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Effectiveness of Transverse Abdominins Plane (TAP) Block for Postoperative Pain management Following Cesarean Sections Among Iraqi Women

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Original Article

Abstract

Background: *Postoperative pain is a common and distressing symptom experienced by patients undergoing cesarean sections. A multimodal approach is currently recommended for pain management. Transverse Abdominins Plane (TAP) Block is an effective method of treating postoperative pain and it is commonly used in many lower abdominal surgeries. Its use after cesarean section is new and fewer studies are available.*

Objective: *To assess the effectiveness of TAP block for postoperative pain management following cesarean section.*

Methods: *A prospective observational and comparative study conducted in our hospital during the period from April 2022 to January 2023, included a total of 76 patients aged 20-35 years who were undergone elective cesarean section under spinal anesthesia. Patients were assigned into two equal groups; TAP block group to whom TAP block was applied according to their request. The second group as control, were managed postoperatively with conventional analgesics. Usage of TAP Block was according to the accepted clinical and anesthesia standards. Postoperative pain assessment was done by using Pain Numerical Rating Scale (NRS). Data analyzed with SPSS version 27 at P. value level of significance of 0.05.*

Results: *Comparison of postoperative pains scores at different time points revealed that at one, 3, 6, 12 and 24 hours, the NRS scale was significantly lower in TAP block group compared to control group, (P <0.001). Incidence of postoperative nausea and vomiting (PONV) was lower in TAP block group.*

Conclusions: *Ultrasound guided Transverse Abdominins Plane (TAP) Block was safe and effective modality and superior to conventional analgesia for management of postoperative pain following cesarean sections among Iraqi women. It reduced significantly the incidence of PONV and the need for rescue opioids*

Keywords: *Cesarean Section, Postoperative Pain, Management, Transverse Abdominins Plane (TAP) Block.*

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1. INTRODUCTION

In daily practice of surgery, cesarean sections (CS) among the commonest surgical procedure performed by gynecologist and obstetricians worldwide , for instance in the United States , almost 32% of births are by cesarean section. In Iraq, according to previous studies the rates of cesarean sections increased from 24.4% in 2012 to reach 34.6% in 2022. The change in trend of cesarean sections was almost 58% in Kurdistan region and 45% in the rest of Iraq (1–3). These rates much higher than the optimal rates of 10-15% that recommended by the World Health Organization since 1985(4). This surgery usually results in substantial post-operative pain due to the incision of the skin, abdominal wall and uterus, as all these organs have different afferent fibers, controlling pain after cesarean section is a challenge. Almost 80% of women who undergo CS report moderate to severe pain at the site of incision for at least 2 months after the operation and about 40% had chronic pain for more than 3 months post cesarean section (5,6). Despite the fact that pain is an unavoidable element of the healing process postoperatively, it sometimes improperly managed that can leads to negative impacts on the on the clinical and psychological outcome of surgery and affect the quality of life and satisfaction of the patients and also raising the morbidity. In adequate management of postoperative pain after cesarean section can leads to delay in recovery of patients and affects the daily activities. Unfortunately, almost 20-80% of patients still inadequately managed for their postoperative pain (7–9). In addition, postpartum pain is directly related to postpartum depression and excessive use of opioids, also, prevents the bond mother and child, all this has great repercussions on the lives of patients who are affected in several dimensions. Pain control is the cornerstone for optimal postsurgical recovery, for this reason, the American College of Obstetrician-Gynecologists recommends a stepwise approach combining multimodal analgesia, always individualized for the needs of each patient (10,11). Different approaches have been used for postoperative pain management, TAP block is an effective method of treating postoperative pain in patients with midline incisions in the abdominal wall. It is commonly used in many lower abdominal surgeries, but its use after cesarean section is new and fewer studies are available. However, this technique was first described in 1993 by Kuppuvelumani et al and documented by Rafi in 2001(12,13). It has been documented that Intrathecal morphine is the gold standard in management of intense pain (14), however, TAP block is a

viable option that has been shown to be effective in patients who have not been given intrathecal morphine (15,16). Transverse abdominins plane (TAP) block practiced at the level of the transverse abdominal plane that delimits the neurovascular bundle. At this level, between the internal oblique muscle and the transverse abdominis muscle are the terminal branches of the somatic nerves that make up the anterior rami of the six lower thoracic nerves (T7 to T12) and the first lumbar nerve (L1) and innervate the anterior abdominal wall (skin, muscles, and parietal peritoneum) (17,18). Transverse abdominis plane (TAP) block was first discussed in 2007 by Hebbard et al. (19). It consists of placing the ultrasound probe in the mid-axillary line between the costal margin and the iliac crest, introducing the needle in a medial plane while the three muscle planes are seen on the ultrasound (external oblique m, internal oblique m and transverse m). abdomen) and injection of the local anesthetic by bulging the transverse abdominis muscle downwards (19). Therefore, access to perform the transverse abdominal plane block can be performed in either the supine or lateral position, the latter being preferable particularly in obese patients (17,20). Regarding the complications that may arise, such as intraperitoneal injection or systemic toxicity, they are rare, yet no serious complication are reported (21), with only one case of liver laceration being recorded by Lancaster and Chadwick (22). Nonetheless, further studies to assess the effectiveness and safety of TAP block after cesarean section are still needed and such studies are scarce in our country, hence we aimed in this study to assess the effectiveness and safety of TAP block for management of postoperative pain management among group of Iraqi women undergone cesarean section.

2. PATIENTS and METHODS

This was a prospective observational and comparative study conducted during a period of 10 months , from the first of April 2022 to the end of January 2023 at our hospital, department of gynecology and obstetrics and department of anesthesia.

Study population: The study included a total of 76 patients aged 20-35 years who were undergone elective cesarean section under spinal anesthesia. Patients were assigned into two equal groups;

Group 1 namely TAP block group: Included 38 women to whom TAP block was applied according to their request.

Group 2 namely control group: Included 38 women who did not receive TAP block and were managed postoperatively with conventional analgesics that used in our practice

Participation and Eligibility criteria:

Researchers looked for women who fit a certain eligibility criteria like personal information, general health status, medical and surgical history and previous treatments and patient's request to receive TAP block to be assigned into the TAP block group.

Inclusion criteria:

• Age between 20 and 35 years

• Singleton pregnancy

• Planned for elective caesarean section

• Fit for spinal anesthesia, at class I and II of the American Society of Anesthesiologists classification of physical status (ASA)

• For TAP block group, patient have to sign a written request to receive TAP block

Exclusion criteria:

• Patient who had contraindication to spinal anesthesia

• Patients of ASA class III and IV

• Known allergic to local anesthesia

• Patients with hypertensive disorders of pregnancy; preeclampsia /eclampsia or complicated pregnancy

• History of chronic pain or are chronic pain medication user or received any type of analgesia within the past 24 hours.

• Bleeding disorder or are taking anticoagulant medication.

• Undergone previous abdominal surgery or have significant abdominal scarring.

• History of significant cardiovascular or respiratory disease

• History of significant psychiatric or neurological disorders.

• Body mass index (BMI) greater than 40 kg/m2.

• History of drug or alcohol abuse.

• Cases who required to be converted to general anesthesia

• Refuse to participate in the study

Study protocol Interventions:

1. All necessary investigations were performed for all patients with the guidance of the surgeon and anesthesiologist

2. Vital signs were measured and monitored preoperatively, before the induction of anesthesia, intraoperative and postoperative

3. Intraoperative measurement of vital signs was performed and recorded every 5 minutes.

4. All patients received the similar standard spinal anesthesia protocol and the spinal anesthesia was administered according to our hospital practiced guideline

TAP block protocol:

Usage of the Transversus Abdominis Plane (TAP) Block was according to the accepted clinical and anesthesia standards. With 20 ml of 0.25% bupvicaine applied to the midline at the conclusion of a cesarean section, an ultrasound-guided TAP block was performed. In order to relax the abdominal muscles, the patient was lying on his back with a pillow supporting his knees. On the abdominal wall, an ultrasound probe is positioned transversely. Under ultrasound guidance, a needle is injected with anesthetic into the TAP. The anesthetic substance is administered into the TAP once the needle tip is in the ideal location. The weight of the patient determines how much anesthesia is injected. By using ultrasound visualization and monitoring the patient's reaction to a test stimulus, the block was verified. Any negative side effects were kept an eye on for the patient.

Postoperative pain assessment

Postoperatively patients in both studied groups were assessed for their postoperative pain using Numerical Rating Scale (NRS) as one of the commonest tools used for assessment of postoperative pain. The NRS is an 11-points scale rate the pain from zero to 10 , the higher score out of 10 indicates the worst pain experiences (23). To address the pain experiences by our patients in both groups they were asked to rate their postoperative pain by choosing the most suitable number that describe their current pain intensity. We assess the pain experienced by the patients at 5 postoperative time-points; one hour, 3 hours, 6 hours , 12 hours and 24 hours and postoperatively. The pain scores were recorded and compared later between both groups

Primary and Secondary outcome measures:

As primary outcome we assessed the postoperative pain intensity in both studied groups according to the NRS within 24 hours after the operation. Also we were looked for the postoperative need for and use of opioid.

As a secondary outcome we assessed frequency of vomiting within 24 hours after operation. Additional we reported the time after surgery when the first opioid dose is required and also the total administered doses. Patients in both groups were followed up for assessment of any possible early postoperative complications and pain scores in addition postoperative nausea and vomiting were also been assessed

Data collection:

Data were collected through full history taking and thorough clinical examination, For the purpose of this study we constructed a data collection sheet (questionnaire) to gather the demographic and clinical data of the patients. Data included personal age, residence, level of education, smoking history , medical history, indication of cesarean section, preoperative examination findings, intraoperative and postoperative findings, operative parameters ; vital signs monitoring schedule, time of operation, time of anesthesia, duration of hospital stay, pain score (NRS) values at the scheduled time at , 1, 3, 6, 12, and 24 hours postoperatively.

Statistical analysis:

The statistical program for social sciences (SPSS) version 27 was used for the statistical analysis. The distribution of the variables was evaluated using the Kolmogorov-Smirnov method. In cases where the chi-square test is not appropriate, Fisher's exact test is used instead to compare categorical variables between the two groups. When the variable had a normal statistical distribution, the means were compared using the Student's t test for two independent samples. Mann-Whitney When a variable deviates from the normal statistical distribution, the U test is employed. Bivariate The association between the scale variables was evaluated using Pearson's correlation analysis, and the correlation coefficient (r) value was computed. A level of significance of 0.05 must be used for all statistical tests and procedures to be considered significant.

3. RESULTS

The two TAO block and control groups were almost matched for their baseline characteristics, (P. value>0.05, in all comparisons). The median age was 28 years in both groups, and more than 70% of the patients at the age 26-35 years. More than half of the patients in both groups were overweight and obese. Almost two-third of patients of ASA I , more than 70% were less than gravida 2, parity < 3 and only two patients in TAP block group and one patient in controls had history of abortion. History of chronic diseases reported in 5 patients, 3 in TAP block and 2 in control groups, (**Table 1**). The indications of the current cesarean section are shown in (**Table 2**), previous cesarean section was the most frequent indication in TAP block and controls, it contributed for 55.3% and 57.9%, respectively, followed by maternal request, malpresentation and fetal distress these contributed for 26.3%, 13.2% and 5.3% , respectively in the TAP block and 18.4%, 15.8% and 7.9% , respectively, in the control group. No significant difference in these indications between both groups, (P. value>0.05). Comparison of postoperative pains scores at different time points revealed that at one, 3, 6, 12 and 24 hours, the NRS scale was significantly lower in TAP block group compared to its corresponding values in control group, in all comparisons, P. value was highly significant <0.001, in both studied groups , (**Table 3**), the difference in the NRS score continued across all time points, however, an increase in the pain intensity was observed with the time in both studied groups, but the change was minimal in TAP block group compared to controls, (**Figure 1**). As shown in (**Table 4**), the opioid required in both group but it was less required in TAP block compared to controls. The median total dose of opioids used in TAP block group was 11 mg (IQR: 5 -9) compared to 30 mg (IQR: 15 -25) in control group, (P. value < 0.001). Furthermore, as a secondary outcome in our study we assessed the incidence of postoperative nausea and vomiting (PONV) in both groups, we observed a significantly lower incidence rate of PONV in TAP block group compared to controls, in TAP block group, nausea occurred in 13.2%, vomiting in 5.3% and concomitant nausea and vomiting (N & V) in 2.6%. Higher rates reported in control group, where the corresponding rates were 23.7% , 13.2% and 5.3%, for nausea, vomiting and concomitant N & V, respectively, (P. value <0.05), (**Figure 2**). Additionally, to assess the possible confounding effect of patients characteristics and clinical variables on the pain scores, we conducted a bivariate correlation analysis by Pearson's and

Spearman's correlation tests using the pain score as dependent variable and patients characteristics and clinical variables as independent ones, we found that TAP block reduced pain scores independent of the other variables while we found that pain score affected positively by patients' age (P. value =0.003) and body mass index (P. value =0.001) , in control group, i.e. older age and heavier women , in control group experienced more intense pain, no other significant correlation was found, (**Table 5**).

Table 1. Baseline characteristics of the studied groups

Variable		TAP block (n=38)		Controls (n=38)		P. value
		No.	%	No.	%	
Age (year)	20 - 25	10	26.3	11	28.9	0.932
	26 - 30	15	39.5	13	34.2	
	31- 35	13	34.2	14	36.8	
Median		28	-	28	-	1.0
Body mass index	Normal	18	47.4	17	44.7	0.881
	Overweight	11	28.9	13	34.2	
	Obese	9	23.7	8	21.1	
ASA class	ASA I	25	65.8	23	60.5	0.812
	ASA II	13	34.2	15	39.5	
Gravidity	≥ 3	10	26.3	11	28.9	1.0
	< 3	28	73.7	27	71.1	
Parity	≥ 3	8	21.1	10	26.3	0.787
	< 3	30	78.9	28	73.7	
Abortion		2	5.3	1	2.6	1.0
History of chronic diseases		3	7.9	2	5.3	1.0

ASA: American Society of Anesthesiologists classification of physical status

Table 2. Distribution of indications of cesarean sections among the studied groups

Indication	TAP block (n=42)		Control (n=42)	
	No.	%	No.	%
Previous cesarean section	21	55.3	22	57.9
Maternal request	10	26.3	7	18.4
Malpresentation	5	13.2	6	15.8
Fetal distress	2	5.3	3	7.9
Total	38	100.0	38	100.0

P. value = 0.871 not significant

Table 3. Comparison of postoperative pains scores at different time points in both studied groups

Pain score / NRS	TAP block (n=38)		Control (n=38)		P. value*
	Mean	SD	Mean	SD	
After one hour	2.31	0.39	3.86	0.62	<0.001
After 3 hours	2.44	0.45	4.55	0.71	<0.001
After 6 hours	2.62	0.41	5.31	0.85	<0.001
After 12 hours	2.91	0.54	5.68	0.92	<0.001
After 24 hours	3.18	0.67	6.42	0.88	<0.001

*High significant difference in all comparisons, P<0.001
NRS: numerical rating scale

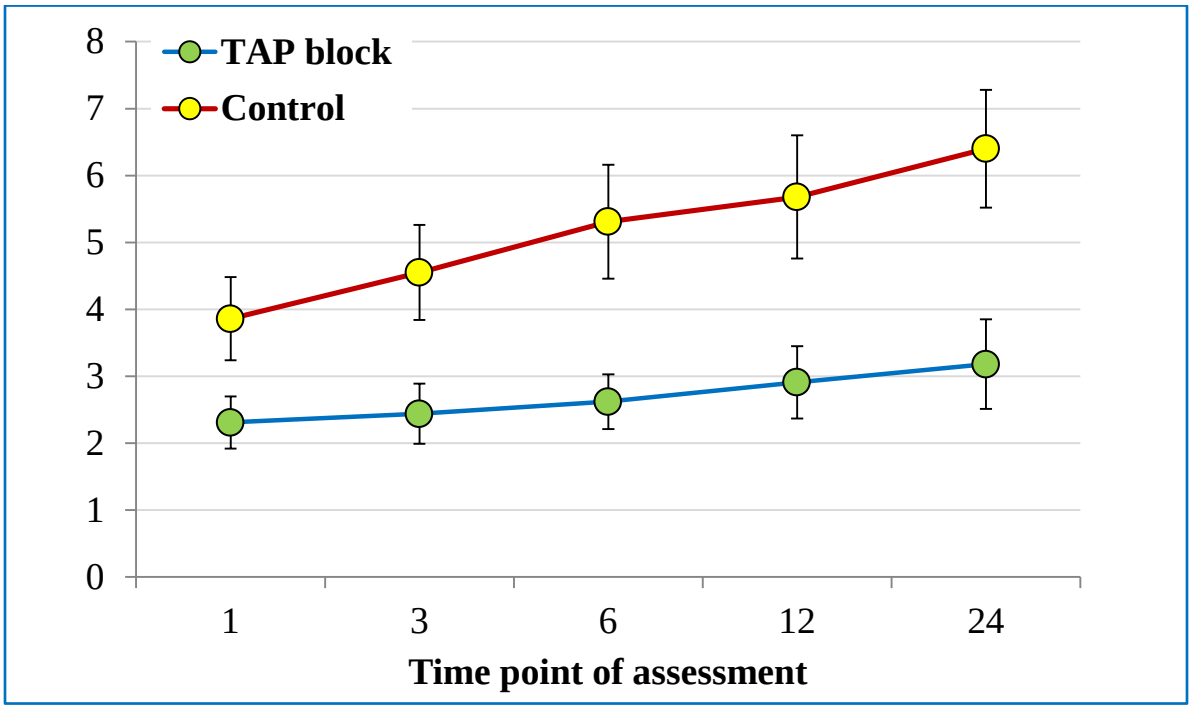

Figure 1. Change in pain scores assessed by NRS at different time points

Table 4. Comparison of Median total dose of opioid required by in both studied groups

Variable	Total Opioid Consumption (mg)	
Group	Median	IQR
TAP block (n=38)	11.0	5 – 9
Conventional (n=38)	30.0	15 - 25
P. value	<0.001 significant	

IQR: interquartile range

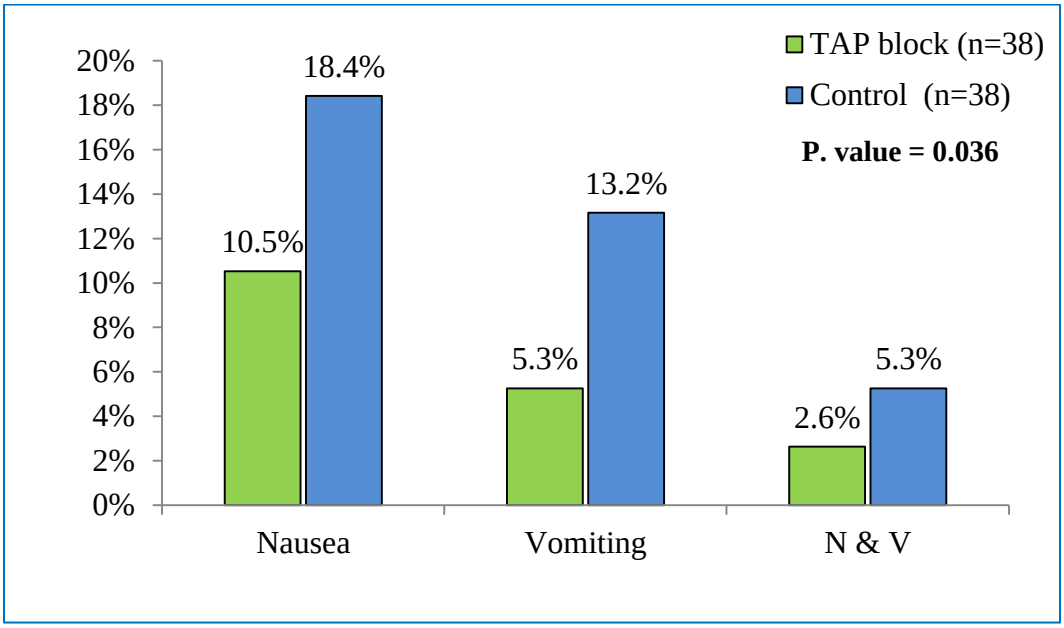

Figure 2. Incidence of postoperative nausea and vomiting within 24 hours after cesarean section in both studied groups (N & V: nausea and vomiting)

Table 5. Results of bivariate Pearson's and Spearman's correlation analyses for postoperative pain score and other variables in both groups

Variable	TAP block		Conventional	
	R	P. value	R	P. value
Patient's age	0.136	0.380	0.338	0.003
Body mass index	0.189	0.072	0.418	0.001
Gravidity	0.079	0.661	0.069	0.758
Parity	0.022	0.904	0.040	0.853
Abortion	0.106	0.476	0.147	0.305
ASA class	0.100	0.506	0.182	0.149
History of chronic diseases	0.108	0.461	0.126	0.424
Indication of CS	0.015	0.932	0.033	0.844

4. DISCUSSION

Postoperative pain is a common and distressing symptom experienced by patients undergoing gynecological and obstetrics surgeries. In the daily practice of gynecological and obstetrics field almost all surgeries are associated with postoperative pain which represents a significant problem for all patients undergoing these surgeries. (24,25). The pathophysiology of postoperative pain is multifactorial and involves complex interactions between the surgical site, nervous system, and other physiological processes. Surgical trauma causes tissue injury, inflammation, and activation of nociceptors (pain receptors), which transmit pain signals to the spinal cord and brain. The intensity and duration of pain are influenced by the extent of tissue damage, the type and duration of surgery, the patient's pain threshold, and other factors such as anxiety and depression(26). Cesarean section is associated with higher levels of postoperative pain where almost 84% of women experienced moderate to severe pain after cesarean section at 24 hours after surgery, This is because cesarean section typically involves a larger surgical incision, deeper tissue dissection, and a longer duration of surgery (8). A multimodal approach is currently recommended for pain management. Postoperative pain control is of utmost importance as it reduces patients' morbidity. A meta-analysis published in PubMed in 2010 (27) concluded that the TAP block decreased pain at rest and on movement in the first 24 postoperative hours after abdominal surgery. Also that study reported a significant reduction in the opioid required postoperatively, as well as reduction in the incidence of nausea and vomiting, hence the meta-analysis recommended the use of TAP block. Gao et al. (28) found that TAP block can achieve similar analgesic effect to the patients controlled intravenous analgesia (PCIA) postoperatively in patients undergone cesarean sections. A double-blind clinical trial published in 2022 (29), included 80 participants who underwent a cesarean section, TAP block was combined with PCIA after surgery. Postoperative pain was assessed in both groups, results of that study indicated that combination of TAP block with PCIA had better analgesic effect and less incident side effect with reduction in the required opioids. Despite these encouraging findings and recommendations, some clinical trials found that TAP block was not more effective than other approaches for pain management in post cesarean sections, however, these trials did not compare TAP block to conventional analgesia but to

other interventional techniques like anesthetic infiltrations in the surgical incisions, of cesarean section or a continuous infusion of analgesics into the surgical wound (30,31). Another study conducted by Kanta et al. documented that combined TAP block and intraoperative diclofenac aqueous was superior to TAP block alone in analgesic effect postoperatively with better satisfaction to the patients (32). In 2019, Dereu et al. (33) confirmed in their study that intrathecal morphine was better and superior to TAP block which was not comparable to intrathecal morphine in reduction of pain score and the incidence of postoperative nausea and vomiting. Interestingly, Mohanan et al. (34)compared TAP block versus a combination of sodium diclofenac and acetaminophen for management of postoperative pain following cesarean section. Mohanan et al. (34) concluded that TAP block was better in reducing the postoperative pain and the use of rescue analgesia. Hemimi et al. (35) found that ultrasound guided TAP block had significantly decrease the need for systemic analgesia and decrease the pain scores within 24 hours after cesarean sections compared to conventional systemic analgesia. A recent study conducted by Elhouty et al. and published in 2022 compared the TAP block alone against combination of TAP block with peritoneal block and found that TAP block alone was excellent to relief pain postoperatively after cesarean section, however, its effect enhanced when combined with peritoneal block (36). Furthermore, in 2022, Benedicta et al. (37) in their clinical trial the efficacy of TAP block was compared to that of Quadratus Lumborum block (QLB) in patients undergone lower segment cesarean section and found better postoperative analgesic effect with QLB compared to TAP block. We found a significant reduction in the incidence of PONV in the TAP block group compared to controls, in total, PONV occurred in 21.1% and 42.1%, respectively. However, the incidence of PONV could be attributed to the side effect of opioids where some patients in both groups need to use these agents in different rates. These findings agreed that reported in other studies worldwide where TAP block appeared to be not only reduce the pain intensity but also the incidence of PONV and the side effect of opioids (33,38,39), nonetheless, there still controversy about the effectiveness of TAP block in reduction of incidence of PONV (40). Also we found no significant correlation between the postoperative pain scores and patients characteristics and clinical variables in TAP block group. In controls, we observed that older age and heavier BMI significantly increase intensity of pain experiences by women which recognized by increased

NRS score with the increased age and BMI of patients in control group. Similar findings reported in Malaysia by Jasim et al. (41) . Conversely, Duan found no correlation between pain intensity and each of age and BMI, in patients underwent cesarean section (42).

5. CONCLUSIONS

Ultrasound guided Transverse Abdominins Plane (TAP) Block was safe and effective modality and superior to conventional analgesia for management of postoperative pain following cesarean sections among Iraqi women. TAP block significantly reduced the incidence of postoperative nausea and vomiting, significantly reduce the need for rescue opioids and their side effect. No adverse effect was reported in association with the use of TAP block. Therefore, we recommend and encourage the use of TAP block to obtain better patients satisfaction and outcomes.

Ethical Clearance:

Ethical issues were taken from the research ethics committee. Informed consent was obtained from each participant. Data collection was in accordance with the World Medical Association (WMA) declaration of Helsinki for the Ethical Principles for Medical Research Involving Human Subjects, 2013 and all information and privacy of participants were kept confidentially.

Conflict of interest: Authors declared none

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6. *REFERENCES*

1. *Mohammed AK. A cross-sectional Analytic study of Rate and Indication of Caesarean Section. Res Sq. 2022;1(3):1–12.*
2. *Shabila NP. Rates and trends in cesarean sections between 2008 and 2012 in Iraq. BMC Pregnancy Childbirth. 2017;17(1):4–9.*
3. *Shabila NP. Trends and changes in cesarean delivery rates in Iraq: findings from the multiple indicator cluster surveys, 2011–2018. J Matern Neonatal Med. 2022;35(25):6272–7.*
4. *Betran AP, Torloni MR, Zhang J, Ye J, Mikolajczyk R, Deneux-Tharaux C, et al. What is the optimal*

rate of caesarean section at population level? A systematic review of ecologic studies. Reprod Health. 2015;12(1):1–10.

5. *Jemal B, Mohammed F, Tesema HG, Ahmed S, Mohammed A, Regasa T, et al. Analgesic Efficacy of Spinal Morphine in Comparison With Transversus Abdominis Plane Block for Postoperative Pain Management in Patients Undergoing Cesarean Section Under Spinal Anesthesia: A Randomized Controlled Trial. Front Med. 2022;9:32.*
6. *Niklasson B, Georgsson Öhman S, Segerdahl M, Blanck A. Risk factors for persistent pain and its influence on maternal wellbeing after cesarean section. Acta Obstet Gynecol Scand. 2015;94(6):622–8.*
7. *Admassu WS, Hailekiros AG, Abdissa ZD. Severity and risk factors of post-operative pain in University of Gondar Hospital, Northeast Ethiopa. J Anesth Clin Res. 2016;7(10):675.*
8. *Hussen I, Worku M, Geleta D, Mahamed AA, Abebe M, Molla W, et al. Post-operative pain and associated factors after cesarean section at Hawassa University Comprehensive Specialized Hospital, Hawassa, Ethiopia: A cross-sectional study. Ann Med Surg. 2022;81:104321.*
9. *Joseph JM, Gori D, Curtin C, Hah J, Ho VT, Asch SM, et al. Gaps in standardized postoperative pain management quality measures: A systematic review. Surgery. 2022;171(2):453–8.*
10. *Sangkum L, Thamjamrassri T, Arnuntasupakul V, Chalacheewa T. The Current Consideration, Approach, and Management in Postcesarean Delivery Pain Control: A Narrative Review. Pearl RG, editor. Anesthesiol Res Pract. 2021;2021:2156918.*
11. *Mustafa HJ, Wong HL, Al-Kofahi M, Schaefer M, Karanam A, Todd MM. Bupivacaine Pharmacokinetics and Breast Milk Excretion of Liposomal Bupivacaine Administered After Cesarean Birth. Obstet Gynecol. 2020;136(1).*
12. *Mishra M, Mishra SP. Transversus abdominis plane block: The new horizon for postoperative analgesia following abdominal surgery. Egypt J Anaesth. 2016;32(2):243–7.*
13. *Sharma P, Chand T, Saxena A, Bansal R, Mittal A, Shrivastava U. Evaluation of postoperative analgesic efficacy of transversus abdominis plane block after abdominal surgery: A comparative study. J Nat Sci Biol Med. 2013 Jan;4(1):177–80.*
14. *DeSousa KA, Chandran R. Intrathecal morphine for postoperative analgesia: current trends. world J Anesthesiol. 2014;3(3):191–202.*
15. *Kwikiriza A, Kiwanuka JK, Firth PG, Hoeft MA, Modest VE, Ttendo SS. The analgesic effects of intrathecal morphine in comparison with ultrasound-guided transversus abdominis plane block*

after caesarean section: a randomised controlled trial at a Ugandan regional referral hospital. Anaesthesia. 2019;74(2):167–73.

16. *Yang T, He X, Li X, Wang R. Intrathecal morphine versus transversus abdominis plane block for caesarean delivery: a systematic review and meta-analysis. BMC Anesthesiol. 2021;21(1):174.*
17. *Mallan D, Sharan S, Saxena S, Singh TK, Faisal. Anesthetic techniques: focus on transversus abdominis plane (TAP) blocks. Local Reg Anesth. 2019;81–8.*
18. *Tsai H-C, Yoshida T, Chuang T-Y, Yang S-F, Chang C-C, Yao H-Y, et al. Transversus Abdominis Plane Block: An Updated Review of Anatomy and Techniques. Biomed Res Int. 2017;2017:8284363.*
19. *Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane (TAP) block. Anaesth Intensive Care. 2007;35(4):616–8.*
20. *Chakraborty A, Khemka R, Datta T. Ultrasound-guided truncal blocks: A new frontier in regional anaesthesia. Indian J Anaesth. 2016 Oct;60(10):703–11.*
21. *Young MJ, Gorlin AW, Modest VE, Quraishi SA. Clinical implications of the transversus abdominis plane block in adults. Anesthesiol Res Pract. 2012;2012:731645.*
22. *Lancaster P, Chadwick M. Liver trauma secondary to ultrasound-guided transversus abdominis plane block. BJA Br J Anaesth. 2010;104(4):509–10.*
23. *Lee H-J, Cho Y, Joo H, Jeon JY, Jang Y-E, Kim J-T. Comparative study of verbal rating scale and numerical rating scale to assess postoperative pain intensity in the post anesthesia care unit: A prospective observational cohort study. Medicine (Baltimore). 2021;100(6).*
24. *Sommer M, De Rijke JM, Van Kleef M, Kessels AGH, Peters ML, Geurts J, et al. The prevalence of postoperative pain in a sample of 1490 surgical inpatients. Eur J Anaesthesiol. 2008;25(4):267–74.*
25. *Gan TJ. Poorly controlled postoperative pain: prevalence, consequences, and prevention. J Pain Res. 2017;2287–98.*
26. *Brennan TJ. Pathophysiology of postoperative pain. Pain. 2011;152(3):S33–40.*
27. *Petersen PL, Mathiesen O, Torup H, Dahl JB. The transversus abdominis plane block: a valuable option for postoperative analgesia? A topical review. Acta Anaesthesiol Scand. 2010;54(5):529–35.*
28. *Gao Y, Guo M, Du C, Zhang H, Zhang H. Clinical study of ultrasound-guided transversus abdominis plane block for analgesia after cesarean section. Medicine (Baltimore). 2019 Oct;98(41):e17542.*
29. *Xue M, Guo C, Han K, Bai R, An R, Shen X. Analgesia Effect of Ultrasound-Guided Transversus Abdominis Plane Block Combined with Intravenous Analgesia After Cesarean Section: A Double-Blind Controlled Trial. Pain Ther. 2022;11(4):1287–98.*

30. Telnes A, Skogvoll E, Lonnée H. Transversus abdominis plane block vs. wound infiltration in Caesarean section: a randomised controlled trial. Acta Anaesthesiol Scand. 2015 Apr;59(4):496–504.

31. Chandon M, Bonnet A, Burg Y, Barnichon C, DesMesnards-Smaja V, Sitbon B, et al. Ultrasound-guided transversus abdominis plane block versus continuous wound infusion for post-caesarean analgesia: a randomized trial. PLoS One. 2014;9(8):e103971.

32. Kanta B, Sonali D, Gazala P, Yunus K, Kiran K. A randomised comparative study of transversus abdominis plane block with or without intravenous diclofenac sodium as a component of multimodal regimen for post-operative analgesia following caesarean section. Indian J Anaesth. 2021 Apr;65(4):316–20.

33. Dereu D, Savoldelli GL, Mercier Y, Combescure C, Mathivon S, Rehberg B. The impact of a transversus abdominis plane block including clonidine vs. intrathecal morphine on nausea and vomiting after caesarean section: A randomised controlled trial. Eur J Anaesthesiol | EJA. 2019;36(8).

34. Mohanan N, Raghu KG. Transverse abdominis plane block versus sodium diclofenac-acetaminophen combination for postoperative analgesia following cesarean section. Bali J Anesthesiol. 2020;4:39–41.

35. Hemimi YA, Kamaly AM, Talaat SM, Nosseir M. Ultrasound-guided bilateral transversus abdominis plane block versus conventional systemic analgesia after cesarean section. Ain-Shams J Anaesthesiol. 2014;7:400–5.

36. Elhouty MG, Sabaa MMAA, Elawady MS. Transversus Abdominis Plane Block Combined with Peritoneal Block Versus Transversus Abdominis Plane Block Alone for Postoperative Analgesia after Cesarean Section: A Prospective Randomized Controlled Double-Blinded Study. In 2022.

37. Benedicta R, Jain M, Dixit N, Shivappagoudar VM. The Efficacy of Ultrasound-guided Transversus Abdominis Plane Block Versus Quadratus Lumborum Block for Postoperative Analgesia in Lower-Segment Cesarean Section with Low-Dose Bupivacaine: A Randomized Controlled Trial. Anesth Essays Res. 2022;16:203–7.

38. Pervez S, Patel SD, Sandra J, Carvalho B, Halpern SH. Transversus abdominis plane block compared with wound infiltration for postoperative analgesia following Cesarean delivery: a systematic review and network meta-analysis. Can J Anesth. 2020;67(12):1710–27.

39. Alemnew EF, Lemma DT. Analgesic effectiveness of transversus abdominis plane block versus

wound site infiltration after cesarean delivery under spinal anesthesia at Debre Tabor General Hospital, Debre Tabor, Ethiopia: A prospective cohort study, 2019. Int J Surg Open. 2020;23:17–22.

40. *Umalkar M, Londhe N. Evaluation of magnesium sulfate as an adjuvant to bupivacaine for postoperative analgesia in ultrasound-guided transversus abdominis plane block in patients scheduled for lower segment caesarean section under subarachnoid block-A prospective, randomized, double-blind study. Indian J Pain. 2020;34(3):189.*
41. *Jasim HH, Sulaiman SABS, Khan AH, S Rajah UA. Factors Affecting Post Caesarean Pain Intensity among Women in the Northern Peninsular of Malaysia. J Clin Diagn Res. 2017 Sep;11(9):IC07-IC11.*
42. *Duan G, Yang G, Peng J, Duan Z, Li J, Tang X, et al. Comparison of postoperative pain between patients who underwent primary and repeated cesarean section: a prospective cohort study. BMC Anesthesiol. 2019;19(1):189.*