominal wall, just cephalad to the iliac crest in the midaxillary plane. The needle (sonoplex 22G,80mm) was entered in-plane from anterior-to-posterior trajectory, traversing the external oblique muscle (EOM) and IOM. Following puncture of the TAM's deep fascia and visualization of the TF, an injection of 20ml of 0.25% bupivacaine (Sunnypivacaine) was administered as the deep fascia of the TAM was passed with visualization of retroperitoneal fat movement to deep plane [2] (Figure 1).

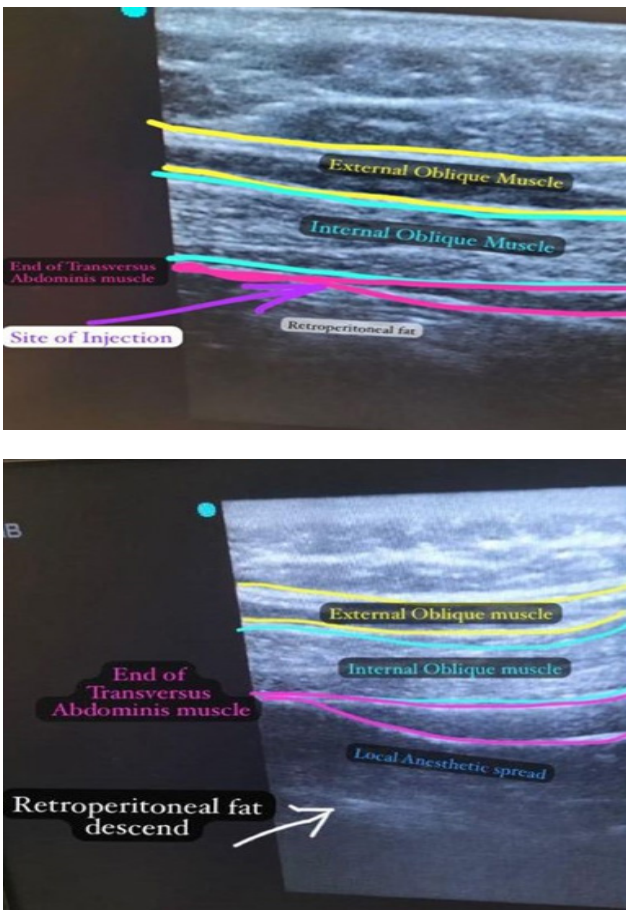


**Figure 1:** Technique for TFPB.

For participants in Group B (USG-TAPB), the linear probe was positioned transversely between the costal margin and iliac crest in the anterior axillary line, the probe was maneuvered to delineate the EOM, IOM, and TAM. The block was executed in the midaxillary plane, with the needle advanced in-plane from a medial to lateral direction. Under direct ultrasonographic visualization, 20mL of 0.25% bupivacaine was injected into the space between the TAM and IOM [10] (Figure 2).

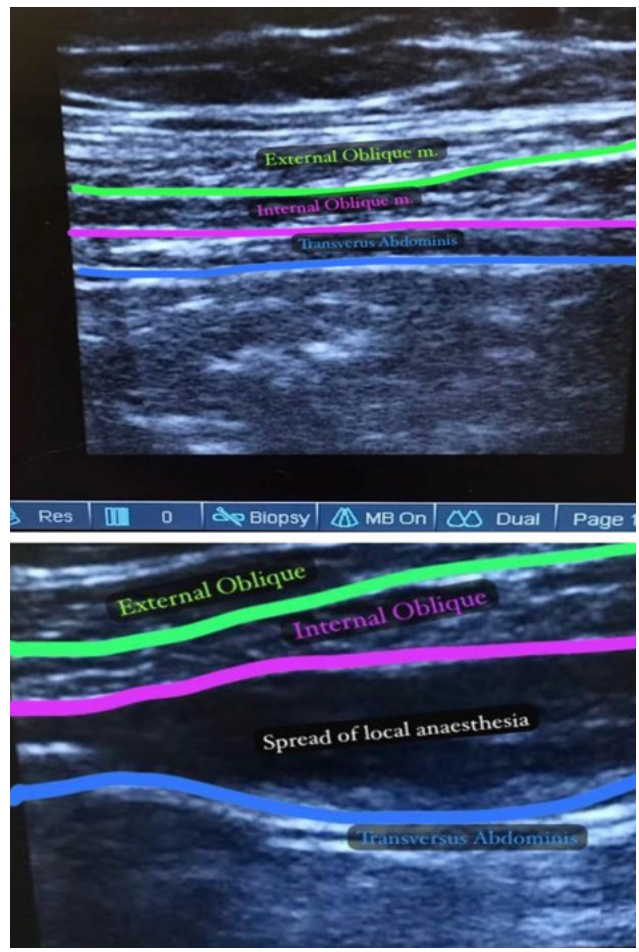


**Figure 2:** Technique for TAPB.

**Post-operative pain management:**

All patients received 1gm paracetamol intravenously every 6hrs. Postoperative pain assessment with VAS was evaluated at the recovery room (zero hour) and at, 2, 4, 6, 12, 18, and 24 hours. If VAS record >3, 3mg IV morphine was given.

The primary outcome was to compare postoperative analgesic efficacy of USG-TFPB versus USG-TAPB in parturient after CS in terms of total analgesic consumption. The secondary outcomes were patient satisfaction and rate of postoperative nausea and vomiting (PONV).

**Sample Size Calculation:**

Sample size was calculated according to the following equation [11] Where:

$$n = 2\left[\frac{(Z_{\alpha/2} + Z_{\beta}) * \sigma}{\mu_1 - \mu_2}\right]^2$$

*n*= sample size.

Zα/2= 1.96 (The critical value that divides the central 95% of the Z distribution from the 5% in the tail).

Z*β*= 0.84 (The critical value that separates the lower 20% of the Z distribution from the upper 80%) 23.24.

σ= 4.6= the estimate of the standard deviation [6].

μ1= 5.2= mean morphine consumption (mg) in the TFPB group [6].

μ2= 8.4= mean morphine consumption (mg) in the control group [6]. By equation *n*= 33 and after adding 10% for drop out, it will be 37 in each group.

**Statistical analysis:**

SPSS version 27 (IBM©, Armonk, NY, USA) was utilized for all statistical computations. Data normality was determined by the Shapiro-Wilk test and histogram review. Normally distributed measures, represented as mean±SD, were assessed by the unpaired *t*-test. Non-normally distributed measures, represented as median (IQR), were assessed by the Mann-Whitney test. Categorical measures, represented as frequencies and percentages, were assessed by the Chi-square or Fisher's exact test, where applicable. A two-tailed *P*-value <0.050 was deemed statistically significant.

## RESULTS

Eligibility screening was conducted on 96 patients, with 13 failing to meet the inclusion criteria and 9 opting out of participation. The 74 continuing cases were randomly allocated into two sets, each consisting of 37 individuals. All randomized patients were included in the follow-up and statistical evaluation (Figure 3).

Table (1) shows no substantial variation between both groups regarding demographic data (Age and BMI).

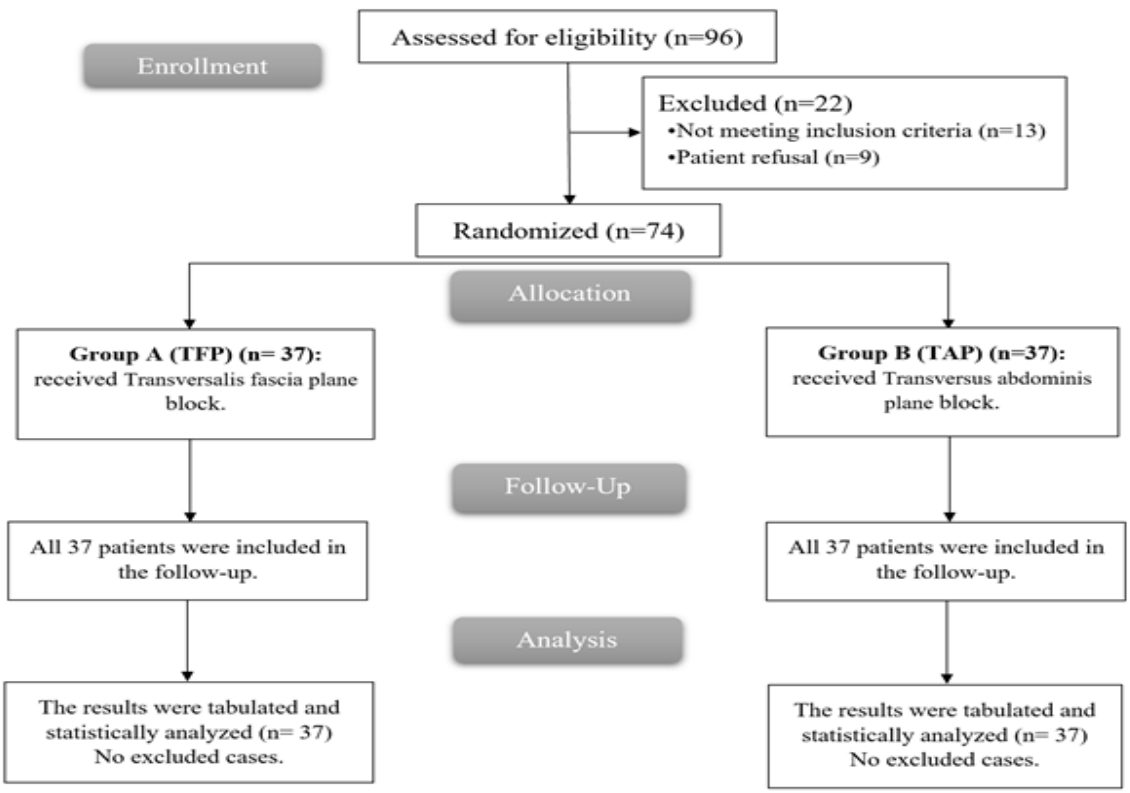


**Figure 3:** CONSORT flowchart of the studied patients.

**Table 1:** Demographic data of the patients studied:

| | Group A (*n*=37) | Group B (*n*=37) | *P* value |
|---|---|---|---|
| Age (years) | 27.4±3.3 | 28.9±4.8 | 0.125 |
| Body mass index (kg/m$^2$) | 23.0±2.1 | 22.4±1.9 | 0.189 |

Data are presented as mean±SD.

The comparison of VAS scores at rest among the study groups shows significant differences in pain levels at certain time points post-operation. At the 6-hour mark post-surgery, the TFP group had a notably lower mean VAS score compared to the TAP ($P$<0.001). This significant difference continued at 12, 18, and 24 hours ($P$<0.001, $P$<0.001, and $P$= 0.033, respectively). At the 0-hour, 2-hour, and 4-hour marks post-operation, both groups reported no pain at all (Table 2 and Figure 4).

**Table 2:** VAS Scores post operative at rest among study groups:

| | Group A (*n*=37) | Group B (*n*=37) | *P* value |
|---|---|---|---|
| Recovery room (zero hour) | 0(0-0) | 0(0-0) | 1.000 |
| 2h | 0(0-0) | 0(0-0) | 1.000 |
| 4h | 0(0-0) | 0(0-0) | 1.000 |
| 6h | 0(0-2) | 1(0-3) | <0.001 |
| 12h | 1(0-2) | 2(0-5) | <0.001 |
| 18h | 1(0-5) | 2(0-4) | <0.001 |
| 24h | 2(1-5) | 3(1-5) | 0.033 |

Data are presented as median (IQR).

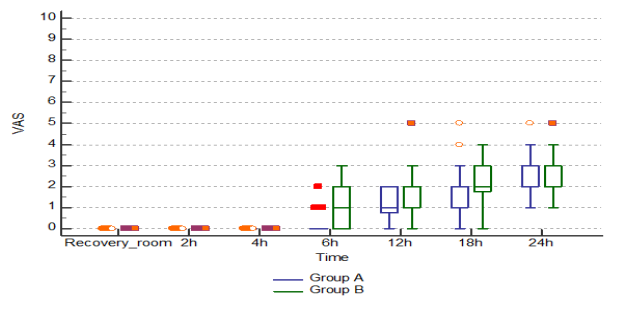


**Figure 4:** VAS trend graph.

Patients in the TFP group requested their first analgesic significantly later compared to TAP group ($P$<0.001). The time for first morphine request was significantly delayed among the TFPB group than the other group (12.7±2.2 vs 10.2±2.1, respectively with a $p$ value <0.001). The total morphine dose required in the TFPB group was 2.9±0.8 and in the TAPB group was 3.8±1.5 ($P$ value <0.001). Dizziness (3/37, 10.8%) and nausea/vomiting (3/37, 10.8%) were reported in the TAPB group with no side effects reported in the TFPB group ($p$ value 0.045, each). A significantly higher patient satisfaction was noted in the TFPB group with 86.5% and 13.5% reporting excellent and very good satisfaction, respectively ($p$ value 0.001) (Table 3).

**Table 3:** Time to first morphine request, total morphine consumption, complications, and satisfaction among study groups:

| | | Group A (*n*=37) | Group B (*n*=37) | *P* value |
|---|---|---|---|---|
| Time to first morphine request (hours) | | 12.7±2.2 | 10.2±2.1 | <0.001 |
| Total morphine consumption (mg) | | 2.9±0.8 | 3.8±1.5 | <0.001 |
| Nausea/Vomiting | | 0(0.0%) | 3(8.1%) | 0.077 |
| Dizziness | | 0(0.0%) | 3(8.1%) | 0.077 |
| Satisfaction | Excellent | 32(86.5%) | 15(40.5%) | 0.001 |
| | Very good | 5(13.5%) | 11(29.7%) | |
| | Moderate | 0(0.0%) | 11(29.7%) | |

Data are presented as mean±SD, or number (%).

## DISCUSSION

Postoperative pain constitutes a significant clinical problem. CS continues to be associated with substantial postoperative pain concerns [12].

The administration of intrathecal long-acting opioids is a significant method for post-CS pain mitigation. Nevertheless, the potential for adverse events associated with opioids may lead to their avoidance by some clinicians. The expanding utilization of peripheral nerve blocks is facilitated by the widespread adoption of USG in anesthesia and the increasing preference for multimodal analgesic protocols that minimize opioid consumption [13].

TAPB, and TFPB have been documented as effective in the alleviation of pain after CS. However, there is insufficient evidence to determine which technique is more effective [14].

In our study, the comparison of VAS scores at rest among the study groups shows significant differences in pain levels at certain time points post-operative. The VAS score was significantly lower among the TFPB group from 6- 24 hours after CS.

In this context, Sripriya *et al.,* [15] indicated that cases receiving TAPB experienced pain scores reduction compared to control and TFPB groups over the study duration. At the 12-hour mark, the TAPB group reported notably lower pain scores than the control group ($P$<0.001). Moreover, pain levels in the TAPB group remained notably lower at 12 hours ($P$= 0.002) and 16 hours ($P$<0.001) than the TFPB group. In contrast, the TFPB group did not exhibit

substantial pain score variations from the control group for more than two consecutive time points, suggesting a diminished consistency in analgesic efficacy.

This discrepancy would be explained by the fact that post CS, women suffer from visceral pain rather than pain at the CS incision. This raised the assumption that neither block would be effective. Another explanation would be related to the technique of LA administration as it is directed to the nerves, but involved LA infiltration in the anatomical plane including the nerve pathway, which has a wide range of variations. Additionally, truncal myotomes and dermatomes are not clearly determined, unlike peripheral nerves. Also, visceral pain is carried by an autonomic nervous system component, the blockade of which can't be assessed properly. Complex interconnections between the thoraco-lumbar nerves played a significant role in the variable blockade results [15].

In our study, Time to first morphine request comparison between study groups revealed a significant difference favoring the TFP group. Patients in the TFP group requested their first analgesic significantly later, with a mean time of first morphine request is 12.74 hours compared to 10.20 hours in the TAP group. These results indicate that the TFPB provided longer-lasting pain relief, delaying the need for additional analgesics compared to the TAPB, highlighting its effectiveness in postoperative pain management.

These results corroborate the observations of Srivastava *et al.,* [16] wherein the control group (no block) exhibited a notably shorter time to first analgesic request than TAPB group. The TAPB group demonstrated a notably longer duration before requiring analgesia, indicating more efficacious and prolonged analgesic effects. However, they used TAPB supplemented by IV diclofenac with patient- controlled analgesia with tramadol [16]. Time to request analgesia differed greatly between studies and was rendered to different LA used, the dose and concentration of the given anesthetic, and the baseline analgesia given [15].

The current study revealed that the mean morphine dose needed was notably lower in the TFP group than TAP group. Contrary to our findings,, Rahimzadeh *et al.,* [17] concluded that TFPB provided pain management equivalent to TAPB, although not statistically significant. However, their study indicated that TAPB may offer enhanced analgesia, as reflected by a longer duration of pain relief, reduced cumulative analgesic use, and a greater percentage of patients who did not require supplementary analgesics.

Corresponding to other research, Serifsoy *et al.,* [18] indicated no substantial decrease in pain scores in the TFPB than the control group. However, tramadol consumption was elevated in the control group, potentially resulting from the absence of baseline analgesic administration in their study design.

Our investigation revealed that patients undergoing TFPB did not report PONV, or dizziness. However, in the TAPB group, 10.8% of patients experienced PONV, and a matching percentage experienced dizziness. These distinctions were statistically significant, suggesting that TFPB is associated with fewer complications than TAPB, allowing for better patient experience.

Srivastava *et al.,* [16] however, reported a contrasting result, with PONV occurring more often in the control group (no block). Thirteen control group patients experienced PONV and were administered ondansetron, compared to 5 patients in the TAPB group who required antiemetic medication. This was explained by the adverse effects associated with increased tramadol consumption in the control group [16].

## CONCLUSION

TFPB provided a durable pain relief and less morphine consumption compared to TAPB.

## LIMITATIONS

This study was conducted as a randomized clinical trial; however, the lack of a control group is a limitation. Additionally, a small sample size and conducting the study in a single center hindered the ability to generalize of the study results. The technique was performed using ultrasound guidance to ensure safety and accuracy of the needle position. Both groups were offered IV paracetamol only, for better evaluation of the analgesic effect of both techniques.

## CONFLICTS OF INTEREST

There are no conflicts of interest.

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