Original Article

Transversus Abdominis Plane Block versus Intravenous Patient Controlled Analgesia for Postoperative Pain Relief in Cesarean Section

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ABSTRACT

Objectives: This work aimed to contrast two methods (TAP block and PCA) for postoperative analgesia following caesarean section (CS).

Study Design: Prospective Randomized Work.

Patients and Methods: This Prospective Randomized work was performed on 100 participants aged from 19 to 40 years old, female, singleton pregnancies undergoing elective caesarean delivery utilizing spinal anesthesia undergoing elective CS. Participants had been divided randomly into two equal groups: Group 1: underwent TAP block and Group 2: used controlled analgesia.

Results: Time till the first demand for analgesics had been substantially prolonged in group I contrasted to group II (P <0.001). Total ketorolac Tromethamine dose in 1st 24 hours postoperative was substantially decreased in group I contrasted to group II (P <0.001). Visual analogue scale (VAS) score measurements were substantially reduced at 2h, 4h and 8h in group I contrasted to group II (P<0.05). satisfaction of patient was substantially greater in group I contrasted to group II (P =0.004). Postoperative vomiting and nausea were substantially lower in group I contrasted to group II (P =0.001). Respiratory depression was insignificant different between both groups.

Conclusion: TAP block was found to produce better analgesic effects and less analgesic consumption compared to PCA in patients undergoing CS delivery. TAP block was also associated with better patient's satisfaction and less occurrence of complications.

Key Words: Caesarean section, pain relief, patient-controlled analgesia, transversus abdominis plane block, VAS.

Received: 10 August 2024, **Accepted:** 12 March 2025

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ISSN: 2090-7265, 2025, Vol. 15

INTRODUCTION

Effective pain management following surgery is crucial in order to avoid potential consequences such as breathing problems, thromboembolism in the veins, and prolonged hospitalizations. Postoperative discomfort and pain are anticipated following a caesarean section (CS); thus, the analgesic protocol should provide effective and secure pain relief. Opioids are frequently utilized to provide pain management after a CS. Although the most troubling side effect is respiratory depression, which varies depending on the dosage, there are other less significant side effects that include pruritus, itchiness, gastrointestinal disturbance, and urine retention that may be troublesome throughout the initial puerperium[1]. Effective analgesia after CS is critical to allow for mother-child bonding, early postoperative ambulation and discharge, resulting in greater patient satisfaction. Use of regional anesthesia for CS has provided an option for rendering post-operative analgesia with neuraxial opioids. Also, it is associated with a decline in anesthesia-related maternal morbidity[2].

Common approaches for managing pain following a CS often include the continuous delivery of analgesics via spinal or epidural routes, as well as the utilization of opioid analgesics administered by subcutaneous, intramuscular, or intravenous routes, continues wound infiltration, ketamine and non-steroid anti-inflammatory drugs[3].

Since 1976, the utilization of intravenous patient-controlled analgesia (IV-PCA) in obstetrics has been extensively employed[4]. PCA is a method that allows patients to deliver analgesics to themselves intravenously utilizing a computerized pump, that delivers precise dosages via an intravenous line. The objective of PCA is to enhance pain management. Conventional PCA employs regular administration of lesser amounts of analgesic medications, ensuring consistent levels of drug in the

DOI:10.21608/EBWHJ.2024.310647.1346

bloodstream. According to reports, it offers improved pain management while using less medication, resulting in higher satisfaction among patients, fewer hospitalizations, and less negative effects on the respiratory system[5].

In recent times, a technique called peripheral nerve blockage has been utilized to efficiently manage postoperative pain[6,7].

A transversus abdominus plane (TAP) block is performed to anesthetize the sensory nerves of the front part of the abdominal wall, which helps in reducing discomfort following procedures in the lower abdomen[8,9].

The utilization of ultrasonography-guided nerve block has notably risen, with ultrasound guidance providing the benefit of direct view of the needle and the anatomical structures. Consequently, real-time images may be seen throughout the process, allowing for more precise and quick injection of medicines into the target region compared to blindly inhibiting peripheral nerves using a nerve stimulator. In the end, this improves the safety and effectiveness of the process[10].

This study aimed to contrast two techniques (TAP block and PCA) for postoperative analgesic following CS.

PATIENTS AND METHODS

This prospective randomized work was performed on 100 participants aged from 19 to 40 years old, female, singleton pregnancies undergoing elective CS utilizing spinal anaesthesia undergoing elective CS. The work was performed from April 2022 to July 2023 following permission from the Ethics Committee Tanta University Hospitals, Tanta, Egypt. All participants provided a well-informed written consent.

Criteria for exclusion were history of opioid addiction, hypersensitivity to any of the drugs that were used [morphine, bupivacaine, non-steroidal anti-inflammatory drugs (NSAIDs), ampicillin sulbactam and gentamicin], morbid obesity, substantial cardiovascular, renal, or hepatic disorders, chronic use of NSAIDS or central nervous system (CNS) depressant as antiepileptic and patient with mental or physical conditions that might vaguely measuring postoperative pain after surgeries.

Randomization

Participants were divided by closed envelope into two equal groups at random: Group 1: underwent TAP block and Group 2: used controlled analgesia.

Each participant had been exposed to history taking, physical examinations, laboratory tests (full blood picture (CBC), random blood sugar, C-reactive protein (CRP), liver function enzymes (SGOT, SGPT) and renal function tests [Urea and Creatinine)), maternal characteristics including weight and parity, making patients familiar with VAS (0:no pain to 10: intensive pain)[11].

The consultant anesthesiologist administered spinal anaesthesia to all female patients prior to their surgeries. Every woman had a straightforward CS procedure with little blood loss, which was less than 500 ml[8]. Following the monitoring of each participant, pulse oximetry, non-invasive blood pressure, and electrocardiogram (ECG). They received spinal anaesthesia with 12.5 mg of hyperbaric bupivacaine 0.5% at the level of L2-L3 under complete aseptic conditions. The caesarean delivery procedure was same in all selected women. At the end of the operation, the participating parturient had been enrolled in one of two equal groups at random (n= 50 patients /group):[9].

Group (1)

Participants are introduced to a TAP block via US-guidance with only one injection, while following aseptic measures. The needle had been inserted into the plane of the ultrasonic probe, right underneath it, and then progressed till it reached the plane between the transversus abdominis and internal oblique muscles. The probe was guided along the needle entrance location to prevent injections into the peritoneal cavity, muscles, or veins. Prior to injections, aspiration is performed to verify the correct placement of all LA. Following achieving the plane, a 2 ml saline injection had been introduced to verify the accurate needle placement [hydro-dissection], followed by an injection of 20 ml Bupivacaine at a concentration of 0.25.

Group (2)

An elastomeric PCA pump single usage with 100 ml capacity morphine 1mg/ml was utilized. loading dose of intravenous morphine 0.1mg/kg was introduced immediately after surgery with basal continuous infusion 1mg/h with a button utilized to offer a further morphine bolus dosage of 1 mg (1mg/ml) as required with a lockout time of 15 min.[12].

Postoperative pain evaluation was evaluated by VAS where zero means no pain and ten means severe pain. Pain was assessed in words 2, 4, 6, 8, 12, and 24 hours after surgeries. Postoperative analgesia was given according to VAS. Patients with VAS ≤4 was given IV paracetamol 1g with 1g every 6 hours if the VAS≥4 patients received IV morphine 0.05mg/kg and was recorded.

Postoperative follow-up

The women were assessed at certain time intervals: 2 hours (following the spinal anaesthesia), 4, 6, 12, and 24 hours following the surgeries. The collected data include vomiting, nausea, pain score, respiration rate, heart rate,

uterine contractility measured by fundal level, motility of intestines, time taken to initiate mobilization, and require for more analgesics. The maternal pain score was assessed and recorded in the patients' medical records at the maternity ward. VAS was utilized. The discomfort was assessed at 2, 4, 6, 12, and 24 hours following the procedure. The pain scale varied from 0, indicating no pain, to 10, representing the most severe suffering one can imagine[13].

Sample Size Calculation

The sample size and power analysis were computed utilizing the Epi-Info software statistical program developed by the World Health Organization and the Centers for Disease Control and Prevention, based in Atlanta, Georgia, USA. The specific version used was 2002. The criteria utilized in calculating the sample size were as the following: (At least 45 participants had been needed to detect a 20% difference in the pain score among groups, 0.05 error, 80% Power of study). 50 participants had been enrolled in each group to avoid dropout cases.

Statistical analysis

The statistical analysis had been conducted utilizing SPSS v27 (IBM©, Armonk, NY, USA). The normality of the data distribution was evaluated utilizing the Shapiro-Wilks test and histograms. The quantitative parameters were displayed as the mean and standard deviation (SD) and analysed utilizing an unpaired Student's t-test. The quantitative non-parametric data were reported using the median and interquartile range (IQR) and analysed utilizing the Mann Whitney-test. The qualitative parameters have been displayed as frequencies and percentages (%) and analysed utilising the Chi-square test or Fisher's exact test, as appropriate. A two-tailed *P value* <0.05 was considered.

RESULTS

A total of 108 individuals were evaluated for their eligibility in this research, out of which 8 patients declined to participate. The remaining individuals were assigned to two groups equally at random, with 50 participants in each group. Statistical analysis was conducted on all selected participants throughout the follow-up period (Figure 1).

Participant characteristics and duration of the surgery had been insignificantly various among the two groups (Table 1).

Postoperative HR measurements were significantly lower at 2h, 4h and 8h in group I contrasted to group II (P<0.05) and were insignificantly different at 6h, 12h and 24h between both groups. Postoperative MAP measurements were significantly lower at 2h, 4h and 8h in group I contrasted to group II (P <0.05) and were insignificantly different at 6h, 12h and 24h between both groups (Figure 2).

VAS score measures were significantly lower at 2h, 4h and 8h in group I contrasted to group II (*P value* <0.05) and were insignificantly different at 6h, 12h and 24h among the two groups (Table 2).

Time till the first demand for analgesics had been substantially prolonged in group I contrasted to group II (P <0.001). Total ketorolac Tromethamine dose in 1st 24 hours postoperative was substantially reduced in group I contrasted to group II (P <0.001) (Table 3).

Patient satisfaction had been substantially greater in group I contrasted to group II (P =0.004). Postoperative vomiting and nausea were substantially lower in group I contrasted to group II (P =0.001). Respiratory depression was insignificant various among the two groups (Table 4).

Table 1: Patient characteristics and duration of the surgeries of the groups under the study

		Group I (n=50)	Group II (n=50)	*P*
Age (years)		30.8 ± 6.24	29.2 ± 5.59	0.180
Weight (Kg)		73 ± 8.78	75 ± 9.43	0.270
Height (cm)		162.8 ± 4.87	164.6 ± 5.87	0.102
BMI (Kg/m^2)		27.6 ± 3.76	27.8 ± 4.24	0.799
ASA physical status	I	45 (90%)	44 (88%)	0.749
	II	5 (10%)	6 (12%)	
Gravidity	1	7 (14%)	7 (14%)	0.300
	2	15 (30%)	8 (16%)	
	3	16 (32%)	17 (34%)	
	4	9 (18%)	15 (30%)	
Parity	1	20 (40%)	22 (44%)	0.599
	2	18 (36%)	18 (36%)	
	3	12 (24%)	10 (20%)	
Duration of the surgery (min)		67.8 ± 14.04	66.1 ± 14.19	0.548

Data are displayed as mean ± SD or frequency (%). BMI: Body mass index, ASA: American society of anesthesiologists.

Table 2: VAS score measurements of the studied groups

	Group I (*n*=50)	**Group II (*n*=50)**	***P***
2h	0 (0 - 1)	1 (0 - 4)	0.002*
4h	1 (0.25 - 4)	2 (2 - 4)	0.010*
6h	2 (1 - 4.75)	2 (1 - 3)	0.742
8h	2 (1 - 3)	3 (2 - 4)	0.002*
12h	3 (2 - 4)	3 (2 - 4)	0.171
24h	3 (2 - 4)	4 (2 - 4)	0.382

Data are presented as median (IQR). *: Significant as $P \leq 0.05$, VAS: Visual analog scale.

Table 3: Time till the first demand for analgesics and total ketorolac Tromethamine dose in 1st 24 hours postoperative of the studied groups

	Group I (*n*=50)	**Group II (*n*=50)**	*P*
Time to first analgesic request (h)	6.1 ± 2.3	3.7 ± 1.48	<0.001*
Total ketorolac Tromethamine dose in 1st 24 h postoperative (mg)	30 ± 14.55	73.8 ± 25.86	<0.001*

Data are presented as mean ± SD. *: Significant as *P value*≤0.05.

Table 4: Patient satisfaction and adverse events of the studied groups

	Group I (*n*=50)	**Group II (*n*=50)**	*P*
Patient satisfaction	45 (90%)	33 (66%)	0.004*
Adverse events			
Postoperative nausea and vomiting	5 (10%)	20 (40%)	0.001*
Respiratory depression	0 (0%)	3 (6%)	0.079

Data are displayed as frequency (%). *: Significant as *P value* ≤0.05.

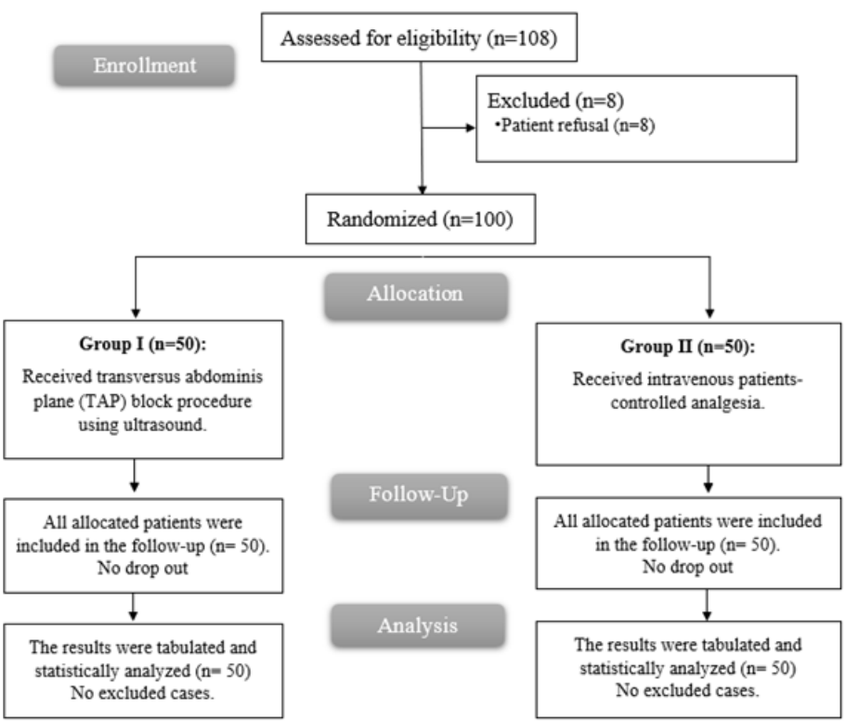

Fig. 1: CONSORT flow diagram of the patients through all stages of the trial

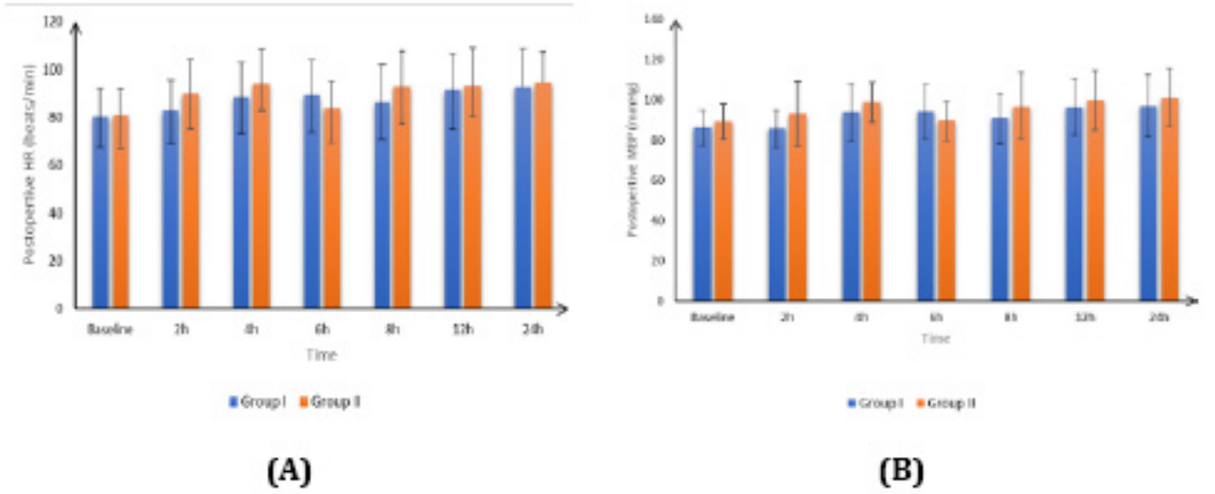

Fig. 2: Postoperative (A) heart rate (beats/min) and (B) mean arterial blood pressure (mmHg) measurements of the studied groups

DISCUSSION

The prevalence of caesarean deliveries has reportedly substantially increased recently, particularly in Egypt[14]. This increase is accompanied by an increase in awareness of women aout the need for pain-free procedures both throughout and following the surgery. PCA is additionally recommended as a viable option for women experiencing labor. Contractional pain can be effectively managed and reduced, especially when it is aggravated by the usage of induction medications like oxytocin[15].

Our study reported that Postoperative HR measurements were significantly lower at 2h, 4h and 8h in group I contrasted to group II (P <0.05) and were insignificantly different at 6h, 12h and 24h between both groups. In a similar manner to our research, Salem *et al*.[16] conducted a work to directly assess the effectiveness of US-assisted TAP block and IV PCA in the first 24 hours following CS surgeries. This research is a cross-sectional analysis that has been carried out on a cohort of 70 women who are scheduled to have elective CS. The participants were categorized into two groups: "group A" (n=35), consisting of those who underwent TAP block, and "group B" (n=35), consisting of those who obtained PCA. The pain score, respiration rate, heart rate, motility of the intestines, vomiting, and nausea were evaluated at 2, 4, 6, 12, and 24 hours after the surgery. Women in "group B" had a considerably greater heart rate contrasted to those in "group A" at 2 and 4 hours after the operation (P < 0.001). However, no substantial variation existed among the two groups in other time periods (P > 0.05), which is consistent with our results.

In accordance with our research, Abouhi *et al*.[15] found that no significant variations existed among the study groups in terms of heart rate baseline, at the 5th, 10th, 15th, 20th, 30th, and 40th minutes. Within each group, a notable variation was existed in heart rate as time progressed. In research done by Erbabacan *et al*.[17], the objective was to evaluate the efficiency of USG-assisted TAP block and IV morphine PCA in providing postoperative analgesia during the first 24 hours for individuals following lower abdominal surgeries, which is like our own study. Like our findings, HR was statistically substantially reduced in the TAP group contrasted to the PCA group.

Our work reported that postoperative mean arterial blood pressure measures were significantly lower at 2h, 4h and 8h in group I contrasted to group II (P <0.05) and were insignificantly various at 6h, 12h and 24h between both groups. Different from our findings, Erbabacan *et al*.[17] stated that no statistically substantial variation existed among both groups as regard MAP.

Our study reported that VAS score measurements were significantly lower at 2h, 4h and 8h in group I contrasted to group II (P <0.001) and were insignificantly different at 6h, 12h and 24h between both groups. Similar to our results, Srivastava *et al*.[18] showed that NRS was statistically substantially decreased in the TAP group contrasted to PCA group at all time points. Disagreeing with our findings, Salem *et al*.[16] stated that NRS score was statistically substantially decreased in PCA group contrasted to TAP group at 2h, 4h, 6h, 12h and 24h post-operatively.

Our work reported that the Time till the first demand for analgesics ranged from 4 to 12 h with a mean value (± SD) of 6.12 (±2.3) h in group I and ranged from 2 to 6 h with a mean value (± SD) of 2.8 (±1.07) h in group II. Total morphine dose in 1st 24 h postoperative ranged from 3 to 15 mg with a mean value (± SD) of 6.74 (±2.91) mg in group I and ranged from 12 to 18 mg with a mean value (± SD) of 15.28 (±1.75) mg in group II.

Time till the first demand for analgesics was substantially prolonged in group I contrasted to group II (*P value* <0.001). Total morphine dose in 1st 24 hours postoperative was substantially decreased in group I contrasted to group II (*P* <0.001). Comparable to our results, Srivastava *et al*.[18] reported that the initial tramadol usage during the first 4 hours following surgery was comparable in the two groups. However, it was considerably lower after 8-, 12-, and 24-hours following surgeries in the TAP group contrasted to the PCA group. The total tramadol consumption throughout the first 24 hours following surgeries was considerably lower in the TAP group contrasted to the PCA group (75 ± 22 mg in the TAP group vs. 168 ± 45 mg in the PCA group, *P* < 0.0001). The TAP group exhibited a significant decrease in tramadol intake, with a reduction of roughly 50% contrasted to the PCA group in the first 48 hours (127 ± 24 mg in the TAP group vs. 253 ± 52 mg in the PCA group, *P* < 0.0001). Contrary to the results of Abouhi *et al*.[15], it was found that substantial statistical variations were observed among the research groups as regard the time it took for the initial analgesia. The TAP block group experienced a shorter duration (mean of 4.785 hours) compared to the PCA group (8.5 hours). Statistically substantial variations were seen across the studied groups in terms of the frequency of individuals requiring rescue analgesia. The percentage of individuals requiring analgesia was 22% in the TAP block group, compared to 14% in the PCA group.

Our study showed that patient satisfaction was substantially greater in group I contrasted to group II (*P* =0.004). Similar to our findings, Srivastava *et al*.[18] reported that satisfaction was statistically substantially higher in the TAP group contrasted to the PCA group.

Our work reported that postoperative nausea and vomiting occurred in 5 (10%) participants in group I and 20 (40%) participants in group II. Postoperative vomiting and nausea were substantially decreased in group I contrasted to group II (*P*=0.001). Respiratory depression and LAST did not occur in any patient in group I and group II. Similar to our findings, Salem *et al*.[16] reported that vomiting and nausea were statistically substantial greater in the PCA group contrasted to the TAP group. Similar to our findings, Abouhi *et al*.[15] reported that vomiting and nausea were statistically substantially greater in PCA group contrasted to TAP group.

Limitations of this work include that the work was performed at a single center. No placebo group was used. No investigation of different drugs or different doe.

CONCLUSION

TAP block was found to produce better analgesic effects and less analgesic consumption compared to PCA in patients undergoing CS delivery. TAP block was also associated with better patient satisfaction and less occurrence of complications.

INFORMED CONSENT

Written informed consent was obtained from all participants for participation, photography, and research publishing

CONFLICT OF INTERESTS

There are no conflicts of interest.

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