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Effect Of Transverse Abdominis Plane Block With 0.25% Bupivacaine On Post-Operative Opioid Consumption After Cesarean Section: A Prospective Study

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Abstract

Objective: In our study, we investigated whether or not a TAP block administered in conjunction with 0.25% bupivacaine was effective as an analgesic during the full 24-hour postoperative period after cesarean section.

Methods: 100 patients undergoing spinal anaesthesia for caesarean section were randomly chosen to receive TAP block (50 patients in each group). Following surgical intervention, a bilateral TAP plane block was carried out by giving 0.25% bupivacaine to Group A patients and 0.9% normal saline to Group B patients (10 ml on each side). The procedure was guided by ultrasonography. An investigator blinded to the procedure evaluated the post-operative visual analogue scale VAS pain score of each patient and noted the amount of tramadol demanded over the next twenty-four hours.

Results: Patients who received TAP block with 0.25% bupivacaine had a significantly lower post-operative VAS score at first analgesic request time, at 12 hours and 24 hours as compared to those patients who received normal saline ($p < 0.05$). The mean consumption of intravenous opioid (tramadol) given during 24 hours by the surgical ICU staff was significantly decreased in Group A as compared to Group B ($p < 0.05$).

Conclusion: Ultrasound-guided bilateral TAP block with 0.25% bupivacaine lowers postoperative opioid analgesic intake in patients undergoing caesarean section.

Keywords: Bupivacaine, Cesarean section, Prospective study

Introduction

The administration of post-operative analgesia is required after surgery to reduce the risk of complications such as deep vein thrombosis and an extended length of stay in the hospital. After cesarean section, severe pain is noted in the post-operative period after the effects of spinal anaesthesia wear off, therefore, a treatment plan for optimal pain management that is both safe and effective ought to be provided.[1] Simple fascial plane blocks, such as transverse abdominis plane TAP blocks, are an easy technique in which local anesthetic agent is deposited in the plane between the transverse abdominis muscle and the internal oblique muscle, where the thoracolumbar nerves T10–L1 are found which also includes subcostal T12 nerve, causing effective sensory block to the anterior abdominal wall musculature. Multimodal analgesia is one of the more well-known approaches to pain management after surgical procedures. To get superior results, multimodal analgesia involves the coordinated administration of multiple medications with varying half-lives. In addition, the rapid onset of action decreases the likelihood that a patient would experience negative reactions to a particular medication.[2,3] Our study was done on the hypothesis that since ultrasound-guided TAP block with 0.25% bupivacaine offers adequate and powerful analgesia, it would reduce the demand and consumption of opioids postoperatively.

Materials And Methods

100 American Society of Anesthesiologists (ASA) I and II female patients scheduled for elective and emergency caesarean section were included in a 6-month prospective study, which employed a non-probability, consecutive sampling technique. This study was conducted according to ethical standards and principles. Ethics Committee approval was obtained before the commencement of the research. Informed consent was acquired from all participants involved in the study. The research was conducted with respect for participant privacy, confidentiality and autonomy. Patients were excluded from the study if they declined, had spinal anaesthesia contraindications, needed general anaesthesia for the surgery, had local anaesthetic sensitivity, or were morbidly obese. A random number table was used to produce the allocation sequence. The allocation was concealed from the patients, anesthesiologists, and staff. By sealed envelope technique, patients were randomly assigned to either ultrasound-guided TAP block with 0.25% bupivacaine (n =50) or ultrasound-guided TAP block with 0.9% normal saline (n =50).

- Group A: Bilateral TAP block with 0.25% bupivacaine 10 ml on each side.
- Group B: Bilateral TAP block with 0.9% normal saline, 10 ml on each side.

All patients were given spinal anaesthesia with 0.5% hyperbaric bupivacaine 10 mg. After the surgery, all patients received a 1g intravenous (IV) infusion of paracetamol. Following skin closure, TAP block was given utilising the SonoSite NanoMaxxTM ultrasonography machine and a linear array transducer probe using an in-plane, posterior technique (6-13 MHz). Patients were then taken to the post-anaesthesia care unit (PACU). Pain intensity was assessed using a visual analogue scale (VAS), with 0 representing no discomfort and 10 representing the worst possible pain. An investigator, who was blind to the allocation, assessed the pain severity of the patient when the first analgesic request was made and at 12 and 24 hours after surgery. Patients were administered rescue analgesia in the form of IV tramadol 0-30 mg along with antiemetic injection metoclopramide 10mg on demand by PACU and post-operative obstetrics ward staff, respectively (VAS score>4). Patients were advised to take the paracetamol tablet as needed after they started taking food orally.

The primary study outcomes evaluated and compared in both groups were the time to first seek analgesia, total tramadol requirement in 24 hours, and VAS at first analgesic request and at 12 and 24 hours after surgery. Secondary outcomes were the evaluation of hemodynamic parameters (mean arterial pressure and heart rate) before induction of spinal anaesthesia and at the time of first analgesic request.

Based on the study by Chansoria et al,[5] with a 95% confidence interval and margin of error of 5% (p-value <0.05), a sample size of 100 was determined using the OpenEpi sample size calculator. Data was obtained using a proforma that included demographic information as well as other post-operative pain variables. SPSS 23 software was used for statistical analysis. The chi-square test was used to compare postoperative complications (nausea, vomiting, hypotension, etc.) and patients' satisfaction regarding pain control between the two groups (Group A and Group B). Using the Independent samples T-test, comparisons of age, BMI, hemodynamic parameters such as heart rate and mean arterial pressure, VAS scores measured at different time intervals and post-operative opioid demands were made between the two groups, taking p-value less than 0.05 as statistically significant. The Two-way ANOVA test for Repeated Measures was performed to compare the two groups' VAS scores at initial analgesic request time and at 12 and 24 hours after surgery.

Results

This study included 100 patients, 50 of whom were randomly assigned to receive TAP block with 0.25% bupivacaine (Group A) and the remaining 50 with 0.9% normal saline (Group B). In both groups, the clinico-demographic profile, such as age, BMI, heart rate, and mean arterial pressure before the induction of spinal anesthesia were comparable and non- significant. See Table 1.

In Group A, the baseline heart rate and mean arterial pressure were 82.980±1.28 beats/minute and 77.700±7.70 mmHg in Group A respectively and 82.400±1.78 beats/minute and 78.960±7.49 mmHg in Group B respectively, however, at the time of first analgesic request, heart rate and mean arterial pressure were 85.080±0.82 beats/minute and 89.540±3.51 mmHg in Group A respectively and 92.460±1.40 beats/minute and 92.400±1.71 mmHg in Group B respectively, a statistically significant difference (p-value <0.05). VAS score at the time of first analgesic request was 4.480±0.504 in Group A and 6.860±0.808 in Group B (p-value <0.05). The time to initial analgesic treatment (tramadol) was considerably longer in Group A (678.100±34.170 minutes) as compared to Group B (408.360±52.02 minutes; p-value <0.05). The frequency of painkiller demand was significantly reduced in patients who received TAP block with 0.25% bupivacaine (Group A) compared to those who received 0.9% normal saline (Group B; p-value <0.05). The mean tramadol requirement for Group A was 47.800±8.154 mg, while Group B required considerably larger amounts of the drug intravenously (170.200±28.890 mg; p-value <0.05). Regarding patient satisfaction, 45 patients of Group A were satisfied with their postoperative pain management, while 11 patients of Group B were satisfied with pain control after their surgery (p-value<0.001). See Table 2 and Figure 1.

Table 1: Clinico-demographics of patients in both groups (N=100)

Clinico-demographics	Mean±SD Group A (0.25% bupivacaine TAP block) n=50	Mean±SD Group B (0.9% normal saline TAP block) n=50	P value
Age	26.420±1.85	26.580±1.86	0.668
BMI	26.620±1.85	26.640±1.93	0.958
Baseline MAP before spinal anaesthesia (mmHg)	77.700±7.70	78.960±7.49	0.409
MAP at first analgesic request (mmHg)	89.540±3.51	92.400±1.71	**<0.001**
Baseline heart rate before spinal anaesthesia (beats/min)	82.980±1.28	82.400±1.78	0.065
Heart rate at first analgesic request (beats/min)	85.080±0.82	92.460±1.40	**<0.001**

Table 2: Primary outcomes of the study in both groups of patients (N=100)

Pain control after cesarean section	Mean±SD Group A (0.25% bupivacaine TAP block) n=50	Mean±SD Group B (0.9% normal saline TAP block) n=50	P value
VAS score at first analgesic request	4.480±0.504	6.860±0.808	**<0.001**
VAS score at 12 hours after surgery	2.340±0.478	2.740±0.443	**<0.001**
VAS score at 24 hours after surgery	1.200±0.404	1.440±0.501	**<0.001**
Mean analgesia duration (minutes)	678.100±34.170	408.360±52.02	**<0.001**
Mean opioid consumption in 24 hours (mg)	47.800±8.154	170.200±28.890	**<0.001**
Frequency of painkillers demanded in 24 hours	1.860±0.728	6.880±0.895	**<0.001**
Patient satisfaction regarding pain control (yes: no)	45:5	39:11	**<0.001**

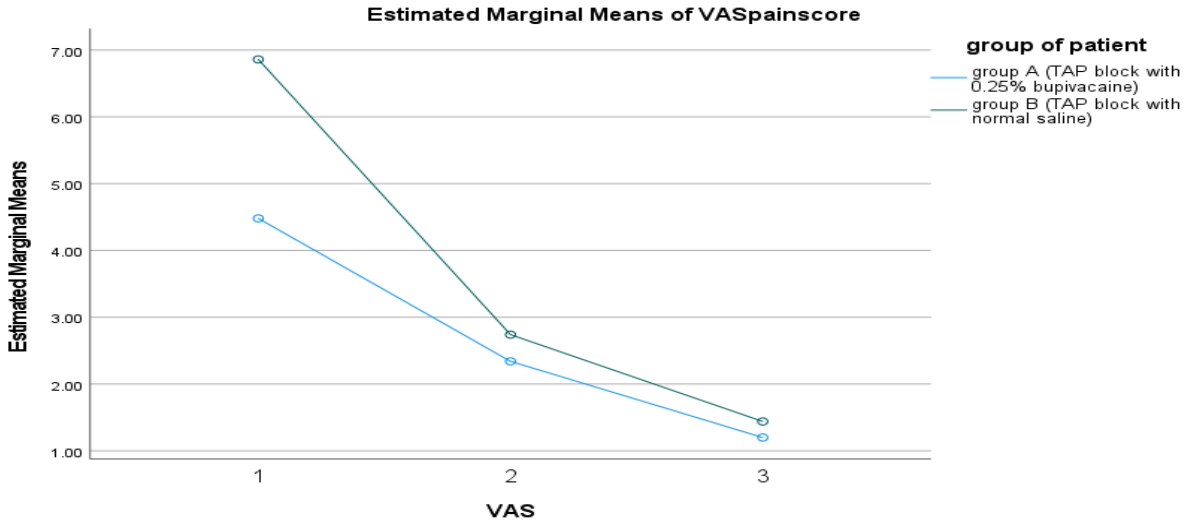

Figure 1: Plotting of VAS pain scores at different time intervals (1= VAS score at first analgesic request, 2= VAS score at 12th hour, 3= VAS score at 24th hour) in both groups of patients

Complications such as nausea and vomiting over 24 hours post-operatively occurred in 19 Group A patients and 27 Group B patients, while shivering occurred in 7 Group A patients and 3 Group B patients after spinal anaesthesia. See Table 3.

Table 3: Complications after spinal anaesthesia in both groups of patients (N=100)

Complications	Mean±SD Group A (0.25% bupivacaine TAP block) n=50	Mean±SD Group B (0.9% normal saline TAP block) n=50	*P value*
Postoperative nausea and vomiting	19	27	0.411
Shivering	7	3	
Bradycardia	1	1	
Hypotension	1	2	

Discussion

To improve post-cesarean analgesia and guarantee proper pain management, several strategies are used. Regional anaesthetic techniques (spinal with low-dose intrathecal morphine or other opioids, and epidural anaesthesia), systemic opioid administration, non-steroidal anti-inflammatory drug (NSAID) use, regional nerve blocks, wound infiltration or continuous wound infusion, and patient-controlled analgesia are a few examples. Various studies have shown that opioids given intravenously, intrathecally or through epidural administration have been demonstrated to be an efficient technique of delivering post-operative analgesia, particularly in the case of caesarean sections. However, opioids have been linked to a host of negative side effects, including drowsiness, nausea, vomiting, itching and respiratory depression.[3-6] Non-steroidal anti-inflammatory drugs (NSAIDS) are also widely utilised for postoperative pain control after cesarean section, but they have been linked to complications such as gastrointestinal bleeding, uterine atony and increased bleeding in the postpartum period. Additionally, indomethacin, acetaminophen, and diclofenac suppositories have been utilised as pain relievers following surgical procedures.[7,8] Epidural analgesia is an excellent option for post-operative pain treatment, but the gravid uterus increases the risk of dural and vascular puncture, making the space difficult to locate. Furthermore, in the event of an emergency caesarean section, it may not be preferable.[9] Local anaesthetic infiltration is also used to relieve pain, but it is ineffective for long-term analgesia.[10]

When combined with a multimodal analgesic regimen, the TAP block lowered VAS pain score, decreased the need for opioid analgesics and postponed the requirement for rescue analgesia following a caesarean delivery.[11-13] Rafi's original description of the TAP block in 2001 involved the use of landmark-based techniques to deposit local anaesthetic in the transverse abdominis plane when he identified the Petit lumbar triangle using anatomic markers (iliac crest). Hebbard's later work in 2007 popularised the use of ultrasound guidance for the TAP block, making the procedure more accurate and safer.[12] He discovered that pressing the ultrasound probe against the abdominal wall in the transverse position made it possible to see all three layers of muscle. After which, shifting the probe to the mid-axillary line made the Petit triangle come into view, which is situated directly above the iliac crest. Under direct vision of the probe, the TAP block can be done by placing the needle on the medial side. This process was formerly known as the posterior technique, and our study utilises this methodology to conduct ultrasound-guided TAP block on our patients.

In a separate meta-analysis done by Tao et al, 20 millilitres of either levobupivacaine or 0.25% bupivacaine was used to induce TAP block after giving spinal anaesthesia in patients with ASA grade I or II who were due to have an elective caesarean section. During these investigations, the post-operative analgesic efficacy of TAP block in these patients was analysed. According to the results of these studies, the groups who participated in the study reported significantly less pain than the control groups (those who did not take any medicine) and required a significantly longer amount of time before feeling any pain, similar to our study findings.[14] Mamdouh et al conducted a study in which 40 millilitres of 0.25% bupivacaine vs 40 millilitres of normal saline was injected bilaterally in 60 ASA II patients who were undergoing spinal anaesthesia in preparation for a cesarean section. The findings demonstrated a reduction in the need for opioids as well as a decrease in the mean VAS score ($p < 0.05$), augmenting our study findings.[15] In a similar study done by Sravani and his colleagues, TAP block was used after caesarean section to study its effect on postoperative analgesia. Patients were divided into two groups, with Group A receiving TAP block with 20 ml of 0.25% bupivacaine after spinal anaesthesia with hyperbaric bupivacaine, while Group B received only spinal anaesthesia with hyperbaric bupivacaine. This trial had shown that TAP block using bupivacaine was effective due to a reduction in both the VAS score and the amount of tramadol required post-operatively over the next 48 hours, as well as a prolonged time to requirement of the rescue analgesic demand (50 mg vs 180 mg, p-value= 0.001).[16] To avoid the complications of morphine, we also used tramadol instead.[16] Similar results have been found by a study done by Innamorato et al and Erol and his colleagues, who discovered that TAP block given after cesarean section was effective in reducing post-operative analgesic consumption.[17,18]

Reshma et al conducted a trial comparing 0.2% ropivacaine vs 0.2% ropivacaine with dexamethasone with ultrasound-guided TAP block following caesarean section. Group A required less tramadol throughout 24 hours than Group B, with time to first rescue analgesia being significantly prolonged in the latter group (15 hours vs 22 hours).[19] To circumvent the problems of the blind method, we adopted an ultrasound-guided TAP block in our investigation. We utilised 0.25% bupivacaine in 20 ml increments, taking care not to exceed the lethal dose of 2 mg/kg. While other regional block techniques are significantly more difficult to administer to obese persons, the TAP block may be simply performed on obese patients. Proper insertion of the needle under the ultrasound guidance guarantees safety and prevents the potential risk of puncturing or damaging nearby organs, such as the bowel or liver. Simple measures, such as withdrawing the plunger before injecting the anaesthetic medicine to make sure the needle tip is not in a blood artery, can help lower the potential risk of intravascular injection of the local anaesthetic. Using ultrasound guidance can help mitigate these risks and improve the safety and efficacy of the TAP block. No difficulties were reported after the TAP block technique in our research.[20]

Conclusions

Ultrasound-guided bilateral TAP block with 0.25% bupivacaine lowers postoperative opioid analgesic consumption in patients undergoing caesarean section. Patients who were obese were not included in the study since it was more difficult to administer the block to them. Additionally, the evaluation was restricted to the first twenty-four hours after surgery (by which time pain levels had already begun to decrease even in the control group). Limitations of this study were that it was a single-centre study. A multiple-centred study is recommended for further clinical implications.

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