**ORIGINAL ARTICLE**

**EFFECT OF ADDITION OF DEXAMETHASONE TO ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A PROSPECTIVE, RANDOMISED, DOUBLE-BLIND STUDY**

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**ABSTRACT: BACKGROUND:** Addition of adjuvant has been widely used to prolong the duration of peripheral nerve block. We evaluated the effect of adding dexamethasone to ropivacaine in supraclavicular brachial plexus block. **METHODS:** Sixty patients of age group 18-60 years, scheduled for various elective upper limb surgeries under supraclavicular brachial block were divided into 2 groups in a randomized, double-blinded fashion. In group R (n=30), 30ml of 0.5% ropivacaine +1.5ml saline and in group D (n=30), 30ml of 0.5% ropivacaine +1.5ml dexamethasone (6mg) were given. The time of onset of motor and sensory blockade, duration of analgesia and pain scores were recorded. **RESULTS:** Demographic data and surgical characteristics were similar in both groups. The sensory and motor block onset time was earlier in group D as compared to group R (P<0.001). Duration of analgesia was longer in group D than in group R (P<0.001). Pain score in the two groups – group R had moderate to extreme pain while the group D had no pain to moderate pain in the first 24 hours postoperatively. **CONCLUSION:** Addition of dexamethasone to 0.5% ropivacaine in supraclavicular brachial plexus block speeds the onset and prolongs the duration of sensory and motor blockade. **KEYWORDS:** Dexamethasone, Ropivacaine, Supraclavicular Brachial Plexus Block.

**INTRODUCTION:** Brachial plexus block is a popular approach for upper limb surgeries as an alternative to general anaesthesia. This type of block mainly avoids the untoward effects of general anaesthesia and is attractive due to its cost effectiveness and margin of safety, along with good postoperative analgesia.

Of various local anaesthetics, lignocaine and bupivacaine are the most frequently used as it has faster onset and longer duration of action respectively. However there are limitations like shorter duration of action with lignocaine and increased incidence of toxicity with bupivacaine.¹ Ropivacaine is structurally closely related to bupivacaine. Compared to racemic bupivacaine, ropivacaine has lower central nervous system toxicity and cardiotoxicity.²-⁴ However ropivacaine alone provides analgesia for lesser duration in peripheral nerve blocks. Different additives like opioids, neostigmine, midazolam, clonidine, dexamethasone etc., have been used to prolong regional blockade, but they are associated with side effects.⁵-⁶ It is widely believed that dexamethasone improves the quality and duration of peripheral nerve blockade.⁷-¹⁰ This is thought to be mediated by attenuating the release of inflammatory mediators reducing ectopic neuronal discharge and inhibiting potassium channel-mediated discharge of nociceptive C-fibres.¹¹-¹³
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In this study, we evaluated the onset time of sensory and motor blockade, duration and quality of post-operative analgesia of ropivacaine (0.5%)-dexamethasone combination compared to plain ropivacaine (0.5%) for brachial plexus block by supraclavicular approach.

MATERIALS AND METHODS: After obtaining ethical clearance, a randomized prospective placebo controlled double blind study was conducted on 60 patients of either sex aged between 18 to 60 years undergoing upper limb surgeries under supraclavicular brachial plexus block. Patients with ASA grade 4 and 5, infection at the site of injection, presence of coagulopathies, hypersensitivity to ropivacaine, and dexamethasone were excluded from the study. An informed and written consent was obtained from all the patients. These patients were randomly divided into 2 groups.

**Group R:** received 30ml of ropivacaine 0.5% and 1.5ml (0.9%) saline (placebo)

**Group D:** received 30ml of ropivacaine 0.5% and 1.5ml dexamethasone (4mg/ml)

A detailed preanaesthetic evaluation and appropriate baseline investigations were carried out prior to the surgery.

On the day of surgery preoperative heart rate, SpO2, noninvasive blood pressure, respiratory rate readings were recorded. On the operation table intravenous line was secured with 18G cannula and ringer lactate 500ml infusion was started. Patients were connected to noninvasive monitoring with 5-lead electrocardiograph (ECG), pulseoximeter, non-invasive sphygmomanometer and EtCO2 monitor. Inj. glycopyrrolate 0.2mg iv slowly was administered and 1 minute later the patients received sedation with inj. midazolam iv and analgesia with inj. fentanyl 2µg/kg body weight iv.

Supraclavicular block was performed using nerve stimulation technique in the supine position with head turned 45° to the opposite side and arm placed by the side of chest. Under asepsis a peripheral nerve locator (Fisher and Paykel, Newzealand) connected to a 22 G, 50-mm-long stimulating needle (Stimuplex, Braun, Germany ) was inserted almost perpendicularly to the skin in a caudal and posterior direction, 1-1.5cm above the midclavicular point lateral to subclavian artery pulsation. After proper location of the brachial plexus 30ml local anesthetic mixture was injected with intermittent negative aspiration. Patients were evaluated at 5min interval for 30min for developing the sensory and motor block. In case of inadequate blockade due to any reason the case was converted to general anesthesia and it was not considered for the study. The surgery was allowed to proceed when complete anesthesia was achieved. All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma, local anesthetic toxicity and post-block neuropathy in the intra and postoperative periods. Postoperatively verbal response score (VRS) was assessed and Inj. fentanyl was administered as rescue analgesic.

**Collection of Data:** The time of onset for sensory blockade defined as the time between injection of local anaesthetic and abolition of pinprick response was evaluated in four nerve areas (Radial, ulnar, median, musculocutaneous) at every 5 min until 30 min after the injection. The block was judged failure if anaesthesia was not present in 2 or more peripheral nerve distribution and such patients were excluded from study.
For motor blockade, the inability to flex or extend the following joints: musculocutaneous nerve (Flex elbow), median nerve (Flex distal interphalangeal joint of 2nd finger), radial nerve (Extend wrist), ulnar nerve (abduct 3rd and 4th fingers) was tested. Time of onset of motor block, defined as the time between injection of local anaesthetic and inability to move the joints was evaluated every 5 min and time to block at least 2 major nerves was noted.

The duration of analgesia, defined as the time between the end of local anaesthetic administration and request for the first rescue analgesic was evaluated every 5 min and time to block at least 2 major nerves was noted.

Pain was assessed by standardized verbal response score (VRS) at 0, 1, 3, 6, 9, 12, 24 hours postoperatively. VRS score more than 3 was considered inadequate analgesia and inj.fentanyl was used as rescue analgesic and the total amount of fentanyl required in first 24hrs postoperatively was noted.

**STATISTICAL ANALYSIS:** All the data was compiled systematically and analyzed using Student’s t-test, Chi square test.

**Significant Figures:**
- + Suggestive significance (p value: 0.05<p<0.10).
- * Moderately significant (p value: 0.01<p<0.05).
- ** Strongly significant (p value: p<0.01).

**RESULTS:** The present study was conducted on 60 patients of either sex in the age group of 18-60 years scheduled for elective upper limb surgeries under supraclavicular brachial plexus block using ropivacaine 0.5% and ropivacaine 0.5% plus dexamethasone 6 mg, at Vydehi Medical College and Research Centre, Bangalore from December 2012 to June 2014.

Both groups were comparable in terms of age, sex, height and weight.

**Table 1: Demographic data of patients in both groups**

|                | Group D     | Group R     | P value |
|----------------|-------------|-------------|---------|
| Age (yrs)      | 37.73±10.64 | 34.67±9.75  | 0.249   |
| Sex (M/F) %    | 80:20       | 66.7:33.3   | 0.243   |
| Height (cm)    | 167.07±5.6  | 165.93±6    | 0.45    |
| Weight (kgs)   | 67.10±8.07  | 68.03±7.4   | 0.643   |

Values are expressed as mean ± SD

The mean time of onset of sensory block in group R was 21.00±3.32 min and 13.83±5.20 min in group D.

The mean time of onset of motor block in group R was 28.83±2.15 min and 22.17±4.68 min in group D. There was significant difference between the onsets of both sensory motor block in both groups. Group D had faster onset of both sensory and motor blockade.
The primary objective of this study is to evaluate the post-operative analgesia in both the groups. The patients in group R first complained of pain at 15.92±3.53 hours and group D complained of pain at 20.84±3.13 hours, which is very significant. The time of first rescue analgesic administration and the total dose of rescue analgesics required by group R were 16.67±3.62 hours and 105.33±51.86 mcg respectively, whereas the first time of rescue analgesic given was at 21.44±3.16 hours and the total dose of fentanyl used was 25.33±7.19 mcg in group D. These values were statistically very significant. We infer that patients receiving ropivacaine only required rescue analgesic earlier and in larger quantities where as those receiving ropivacaine-dexamethasone was much later and lesser.

When comparing the pain score in the two groups, the ropivacaine group had moderate to extreme pain while the ropivacaine-dexamethasone group had no pain to moderate pain in the first 24 hours postoperatively. This shows that adding dexamethasone to ropivacaine improves the postoperative pain relief in patients significantly.
DISCUSSION: Brachial plexus block has emerged as a popular technique among the anaesthetists for upper limb surgeries. Peripheral nerve blocks not only provide intraoperative anaesthesia but also extend analgesia in the post-operative period without any systemic side effects.\(^\text{14}\) Several adjuvants like ketamine, epinephrine, opioids, alpha2 agonists, dexamethasone etc. have been added to local anaesthetics to prolong the duration of action. Many studies have successfully proved the usefulness of dexamethasone as an effective adjuvant in peripheral nerve blocks.\(^\text{7-10}\) The mechanism of action of corticosteroids in prolonging peripheral neural blockade may be secondary to a local action on nociceptive C-fibers \(^\text{11}\) mediated via glucocorticoid receptors and the up-regulation of function of potassium channels in excitable cells.\(^\text{11,13}\)

In our study we evaluated the efficacy of dexamethasone added to ropivacaine for supraclavicular brachial plexus block. This study demonstrates that dexamethasone significantly prolongs the analgesic effect of plain ropivacaine 0.5% used as a single injection brachial plexus block.
block. The mean time of onset of sensory block (13.85±5.20min) and motor block (22.17±4.68min) was significantly faster in group D compared to group R. This correlated to a study conducted by Feroz Ahmad Dar10 who showed significantly early onset of sensory and motor block in group which received ropivacaine-dexamethasone compared to group which received only ropivacaine (p<0.05) and postulated that the early onset of action might be due to synergistic action of dexamethasone with local anaesthetics on blockage of nerve fibres.

Our finding that dexamethasone prolonged the duration of analgesia in peripheral nerve block correlates well with other recently published investigations. In the year 2011, a study by Cummings KC et al,8 the mean duration of postoperative analgesia was around 22 hours in a group which received ropivacaine with dexamethasone and its was around 11.8 hours in group receiving ropivacaine only.

In this study, the mean time of onset of first complaint of pain with ropivacaine-dexamethasone was 20.84±3.13hrs and with ropivacaine alone was 15.92±3.53hrs. The mean number of rescue analgesic dose was also lesser in dexamethasone group than the other group, which is in favour of this study. No side effects like nausea, vomiting, hypotension, and hypoxemia were reported in either group. This study demonstrates that dexamethasone significantly prolongs the analgesic effect of plain ropivacaine 0.5% without any side effects in supraclavicular brachial plexus block.

CONCLUSION: Brachial plexus block has been popular technique in delivery of anaesthesia in patients undergoing upper limb surgeries. This technique helps in safe delivery of anaesthesia and also addition of adjuvants assures prolonged analgesia by preventing the side effects of general anaesthesia. Addition of Dexamethasone as an adjuvant to ropivacaine for supraclavicular brachial plexus block significantly fastens the onset of sensory and motor blockade, prolongs the duration of action, decreases the post-operative opioid consumption and decreases the incidence of postoperative nausea and vomiting in patients undergoing upper limb surgeries.

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