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Comparison Between Ultrasound Guided Transversalis Fascia Plane and Transversus Abdominis Plane Block on Postoperative Pain in Patients Undergoing Elective Cesarean Section: A Randomized Clinical Trial

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Abstract

Background: Postoperative pain is a common complication after Cesarean Section (CS) and its management is essential to prevent adverse effects of pain. Various methods are used to control pain after CS. Regional anesthesia using Transversalis Fascia Plane (TFP) and Transversus Abdominis Plane (TAP) block is shown to reduce pain after abdominal surgery.
Objectives: This study aimed at evaluating the efficacy of these two methods in controlling pain after CS.
Methods: In this randomized clinical trial, 56 patients undergoing elective CS under spinal anesthesia were randomly allocated to receive TFP or TAP block after surgery with ultrasound guidance. The pain severity using Visual Analogue Scale (VAS) at rest and during coughing at 0, 2, 4, 6, 12, 24, and 36 hours after surgery, time to first analgesic request, and dosage of analgesic use and complications were compared between groups.
Results: There were no significant differences between groups in pain severity at rest or coughing at0, 2, 4, 6, 12, 24 and 36 hours, postoperatively. There was no considerable nausea and vomiting between groups (14.3% vs. 10.7%, P = 0.68), and time to the first analgesia (100.00 ± 69.28 versus 123.12 ± 50.19 minutes, P = 0.47) and total analgesic use (33.33 ± 14.43 vs. 25.00 ± 15.81 mg, P = 0.57) were comparable between groups. There were no complications in any of the groups. Patients in both groups were mostly satisfied for pain control after surgery (good to perfect, 89.3% versus 82.1%, P = 0.7).
Conclusions: Ultrasound-guided TFP provided pain control the same as TAP block after CS with a comparable decreased need of analgesics.

Keywords: Cesarean Section, Nerve Block, Pain Management, Transversalis Fascia Plane Block, Transversus Abdominis Plane Block

1. Background

Postoperative pain is a common complication after Cesarean Section (CS) and its management is essential to prevent adverse effects of pain, and helps with early mobilization, maternal bonding with the infant, and improvement of breastfeeding (1, 2).

Post-operative pain can cause a neuroendocrine stress response, physiological stress leading to hypercoagulable state and possible deep vein thrombosis and impaired immune response, which could cause possible side effects post-surgery (3-5). Different methods have been introduced to control postoperative pain and improve these responses, improve the recovery period, and the ability to function after surgery (6-9).

The mode and type of analgesia should be safe and effective. A stimulus caused by a lesion in tissue or organs during surgery is the cause of postoperative pain (10). The primary source of pain after abdominal surgeries, including CS, are the anterior abdominal wall and abdominal viscera, and blocking this area could provide proper analgesia after these surgeries (11, 12). Different anesthetic methods have been proposed to control post-CS pain. Spinal anesthesia could have complications, while peripheral nerve block has a faster release and is effective in reducing postoperative pain and increasing patients' early movement (13-15). Different regional anesthetic techniques have been introduced, including ilioinguinal nerve blocks, abdominal field blocks, Transversalis Fascia Plane (TFP) blocks, and Transversus Abdominis Plane (TAP) blocks to alleviate pain

from the abdominal wall incision (16, 17).

The TAP block technique is performed on the midaxillary line and can block the T6-L1 nerve roots, which provides analgesia of the parietal peritoneum, anterior abdominal wall, and skin (18, 19). It is relatively easy to perform and is safe (19, 20). TAP block is accepted for pain management after CS and reduces opioid consumption and improves pain management and patient satisfaction (21, 22). Transversalis Fascia Plane, performed in the posterior axillary line, is another method, which blocks branches of L1 nerve roots, including ilioinguinal and iliohypogastric nerves. This method has been used to control postoperative pain in patients undergoing different lower abdominal surgeries (17, 23-26). Ultrasound imaging has become a popular technique to perform regional anesthesia and pain procedures (27). Peripheral blocks using ultrasound guide could increase its accuracy and efficacy (17). As there are a few studies evaluating the efficacy of TFP block on different surgeries with limited sample size, there is a need for further studies, especially in females after C/S, to clarify its efficacy and applicability.

2. Objectives

This study aimed at comparing the efficacy of ultrasound- guided TAP and TFP block on post-cesarean section pain.

3. Methods

In this randomized clinical trial, 56 females undergoing elective CS under spinal anesthesia during 2017 at Rasoul-e-Akram Hospital, a tertiary academic referral center, were recruited. Inclusion criteria were female gender, an age of between 18 to 50 years old, and ASA I and II undergoing elective CS under spinal anesthesia. Patients with Body Mass Index (BMI) > 40 kg/m^2, those who had received analgesic 24 hours before surgery, those with systemic disease, including renal and hepatic disease or coagulopathies, and those allergic to Bupivacaine were excluded. The study was reviewed and approved by the Ethics Committee and written informed consent was obtained from all subjects before inclusion in the study (IRCT registration number: IRCT2017072210599N18).

The sample size was calculated based on the study of Arafa et al. (28) and using Equation 1.

Considering $\alpha = 0.05$, a power of 90%, and opium doses (11.58 $\pm$ 4.100 versus 15.46 $\pm$ 3.643), 21 patients were included per group. Finally, considering 25% attrition, the last calculated sample size was 56 (Figure 1). All patients underwent eight hours of fasting prior to surgery. Preloading was done with Ringer lactate solution (5 mL/kg body weight). Standard monitoring, including Non-Invasive Blood Pressure (NIBP), Electrocardiogram (ECG), heart rate, and pulse oximetry, was performed. All patients received supplemental oxygen via an oxygen mask (5 L/minute). Under proper aseptic conditions, spinal anesthesia was administered at the level of L4 to L5 interspace in sitting position, using a midline or paramedian approach, by a 25 G Quincke spinal needle. Two milliliters of Bupivacaine 0.5% was injected at a rate of approximately 2 mL/second, and then all patients have lied on the supine position. Furthermore, CS was started after sensory level reached T4.

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 (sd_1{}^2 + sd_2{}^2)}{d^2}$$

Equation 1

Hypotension was defined as a decrease in Systolic Blood Pressure (SBP) of more than 30% of baseline or SBP < 90 mmHg and if occurred, it was treated with 10 mg Ephedrine. If bradycardia (heart rate below 50 pulses per minute) occurred, 0.6 mg of Atropine was administered.

The patients and the physician evaluating the outcome of the trial were both blinded to the allocated groups. Using block randomization, patients were randomly allocated to TAP or TFP block groups in recovery. Under proper aseptic conditions, patients had bilateral TAP using the mid-axillary approach or TFP block with the guide of linear array probe (6 - 13 MHz, SonoSite M-Turbo; Sonosite Inc., Bothell, WA, USA). In both groups, 15 mL of Bupivacaine 0.25% (AstraZeneca, Sweden) by a 23 G spinal needle was administered on each side. For TAP block, in the mid - axillary line, internal oblique and transverse abdominis muscles were identified near the costal margin and iliac crest and the injection was performed. In TFP block, the probe was placed in transverse position, above the iliac crest. After visualization of internal oblique, external oblique, and transverse abdominis muscles, they were followed until the transverse abdominis and internal oblique reached the aponeurosis. After the tip of the needle was visualized between transverse abdominis and beneath fascia, bupivacaine was injected.

Pain severity was assessed using the Visual Analogue Scale (VAS) at rest and while coughing at 0, 2, 4, 6, 12, 24, 36 hours after CS with 0 considered as no pain and 10 as the worst possible pain. Patients' satisfaction was measured using the Likert scale as poor, moderate, good, very good, and excellent. In patients requesting analgesics af-

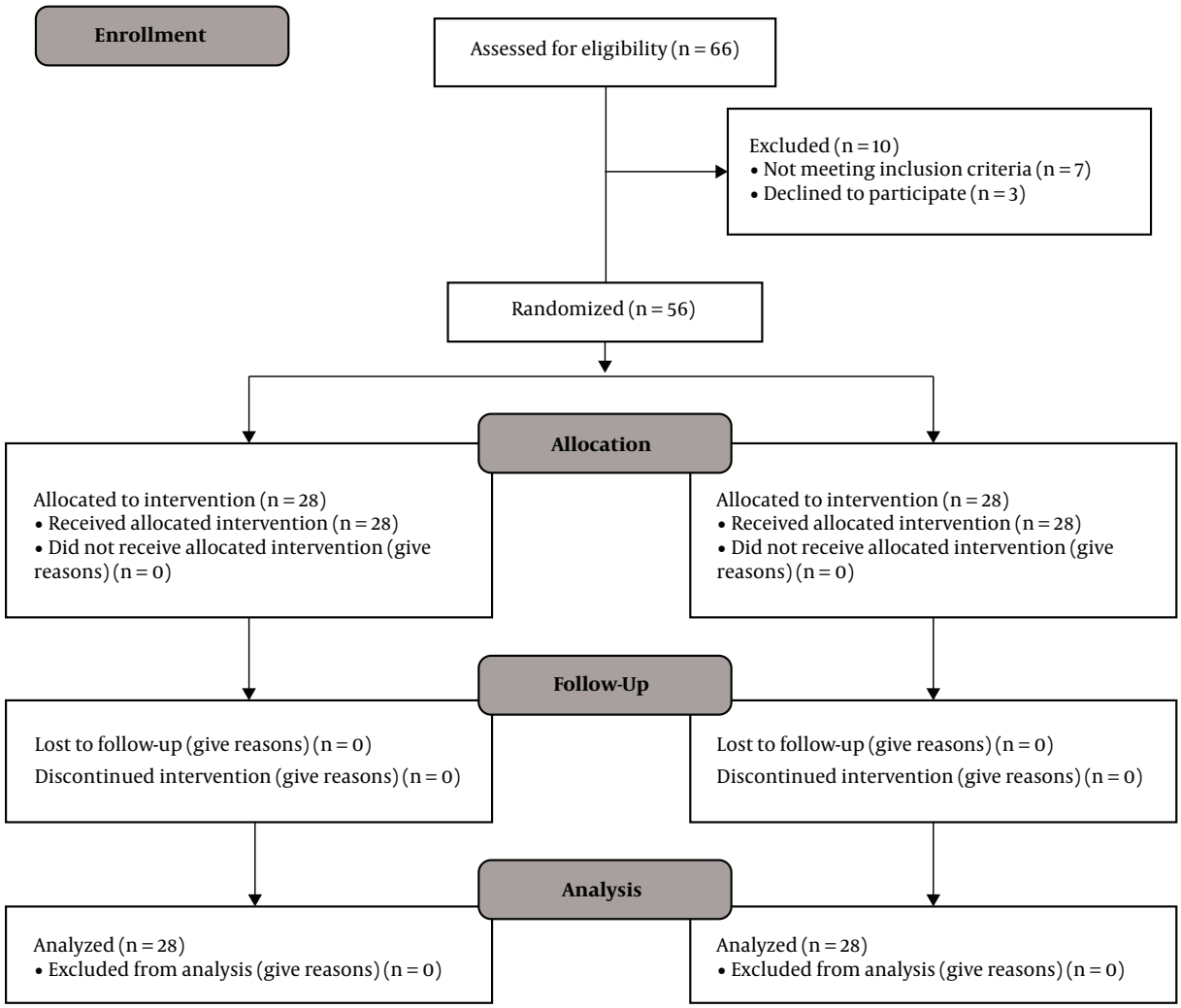

Figure 1. Consort diagram of the study

ter surgery, time after block to the first request for analgesics and total tramadol requirement in 36 hours post-surgery along with the rate of post-operative nausea and vomiting were also recorded. Complications regarding the block procedure were also recorded.

3.1. Statistical Analysis

Statistical analysis was performed with Statistical Package for Social Sciences, SPSS for Windows version 22.0 (IBM Corp., Armonk, N.Y., USA). First, the normality of quantitative variables was assessed based on the Kolmogorov-Smirnov test. Therefore, to compare quantitative variables in two groups, Independent *t*-test or U-Mann-Whitney test was used, to compare quantitative variables before and postoperative times, repeated-measures analysis of variance test was used, and to compare qualitative variables in the two groups, Chi-square or Fisher exact test was used. $P < 0.05$ was considered significant.

4. Results

The TAP (n = 28) and TFP (n = 28) groups were comparable considering age and weight (Table 1).

There was no significant difference in pain at rest and while coughing at different time periods between groups ($P > 0.05$) (Figure 2). Pain severity at rest and while coughing significantly decreased in both groups ($P < 0.001$), yet the difference between groups was not significant ($P = 0.8$).

There was no considerable nausea and vomiting between groups at different hours after surgery with total

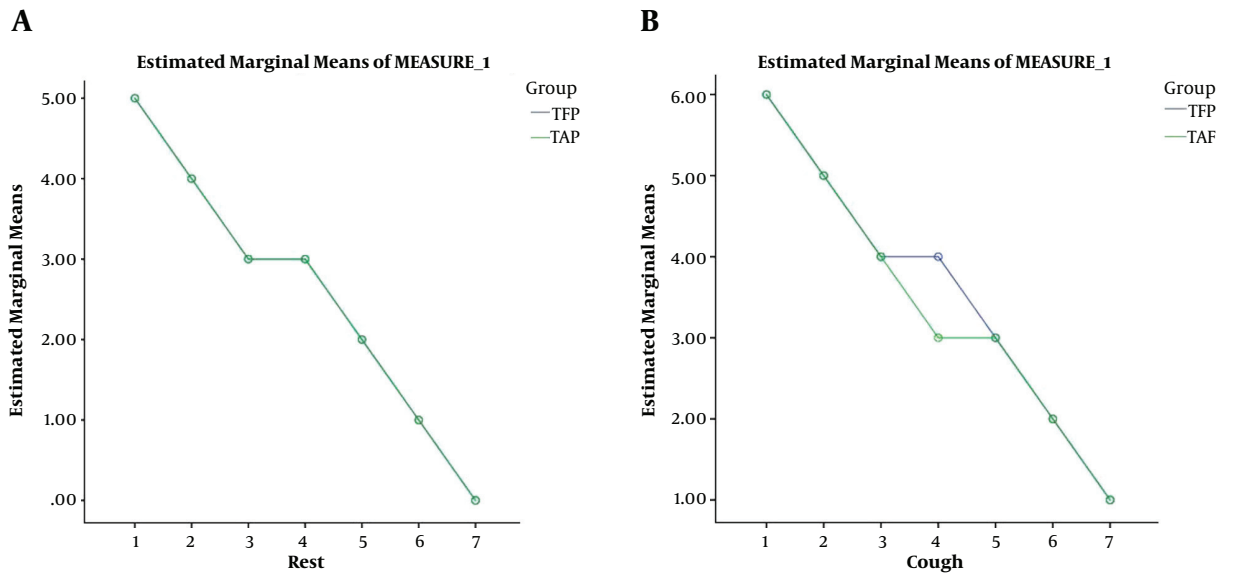

Figure 2. Serial changes in pain severity at rest and while coughing between groups. TAP, transversus abdominis plane block; TFP, transversalis fascia plane.

Table 1. Baseline Findings Between Groups

	TFP	TAP	P Value
Age, y	31.35 ± 5.06	30.64 ± 4.83	0.68
Weight, kg	74.21 ± 12.81	75.12 ± 8.58	0.50
BMI, kg/m²	27.1 ± 3.81	26.22 ± 3.45	0.23

rate comparable between groups (Table 2).

Table 2. Nausea and Vomiting Rate After Surgery Between Groups

Nausea and Vomiting	TFP Block, No. (%)	TAP Block, No. (%)
0 hour after surgery	1 (3.6)	1 (3.6)
2 hour after surgery	1 (3.6)	1 (3.6)
4 hour after surgery	1 (3.6)	0
6 hour after surgery	1 (3.6)	0
12 hour after surgery	0	1 (3.6)
24 hour after surgery	0	0
36 hour after surgery	0	0
Total	4 (14.3)	3 (10.7)

Abbreviations: TAP, transversus abdominis plane; TFP, transversalis fascia plane.

Three patients (10.7%) in the TFP block and five patients (17.9%) in TAP block requested analgesics after surgery with no significant difference between groups (Table 3). The TFP block patients requested analgesics earlier than the TAP block group with higher doses with no significant difference between groups. There were no complications during the surgery and after blocks.

Table 3. Total Analgesic Use and Time After Surgery Between Groups

	TFP Block	TAP Block	P Value[a]
Analgesic need, No. (%)	3 (10.7)	5 (17.9)	0.70
Time - to - first analgesic, min	100.00 ± 69.28	123.12 ± 50.19	0.47
Total analgesics use, mg	33.33 ± 14.43	25.00 ± 15.81	0.57

Abbreviations: TAP, transversus abdominis plane; TFP, transversalis fascia plane.
[a] P < 0.05 was considered significant.

Patients' satisfaction with pain control was also evaluated (Table 4) and most patients in both groups reported good to very good satisfaction score (89.3% versus 82.1%, P = 0.7).

Table 4. Patients' Satisfaction in Both Groups

	TFP Block, No. (%)	TAP Block, No. (%)	P Value
Poor	1 (3.6)	0	Non applicable
Acceptable	2 (7.1)	5 (17.9)	
Good	13 (46.4)	12 (42.9)	
Very good	12 (42.9)	11 (39.3)	

Abbreviations: TAP, transversus abdominis plane; TFP, transversalis fascia plane.

5. Discussion

This randomized clinical trial evaluated the analgesic efficacy of ultrasound-guided TAP and TFP blocks in patients undergoing CS, and both methods could control post-CS pain at rest and while coughing and decreased the need for analgesics and increased time to request analgesics after surgery. However, the results were comparable between groups with no superiority in any of them.

Studies evaluating these methods and similar methods have reported contradicting results. Unlike these findings, Kiran et al. (29) observed that TAP block compared to ilioinguinal-iliohypogastric block after CS had a significantly better pain control in females undergoing low segment CS. In their study, TAP block had significantly lower need for analgesics. In TFP, the L1 root branches were also blocked, ilioinguinal and iliohypogastric; thus, these two studies seem similar regarding methods to the present study. Gucev et al. (30) also observed that ilioinguinal-iliohypogastric block after CS is associated with significantly reduced pain score and decreased analgesics use.

A few studies have evaluated these two methods in CS. According to findings in the current study, it could be noted that both TAP and TFB block had acceptable efficacy in pain control, reducing the need for analgesics and opium, and increasing the duration of analgesia, yet with no significant difference between groups. Thus, both methods could be used for post-CS pain control.

Nausea and vomiting are common findings after surgery, which are associated with the amount of used opioid (21). In the current study, the rate of nausea and vomiting were low with no comparable difference between groups. Gucev et al. (30) also noted that using the ilioinguinal-iliohypogastric block was accompanied with no nausea and vomiting. Also, different clinical trials on TAP block after CS have shown a significant reduction in nausea and vomiting after surgery, although there are limited data regarding TFP effects on nausea (30-33).

Lopez-Gonzalez et al. (26), by comparing the efficacy of TAP and TFP block in inguinal hernia surgery, observed no significant differences between groups in nausea, vomiting, and complications. This research also encountered no complications in any of the patients.

This study also observed that patients in both groups had a high rate of satisfaction similar to both groups. Lopez-Gonzalez et al. (26) also reported that patients had a high and similar rate of satisfaction in both TAP and TFP block groups with no significant difference between groups; their findings were similar to the current study.

Transversalis Fascia Plane blocks the main branches of the L1 root, including ilioinguinal and iliohypogastric nerves. Therefore, it was expected that this method had better and higher pain control compared to TAP block; however, the results showed that both methods had similar efficacy in pain control after CS. Furthermore, TFP is located continuously lateral with the plane of the lumbar plexus, and opening this plane under ultrasound guidance with the injectate may provide an alternative lateral approach to lumbar plexus block (23). Somatic pain is one of the leading causes of postoperative pain in gynecologic surgery, and blocking lumbar plexus by TFP or TAP could also block this pain pathway and reduce the pain after CS; however, drugs may enter the paravertebral space and cause the deeper block, while performing more posterior injection in TFP, may cause the formation of a depot or focus for the local anesthetic in the neuro-fascial plain (22).

This study had limitations, such as lack of a control group receiving a placebo injection, small sample size, and limited timeframe for patients' assessment. To improve the power of results by these blocks, larger studies are recommended using other drugs and doses, and infusion through a catheter insertion with even multicentric larger sample sizes. As TFP has not been performed frequently in previous studies, data are scarce and need further evaluations; thus, the current findings could be useful in this setting.

5.1. Conclusion

Based on the results, there is no difference between TAP and TFP block in pain severity at rest and while coughing, nausea, and vomiting, and satisfaction rate; both methods have proper pain control effect with no method superior to the other one.

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Footnotes

Authors' Contribution: Study concept and design: Poupak Rahimzadeh; acquisition of data: Farnad Imani, Seyed Hamid Reza Faiz; analysis and interpretation of data: Poupak Rahimzadeh, Masoumeh Rahimian Jahromi; drafting of the manuscript: Poupak Rahimzadeh, Masoumeh Rahimian Jahromi, Seyed Hamid Reza Faiz; overview of the manuscript for important intellectual contents: Farnad Imani, Poupak Rahimzadeh; administrative, technical, and material support: Poupak Rahimzadeh; study supervision: Poupak Rahimzadeh.

Conflict of Interests: The authors declare that they had no conflict of interest.

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