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Efficacy of Intraoperative Trans-peritoneal TAP Block for Post-Cesarean Analgesia: A Randomized Clinical Trial

Mohamed Abd Elfattah Elsenity, Ahmed Sherif Abdel Hamid, Abdallah Sami Abdallah Mashaal, Salah Taha Ahmed, Ahmed Hamdy Naguib, Hassan Morsi

Department of Obstetrics and Gynecology Faculty of Medicine Ain Shams University, Cairo, Egypt

Correspondence
Abdallah Sami Abdallah Mashaal, MSc., Department of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, Cairo, Egypt, Email: abdallahsamii869@gmail.com

Abstract

Background: Most post-abdominal surgery pain comes from the abdominal wall incision. The TAP block is important for multimodal pain relief after cesarean delivery.

Aim of the Work: This study aimed to assess if the intraoperative TAP (I-TAP) block effectively reduces opioid use without raising pain scores.

Patients and methods: This randomized controlled trial was conducted at Ain Shams University Hospital from January to April 2021, involving 100 women undergoing elective cesarean sections, divided into two groups of 50. Group A (control) received 75 mg of diclofenac sodium and intramuscular pethidine (50 mg) as needed. Group B was treated similarly but included an intra-abdominal anesthetic block. The primary outcome was the mean 24-hour narcotics requirement, while secondary outcomes included postoperative pain at various intervals (2h, 4h, 6h, 8h, 12h, and 24h) measured by a 10-point visual analog scale (VAS) and time to first rescue analgesia.

Results: The TAP block group showed a significant reduction in total narcotics administered (5 patients in TAP Block vs. 28 patients in the Control group, P-value: < 0.001; RR: 0.18 (95% CI: 0.08–0.43) and a lower narcotic requirement in TAP vs. control (55.0 ± 11.2 mg vs. 88.4 ± 17.3 mg with a mean difference of 33.4 mg.. Patients reported decreased pain perception (VAS-10) in TAP block versus the control group at rest after 2 hours as follows (0.1 ± 0.3 versus 0.2 ± 0.4, P-value = 0.063), at 4 hours (0.1 ± 0.3 versus 1.8 ± 1.3, P-value < 0.001), at 8 hours (2.0 ± 0.8 versus 4.3 ± 1.0, P-value < 0.001), at 12 hours (2.3 ± 0.5 versus 4.0 ± 0.7, P-value < 0.001), at 24 hours (1.1 ± 0.5 versus1.3 ± 0.6, P-value = 0.070). The main limitation was the increased risk of performance bias as no blinding of participants or surgeons was conducted.

Conclusion: The TAP block significantly decreased VAS pain scores. Consequently, there was a notable reduction in the use of narcotics within the TAP block group.

Keywords: Surgical transversus abdominis plane block, postoperative pain relief, Cesarean section

Introduction

The introduction of local anesthetic administration into the transversus abdominis plane (TAP) occurred in 2001, presenting a new method for blocking neural signals to the front of the abdominal wall (1). The transversus abdominis plane block diminishes the need for systemic morphine by 70% following abdominal surgery (2).

The transversus abdominis plane block is typically performed by the anesthesiologist either before or after surgery, utilizing a percutaneous method with ultrasound guidance, as blind needle insertion (a technique reliant on anatomical landmarks for the TAP block) could lead to improper injection and harm to intra-abdominal organs. Nevertheless, it can be challenging to identify muscle planes using ultrasound in obese individuals and those with diminished muscular tone (3-4).

Moreover, ultrasound-guided blocks may be time-consuming due to the need to re-prepare and drape the patient, set up the ultrasound probe, and resolve technical challenges in obese patients. As interest in 'Enhanced Recovery After Surgery' (ERAS) increases, surgeons play a larger role in managing postoperative pain, including performing the TAP block. Surgeons are developing procedures to conduct the TAP block independently during surgery while directly observing the intra-abdominal structures, thus reducing the risk of intraperitoneal injury (5).

There have been reports of a surgeon-administered TAP block conducted via laparoscopy in patients undergoing minimally invasive surgeries. Research on the intraoperative trans-peritoneal surgeon-administered TAP block (surgical TAP) for mitigating postoperative pain after cesarean delivery is limited (6).

The surgeon-administered TAP block is straightforward to execute and can be quickly learned by any obstetrician. It offers effective and extended postoperative pain relief and a notable decrease in the need for postoperative rescue pain medication. The surgical TAP block serves as a crucial addition to the multimodal pain management approach that can greatly enhance patient satisfaction ratings for those undergoing cesarean deliveries (7).

Objective of the study: This study aimed to assess if intraoperative TAP (transverse abdominis plane) block (I-TAP) offers effective pain management and reduces the requirement for opioids while not elevating pain levels.

Patients and methods

A randomized controlled clinical trial was conducted at Ain Shams Maternity Hospital in Cairo, Egypt, from January 2021 to April 2021. The study gained ethical committee approval from the Faculty of Medicine, AIN University, number FMASUMS12/2021. All procedures were done per the Declaration of Helsinki. The study complies with CONSORT guidelines for RCT studies. Written consents were taken from all patients pre-randomization.The study was registered in Pan African trials for clinical registry (PACTR202412635802306).

Inclusion criteria: The study included 100 eligible pregnant women aged 18 to 40 who were planning to undergo an elective cesarean section.

Women with chronic pain, opioid dependency, or allergies to local anesthetics were excluded, as were those slated for surgeries lasting over two hours or experiencing blood loss greater than 2 L. Those undergoing emergency cesarean sections were also

not part of the study.

The study's primary outcome was the mean 24-hour narcotics requirements (the only narcotic use was the intramuscular pethidine)

The secondary outcome was postoperative pain (2h, 4h, 6h, 8h, 12h, and 24 hours) during rest and movement. The pain scores of the studied cases were determined using a 10-point visual analog scale (VAS using the VAS ranging from "0" (no pain) to "10" (worst imaginable pain).Pain scores were normalized among patients by presenting them with a visual analog scale (VAS) that ranged from "0" (indicating no pain) to "10" (representing the worst pain possible). The patients did not receive any special training; they were simply presented with the VAS diagram and asked to indicate their level of pain. VAS: visual analog scale, the time of request for the first rescue analgesia, and the operative time.

Sample size justification: The calculation of sample size was conducted using PASS 11.0, referencing a study by Owen et al. (2010) that reported a mean morphine requirement over 24 hours of (23.4 +/-11) for group 1, labeled as "standard analgesia," and (14.1 +/-8) for group 2, which received the "TAP Block." For each group, sample sizes of 50 were determined to achieve 95% power for identifying a difference of 9.3 between the null hypothesis, where both group means are 23.4, and the alternative hypothesis, where the mean of group 2 is 14.1, with estimated standard deviations of 11.0 and 8.0 respectively, along with a significance level (alpha) of 0.05. To address potential attrition, the sample size was increased by 10%.

Procedure: After achieving hemostasis and closing the uterus during the cesarean section, and with the consent of the woman and the anesthetist's approval, the rectus muscle was gently lifted using a retractor, allowing the surgeon to feel its lateral edge; this method assisted in indirectly locating the inferior epigastric vessels situated between the rectus abdominis and its posterior sheath. Measures were taken to prevent any harm to these vessels. The nerves supply the anterior abdominal wall and run through the neurofascial plane between the internal oblique and transversus abdominis muscles (Figure 1). Gaining access to this plane was easily achieved by inserting a blunt needle (BD Blunt needle 18G) through the parietal peritoneum, and a smooth, steady advancement led to a noticeable loss of resistance ('one pop'), indicating that the correct plane had been located. Following a thorough aspiration to ensure there was no vascular injury, 20 ml of 0.25% bupivacaine was administered slowly. The surgeon observed that the extent of this area was notable as a significant volume was injected with minimal resistance. Like the traditional approach, the anesthetist closely monitored for any indications of toxicity. The surgical TAP block was subsequently performed on the opposite side using the same technique. The surgeon found it more convenient to shift to the opposite side of the operating table to carry out the contralateral block. Throughout the procedure, the surgeon was able to

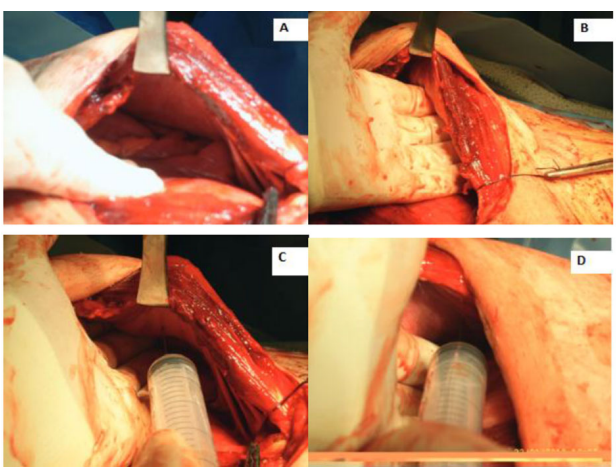

Figure 1. (A) A retractor carefully lifts the rectus muscle. (B) The surgeon identifies the inferior epigastric vessels. (C) A blunt needle is inserted through the parietal peritoneum and transversus abdominis muscle to access the transversus abdominis plane safely. (D) A surgical TAP block is introduced on the opposite side.

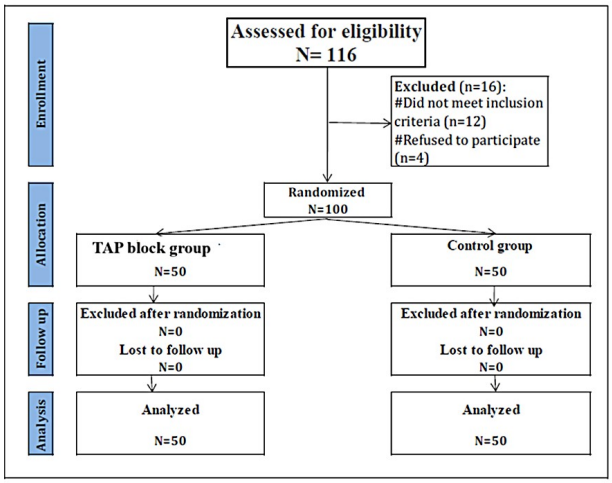

Figure 2. Consort flow chart for participating patients

maintain a clear view of the injection site, ensuring that there was no unintentional harm to the internal organs. The skin and rectus sheath were sutured following standard procedures. The main surgeon administering The TAP Block in all patients was the first author as the consultant on duty, he was aided by different resident in each time. No inadvertent peritoneal or vascular injury was done. All the operative data are recoded in electronic files and written operative notes

Randomization: After obtaining informed consent, patients were recruited in the preoperative holding area and randomly assigned through sequentially numbered folders and a computer-generated randomization table to receive either the surgical TAP or not. Simple randomization using a randomization table created by a computer software program. Allocation was done using sealed opaque envelopes. Patients were allocated to groups based on their recruitment order. The assignment details were provided to the anesthesiologist and surgeon while keeping it hidden from the postoperative care team. A total of 100 women who underwent elective cesarean sections were randomized into two groups, each containing 50 women. Group A (the control group): was given diclofenac sodium 75mg and prescribed intramuscular pethidine (50 mg) as necessary. Group B was identical to the control group but included an intra-abdominal technique for a well-established anesthetic block.

All patients were observed during the postoperative phase at 2, 4, 6, 8, 12, and 24 hours for pain assessment, utilizing visual analog scores (VAS). The timing of every patient's initial request for rescue analgesia was documented. The total rescue anal-

Table 1. Basal demographic and clinical characteristics in the two study groups.

Items	Measure	TAP block (N=50)	Control (N=50)	P-value
Age (years)	Mean±SD	32.1±3.0	31.6±4.0	^0.536
	Range	24.0–39.0	21.0–39.0	
BMI (kg/m^2)	Mean±SD	28.7±2.5	29.4±2.5	^0.154
	Range	21.7–36.3	23.0–34.2	
Parity,(n, %)	primigravida	18 (36.0%)	19 (38.0%)	#0.836
	Multigravida	32 (64.0%)	31 (62.0%)	
Indications,(n, %)	Repeated CS	19 (38.0%)	15 (30.0%)	§0.697
	Postdate	19 (38.0%)	20 (40.0%)	
	PROM	7 (14.0%)	11 (22.0%)	
	IUGR	5 (10.0%)	4 (8.0%)	
Gestational age (Week)	Mean±SD	39.7±1.4	39.9±1.3	^0.554
	Range	37.0–42.0	37.0–42.0	
Operation duration (minutes)	Mean±SD	44.8±4.9	46.3±5.8	^0.167
	Range	35.0–54.0	36.0–64.0	

Table 2. Patients' pain perception (VAS-10) during rest and during movement among the studied groups.

Time	Measures	TAP block (N=50)	Control (N=50)	^p-value	Relative effect Mean±SE 95% CI
Patients' pain perception (VAS-10) during rest					
Hour-2	Mean±SD	0.1±0.3	0.2±0.4	0.063	-0.1±0.1
	Range	0.0–1.0	0.0–1.0		-0.3–0.0
Hour-4	Mean±SD	0.1±0.3	1.8±1.3	<0.001*	-1.7±0.2
	Range	0.0–1.0	1.0–6.0		-2.0–-1.3
Hour-8	Mean±SD	2.0±0.8	4.3±1.0	<0.001*	-2.3±0.2
	Range	1.0–4.0	2.0–6.0		-2.7–-2.0
Hour-12	Mean±SD	2.3±0.5	4.0±0.7	<0.001*	-1.7±0.1
	Range	2.0–4.0	3.0–5.0		-1.9–-1.5
Hour-24	Mean±SD	1.1±0.5	1.3±0.6	0.070	-0.2±0.1
	Range	1.0–3.0	1.0–3.0		-0.4–0.0
Patients' pain perception (VAS-10) during movement					
Hour-2	Mean±SD	0.3±0.5	0.5±0.5	0.133	-0.2±0.1
	Range	0.0–2.0	0.0–2.0		-0.4–0.0
Hour-4	Mean±SD	0.5±0.7	2.5±0.9	<0.001*	-2.0±0.2
	Range	0.0–3.0	2.0–5.0		-2.3–-1.7
Hour-8	Mean±SD	3.1±0.7	5.4±0.9	<0.001*	-2.3±0.2
	Range	2.0–5.0	3.0–7.0		-2.6–-2.0
Hour-12	Mean±SD	3.2±0.5	4.5±0.6	<0.001*	-1.4±0.1
	Range	2.0–4.0	3.0–6.0		-1.6–-1.1
Hour-24	Mean±SD	1.9±0.4	2.1±0.5	0.089	-0.2±0.1
	Range	1.0–3.0	1.0–4.0		-0.3–0.0

gesics needed within the first 24 hours was also noted. Any complications that arose were recorded.

Data management and analysis: The collected data were coded, organized, and statistically analyzed using IBM SPSS Statistics (Statistical Package for Social Sciences) software version 22.0, IBM Corp., Chicago, USA, 2013. The Independent-samples t-test of significance was used when comparing between two means. The Comparison between groups with qualitative data was done by using Chi-square test and Fisher's exact test instead of Chi-square test only when the expected count in any cell less than 5; the confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: P-value <0.05 was considered significant, P-value <0.001 was considered as highly significant and P-value >0.05 was considered insignificant.

The intention-to-treat (ITT) analysis was used, as there were no dropouts in the study and all patients adhered to the protocol.

Results

As illustrated in Figure 2, we evaluated 116 patients for their eligibility; 12 patients were excluded, and 4 chose not to participate. The results for the 100 women who underwent elective cesarean sections were divided into two groups, each consisting of 50 women. Group A (the control group) received diclofenac sodium 75mg and was prescribed intramuscular pethidine (50 mg) as needed. Group B was similar to the control group but incorporated an intra-abdominal technique for

Table 3. Narcotics required analgesia among the studied groups.

	Narcotics first dose time (hours) in cases that required analgesia			
Findings	TAP block (N=50)	Control (N=50)	P-value	Effect size RR (95% CI)
Required (0.08–0.43)	5 (10.0%)	28 (56.0%)	#<0.001*	0.18
Not required	45 (90.0%)	22 (44.0%)		
	Narcotics first dose time (hours) in cases that required analgesia			
Measures	TAP block (N=5)	Control (N=13)	^P-value	Effect size Mean±SE 95% CI
Mean±SD	10.4±1.5	4.5±1.1	<0.001*	5.9±0.6
Range	9.0–12.0	3.0–8.0		4.8–7.1
	Narcotics first dose time (hours) in cases that required analgesia			
Measures	TAP block (N=5)	Control (N=13)	^P-value	Effect size Mean±SE 95% CI
Mean±SD	55.0±11.2	88.4±17.3	<0.001*	-33.4±8.1
Range	50.0–75.0	50.0–100.0		-49.9–-16.9
Range	1.0–3.0	1.0–4.0		-0.3–0.0

a well-established anesthetic block.

There were no significant differences between the groups concerning age, body mass index, parity, reasons for surgery, gestational age, and duration of operation (see Table 1).

Pain perception reported by patients (VAS-10) at rest during various follow-up times was lower in the TAP block group, with statistically significant differences observed at hours 4 and 8. Patients' pain perception (VAS-10) during movement at various follow-up times was also lower in the TAP block group, with statistically significant differences noted at hours 4 and 8. The necessity for narcotics was significantly reduced in the TAP block group. The time until the initial narcotic dose was noticeably extended in the TAP block group. The total amount of narcotics administered was significantly decreased in the TAP block group. The rate of the narcotic requirement was markedly lower in the TAP block group (see Tables 2 and 3).

Discussion

The TAP block has recently been recognized as an effective method for reducing pain in patients undergoing various abdominal surgeries (7). TAP works by blocking the nerve signals of the anterior abdominal wall by administering a local anesthetic in the neurofascial plane between the internal oblique and transversus abdominis muscles (8).

This research included 100 patients who had elective cesarean deliveries, organized into two groups of 50 women each. Group A (the control group) was administered diclofenac sodium at 75mg and given intramuscular pethidine (50 mg) as needed. Group B received the same treatment as Group A, but also had a standard anesthetic block implemented through an intra-abdominal technique. There were no notable differences between the groups in terms of age, body mass index, parity, reasons for surgery, gestational age, and duration of the operation.

Our results and their comparison to similar studies

Our research findings indicate that the pain levels (VAS-10) at rest at various follow-up intervals were lower in the TAP block group, with significant differences observed at 4 and 8 hours. The pain levels (VAS-10) experienced during movement at different follow-up times also revealed lower scores in the TAP block group, with significant differences identified at 4 and 8 hours. The requirement for narcotics was considerably less frequent among patients in the TAP block group.

Consistent with our findings, research conducted by Mohanan et al. (9) compared the effectiveness of the TAP block versus traditional analgesic methods in managing postoperative pain in cesarean section patients. Their findings indicated that patients who received a TAP block reported lower pain levels and had reduced need for additional pain relief throughout the evaluation periods. In the investigation by Sharma et al. (10), the success of the TAP block for pain alleviation was compared to a systemic analgesic regimen in patients undergoing major abdominal surgeries. They concluded that the TAP block offered highly effective pain relief in the first 24 hours post-surgery, with no complications. Similar outcomes were found in studies by Naveen et al. (11) and Kahsay et al. (12).

Owen et al. (13) reported that categorical pain scores after 6–9 hours of surgery were significantly lower in women who received surgical TAP blocks, mirroring the findings of the study conducted by Sravani et al. (7). In the study performed by Bharti et al. (14), the TAP block group demonstrated reduced postoperative VAS scores both while at rest and during knee movement. Consequently, the patients who received the TAP block were able to move quickly and enjoyed peaceful sleep. Consequently, 70% of the participants in the TAP block group reported contentment with pain management.

Similarly, Eslamian et al. (15) and Tan et al. (16) evaluated the efficacy of TAP block versus no block in patients undergoing cesarean delivery with general anesthesia. Patients in the TAP group reported reduced VAS pain scores both while resting and during coughing.

Conversely, a limited number of studies, such as a meta-analysis and a review from the Cochrane database, indicated that TAP block did not enhance the postoperative pain measurements (17, 18, 19).

The findings of this study indicate that the initial dose time for narcotics was notably longer in the TAP block group. The total dose of narcotics was notably reduced in the TAP block group. The necessity for narcotics was notably reduced in the TAP block group.

Consistent with the findings of Kahsay et al. (11), Srivastava et al. (20) observed a decrease of up to 50% in opioid usage during the TAP block. This has important implications for postoperative care, as decreased opioid consumption results in a lower incidence of opioid-related side effects.

In the study done by McDonnell et al. (21), 50 women in labor were randomized to receive a TAP block with either ropivacaine or a placebo after a cesarean section under spinal anesthesia, in addition to regular postoperative analgesia. The TAP group showed a significant reduction in morphine consumption, pain intensity, and side effects at 48 hours after surgery. Other authors, such as Belavy et al. (22) and Baaj et al. (7), also recognized similar benefits.

Additionally, Champaneria et al. (23) discovered that the transversus abdominis plane block improves immediate postoperative pain relief during rest and movement in comparison to cases without this block; nonetheless, this advantage appears to decline by 24 hours after surgery. The transversus abdominis plane block significantly reduces opioid consumption at 24 hours; however, by 48 hours, the

difference is no longer significant. In the study by Pradhan et al. (24), opioid use 24 hours post-surgery was significantly reduced, consistent with results from the research conducted by Mankikar et al. (25).

Studies carried out by Sivapurapu et al. (26); Saxena et al. (27); Mishriky et al. (28) showed a notable reduction in the administration of postoperative analgesics like diclofenac in the first 48 hours for TAP block groups. In the study performed by Saxena et al. (27), there was almost a 50% reduction in the requirement for diclofenac post-surgery. The time until the first request for pain relief was significantly longer in the TAP block group ($P < 0.0038$) compared to the placebo group.

Clinical Implication of Our Study

The surgical TAP block is a recognized method for managing postoperative pain after abdominal surgeries. Nevertheless, it has not been widely utilized by obstetricians.

Strengths and limitations of our study

The strength of this study is attributed to the suitable methodology and the effective randomization that reduces selection bias. The relatively large sample size further reinforced our confidence in the safety and simplicity of this technique.

The limitation of our study was the absence of blinding of participants or surgeons. This increases the risk of performance bias and a lack of documentation regarding the various surgical steps taken during the CS for each patient. For instance, whether the surgeon dealt with adhesions or the repositioning of the bladder during repeat CS, whether the obstetrician chose to close the parietal peritoneum, etc. These factors could impact the total amount of rescue analgesia administered and the timing for the first dose of rescue analgesia needed. Also the use of VAS score has the potential for variability in subjective reporting which is considered as a limitation.

Recommendation for further studies: Multicentric randomized controlled studies are required to assess the efficacy of the surgeon-performed TAP block and its comparison to preoperative TAP blocks, so that it can be incorporated into standard obstetrician practices. Also studies are required to emphasize the need for longer-term follow-up studies on pain relief and opioid use.

Conclusion

The TAP block significantly decreased the VAS pain scores at rest and under stressors. Consequently, the use of narcotics was notably reduced in the TAP block group.

Authors contributions

All authors jointly contributed to the conception and design of the study.

Mohamed Abd Elfattah Elsenity: Design of the study, performing the surgical procedures, helped review literature, revise results and data analysis.

Ahmed Sherif Abdel Hamid: Revision of the manuscript and submission to the journal.

Abdallah Sami Abdallah Mashaal: design of the study, revision of review of literature, and revision of the manuscript.

Salah Taha Ahmed: obtaining ethical committee approval, reviewing the literature, sharing in the collection of Data, patient recruitment.

Ahmed Hamdy Naguib: design of the study, revision of the review of literature, and revision of the manuscript.

Hassan Morsi: revision of results and data analysis, writing the manuscript.

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Disclosure of Interest

The authors declare no conflict of interest.

Ethics Approval and Informed Consent to Participate

Following local regulations, the study gained ethical committee approval from the Faculty of Medicine, AIN University, number FMASUMS12/2021. All procedures were done per the Declaration of Helsinki.

Data Sharing

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgment

Not applicable.

References

1. Rafi AN. Abdominal field block: a new approach via the lumbar triangle. Anesthesia. 2001; 56:1024-6.
2. McDonnell JG, Curley G, Carney J. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: a randomized controlled trial. Anesth Analg. 2008; 106(1):186-91.
3. McDermott G, Korba E, Mata U. Should we stop doing blind transversus abdominis plane blocks? Br J Anaesth. 2012; 108(3):499-502.
4. Lancaster P and Chadwick M. Liver trauma secondary to ultrasound-guided transversus abdominis plane block. Br J Anaesth. 2010; 104(4):509-10.
5. Elamin G, Waters PS, Hamid H. Efficacy of a laparoscopically delivered transversus abdominis plane block technique during elective laparoscopic cholecystectomy: a prospective, double-blind, randomized trial. J Am Coll Surg. 2015; 221:335-44.
6. Brogi E, Kazan R, Cyr S, Giunta F, Hemmerling TM. "Transversus abdominal plane block for postoperative anal-gesia: a systematic review and meta-analysis of randomized-controlled trials," Canadian Journal of Anesthesia/Journal canadien d'anesth´esie, 2016; 63(10): 1184–1196.
7. Sravani P, Indrani C, Rajanna SP, et al. Efficacy of Surgical Transversus Abdominis Plane Block in Patients Undergoing Cesarean Delivery. J South Asian Feder Obst Gynae 2020;12(5): 302–306.
8. Baaj JM, Alsatli RA, Majaj HA, Babay ZA, Thallaj AK. Efficacy of ultrasound-guided transversus abdominis plane (TAP) block for postcesarean section delivery analgesia — A double-blind, placebo-controlled, randomized study. Middle East J Anaesthesiol 2010;20:821-6.
9. Mohanan N, Raghu K. Transverse abdominis plane block versus sodium diclofenac-acetaminophen combination for postoperative analgesia following cesarean section. Bali J Anaesthesiol 2020;4:39-41.
10. 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;4:177-80.
11. Naveen S, Singh RK, Sharma PB, Anne S. Evaluation of transversus abdominis plane block for postoperative analgesia after lower segment cesarean section. Karnataka Anaesth J 2017;3:41-4.
12. Kahsay DT, Elsholz W, Bahta HZ. Transversus abdominis plane block after Caesarean section in an area with limited resources, Southern African. J Anaesth Analg 2017;23:90-5.
13. Owen D, Harrod I, Ford J, Luckas M, Gudimetla

V. The surgical transversus abdominis plane block-a novel approach for performing an established technique. BJOG 2011;118:24–27.
14. Bharti N, Kumar P, Bala I, Gupta V. The efficacy of a novel approach to transversus abdominis plane block for postoperative analgesia after colorectal surgery. Anesth Analg 2011;112:1504-8.
15. Eslamian L, Jalili Z, Jamal A, et al. Transversus abdominis plane block reduces postoperative pain intensity and analgesic consumption in elective cesarean delivery under general anesthesia. J Anesth 2012;26(3):334–8.
16. Tan TT, Teoh WH, Woo DC, Ocampo CE, Shah MK, Sia AT. A randomised trial of the analgesic efficacy of ultrasound-guided transversus abdominis plane block after caesarean delivery under general anesthesia. Eur J Anaesthesiol 2012;29:88-94.
17. Petersen PL, Mathiesen O, Stjernholm P, et al. The effect of transversus abdominis plane block or local anaesthetic infiltration in inguinal hernia repair: a randomised clinical trial. Eur J Anaesthesiol 2013;30(7):415–421.
18. Charlton S, Cyna AM, Middleton P, et al. Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery. Cochrane Database Syst Rev 2010;8:CD007705.
19. Johns N, O'Neill S, Ventham NT, et al. Clinical effectiveness of transversus abdominis plane (TAP) block in abdominal surgery: a systematic review and meta-analysis. Colorectal Dis 2012;14(10): 635–642.
20. Srivastava U, Verma S, Singh TK, Gupta A, Saxsena A, Jagar KD, et al. Efficacy of trans abdominis plane block for post cesarean delivery analgesia: A double-blind, randomized trial. Saudi J Anaesth 2015;9:298-302.
21. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: A prospective randomized controlled trial. Anesth Analg 2007;104:193-7.
22. Belavy D, Cowlishaw PJ, Howes M, Phillips F. Ultrasound-guided transversus abdominis plane block for analgesia after Caesarean delivery. Br J Anaesth 2009;103:726-30.
23. Champaneriaa R, Shaha L, Geogheganb J, Guptac JK, Daniel JP. Analgesic effectiveness of transversus abdominis plane blocks after hysterectomy: ameta analysis, European Journal of Obstetrics & Gynecology and Reproductive Biology. 2013; 166(13): 1–9.
24. Pradhan R, Mishra SK, Rajbanshi LK, Khanal K, Arjyal B, Pokharel HP. Effectiveness of Transversus Abdominis Plane Block for Postoperative Analgesia in Obstetric Cases Undergoing Caesarean Section BJHS 2019;4(2)9: 755 – 758.
25. Mankikar MG, Sardesai SP, Ghodki PS. Ultrasound-guided transversus abdominis plane block for postoperative analgesia in patients undergoing caesarean section. Indian J Anaesth 2016;60:253-7.
26. Sivapurapu V, Vasudevan A, Gupta S, Badhe AS. Comparison of analgesic efficacy of transversus abdominis plane block with direct infiltration of local anesthetic into surgical incision in lower abdominal gynecological surgeries. J Anaesthesiol Clin Pharmacol 2013;29:71-5.
27. Saxena A, Gupta A, Mitra D, Singhal J, Agarwal M. To evaluate the efficacy of novel approach to transversus abdominis plane block for postoperative analgesia after abdominal surgeries. Saudi Surg J 2016;4:29-33.
28. Mishriky BM, George RB, Habib AS. Transversus abdominis plane block foranalgesia after Cesarean delivery: a systematic review and meta-analysis. Can J Anesth 2012;59(8):766–78.

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