

A Clinical Comparison between 0.5% Ropivacaine and 0.5% Ropivacaine with Dexamethasone 8mg Combination in Brachial Plexus Block by Supra Clavicular Approach

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ABSTRACT

Dexamethasone as an adjuvant to bupivacaine for supraclavicular brachial plexus (SCBP) block prolongs motor and sensory blockade. However, the effect of dexamethasone (8 mg) when added to Ropivacaine has not been well studied. This study was conducted to find out analgesic efficacy of dexamethasone as adjuvant to Ropivacaine in SCBP block. Ultrasound-guided SCBP block was given to eighty patients, randomly assigned into two groups. Group R (forty patients) received 2 mL normal saline with 30 mL Ropivacaine (0.5%) and Group D (forty patients) received 2 mL of dexamethasone (8 mg) with 30 mL of Ropivacaine (0.5%), respectively. Time for the first rescue analgesia, number of rescue analgesics required in 24 h and different block characteristics was assessed. Chi-square test and Student's t-test were used for statistical analysis. Time for request of the first rescue analgesia was 400.13 ± 109.42 min in Group R and 700.80 ± 121.46 min in Group D ($p < 0.001$). The requirement for rescue analgesics was more in Group R when compared to Group D. The onset of sensory and motor block was faster in Group D when compared to Group R. The mean duration of sensory and motor block was significantly longer in Group D than Group R. The addition of dexamethasone to Ropivacaine in SCBP blockade prolonged time for first rescue analgesia and reduced the requirement of rescue analgesics with faster onset and prolonged duration of sensory and motor block.

KEY WORDS: brachial plexus block, supraclavicular brachial plexus, bupivacaine

INTRODUCTION:

Brachial plexus block is often used either as an adjuvant to general anesthesia or as sole anesthesia modality. It can significantly reduce pain and nausea, allowing for faster discharges from hospital when compared with general anesthesia^[1]. It provides a superior quality of analgesia and avoids the common side effects associated with general anesthesia^[2] and is equally useful in patients with significant comorbidities.

Bupivacaine is a long acting local anesthetic but has significant cardio toxicity when given in high concentration or administered intravascularly.

Ropivacaine is a long acting regional anesthetic that is structurally related to bupivacaine, developed for the purpose of reducing toxicity^[3]. Investigators have tried mixing local anesthetic with adjuvant drugs to prolong anesthesia including epinephrine, clonidine^[4,5], opioids^[6,7], ketamine^[8] and midazolam^[9]. Most of these have side effects. Dexamethasone can prolong the effect of regional anesthesia^[10] and doesn't have sedative-opioid related side effects. Hence the study was designed to assess the analgesic efficacy of dexamethasone as adjuvant to ropivacaine in ultrasound guided supraclavicular brachial plexus block.

The primary aim of the present study was to determine whether dexamethasone (8mg) as adjuvant to ropivacaine in ultrasound guided supraclavicular brachial plexus block would delay the need for rescue analgesia and the number of rescue analgesia requirement in first 24 hour after surgery & its effects on sensory or motor block characteristic of 0.5% ropivacaine.

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MATERIALS AND METHODS:

A randomized prospective study was conducted in Rama Medical College Hospital & Research Center from March 2017 to November 2017 after approval of the institutional ethics committee. Patients with American society of anesthesiologist grade I or II status, between 18-60 years of either gender, posted for upper limb surgery were included in the present study. Patients who refused to give informed consent, obese and short neck patients, patients with coagulopathy, neuropathy or local infection at the site of block, those with a history of allergy to the study drug or of drug abuse and an anticipated operative time more than 2 hour were excluded from the study.

The procedure of block along with possible complication was explained to the patients, and written informed consent was obtained. All patients were given oral alprazolam 0.5 mg and ranitidine 150 mg on the night before the surgery, and were fasting overnight.

Eighty patients were divided randomly into two groups (Group R, n=40 and Group D; n=40) using a computer-generated programme. Assigned random group was enclosed in a sealed envelope to ensure concealment of allocation sequence. The anesthesiologist who was not involved in the study, opened the envelope in operation theatre and prepared the drug accordingly. Observations were done by the anesthesiologist who was blinded to the drug. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), peripheral oxygen saturation (SpO₂) and 3 lead ECG were monitored.

The SCBP block was performed using a portable ultrasound machine (Sonosite Micromaxx, Sonosite Inc. WA, USA) with a linear ultrasound transducer (8-13 MHz). Under all aseptic precautions with the patient in supine position, the affected arm adducted and head turned to the contra lateral side, the brachial plexus was visualized by putting the transducer in the supraclavicular fossa behind the middle third of the clavicle. The plexus either appeared as a cluster of grapes (5-6 hypoechoic circles) or as 3 hypoechoic circles with the hyperechoic outer ring, located lateral and superior to subclavian artery between anterior and middle scalene muscles. The drug solution, based on group allocation was injected after negative aspiration to avoid accidental intravascular needle puncture and the spread of drug was observed in tissue planes. Distension of the brachial plexus sheath was

considered as an indication of correct needle placement. Group R(40) received 30ml 0.5% ropivacaine plus 2ml normal saline, and group D (40) received 30 ml 0.5% ropivacaine plus 2 ml dexamethasone (8mg) around the brachial plexus. Midazolam 0.05 mg/kg intravenous was administered after the block was given. Sensory blockade was assessed by pinprick method at each minute after completion of the block. Block of the median and ulnar nerves were assessed by testing the palmar surfaces of the index and little finger, respectively and the dorsal surface of thumb was used to test block of the radial nerve. Grading of sensory block was done as^[11] Grade 0 : Normal sensation to pin prick. Grade 1: Dull sensation to pinprick. Grade 2: No sensation felt. Onset of sensory block was defined as the time interval between drug administration and onset of grade 1 sensory block in the hand (3 nerve distribution). The full sensory block was defined as the complete loss of sensation to a pinprick. Duration of sensory block was defined as the time interval between the complete sensory block and the return of normal sensation.

Motor block was monitored by thumb adduction (ulnar nerve), thumb abduction {radial nerve}, thumb opposition (median nerve) and flexion of elbow and pronation of forearm (musculocutaneous nerve) using a Lovet rating scale.^[12] The onset of motor block was the time between completion of local anaesthetic injection and complete paralysis, and the duration of motor block was taken as the time interval from complete paralysis to complete recovery of motor function. The block was considered as failed block when at least two of the four nerves (radial, median, ulnar and musculocutaneous) were not affected even after 30 min after performing the block. As per complaint of surgeon and patient, the quality of the operative condition was monitored on the following scale; Grade 4 : No complaint (excellent), Grade 3 : Minor complaint (good), Grade 2 : Complaint requiring analgesics (moderate) and Grade 1: patient given general anaesthesia (unsuccessful).^(11,12)

The performance of block, intra operative parameters and post-operative analgesia were monitored by an anaesthesiologist who was neither aware of group allocation nor involved in the drug preparation. Post-operative analgesia was monitored as per a numeric rating scale of 0-10 at every hour up to 24 hours.⁽¹²⁾ If the numerical rating scale score was 5 or more, it was considered that analgesic action of the block had terminated, and injection tramadol 100 mg intravenously was given as rescue analgesia. Side

effects such as nausea, vomiting, convulsion, dryness of mouth, respiratory problems, pneumothorax in intra-operative period and neuropathy in the post-operative period noted. HR, SBP, DBP and SpO₂ were recorded pre-operatively administration, at 0 min (just after drug administration), 15 min, 30 min, 45min, 60 min, 75 min, 90 min, 105 min, 120 min, 4 h, 8 h, 12 h and 24 h.

The mean onset time and duration of sensory and motor block were noted. The time for the first rescue analgesic, the total dose of rescue analgesic needed for first 24 hours, all haemodynamic parameters (SBP, DBP, MAP and HR) and any other complication were also noted.

The patients data and characteristics, the time of onset and duration of the block were categorized and analysed appropriately using student's unpaired t-test and chi-square test. A $p < 0.05$ was considered as statistically significant and a $p < 0.001$ as statistically highly significant.

RESULTS:

Block was successful in all the patients, and all the enrolled patients completed the study. Demographic data such as age, sex, weight and duration of surgery between two groups were comparable (Table 1). The request for first rescue analgesic was significantly earlier in Group R than Group D (Table 2). Figure 2 shows that in Group R 80% of patients required three, and 20% of patients were given two rescue analgesic doses in the post-operative 24 hours. In Group D, 60% of patients were given only one rescue analgesic dose and 30% of patients were given two, whereas only 10% of patients were given three rescue analgesic doses in the post-operative 24 hours. This difference in both groups was statistically highly significant ($p < 0.001$).

In this study, the onset of motor and sensory block in Group R was delayed in comparison to Group D. This difference in both Group R and Group D was very highly significant ($p < 0.001$) (Table 2). Duration of motor and sensory block in Group D was prolonged compared to Group R ($p < 0.001$) (Table 2).

There was no case of failed block or patchy block. None of the patients of either groups required supplemental analgesia or general anesthesia. Qualities of the operative condition in both groups were excellent, and there was no statistically significant difference between two groups. Intra and post-operative haemodynamic parameters were comparable between the two groups. There were no side effects during intra and post-operative period.

Table 1 : Demographic parameters.

Parameters	Group R	Group D
Age (year)	37.17 ±11.72	38.77 ±11.61
Gender (male/female)	21/19	20/20
Weight (kg)	65.23 ±7.92	66.77 ±6.74
American Society of Anesthesiologists status (I/II)	28/12	26/14
Duration of surgery (min)	112.4 ±8.4	110.8 ±9.2

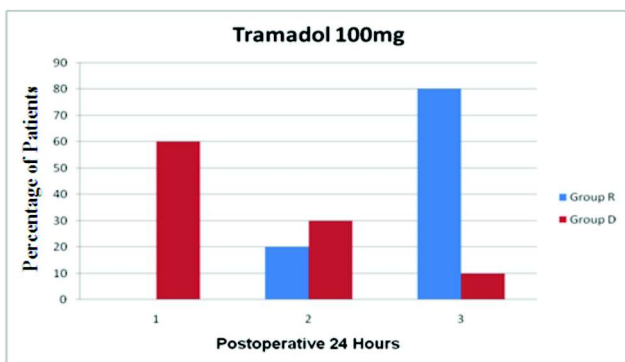
DISCUSSION:

Supraclavicular block provides a rapid, dense, and predictable anesthesia of the entire upper extremity in the most consistent manner of any brachial plexus technique^[13]. Although this is an excellent technique in experienced hands, the use of ultra sound has shown the considerable increase in the success rate of block. That is why we selected ultra sound guided supraclavicular approach to supraclavicular brachial plexus block in our study.

Our study results demonstrate that the addition of dexamethasone to ropivacaine significantly prolongs the analgesic effect of plain ropivacaine postoperatively. These results are in keeping with the trend of previous studies using dexamethasone and a brachial plexus model^[14,15,16,17] however, accurate comparisons are challenging because of the variety of local anesthetic mixtures and adjuvants used, different blocks studied, and different methods of evaluating block duration. The block prolongation we observed (approximately twofold with ropivacaine and dexamethasone). Is consistent with observation of Pathak et al,^[13] who noticed significant prolongation of analgesia and motor block when dexamethasone was added to a mixture of 1.5% adrenalized xylocaine and 0.5% bupivacaine. Many other studies reported the prolonged duration of sensory and motor block when dexamethasone was used as an adjuvant with bupivacaine and lignocaine in brachial plexus block, but they differed regarding the onset of sensory and motor block^[18-21]. Effect of dexamethasone with bupivacaine was studied in interscalene block and it was concluded that the sensory block was prolonged and use of opioid was reduced post operatively using dexamethasone^[16]. Pani et al observed adding dexamethasone (8mg) to levobupivacaine delayed the time of first rescue analgesic and decreased the number of rescue analgesics required^[23]. In addition there was early onset of sensory and motor block similar results were found in our study with ropivacaine.

Table 2: Brachial plexus block characteristics.

Variables	Group R (n=40)	Group D (n=40)	p-value
Sensory block-onset (min)	7.00 ±1.73	4.40 ±1.32	<0.001
Motor block-onset (min)	10.03 ±1.73	06.33 ±0.96	<0.001
Sensory block-duration (min)	180.60 ±30.26	410.73 ±80.87	<0.001
Motor block-duration (min)	155.70 ±32.52	310.93 ±70.24	<0.001
Time to request for first rescue analgesia (min)	400.13 ±109.42	700.80 ±121.46	<0.001

**Figure 1:** Number of Rescue Analgesic Dosage (Tramadol 100mg) in Postoperative 24 hours.

The mechanism of analgesia induced by corticosteroids is not fully understood. This effect is suspected to be mediated by their anti-inflammatory or immunosuppressive effects^[24,25]. According to the traditional theory of steroid action, steroids bind to intracellular receptors and modulate nuclear transcription. Honorio et al^[26] found that steroids produce analgesia by blocking transmission in nociceptive c-fibers and suppressing ectopic neuronal discharge. According to Attardi et al,^[27] steroids might bring about this effect by altering the function of potassium channels in the excitable cells and this might be the probable mechanism of action by dexamethasone for the prolongation of blockade in our study. The dose of dexamethasone as an adjuvant to local anesthetics for peripheral nerve block has not been described. We selected a dose of 8 mg because administration of this dose seems to be safe in adults. Adverse effects with a single dose of dexamethasone are probably extremely rare and minor in nature, and the previous studies have demonstrated that short-term (<24 h) use of dexamethasone was safe^[28,29]. Several studies have shown that addition of 4-8 mg of dexamethasone to local anesthetics effectively and significantly prolongs the duration of analgesia^[13] qualities of operative conditions was good and same

in both groups in agreement with study by pani et al while other study by santosh kumar et al showed comparatively good operative conditions in dexa-methasone group^[27].

There are some concerns regarding the safety of perineural administration of dexamethasone, but there are no reports available regarding long term effects on peripheral nerves of single dose of 8mg dexamethasone, the side effect associated with clonidine and opioids can be reduced with dexamethasone. Systemic toxicity from a single dose of dexamethasone is unlikely. Hence, dexamethasone may be a preferred adjuvant to ropivacaine.

Limitation of our study was that we did not study incidence of steroid induced hyperglycemia and late onset neuropathy as long term follow up was not performed.

CONCLUSION:

Dexamethasone (8mg) as adjuvant to 0.5% ropivacaine when used in ultra sound guided supraclavicular brachial plexus block produced faster onset and prolonged duration of sensory and motor blockage and decreased the requirement of analgesics in post operative period. So dexamethasone can be used as an adjuvant to 0.5% ropivacaine. Further studies needed to know the incidence of steroid-induced hyperglycemia and late onset neuropathy.

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