



## Dexamethasone as an adjuvant with Ropivacaine for Supraclavicular Brachial Plexus Block

Authors

**Dr Sunil.R<sup>1</sup>, Dr Amminikkutty.C.M<sup>2</sup>, Dr Shilpa Jose<sup>3</sup>**

<sup>1</sup>Assistant Professor, Dept of Anaesthesiology, Govt. Medical College, Thrissur, India

<sup>2</sup>Additional Professor, Dept of Anaesthesiology, Govt. Medical College, Thrissur, India

<sup>3</sup>Junior Resident, Dept of Anaesthesiology, Govt. Medical College, Thrissur, India

Corresponding Author

**Dr Sunil. R**

Email: [drsnilr@gmail.com](mailto:drsnilr@gmail.com)

### Abstract

*Ropivacaine is one of the most frequently used local anaesthetic for peripheral nerve blocks. It has the drawback of delayed onset of sensory and motor block. Dexamethasone is a very potent glucocorticoid with very good anti-inflammatory and analgesic activity. In this study we observed, compared and evaluated block characteristics when Ropivacaine alone and ropivacaine with dexamethasone were used for supraclavicular block. A total of 80 adult patients undergoing elective forearm surgery under supraclavicular brachial plexus blockade using nerve stimulator were included in the study. Patients were randomly allocated to the two groups of 40 each. Group A received 30ml of 0.5% ropivacaine with distilled water (2ml). Group B received 30ml of 0.5% ropivacaine with 8mg dexamethasone (2ml). Onset and duration of sensory block, motor block and analgesia were assessed. Data analysed using IBM SPSS Statistics 20.0 software and  $P < 0.05$  was considered as statistically significant. Mean sensory onset time in group A was  $4.05 \pm 0.678$  min and in group B was  $3.60 \pm 0.383$  min ( $p < 0.05$ ). Mean motor onset time in group A was  $5.58 \pm 0.418$  min and in group B was  $4.75 \pm 0.308$  min ( $p < 0.05$ ). Mean duration of sensory block in group A was  $579.18 \pm 111.454$  min and in group B was  $1174.70 \pm 7.690$  min ( $p < 0.05$ ). Group A had a mean duration of motor block of  $489.38 \pm 80.329$  min and  $1085.82 \pm 36.070$  min in group B ( $p < 0.05$ ). Duration of analgesia of group A was  $647.72 \pm 91.743$  min and in group B was  $1202.00 \pm 14.881$  min ( $p < 0.05$ ).*

**Conclusion:** *The study demonstrates that Ropivacaine with dexamethasone as adjuvant produces faster onset and better sensory and motor blockade as well as longer duration of analgesia than with Ropivacaine and distilled water.*

**Keywords:** *Ropivacaine, dexamethasone, supraclavicular brachial plexus block, nerve stimulator, forearm surgery.*

### Introduction

Regional anaesthesia is an integral part of everyday anaesthetic practice. It offers potent analgesia as well as reduction in stress response, systemic analgesic requirements and opioid related side-

effects. The use of peripheral nerve blockade has become popular as it decreases postoperative pain, decreases the need for postoperative analgesics, decreases the incidence of nausea, shortens post-anaesthesia care unit time, and improves patient satisfaction. Brachial plexus blockade for upper

limb surgery provides a useful alternative to general anaesthesia for upper limb surgery by being safe, decreasing the cost of anaesthetic agents, decrease operation theatre pollution and with an advantage of prolonged post-operative pain relief. Blockade of the brachial plexus (C5-T1) at several locations from the roots to the terminal branches will allow for surgical anaesthesia of the upper extremity and shoulder<sup>1</sup>. Supraclavicular approach is a very consistent and easiest method for anaesthesia and post operative pain Management<sup>2,3,4</sup>.

Local anaesthetics block the conduction of nerve impulses at the level of cell membrane. Local anaesthesia results when local anaesthetics bind sodium channels and inhibit the sodium permeability that underlies action potentials<sup>1</sup>. The clinically observed rates of onset and recovery from blockade are governed by the relatively slow diffusion of local anaesthetic molecules into and out of the whole nerve. In presence of local anaesthetics, Na<sup>+</sup> channels are less likely to open in response to stimulus.

Ropivacaine is chosen for supraclavicular brachial plexus blockade for elective surgeries of the forearm and hand which last for longer durations. With a duration of action similar to bupivacaine, ropivacaine is more motor-sparing than bupivacaine<sup>5</sup>. However, it has limiting factors like delayed onset, patchy or incomplete analgesia. To minimize these drawbacks many drugs like Neostigmine, Opioids, Hyaluronidase, Midazolam, Clonidine, Dexamethasone etc<sup>13</sup>, have been added to local anesthetics to improve the quality and duration of action and postoperative analgesia<sup>3</sup>.

The steroids have been shown to reduce the inflammation and also have shown analgesic effects. The pain relief after administration of steroids is due to reduction of inflammation by inhibition of Phospholipase A2 and also blocks the transmission in nociceptive C – fibers to reduce the pain<sup>10</sup>. Phospholipase A2 has been found to induce membrane injury and edema by generating inflammatory mediators. It is the enzyme responsible for liberation of arachidonic acid leading to the production of prostaglandins and

leukotrienes. They also sensitize small neurons and enhance pain generation by abnormal conduction and intraneural edema.

Dexamethasone is very potent and highly selective glucocorticoid. Basically it is used as anti-inflammatory and immunosuppressant. Its potency is about 40 times that of hydrocortisone. Clinical Uses of Dexamethasone are for treatment of many inflammatory and autoimmune conditions but Glucocorticoids are also used to treat patients suffering from neuropathic pain and complex regional pain syndromes (CRPS). So, steroids have anti-inflammatory as well as analgesic effects<sup>3</sup>. Many studies have successfully proved the usefulness of Dexamethasone as an effective analgesic<sup>6,7,8,9</sup>.

Numerous studies shown that Ropivacaine when compared to bupivacaine produces less cardiac and central nervous system toxic effects, less motor block, and similar duration of sensory analgesia<sup>10</sup>.

However the studies are scant in this part of the country about the analgesic efficacy of the Dexamethasone. Hence this study was taken up to assess the efficacy of Dexamethasone as an analgesic especially for upper limb surgeries.

### Materials and Methods

A total of 80 adult patients having physical status grade 1 or 2 according to American Society of Anaesthesiologists (ASA) in the age group 18-65 years undergoing elective forearm surgery under supraclavicular brachial plexus blockade using nerve stimulator were included in the study.. Patients were randomly allocated to one of the two groups. Each group consisted of 40 patients. Group A patients received 30ml of 0.5% ropivacaine with distilled water (2ml). Group B patients received 30ml of 0.5% ropivacaine with 8mg dexamethasone (2ml). The patients with infection at site, peripheral neuropathy, recent corticosteroid therapy, pregnancy are excluded. Institutional ethical committee clearance was obtained. Informed written consent was taken from all patients in the local language. A proper pre-anesthetic checkup was done on the previous day of surgery. Consent was

taken after explaining the procedure and its implications. Tab. Alprazolam 0.25 mg PO given on the night before and Tab. Ranitidine 150mg PO in the morning with sips of water. Peripheral wide bore intravenous cannula inserted and placed in supine position with all essential monitors. . Patients were administered 1mg midazolam IV. Head was turned 45<sup>0</sup> to the opposite side. After skin sterilization with povidone iodine and local infiltration with 2% lignocaine, a skin electrode will be placed on the patient's shoulder and connected to the positive electrode of the nerve stimulator. Under strict aseptic precautions, all blocks were performed with peripheral nerve stimulator guidance. Nerve stimulator was set to deliver 0.6mA at 2Hz. The identity of each nerve ie., median, radial, ulnar and musculocutaneous was confirmed with peripheral nerve stimulator and a total of 30ml local anaesthetic solution was given Group A recieved 30ml of 0.5% Ropivacaine with distilled water(2ml) and group B 30ml of 0.5%Ropivacaine with 8mg dexamethasone (2ml). During the conduct of block and there after all patients were observed for any complications of the block and for any reactions to the drug used. All blocks were performed by qualified anesthesiologists.

Onset of motor and sensory block was tested every 5 minutes for the next 30 minutes and total duration of sensory and motor blockade was also assessed post operatively. These assessments were carried out by the principal investigator who was blinded to the drug used in the block. The drug used for block was prepared by another anesthetist not involved in the study.

Motor block was assessed at 5 minute intervals by thumb opposition for median nerve, finger adduction for ulnar nerve, elbow extension for radial nerve, and elbow flexion for musculocutaneous nerve. (0=no block: normal movements possible; 1=partial block: decreased movements with inability to perform movements against resistance; 2= complete loss of motor power) Sensory block was assessed by pain sensation in the skin by skin prick using blunt end of a 27-gauge

needle comparing to the opposite arm. (0= no block; 1= partial block; 2= complete loss of sensation) Block characteristics was assessed for 30 minutes. After 30 minutes, if any nerve territory is found incompletely blocked, patient was excluded from the study.

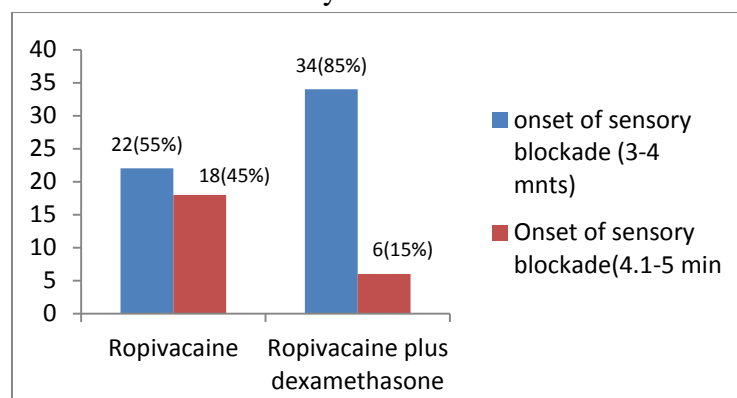
Post operative evaluation was done in recovery room and ward .Duration of sensory block is defined as time elapsed between injection of drug and appearance of pain requiring rescue analgesia. Duration of analgesia was noted according to 0-10 visual analogue scale for pain at 0 hour ,and every 3 hours thereafter for next 24 hours. Injection diclofenac sodium (75 mg IM) was given as first rescue analgesia when the VAS score  $\geq 4$ . If the pain still persists, Inj Tramadol 50 mg+ Promethazine 12.5 mg IM were given as second rescue analgesia. In a similar way duration of motor block was also assessed. Duration of motor block is defined as time elapsed between injection of drug and return of muscle power by asking the patients to move their fingers.

Patients who felt pain with surgical incision or those who were uncomfortable during the surgical procedure was given general anesthesia. There were no adverse events related to the procedure.

## Results

Results were analysed using statistical software SPSS and Quantitative data were analyzed by Independent T test and qualitative data were analyzed by Chi square test. p value < 0.05 would be considered statistically significant.

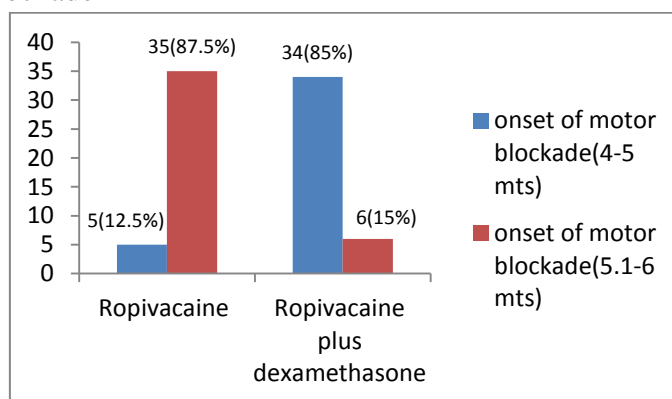
**Table 1** Onset of Sensory Block



Mean time of onset of sensory block was  $4.05 \pm 0.678$  min in group A and in group B was  $3.60 \pm 0.383$  min. Statistical analysis showed that the time of

onset of sensory block was significantly faster in group B compared to group A (p Value <0.5)

**Table: 2** Onset of Motor Blockade



Mean time of onset of motor block was  $5.58 \pm 0.418$  min in group A and in group B was  $4.75 \pm 0.308$  min. Statistical analysis showed that statistically

significant difference in the time of onset of motor block in group B. (p Value 0.00)

**Table 3:** Duration of Sensory Block

	GROUP	N	MEAN	SD	P VALUE
DURATON OF SENSORY BLOCKADE	A	40	579.18	111.454	0.000
	B	40	1174.70	7.690	

**Table 4:** Duration of Motor Blockade

	GROUP	N	MEAN	SD	P VALUE
DURATION OF MOTOR BLOCKADE	A	40	489.38	80.329	0.00
	B	40	1085.82	36.070	

**Table 4:** Duration of Analgesia

	GROUP	N	MEAN	SD	P VALUE
DURATION OF ANALGESIA	A	40	647.72	91.743	0.00
	B	40	1202.00	14.881	

Mean duration of sensory block was  $579.18 \pm 111.454$  min in group A and in group B was  $1174.70 \pm 7.690$  min. Statistical analysis showed that statistically significant difference in the duration of sensory block in B group. (p Value 0.000)

Mean duration of motor block was  $489.38 \pm 80.329$  min in group A and in group B was  $1085.82 \pm 36.070$  min. Statistical analysis showed that statistically significant difference in the duration of motor block in A group. (p Value 0.000)

Mean duration of analgesia was  $647.72 \pm 91.743$  min in group A and in group B was  $1202.00 \pm 14.881$  min. Statistical analysis showed that statistically significant difference in the duration of analgesia in group A.

**Discussion**

Brachial plexus block has been emerged as a popular technique among the anesthetists for upper limb surgeries. This type of anesthesia avoids the untoward effects of general anesthesia like complications related to upper airway instrumentation. The research has also shown that this approach is attractive approach and effective in terms of cost, performance, margin of safety and also provides good post operative analgesia.<sup>3</sup> Many approaches of brachial plexus block are also described and the available literature has consistently shown that supraclavicular block is superior and easiest method for anesthesia and post operative pain management.<sup>3</sup>

Several drugs have been tried as anesthetics in brachial plexus block and Ropivacaine was commonly used for its longer duration of action. However, the Ropivacaine is condemned for its delayed onset, patchy or incomplete analgesia. Dexamethasone, being glucocorticoid, has emerged as a potent corticosteroid

when used along with Ropivacaine. Many studies have successfully proved the usefulness of Dexamethasone as an effective analgesic.<sup>4, 5, 10 11</sup>

However, the studies are scant to evaluate the efficacy of Ropivacaine alone and when used in combination with corticosteroids like

Dexamethasone. Hence this study was under taken to evaluate the efficacy of it.

“A comparative study of 0.5% ropivacaine versus 0.5% ropivacaine with dexamethasone for post operative analgesia with supra clavicular brachial plexus block for fore arm surgeries.” was undertaken in Medical College Hospital, Government Medical College Thrissur.

A total of 80 patients selected by the department and based on the adjuvant received; were divided into two groups. Group A included patients receiving 30ml of 0.5% ropivacaine with distilled water (2ml) and Group B included patients receiving 30ml of 0.5% ropivacaine with 8mg dexamethasone (2ml). Under strict aseptic precautions supraclavicular brachial plexus block was performed after neural localization of brachial plexus by peripheral nerve stimulator.

The two groups were demographically comparable with respect to Age with (p value = 0.521), weight (p value = 0.471), and gender (p value = 0.498).

#### **Onset of sensory block**

Time taken for onset of sensory block was compared between the two groups. The time of onset was taken as the earliest time when all the four nerve territories showed complete sensory block. The mean time of onset of sensory block in Group A was  $4.05 \pm 0.678$  min in group A and in group B was  $3.60 \pm 0.383$  min. P value was  $< 0.05$ . There was significantly earlier onset of sensory block in Group B with dexamethasone as adjuvant. Yadav et al compared three different drugs by

supraclavicular brachial plexus block. However, the onset of anesthesia in Dexamethasone group was faster than other two groups of drugs<sup>2</sup>. In a study by Islam et al, the onset of sensory block also lesser in Dexamethasone group than the plain local anesthetic group<sup>9</sup>.

#### **Onset of motor block**

Time taken for onset of motor block was compared between the two groups. The time of onset was taken as the earliest time when all the four nerve territories showed complete motor blockade. The mean time of onset of motor block in Group A was  $5.58 \pm 0.418$  min and that in Group B was  $4.75 \pm 0.308$  min. p value calculated was  $< 0.05$ . There was statistically significant earlier onset of motor block in Group B with dexamethasone as adjuvant.

#### **Duration of sensory block**

Total duration of sensory block was compared between Group A and Group B. Mean duration of sensory block in Group A was  $579.18 \pm 111.454$  min and that in Group B was  $1174.70 \pm 7.690$  min. p value was 0.00 and was found to be of statistical significant.

#### **Duration of motor block**

Mean duration of motor block was  $489.38 \pm 80.329$  min in group A and in group B was  $1085.82 \pm 36.070$  min. Statistical analysis showed statistically significant difference in the duration of motor block with group A showing greater duration of motor blockade (p value  $< 0.05$ ).

#### **Duration of analgesia**

Mean duration of analgesia in our study was  $647.72 \pm 91.743$  min in group A and  $1202.00 \pm 14.881$  min in group B, which was statistically significant with p value of 0.00.

There was statistically significant difference in duration of action between Ropivacaine and Ropivacaine –Dexamethasone groups. A similar study in Nepal found that the duration of action of the local anesthetic as 3.16 hours in local anesthetic group and 12.75 hours in steroid group<sup>2</sup>. In a study by Shreshtha et al<sup>8</sup>, the mean duration of post operative analgesia was around 16 hours in a group who received Bupivacaine with Dexamethasone and

its was around 8 hour in Bupivacaine – Tramadol group. This shows that the addition of steroids certainly prolongs the duration of anesthesia and also produces earlier onset of action. This might be due anti-inflammatory effect of Dexamethasone. It has also been proved in many studies that the addition of Dexamethasone to local anesthetic prolongs the duration of action. However, another study also noted that the mean duration of analgesia was more in Dexamethasone group than plain anesthetic group<sup>8</sup>.

The mean numbers of rescue analgesic doses were lesser in Dexamethasone group than Ropivacaine alone group significantly. In a study by Yadav et al, the mean number of rescue analgesic doses was also lesser in Dexamethasone group than other two groups<sup>2</sup>. No adverse effects were reported in both the groups in this study. This study has shown that addition of 4 – 8 mg of Dexamethasone effectively and significantly prolongs the duration of analgesia also by producing early onset of action. This study has also shown that the early onset of action in steroid group can be attributed to synergistic action with local anesthetic on blockage of nerve fibers. The prolongation of duration of block is the local effect of steroid than the systemic action. There was no systemic side effects as well<sup>21</sup>. The effects are mainly mediated by glucocorticoid receptors. The blockade is not produced by the action of steroid alone. Hence it should be used in addition to a local anesthetic.

### Future

Use of ultrasound guidance can further accelerate the onset of blockade and offers scope for more accurate blocks and better comparable data.

### Conclusion

In our study we compared the onset of sensory block, onset of motor block, duration of sensory block and duration of motor block duration of analgesia when Ropivacaine alone and Ropivacaine with dexamethasone was used in supraclavicular brachial plexus block.

From our study, we concluded that there is significantly early onset of sensory block and motor block when dexamethasone was added as adjuvant for Ropivacaine in supraclavicular brachial plexus blockade. Duration of analgesia and of sensory, motor blockade were significantly longer in the dexamethasone as adjuvant to ropivacaine group.

### References

1. Terese T.H, Sandra L.K, Denise J.W. Peripheral nerve blocks. In: Miller.R.D editor. Miller's Anesthesia. 8th ed. Philadelphia : Elsevier Saunders;2015;1721-51
2. Yadav RK, Sah BP, Kumar P, Singh SN, et al., Effectiveness of addition of neostigmine or dexamethasone to local anesthetic in providing perioperative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. Kathmandu University Medical Journal 2008;6(1):302-309.
3. Pham – Dang C, Gunst J, Gouin J, Gouin F, Poirier P, Touchais S, et al, A novel Supraclavicular Approach to Brachial Plexus Block, *Anesth Analg* 1997;85:111–16.
4. Dalens B, Vanneuville G, Tanguy A, A new parascalene approach to the brachial plexus in Children: Comparison with the supraclavicular approach, *Anesth Analg* 1987;66:1264–71
5. Lawrence LB .Local anesthetics. In: Goodman and Gilman's The pharmacological basis of therapeutics.12th edition, 2011; 572-608
6. Honorio T. Benzon, Epidural Steroids. In P. Prithvi Raj. Pain medicine, a comprehensive review. Mosby publications 1999.p.259 – 263.
7. Shrestha BR, Maharjan SK, Tabedar S et al., Supraclavicular brachial plexus block with and without dexamethasone - a comparative study. Kathmandu Univ Med J (KUMJ). 2003 Jul-Sep;1(3):158-60.

8. Shrestha BR, Mahajan SK, Shrestha G, Goutham B, et al., Comparative study between tramadol and dexamethasone as an admixture to bupivacaine in supraclavicular brachial plexus block. *J Nepal Med Assoc* 2007;46(168):158- 64.
9. Islam SM, Hossain MHMD, Maruf AA, et al., Effect of addition of Dexamethasone to local anesthetics in supraclavicular brachial plexus block. *JAFMC Bangladesh* 2011;7(1):11–14.
10. Hansen TG. Ropivacaine: a pharmacological review. *Expert review of neurotherapeutics*. 2004 Sep 1;4(5):781-91.
11. De Jong RH, Wagman IH. Physiological mechanism of peripheral nerve block by local anesthetics. *Anesthesiology* 1963;24:684–727.
12. G. Hirschel, “Anesthesia of the brachial plexus for operations on the upper,” *München Med Wochenschr*, vol. 58, pp. 1555–1556, 1911.
13. Bazin JE, Massoni C, Bruelle P, Fenies V, Groslier D, Schoeffler P. The addition of opioids to local anaesthetics in brachial plexus block: the comparative effects of morphine, buprenorphine and sufentanil. *Anaesthesia*. 1997 Sep 1;52(9):858-62.
14. Chattopadhyay S, Mitra LG, Tramadol as an adjuvant for Brachial plexus block, *J Anaeth Clin Pharmacol*, 2007;23(2):187–9.
15. Kothari D, Supraclavicular Brachial Plexus Block, *Indian J Anaesth*, 2003;47(4):287–288
16. Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without Dexamethasone –A Comparative Study. *International Journal of Scientific and Research Publications*, December: 2012;2(12):1–7.
17. Attardi B, Takimoto K, Gealy R et.al: Glucocorticoid induced upregulation of a pituitary K<sup>+</sup> channel mRNA in vitro and in vivo. *Receptors channels* 1: 287-93; 1993.