ORIGINAL RESEARCH

Effect of Adding Dexamethasone to Ropivacaine in Transversus Abdominis Plane Block for Lower Abdominal Surgeries: A Prospective Randomized Trial

Kewal K Gupta[1], Himani Garg[2], Gurpreet Singh[3], Amanjot Singh[4]

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Abstract

Background: Several adjuvants have been used to improve the efficacy of transversus abdominis plane (TAP) block because it has been used as an effective component of multimodal analgesic treatment for infraumbilical surgeries. Here, we evaluated the effectiveness of dexamethasone as an additive to local anesthetic in TAP block for infraumbilical surgeries under general anesthesia in terms of time to first rescue analgesia, verbal numeric rating scale (VNRS) pain score, and mean total analgesic consumption over 24 hours.

Materials and methods: This study was conducted on 60 adult patients who were randomly allocated into two groups of 30 patients each. In group A, 2 mL of normal saline and in group B, 8 mg (2 mL) dexamethasone was used with 20 mL of 0.25% ropivacaine in ultrasound (USG) guided TAP block bilaterally after induction of general anesthesia. Statistical analysis was done using chi-square test, Student's *t*-test, and Mann–Whitney *U* test.

Results: The duration of analgesia was significantly longer in group B than group A (619.4 ± 21.4 minutes and 240.3 ± 18.6 minutes, respectively) ($p < 0.001$). VNRS was lower in both the groups, except at 4th, 5th, and 8th hours in group A and 12th hours in group B. Total mean analgesic consumption over 24 hours postoperatively was also significantly lower in group B than group A ($p < 0.001$).

Conclusion: Using dexamethasone as an additive to 0.25% ropivacaine improves the efficacy of TAP block in terms of duration and quality of analgesia with significant reduction of postoperative analgesic requirement without any adverse effects.

Keywords: Dexamethasone, Ropivacaine, Transversus abdominis plane block.

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Introduction

Postoperative pain after lower abdominal surgeries is usually severe, sustained, and can increase morbidity in terms of patient discomfort, thromboembolic phenomenon due to prolonged immobilization, and respiratory complications. Although various analgesics such as opioids and nonsteroidal anti-inflammatory drugs can provide satisfactory analgesia but their use is associated with several unwanted side effects. Recently, nerve blocks have been advocated to provide good analgesia in addition to alleviating the above difficulties.

The TAP block involves the deposition of a local anesthetics into a transversus abdominis fascial plane as defined by Rafi.[1] It usually anesthetizes anterolateral abdominal wall supplied by nerve roots of T7–L3 involving the parietal peritoneum, muscles, and skin. It is an advanced, relatively straightforward, and rapidly expanding analgesic technique. Recently, the use of USG is recommended for block placement over the landmark technique to ensure accurate placement of local anesthetics which increases the effectiveness of TAP block.[2]

[1–4]Department of Anesthesia, Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, India

Corresponding Author: Kewal K Gupta, Department of Anesthesia, Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, India, Phone: +91 9988316306, e-mail: doc_krishan31@yahoo.co.in

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Ropivacaine is the most commonly used local anesthetic for peripheral nerve blocks due to prolonged duration, differential blockade, and lesser cardiac toxicity.[3] Routinely, single-shot local anesthetics injections result in good postoperative analgesia for 4–10 hours only depending

on the agent used. So, different additives like morphine, tramadol, fentanyl, ketamine, dexmedetomidine, and clonidine have been used in the past to increase the efficacy of peripheral nerve blocks.[4–7]

Dexamethasone could be used as an additive in regional nerve blocks due to its anti-inflammatory and antagonistic nociceptor C fibers effects.[8] Although, its role as an additive to local anesthetics is proven in different peripheral nerve blocks with 0.5% ropivacaine or bupivacaine but the sufficient data supporting use of dexamethasone (8 mg) with 0.25% ropivacaine in TAP block for lower abdominal surgery under general anesthesia are still in paucity. Hence, this study was carried out to estimate the effectiveness of dexamethasone as an additive to 0.25% ropivacaine for TAP block which was measured in terms of quality and duration of analgesia for lower abdominal surgeries.

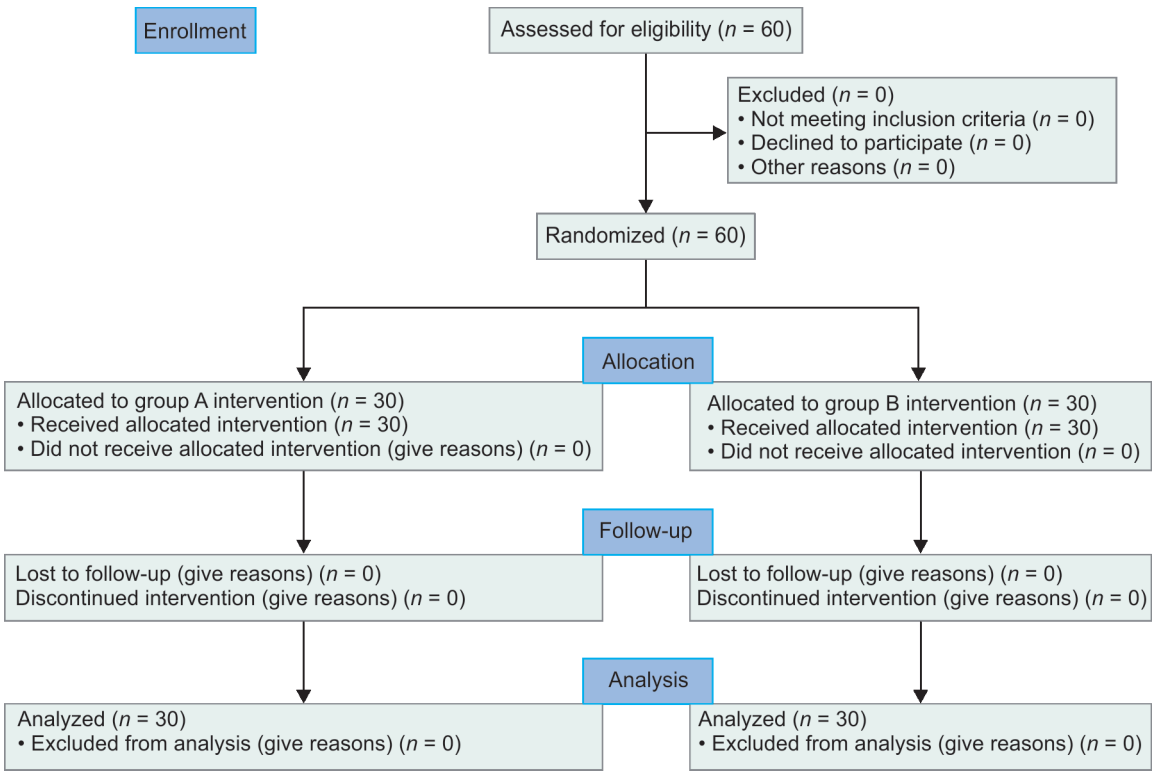
Materials and Methods

This randomized, prospective trial was carried out after registering the trial (CTRI/2019/06/019601) and the institutional ethical committee approval. Sixty adult patients aged between 18 and 65 years, of either sex with American Society of Anesthesiologists (ASA) I or II physical status, posted for different elective lower abdominal surgeries (total abdominal hysterectomy or bilateral inguinal hernia) under general anesthesia were included in this trial. Any contraindication to peripheral nerve block, substance abuse, allergy to trial drugs, local site infection, higher body mass index (>28 kg/m^2), and diabetes mellitus were considered in exclusion criteria. By the computer-generated randomization table, all the patients were randomly allocated and divided into two groups (Flowchart 1). In group A (30 patients), 2 mL of normal saline and in group B (30 patients), dexamethasone 8 mg (2 mL) was given as an additive to 20 mL of 0.25% ropivacaine through USG guided TAP block on each side. The study drugs for block was prepared by an observer who was not involved in subsequent part of study like TAP block or data collection. Similarly, anesthesiologist performing block and assessing postoperative pain were also blinded to drug prepared and injected in TAP block.

Before surgery, thorough preoperative anesthetic checkup of each patient was done and required detailed information regarding trial was given. All the patients were premedicated orally with tab ranitidine 150 mg at night before surgery and were kept nil per orally as per standard protocol. On receiving the patient in the operative room, monitors including electrocardiography, pulse oximeter (SpO_2), and noninvasive blood pressure were connected and vital parameters were noted.

Standard general anesthesia technique involving fentanyl (1–2 μg/kg), propofol (1.5–2.5 mg/kg), and succinylcholine (1–2 mg/kg) intravenously was followed for each patient and airway was secured. Anesthesia was maintained with oxygen and nitrous oxide mixture (40:60) and isoflurane (0.2–1 MAC) along with intravenous vecuronium. Ultrasound guided TAP block by posterior approach which covers anterolateral abdominal wall at the infraumbilical area supplied by T7–12 thoracolumbar nerves, was given under all aseptic precautions after induction in supine position. A linear probe

Flowchart 1: CONSORT flow diagram



(7–10 MHz frequency) was used to scan abdominal fascial plane in mid axillary line. Then, the probe was moved more posteriorly to visualize the transversus abdominis muscle plane. Under USG guidance, Quincke spinal needle (23G) was medially inserted (in the plane technique) and directed toward the TAP. After confirmation of the correct needle placement (i.e., separation of the plane existing between the internal oblique and transversus abdominis muscles and formation of a well-defined, hypoechoic, elliptical shadow on USG image), the study drug was injected as per group allocation. The same steps were repeated on the contralateral side also.

All the patients were monitored for vital parameters at every 5 minutes interval till the end of surgery and postoperatively also. Hypotension (decrease in mean arterial pressure of >20% of baseline values), and bradycardia (heart rate of ≤50/min), was managed by standard protocol. Before the completion of surgery, intravenous paracetamol 15 mg/kg was given as standard postoperative analgesia. On completion of surgery and successful extubation, the patients were shifted to postoperative care unit.

Each patient was monitored for hemodynamic parameters and VNRS scale at every hour for the first 8 hours, then at 12, 16, 20, and 24 hours postoperatively. Eleven-point VNRS scale (quality of analgesia) was used as 0 = no pain and 10 = worst pain. Any patient experiencing VNRS more than 3 postoperatively, was given first rescue analgesia in the form of intravenous 50 mg tramadol. Inj diclofenac was used as second rescue analgesia if the patient still had VNRS score >3. Total analgesics amount used and mean number of rescue analgesic doses given over 24 hours postoperatively were noted. Postoperatively after 24 hours, patient satisfaction score was measured with five-point numerical scale. Any side effects like hypotension, vomiting, sedation, or block related complication were also noted.

Statistical Analysis

Based on previous literatures,[18,19] to detect the mean difference of at least 4 hours in duration of analgesia between both the groups and using level of significance of 0.05 along with 80% power, sample size of 28 patients in each group was calculated. We enrolled total 60 patients to cover any dropout. Statistical analysis was done using statistical software SPSS 21.0 for Windows. *p*-value <0.05 was taken as significant for statistical analysis.

Results

Demographic characteristics like age, weight, sex, ASA I/II status, body mass index (BMI), and duration of surgery were comparable among both the groups (Table 1). The duration of analgesia (time between the completion of TAP block to the request of first rescue analgesia) was significantly prolonged in group B as compared to group A with mean duration of 619.4 ± 21.4 minutes and 240.3 ± 18.6 minutes, respectively (Table 2). Perioperative vital parameters were comparable among these two groups. Total analgesic consumption over 24 hours (tramadol use) was also significantly higher in group A as compared to group B (Table 2). In group A, three rescue analgesic doses were given to 33.3% of patients and two analgesic doses were given to 66.7% of patients while in group B, only one rescue analgesic dose was demanded by 70% patients and two analgesic doses were demanded by 30% of patients over 24 hours. Moreover, number of mean rescue analgesic doses was significantly higher in group A (2.3 ± 0.5) as compared to group B (1.3 ± 0.5) postoperatively (Fig. 1). VNRS scores were <3 in both the groups except at 4th, 5th, and 8th hours in group A and 12th hours in group B (Fig. 2). As compared to group A, VNRS was significantly lower in group B till 12 hours postoperatively (*p*-value < 0.05), after which there was no significant difference in VNRS scores between both the groups. Although better satisfaction score was noted in group B patients as compared to group A but with statistically insignificant difference. No significant side effects were noted in any group.

Discussion

The use of USG for TAP block,[2] has augmented the success rate and safety profile of this block. TAP blocks have been designated as an effective component of multimodal analgesia for different abdominal surgical procedures.[9–13] Various studies have verified the adjuvant role of corticosteroids in central neuraxial and different peripheral blocks. Dexamethasone has been found to be an effective adjuvant to local anesthetics for brachial plexus block through different approaches.[8,14,15] But data regarding its analgesic efficacy with 0.25% ropivacaine in TAP block are very limited.

Cummings et al.[8] reported prolonged analgesia with dexamethasone use as an adjuvant for interscalene block,

Table 1: Demographic data and duration of surgery

Parameters (mean ± SD)	*Group A (n = 30)*	*Group B (n = 30)*	*p-value*
Age (years)	53.70 ± 3.05	52.30 ± 4.68	0.176
Sex (M/F)[a]	6/24	6/24	–
Weight (kg)	71.37 ± 2.54	70.30 ± 3.52	0.184
BMI (kg/m^2)	25.59 ± 1.40	25.77 ± 1.75	0.667
ASA I/II[a]	13/17	14/16	0.795
Duration of surgery (min)	80.00 ± 9.65	76.83 ± 12.83	0.284

[a]Chi-square test

Table 2: Mean duration of analgesia and total analgesic consumption among two groups

	Group A (n = 30)	*Group B (n = 30)*	
Variable	*Mean ± SD*	*Mean ± SD*	*p-value*
Mean duration of analgesia (min)	240.3 ± 18.6	619.4 ± 21.4	<0.001
Total analgesic consumption (mg)	116.7 ± 24.0	65.0 ± 23.3	<0.001

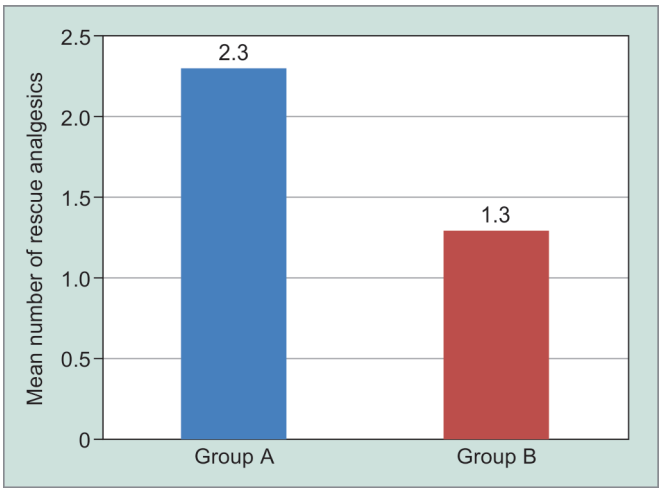


Fig. 1: Total number of rescue analgesics given in both groups

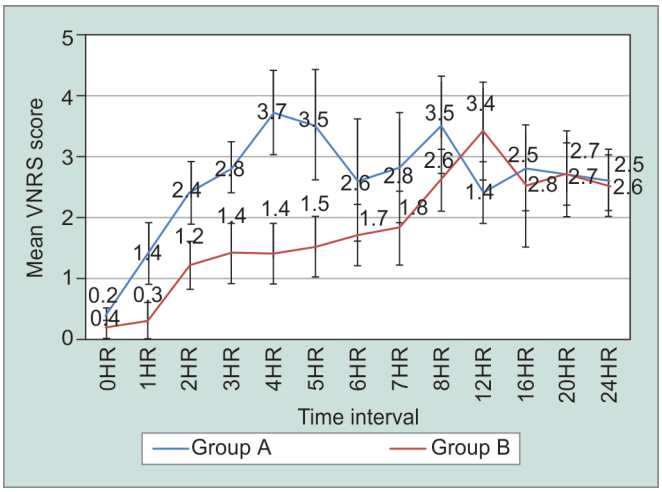


Fig. 2: Comparison of mean VNRS values of both the groups

with the more potent effect with ropivacaine as compared to bupivacaine. The several studies conducted so far, had used ropivacaine in different doses and concentration (0.25 or 0.5%) for TAP block. In all the previous studies, dexamethasone was used in dose of 4–8 mg for different peripheral block and was found to be safe without any adverse effects.[16] So, the standard guidelines regarding doses of ropivacaine and dexamethasone for TAP block is not established till now. So, we used dexamethasone in doses of 8 mg as additive to 0.25% ropivacaine.

We found that use of 8 mg dexamethasone as an adjuvant to 0.25% ropivacaine for TAP block had increased the duration of analgesia, reduced the total analgesic consumption, and had better quality of analgesia in patients undergoing lower abdominal surgeries.

These findings of our study have been supported by Bharadiya et al.,[17] where they compared dexamethasone 8 mg with that of clonidine 75 µg when used as an additive to 0.5% ropivacaine in TAP block in inguinal hernioplasty. Here, duration of analgesia was prolonged with dexamethasone (616.09 ± 31.36 minutes) as compared to that of clonidine (424.53 ± 34.13 minutes) and VAS score was also significantly lower in dexamethasone group till 12 hours postoperatively. Our results are also in concordance with the study of Gnanasekar et al.,[18] where they evaluated the effect of 8 mg of dexamethasone with 0.25% ropivacaine in TAP block in 70 patients undergoing abdominal hysterectomies under general anesthesia. Duration of analgesia was prolonged in dexamethasone (525.8 ± 81.30 minutes) compared to that of (243 ± 97.36 minutes) in control group and the mean pain scores were significantly lesser in dexamethasone group till 12th postoperative hours. Our findings correlate well with the result by Ammar and Mahmoud,[19] where duration of analgesia was significantly more with dexamethasone when used as an additive to bupivacaine in TAP block in 60 patients undergoing abdominal hysterectomy and they also had significantly lower VAS scores till 12th hour postoperatively.

In our study, there was almost 50% reduction in the rescue analgesic consumption postoperatively in dexamethasone group as compared to ropivacaine alone. Similarly, Deshpande et al.,[20] also found lesser tramadol requirement in first 24 hours in group RD (ropivacaine plus dexamethasone) as compared to group R (ropivacaine alone) (50.2 ± 34 mg vs 94 ± 35 mg, $p < 0.001$) where they evaluated the use of 4 mg of dexamethasone as an adjuvant to ropivacaine in TAP block for total abdominal hysterectomy under spinal anesthesia. They also found longer time to first rescue analgesia along with lesser VAS pain scores in group RD. Our results are also in concordance with a study which found that total tramadol consumption was significantly higher in group ropivacaine alone (86.67 ± 30.55 mg) than group dexamethasone plus ropivacaine (35.56 ± 39.54 mg).[21] Due to use of USG guided TAP block in our study, none of the patient from either group experienced any block related adverse effects such as injury to adjacent viscera, hematoma, or local anesthetic toxicity as supported by previous study.[22]

Limitation of Study

Firstly, these beneficial effects of dexamethasone could be due to its systemic absorption. Hence, a third group (TAP block + IV dexamethasone) could have been included to answer this query. Secondly, previous studies have demonstrated the TAP block analgesia up to 48 hours, whereas in this study patients were assessed only for first

24 hours. Thirdly, in present trial, spinal needle was used instead of stimuplex needle (blunt end) because of cost constraints. However, no block related complication was observed in our study as procedure was carried out under USG guidance.

Conclusion

We conclude that use of dexamethasone as an adjuvant to 0.25% ropivacaine in USG guided TAP block prolongs the duration of analgesia and reduces the analgesic requirements for infraumbilical surgeries under general anesthesia resulting in better patient satisfaction and recovery without any major side effects.

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