ABSTRACT

Background: Transversus abdominis plane (TAP) block is a recently described technique to provide analgesia in lower abdominal surgery. The technique has been refined by ultrasound (US) guidance to deliver the local anaesthetic into the neurofascial plane between the internal oblique and the transversus abdominis muscles. We evaluated the analgesic efficacy of US-guided TAP block in patients undergoing caesarean delivery.

Methods: Fifty women undergoing caesarean section were randomised to undergo bilateral TAP block with ropivacaine 0.5% (N = 25) versus placebo (N = 25), in addition to standard postoperative analgesia comprising of oral acetaminophen (600 mg) 6 hourly, with IV morphine (3 mg) analgesia for ‘breakthrough’ pain. Each patient was assessed postoperatively by a blinded investigator for morphine usage, average pain score, nausea, vomiting, pruritus, drowsiness and satisfaction with pain relief.

Results: In the TAP group, postoperative morphine requirements up to 24 hours were significantly reduced (median 18.0 mg) compared with the placebo group (median 33 mg). Patients in the TAP group reported lower visual analogue scale scores than patients in the placebo group. Fewer patients required antiemetic in the TAP group. There were no local complications attributable to the TAP block.

Conclusion: US-guided bilateral TAP block used in conjunction with oral acetaminophen significantly reduces the need for IV morphine and is an effective component in a multimodal strategy for postoperative analgesia following caesarean delivery.

Keywords: Obstetric, Regional analgesia, Multimodal therapy, Transversus abdominis plane block.

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INTRODUCTION

Acute severe pain after caesarean delivery is frequent. Atleast 10 to 15% of the women develop chronic pain.1 There is considerable interest in controlling acute postoperative pain to ultimately reduce the potential to develop chronic pain. The administration of opioids, local blocks and other analgesic medication is instituted to decrease the duration and intensity of postoperative pain as a part of a multimodal analgesic regimen. The transversus abdominis plane (TAP) block is an effective method of providing postoperative analgesia in patients undergoing lower abdominal surgery.2,3 The block has evolved from the traditional landmark-guided technique to an ultrasound (US)-guided technique.4,5

We evaluated the analgesic efficacy of US-guided TAP block in patients undergoing caesarean delivery via a transverse lower abdominal wall incision.

METHODS

A randomized, double-blinded, placebo-controlled trial was performed at our tertiary maternity hospital. After obtaining approval by the hospital ethics committee and written informed patient consent, we studied 50 ASA physical status I–II patients. All participants were 19 years or older and more than 28 weeks’ gestation. Mothers with ASA classification 3 or above, mothers undergoing emergency caesarean delivery for fetal heart rate abnormalities or caesarean delivery under general anaesthesia, mothers with a BMI > 35 kgm–2, those with a history of drug allergy, intolerance or sensitivity to morphine or any local anaesthetics, were excluded from the study. All patients received spinal anaesthesia using hyperbaric 0.5% bupivacaine 7.5 mg and fentanyl 25 µg.

US-guided TAP block was performed at the end of surgery. The US-guided TAP block technique was similar to the method described by Hebberd et al.6 The different layers of the abdominal wall were identified using a high-frequency (5.7-13.3 MHz) 45 mm linear array probe (Vivid 4 GE). A 90 mm long 25G short bevel needle (Becton Dickson SAS, Agustin Del Guadalix Madrid, Spain) was inserted in plane with the ultrasound beam until it reached the plane between the internal oblique and the transversus abdominis muscle where 20 ml of the study solution was injected. This procedure was repeated on the opposite side of the midline. Successful injection produced an echoluent space between the muscles.

Patients received either 40 ml saline (placebo group) or 40 ml of 0.5% ropivacaine (TAP group) (Fig. 1).

All patients received oral acetaminophen 500 mg 6 hourly with IV morphine (3 mg) for ‘breakthrough’ pain. Each patient was assessed at 2, 4, 6, 12 and 24 hours for total morphine usage which included the initial bolus and subsequent cumulative doses. The patients recorded average pain scores using a 100 mm visual analogue scale (VAS).
with no pain at 0 and very severe pain at 100. Participants were asked to rate the severity of nausea, vomiting, pruritus and drowsiness on a 4 point scale (none, mild, moderate, severe). Any local complications of TAP block was recorded.

The primary outcome measure in this study was 24 hours morphine consumption. Secondary outcome measures included VAS scores and side-effects associated with morphine consumption. For the purpose of sample size calculation, we assumed that a clinically important reduction in 24 hours morphine consumption would be a 25% absolute reduction. We calculated that 23 patients per group would be required for an experimental design incorporating two equal-sized groups, using $\alpha = 0.05$ and $\beta = 0.2$. To minimize any effect of data loss, we elected to recruit 25 patients in each group into our study assuming a 10% dropout rate.

Statistical analyses were performed using a standard statistical program (Microsoft Excel 2007, PH stats, data analyser). Demographic data were analysed using student’s t-test or Fisher’s exact tests, as appropriate. Repeated measurements (pain scores, nausea scores) were analysed by repeated measures analysis of variance which where normally distributed, with further paired comparisons at each time interval performed using the single factor. The $\alpha$ level for all analyses was set as $P < 0.05$, and the Bonferroni correction for multiple comparisons was used where appropriate.

**RESULTS**

Fifty participants were randomized in TAP group ($N = 25$) or placebo group ($N = 25$). All patients underwent caesarean delivery via Pfannenstiel incision. The general characteristics of the two groups are summarized in Table 1. Patients in the TAP group had a longer time to first request for analgesia. There were reduced cumulative morphine requirements within 24 hours in the TAP group (mean of 17.6, SD 5.09 and SEM 1.02) compared with the placebo group (median 31.8, SD 6.18, SEM 1.24 mg, $P < 0.0001$) shown in Figure 2. Patients in the TAP group had lower VAS scores compared with the placebo group (median 26 vs 47 mm, $P = 0.008$) (Fig. 3). There was a significant difference in the incidence and severity of postoperative nausea and vomiting in the two groups in the 1st hour after surgery but not in 24 hours after surgery. Fewer patients required antiemetic medication in the TAP group ($P = 0.03$). There was no significant difference in the severity of drowsiness or itching between the two groups ($P = 0.8$ and $P = 0.35$ respectively). There were no local complications attributable to the TAP block in this study.

<table>
<thead>
<tr>
<th>Table 1: Patient data</th>
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<tbody>
<tr>
<td><strong>Active</strong></td>
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<tr>
<td>Age in years</td>
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<tr>
<td>BMI</td>
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<tr>
<td>Previous abdominal surgery</td>
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<td>Duration of surgery (minute)</td>
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![Fig. 2: Morphine requirement in 24 hours (Placebo vs TAP group)](image)

![Fig. 3: Visual analogue score in two groups](image)
**DISCUSSION**

Pain after caesarean delivery has certain peculiarities. Sugery related pain, frequently described as ‘aching’ in nature, is generally limited near the surgical site. Pain increases due to activities, such as coughing, getting out of bed, physiotherapy, dressing changes and nursing the child. The aim of postoperative pain management in this setting is to inhibit trauma-induced nociceptive impulses by blunting autonomic and somatic reflex responses to pain with subsequent restoration of function. This allows the patient to breathe, cough, move more easily and take proper care of the newborn.

A multimodal analgesic regimen is most likely to achieve these goals. However, the optimal components of this regimen continue to evolve. Opioids have been the mainstay of treatment in form of intravenous patient-controlled analgesia but inhibit only one component of the pain pathway. Opipid-mediated side effects, like nausea, pruritus, sedation and respiratory depression, limit their use. Various studies have shown that local anaesthetics have improved recovery via better pain relief and opioid-sparing effect.

Our study demonstrates that single shot TAP block reduces overall postoperative morphine requirements by about 50% in the first 24 postoperative hours. Other studies have shown an analgesic effect after single shot TAP blocks of 36 to 48 hours. This has been explained by poor vascularisation of the TAP area and subsequent slow drug clearance.

There are some important conclusions from the Figure 3. The SD of the placebo group at various time interval is higher than the TAP group of patients which is because of frequent ‘top up’ of morphine at variable interval of times. However, after the initial 2 hours, the SD of the placebo group is lower when compared with TAP group; but theVAS score is persistently higher. This explains the efficacy of ropivacaine without any placebo effect. When the mean of VAS at 2 hours is compared with the mean of VAS at other time interval; it is found to be higher. This could be due to ‘synergism’ between ropivacaine and morphine bringing down the pain scores compared with only ropivacaine alone during the first 2 hours.

There has been controversy in the literature regarding the spread and level of block achieved with a single posterior TAP injection. Belavy et al recommended a more anteriorly placed needle to block the I1 dermatome more reliably. Our patients with Pfannenstein incision had satisfactory analgesic effect in the region of T10 to L1. The subcostal modification, as advocated by Lee et al, may be sufficient for anterior midline incision.

There are a few notable complications with TAP block, such as inadvertent visceral and vascular injury. Real-time US guidance has improved the safety and the efficacy of the TAP block by allowing the clinician to accurately and consistently deposit local anaesthetic between the internal oblique and the transversus abdominis muscles.

**CONCLUSION**

Acute pain after caesarean delivery can be severe and needs to be treated effectively in order to prevent postoperative complications and/or the development of chronic pain. The present study demonstrates the analgesic efficacy of US-guided TAP block. It reduces the morphine consumption and improves patient satisfaction with analgesia. The TAP block should be considered in all women undergoing caesarean delivery as part of a multimodal analgesic regimen.

**REFERENCES**


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