ORIGINAL ARTICLE

Analgesic Effectiveness of Surgical Transversus Abdominis Plane Block after Cesarean Delivery

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Abstract

Background: Surgical block of the transversus abdominis plane (TAP) provides effective pain relief of the somatic component of pain after surgery. This study was carried out to determine the efficacy of the TAP block administered during surgery as a part of multimodal analgesia after lower segment cesarean section.

Materials and methods: We conducted a prospective case–control study with 160 antenatal women with 80 cases (group I) and 80 controls (group II) undergoing cesarean section from JSS Hospital, Mysuru, Karnataka, India, who were randomized to be given surgical TAP block with 30 mL of bupivacaine (0.25%) after getting written, informed consent from the participants. All women received the conventional regimen of 75 mg of diclofenac sodium every eight hours for postoperative pain relief. Tramadol hydrochloride was used as rescue analgesia. Postoperatively visual analog scale (VAS) score was assessed at 1, 2, 4, 12, and 24 hours. The pulse rate and blood pressure of all women were monitored at the same intervals.

Results: Age, height, body mass index (BMI), and duration of surgery were comparable between groups I and II. The mean postoperative time required to start analgesics was comparatively longer in group I when compared to group II. The difference in pulse rate and mean arterial pressure within the groups was found to be statistically significant. The mean of VAS score at all the intervals was found to be significantly lower in group I. About 33.8% of women in group II needed additional analgesia, whereas only 3.8% patients required additional analgesics in group I.

Conclusion: Surgical TAP block is a safe and efficacious method to provide pain relief in the postoperative period with minimal side effects and complications.

Keywords: Cesarean section, Multimodal analgesia, Surgical transversus abdominis plane block.

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Introduction

Cesarean section is a commonly done procedure which causes substantial postoperative pain and discomfort. The pain interferes with early ambulation and causes discomfort while feeding.[1] Effective postoperative analgesia ensures that the mother can be ambulatory in a short time, and can prevent thromboembolic episodes. It promotes maternal bonding with the neonate and improves infant weight gain. Somatic pain due to an incision on the abdominal wall and visceral pain due to a uterine incision are the two components of pain following cesarean section.[2]

Opioids through the neuraxial route need to be administered by trained personnel and require proper monitoring but are safe and effective.[3] Opioids can also be given by intravenous route and as patient-controlled analgesia.[4] However, undesirable outcomes like nausea, vomiting, itching, sedation and sometimes respiratory depression can occur. Secretion in breast milk is a major disadvantage of opioids.[3] Other modes of analgesia that supplement but are not effective on their own are nonsteroidal anti-inflammatory drugs (NSAIDs) and paracetamol.[3] Multimodal analgesia, is the need of the hour and may be achieved by systemic administration of analgesics, or regional blocks. Various methods of regional analgesia, such as epidural, local wound infiltration, or peripheral nerve blocks, like the transversus abdominis plane (TAP) block.[5]

The TAP block was described in anesthesia practice in 2001 by Rafi, as a blind pop technique by passing a needle blindly between the plane of the internal oblique and transversus abdominis muscles.[6] TAP block provides sensory nerve blockade to the parietal peritoneal layer, the skin, and muscles of the anterior and lateral abdominal wall. The distribution of sensory block is from the T7–T12 and L1–L3 roots. This landmark-based blind technique had severe complications like injury to inferior epigastric vessels and the liver.[7] McDonnell described by using the two-pop technique, a blind needle is placed behind the mid-axillary line, superior to the iliac crest, perpendicular to the skin. The landmark-based TAP block by McDonnell et al. reported an 85% success rate among experienced practitioners.[8]

An ultrasonography (USG)-guided TAP block was first promoted by Hebbard et al.,[9] which had decreased the incidence

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of complications. However, it is a time-consuming procedure and difficult to perform in patients with abdominal obesity.

Owen et al. devised the surgical approach to TAP block. The plane is approached intra-abdominally, under strict asepsis. As the surgeon directly visualizes needle placement, the chances of injury to inferior epigastric vessels, and the bowel are greatly reduced.[10]

This study was carried out to determine whether surgical TAP block can be effectively used in women undergoing cesarean delivery (CD).

Objectives

- Primary objective: To assess the postoperative pain relief in the first 24 hours following the lower segment cesarean section as monitored by VAS.
- Secondary objective: To determine the time needed to ask for first postoperative analgesia and the total need for analgesics in the first 24 hours.

Methodlogy

This was an interventional, prospective randomized case–control study conducted in the Department of Obstetrics and Gynaecology, JSS Medical College and Hospital, Mysuru, Karnataka, India, following approval from the institutional ethical committee from January 2021 to June 2022. The study included pregnant women after 34 weeks of gestation who were admitted to JSS hospital for cesarean section who fulfilled the inclusion and exclusion criteria.

Inclusion Criteria

Women undergoing cesarean section at period of gestation (POG) above 34 weeks with the American Society of Anesthesiologists (ASA) score of 1–2.

Exclusion Criteria

- Pregnant women with known allergy to the drug bupivacaine.
- Thrombocytopenia, hemolysis, elevated liver enzymes, low platelet count (HELLP) syndrome, eclampsia, connective tissue disorders, and antiphospholipid antibody syndrome.
- Women requiring general anesthesia.
- Local infection at injection site.
- Severe maternal or fetal compromise.
- Prolonged duration of surgery [due to postpartum hemorrhage (PPH), bladder injury].
- Previous pelvic surgery due to increased risk of adhesions apart from previous lower (uterine) segment cesarean section (LSCS).

The sample size was calculated to be 160, that is, 80 patients in group I (TAP block–case) and 80 patients in group II (control).

Study Setting and Method of Data Collection

Pregnant women after 34 weeks of gestation were randomized into two groups; group I received TAP block and group II served as control. Height, weight, and BMI were recorded.

Under aseptic precautions, following extraction of the baby and uterine closure and achieving hemostasis, the abdominal wall was retracted upward, and a sterile pack was inserted to prevent bowel injury. The lateral border of the rectus sheath was palpated, and the position of inferior epigastric vessels was determined.

A 23-gauge lumbar puncture needle was passed under vision till there was a loss of resistance.

Table 1: Demographic parameters among cases and controls

Variable	*Control*	*Cases*
Age (years)		
<20	8 (10%)	6 (7.5%)
21–25	38 (47.5%)	36 (45%)
26–30	29 (36.3%)	26 (32.5%)
31–35	4 (5%)	10 (12.5%)
36 and above	1 (1.3%)	2 (2.5%)
POG		
Preterm	18 (22.5%)	25 (31.3%)
Term	62 (77.5%)	55 (68.8%)
Education		
SSLC and below	20 (25.88%)	19 (23.75%)
PUC	30 (35.29%)	21 (26.25%)
Degree and above	30 (38.82%)	40 (50%)
Occupation		
Housewife	79 (98.82%)	78 (97.5%)
Working	1 (1.18%)	2 (2.5%)
OBS score		
Primigravida	42 (49.5%)	38 (48.5%)
Multigravida	38 (48.5%)	42 (49.5%)
C-section		
Elective	20 (25%)	33 (41.25%)
Emergency	60 (75%)	47 (58.75%)

OBS, obstetrics; POG, period of gestation; PUC, preuniversity course; SSLC, secondary school leaving certificate

15 mL of bupivacaine (0.25%) was given after careful aspiration to prevent accidental intravascular injection, on both sides successively.

Both groups received a 75-mg injection diclofenac sodium intramuscularly/intravenously every 8th hour. Injection Tramadol hydrochloride 50 mg intramuscularly/intravenously, on demand, was used as rescue analgesia in the control group.

Postoperative period pain was observed by a single observer by use of VAS at various intervals, that is, 1, 2, 4, 6, 12, and 24 hours. A zero score indicates no pain and a score of 10 implies the worst possible pain. Patient pulse rate and blood pressure were monitored at the same intervals.

Results

Data analysis was done with the help of MS Excel and R-4.1.2 statistical software. The tests were carried out at a 5% level of significance. Descriptive statistics, such as frequency tables, summary statistics, and inferential statistics, were used along with various other tests such as independent sample *t*-test, Kruskal–Wallis test, and Tukey's *post hoc* test (Tables 1 to 3).

The average of the VAS scores at all the intervals was significantly less in the study group compared to the controls.

Although there was a significant difference in the body mass index (BMI) between the study and control groups, this did not affect the analgesic requirement. We further divided cases and controls based on their BMI as those with ideal BMI, overweight,

Table 2: Comparison of mean postoperative pain score between study and control group

Postoperative pain score as per VAS (hours)	Study		Control		
	Mean	SD	Mean	SD	p-value
1	1.71	0.715	1.93	0.348	0.018
2	3.15	0.843	4.24	1.150	0.001
4	5.36	0.846	7.30	0.644	0.001
6	5.32	1.247	5.85	0.713	0.001
12	5.30	0.582	5.90	0.836	0.001
24	5.20	0.537	5.64	0.733	0.001

SD, standard deviation; VAS, visual analog scale

Table 3: Analgesic requirement in 24 hours following surgery between study and control groups

Total analgesics in 24 hours	Group				Total		
	Study		Control				
	N	%	N	%	N	%	p-value
3-injection diclofenac sodium	77	96.3	53	66.3	130	81.3	0.001
3-injection diclofenac sodium + 1-tramadol hydrochloride	3	3.8	27	33.8	30	18.8	
Total	80	100	80	100	160	100	

and obese, and studied them with respect to the time required for requesting analgesics. Within each subgroup, we found that women in the control group required analgesics at a significantly shorter interval. The mean postoperative time required to start analgesics was higher/longer among the study group (4.23 ± 0.413) compared to the control group (3.66 ± 0.364). This difference was found to be significant statistically.

About 33.8% of patients in the control group required additional analgesic, whereas only 3.8% of patients required additional analgesia in the study group. This association was found to be statistically significant.

When we compared the VAS scores at different time intervals within the case group, we found that the intensity of pain at all intervals was significantly higher when compared to the first hour. Similar results were seen in comparing later intervals to the second hour. However, when we compared the pain scores after 4 hours, we did not find a significant difference in pain scores at 4, 12, or 24 hours. This was probably due to additional analgesics being administered.

Similar results were seen in comparing pain scores within the controls. However, there was a non-significant decrease in pain intensity only after 6 hours, whereas before 6 hours there was a steady increase in pain intensity. This shows that there is a good analgesic effect of the surgical transversus abdominis block as seen by a reduction in the intensity of pain within 6 hours postoperative in the case group. Also, this shows that additional analgesia, that is, injection diclofenac sodium was needed by both groups. Hence, TAP block cannot be used as a single form of postoperative analgesia. It requires supplementation with other analgesics. The advantage of the surgical TAP block was seen as patients were more comfortable after surgery, especially in the first 6 hours, and decreased requirement for rescue analgesia.

We noticed an increase in the pulse rate after 4–6 hours in both the cases and controls, which could be explained due to the effect of subarachnoid block causing bradycardia immediately after surgery.

We also observed a significant rise in the systolic and diastolic pressures in the 2–4-hour interval in both case and control groups. This remained constant after 4 hours, probably reflecting a slight fall in arterial pressure immediately after surgery due to the effect of spinal anesthesia. As the change was same within both groups, we can safely assume that the TAP block did not have any effect on the hemodynamic parameters of the subjects.

From our study we can come to an understanding that surgical TAP block is a safe and efficacious method providing postoperative pain relief, when used along with intravenous analgesics, to help the patient tide over immediate discomfort caused by somatic pain after surgery.

Discussion

The surgical TAP block has shown significant postoperative pain relief in various surgeries like hysterectomy, gastrointestinal surgery, appendicectomy, laparoscopic cholecystectomy, hernia repair, prostatectomy, bariatric surgery, and cesarean section. Some problems have been reported with USG-guided TAP block, such as time, need the for ultrasonography in operating room, and trained personnel and it is difficult to perform in patients with obesity.[11]

Regional nerve block procedures have been on the rise in recent years since they decrease the supplemental analgesic requirement thereby lowering the likelihood of medication-related side effects.[8,12,13] A relatively novel abdominal nerve block with good efficacy is the surgical TAP block. Therefore, it may be a viable supplementary analgesic therapy for postoperative pain relief following CD.

In our study, there was a significant difference in the mean VAS score at each specified time interval between the cases and controls. We also found that there were significant differences in the mean VAS scores within the study and the control groups.

This supports our objective that the surgical TAP block was successful in giving patients considerable postoperative pain relief for a short period in women who have undergone CD.

According to Owen et al., surgical TAP blocks considerably reduced the intensity of pain after 6–9 hours postoperative, which is consistent with the findings of our study.[10] McDonnell et al., who gave transcutaneous TAP blocks following cesarean section, and Carney et al., who administered TAP blocks after open appendicectomy and abdominal hysterectomy,[14,15] both observed similar findings. In their multicenter review study, Sravani and Rajanna SP and Ripollés et al. discovered that surgical TAP block minimizes the requirement for analgesics and lower VAS scores were observed in the first 24 hours following surgery.[16,17]

To determine the dose of local anesthetic drug needed for TAP block, Ng et al. performed a meta-analysis. Both groups showed comparable effects on opioid-sparing and postsurgical analgesia (opioid use, time for the first request, and pain intensity at 24 hours). It was concluded as a result that administration of a local anesthetic was not better above a particular dose threshold. A low-dose post-C-section TAP block can maintain analgesic efficacy while reducing the chance of local anesthetic toxicity.[18]

The mean postoperative time required to start analgesics was longer among group I (4.23 $\pm$ 0.413 hours) compared to group II (3.66 $\pm$ 0.364 hours) in the present study. We found a statistically significant variation in the meantime required to start analgesics in the postoperative period. In our cohort, only 3 patients requested rescue analgesia among the cases and 27 patients among controls asked for additional pain relief.

Abouhi et al. reported significant differences in the time of pain relief across the study groups, with those in the group II reporting pain at a considerably higher rate. Regarding the timing of the first analgesic, which was later in the group II, there were statistically significant variations between the study groups (mean 4.785 hours for the group I vs 8.5 hours for group II). The frequency of patients who required rescue analgesia varied between the examined groups in statistically meaningful ways. Twenty-two percent in the T block group as compared to 14% in group II required additional drugs for pain relief.[19]

In a study by Sravani and Rajanna SP, the control group required a rescue dose of analgesia at 2.1 $\pm$ 1.125 hours and the cases at 11.7 $\pm$ 7.344 hours. They reported a highly significant difference ($p < 0.001$). Within the first 6 hours of CD, additional pain relief was requested by all patients in the control group, whereas 18% of the study group's participants needed extra analgesics in the first 6 hours.[16] These outcomes are identical to the current analysis.

This supports our main conclusion that, in women who undergo a cesarean section, a surgical TAP block given before the abdominal incision is closed provides good postoperative analgesia in the first 24 hours.

Despite the delivery of surgical TAP block, inadequate analgesia was occasionally observed as evidenced by the early need for rescue analgesia. This could be a result of poor technique, where the tip of the needle tip was not properly placed, or as a result of the visceral pain component that the TAP block does not treat.[20]

In our study, 33.8% of subjects in the control group required additional analgesic, whereas only 3.8% of subjects required additional analgesic in the study group. This association was found to be statistically significant.

Owen et al. showed that a surgical TAP block administered during CD significantly reduced the need for postoperative opioids.[10] Kahsay et al.[21] and Jadon et al.[22] have reported similar findings. Postoperative nausea, vomiting, and respiratory depression are frequently caused by opioid use. An effective postoperative analgesic equivalent to most other opioid derivatives, tramadol hydrochloride is an opioid analgesic that has better patient tolerance. However, with surgical TAP block, the need for opioids is considerably decreased.

Conclusion

A well-established regional block can now be performed using a new technique called a surgical TAP block to treat postoperative pain. Any obstetrician can quickly learn how to use and perfect the procedure. It offers efficient and long-lasting postoperative analgesia and considerably reduces the need for rescue analgesia. The surgical TAP block is a crucial addition to the basket of options available for pain management approach which will greatly enhance postoperative pain management for women who undergo cesarean section.

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