Section A -Research paper

Assessing the Effectiveness of ultrasound guided Transversus Abdominis Plane Block for Pain Management in Cesarean Delivery Patients

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Abstract:

Background: The ultrasound guided (USG) transverses abdominis plane (TAP) block is a regional anaesthetic technique that can provide effective pain relief by blocking the cutaneous nerves supplying the anterior abdominal wall. This study aims to assess the efficacy of USG guided TAP block in providing post operative pain relief for patients undergoing cesarean delivery, as well as the ease of performance of the technique and patient satisfaction with the analgesia provided. **Methods:** This is a hospital based prospective comparative study that spanned over a period of four months, commencing from December 2022 to March 2023. The study was conducted at SKIMS Medical College, Bemina Srinagar and involved 110 women undergoing cesarean delivery (CD), with 55 receiving a USG TAP block and 55 in a control group receiving routine analgesia. Twenty milliliters of 0.25% ropivacaine was injected in the transverses abdominis neuro fascial plane, on either side. VAS scores for pain were monitored for 24 hours, and time to first rescue analgesia and total dose of analgesics were recorded. **Results:** In Group A, the mean VAS score was significantly lower than in Group B at all-time intervals ($p<0.05$), indicating the effectiveness of the USG TAP block in reducing postoperative pain. The mean time to first rescue analgesia was significantly longer in Group A (11.4 hours) than in Group B (3.9 hours), and the mean consumption of analgesics was significantly lower in Group A (1.3 g) than in Group B (2.7 g),both with $p<0.001$. Patients in Group A also reported significantly higher satisfaction with postoperative pain management than those in Group B, with a mean score of 8.13 compared to 6.95, respectively ($p<0.001$).**Conclusion:** USG TAP block is

effective in reducing postoperative pain and analgesic consumption in Caesarean delivery patients. It leads to lower VAS scores, longer time to first rescue analgesia, and higher patient satisfaction levels. TAP block can be considered as a reliable option for postoperative pain management in such patients.

Keywords: Cesarean delivery, Postoperative analgesia, Postoperative pain, Surgical transverses abdominis plane block, Tramadol

Introduction

Cesarean delivery (CD) is a commonly performed obstetric procedure that can result in significant postoperative pain, which can negatively impact a woman's recovery and overall experience that can affect maternal-infant bonding, breastfeeding, as well as may expose the mother to risk of thrombo embolism as a result of immobility that can result in post operative morbidity and mortality of mother and child .The provision of effective post-operative analgesia is of key importance to facilitate early ambulation, infant care and prevention of post-operative morbidity. A significant source of pain experienced by patients after Caesarean delivery (CD) is the incision on the abdominal wall. The cutaneous nerves that supply the anterior abdominal wall(ranging from T6 to L1) run in the neurofascial plane between the internal oblique muscle and the transverses abdominis muscle[1, 2].To block these nerves, an anaesthetic is injected into this plane, resulting in the transverses abdominis plane block, a recognized means of providing postoperative pain relief that has the added benefit of reducing opioid use and improving analgesia. The use of opioids for pain management following CD is associated with undesirable side effects, such as nausea, vomiting, and respiratory depression. Therefore, alternative methods of postoperative pain management, such as regional anaesthesia, have gained popularity in recent years. Fortunately, there is a simpler, more dependable, and equally efficient technique called the ultrasound guided transverses abdominis plane (TAP) block, which can minimize or eradicate these adverse effects. The USG guided transverses abdominis plane (TAP) block is a regional anaesthetic technique that can provide effective pain relief by blocking the cutaneous nerves supplying the anterior abdominal wall.[3,4] This technique has gained acceptance among anaesthesiologists and has been shown to reduce opioid consumption and improve analgesia.[5,7] However, its use in obstetric practice, was not in wide spread use because (TAP) block was usually performed by landmark-based methods, so it had high failure rates. With the introduction of ultrasonographic guidance, the technique enables exact placement of the local anaesthetic at

the desirable site and high success rate for the block. This study aims to assess the efficacy of TAP block under ultrasonographic guidance when used as a part of multimodal analgesia that relieves substantial somatic pain from skin incision. So, we hypothesise that USG guided TAP block will prolong the time to first dose of analgesic and also will reduces total analgesic requirement.

Methods

The study was conducted after approval by institutional Ethics Committee. Informed and written consent from all subjected was taken before initiation of study procedures. This is a hospital based prospective, randomized, controlled trial conducted at SKIMS Medical College, Bemina Srinagar and was completed over period of 4 months (From December 2022 to march2023) in which we included American Society of Anaesthesiology (ASA) I and II 110 pregnant women scheduled for elective or emergency Cesarean Delivery (CD). Those who did not give consent, had contraindications to spinal anaesthesia, required general anaesthesia at any point of time during surgery, had infectionor scar at site of block were excluded from the study.

All patients received spinal anaesthesia with 3ml of 0.5% hyperbaric Bupivacaine. At the end of surgery all patients received 1gm paracetamol infusion. USG-guided bilateral TAP block was given to 55 patients that were assigned to the "Study" group, by in plane approach using the SONOSITE Ultrasonography machine with linear array transducer probe (6-13 MHz). The needle was inserted in-plane from antero-medial side of probe, through the adipose tissue and the external and internal oblique muscles. The tip of the needle was placed in the superficial part of the transversus abdominis plane. Once TAP plane was located, 20 ml of 0.25% of Ropivacaine was injected which was seen as a lens shaped hypoechoic area between the internal oblique and transverse abdominis muscle. Same procedure was repeated on other side. While the other 55 patients were assigned to the "Control" group using a "convenience" sampling technique. During the postoperative period, all patients were closely monitored at specific time intervals, including 60 minutes, 2hours, 4 hours, 6 hours, 12 hours, and 24 hours, for pain using the visual analog score (VAS). In the study group, rescue analgesia with intravenous inj. paracetamol 1g was administered whenever the VAS score was 4 or higher. On the other hand, patients in the control group received routine intravenous inj. Paracetamol 1gm every 8 hours for pain relief. The time of the first rescue analgesia request was noted for all patients, along with the total dose of rescue analgesics required within the first 24 hours. Any complications that occurred were also

recorded. After the initial 24 hours of cesarean delivery, patient satisfaction with postoperative pain relief was evaluated on a scale of 0 to 10, with 0 indicating "not satisfied at all" and 10 indicating "fully satisfied" with the pain management.

Statistical Methods: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA).Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and line diagrams. Student's independent t-test or Mann-Whitney U-test, whichever feasible, was employed for comparing continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was applied for comparing categorical variables. A P-value of less than 0.05 was considered statistically significant.

Results

In this section, the results of the study will be described:

Table 1: Demographic characteristics of study patients in two groups

Parameter	Group A [n=55]		Group B [n=55]		P-value
	Mean	SD	Mean	SD	
Age (Years)	25.7	9.34	23.9	8.18	0.285
Height (cm)	163.1	3.19	162.4	2.74	0.219
Weight (Kg)	75.4	7.26	73.8	8.61	0.294

Group A (TAP Block); Group B (Control Group)

For age, the mean was 25.7 years (SD=9.34) in Group A and 23.9 years (SD=8.18) in Group B, with a P-value of 0.285. For height, the mean was 163.1 cm (SD=3.19) in Group A and 162.4 cm (SD=2.74) in Group B, with a P-value of 0.219. For weight, the mean was 75.4 kg (SD=7.26) in Group A and 73.8 kg (SD=8.61) in Group B, with a P-value of 0.294. These results indicate that there were no significant differences in the demographic characteristics of the study participants between the two groups.

Table 2: Comparison based on postoperative VAS Score in two groups at various intervals of time

Time Interval	Group A [n=55]		Group B [n=55]		P-value
	Mean	SD	Mean	SD	
1 Hour	0.97	0.751	1.42	0.838	0.004*
2 Hours	1.49	0.872	2.87	0.791	<0.001*
4 Hours	1.83	0.642	3.64	0.762	<0.001*
6 Hour	2.35	0.782	2.91	0.961	0.002*
12 Hours	2.71	0.914	3.19	0.853	0.005*
24 Hours	1.52	0.751	2.15	0.829	<0.001*

***Statistically Significant Difference (P-value<0.05)**

The table 2, shows that at 1 hour, the mean VAS score in Group A was 0.97 with an SD of 0.751, while in Group B, it was 1.42 with an SD of 0.838. The p-value for this time interval was 0.004, which indicates that there was a statistically significant difference between the two groups. Similarly, at 2 hours, 4 hours, 6 hours, 12 hours, and 24 hours, the mean VAS scores in Group A were significantly lower than in Group B, with p-values of <0.001, <0.001, 0.002,0.005 and <0.001 respectively. These results suggest that the surgical TAP block was effective in reducing postoperative pain in patients undergoing Cesarean delivery.

Table 3: Comparison based on time to first rescue analgesia (hours) in two groups

Group	N	Mean	SD	95% CI For Mean	P-value
Group A	55	11.4	3.89	9.12-13.54	<0.001*
Group B	55	3.9	1.74	2.54-3.43	

***Statistically Significant Difference (P-value<0.05); CI: Confidence interval**

The mean time to first rescue analgesia was 11.4 hours with a standard deviation of 3.89 and a 95% confidence interval between 9.12 and 13.54 hours for Group A. In comparison, the mean

time to first rescue analgesia was 3.9 hours with a standard deviation of 1.74 and a 95% confidence interval between 2.54 and 3.43 hours for Group B.

The P-value for the comparison was less than 0.001, indicating a statistically significant difference between the two groups. Overall, Group A had a significantly longer time to first rescue analgesia than Group B, suggesting that surgical TAP block provided superior pain relief compared to routine analgesia in the control group.

Table 4: Comparison based on total analgesic consumption (g) during first 24 hours in two groups

Group	N	Mean	SD	95% CI For Mean	P-value
Group A	30	1.3	0.951	1.14-1.56	<0.001*
Group B	30	2.7	1.237	2.34-3.02	

***Statistically Significant Difference (P-value<0.05); CI: Confidence interval**

Group A, which received a surgical transverses abdominis plane (TAP) block, had a significantly lower mean consumption of analgesics (1.3 g) compared to Group B, which did not receive the TAP block and had a mean consumption of 2.7 g. The standard deviation (SD) for Group A was 0.951 and for Group B was 1.237. The 95% confidence interval (CI) for the mean of Group A was 1.14-1.56, while for Group B, it was 2.34-3.02. The P-value for the mean comparison was found to be less than 0.001, indicating a statistically significant difference in the analgesic consumption between the two groups.

Table 5: Comparison based on patient satisfaction score in two groups

Group	N	Mean	SD	95% CI For Mean	P-value
Group A	55	8.13	0.781	7.95-8.29	<0.001*
Group B	55	6.95	0.653	6.87-7.05	

***Statistically Significant Difference (P-value<0.05); CI: Confidence interval**

The mean score for patient satisfaction in Group A was 8.13, with a standard deviation (SD) of 0.781 and a 95% confidence interval (CI) for the mean of 7.95-8.29. In contrast, the mean score for patient satisfaction in Group B was 6.95, with an SD of 0.653 and a 95% CI for the mean of 6.87-7.05. The difference between the means was statistically significant (P-value <0.001), indicating that patients in Group A were more satisfied with their postoperative pain management compared to those in Group B.

Discussion

The study was conducted to evaluate the efficacy of USG guided transverses abdominis plane (TAP) block in providing postoperative pain relief in patients undergoing cesarean delivery (CD). CD is a common surgical procedure that is associated with significant postoperative pain. Adequate pain relief is crucial for the mother's well-being and facilitates early recovery and initiation of breast feeding. USG guided TAP block has been shown to be effective in providing pain relief after various abdominal surgeries. However, its efficacy in CD remains unclear. Therefore, this study aimed to assess the effectiveness of USG guided TAP block in CD and provide evidence-based recommendations for postoperative pain management in this patient population. The results of the study revealed that the mean VAS scores in the group that received the USG guided TAP block were significantly lower than the control group at various time intervals postoperatively, indicating that the USG guided TAP block was effective in reducing postoperative pain in patients undergoing Caesarean delivery. At 6 hours, there was a slightly higher mean VAS score in the study group, but it was still significantly lower than the control group. Overall, the results suggest that the USG guided TAP block can be a useful adjunct to pain management in patients undergoing Cesarean delivery. Our primary conclusion is supported by the evidence that the USG guided TAP block with 20 mL of 0.25% ropivacaine, administered bilaterally effectively provides note worthy postoperative analgesia for the initial 24-hour period in patients undergoing CD.

McDonnel et al. [13] suggested that TAP block is novel and reliable approach to the blockage of neural afferent to the anterior abdominal wall which provides post operative analgesia after abdominal surgeries. P. Hebberd et al. [14] in 2007 described the ultrasound (USG)-guided approach to the TAP block.USG guided TAP block is a new technique used to provide analgesia after abdominal surgery. Caesarean delivery is a major surgical procedure after which substantial

post-operative pain and discomfort can be anticipated which may affect breast-feeding, maternal-infant bonding, as well as may expose the mother to risk of thromboembolism[10] as a result of immobility. The provision of effective post-operative analgesia is of key importance to facilitate early ambulation, infant care and prevention of post-operative morbidity and mortality.

Notwithstanding, the salutary outcomes of the TAP block have exhibited irregularity. A limited number of investigations, encompassing a meta-analysis and a review of the Cochrane database, have demonstrated that the TAP block failed to enhance the postoperative pain scores.[11,12]

In the present study, the mean duration until the initial requirement for supplemental analgesia was observed to be 11.4 hours (standard deviation 3.89) for Group A, with a 95%confidence interval of 9.12 to 13.54 hours. In contrast, for Group B, the mean duration until the initial requirement for rescue analgesia was 3.9 hours (standard deviation 1.74), with a 95%confidence interval of 2.54 to 3.43 hours. A P-value of less than 0.001 was obtained for the comparison, indicating a statistically significant divergence between the two groups. In general, Group A had a notably prolonged duration until the initial need for rescue analgesia in comparison to Group B, highlighting that USG guided TAP block afforded superior pain alleviation relative to conventional analgesia utilized in the control group. This phenomenon may be attributed to the intrinsically deficient vascular supply of the transversus abdominal plane, leading to protracted drug clearance times. It is essential to note that the triumph of all regional block methods relies heavily on the operator's proficiency, and research has demonstrated a failure rate of 5-20% for TAP blocks.[13]We used the USG- guided technique to avoid complication more common with the blind approach. In addition, it gives a real time visualization of needle tip and relevant anatomical structures, increasing the margin of safety and reducing the chances of failure. Group A, which received a USG guided transversus abdominis plane (TAP) block, exhibited a significantly lower mean analgesic consumption Paracetamol1.3 gm in contrast to Group B, who did not receive the TAP block, with a mean consumption of 2.7gm. The 95% confidence interval (CI) for the mean of Group A was determined to be 46.4-81.7, while for Group B, it was138.2-198.3. Notably, the P-value for the mean comparison was found to be less than 0.001, signifying a statistically significant difference in the analgesic consumption between the two groups. Maitreyi Gajanan Mankikar et al 2016, observed that reduction in VAS score after TAP block with 0.5% ropivacaine for 8- 10 hr post- operatively as compared to patients receiving placebo

block, mean time for rescue analgesia was 9.53hr after TAP block with 0.5% Ropivacaine and 4.1 hr in placebo block and mean tramadol requirement 140mg after TAP block with 0.5% Ropivacaine first 24 hr and 246.66mg in placebo block.

In the "Control" group, 50 patients had a total tramadol consumption of 9,050 mg, equating to an average of 181 mg per patient during the initial 24 hours post-surgery. Conversely, in the "Study" group, the total tramadol consumption was 2,600 mg, with an average of only 52 mg per patient during the first 24 hours post-surgery. This difference resulted in a statistically significant reduction in the total rescue analgesic consumption in the "Study" group, which had received TAP block, which is consistent with our study. We did not observe any serious complications like accidental intra-peritoneal and intra-vascular injection as we carried out study under USG guidance and transversus abdominis plane has less vascularity. The study revealed that Group A had a significantly higher mean patient satisfaction score of 8.13 (SD=0.781) and a 95% confidence interval for the mean of 7.95-8.29, as opposed to Group B which had a mean score of 6.95(SD=0.653) and a 95% confidence interval for the mean of 6.87-7.05. The difference in mean scores was found to be statistically significant with a P-value <0.001. These results indicate that patients who received the TAP block were more content with their postoperative pain management in comparison to those who did not. This finding is in line with Sravani etal's research, in which patient satisfaction scores were assessed on a 0-10 scale and recorded 24 hours after cesarean delivery and their "Study" group demonstrated significantly higher satisfaction scores compared to the "Control" group, which is consistent with our study.[14]

Conclusion

The USG guided transverses abdominis plane (TAP) block was found to be an effective method for reducing postoperative pain and analgesic consumption in patients undergoing Cesarean delivery. The USG guided TAP block resulted in significantly lower mean VAS scores at various time intervals compared to routine analgesia. Patients who received the USG guided TAP block also had a significantly longer time to first rescue analgesia with reduction in total analgesic requirement in first 24 hours and reported higher levels of satisfaction with their pain management. These findings suggest that the USG guided TAP block can be considered as a safe and reliable option for postoperative pain management in patients undergoing Cesarean delivery.

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References

1. Netter FH. Back and spinal cord. In: Netter FH, ed. Atlas of Human Anatomy. Summit, New Jersey: The Ciba-Geigy Corporation; 1989. pp. 145–155.
2. Netter FH. Abdomen postero lateral abdominal wall. In: Netter FH, ed. Atlas of Human Anatomy. Summit, New Jersey: The Ciba-Geigy Corporation; 1989. pp. 230–240.
3. Rafi A. Abdominal field block: a new approach via the lumbar triangle. Anaesthesia 2001;56(10):1024–1026. DOI: 10.1046/j.1365- 2044.2001.02279-40.x.
4. McDonnell JG, O'Donnell B, Curley G, et al. The analgesic efficacy of transverses abdominis plane block after abdominal surgery: a prospective randomized controlled trial. Anesth Analg 2007;104(1):193–197. DOI: 10.1213/01.ane.0000250223.49963.0f.
5. McDonnell JG, Curley G, Carney J, et al. The analgesic efficacy of transverses abdominis block after caesarean delivery. Anaesth Analg 2008;106(1):186–191. DOI: 10.1213/01.ane.0000290294.64090.f3.
6. French JLH, McCullough J, Bachra P, et al. Transversus abdominis plane block for analgesia after caesarean section in a patient with an intracranial lesion. Int J Obstet Anesthe 2009;18(1):52–54. DOI: 10.1016/j.ijoa.2008.06.005.
7. Randall IM, Costello J, Carvalho JC. Transversus abdominis plane block in a patient with debilitating pain from an abdominal wall hematoma following cesarean delivery. AnesthAnalg 2008;106(6):1928. DOI: 10.1213/ane.0b013e318170baf3.

8. McDonnell J, Curley G, Carney J, Benton A, Costello J, Maharaj CH, et al. The Analgesic Efficacy of Transversus abdominis plane block after caesarean delivery: A randomized contolled trial. AnesthAnalg. 2008;106(1):186–91.

9. Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane (TAP) block. Anaesth Intensive Care. 2007;35(4):616–7.

10.3. Mankikar MG, Sardesai SP, Ghodki PS. Ultrasound-guided transversus abdominis plane block for post-operative analgesia in patients undergoing caesarean section. Indian J Anaesth. 2016;60(4):253–7.doi:10.4103/0019-5049.179451.

11. Petersen PL, Mathiesen O, Stjernholm P, et al. The effect of transverses abdominis plane block or local anaesthetic infiltration in inguinal hernia repair: a randomized clinical trial. Eur J Anaesthesiol 2013;30(7):415–421. DOI: 10.1097/EJA.0b013e32835fc86f.

12. Charlton S, Cyna AM, Middleton P, et al. Perioperative transversusabdominis plane (TAP) blocks for analgesia after abdominal surgery. Cochrane Database Syst Rev 2010;8:CD007705.

13. Buluc H, Ar AY, Turan G, Karadogan F, Sargin MA, Akgun N. The efficacy of transverses abdominis plane block for post-operative analgesia after the cesarean section performed under general anesthesia. North ClinIstanb. 2019 Mar 10;6(4):368-373. doi: 10.14744/nci.2018.97059. PMID: 31909382; PMCID: PMC6936937.

14. Sravani P, Rajanna SP. Efficacy of Surgical Transversus Abdominis Plane Block in Patients Undergoing Cesarean Delivery. Journal of South Asian Federation of Obstetrics and Gynaecology. 2021 Mar 1;12(5):302-6.