Original Article

Ultrasound-guided transversus abdominis plane block for post-operative analgesia in patients undergoing caesarean section

Address for correspondence:
Dr. Maitreyi Gajanan Mankikar,
Flat No. 101, DSK Rohan Model Colony, Shivajinagar,
Pune - 411 016,
Maharashtra, India.
E-mail: mgm251988@gmail.com

Maitreyi Gajanan Mankikar, Shalini Pravin Sardesai, Poonam Sachin Ghodki
Department of Anaesthesiology, Smt. Kashibai Navale Medical College and General Hospital, Pune, Maharashtra, India

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ABSTRACT

Background and Aims: Transversus abdominis plane (TAP) block is a fascial plane block providing post-operative analgesia in patients undergoing surgery with infra-umbilical incisions. We evaluated analgesic efficacy of TAP block with ropivacaine for 24 h after caesarean section through a Pfannenstiel incision. **Methods:** Sixty patients undergoing caesarean section under spinal anaesthesia were randomised to undergo TAP block with ropivacaine (n = 30) versus control group (n = 30) with normal saline, in addition to standard analgesia with intravenous paracetamol and tramadol. At the end of the surgery, ultrasound-guided TAP plane block was given bilaterally using ropivacaine or normal saline (15 ml on either side). Each patient was assessed post-operatively by a blinded investigator at regular intervals up to 24 h for visual analogue score (VAS) and requirement of analgesia. SPSS version 18.0 software was used. Demographic data were analysed using Student's t-test and the other parameters using paired t-test. **Results:** TAP block with ropivacaine compared with normal saline reduced post-operative VAS at 24 h (P = 0.004918). Time for rescue analgesia in the study group was prolonged from 4.1 to 9.53 h (P = 0.01631). Mean requirement of tramadol in the first 24 h was reduced in the study group. **Conclusion:** US guided TAP block after caesarean section reduces the analgesic requirement in the first 24 h.

Key words: Caesarean section, multimodal analgesia, ropivacaine, transversus abdominis plane block

INTRODUCTION

Post-operative analgesia is important after surgery to avoid various complications such as venous thromboembolism, respiratory complications and prolonged hospital stay. Substantial pain and discomfort are anticipated after caesarean delivery; hence, analgesic regimen should ensure effective and safe analgesia.[1]

The transversus abdominis plane (TAP) is the fascial plane between the internal oblique and transversus abdominis muscle containing the thoracolumbar nerves T10 to L1. The introduction of local anaesthetic in this plane blocks these nerves (T10 to L1). We hypothesised that ultrasonography (USG)-guided TAP block reduces requirement of opioids and provides effective and adequate analgesia.[2]

METHODS

After obtaining approval from the Institutional Ethics Committee and written informed consent, sixty American Society of Anesthesiologists (ASA) I and II patients posted for elective and emergency caesarean section were included in a prospective, randomised,

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double-blind, controlled clinical trial which was completed over a period of 6 months.

Patients were excluded from the study if they refused, had contraindications to spinal anaesthesia, required general anaesthesia for the surgery, had local anaesthetic sensitivity or were morbidly obese.

Patients were randomised by sealed envelope technique to undergo USG guided TAP block with 0.5% ropivacaine (n = 30) 15 ml on either side – Group S or USG guided TAP block with 0.9% normal saline (n = 30) 15 ml on either side – Group C. The allocation sequence was generated by random number table. The patients, anaesthesiologists and staff were blinded to the allotment. All patients received spinal anaesthesia with 0.5% hyperbaric bupivacaine 10 mg. All patients also received injection paracetamol 1 g intravenously (IV) at the end of the surgery.

USG-guided TAP block was given to all patients after skin closure. TAP block was administered by the posterior approach using the SonoSite NanoMaxx™ Ultrasonography machine with a linear array transducer probe (6–13 MHz). Patients were then transferred to the post-operative recovery room.

Pain severity was assessed by an investigator blinded to the allotment every 2, 4, 6, 8, 12, 18 and 24 h. It was measured using visual analogue score (VAS) (0 = no pain and 10 = worst possible pain). Rescue analgesia was given to patients on demand or when VAS was more than 4 in the form of IV tramadol 2 mg/kg.

The parameters studied and compared in both the groups were time to first request for analgesic, total tramadol requirement in 24 h and VAS at 2, 4, 6, 8, 12, 18, 24 h.

For sample size calculation, we considered that a clinically important reduction in 24 h tramadol consumption would be 25% absolute reduction. This was a conservative assumption based on our pilot data. We calculated that 28 patients per group would be required for an experimental design incorporating two equal-sized groups, using 0.05 and 0.2 alpha and beta errors. To minimise any effect of data loss, we elected to recruit 30 patients per group into the study.

Statistical analysis was done using the SPSS software (SPSS Inc. Released 2009. PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc.) Demographic data were analysed using Student's t-test or Fisher's exact test as appropriate. The comparison of total tramadol requirement, time to first analgesic administration and VAS between the two groups was done by paired t-test. Confidence interval was 95%. $P < 0.05$ was considered statistically significant.

RESULTS

Sixty patients were recruited in the study, of these thirty were randomised to undergo TAP block with 0.5% ropivacaine and remaining 30 with placebo. Demographic profile, pulse, blood pressure and saturation were comparable in both groups [Table 1].

Time to first analgesic administration (tramadol) was prolonged significantly in Group S (mean - 9.53 h) as compared to Group C (mean - 4.1 h), $P = 0.0163$ [Figure 1].

In patients receiving TAP block with 0.5% ropivacaine (Group S), the requirement for analgesic significantly reduced as compared to those who received the placebo block (Group C). Mean tramadol requirement for Group S was 140 mg and for the placebo group (Group C) was 246.66 mg, which was statistically significant (P = 0.000000439) [Figure 2].

VAS was noted at 2, 4, 6, 8, 12, 18 and 24 h. VAS was reduced after TAP block with 0.5% ropivacaine for the first 8–10 h post-operatively as compared to patients receiving placebo block [Figure 3].

DISCUSSION

The results of our study show that TAP block when used as part of multimodal analgesic regimen after caesarean delivery delayed time for rescue analgesia, reduced requirement of opioid analgesic and decreased VAS. Multimodal analgesia is an established technique for controlling post-operative pain. Multimodal analgesia provides better results by combining various drugs with different duration, and onset of action also reduces the side effects of individual drugs.[3]

Table 1: Demographic data were comparable in both groups

Parameter	Group S	Group C	*P*
Age (years)	22.6±6.3	23.2±6.2	
Weight (kg)	62.5±4.2	64.4±4.5	
ASA I/II	27/3	26/4	
Heart rate (/min)	75.5±6.2	78.5±6.5	NS
Mean arterial pressure (mmHg)	101.64±7.2	103.7±7.5	NS

NS: Not significant, ASA: American Society of Anesthesiologists

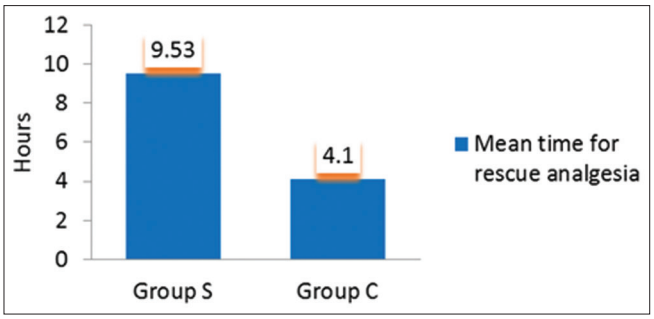

Figure 1: Time for rescue analgesia in hours

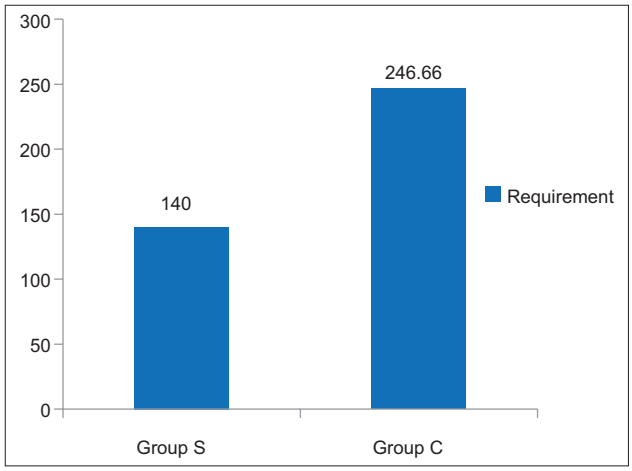

Figure 2: Mean tramadol requirement in milligrams in the first 24 h after caesarean delivery

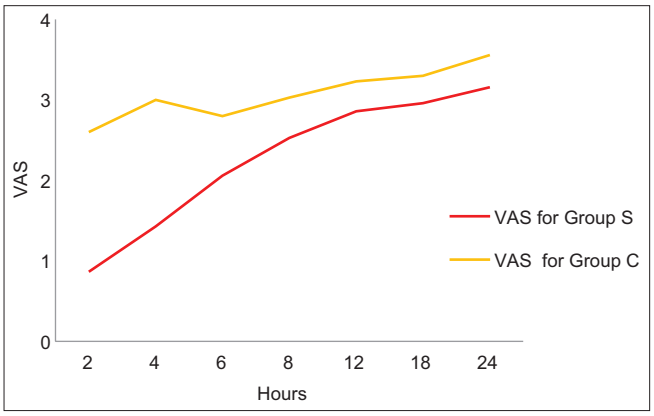

Figure 3: Comparison of visual analogue score between Group S and Group C

Various other drugs can also be used for improving post-operative analgesia. Opioids have been effectively used to provide post-operative analgesia after caesarean section. Various studies have been conducted in which opioids have been used IV,[4] intrathecally and also epidurally.[5] However, opioids are associated with complications such as respiratory depression, pruritus, sedation, nausea and vomiting.[4,5] Non-steroidal anti-inflammatory drugs are commonly used but are associated with complications such as bleeding tendencies, uterine atony and gastrointestinal bleeding.[6,7] Ketamine can also be used, but it affects interaction between the mother and the new-born.[8] Diclofenac, indomethacin and acetaminophen suppositories have also been used for post-operative pain relief.[9]

Epidural analgesia is a good alternative for post-operative pain relief, but the gravid uterus increases the chances of dural and vascular puncture,[10] also making it difficult to identify the space. Furthermore, it may not be preferred in case of emergency caesarean section. Infiltration of local anaesthetic is also used to provide pain relief, but it is not effective for prolonged analgesia.[11]

TAP block was introduced by Rafi in 2001.[12] He described it as block delivering local anaesthetics in the TAP using the anatomical landmarks (iliac crest) by first identifying the lumbar triangle of Petit. In 2007, Hebbard *et al*. introduced the USG-guided approach for TAP block.[13] The USG probe was placed transverse to the abdominal wall which made the three muscle layers distinctly visible after which the probe was moved to the mid-axillary line just above the iliac crest (i.e., over the triangle of Petit). The needle was then advanced medially by in-plane approach. This is referred to as the posterior approach. This approach is used in our study.

TAP block has been used for various abdominal procedures other than caesarean section such as large bowel resection, open/laparoscopic appendectomy, total abdominal hysterectomy, laparoscopic cholecystectomy, open prostatectomy, abdominoplasty with or without flank liposuction, inguinal hernia and iliac crest bone graft.[14-21] The TAP has poor vascularity, and hence the action is prolonged and not associated with any major complications. We used the USG-guided technique to avoid complication more common with the blind approach.[22] In addition, it gives a real-time picture and chances of failure are reduced.

A study using USG-guided TAP block with 0.5% ropivacaine after caesarean section[23] was associated with reduction in total morphine use in 24 h in the active group (median 18 mg) compared with the placebo group (median 31.5 mg). VASs also reduced in the active group compared to placebo group (96 mm vs. 77 mm $P = 0.008$).

Similarly, a study was conducted in 2008 using TAP block after caesarean delivery by the blind approach, with 1.5 mg/kg ropivacaine (to a maximal dose of 150 mg) or saline on each side.[24] The study confirmed the usefulness of TAP block as seen by the reduced the VAS and requirement for morphine (66 ± 26 mg vs. 18 ± 14 mg, $P < 0.001$).

Two similar studies of TAP block were conducted in ASA I and II patients undergoing elective caesarean section under spinal anaesthesia using 20 ml of 0.25% bupivacaine or levobupivacaine. The studies revealed that pain scores were lower and time of demand for first analgesia was significantly longer in study groups compared to control (no drug) groups.[25,26] Another study was conducted using 20 ml of 0.375% ropivacaine on either side, which included ASA II patients undergoing caesarean section under spinal anesthesia; reduction in mean VAS score ($P < 0.001$) and reduced opioid requirement were observed.[27]

In our study, we used USG-guided technique for TAP block to avoid the complications of blind technique. We used tramadol instead of morphine to avoid its complications.[28] We used 0.5% ropivacaine 30 ml and also took care not to exceed the toxic dose that is, 3 mg/kg.

A study conducted in patients undergoing caesarean section using ropivacaine, 0.375%, 40 ml for TAP block for post-operative analgesia showed that the pain scores and opioid consumption were similar between the two groups. The groups consisted of one that received TAP block with ropivacaine ($n = 50$) and the other, placebo ($n = 50$). The mean (standard deviation) VAS on movement at 24 h in the ropivacaine and placebo groups was 3.4 (2.4) and 3.2 (2.2) cm, respectively, $P = 0.47$.[29] McKeen *et al*. in 2014 conducted a similar study using TAP block and observed no significant difference in opioid consumption ($P = 0.2$) and VAS ($P = 0.61$).[30]

Obese patients were excluded as the block was difficult to perform, and assessment was limited to only 24 h post-operatively (but pain severity reduced even in control group by this time). This may be considered as a limitation to our study.

CONCLUSIONS

USG-guided bilateral TAP block with 0.5% ropivacaine (total 30 mL) reduces the postoperative opioid analgesic consumption in caesarean section patients.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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