

# Comparison of Bupivacaine with Tramadol vs Bupivacaine with Dexamethasone in Supraclavicular Block: A Prospective Randomized Double-blind Study

<sup>1</sup>Vrishali Y Apte, <sup>2</sup>Maya A Jamkar

## ABSTRACT

**Introduction:** There is a list of additives for supraclavicular block to facilitate onset, intensity, and duration of the block, which may also be prudent for postoperative analgesia.

**Aim:** To compare dexamethasone and tramadol in combination with bupivacaine in terms of duration of sensory and motor block, onset of block, postoperative duration of analgesia and safety.

**Materials and methods:** Sixty patients of American Society of Anesthesiologists (ASA) physical status I and II undergoing below elbow surgery under brachial plexus block were randomly allocated in two groups of 30 each to receive either dexamethasone 8 mg + bupivacaine (0.5%) (0.5 mL/kg) (group I) or tramadol 1 mg/kg + bupivacaine (0.5%) (0.5 mL/kg) (group II). Primary objectives were to study the onset of sensory and motor blockade, duration of sensory and motor blockade, and duration of analgesia. Secondary objective was to study the side effects. Two-sample t-test was used to compare various parameters like onset of sensory blockade, onset of motor blockade, sensory offset, motor offset, and duration of analgesia.

**Results:** The onset of sensory blockade in groups I and II ( $7.86 \pm 1.63$  vs  $8.68 \pm 1.74$  minutes, respectively) and onset of motor blockade ( $9.63 \pm 1.28$  minutes in group I and  $9.86 \pm 1.42$  minutes in group II) were statistically comparable while duration of sensory blockade ( $1038 \pm 112.4$  minutes in group I and  $302.8 \pm 27.50$  minutes in group II), duration of motor blockade ( $889.5 \pm 89.4$  minutes in group I and  $274.5 \pm 27.08$  minutes in group II), and postoperative duration of analgesia ( $20.43 \pm 1.75$  hours in group I and  $7.08 \pm 1.47$  hours in group II) were significantly prolonged in group I compared with group II. No significant side effects were seen in any of the groups.

**Conclusion:** Addition of dexamethasone to 0.5% bupivacaine in supraclavicular brachial plexus block significantly prolongs the duration of sensory and motor blockade and postoperative duration of analgesia when compared with tramadol as additive. Both the drugs were comparable in terms of safety.

**Keywords:** Additive, Dexamethasone, Supraclavicular block, Tramadol.

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**Conflicts of interest:** None

## INTRODUCTION

Regional anesthesia is superior to general anesthesia for upper extremity surgeries as it is associated with less complications and good postoperative analgesia. The supraclavicular approach is technically easy and provides intense anesthesia for forearm surgeries. Single-shot injection providing limited duration of anesthesia is the limiting factor in regional anesthesia which can be overcome by various additives. Traditional anesthetics used for blocks lead to short-lived analgesia usually lasting less than 6 hours. So various adjuvants have been used in an attempt to prolong analgesia like epinephrine, midazolam, clonidine, fentanyl, buprenorphine, ketamine, etc.<sup>1,2</sup> One of the common additives used is an opioid tramadol.<sup>3</sup> Though it is not associated with hemodynamic instability, it has high incidence of nausea and vomiting, especially in intravenous (IV) or oral form.<sup>4</sup> Dexamethasone is long-acting glucocorticoid. It has antiinflammatory and analgesic effects. Adverse effects with a single dose of dexamethasone are probably extremely rare and minor in nature, and short-term (<24 hours) use of dexamethasone is safe. Many studies have been conducted to study the effect of dexamethasone with different local anesthetics.<sup>5-13</sup>

We are commonly using tramadol as an adjuvant to local anesthetic in our institute. Hence, this randomized clinical trial was conducted to compare dexamethasone and tramadol as adjuvants to bupivacaine in supraclavicular brachial plexus block. Primary aims and objectives of this study are to compare dexamethasone and tramadol in combination with bupivacaine (0.5%) in terms of the duration of sensory and motor block, onset of block, postoperative duration of analgesia and secondary aim is to compare safety of the two drugs in the form of side effect profile.

<sup>1</sup>Assistant Professor, <sup>2</sup>Associate Professor

<sup>1</sup>Department of Anesthesiology, Dr. D. Y. Patil Medical College Hospital & Research Centre, Pune, Maharashtra, India

<sup>2</sup>Department of Anesthesiology, B. J. Medical College, Pune Maharashtra, India

**Corresponding Author:** Vrishali Y Apte, Assistant Professor Department of Anesthesiology, Dr. D. Y. Patil Medical College Hospital & Research Centre, Pune, Maharashtra, India, e-mail: vya1210@yahoo.co.in

## MATERIALS AND METHODS

After Ethical Committee approval and written informed consent in local vernacular language, 60 patients of ASA grade I or II in the age group of 18 to 60 years posted for various surgeries on elbow, forearm, and hand were included in this randomized clinical trial and divided into two groups of 30 subjects each by using computer-generated randomization charts. Each patient was given all information and details about the procedure and drugs used. Patients in group I received dexamethasone 8 mg + bupivacaine (0.5%) (0.5 mL/kg) and patients in group II received tramadol 1 mg/kg + bupivacaine (0.5%) (0.5 mL/kg). Drugs used as adjuvants, i.e., tramadol and dexamethasone, were loaded by one person and syringes were masked and drugs were given by another person for blinding.

Patients with hypersensitivity to local anesthetics, preexisting peripheral neuropathy, uncontrolled diabetes mellitus, respiratory disorders, pregnancy, local infection at the site of block, bleeding disorders were excluded from the study. All the patients had undergone thorough preoperative assessment including detailed case history, clinical examination, and all necessary investigations like hemoglobin, bleeding time, clotting time, electrocardiogram (ECG) when indicated. After arrival in operation theater, IV line was secured on nonoperative hand and monitors attached, i.e., ECG monitor and pulse oximeter, and blood pressure (BP) cuff was tied. Basal values of pulse, BP, SpO<sub>2</sub> were noted. The patients were premedicated with glycopyrrolate 5 µg/kg intramuscularly (IM), ondansetron 0.08 mg/kg, and midazolam 0.03 mg/kg intravenously.

Supraclavicular brachial plexus block was performed by paresthesia technique. Patient was asked to lie in supine position with the head turned to opposite side and the arms extended and pulled toward the knee. The midclavicular point, external jugular vein, subclavian artery pulsations were identified. About 2 cm above the midclavicular point, 22G 1½-inch needle was introduced and directed just lateral to the subclavian artery pulsations caudad, posteriorly and medially until paresthesia is encountered. A 3-minute massage was given for even drug distribution. Sensory block was assessed by pin prick method by loss of sensation to prick over forearm. It was graded as:

- *Grade 0*: sharp prick felt; *Grade 1*: Analgesia (dull sensation felt); *Grade 2*: Anesthesia (no sensation felt).

Motor block was assessed by movement of upper limb.

It was graded as:

- *Grade 0*: normal motor function with full flexion and extension of elbow, wrist, and fingers; *Grade 1*: Decreased motor strength with ability to move fingers only; *Grade 2*: Complete motor block with inability to move the fingers.

Patients were monitored for pulse rate, blood pressure (BP), SpO<sub>2</sub>, and ECG after performance of block every 15 minutes for first hour, then every 30 minutes intraoperatively. Patients were monitored for duration of sensory and motor block, duration of analgesia, and side effects like nausea, vomiting, sedation postoperatively 1 hourly for 24 hours. Sensory and motor block was assessed as mentioned earlier. The visual analog scale score of >6 (moderate pain) was regarded as the endpoint for duration of analgesia, and rescue analgesia was given in the form of IV diclofenac (1–1.5 mg/kg). Patients were asked for any symptoms of nausea and episodes of vomiting and assessed for sedation by Ramsay sedation score.

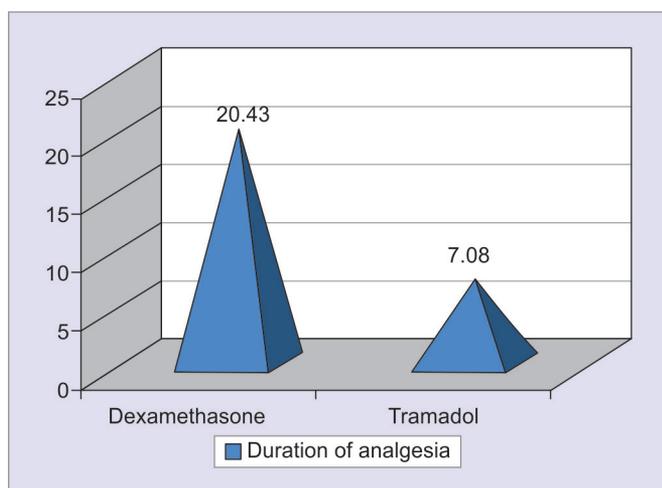
With power of study 80% and type 1 error of 5% (level of significance [ $\alpha$ ] = 0.05), the sample size required was calculated as 25 in each group and to compensate for any possible dropouts and for better validation of results, a sample size of 30 subjects per group was chosen. The data were expressed as mean  $\pm$  SD (standard deviation). Two-sample t-test is used to investigate and model impact of various parameters like age, weight, sex, onset of sensory blockade, onset of motor blockade, sensory offset, motor offset, duration of surgery, and duration of analgesia in groups I and II. A p-value <0.05 was considered statistically significant. Statistical analysis was performed using Statistical Package for the Social Sciences for Windows (version 13.0).

## RESULTS

Both groups were comparable in terms of age, weight, sex, ASA grade, and duration of surgery. Average age of the patient was 37.43  $\pm$  10.90 years in group I and 37.60  $\pm$  9.42 years in group II (p-value = 0.91). Average weight of the patient was 54.3  $\pm$  6.52 kg in group I and 54.43  $\pm$  5.92 kg in group II (p-value = 0.93). Average duration of surgery was 107.2  $\pm$  12.51 minutes in group I and 107.06  $\pm$  9.85 minutes in group II (p = 0.96). Various surgeries in both the groups were comparable (Table 1). All the patients in both the groups were monitored for pulse rate, systolic and diastolic BP, SpO<sub>2</sub>, and ECG intraoperatively at 5 minutes after giving supraclavicular block and then at 15 minutes till 1 hour and thereafter every 30 minutes till

**Table 1:** Types of surgeries in both the groups

Type of surgery	No. of patients	
	Group I	Group II
Fracture radius plating	6	8
Fracture ulna plating	7	6
Fracture radius/ulna plating	6	4
Crush injury hand flap	2	3
Burn contracture release	3	5
Tendon repair hand	4	3
Hand cellulitis debridement	2	1



Graph 1: Duration of analgesia

the end of surgery. Both the groups were comparable in terms of pulse rate, BP, and SpO<sub>2</sub>. No ECG changes were found in any patient intraoperatively.

Mean duration of sensory blockade was 1038 ± 112.4 minutes in group I and 302.8 ± 27.50 minutes in group II (p-value = 0.0001). The difference is statistically significant (p < 0.05). Mean duration of motor blockade was 889.5 ± 89.4 minutes in group I and 274.5 ± 27.08 minutes in group II (p-value = 0.0001). The difference is statistically significant (p < 0.05).

Mean duration of analgesia was 20.43 ± 1.75 hours in group I and 7.08 ± 1.47 hours in group II (Graph 1). The difference is statistically significant (p-value = 0.0001; p < 0.05).

All the patients were monitored for side effects like nausea, vomiting, sedation for 24 hours postoperatively every hour. None of the patients in any group had nausea or vomiting. All the patients were assessed for sedation by Ramsay sedation score. None of the patients in both the groups were sedated and had Ramsay sedation score of 2.

## DISCUSSION

Supraclavicular brachial plexus block is widely employed regional nerve block to provide anesthesia and analgesia for upper extremity surgeries on elbow and below elbow. Currently available local anesthetics can provide analgesia for limited period of time when used as a single injection. Plain bupivacaine provided better operating conditions but the duration of analgesia is rarely maintained for more than 4 to 6 hours. The alleviation of the suffering is, of course, a primary concern of the anesthesiologist. Any method of postoperative pain relief must meet three basic criteria. It should be effective, safe, and feasible. To extend the analgesia period postoperatively, various adjuvants to local anesthetics have been studied as mentioned before.

Shrestha et al<sup>5</sup> conducted a study to compare the analgesic efficacy of local anesthetic with and without dexamethasone in supraclavicular brachial plexus block. They concluded that addition of dexamethasone for brachial plexus block significantly prolongs the duration of analgesia as compared with only local anesthetic. Similarly, Movafegh et al,<sup>6</sup> Parrington et al,<sup>7</sup> Islam et al,<sup>8</sup> Pathak et al,<sup>9</sup> Kim et al,<sup>10</sup> Dar et al,<sup>11</sup> and Biradar et al<sup>12</sup> found that the addition of dexamethasone to various local anesthetics significantly prolongs duration of sensory and motor block as well as duration of analgesia compared with only local anesthetics when used for brachial plexus blockade in any form, i.e., interscalene, supraclavicular. Also, Choi et al<sup>13</sup> found in meta-analysis of randomized trials that perineural administration of dexamethasone with local anesthetic prolongs brachial plexus block.

Kapral et al<sup>14</sup> conducted a study to assess the impact of tramadol added to mepivacaine on the duration of an axillary brachial plexus blockade and found that duration of sensory and motor block was significantly prolonged in tramadol group. Similarly, Robaux et al<sup>15</sup> and Chattopadhyay et al<sup>16</sup> found that there is significant prolongation of duration of analgesia after addition of tramadol as compared with local anesthetic without tramadol.

Addition of steroid to local anesthetics effectively and significantly prolongs the duration of analgesia. Steroids are very potent anti-inflammatory and immunosuppressive agents. Various steroids have been used for this purpose, but dexamethasone is preferred because of its highly potent anti-inflammatory property. It is about 25 to 30 times as potent as hydrocortisone and without any mineralocorticoid activity. Thus was found to be safer and devoid of potential side effects. Dexamethasone is also known to reduce postoperative nausea and vomiting. The possible mechanism of analgesic and antiemetic actions are due to anti-inflammatory property of dexamethasone. The mechanism of the analgesia induced by corticosteroids is not fully understood. This effect is suspected to be mediated by their anti-inflammatory or immune-suppressive effects. According to the traditional theory of steroid action, steroids bind to intracellular receptors and modulate nuclear transcription. Corticosteroids may have a local effect on the nerve; the dexamethasone effect may be related to this action. Adverse effects with a single dose of dexamethasone are probably extremely rare and minor in nature and previous studies have demonstrated that short-term (24 hours) use of dexamethasone is safe.<sup>8</sup>

With addition of tramadol to local anesthetic agents, the onset and duration of motor blockade are improved.<sup>14-16</sup> The unique mechanism of tramadol along with probable local anesthetic effects and inhibiting serotonin reuptake by nerve endings potentiates the block effects. The lack

of significant side effects like respiratory depression and sedation makes tramadol an attractive choice as an adjuvant for supraclavicular brachial plexus block.

The limitations of our study are that: (1) It is not useful in patients mentioned in the exclusion criteria as before and as the supraclavicular block is given blindly by paresthesia technique patient needs to be cooperative and also block failure can occur. To prevent block failure, newer techniques like peripheral nerve stimulator or ultrasonography guidance can be used. (2) Also as injection ondansetron was given as premedication, effect of the study drugs on nausea, vomiting could not be commented till the effect of ondansetron wore off (around 6–8 hours). But the patients were followed up for 24 hours postoperatively, still none of the patient in any group had nausea or vomiting.

Our study findings showed that:

Duration of sensory blockade ( $1,038 \pm 112.4$  minutes) and motor blockade ( $889.5 \pm 89.4$  minutes) was prolonged in dexamethasone group significantly. Postoperative duration of analgesia ( $20.43 \pm 1.75$  hours) also prolonged significantly in dexamethasone group. Similar findings were also observed in previous studies except duration of sensory blockade which was not included in any study.<sup>17,18</sup>

Also, dexamethasone is cost-effective as it provides prolonged analgesia, thus reducing requirements of other means for providing analgesia. One ampoule of dexamethasone costs approximately Rs. 5 to 6 as compared with Rs. 25 to 30 of that of tramadol. So it will be very useful in developing countries. Though cost-effectiveness was not included in our study parameters, it is found as useful incidental finding.

## CONCLUSION

Dexamethasone is superior to tramadol in terms of duration of sensory blockade and motor blockade and postoperative duration of analgesia when used as an adjuvant to bupivacaine in supraclavicular brachial plexus block. There was no difference in terms of onset of sensory and motor block. Also, there are no significant side effects due to any of the drug.

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