

## Original Research Article

# Impact of Dexamethasone on Lignocaine and Ropivacaine Mixture for supraclavicular Brachial Plexus Block: A Prospective, Randomized, Double Blind Trial

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**Abstract:** Supraclavicular brachial plexus block is a common regional anesthesia technique used for upper extremity orthopedic surgeries. The addition of adjuvants to local anesthetics can prolong the duration of analgesia and improve the quality of the block. This prospective, randomized, double-blind study aimed to investigate the impact of dexamethasone on the efficacy of a lignocaine and ropivacaine mixture for ultrasound guided supraclavicular block. A total of 80 patients scheduled for major forearm orthopedic surgery were randomly assigned to receive either a mixture of lignocaine 2% and ropivacaine 0.5% (control group) Group A or the same local anesthetic mixture with the addition of dexamethasone 8 mg (dexamethasone group) Group B. The primary outcome was the duration of analgesia, defined as the time from block placement to the first request for rescue analgesia. Secondary outcomes included the onset time of sensory and motor block, the quality of the block, and the incidence of adverse events. The results showed that the addition of dexamethasone significantly prolonged the duration of analgesia compared to the local anesthetic mixture alone ( $135 \pm 10$  min vs.  $170 \pm 15$  min, respectively,  $p < 0.001$ ). Addition of dexamethasone to mixture of lidocaine and ropivacaine in supraclavicular block results in prolonged duration of sensory and motor block and also improves quality of analgesia without affecting its onset.

**Keywords:** Analgesia, Supraclavicular Block, Dexamethasone, Ropivacaine, Ultrasound.

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## INTRODUCTION

Brachial Plexus block is a block of its roots, divisions and trunks and was performed first by Halsted in 1884 [1]. Supraclavicular approach of this block is provided at the trunk level where the plexus is placed most compactly and the block once successful at this level, provides excellent anesthesia at elbow, forearm and hand surgery. The compactness may explain the blocks historical reputation for providing a short latency, complete and reliable anaesthesia for upper extremity [2, 3].

The duration of local anaesthetic action can be prolonged by using various adjuvants like vasoconstrictors, opioids, verapamil etc, but the results are either inconclusive or associated with side effects [4-6]. Intrathecal use of steroids has been associated with arachnoiditis but there is no evidence of neuritis when

steroids are used in low concentration in peripheral nerve blocks. Steroids have anti inflammatory and analgesic property and there are many studies which have demonstrated such effects [7-9].

Supraclavicular Brachial Plexus block is the commonest anaesthetic technique for upper limb surgeries in our hospital. Apart from its advantages like avoiding dangers of general anaesthetic drugs. Airway manipulation and instrumentation it provides good operating conditions and excellent perioperative analgesia. In our set up where we have long waiting list of trauma and elective cases to be operated in Orthopedics department of our hospital, this block is an excellent tool in the hands of anaesthesiologist for patients with poor general condition and not adequately prepared. It provides a safe and economical alternative in many such situations provided that it is given meticulously under expert and experienced supervision

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and requires very intensive perioperative care to avoid complication like pneumothorax. In our study we used dexamethasone as an additive to local anaesthetic mixture of lidocaine and ropivacaine to evaluate onset, duration of analgesia and quality of block in surgeries of hand, forearm and elbow.

## MATERIALS AND METHODS

This prospective randomized double-blind study was carried out in the Department of Anaesthesiology Government Medical College, Baramulla, Jammu and Kashmir, in year 2023. Following approval from the Ethics Committee and obtaining informed consent, 80 patients were selected for upper limb orthopedic surgery under a supraclavicular brachial plexus block. Participants were ASA physical status I or II, aged 18-65, of either sex, and scheduled for either elective or emergency orthopedic procedures. Exclusion criteria included uncontrolled diabetes, renal and liver diseases, circulatory instability, peptic ulcer disease, allergies to local anesthetics, and long-term steroid use.

Patients were randomly assigned to two groups of 40 each. Group A (Control) received a mixture of 9 ml of 2% lidocaine, 19 ml of 0.5% ropivacaine, and 2 ml of normal saline (NS). Group B (Cases) received the same local anesthetic mixture, but 2 ml of NS was replaced with 2 ml (8 mg) of dexamethasone. Each patient received a total volume of 30 ml of the mixture.

In the operating room, a multichannel monitor was attached to record baseline heart rate, ECG, blood pressure, SpO<sub>2</sub>, and respiratory rate. A 20-gauge IV cannula was placed in the opposite arm, and Ringer's lactate was administered. Using aseptic techniques, landmark points identified on ultrasound. The 30 ml drug mixture was then injected incrementally after checking for blood and air using appropriately sized ultrasound compatible needle.

Sensory and motor block of the radial, median, musculocutaneous, and ulnar nerves were assessed at 15, 30, 60, 90, and 120 minutes, and then every half hour. Sensory block was evaluated using pinprick tests compared to the opposite hand. Onset time for sensory block was defined as the period from injection to the onset of dull sensation in any nerve distribution. Analgesia duration was measured using the Visual Analogue Scale (VAS), with 0 indicating no pain and 10 representing the worst possible pain.

Pain intensity was assessed using the Visual Analogue Scale (VAS), with 0 indicating no pain and 10 representing the most severe pain. Motor block for each nerve was evaluated as follows: thumb abduction for the radial nerve, thumb adduction for the ulnar nerve, thumb opposition for the median nerve, and forearm pronation with elbow flexion in supination for the musculocutaneous nerve. Motor block was measured using the modified Lovett rating scale (LRS). Age, weight, and surgery duration were also recorded.

The duration of sensory block was defined as the time from the injection of the local anesthetic mixture to the onset of the first postoperative pain. The duration of motor blockade was measured from the local anesthetic administration to the complete recovery of motor function in all affected nerves. Patients who experienced pain or discomfort during surgery, or whose block effects diminished due to an unusually prolonged procedure, were converted to general anesthesia and excluded from the study.

Postoperatively, a chest X-ray was performed six hours after the block was administered or earlier if the patient showed signs of pneumothorax. Findings were recorded and managed accordingly. Statistical analysis was conducted using SPSS for Windows version 16. Demographic data and group comparisons were analyzed using Student's t-test and Mann-Whitney U test, with a p-value of less than 0.05 considered significant.

## RESULTS

The demographic profiles of the two groups showed no statistically significant differences ( $p > 0.05$ ) (Tables 1). The onset times for both sensory and motor blocks were similar between the groups and were statistically insignificant. However, duration of analgesia, were notably longer in Group B, and the difference was statistically significant (Table 2).

VAS scores and motor block scores, as assessed by the Lovett rating scale at various time points (15, 20, 30, 60, 90, 120, 150, and 180 minutes), were significantly lower in Group B compared to Group A-Figures 1&2 ( $p < 0.05$ ). No adverse events were noted in either group during the course of study.

**Table 1: Demographics**

Variable	Group A	Group B	P-value
AGE	41±8	42±7	>0.5
WEIGHT	53±9	55±6	>0.25

**Table 2: Characteristics of supraclavicular block**

Variable in min	Group A	Group B	P-value	Remarks
Onset time(SB)	26.8±3	27.4±5	0.450	Not significant
Onset time(MB)	35.4±6	34.9±3	0.95	Not significant
Duration of analgesia	135±10	170±15	<0.001	Significant

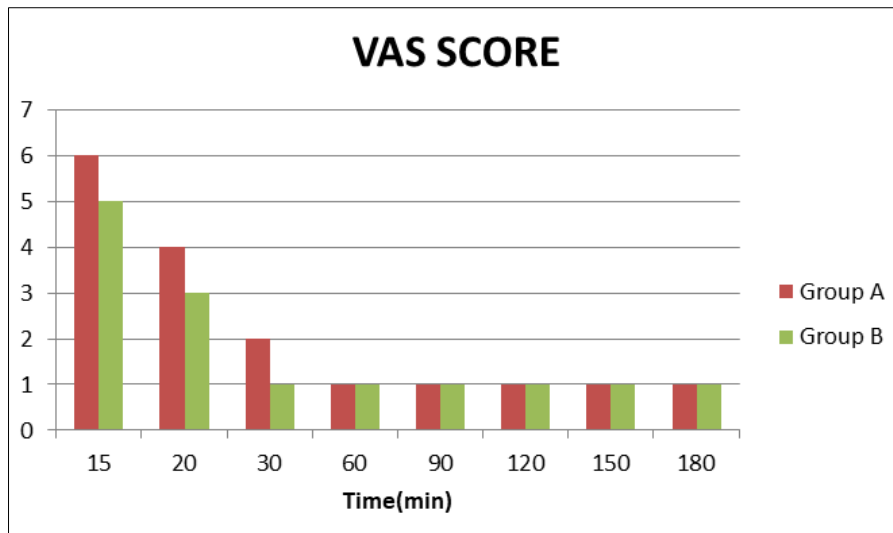


Figure 1: Vas Score

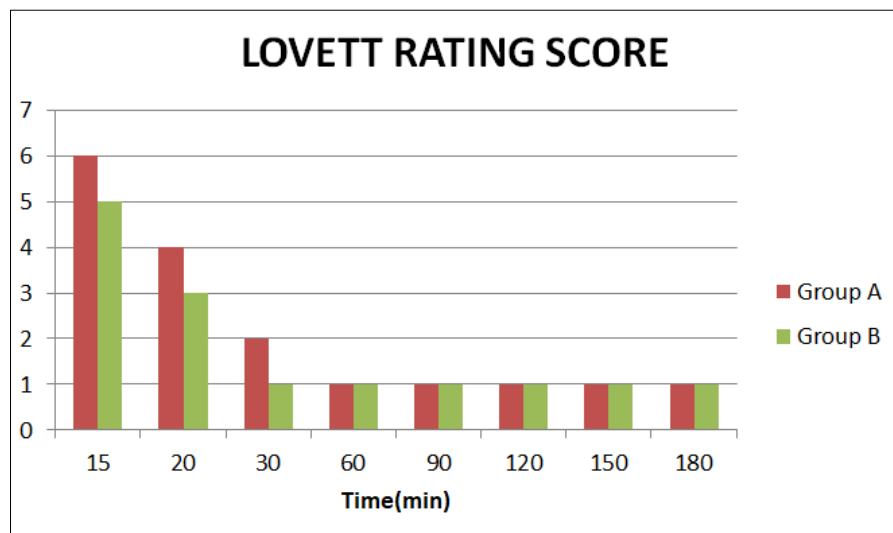


Figure 2: Lovett Rating Score

## DISCUSSION

Glucocorticoids like dexamethasone, inhibit cytokine mediated pathways by binding in cytoplasm and combining with glucocorticoid receptors, this complex then moves into nucleus of cells where it binds to specific DNA sequences to regulate gene transcription involved in the function of inflammatory response mediators. This results in the induction and repression of genes related to inflammatory processes.

Dexamethasone in bupivacaine microspheres also prolonged local analgesia when injected subcutaneously [15], and in intercostal nerve blockade [16]. Dexamethasone has also been found to enhance the analgesia of intravenous regional anaesthesia (IVRA) and reduce postoperative analgesic requirements [17].

Action on glucocorticoid receptor alters the functioning of ion channels or produces local acidosis in the nerve cell, thereby reducing the concentration of local anaesthetic required for conduction failure or

trapping the highly ionized bupivacaine molecule into the neuronal cell [12-16]. These events produce an extended action of local anaesthetics. Short term single dose of dexamethasone in 24 hours is safe as demonstrated in many studies [19], but at the same time may cause problems in diabetic patients and patients having chronic infections.

Dexamethasone is one of the most effective ligands for glucocorticoid receptor activation there by having a strong anti-inflammatory effect [18]. These effects are, therefore mediated via the classical glucocorticoid receptor and are local effects rather than systemic since incorporation of dexamethasone has not been shown to alter kinetics of bupivacaine release from microcapsules [13].

In conclusion, addition of dexamethasone 8mg to lidocaine 2% and ropivacaine 0.5% mixture in supraclavicular block results in prolonged duration of sensory and motor block and it is useful in situations such

as hypertension and ischemic heart disease patients were drug such as epinephrine must be avoided. Further studies are required at biochemical level to know exact mechanism of action of dexamethasone.

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