The Analgesic Efficacy of Dexamethasone Added to Ropivacaine in Transversus Abdominis Plane Block for Transabdominal Hysterectomy under Subarachnoid Block

Jyoti P. Deshpande, Poonam S. Ghodki, Shalini P. Sardesai
Department of Anesthesia, Shrimati Kashibai Navale Medical College and General Hospital, Narhe, Pune, Maharashtra, India

Abstract

Background and Aims: Ultrasound-guided transversus abdominis plane (TAP) block has been proven as a safe and effective analgesic technique for several lower abdominal surgeries. Various adjuvants have been used to intensify the quality and prolong the local anesthetic effect. We evaluated the analgesic efficacy of dexamethasone addition to ropivacaine in TAP block following open abdominal hysterectomy.

Materials and Methods: After clearance from the Institutional Ethics Committee, a double-blind, prospective, randomized study was carried out on sixty patients aged 40–60 years posted for elective open abdominal hysterectomy comparing bilateral TAP block using 20 ml of 0.5% ropivacaine + 1 ml of 0.9% saline (control Group R) or 20 ml of 0.5% ropivacaine + 4 mg dexamethasone (Group RD). The aim of our study was to observe postoperative pain score (visual analog scale [VAS]), time for first analgesic (TFA) demand, total analgesic consumption, and incidence of nausea or vomiting. Statistical Analysis: Chi-square test and Student’s t-test were used, and P < 0.05 was considered as statistically significant. Results: Postoperative VAS pain scores were significantly lower at 4, 6, and 12 h in Group RD as compared to Group R (P < 0.05). Significantly longer TFA (13.2 ± 7.6 vs. 7.1 ± 4.6 h, P < 0.001) with lesser tramadol requirement in first 24 h (50.2 ± 34 vs. 94 ± 35 mg, P < 0.001) were observed in Group RD as compared to Group R. Incidence of nausea or vomiting was statistically insignificant between the groups (P > 0.05). Conclusions: Addition of dexamethasone to ropivacaine TAP block prolonged the postoperative analgesia and reduced analgesic requirement following abdominal hysterectomy.

Keywords: Dexamethasone, postoperative analgesia, ropivacaine, transversus abdominis plane block
spinal anesthesia were enrolled in a prospective, randomized, double-blind, and controlled clinical study. Exclusion criteria included patient’s refusal, allergy to study drug, contraindication to spinal anesthesia, those who required general anesthesia for surgery, morbid obesity, or chronic analgesic user.

After explaining the procedure and the nature of safety of the procedure, a written informed consent was obtained.

Patients were randomly allocated into two equal groups using a random number table generated by Microsoft Excel through sealed envelope technique to get either TAP block with 20 ml ropivacaine 0.5% +1 ml saline 0.9% (control group, Group R, n = 30) or 20 ml ropivacaine 0.5% +1 ml saline dexamethasone 4 mg (Group RD, n = 30) on either side. The patients, anesthesiologists and evaluating staff were blinded to the allotment. Standard monitoring included electrocardiogram, pulse oximetry, and noninvasive blood pressure. A 20-gauge intravenous access was established for all the patients included in the study. Under all aseptic precautions, spinal anesthesia was administered with 0.5% bupivacaine 17.5 mg (3.5 cc) intrathecally. At the end of surgery, ultrasound-guided (USG) TAP block was administered by posterior approach, in-plane technique using Sonosite NanoMaxx USG Machine. During the injection, the distribution of local anesthetic was observed as a hypoechoic enlargement on ultrasonography. All patients received intravenous paracetamol 1 g before shifting to recovery room as a part of multimodal analgesia. Pain severity was assessed by an investigator blinded to the group assignment every 2, 4, 6, 12, and 24 h using visual analag scale (VAS 0 = no pain and 10 = worst possible pain). Intravenous tramadol (1 mg/kg) was given as rescue analgesia on patient’s demand or when VAS >4. Primary outcomes to be studied were time to first (TFA) request and VAS score, while secondary outcomes were 24 h tramadol consumption and the occurrence of nausea or vomiting. The patients were monitored and any side effects (nausea or vomiting)/complications were recorded.

**Statistical analysis**

For the sample size calculation, we assumed that there would be 25% absolute reduction in 24 h tramadol consumption due to dexamethasone-TAP block administration as a clinically significant end-point. This was a conservative assumption based on our pilot study and previous studies. [7,8] We calculated that 24 patients in each group would be enough to detect a 25% difference between the groups (α = 0.05 and β = 0.2). To cover for dropouts, we elected to recruit thirty patients per group into the study. Statistical analysis was done using the computer statistical software system, SPSS version 18.0 (SPSS Inc., Chicago, IL, USA). Numerical data were analyzed using Student’s t-test. Categorical data were analyzed by Chi-square test or fisher’s exact test as appropriate. Results were expressed as mean ± standard deviation, number or percentage (%). Results were considered statistically significant if P < 0.05.

**RESULTS**

Out of 60 patients scheduled for open abdominal hysterectomy, 30 were randomized to undergo TAP block with 0.5% ropivacaine with dexamethasone (Group RD = 30) and remaining 30 with 0.5% ropivacaine (Group R = 30). Both the groups were comparable regarding demographic data and duration of surgery [Table 1]. Addition of dexamethasone to ropivacaine TAP block provided lower postoperative VAS pain score [Table 2], longer TFA (13.2 ± 7.6 vs. 7.1 ± 4.6 h, P < 0.001) [Table 3], lesser tramadol (50.2 ± 34 vs. 94 ± 35 mg, P < 0.001) [Table 3] requirements during postoperative 24 h, and lower incidence of nausea and vomiting (two vs. four patients, P > 0.05) as compared to control group. No complications or adverse effects related to procedure were observed.

**DISCUSSION**

The present study showed that the addition of 4 mg dexamethasone to 20 ml ropivacaine 0.5% for bilateral TAP block prolonged the TFA, reduced opioid consumption, and decreased VAS pain score over postoperative 24 h in patients undergoing transabdominal hysterectomy.

| Parameters               | Mean±SD | P       |
|--------------------------|---------|---------|
| Age (years)              | 43.95±10.62 | 44.0±10.55 | NS |
| Weight (kg)              | 63.8±10.1 | 66.5±12.1 | NS |
| Height (cm)              | 160.5±9.7 | 161.2±9  | NS |
| Duration of surgery (min) | 98.0±8.6 | 96.5±10.4 | NS |
| Anesthesia time (min)    | 106.8±32.2 | 112.2±24.2 | NS |

**Table 1: Patient’s characteristics**

| VAS | Group R (n=30) | Group RD (n=30) | P       |
|-----|----------------|-----------------|---------|
| At 2 h | 1.52±1.05 | 1.42±1.04 | 0.658  |
| At 4 h | 2.32±1.37 | 1.42±1.15 | <0.008* |
| At 6 h | 4.57±2.58 | 2.38±1.32 | <0.001* |
| At 12 h | 3.86±1.67 | 3.10±1.32 | ≤0.05*  |
| At 24 h | 3.0±1.32 | 2.8±1.26 | 0.531   |

**Table 2: Mean pain score on visual analog scale**

| Duration of analgesia (h) | Group R (n=50) | Group RD (n=50) | P       |
|---------------------------|-----------------|-----------------|---------|
| 7.1±6.6                   | 13.2±7.6        | <0.001*         |
| Total tramadol requirement in 24 h (mg) | 94.0±35 | 50.2±34 | <0.001* |

**Table 3: Analgesic requirement**

| Data represented in mean±SD. *P<0.05 - significant. VAS=Visual analag scale, SD=Standard deviation |
|-----------------------------------------------|
| Data represented in mean±SD. *P<0.05 - significant. SD=Standard deviation |
Various studies were carried out to demonstrate the analgesic efficacy and safety of corticosteroids in neuroaxial and peripheral block.[17-19] Kikuchi et al. reported that methylprednisolone decreased continuous pain and allodynia in patients with herpetic neuralgia more on intrathecal rather than epidural due to decreased interleukin-8.[11] Dexamethasone has been shown to be safe and effective adjuvant for axillary, supraclavicular as well as interscalene brachial plexus block.[13-15] TAP block is a safe and effective modality for postoperative analgesia as a part of multimodal approach to anesthesia and enhanced recovery in patients undergoing abdominal surgery.[16,17] Several researches demonstrated that the dexamethasone is an effective adjuvant in TAP block.[18-21] Ropivacaine is well-tolerated local anesthetic agent with less toxic potential and better sensorimotor differentiation. Cummings et al. reported longer analgesia when dexamethasone was added to ropivacaine or bupivacaine for interscalene block, with the effect being more potent with ropivacaine.[15] Hence, we decided to study dexamethasone with ropivacaine for TAP block. Ammar and Mahmoud found prolonged analgesia and decreased postoperative nausea and vomiting when dexamethasone was added to bupivacaine in TAP block for abdominal hysterectomy.[18] Our results are in concordance with this study. Although we found lower incidence of nausea or vomiting in our study group, it was statistically insignificant. A study conducted in low-resource setting also recommends bupivacaine-dexamethasone TAP block due to its superior analgesic effect over a parenteral opioid for postoperative analgesia.[19] Foster et al. reported that preoperative bilateral TAP block with 4 mg dexamethasone in patients undergoing open total abdominal hysterectomy reduced the postoperative narcotic requirements and adverse events with shorter length of hospital stay.[20] Akkaya et al. studied the effect of dexamethasone with levobupivacaine in TAP block for cesarean section patients under spinal anesthesia. They observed prolonged postoperative analgesia, reduced tramadol consumption, and no considerable side effects such as nausea or vomiting.[7] We also noted similar findings with dexamethasone-ropivacaine TAP block for hysterectomy patients. El Sharnouby and El Gendy conducted a study with dexamethasone and isobaric bupivacaine in TAP block for laparoscopic bariatric surgeries. They found a significant improvement of analgesia as well as reduced incidence of nausea and vomiting promoting early ambulation in dexamethasone group. They also observed that the addition of 4 mg dexamethasone was equipotent to 8 mg dexamethasone for TAP block.[21] This encouraged us to select a lower dose that is 4 mg dexamethasone for our study. In accordance with the previous studies, our study also demonstrates that the dexamethasone can be used as adjuvant with ropivacaine in TAP block when spinal additives are contraindicated or not used.[17]

Mechanism for analgesic effect of steroids is not well understood. Corticosteroid induces analgesia through their anti-inflammatory or immunosuppressive effects.[22,23] Analgesic action of steroid might be due to modulation of nuclear transcription.[23] In addition, steroids may potentiate the action of local anesthetic through modulation of the function of the K⁺ channels in excitable cells.[24] Some authors also believe that the analgesic effect of corticosteroids is due to their systemic effects.[25] A recent in vivo animal safety models show no adverse event levels and potential neuroprotection and antihypalgesic effects with clinically relevant dosing of perineural dexamethasone to bupivacaine.[26,27] Whatever, the mechanism of action, all previous studies have recommended the use of dexamethasone to potentiate analgesia and anesthesia of local anesthetic agents administered through various routes.

TAP block is a very safe and established block utilized for postoperative analgesia, with the advent of USG, it is associated with higher success rate, and incidence of complications is very rare.[28]

The limitation of the current study is that the extent of block under spinal anesthesia could not be assessed which may be vital in assessing successful block. Delayed rescue analgesia with reduced analgesic consumption is the strength of our study. Another limitation of our study is lacking of control group to assess the beneficial effect of intravenous dexamethasone on TAP block. However, the comparison would have been difficult without monitoring serum levels of dexamethasone. A presumption can be perhaps made that intravenous dexamethasone will also have a similar effect. Extensive studies will be required to prove this hypothesis further.

Conclusions

Addition of dexamethasone to ropivacaine in TAP block prolonged the postoperative analgesia and reduced the analgesic requirements following open abdominal hysterectomy without any major side effects. We recommend the routine use of a ropivacaine-dexamethasone TAP block as part of multimodal analgesic regimen after open trans-abdominal hysterectomy to enhance the recovery process and render patient pain free.

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Conflicts of interest

There are no conflicts of interest.

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