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Efficacy of Trans-Abdominis Plane Block in Post Cesarean Delivery Analgesia

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Abstract

Managing pain following cesarean section is challenging. Over recent years, there has been growing interest in regional nerve block techniques with promising results on efficacy, as they reduce postoperative pain and the need of supplemental analgesia, thereby lower the incidence of drug-related side effects. Aims are evaluated the efficiency of the transvers abdominis plane block in pain control in patients undergoing cesarean section. This is a prospective double-blind study which included a total of 70 adult parturients undergoing elective cesarean section. The recruited patients were randomly assigned to two equal groups: those received transvers abdominis plane block with 20 ml 0.25% bupivacaine and those received no block. Visual analogue score was used to assess pain at 2, 4, 6, 8, 12, 18 and 24 h post-operation. Time for rescue analgesia as well as the total amount of tramadol that received by each patient were calculated. In almost all postoperative time points, the mean pain score in transverse abdominis plane group was significantly higher than that of control group. Time to first analgesic administration was prolonged significantly in transverse abdominis plane group (8.46±4.12 hrs) as compared with control group (4.18±2.53 hrs). Mean tramadol requirement for transverse abdominis plane group was 154.8±61.13 mg and compared with 268.16±92.53 mg for control group, with a significant difference. The operative time correlated significantly with time for rescue analgesia and tramadol requirement. Transverse abdominis plane block could be an effective method in providing analgesia with a substantial reduction in pain score and tramadol requirement during the first 48 hrs after cesarean section when used as adjunctive to standard analgesia.

Keywords: Analgesia; Cesarean Section; Transverse Abdominis Plane Block

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Introduction

The World Health Organization (WHO) suggest and that the ideal C-section rate should be less than 15% [1]. Recently, the number of CS increasing and is now the most frequent abdominal surgery performed in the United States [2]. Postoperative pain relief following a CS is extremely important in order to optimize maternal and neonate wellbeing [3]. An analysis of 50523 patients from 105 hospitals questioning pain intensity on the first postoperative day revealed that CS ranked ninth for pain severity among 179 different surgical procedures [4].

Although not considered a major procedure, post-cesarean pain competed with orthopedic/trauma surgeries for highest pain scores. Further, 'worst pain intensity' and 'pain at mobilization' were significantly higher after CS compared with three types of hysterectomy. At least 10.9% of women experience severe pain within 24 h after CS [5].

Effective postoperative analgesia is critical, because women who undergo cesarean delivery rank avoidance of pain during and after surgery as their highest priority. Management of post-cesarean pain may have lasting effects, and severe acute postoperative pain is associated with persistent pain, greater opioid use, delayed functional recovery, and increased postpartum depression [6].

Intrathecal morphine is the gold standard single-shot drug for post-cesarean pain, providing long-lasting analgesia for 14 to 36 hours [7]. Although most elective cesarean deliveries in the United States are performed with spinal anesthesia [8]. Neuraxial clonidine may improve post-cesarean analgesia when used as an adjunct to local anesthetics and opioids, but it is associated with hypotension and sedation [9]. Although more commonly used in the management of chronic pain, gabapentin has an analgesic and opioid-sparing effect in the acute postoperative period [10]. Ketamine has analgesic and opioid-sparing effects in the first 24 hrs after non-obstetric surgery and cesarean delivery with general anesthesia [11]. Oxycodone, hydrocodone, and tramadol are oral opioids commonly used in the cesarean delivery setting [12].

Wound infiltration of local anesthetics is a commonly used method of supplemental analgesia for abdominal surgery [13]. Women who undergo cesarean delivery with general anesthesia may benefit from local anesthetics delivered via wound infiltration or TAP block. However, in patients who receive spinal anesthesia and neuraxial opioids, the benefit of single-dose local anesthetic wound infiltration is minimal. Single-dose local anesthetic wound infiltration at the time of surgery is unlikely to last beyond the duration of the neuraxial block, affect only somatic (not visceral) pain, and has variable efficacy [14].

Catheter-based local anesthetic instillation has been suggested as an alternative to single-dose infiltration. Continuous wound instillation of local anesthetic reduces pain scores, opioid use, and opioid-related nausea and vomiting for up to 48 hours postoperatively [15].

In patients who undergo general anesthesia or spinal anesthesia without intrathecal or epidural morphine, TAP blocks can significantly improve postoperative pain and reduce opioid consumption. TAP blocks have been found to provide similar analgesia after cesarean delivery compared with continuous wound site local anesthetic instillation. The duration of sensory blockade for single-shot TAP block is limited to 6 to 12 hrs, with a mean analgesic effect of 9.5 hours (8.5-11.9 hrs) [16]. TAP blocks have been used effectively for rescue analgesia in the post-anesthesia care unit for patients with severe postoperative incisional pain who are not responding to routine analgesics and rescue opioids [17]. The addition of sufentanil to TAP block has been shown to decrease opioid requirements after cesarean delivery, fentanyl added to TAP block did not provide additional analgesia compared with systemic administration of the same dose. These conflicting results suggest that systemic absorption may account for the improved analgesia when opioids are added to local anesthetics for transabdominis plane (TAP) block [18].

Patients and Methods

Setting and Design

A prospective double-blind study was conducted at the Department of Surgery/ Baghdad Medical City during the period from April 2018 to August 2019. It included a total of 70 adult parturients belonging to American Society of Anesthesiologists physical status (ASA) I and II requiring elective CS via Pfannenstiel incision.

Inclusion criteria: All parturient undergoing elective CS under spinal anesthesia.

Exclusion criteria:

1. The presence blood coagulation pathologies.
2. Allergies to local anesthetics.
3. Patients of >100 kg weight.
4. Had contraindications to spinal anesthesia.
5. Required general anesthesia for the surgery.
6. ASA ≥ III.

Ethical Consideration

A written consent from each participant was obtained prior to data collection after explaining the aim of study. The study was approved by the Iraqi Council of Medical Specializations.

Spinal Anesthesia

In the operating room, all patients were monitored by non-invasive arterial blood pressure, electrocardiogram and peripheral pulse oximetry. Spinal anesthesia was induced by a needle through-needle (27G pencil-point spinal needle) at L3/4 interspace in the sitting position. After an injection of intrathecal hyperbaric bupivacaine 12 mg and fentanyl 10 mg.

Study Groups

The recruited patients were randomly assigned to two groups on the basis of an opaque envelop, which was opened just before cesarean section:

1. Patients received TAP block with 20 ml 0.25% bupivacaine (35 women).
2. Patients received no block (35 women).

TAP Block

After preparing the skin with an antiseptic solution, a convex 3.5 MHz ultrasound probe (Pro Sound Series SSD6500, Aloka) was placed transversally on the anterior axillary line halfway between the costal margin and the iliac crest and moved toward the navel to identify three layers of muscles (external and internal oblique muscles, and transversus abdominis muscle), the peritoneum, and intraperitoneal structures». «A 22G, 100 mm echo-lucent needle (Sonolect Needle, Hakko) was inserted posteriorly through the skin into the transversus abdominis fascial plane under real-time ultrasound guidance.»The correct position of the block needle was confirmed by direct ultrasound in-plane visualization and distention of the transversus abdominis fascial plane by injecting 1-2 mL of a test solution (5% glucose).»Twenty milliliters of 0.25% bupivacaine was injected into the fascial plane on each side in 5 mL increments after aspiration.

Assessment of Pain Severity

Pain severity was assessed by an investigator blinded to the groups every 2, 4, 6, 8, 12, 18 and 24 hrs. It was measured using visual analogue score (VAS) (0 = no pain and 10 = worst possible pain). Rescue analgesia was given to patients on demand or when VAS was more than 4 in the form of IV tramadol 2 mg/kg. The time for rescue analgesia as well as the total amount of tramadol that received by each patient were calculated.

Data Analysis

Data collected for each patient included demographic characteristics, gestational age, parity and method of skin incision. Associations between variables were assessed by Pearson's Chi square test/Fisher's exact test. Student t-test was used to compare means between TAP group and controls. Pearson's correlation was used to explore the possible correlations between operative time and other variables in control and TAP groups. Statistical significance was set at $p<0.05$. All statistical analyses were performed using SPSS statistical software, version 24 (IBM Corporation, USA).

Results

Demographic and Clinical Characteristics

Mean age of the parturients TAP group was 28.33±6.3 years which was very close to that of control group (29.6±6.6 years) with no significant difference. Likewise, there was no significant difference between the two groups in BMI or gestational age. Although the duration of surgery was longer in TAP group than control group (58.3±13.7 min versus 54.92±11.84 min), the difference was not a significant (Table 1). The Two groups were comparable regarding the distribution of ASA status with no significant difference (Table 1).

Visual Analogue Scale

At baseline, the VAS value was zero in both groups. However, 2

Table 1: Demographic and clinical characteristics of the patients.

Variables	TAP group (n=35)	Control group (n=35)	p-value
Age, years			0.596
Mean±SD	28.33±6.3	29.6±6.6	
Range	18-34	17-38	
BMI, kg/m²			0.442
Mean±SD	26.3±5.1	27.6±6.1	
Range	22.7-34.8	23.1-36.2	
Gestational age, weeks			
Mean±SD	39.3±1.2	39.3±1.1	0.912
Range	38-40	38-40	
Operative time, min			
Mean±SD	58.3±13.7	54.28±11.78	0.418
Range	35-85	35-80	
ASA			
I	19(54.29%)	21(60%)	0.629
II	16(45.71%)	14(40%)	

Table 2: Comparison of visual analogue score between TAP Group and Control group.

VAS	TAP group (n=35)	Control group (n=35)	p-value
Baseline	0.0	0.0	1.0
2 hrs postop	0.91±0.24	2.43±0.26	**0.023**
4 hrs postop	1.32±0.31	3.17±0.34	**0.004**
6 hrs postop	2.11±0.33	2.66±0.42	0.126
8 hrs postop	2.53±0.28	2.92±0.31	0.074
12 hrs postop	2.72±0.32	3.28±0.3	**0.049**
18 hrs postop	2.82±0.22	3.46±0.42	**0.035**
24 hrs postop	3.24±0.34	3.93±0.45	**0.044**

hrs, and 4 hrs post operation, the mean VAS score in TAP group were 0.91±0.24 and 1.32±0.31, respectively, which were significantly higher than that of control group (2.43±0.26 and 3.17±0.34, respectively). Although the mean VAS score from 6 and 8 hrs post operation remained in TAP group continued to be lower than control group, the differences were not significant. In contrast, during the remaining time (12 to 24 hrs post operation), TAP group demonstrated significantly lower VAS score than control group (Table 2) (Figure 1).

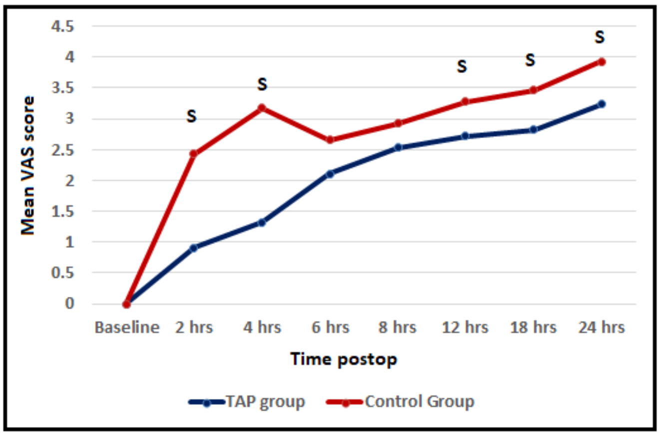

Figure 1: Comparison of visual analogue score between TAP Group and Control group.

Time for Rescue Analgesia

Time to first analgesic administration (tramadol) was prolonged significantly in TAP group (8.46±4.12 hrs) as compared with control group C (4.18±2.53 hrs) as shown in Figure 2.

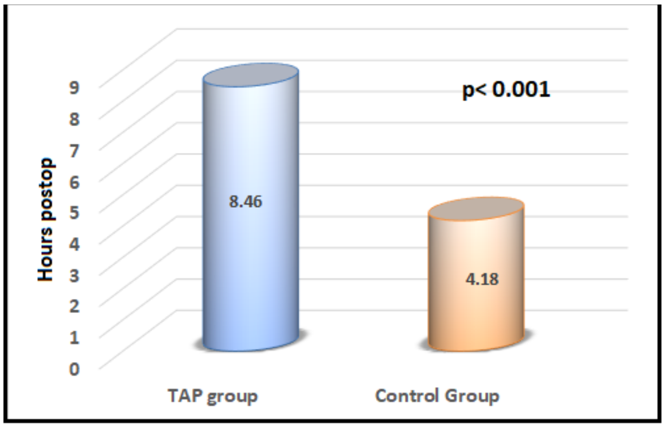

Figure 2: Time for rescue analgesia in hours in TAP Group and Control group.

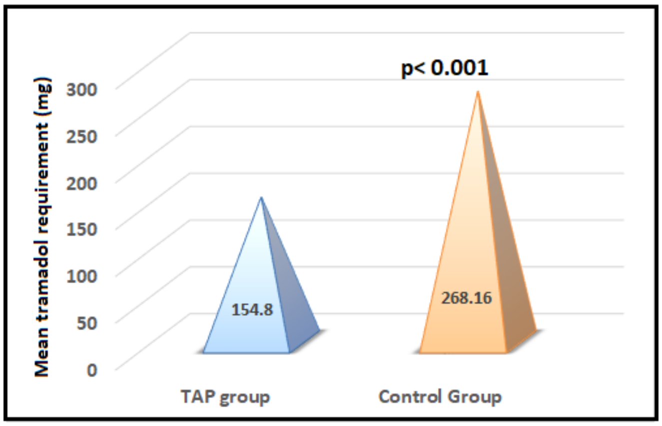

Figure 3: Mean tramadol requirement in milligrams in the first 24 hrs after caesarean delivery.

Mean Tramadol Requirements

In patients receiving TAP block, the requirement for analgesic during the first 24 hrs postop was significantly reduced as compared with control group. Mean tramadol requirement for TAP group was 154.8±61.13 mg and for the control group was 268.16±92.53 mg as shown in Figure 3.

Correlation between Operative Time with other Variables

Pearson's correlation was used to explore the possible correlation between operative time and each of VAS score, time for rescue analgesia and mean tramadol requirement in TAP group and control group. In control group, operative time demonstrated a positive significant correlation with e tramadol requirement (r= 0.341, p= 0.045). In TAP group, operative time had a negative significant correlation with the time for rescue analgesia (r=- 0.338, p= 0.047) and positive correlation with tramadol requirement (r= 0.387, p= 0.022) as shown in Table 3, Figure 4 to Figure 6.

Table 3: Person's correlation between operative time and other variables.

Variable	TAP group		Control group	
	r	p-value	r	p-value
Age	0.177	0.275	-0.008	0.960
Body mass index	0.191	0.239	0.151	0.351
Gestational age	0.014	0.933	-0.188	0.246
VAS at 2 hrs postop	0.243	0.130	0.180	0.254
VAS at 4 hrs postop	0.154	0.344	-0.198	0.220
VAS at 6 hrs postop	0.121	0.458	0.001	0.997
VAS at 8 hrs postop	0.175	0.281	-0.019	0.907
VAS at 12 hrs postop	0.156	0.337	-0.102	0.467
VAS at 18 hrs postop	0.019	0.907	0.072	0.660
VAS at 24 hrs postop	0.035	0.832	0.154	0.344
Time for rescue analgesia	**-0.377**	**0.025**	-0.242	0.129
Tramadol requirement	**0.387**	**0.022**	**0.341**	**0.045**

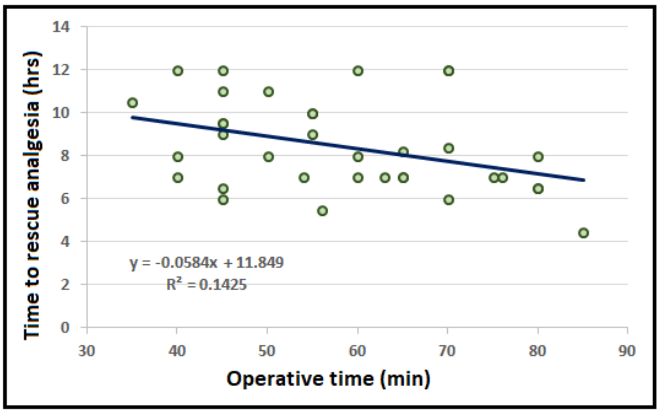

Figure 4: Regression line between operative time and time to rescue analgesia in TAP group.

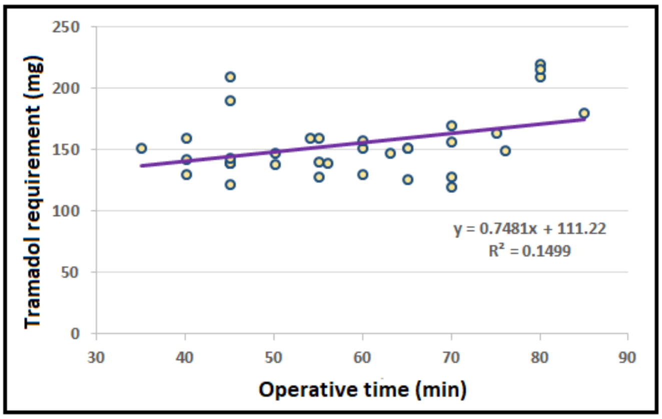

Figure 5: Regression line between operative time and tramadol requirement in TAP group.

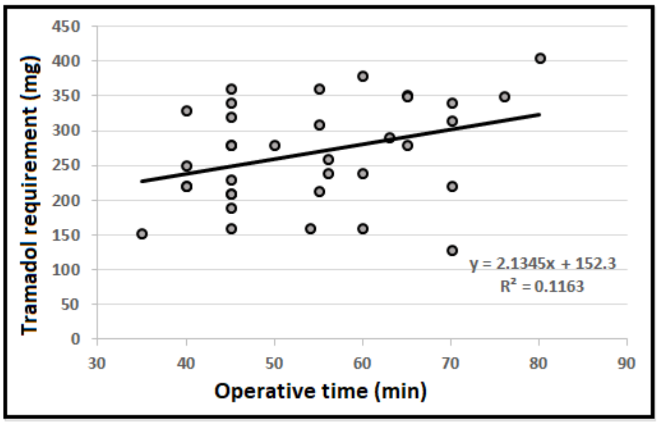

Figure 6: Regression line between operative time and tramadol requirement in control group.

Discussion

The present study aimed to evaluated the efficiency of the transversus abdominis plane block in pain control in patients undergoing cesarean section. Patients in TAP and control group were comparable in demographic and operative data. Therefore, the variation in pain score or need for analgesia could be attributed to TAP intervention. The most interesting finding in the present study was that in most time period post operation (from 2 hrs to 24 hrs), patients in TAP group demonstrated a significantly lower VAS score than their counterparts in control group. Such a result is in complete accordance with many previous studies.

In a similar study by Srivastava U, et al. (2015) [19], the efficacy of TAP block in 62 Indian women undergoing CS. Those women were randomized in a double-blind manner to receive either bilateral TAP block at the end of surgery with 20 ml of 0.25% bupivacaine or no TAP block.»VAS score was assessed at 0, 4, 8, 12, 24, 36, and 48 h after surgery Pain scores were lower at each time point for 24 h in study group (P < 0.001). McDonnell JG, et al. (2008) [20], randomized 50 parturient to receive TAP block with either ropivacaine or placebo at the end of CS under spinal anesthesia in addition to standard postoperative analgesia. A significant reduction in 48 h postoperative pain scores was observed in TAP group.» Similarly, Eslamian L, et al. (2012) [21] and Tan TT, et al. (2012) [22], evaluated efficacy of TAP block versus no block in patients undergoing CS under general anesthesia. Patients in TAP group had lower VAS pain scores than the patients who did not receive block.

A systematic review and meta-analysis [23] reviewed five randomized double-blind studies including 312 parturients receiving TAP block for management of pain after CS. «Out of five, two studies [24,25] used intrathecal morphine along with bupivacaine for spinal anesthesia while others used plain bupivacaine [20,26 and 27]. «Accordingly, the meta-analysis concluded that TAP block was effective in reducing pain scores for 24 h compared to the placebo group».

Mankikar MG, et al. (2016) [28], evaluated analgesic efficacy of TAP block with ropivacaine in 60 parturient women undergoing CS. The patients were allocated into two groups: TAP block with ropivacaine versus control group (n = 30) with normal saline, in addition to standard analgesia with intravenous paracetamol and tramadol.»At the end of the surgery, ultrasound-guided TAP plane block was given bilaterally using ropivacaine or normal saline. There was a significant reduction in VAS score in TAP group compared with compared with control almost in all time points [28].

In contrast, McMorrow RC, et al. (2011) [28], found in their study that spinal morphine (but not TAP block) improved analgesia after the cesarean section. The addition of TAP block with bupivacaine to spinal morphine did not further improve analgesia. Furthermore, many studies indicated that TAP block was effective only when used as the sole analgesic technique. When TAP block and intrathecal morphine were compared, TAP block was shown to be less effective as pain relief but has fewer side-effects [29,30].

These variations between different studies can be attributed to the variation in the choice of local anesthetic and the TAP techniques.

The other most interesting finding in the present study was that time to first analgesic administration (tramadol) was prolonged significantly in TAP group (8.46± 4.12 hrs) as compared with control group C (4.18±2.53 hrs). In accordance with these results are many studies that evaluated efficacy of TAP block versus no block in patients undergoing CS under general anesthesia. Patients in TAP group showed significantly longer time for seeking the first analgesia than those in control group [21,22]. Similarly, in Mankikar MG, et al. (2016) [28] study, time for rescue analgesia in the TAP group was 9.53 hrs compared to 4.1 hrs in control group (P = 0.01631).

Onishi Y, et al. (2013) [31], compared TAP block with epidural anesthesia at 94 patients who had CS with combined spinal-epidural anesthesia. «The median time to the first morphine request was significantly longer in TAP group (555 min) than patients in epidural anesthesia (215 min).

According to the present study, the cumulative amount requested for tramadol during the first 24 hrs in TAP group was 154.8±61.13 mg and for the control group was 268.16± 92.53 mg, with a significant difference. In accordance with this result is a recent randomized, double-blinded controlled trial conducted by Buluc H, et al. (2019) [32], in which the authors compared the analgesic efficacy of the TAP block after CS in a total of 30 Turkish patients who were randomized into two groups: TAP group where TAP block with USG guidance was performed using 0.25% bupivacaine, and controls whom were administered 0.9% NaCl totally 60 ml with USG guidance. «The study revealed that the total dose of meperidine that was used for post-operative analgesia was higher in control group than TAP group (P=0.001). In the study of Srivastava U, et al. (2015) [19], the use of tramadol was reduced in patients given TAP block by 50% compared to patients given no block during 48 h after surgery (P<0.001). A study using USG-guided TAP block with 0.5% ropivacaine after caesarean section [26] was associated with reduction in total morphine use in 24 h in the active group (median 18 mg) compared with the placebo group (median 31.5 mg). Almost similar results were obtained by different studies worldwide [20,33 and 34].»Over the past decade, the TAP block has emerged as a reliable tool of multimodal analgesia. TAP blocks display rapid first phase absorption kinetics and can lead to elevated plasmatic concentrations of total and unbound fractions of local anesthetic [35].»Compared with other truncal blocks (e.g., rectus sheath block), transversus abdominis plane blocks may result in a 50% shorter time to maximum serum concentration of anesthetic. This is because of large, highly vascularized absorptive surface area [36]. Furthermore, accidental intramuscular injection (inside the internal oblique or transversus abdominis muscle) could lead to even faster local anesthetic uptake [37]. All these factors explain the beneficial effect of TAP in reducing the VAS score, prolonging the time for rescue analgesia and reducing the required number of postoperative analgesics.

In the present study, operative time was significantly correlated with time for rescue anesthesia, tramadol requirement, but not with VAS score. This in agreement with a recent study performed by Rapoport Y, et al. (2017) [38], on 330 patients undergoing cataract surgeries. The authors demonstrated that operative time was not associated with increased pain score, irrespective of anesthesia type. On the other hand, longer operations require more sedation and request faster rescue of analgesia which explains the positive correlation between operative time and each of time for rescue anesthesia and tramadol requirement in the present study.

Conclusions

Transverse abdominis plane block with 0.25% bupivacaine could be an effective method to reduce pain in patients undergoing CS. Transverse abdominis plane block can also reduce the tramadol requirement and prolong the time for rescue analgesia during the first 48 hrs after CS when used as adjunctive to standard analgesia. Increase operative time does not associate with increased pain score; however, it can increase the tramadol requirement and reduce the time for rescue analgesia. Ultrasound-guided transverse abdominis plane block has could be an important tool in managing postoperative pain of cesarean delivery as it is easy to perform, is safe and has definite clinical utility.

Declaration of Competing Interest

None.

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None.

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None.

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