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Clinical Comparative Study Between Subcutaneous Continuous Analgesia Versus Continuous Transversus Abdominis Plane Block Post Cesarean Section

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ABSTRACT

Background: A Cesarean section (CS) involves making an incision in the uterus and an open abdominal incision to deliver the fetus. Reduced surgical stress response, more patient satisfaction, and better results are all facilitated by effective postoperative analgesia. The transversus abdominis plane (TAP) block provides for sensory blockage of the lower abdominal wall by depositing local anesthetic between the internal oblique and transverse abdominis.

Objective: This study aimed to compare subcutaneous continuous analgesia (CSA) with continuous TAP block after Caesarean section delivery.

Patients and methods: A clinical trial study was conducted on 100 patients according to the American Society of Anesthesiologists (ASA) physical status I or II in The Obstetrics and Gynecology Department in Shebin El-Kom Teaching Hospital & Menoufia University Hospital during the study period from March 2023 to June 2024.

Results: There was no significant difference between the studied groups regarding ASA I and ASA II (P>0.05). There was no significant difference among the studied groups regarding VAS at movement after 2 hrs, (P > 0.05). VAS at movement after 4 hrs was significantly higher among continuous wound infiltration (2.38 ± 1.41) than continuous bilateral transversus abdominis plane (1.27 ± 0.79), (P < 0.05). VAS at movement after 8 hrs was significantly higher among continuous wound infiltration (2.92±1.58) than continuous bilateral transversus abdominis plane (2.04 ±1.57), (P<0.05). Nausea was significantly more common among continuous wound infiltration (n=12, 24.0%) than in continuous bilateral transversus abdominis plane. Nausea and itching and vomiting were significantly common among continuous bilateral TAP.

Conclusion: The TAP block, with its ability to deliver targeted regional analgesia, demonstrated superior outcomes in terms of prolonged pain relief, reduced systemic side effects, and enhanced patient mobility during the post-operative period. The technique was associated with fewer complications and was particularly effective in reducing opioid consumption compared to CSA.

Keywords: CSA, TAP block, CS.

INTRODUCTION

CS is a fetal birth that involves an open abdominal incision (Laparotomy) and a uterine incision (Hysterotomy). The first reported CS happened in 1020 AD, and since then, the practice has developed dramatically [(1)]. CS is one of the most often performed surgical procedures in the world. Post-operative discomfort affects both the mother and the infant, particularly in the first 48 hours following birth. The discomfort might be unexpected, affecting mother-child bonding [(2)].

Reduced surgical stress response, increased patient satisfaction, and improved results are all facilitated by effective postoperative analgesia. According to WHO, 80% of individuals globally do not obtain proper pain management? Accordingly, one out of every four patients experienced sufficient post-operative pain alleviation [(3)].

In a dose-dependent way, the well-known opioid side effects of nausea, vomiting, itching, and drowsiness can interfere with nursing, postpartum experiences, and mother-child interactions. Nonetheless, a number of different approaches have been proposed to reduce opioid use after surgery [(4)].

A different approach is the TAP block, a regional anesthetic method used for lower abdominal surgery like CS that can deliver a sensory and motor block of the anterior abdominal wall from T10 to L1 without any visceral impact [(5)].

Through local anesthetic deposition between the internal oblique and the transverse abdominis, the TAP block enables sensory blockage of the lower abdominal wall. Because TAP block approaches have a lower risk of problems and produce superior results, they have been widely accepted. Rafi originally reported this groundbreaking technique in 2001 employing Petit's lumbar triangle [(6)].

Nowadays, local anesthetic wound infiltration is often utilized, either alone or in combination, to decrease opioids, enhance postoperative analgesia, and hasten patient recovery [(7)].

Research has looked into the possibility of using the transverse abdominis plane and subcutaneous wound infiltration with local anesthetics to provide analgesia following Cesarean birth and to lower postoperative opioid usage [(8)].

At the end of the procedure, the surgeon inserts a multiorifice subcutaneous or subfascial catheter directly into the wounds to administer NSAID or local anesthetic. This technique is technically efficient and safe. It has the potential to provide complete analgesia or significantly reduce the need for opioids and the associated side effects, can be used for a number of days, and can be used with portable pumps that can be used in an ambulatory setting [(2)]. When compared to a

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single wound injection, continuous wound infiltration with local anesthetic using a multiorifice subcutaneous or subfascial catheter extends the duration of action and improves the effectiveness of the local anesthetic [9].

The benefits of TAP block and continuous wound infiltration for mother and infant include long-lasting and efficient pain relief, early oral nourishment, early mobility, and a brief hospital stay among other advantages [10]. This study compared the clinical effectiveness, safety, and patient outcomes between these two techniques in women undergoing Cesarean sections. By evaluating parameters such as pain scores, opioid consumption, and adverse effects, the study aimed to provide evidence-based insights into the optimal choice for post-operative analgesia in this population.

PATIENTS AND METHODS

A clinical trial study was conducted on 100 patients according to the American Society of Anesthesiologists (ASA) physical status I or II in The Obstetrics and Gynecology Department in Shebin El-Kom Teaching Hospital & Menoufia University Hospital during the study period from March 2023 to June 2024.

Inclusion criteria: Full-term pregnancy, pregnant women aged from 20-40 years, scheduled for elective CS under spinal anesthesia, BMI from 15-25 kg/m^2 and no medical morbidity.

Exclusion criteria: Patients' refusal, documented allergy to local anesthetics, BMI above 35kg/m^2, history of chronic opiate use, emergency CS, coagulopathy, and physical state classified as ASA III or higher.

All admitted women were subject to: Complete history and check of cardio-respiratory state. Examination of the chest, heart, and airway. All women underwent an obstetric ultrasound to confirm their gestational age and assess fetal weight, placental site, grading, and fluid.

- **Full clinical examination:** Focused on general examination that included measuring blood pressure, temperature, respiration rate, and heart rate. Local examinations, which included chest, abdominal, cardiac, and neurological examinations.
- **Routine investigations:** Including complete blood count, serum creatinine (mg/dl), kidney function tests, hepatic function tests (ALT & AST), CRP, blood sugar evaluation, coagulation profile assessment and ECG.
- **Patient monitoring (standard monitoring):** Pulse oximetry, continuous ECG, non-invasive blood pressure monitoring. 5min. interval and temperature.

Preparation:

Patients were randomly assigned to one of two groups using a simple randomization approach using closed envelopes. In Group II, the patient remained anesthetized following skin closure. A bilateral ultrasound-guided TAP (US-guided TAP) block was carried out under strict aseptic circumstances. In the mid-axillary line, between the iliac crest and lower costal border, a linear (5–13MHz) US probe was placed transversely. Under real-time US imaging, a 9-cm 18-G epidural needle was placed in-plane from medial to lateral, between the transversus abdominis and internal oblique muscles. Ten milliliters of 0.25% bupivacaine and ten milliliters of 1% lidocaine were administered through the needle (20 mL) on each side after the needle location was confirmed with one milliliter of normal saline. 7–8 cm of a multi-orifice 20-G epidural catheter was remained within the TAP after it was threaded. For the duration of the research, a maintenance dosage of 5 ml of 0.25% bupivacaine plus 5 ml of 1% lidocaine every two hours (10 mL per catheter) was administered.

In Group I, the CSA set introducer was inserted through the incision angle prior to the surgical procedure's completion. The same individual then inserted the catheter through the introducer, leaving it in the subcutaneous tissue above the abdominal fascia. The peelable sheath was then removed, and the catheter was fixed at the conclusion of the procedure, totaling 40 mL (20 ml for each wound site). Ten milliliters of 0.25% bupivacaine and ten milliliters of 1% lidocaine were utilized for subcutaneous wound site infiltration, then 20 mL (10 mL for each side), followed by 5 mL of 0.25% bupivacaine and 5 mL of 2% lidocaine every two hours for a whole day (study period). Ketorlac (30 mg every six hours) was administered to all patients, with a daily maximum of 120 mg. They were given pethidine (50 mg/IV) if the discomfort continued.

Assessment: At the conclusion of the 2, 4, 8, 12, and 24 hours following surgery, data were collected by staff members who were not aware of the group assignments. At 0, 2, 4, 8, 12, and 24 hours after surgery where blood pressure and heart rate were recorded. Also, administration of the first postoperative rescue analgesic. VAS, which consists of a 10-cm line with "no pain" at one end and "worst imaginable pain" at the other, was used to assess the patient's level of discomfort. The patient was instructed to position or shift the marker to the level that most accurately represented the severity of his discomfort. The frequency of vomiting and nausea was noted. Any adverse event (Such as discomfort) that has happened at any point is reported by the patient.

Ethical consideration: Before the study began, all participants completed a written informed consent forms outlining the purpose, advantages, and potential risks. The Ethics Committee of Menoufia University's Faculty of Medicine gave its permission. Throughout its implementation, the study complied with the Helsinki Declaration.

Statistical analysis

Standard computer tools were used to tabulate and statistically analyze the results using SPSS Version 25.0. Relative percentages and frequencies were used to illustrate the qualitative data. To determine how two or more sets of qualitative variables differ from one another, the X^2-test was used. The mean ± SD, was used to convey quantitative data. Mann-Whitney U test (U), Pearson correlation, Student T test (t), Paired t-test, and Fisher's exact or Monte Carlo correction were used. Statistical significance was defined as a P value ≤ 0.05.

RESULTS

A flowchart of the study population of 123 patients with spinal anesthesia-induced hypotension (SAIH) who were conducted in Menoufia University Hospital. 23 patients were excluded from the study (9 patients declined consent, 14 did not meet the inclusion criteria), and 100 patients participated in the study, the patients were divided into 2 groups: **Group (I)** included 50 patients in continuous wound infiltration and **group (II)** included 50 patients in continuous bilateral TAP.

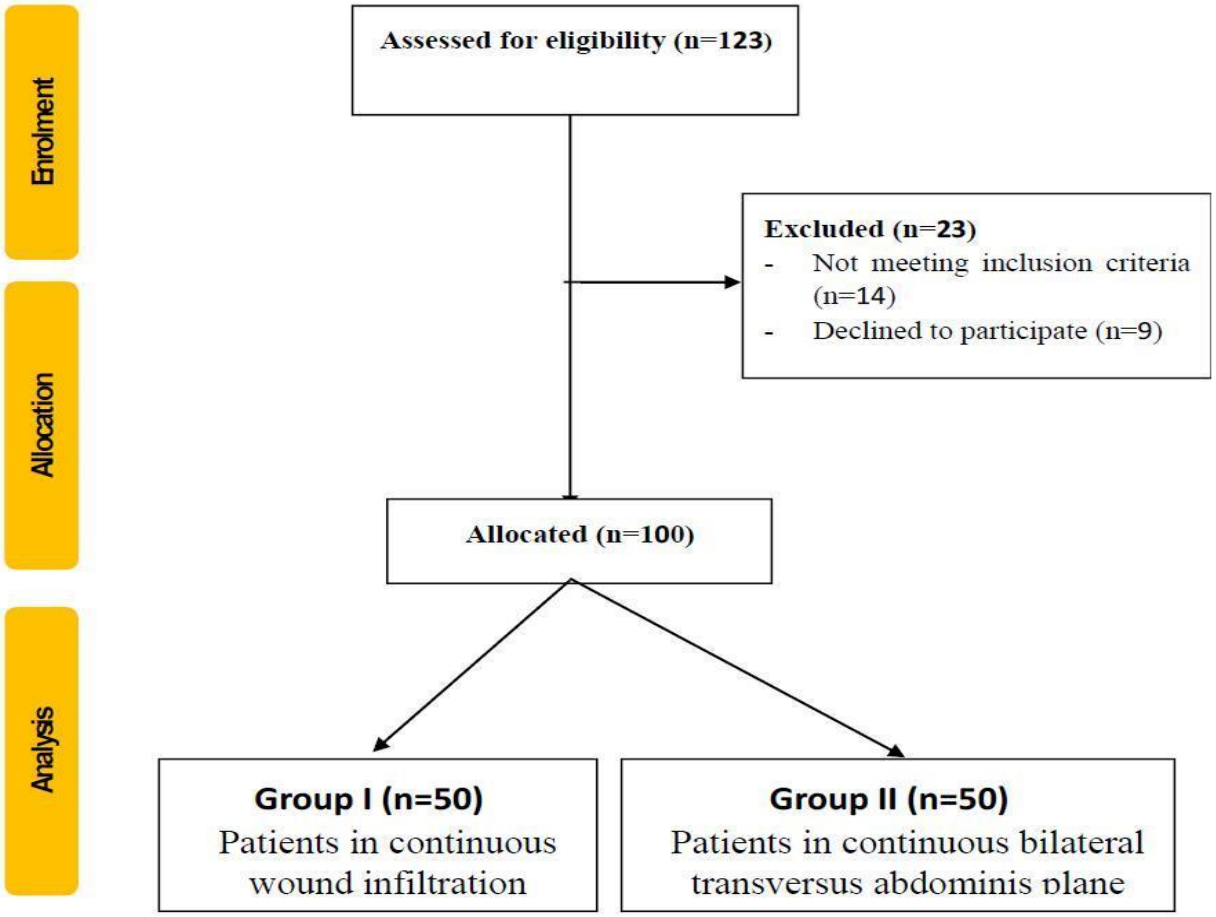

Figure (1): Flowchart of the studied patients.

In our study, there was no significant difference among the studied groups regarding Age (years), BMI and parity, or gravity, (P<0.05) **(Table 1).** In the current study, there was no significant difference between the studied groups regarding ASA I and ASA II (P>0.05) **(Table 2).**

Table (1): Demographic data of the studied groups

Variables	Continuous wound infiltration (n=50)	Continuous bilateral transversus abdominis plane (n=50)	t	*P value*
Age (years) Mean ± SD.	26.66±4.64	25.52±4.21	1.285	0.202
BMI [wt/(ht)^2] Mean ± SD.	24.17±4.26	23.33±4.11	1.004	0.318
Parity Mean ± SD.	1.56±1.39	1.36±1.22	0.764	0.447
Gravity Mean ± SD.	2.56±1.39	2.36±1.22	0.764	0.447

Table (2): Comparative study according to the ASA

Variables	Continuous wound infiltration (n=50)		Continuous bilateral transversus abdominis plane (n=50)		X^2	*P value*
ASA I	**N**	**%**	**N**	**%**	3.184	0.074
	37	74.0	44	88.0		
ASA II	13	26.0	6	12.0	3.184	0.074

ASA I: American Society of Anesthesiologists) physical status I **ASA II:** American Society of Anesthesiologists) physical status II

In the current study, there was a significant difference among the studied groups regarding time of first analgesia rescue and pethidine 50 mg (p<0.05). Time of first analgesia rescue and pethidine 50 mg consumption were significantly higher among continuous bilateral TAP (7.79 ± 2.07 & 0.88 ± 0.64 respectively) than in continuous wound infiltration (4.12 ± 1.33 & 1.42 ± 0.50 respectively) **(Table 3).**

Table (3): Comparative study according to time of first analgesia rescue (hrs) and pethidine 50 mg consumption

Variables	Continuous wound infiltration (N=50)	Continuous bilateral transversus abdominis plane (N=50)	U	*P value*
Time of First Analgesia Rescue (hrs) Mean ± SD.	1.12 ± 1.33	7.79 ± 2.07	166.5	**<0.001***
Median (IQR)	4.00 (2.00-6.00)	8.00 (4.00-12.00)		
Pethidine 50 mg Mean ± SD.	1.42 ± 0.50	0.88 ± 0.64	711.5	**<0.001***
Median (IQR)	1.00 (1.00-2.00)	1.00 (0.00-2.00)		

In the current study, there was no significant difference among the studied groups regarding VAS at rest after 24 hrs (P>0.05). There was a significant difference among the studied groups regarding VAS at rest after 2 hrs, 4 hrs, 8 hrs and 12 hrs (P<0.05). VAS at rest after 2 hrs, 8 hrs, and after 12 hrs were significantly higher among continuous wound infiltration (1.50 ± 1.31, 1.90 ± 0.97 and 1.50 ± 0.93 respectively) than in continuous bilateral TAP (0.67 ± 1.02, 0.81 ± 0.76 and 1.50 ± 0.93 respectively). VAS at rest after 4 hrs was significantly higher among continuous bilateral TAP (0.79±1.11) than among continuous wound infiltration (1.40±1.09) **(Table 4).**

Table (4): VAS at rest between studied groups

Variables	Continuous wound infiltration (n=50)	Continuous bilateral transversus abdominis plane (n=50)	U	*P value*
VAS at Rest After 2 hrs				
Mean ± SD.	1.50 ± 1.31	0.67 ± 1.02	789.500	**0.001***
Median (IQR)	1.50 (0.00-3.00)	0.00 (0.00-3.00)		
VAS at Rest After 4 hrs				
Mean ± SD.	1.40 ± 1.09	0.79±1.11	806.000	**0.001***
Median (IQR)	1.00 (0.00-3.00)	0.00 (0.00-3.00)		
VAS at Rest After 8 hrs				
Mean ± SD.	1.90 ± 0.97	0.81 ± 0.76	548.000	**<0.001***
Median (IQR)	1.00 (1.00-3.00)	1.00 (0.00-2.00)		
VAS at Rest After 12 hrs			692.000	**<0.001***
Mean ± SD.	1.50 ± 0.93	0.73 ± 0.45		
Median (IQR)	1.00 (0.00-3.00)	1.00 (0.00-1.00)		
VAS at Rest After 24 hrs			1100.000	0.150
Mean ± SD.	0.72 ± 0.45	0.88 ± 0.33		
Median (IQR)	1.00 (0.00-1.00)	1.00 (0.00-1.00)		

VAS: Visual analogue scale.

In our study, there was no significant difference among the studied groups regarding VAS at movement after 2 hrs (P>0.05). There was a significant difference among the studied groups regarding VAS at movement after 4 hrs**,** 8 hrs, 12 hrs, and 24 hrs, (P<0.05). VAS values at movement after 4 hrs, 8 hrs, 12 hrs and 24 hrs were significantly higher among continuous wound infiltration (2.38 ± 1.41, 2.92 ± 1.58, 2.10 ± 1.81 and 0.62 ± 0.49) than among continuous bilateral TAP (1.27 ± 0.79, 2.04 ± 1.57, 0.60 ± 0.49 and 0.38 ± 0.49) (Table 5).

Table (5): Pain using VAS at movement between the studied groups.

Variables	Continuous wound infiltration (n=50)	Continuous bilateral transversus abdominis plane (n=50)	U	*P value*
VAS at Movement.After2hrs	2.12 ± 0.72 2.00 (0.00-3.00)	2.46 ± 1.82 3.00 (0.00-5.00)	1088.000	0.247
VAS at Movement After 4 hrs				
Mean ± SD.	2.38 ± 1.41	1.27 ± 0.79	674.500	**<0.001***
Median (IQR)	2.50 (0.00-5.00)	1.00 (0.00-2.00)		
VAS at Movement After 8 hrs				
Mean ± SD.	2.92 ± 1.58	2.04 ± 1.57	844.000	**0.010***
Median (IQR)	3.00 (0.00-6.00)	2.00 (0.00-5.00)		
VAS at Movement After 12 hrs			687.500	**<0.001***
Mean ± SD.	2.10 ± 1.81	0.60 ± 0.49		
Median (IQR)	2.00 (0.00-5.00)	1.00 (0.00-1.00)		
VAS at Movement After 24 hrs			925.000	**0.010***
Mean ± SD.	0.62 ± 0.49	0.38 ± 0.49		
Median (IQR)	1.00 (0.00-1.00)	0.00 (0.00-1.00)		

In our study, there was a significant difference among the studied groups regarding patients who had perioperative complications (nausea and vomiting, or itching), (P<0.05). Nausea was significantly more common among continuous wound infiltration (n=12, 24.0%) than among continuous bilateral TAP (N=0, 0.0%), (P<0.05). 7 (14%) women with continuous wound infiltration had nausea and vomiting (P<0.05). While nausea, itching and vomiting were significantly more common among continuous bilateral TAP (10, 20.0%) and (6, 12.0%) respectively than among continuous wound infiltration (2, 4.0%) and (0,0%) respectively **(Table 6).**

Table (6): Postoperative complications among the studied groups.

Variables	Continuous Wound Infiltration (N=50)		Continuous Bilateral Transversus Abdominis Plane (N=50)		X^2	*P value*
Complications	**N**	**%**	**N**	**%**		
No	29	58.0	34	68.0	30.73	**<0.001***
Nausea	12	24.0	0	0.0		
Nausea, vomiting	7	14.0	0	0.0		
Nausea, itching	2	4.0	10	20.0		
Vomiting	0	0.0	6	12.0		

DISCUSSION

Effective post-operative pain management following Cesarean delivery is crucial for optimizing maternal recovery, facilitating early ambulation, and improving the ability to care for a newborn [(11)].

Pain management strategies aim to minimize opioid consumption, reduce side effects, and improve patient satisfaction, which are particularly important in the context of Cesarean sections, as these procedures can result in significant post-operative pain [(12)]. This study compared the clinical effectiveness, safety, and patient outcomes between these two techniques in women undergoing Cesarean sections. By evaluating parameters such as pain scores, opioid consumption, and adverse effects, the study aimed to provide evidence-based insights into the optimal choice for postoperative analgesia in this population.

According to the current study, there was no discernible difference between the groups under investigation in terms of ASA I and ASA II. In the same line**, Alhosainy *et al.*** [(2)] observed that there was no statistically significant difference between the two groups based on baseline data, such as MABP and HR ($p>0.05$).

According to the current investigation, continuous bilateral TAP substantially increased the time of initial analgesic rescue (in hours) and the intake of 50 mg of pethidine compared to continuous wound infiltration. Similarly, **Alhosainy *et al.*** [(2)] discovered that the TAP group's time of initial analgesia rescue was longer (8.38±2.60) than the CWI group's time (5.46±1.89). Furthermore, **Siddiqui *et al.*** [(13)] found that TAP block not only decreased postoperative opioid requirement but also extended the initial analgesia request, which is in line with our findings. A research by **Telnes *et al.*** [(14)] contradicted our findings. The TAP group's cumulative morphine intake at 48 hours (mean ± standard deviation) was 41 ± 34 mg, whereas the control group's was 38 ± 27 mg (P = 0.7), this is a 3 mg (95% CI −13 to 19 mg) difference. With the exception of a greater level of drowsiness in the TAP group (P = 0.04), side effects were comparable, leading to the conclusion that the TAP block did not lower cumulative morphine intake after CS [(15)]. Likewise, our findings are consistent with **Aydogmus *et al.*** [(16)] who discovered that the time to first analgesic request was longer and that the numerical pain rate values of group TAP block were greater.

The current study showed that VAS at rest after 2 hrs, 8 hrs, and 12 hrs were significantly higher among continuous wound infiltration than among continuous bilateral TAP. While, VAS at rest after 4 hrs was significantly higher among continuous bilateral TAP than among continuous wound infiltration. Our research closely match that of **Alhosainy *et al.*** [(2)] who reported that there was no statistically significant difference between the two groups' VAS during rest. However, during movement, there was a notable difference between the two groups. In the TAP group, the VAS was low after two hours, began to increase at four, eight, and twelve hours, and then began to decline at twelve hours, reaching nearly zero at twenty-four hours. In line with our research, **McDonnell *et al.*** [(17)] found that TAP block produced better analgesia for up to 48 hours when compared to a placebo. Additionally, TAP block produced long-lasting and efficient analgesia, according to **Scharine** [(18)]. In contrast to our investigation, **Bamigboye and Hofmeyr** [(19)] found that NPS within the first hour following wound site infiltration was lower in patients who had Caesarean sections under spinal anesthesia when wound infiltration was compared with a placebo. Additionally, they stated that a single dosage of wound site infiltration is an effective, dependable, and simple way to relieve pain during the first four hours following a Cesarean operation. According to **Aydogmus *et al.*** [(16)]**,** group I had lower post-operative NPS ratings (NPS0) than group T. It could be because, in contrast to USG-guided TAP block, which took longer, wound site administration was applied more quickly.

This study showed that there was no significant difference among the studied groups regarding VAS at movement after 2 hrs. However, VAS at movement after 4 hrs, 8 hrs, 12 hrs, and 24 hrs were significantly higher among continuous wound infiltration than among continuous bilateral TAP. In this concern, **Habtemariam *et al.*** [(3)] found that at two, four, six, and twelve hours after surgery, there was a statistically significant difference in the median pain levels between the TAP group and the other group. At two postoperative hours, the TAP group's median NRS score was 3, whereas the WSI group's was 4. Likewise,

there was a statistically significant difference in the median NRS score between the TAP and WSI groups at 4, 6, and 12 hours. This is consistent with research that compares the two for analgesia following surgery [20, 21]. This is in contrast to a research by **Klasen *et al.*** [5] that found no difference in pain levels across groups at various postoperative periods. According to a different research by **Wayu *et al.*** [22] TAP was better for the extended duration of analgesia, but WSI was more effective in the early postoperative hours.

Our study showed that nausea was significantly more common among continuous wound infiltration (n=12, 24.0%) than among continuous bilateral TAP (N=0, 0.0%). Additionally, 7 (14%) women with continuous wound infiltration had nausea and vomiting. Nausea and itching were significantly more common among continuous bilateral TAP (n=10, 20.0%) than continuous wound infiltration (n=2, 4.0%). Vomiting was significantly higher presented among continuous bilateral TAP (n=6, 12.0%) than among continuous wound infiltration (n=0, 0.0%). However, according to **Alhosainy *et al.*** [2], the consequences of PONV, respiratory depression, and itching were negligible in both groups. Following TAP blocks, several injuries and side effects were reported, including high local anesthetic plasma concentrations, convulsions, and peritoneal perforations with subsequent visceral injury [23]. Additionally, **Habtemariam *et al.*** [3] noted that the percentage of patients experiencing drowsiness, pruritus, nausea, or vomiting was comparable across groups in our investigation ($P > 0.05$). Furthermore, no request was made for the antacid medicine anyhow. According to their results, which were corroborated by **Larsen *et al.*** [24] following day-case open inguinal surgery, there were no changes in PONV or ondansetron use between TAP and II/IH (5.9% vs. 9.3%, $p = 0.69$). Their RCT indicated that prophylactic treatment for PONV was successful.

In contrast to their findings, **Das *et al.*** [20] discovered that patients who received intrathecal morphine had greater nausea scores than those in the TAP group ($P = 0.02$). Significant variation existed between the trials, most likely as a result of various surgical procedures, participant types, TAP block and wound infiltration methods, variations in the amount and dosage of local anesthetic used, and variations in postoperative analgesia.

CONCLUSION

This study highlighted the comparative effectiveness and safety of CSA and continuous TAP block for managing post-operative pain following Cesarean section. Both techniques proved to be effective in providing significant pain relief and minimizing the need for systemic opioids, thereby contributing to improved patient recovery. The TAP block, with its ability to deliver targeted regional analgesia, demonstrated superior outcomes in terms of prolonged pain relief, reduced systemic side effects, and enhanced patient mobility during the post-operative period. The technique was associated with fewer complications and was particularly effective in reducing opioid consumption compared to CSA. Ultimately, the decision between these two approaches should take into account the patient's clinical state, the surgeon's competence, and resource availability. The study underscored the potential benefits of combining regional techniques like the TAP block with adjunct therapies to optimize post-operative outcomes and enhance maternal satisfaction.

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