A Comparative Study of Analgesic Efficacy of Intrathecal Buprenorphine with Ultrasound-Guided Transversus Abdominis Plane Block for Postcesarean Delivery Analgesia

Prakash Marappa, Manjunath Abloodu Chikkapillappa, Nagaraj Mungasuvalli Chennappa, Vinayak Seenappa Pujari
Department of Anaesthesia, M. S. Ramaiah Medical College, Bengaluru, Karnataka, India

Abstract

Background: Women undergoing cesarean (CS) delivery present a unique set of challenges to the anesthetist in terms of postoperative pain management. This study was conducted to compare the analgesic efficacy of intrathecal buprenorphine (ITB) with ultrasound-guided transversus abdominis plane (TAP) block in post-CS delivery pain. Methodology: A prospective randomized comparative study of sixty American Society of Anesthesiologists physical status I and II pregnant patients divided into two groups of thirty each as ITB group and TAP block group after satisfying the inclusion criteria. Results: In the present study, demographic data were comparable between both groups. The time to first analgesic request was significantly longer in ITB group (389.67 ± 90.78 min) compared to TAP group (669.17 ± 140.65 min) and was statistically significant, \( P < 0.001 \). The mean paracetamol consumption in the first 24 h was higher in the TAP group (3.5 g) compared to the ITB group (1.13 g) and was statistically significant, \( P < 0.001 \), and the mean tramadol consumed in first 24 h was higher in the ITB group (46.66 mg) group as compared to the ITB group (16.66 mg) and was statistically significant, \( P < 0.001 \). The mean visual analog scale scores assessed at 4, 6, 12, and 24 h was higher in the TAP group and was statistically significant, \( P < 0.001 \). Conclusions: Our study showed that patients receiving ITB for post-CS pain management reported longer duration of analgesia, lower pain scores, and lower analgesic consumption during the first 24 h. The benefits of neuraxial opiates are significant and far outweigh the side effects.

Keywords: Intrathecal opioids, postcesarean delivery analgesia, transversus abdominis plane block

INTRODUCTION

Women undergoing cesarean (CS) delivery present a unique set of challenges to the anesthetist in terms of postoperative pain management. The aims of postoperative pain management are to provide subjective comfort, inhibit nociceptive impulses, and blunt the neuroendocrine response to pain, thus enhancing early restoration of function. CS patients have additional compelling reasons to be provided adequate pain relief, as early mobilization is a key factor to prevent the risk of thromboembolic disease, and need to be pain-free to care for their newborn and breast-feed them effectively.[1] To achieve this, various drug combinations have been tried, to provide effective and safe analgesia. Favorable results have been observed with buprenorphine as an adjuvant with intrathecal local anesthetics. Buprenorphine is a mixed agonist-antagonist opioid with high affinity at both \( \mu \) and \( \kappa \) opiate receptors.

Buprenorphine is one of the commonly used additives in spinal anesthesia.[2]

Transversus abdominis plane (TAP) block is a regional anesthetic technique that blocks the abdominal wall somatic afferents. Multiple trials have demonstrated the efficacy of TAP block as a component of a multimodal regimen, in providing postoperative analgesia after abdominal surgery, including CS.[3,4] There have been no studies in literature comparing the analgesic efficacy of intrathecal buprenorphine (ITB) with bilateral ultrasound-guided TAP block following CS delivery.

Address for correspondence: Dr. Manjunath Abloodu Chikkapillappa, Department of Anaesthesia, M. S. Ramaiah Medical College, Bengaluru, Karnataka, India. E-mail: mac_acin@yahoo.co.in

How to cite this article: Marappa P, Chikkapillappa MA, Chennappa NM, Pujari VS. A comparative study of analgesic efficacy of intrathecal buprenorphine with ultrasound-guided transversus abdominis plane block for postcesarean delivery analgesia. Anesth Essays Res 2017;11:376-9.

Quick Response Code:  

Website: www.aeronline.org

DOI: 10.4103/0259-1162.206279

© 2017 Anesthesia: Essays and Researches | Published by Wolters Kluwer - Medknow
The present study was designed to compare the analgesic efficacy of ITB with ultrasound-guided TAP block for post-CS delivery pain. The primary outcome was to measure the time to first request for analgesia. The secondary outcome was to measure pain scores, analgesic requirements, and side effects.

**Methodology**

Sixty American Society of Anesthesiologists (ASA) physical status I and II pregnant women aged 20–40 years requiring elective lower segment CS under spinal anesthesia were recruited for the study. Institutional ethical clearance and patient consent were obtained. Patients were randomly assigned into two groups of thirty each using sealed envelope method ITB group and TAP block group. Pregnant women with contraindications to the neuraxial blockade, body mass index >35, history of the major systemic disease (ASA III or more), history of chronic pain, abuse of drugs or alcohol, and history of allergies to any study medications were excluded.

On the day of surgery, the patients were shifted to the operating theater and an intravenous (IV) line was secured with the 18-gauge cannula. The monitoring included noninvasive arterial blood pressure, electrocardiogram, and pulse oximetry. Patients were preloaded with 15 mL/kg of Ringer’s lactate solution. Basal parameters were recorded, lumbar puncture was performed, and 1.75 mL (8.75 mg) of 0.5% hyperbaric bupivacaine and 75 μg (0.25 mL) of buprenorphine totaling to a volume of 2.0 mL injected in ITB group and 1.75 mL (8.75 mg) of 0.5% hyperbaric bupivacaine and 0.25 mL of normal saline totaling to a volume of 2.0 mL injected in TAP group.

After injection, the patient was positioned supine with approximately 10-degree Trendelenburg tilt and left uterine displacement with a wedge under the right buttock. Patients were supplemented with oxygen (4 L/min) through a facemask and surgery was allowed to proceed after confirming the attainment of sensory blockade of T6. Intraoperative hypotension was considered to be present whenever systolic blood pressure (SBP) decreased to <90 mm Hg or <20% of the baseline whichever appeared first and was treated with ephedrine (3 mg aliquots), as and when necessary. Bradycardia was treated with atropine IV 0.02 mg/kg if heart rate (HR) decreased to <60/min. The attending anesthetist assessed the neonatal Apgar scores at 1 and 5 min of delivery of the baby.

In the TAP group, bilateral ultrasound-guided TAP block was performed on the completion of surgery using a GE Healthcare Venue 40 portable ultrasound machine with high-frequency linear array probe of 8–12 MHz. The probe was positioned in the midaxillary line between the lower border of the ribs and the iliac crest. The external oblique, internal oblique, transversus abdominis muscles, and transversus abdominis fascia were visualized. A 22-gauge 100 mm Stimuplex® needle (B. Braun, Bethlehem, PA, USA) was directed under continuous in-plane ultrasound visualization between internal oblique and transversus abdominis muscle into the posterior aspect of the fascial plane. After negative aspiration for blood, 20 mL of the 0.25% of bupivacaine plain solution was injected under ultrasound guidance on each side.

Postoperatively, the patients were evaluated by an independent observer for pain, sedation, nausea, vomiting, pruritus, and urinary retention. Arrival at the postanesthesia care unit was taken as time 0; the patients were subsequently assessed at 2, 4, 6, 12, and 24 h. The pain was quantified on a 10 cm visual analog scale (VAS). Sedation level was evaluated using modified Wilson sedation scale 1 - oriented, 2 - drowsy, 3 - arousable, 4 - unrousable. On first request for analgesia, IV paracetamol 1 g stat was given and repeated every 6 hourly thereafter. Tramadol 50 mg IV was given for breakthrough pain. The time for first analgesic request and supplemental analgesic requirements over 48 h was recorded. Forty-eight hours after surgery, the patients were asked to rate on a three-point scale about their satisfaction with pain management 1 - highly satisfied, 2 - satisfied, 3 - dissatisfied.

**Statistical methods**

The sample size was estimated based on the study by Niraj et al. considering the difference between two means, substituting the values in standard deviation (SD) in the first group - 19, SD in the second group - 18, precision 10%, desired confidence level 95%, the sample size was calculated to be 26 in each group rounded off to 30.

The data collected were analyzed using Statistical Package for Social Sciences, version 17 (SPSS Inc., Chicago, IL, USA). Proportions were compared using Chi-square test of significance. The Student’s t-test was used to determine whether there was a statistical difference between study groups in the parameters measured. \( P < 0.05 \) was considered statistical significance.

**Results**

The demographic data were comparable between the two groups [Table 1] and were not statistically significant. The mean time to first analgesic request was significantly longer in

| Table 1: Demographic profile |
|-----------------------------|
| **Variables**               | **TAP group** | **ITB group** | **P**  |
| Age                        | 28.43±2.921   | 27.87±4.075   | 0.538 |
| Height                     | 159.37±4.687  | 158.4±4.031   | 0.395 |
| Weight                     | 69.13±7.477   | 66.1±8.932    | 0.164 |
| BMI                        | 27.36±3.071   | 26.18±2.898   | 0.130 |
| Gestational age            | 38.17±0.950   | 37.8±0.805    | 0.112 |
| Parity                     | Primi 15 (50) | 15 (50)       | 0.796 |
|                            | Multi 14 (46.70) | 16 (53.30)  |      |
| ASA status                 | I 26 (86.70)  | 24 (80)       | 0.488 |
|                            | II 4 (13.30)  | 6 (20)        |      |
| Duration of surgery (min)  | 55.7±12.09    | 60±13.71      | 0.199 |

BMI=Body mass index, ASA=American Society of Anesthesiologists, TAP=Transverse abdominis plane, ITB=Intrathecal buprenorphine.
The paracetamol consumption in the first 24 h was significantly higher in the TAP group; 19 (63.3%) patients required 3 doses and 11 patients required 4 doses. Whereas in the ITB group, 13 out of 30 patients required 2 doses and 17 patients (56.7%) required 3 doses and was statistically significant, \( P < 0.0001 \) [Table 2].

Tramadol requirement in the first 24 h was significantly higher in the TAP group as compared to the ITB group [Table 2] and was statistically significant (\( P < 0.001 \)). The mean VAS scores assessed at 4, 6, 12, and 24 h were higher in the TAP group and were statistically significant, \( P < 0.001 \) [Table 2]. The incidence of complications was higher in ITB group (46%) compared to TAP group (16%) [Table 3]. Patient satisfaction was 63.30% in ITB group and 6.70% in TAP group [Table 2].

Apgar scores of the newborn assessed at 1 and 5 min intervals following delivery were comparable between the groups, \( P > 0.001 \) [Table 4]. The intraoperative hemodynamic parameters, SBP, diastolic blood pressure, mean arterial pressure, and HR were comparable between the groups in our study. The patients in ITB group had much higher satisfaction compared to those in the TAP block group (19 highly satisfied, 11 satisfied with ITB and 2 highly satisfied, 28 satisfied with TAP, \( P < 0.0001 \)), i.e., 63.30% of parturients in ITB group were highly satisfied compared to 6.70% of parturients in TAP group. The incidence of nausea (23.3% - i.e., 7 in each group) was similar in both groups, and vomiting was higher and statistically significant (13.3% - 4 patients) in ITB group compared to TAP group (3.3% - 1 patient). The incidence of pruritus in ITB group is 13.3% (4) as compared to none in TAP group and is statistically significant (\( P < 0.05 \)). The incidence of drowsiness in ITB group was high and statistically significant (26.7% - 8 patients) as compared to none in TAP group (\( P < 0.002 \)). None of the patients in the study had respiratory depression. Arterial oxygen saturation in all the cases remained above 97% and mean respiratory rate of all the patients was above 17. None of the patients required any respiratory support. Urinary retention could not be assessed as all patients for CS section were catheterized for 24 h postoperatively.

**Table 2: Pain scores, analgesic requirement, and patient satisfaction**

| Time to first analgesic request (min) | TAP group | ITB group | \( P \) |
|---------------------------------------|-----------|-----------|--------|
| Paracetamol requirement in first 24 h | 389.67±90.78 | 669.17±140.65 | <0.001 |
| 2 doses | 0 | 13 | <0.001 |
| 3 doses | 19 | 17 | |
| 4 doses | 11 | 0 | |
| Mean paracetamol consumed in first 24 h in g | 3.5 | 1.13 | |
| Number of patients needing tramadol in first 24 h (%) | 28 (93.44) | 10 (33.33) | <0.001 |
| Mean tramadol consumed in mg | 46.66 | 16.66 | |
| Pain scores at h | | | |
| 4 | 3.57±0.728 | 1.80±0.422 | <0.001 |
| 6 | 3.87±0.507 | 2.41±0.959 | |
| 12 | 4.10±0.662 | 2.97±1.066 | |
| 24 | 3.73±0.944 | 1.50±0.572 | |

**Table 3: Adverse effects**

| | TAP group | ITB group | \( P \) |
|----------------|-----------|-----------|--------|
| Drowsiness | 0 | 8 | 0.002 |
| Nausea | 7 | 7 | 1.000 |
| Vomiting | 1 | 4 | 0.161 |
| Pruritus | 0 | 4 | 0.038 |

**Table 4: Apgar scores at 1 and 5 min in both groups**

| | TAP group | ITB group | \( P \) |
|----------------|-----------|-----------|--------|
| Apgar score 1 (min) | 6.87±0.681 | 6.79±0.65 | 0.640 |
| Apgar score 5 (min) | 8.60±0.498 | 8.61±0.496 | 0.962 |

**Discussion**

Neuraxial opioids mediate selective spinal analgesia by binding to opioid receptors in the substantia gelatinosa of the dorsal horn of the spinal cord near the site of injection. An intrathecal opioid is effective in the treatment of both somatic and visceral pain.\(^{[7]}\) The high affinity of buprenorphine for opioid receptors produces a longer duration of action.\(^{[8]}\) Unfortunately, in comparison with the TAP block, intrathecal opioids were associated with more side effects.\(^{[3]}\)

Recently, a meta-analysis concluded that ultrasonography-guided TAP block provides marginal postoperative analgesic efficacy after abdominal laparotomy or laparoscopy and CS delivery; however, it does not provide an additional analgesic effect in patients who also received spinal anesthesia containing a long-acting opioid.\(^{[9]}\) In our study, time to first analgesic request was significantly prolonged in the ITB group compared to the TAP group; our findings are similar to the previous studies.\(^{[3,4,10,11]}\)

In our study, the time to first analgesic request was significantly prolonged in the ITB group compared to the TAP group. These findings are similar to other studies that could not demonstrate an advantage of TAP block over intrathecal morphine.\(^{[3,4,10,11]}\) VAS scores assessed at different intervals were found to be lower in the ITB group compared to TAP block group; our
findings are similar to other studies, which did not find any advantage of TAP block over intrathecal morphine, and also the morphine consumption in the TAP block group was greater at 24 h compared with the intrathecal morphine group.\[3,4,10,11\]

An intrathecal opioid is effective in the treatment of both somatic and visceral pain.\[7\] This may explain the superiority of intrathecal opioids in comparison with TAP block for the management of post-CS pain.

The paracetamol consumption was higher in the TAP group compared to ITB group. Similarly, the requirement of tramadol as rescue analgesic in the first 24 h was much higher in the TAP block group patients compared to ITB group. Our findings are similar to the previous studies, which reported a reduction in opioid consumption in the first 12 h with intrathecal morphine.\[3,7\]

Better analgesia as evidenced by lower VAS scores and lesser rescue analgesic consumption was observed in patients receiving ITB as compared with patients receiving TAP block.

The patients in ITB group had much higher satisfaction compared to those in the TAP block group; our study findings are similar to other studies with buprenorphine and morphine.\[4-7\] The common side effect of buprenorphine seen in this study was drowsiness. Although drowsy, all patients were easily arousable. Late respiratory depression was not observed in any of the patients in our study. The mean Apgar scores were comparable; our study results are similar to a previous study.\[7\] Buprenorphine, being a lipid soluble drug, is rapidly absorbed into the spinal venous plexus, and therefore, there is a minimal increase in spinal fluid concentration. This minimizes the risk of respiratory depression associated with the rostral spread.\[7,12\]

There was no respiratory depression in both the study groups.

**Conclusions**

Our study showed that patients receiving ITB for post-CS pain management reported longer duration of analgesia, lower pain scores, and lower analgesic consumption during the first 24 h. However, there was increased incidence of nausea, vomiting, drowsiness, and pruritus in comparison with the ultrasound-guided TAP block. The benefits of neuraxial opiates are significant and far outweigh the side effects. The intrathecal procedure is easy to perform, less time-consuming, more predictable, and does not require additional technical skills or extra equipment in comparison with the TAP block. TAP Block as a modality for postoperative analgesia in CS section was inferior to ITB, both with respect to analgesic efficacy and patient satisfaction.

**References**

1. Ismail S. What is new in postoperative analgesia after caesarean sections? (Editorial). Anaesth Pain Intensive Care 2012;1:123-6.
2. Agarwal K, Agarwal N, Agarwal V, Agarwal A, Sharma M, Agarwal K. Comparative analgesic efficacy of buprenorphine or clonidine with bupivacaine in the caesarean section. Indian J Anaesth 2010;54:453-7.
3. Kanazi GE, Aouad MT, Abdallah FW, Khatib MI, Adham AM, Harfoush DW, et al. The analgesic efficacy of subarachnoid morphine in comparison with ultrasound-guided transversus abdominis plane block after cesarean delivery: A randomized controlled trial. Anesth Analg 2010;111:475-81.
4. McMorrow RC, Ni Mhuireheartaigh RJ, Ahmed KA, Aslani A, Ng SC, Conrick-Martin I, et al. Comparison of transversus abdominis plane block vs. spinal morphine for pain relief after caesarean section. Br J Anaesth 2011;106:706-12.
5. Némethy M, Paroli L, Williams-Russo PG, Blanck TJ. Assessing sedation with regional anesthesia: Inter-rater agreement on a modified Wilson sedation scale. Anesth Analg 2002;94:723-8.
6. Niraj G, Searle A, Mathews M, Misra V, Baban M, Kiani S, et al. Analgesic efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing open appendicectomy. Br J Anaesth 2009;103:601-5.
7. Dixit S. Post operative analgesia after caesarean section: An experience with intrathecal buprenorphine. Indian J Anaesth 2007;51:515-8.
8. Vadivelu N, Anwar M. Buprenorphine in postoperative pain management. Anesthesiol Clin 2010;28:601-9.
9. Baeriswyl M, Kirkham KR, Kern C, Albrecht E. The analgesic efficacy of ultrasound-guided transversus abdominis plane block in adult patients: A meta-analysis. Anesth Analg 2015;121:1640-54.
10. Loane H, Preston R, Douglas MJ, Massey S, Papsdorf M, Tyler J. A randomized controlled trial comparing intrathecal morphine with transversus abdominis plane block for post-caesarean delivery analgesia. Int J Obstet Anesth 2012;21:112-8.
11. Costello JF, Moore AR, Wieczorek PM, Macarthur AJ, Balki M, Carvalho JC. The transversus abdominis plane block, when used as part of a multimodal regimen inclusive of intrathecal morphine, does not improve analgesia after caesarean delivery. Reg Anesth Pain Med 2009;34:586-9.
12. Ipe S, Korula S, Varma S, George GM, Abraham SP, Koshy LR. A comparative study of intrathecal and epidural buprenorphine using combined spinal-epidural technique for caesarean section. Indian J Anaesth 2010;54:205-9.

**Conflicts of interest**

There are no conflicts of interest.