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Analgesic Efficacy of Ultrasound Guided Transversus Abdominis Plane Block after Cesarean Delivery

Archana Yadav,[1] Amir Babu Shrestha,[2] Tara Gurung,[2] Sangita Shrestha[2]

[1]Department of Anaesthesia, National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu, Nepal. [2]Paropakar Maternity and Women's Hospital, Kathmandu, Nepal.

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CORRESPONDENCE:
Dr. Archana Yadav
Department of Anaesthesia, Nepal Police Hospital, Maharjgung, Kathmandu, Nepal.
Email: drarchi13@gmail.com,
Tel: +977-9851281402

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ABSTRACT

Introduction: Transversus abdominis plane (TAP) block is a simple and effective technique of providing analgesia for lower abdominal surgeries with easily identifiable landmarks. This study investigated the postoperative analgesic efficacy of bilateral ultrasound-guided transversus abdominis plane blocks, in patients undergoing caesarean delivery at Paropakar Maternity and Women's Hospital, Kathmandu, Nepal.

Methods: Seventy four patients undergoing caesarean section under spinal anesthesia were randomized to receive TAP block with bupivacaine (n =37) versus no TAPgroup (n =37), in addition to analgesia with intravenous paracetamol 1gram 6 hourly. At the end of the surgery, ultrasound guided TAP block was given bilaterally using 0.25% bupivacaine or no TAPblock. Each patient was assessed postoperatively at regular intervals up to 24 hours for numerical pain rating scale and requirement of pethidine. SPSS version 20.0 software was used. Demographic data were analyzed using Student's t test and Mann–Whitney U-test.

Results: The TAP block with bupivacaine compared with no TAP group reduced postoperative numerical pain rating scale. The time to first analgesic demand time was shorter in control group (79.05±26.99) minutes compared to bupivacaine group (416.75±87.29) minutes (P <0.05) which was statically significant. The 24 hours pethidine requirement was less in the bupivacaine group (P<0.05). There were no complications attributable to the TAP block.

Conclusions: Bilateral ultrasound-guided TAP block significantly reduced postoperative pethidine consumption in 24 hours after cesarean delivery.

INTRODUCTION

Women having a cesarean delivery present a unique set of challenges to the anesthesiologists after operation. Adequate pain relief after cesarean is more compelling than any other surgery. The goals include minimizing maternal sedation to facilitate interaction with the newborn, improve mobility to reduce the risk of puerperal thromboembolic events, minimize transfer of analgesics in the breast milk and quicken expected discharge to home after delivery.[1]

The transversus abdominis plane (TAP) is the fascial plane between the internal oblique and transversus abdominis muscle containing

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the thoracolumbar nerves T10 to L1. The introduction of local anaesthetic in this plane blocks these nerves (T10 to L1). We hypothesized that ultrasonography (USG)-guided TAP block reduces requirement of opioids and provides effective and adequate analgesia.[2]

METHODS

After receiving ethical approval from the institutional review board of National Academy of Medical Science(NAMS), 74 patients in Paropakar Maternity and Women's Hospital of ASA grade II undergoing either elective or emergency section by Pfannenstiel incision were included in a prospective, interventional studywhich was completed over a period of November 2016 to January 2017.

Sample size was calculated by using formula n= {2(Za +Zβ) 2 × SD2)} / d2 Where n = the number of patients in each group,Za = constant at given alpha error, Zβ = constant at given beta error,SD = standard deviation, d = difference between two means, or effect size with Type I or Alpha error = 1.96 (P value <0.05), Type II or Beta error = 0.842 (80% power), Confidence Interval of 95% corresponding to 1.96 or P<0.05.

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 and those who were using opioids regularly.

The patients enrolled into the study was randomly allocated to one of the two study groups (B/N, n=37 each). Lottery method was used for randomization, where total 74 small pieces of papers, among which was an equal number (n=37 each) of papers with code name either B or N written in it, were kept inside a container. Patients were asked to pick one of the paper from the bottle and were assigned to the respective group as per written on it and the patients were unaware of the drug coding. Patients were randomized to undergo USG guided TAP block with 0.25% Bupivacine (*n* = 37) 15 ml on bothside- Group B and noTAP block (*n* = 37) – Group N. We used 0.25% Bupivacaine 15 ml and also took care not to exceed the toxic dose that is, 3 mg/kg.

All patients pre-loaded with Ringer Lactate or normal saline amounting 10ml/kg over 15 to 20 minutes as per standard hospital practice and received spinal anesthesia with 2.2 ml of 0.5% heavy bupivacaine. Surgery was conducted after adequate sensory level block achieved. USG-guided TAP block was given to patients after skin closure. TAP block was administered by the posterior approach using the Sonosite ultrasound machine with high frequency with 13 to 6 MHZ a linear transducer probe.Patients were then transferred to the post-operative recovery room.

Injection paracetamol 1gm was given 6 hourly. Pain severity was assessed by an investigator to the allotment every 0, 2, 4, 6, 8, 12, 18 and 24 hours It was measured using numeric pain rating scale. At any point of time if numerical pain rating scale was 4, injection pethidine 50 mg and injection Phenergan 25 mg was given via intramuscular route.

The parameters studied and compared in both the groups were time to first request for analgesic, total pethidine requirement in 24 hours and numerical pain rating scale at 0, 2, 4, 6, 8, 12, 18, 24 hours.

Data entry and statistical analysis was performed using SPSS version 20 for windows. Age, weight, height, and duration of surgery were compared between two groups by independent Student's t test. The numeric pain rating score for pain and the time to first analgesic rescue and postoperative pethidine requirement were compared in groups by the Mann–Whitney U-test.

RESULTS

A total of 74 patients meeting the inclusion criteria were enrolled in the study. Each group included equal number of patients (n=37). Result of randomization was revealed after the completion of the study and it revealed that the Group B patients had received 0.25% bupivacaine15 ml and no TAP block was in Group N. Demographic data of patients were comparable in both groups (Table1).

TABLE 1. Demographic data of the patients.

	Group	Mean	SD	P value
Age	Group B	24.32	5.68	0.81
	Group N	26.05	5.56	
Weight	Group B	62.48	8.51	0.65
	Group N	61.54	9.23	
Height	Group B	149.13	13.26	0.92
	Group N	149.4	11.11	
Duration of surgery	Group B	46.62	10.74	0.25
	Group N	43.78	10.69	

The mean time to first rescue analgesia among the two groups was comparable. The mean time to first rescue analgesia in bupivacaine group(Group B) was 416.75 ± 87.29 min and in no TAP (Group N) was 79.05 ± 26.99 min which was significant statistically ($p<0.05$).(figure 1)

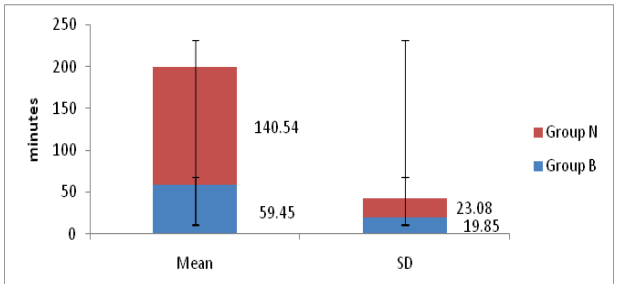

FIGURE 1. Duration of first rescue analgesia distribution in two groups.

Numerical pain rating scale was noted at 0, 2, 4, 6, 8, 12, 18 and 24 h. Numerical pain rating scale was reduced after TAP block post-operatively as compared to patients with no TAP block (Figure 2).

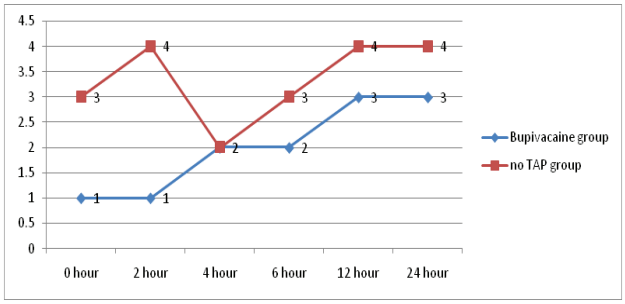

FIGURE 2. Numeric pain rating scale in two groups at different time interval.

The mean total pethidine consumption in first 24 hours in bupivacaine group(group B) was 59.45 ± 19.85 mg and in no TAP group(group N) was 140.54 ± 23.08 mg which was significant statistically ($p<0.05$).

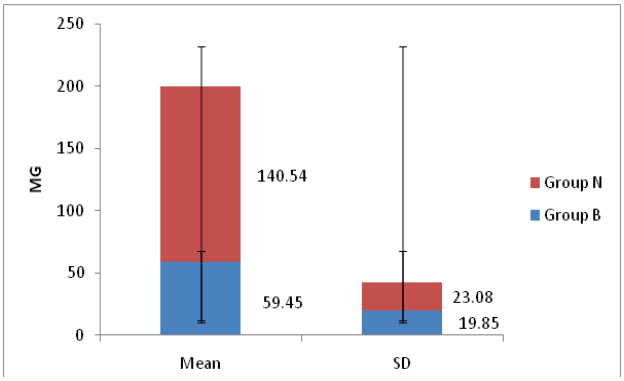

FIGURE 3. Total opioids consumption in first 24 hours.

DISCUSSION

The results of our study showed that TAP block when used as part of analgesic regimen after caesarean delivery delayed time for rescue analgesia, reduced requirement of opioid analgesic and decreased numerical pain rating scale.The prolonged duration of analgesia following TAP block may be because of its poor vascularity thereby causing delayed absorption of bupivacaine and may be due to prolonged action of the amide local anesthetic drug (bupivacaine). 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]

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 however; opioids are associated with complications such as respiratory depression, pruritus, sedation, nausea and vomiting.[4]

Unfortunately, NSAIDs alone are insufficient to effectively treat post-cesarean delivery pain.[5] The disadvantages of NSAIDs include their gastrointestinal side effects and platelet dysfunction.[6] Ibuprofen and the COX-2 inhibitor, rofecoxib, may even be used antepartum as tocolytic drugs.[7] There are case reports of uterine atony after the use of ketorolac and diclofenac in postpartum women.[8]

TAP block was introduced by Rafi in 2001.[9] 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 etal. introduced the USG-guided approach for TAP block.[10] 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.

Mankikar M. G. et al foundthat TAP block reduced postoperative visual analogue scale (VAS) at 24 hours and time for rescue analgesia in the study group was prolonged from 4.1 to 9.53 hours.[11] In their study mean tramadol requirement for ropivacaine group was 140 mg and for the placebo group was 246.66mg, which was statistically significant (P = 0.004918) VAS was measured at 2, 4, 6, 8, 12, 18 and 24 hours. VAS was reduced after TAP block with 0.5% ropivacaine for the first 8–10 hours postoperatively as compared to patients receiving placebo block. Similarly in our study numerical pain rating scale at 0, 2, 4, 6, 8, 12, 24 hours was measured and numeric pain rating scale was lower in bupivacaine group in comparison to normal saline group

Venkatraman R et al found that the duration of TAP block as postoperative analgesialasted for 440 minutes.[12] Paracetamol was needed only after 440 minutes when VAS was more than 3.The most important finding from their study was the significant reduction in the consumption of other analgesics.

Bhattacharjee et al reported duration of postoperative analgesia was 290 minutes following TAP block with bupivacaine, which is similar to this study (416.75 minutes following TAP block with bupivacaine).[13] Baaj J et alfound that total morphine consumption was reduced by more than 60% in the bupivacaine group i.e. total morphine requirements in the first postoperative 24 hours were reduced in the bupivacaine group as compared to the placebo group (25.89 ± 5.13 mg versus 62 ± 4.78, p <0.05) and the bupivacaine group also reported improved satisfaction with their pain relief over 24 hours after surgery and reduced morphine consumption.[14]

Like these two studies, in our study, pethidine requirements was reduced by 50% in TAP block with bupivacaine group i.e. the duration of postoperative analgesia with TAP block in bupivacaine group lasted for 416.75 (mean) minutes in comparison to normal saline group.

Similarly, Abdallah FW et al found that TAP block reduced the mean 24 hours intravenous morphine consumption by 24 mg when spinal morphine was not used.[15]TAP block also reduced visual analogue scale pain scores (10 cm line where 0 cm, no pain, and 10 cm, worst pain) by 0.8cm (95% CI 21.53 to 20.05, P=0.01), and decreased the incidence of opioid-related side effects. McKeen etal. 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).[16]

In our study, we used USG guided technique for TAP block to avoid the complications of blind technique. We used pethidine instead of morphine to avoid its complications such as respiratory depression.[17] We used 0.25% Bupivacaine 15 ml and also took care not to exceed the toxic dose that is, 3 mg/kg. Also patients were excluded from the studies if they regularly used opioids. Inadequate analgesia even after TAP block may be either due to technical failure or due to visceral pain component, which is not addressed by TAP block. As such, till now, all local anesthetic techniques carry an inherent failure rate of 5-20%, depending on the skill of the individual. Multiple studies have demonstrated its superiority over standard medical therapy for postoperative pain control. There were no complications attributable to the TAP block.

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

CONCLUSIONS

The conclusion of this study is that USG-guided bilateral TAP block with 0.25% bupivacaine (15mL bilaterally) reduces the postoperative opioid

analgesic consumption in cesarean section patients. Transversus abdominis plane blocks are relatively new technique used in an approach to provide postoperative analgesia following abdominal surgery. The TAP block is an effective and safe adjunct to multimodal postoperative analgesia. Multiple studies have demonstrated its superiority over standard medical therapy for postoperative pain control. Studies have shown that the consumption of intravenous opioids has been reduced with use of TAP block, resulting in fewer opioid-mediated side effects.

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LEGENDS

TABLE

Demographic Data of the Patients Table 1.

FIGURES

Duration of first rescue analgesia distribution in two groupsfigure 1.

Numeric pain rating scale in two groups at different time interval figure 2.

Total opioids consumption in first 24 hours figure 3.