# Dexamethasone as an Adjuvant to 0.5 % Ropivacaine for Ultrasound Guided Supraclavicular Brachial Plexus Block

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**ABSTRACT**

**BACKGROUND**

Supraclavicular brachial plexus block is a reliable, regional anaesthetic technique for upper limb surgeries. Also known as "spinal of upper limb".[1] The present study was conducted to assess the analgesic efficacy of dexamethasone as an adjuvant to 0.5 % ropivacaine for ultrasound sonography (USG) guided brachial plexus block.

**METHODS**

50 adult patients of American Society of Anaesthesiologists (ASA) physical status I and II of both genders, aged 18 - 50 years scheduled for elective upper limb surgeries under brachial plexus block via supraclavicular approach were randomised into 2 groups of 25 patients each to receive either 20 ml of 0.5 % ropivacaine with 2 ml of normal saline (group A) or 20 ml of 0.5 % ropivacaine with 2 ml of dexamethasone (8 mg) (group B).

**RESULTS**

Use of ultrasound helps in better visualisation of nerves, needle & spread of local anaesthetic at brachial plexus block site. So, less amount of drug volume is required for the block. Time of onset of sensory and motor block was significantly lower in group B compared to group A. Mean duration of motor and sensory block was significantly longer in group B than group A. The duration of postoperative analgesia was 18.79 ± 2.31 hours in group B & 9.06 ± 0.35 hours in group A, with statistically highly significant difference ($P < 0.05$). There were no perioperative haemodynamic variations between the two groups and no complication of technique or adverse effects due to dexamethasone occurred.

**CONCLUSIONS**

Dexamethasone 8 mg has significantly extended duration of analgesia of brachial plexus block with no adverse effects.

**KEYWORDS**

Brachial Plexus Block, Ropivacaine, Dexamethasone, Supraclavicular Approach, Ultrasound Guidance

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## BACKGROUND

Regional blocks remain a well-accepted component of comprehensive anaesthesia care. Its role has expanded from operating room into the area of postoperative & chronic pain management. Brachial plexus blocks for upper limb surgeries has advantages over general anaesthesia like,

- It avoids stress response to laryngoscopy and airway manipulation
- It decreases postoperative nausea, vomiting
- It also facilitates early ambulation and early return to normal activity, so decreases chances of thromboembolism. Hence, reduces hospital stay and cost.

The advantages of ultrasound guided brachial plexus block:

- Helps in better visualisation of nerves, needle and spread of local anaesthetic at brachial plexus.[2,3]
- Less amount of drug volume is required for the blocking the nerve.[4]

Peripheral nerve blocks with local anaesthetics provide excellent operating conditions but the duration of analgesia may not be sufficient even with the longest acting local anaesthetics. So, various adjuvants like opioids, steroids, α2 adrenergic agonist, adrenaline etc. are used with local anaesthetics to enhance analgesic efficacy and to maximize the duration of the blockade.[5]

Steroids have powerful anti-inflammatory and vasoconstriction effect. On perineural injection, they reduce the local anaesthetic absorption, thus prolonging their effect. They relieve pain by reducing inflammation and blocking transmission in nociceptive C-fibers and by suppressing ectopic neural discharge.[6]

Various steroids have been used for this purpose but dexamethasone, a synthetic glucocorticoid, has a good anti-inflammatory property without mineralocorticoid activity. So, it is found to be safer and without any side effects.[7]

### Objectives

The study was conducted to evaluate the efficacy of injection dexamethasone (8 mg) as an adjuvant to 0.5 % 20 ml ropivacaine in ultrasound guided supraclavicular brachial plexus block in 50 adult patients (ASA I and II).

- To evaluate the onset and duration of sensory and motor blockade.
- To study the perioperative haemodynamic stability.
- To observe the perioperative complications.
- To study the duration of postoperative analgesia.

## METHODS

This was a prospective, randomised, single blinded controlled study. The method of randomisation was by "chit and box method". The sample size was calculated as 25 subjects in each group with alpha error 0.05 and power 80 %.

### Study Period

This study was carried out in 50 patients, aged 18 - 50 years, of ASA physical status I or II of either sex, scheduled for elective upper limb orthopaedic surgeries (between May 2018 to April 2019) under brachial plexus block via ultrasound guided supraclavicular approach.

### Exclusion Criteria

- Patient refusal
- Previous nerve injury
- History of drug dependence / abuse
- History of drug allergy
- Patients on chronic analgesics drugs, antiplatelet agents
- Any major systemic / psychiatric illness
- Local infection, swelling, trauma, hematoma, deformity
- Bleeding disorder

All the patients were subjected to detailed pre anaesthetic evaluation with clinical history, general and systemic examination. Routine investigations like haemoglobin, blood sugar, renal function test, liver function test, serum electrolyte, x-ray and electrocardiogram (ECG), human immunodeficiency virus (HIV0 and hepatitis B surface antigen (HBsAg) and other specific investigations were done as per patient's clinical condition.

Patients were randomly divided into two groups of 25 patients in each, with help of chit and box method.

Group A: Injection ropivacaine 0.5 % 20 ml + 2 ml normal Saline.

Group B: Injection ropivacaine 0.5 % 20 ml + Injection dexamethasone 2 ml (8 mg).

Each patient was explained in detail regarding the procedure of anaesthesia and was explained 0 - 10 point visual analogue scale (VAS) on a sheet of paper where score of 0 labelled as no pain and 10 as worst possible pain.

All the patients were kept nothing by mouth (NBM) for six hours before the surgery. In the operation theatre, after securing an intravenous cannula, lactated Ringer's solution was commenced. After establishing standard monitoring, baseline parameters such as heart rate, blood pressure, electrocardiogram, oxygen saturation and respiratory rate were recorded. All the necessary equipments and drugs needed for administration of general anaesthesia and for emergency resuscitation were kept ready.

### Technique

Under all aseptic precautions the block was performed with the patient in supine position with the head turned to the contralateral side and with the ipsilateral arm adducted gently by an assistant and the shoulder slightly pulled down. The ultrasound probe (linear) was put in the supraclavicular fossa, parallel to the middle third of clavicle, in the sagittal plane, to visualise the brachial plexus as a bunch of grapes like cluster of 5 - 6 hypoechoic circles located lateral and superior to the subclavian artery at the lower cervical region. A 23 gauge, 1.5 inches needle was inserted in the in-plane technique. Upon visualising its path to the desired location

the local anaesthetic mixture was injected according to the allocated group A or B. The predetermined volume of drug solution was administered after negative aspiration around the brachial plexus. End of injection was considered as time 0. Sensory characteristics of the block were assessed using response to pinprick with needle. Palmar surface of index and little finger and dorsum of thumb were assessed to test for median, ulnar and radial nerve respectively.

Onset of sensory blockade was taken as the time from the end of injection to complete loss of pin prick sensation in areas of nerve to be assessed.

Motor characteristics of the block were assessed by asking the patient to flex the forearm and hand against gravity and adduct the shoulder. Onset of motor blockade was considered as the time from end of injection to the time of inability to do movements to be assessed.

Only patients with complete motor and sensory block were included in the study. After achieving a complete motor and sensory block, surgery was started and time of starting of surgery was noted.

Intraoperative haemodynamic vitals (pulse rate, blood pressure, oxygen saturation (Spo2) and respiratory rate) were recorded at 0, 15, 30, 60, 90, 120 mins till the end of surgery.

Intraoperative complications like hypotension (fall in mean arterial blood pressure > 20 % from the baseline), bradycardia (heart rate < 60 / min), nausea, vomiting and respiratory depression were observed.

Time of end of surgery was noted and total duration of each case was noted. The duration of sensory block (time elapsed between injection of the drug to return of pin prick sensation) and the duration of motor block (time elapsed between injection of the drug to return of motor power evaluated by finger and shoulder movement) were recorded.

Postoperatively pulse rate, blood pressure, SpO2, respiratory rate and VAS scores were recorded at 0, 30 minutes then at 1, 2, 3, 4, 6, 9, 12, 15, 18, 24 hrs. All the patients were observed for postoperative complications (pneumothorax, surgical emphysema, local hematoma and nerve injury). Duration of postoperative analgesia was taken as time from onset of sensory block to the time of administration of first rescue analgesic. Postoperatively, VAS was recorded up to 24 hours.

Whenever VAS ≥ 5 or patient complained of pain, injection diclofenac Sodium (1.5 mg / kg) 75 mg IV was given as rescue analgesic. Results were expressed as mean ± SD (standard deviation). Statistical analysis was performed using unpaired student's t-test for intergroup comparison. P < 0.05 considered as statistically significant.

## RESULTS

After studying 50 cases, observation and results were summarised in tabulated form and described below.

| | Group A | Group B |
|---|---|---|
| Sex (M / F) | 18 / 7 | 20 / 5 |
| Age (years) | 37.13 ± 10.41 | 35.4 ± 10.12 |
| Weight (kg) | 69.30 ± 11.98 | 66.16 ± 6.63 |

***Table 1. Demographic Data***

No statistically significant difference was seen in male female ratio, weight and age of patients between both groups (P > 0.05).

| Duration of Surgery | Group A | Group B |
|---|---|---|
| Mean duration (mins) | 95.8 ± 19.4 | 89.8 ± 21.06 |

***Table 2. Duration of Surgery***

This table shows no statistically significant difference in duration of surgery between the two groups (P > 0.05).

| Onset of Anaesthesia | Group A | Group B |
|---|---|---|
| Mean sensory (min) block | 12.4 ± 1.23 | 10.6 ± 1.00 |
| Mean complete motor block | 16.6 ± 1.05 | 14.24 ± 1.50 |

***Table 3. Onset of Anaesthesia***

This table shows mean time of onset of sensory and motor block was significantly lower in Group B compared to Group A (P < 0.05).

| Time (hrs.) | Group A | Group B |
|---|---|---|
| Mean duration of motor block | 6.22 ± 0.64 | 7.49 ± 0.54 |
| Mean duration of sensory block | 7.12 ± 0.58 | 8.18 ± 0.49 |
| Mean time of 1st analgesic | 7.58 ± 0.42 | 8.49 ± 0.65 |

***Table 4. Duration of Analgesia and Anaesthesia***

This table shows mean duration of motor block and sensory block were significantly longer in Group B than Group A (P < 0.05).

Mean time for the first analgesia requirement for Group B was (18.79 ± 2.31) hrs. and it was significantly longer than group A (9.06 ± 0.35) P < 0.05.

No statistically significant difference in intra operative pulse and blood pressure were seen in both groups (P > 0.05). No statistically significant difference in intra operative respiratory rate and SpO2 were seen between both the groups (P > 0.05). No statistically significant difference in postoperative pulse and blood pressure were seen between both the groups (> 0.05). No statistically significant difference in postoperative respiratory rate and Spo2 werer seen between both the groups (> 0.05).

| Complications | Group A | | Group B | |
|---|---|---|---|---|
| | Intra-Operative | Post-Operative | Intra-Operative | Post-Operative |
| Nausea | 0 | 0 | 0 | 0 |
| Vomiting | 0 | 0 | 0 | 0 |
| Hypotension | 0 | 0 | 0 | 0 |
| Bradycardia | 0 | 0 | 0 | 0 |
| Respiratory depression | 0 | 0 | 0 | 0 |
| Pneumothorax | 0 | 0 | 0 | 0 |
| Surgical emphysema | 0 | 0 | 0 | 0 |
| Nerve injury | 0 | 0 | 0 | 0 |
| Local haematoma | 0 | 0 | 0 | 0 |

***Table 5. Perioperative Complications***

No complications and adverse events were observed in either group.

## DISCUSSION

During the present study, the brachial plexus was successfully blocked under ultrasound guidance and the anatomical variations of important structures, individual nerves and accurate needle placement could be visualised at

brachial plexus site before infiltration of study drug solutions.

With the use of ultrasound, Sainz Lopez et al.[4] Used injection of 10 ml mepivacaine 2 % and demonstrated that ultrasound guidance enabled the use of reduced dose of local anaesthetic for supraclavicular brachial plexus block to minimise the risk of the systemic toxicity of local anaesthetic drugs.

In the present study, we have used only 20 ml (100 mg) of 0.5 % ropivacaine to establish the effective block.

Onset of anaesthesia in Feroz Ahmed Dar et al.[8] study (2013) where they used 2 ml (8 mg) dexamethasone + 30 ml (150 mg) 0.5 % ropivacaine in their study and found that onset of sensory block and motor block in dexamethasone group was earlier than in the control group (ropivacaine 30 ml + normal saline 2 ml).

In our study, the onset of sensory and motor block was significantly faster in patients who received a combination of local anaesthetic and dexamethasone. In both the groups the onset of sensory block was earlier than motor blockade. As the order of blockade of fibres by local anaesthetic is vasomotor, cold, warmth, slow pain, fast pain, touch, motor, joint sensation and pressure and also small, myelinated A-γ and A-δ are more susceptible to impulse annihilation followed by large myelinated A-α and A-β fibres and hence the onset of sensory block precedes onset of motor block.

The mean duration of onset of sensory blockade in Group B (dexamethasone) was 10.6 ± 1.00 mins as compared to 12.4 ± 1.23 mins in Group A and the mean duration of onset of motor blockade in Group B was 14.24 ± 1.50 mins as compared to 16.6 ± 1.05 mins in Group A.

### Duration of Analgesia and Motor and Sensory Blockade

Intensity of postoperative pain was evaluated using visual analogue scale. The scale consists of a ruler with markings from 0 to 10. The patient was asked to state their present perception of pain, assuring 0 to be no pain at all and 10 to be the worst possible pain they could imagine.

The duration of postoperative analgesia was assessed in terms of first rescue analgesic requirement (VAS > 5). Kalpna K et al.[9] (2014) conducted a study using dexamethasone 6 mg as an adjuvant to 20 ml ropivacaine 0.5 % in brachial plexus block and showed that dexamethasone group had prolonged duration of postoperative analgesia.

Kumud Ganvit et al.[10] (2012) conducted a study using dexamethasone 8 mg as an adjuvant to 28 ml ropivacaine 0.5 % in brachial plexus block and demonstrated that addition of dexamethasone to local anaesthetic causes significant prolongation of postoperative analgesia.

In our study (Table 4), the mean duration of sensory blockade was 7.12 ± 0.58 hrs in Group A and 8.18 ± 0.49 hrs in Group B. The duration of sensory block was more in Group B ($P < 0.001$). The mean duration of motor blockade was 6.22 ± 0.64 hrs in Group A as compared to 7.49 ± 0.54 hrs in Group B. The duration of motor block was more in Group B ($P < 0.001$).

In our study (Table 4), the time for first analgesic requirement in control group (Group A) was 7.58 ± 0.42 hrs compared to 8.49 ± 0.65 hrs. in dexamethasone group (Group B) which means duration of postoperative analgesia was significantly more in Group B ($P < 0.001$).

Thus the duration of motor and sensory block in the dexamethasone group was significantly higher than the control group.

### Peri Operative Haemodynamics

S. Kumar et al.[11] (2014) conducted a study using 2 ml dexamethasone (8 mg) as an adjuvant to 30 ml ropivacaine 0.5 % in one group and normal saline 2 ml+ 30 ml ropivacaine in other group in brachial plexus block and demonstrated that, use of dexamethasone with local anaesthetic in supraclavicular brachial plexus block, there were no significant difference in both group of study in terms of haemodynamic variables like pulse, blood pressure, respiratory rate and spO2.

Kumud Ganvit et al.[10] (2012) conducted a study using dexamethasone 8 mg as an adjuvant to 28 ml ropivacaine 0.5 % in one group and normal saline 2 ml + 28 ml ropivacaine in other group in brachial plexus block and concluded that haemodynamics remained stable in both groups intraoperatively and postoperatively.

In our study there was no significant difference in the haemodynamics found between the two groups perioperatively.

### Perioperative Complications

S. Kumar et al.[11] (2014) conducted a study using 2 ml dexamethasone (8 mg) as an adjuvant to 30 ml ropivacaine 0.5 % in brachial plexus block and showed that no adverse effects occurred in dexamethasone group intraoperatively and postoperatively.

In our study, no major side effects like nausea, vomiting, bradycardia or hypotension were noted in both groups intraoperatively. Postoperatively no complications (pneumothorax, surgical emphysema, nerve injury or local hematoma) were observed in any group.

## CONCLUSIONS

Dexamethasone 8 mg as an adjuvant to 0.5 % ropivacaine for ultrasound guided supraclavicular brachial plexus block in patients undergoing various elective upper limb surgeries is associated with rapid onset of sensory and motor block and there is significant increase in the duration of both sensory and motor block and also enhances the duration of analgesia without any adverse effects and vital stability. There was no incidence of technique related complications because of ultrasound guidance.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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