The efficacy of dexamethasone added as an adjuvant to ropivacaine (0.5%) for brachial plexus block

Kumud S. Ganvit¹*, Akshay H.M.², Isha Singhal³, M.R. Upadhyay³

¹Assistant Professor, ²Resident, ³Professor and Head, Department of Anaesthesiology, Medical College, Baroda, Gujarat

ABSTRACT

BACKGROUND: The aims of the study was to evaluate the effect of dexamethasone added to ropivacaine on blockade characteristics, postoperative analgesia and complications if any. MATERIALS AND METHODS: A prospective randomised study was conducted in 60 ASA I &II patients undergoing upper limb surgeries. They were divided into two groups of 30 each, Group (R) received ropivacaine (0.5%) 30 ml+ Inj. Normal Saline 2ml and Group(RD) received ropivacaine (0.5%) 30 ml+ Inj. Dexamethasone 2ml (8mg). RESULTS: Both the groups were demographically comparable. Onset and peak effects of sensory and motor block, hemodynamic parameters were statistically not significant. Duration of sensory block in RD (10.17±1.13 hours) was prolonged compared to group R (6.5±0.65 hours) (p<0.001). Duration of motor block in RD (8.35±0.18 hours) was also prolonged compared to group R (7.42±0.89 hours) (p<0.001) duration of post operative analgesia was significantly prolonged in RD (21.2±3.2 hours) compared to (10.24±1.57 hours) group R (p<0.001). CONCLUSION: Ropivacaine (0.5%) with dexamethasone can be safely used in supraclavicular brachial plexus block and it has prolonged duration of anaesthesia as well as prolonged post-operative pain relief in comparison with Ropivacaine alone without any side effects.

Keywords: Ropivacaine, Dexamethasone, Supraclavicular brachial plexus block

INTRODUCTION

Regional blocks remain a well accepted component of comprehensive anaesthesia care today. Its role has expanded from operating suite into the arena of Postoperative & chronic pain management¹,². In 1885, Halsted and Hall first described the technique of Brachial plexus block for upper limb surgeries. Since then a variety of modifications in the technique has been described and in recent years it has gained momentum and the role of regional analgesia for Postoperative pain relief is a current tradition³,⁴. Various adjuvants are added to LA to prolong post operative analgesia. Dexamethasone a corticosteroid, is one such adjuvant added to LA solution improves post operative analgesia. It has highly potent anti-inflammatory property without mineralocorticoid activity and is also found to be safer and devoid of potential side effects. Supraclavicular brachial plexus block provides anaesthesia for surgeries around elbow, forearm and hand. As it provides dense block and also relieves tourniquet pain, this technique was chosen for upper limb surgeries in our study. Ropivacaine is relatively new amide type long acting, pure enantiomer-ß-type used for surgery and Post-operative pain relief.

*RCorresponding Author

Dr. Kumud S. Ganvit
#09 Vishwas Duplex
Behind Yash Complex
Gotri, Baroda-390021 (Gujarat-India)
Email: drkumudsganvit@gmail.com

Ropivacaine first introduced in 1988 and first approved to be used in North America in 1996⁵.

MATERIALS AND METHODS

A single blinded, randomized prospective clinical study was carried out from December 2011 to October 2012 in S.S.G hospital Vadodara. Approval from the local hospital ethics committee was obtained. ASA class I and II patients aged 20-60 years undergoing elective and emergency surgery of hand, forearm or elbow were included in the study. Patients with uncontrolled diabetes mellitus or hypertension, peripheral neuropathy, hepatic or renal disease, pregnant patients, patients with acid peptic disease and known allergy or hypersensitivity to local anaesthetic drugs were excluded from the study. Explained written consent was taken after explaining in detail about the objective of study, methodology, advantage and likely complications. Patients were fasted for 6 h before the surgery and pre-medicated with oral diazepam 0.15 mg/kg on the night before and on the morning of surgery. Patients were randomly allocated into one of the following two groups depending upon the drugs; they were to receive for brachial plexus block.

Group- RD: (n=30) Patients received-
- Inj. Ropivacaine Hydrochloride 0.5% 30 ml
- Inj. Dexamethasone 8mg 2ml Total volume of 32ml.

Group- R: (n=30) Patients received -
- Inj. Ropivacaine Hydrochloride 0.5% 30ml

Peripheral nerve stimulator guided supraclavicular
block technique was used for brachial plexus blockade\(^6\). In the operation theatre, intravenous (IV) access was secured with 18-G cannula on the contralateral hand and monitors were connected (pulse oximetry, electrocardiography and noninvasive arterial blood pressure monitoring). Oxygen was administered via a Hudson mask at a rate of 5 l/min. Patient was placed in supine position without a pillow, arms at the side and head turned slightly to the opposite side. The arm was kept by the side of patient so that his fingers were in touch with his knee. The anesthesiologist stood at the side of the patient to be blocked, facing the foot of the table. The area was aseptically prepared and draped. The subclavian artery pulsation was felt 1 cm above the mid point of the clavicle, the tip of the index finger was rested in the supraventricular fossa directly over the arterial pulsations and the artery retracted medially inwards and downward if possible. Needle puncture: An intradermal wheal was raised just above the palpating finger with a 24G needle. A 1.5 inch 24G short bevel needle connected to a syringe and nerve locator was inserted through the skin wheal and advanced slowly Backwards (posteriorly), slightly Inward (Medially) and Downward (caudal) [BID] gradually towards first rib so that the shaft of the needle and syringe are almost parallel to the patient’s head. We used a nerve stimulator (Inmed nerve locator India) with a 22-G, 5-cm insulated needle for precise localisation of the brachial plexus. A skin wheal was raised in the interscalene groove 1.5-2 cm posterior to the midpoint of clavicle. The subclavian artery was usually palpable at this site. The nerve stimulator frequency was set at 1 Hz and the intensity of the stimulating current was initially set to deliver 2 mA. The needle was inserted through the skin wheal in a posterior, caudal and medial direction until a distal motor response was elicited. The position of the needle was considered acceptable when an output current ≤0.6 mA still elicited. At this point, the local anaesthetic mixture, total volume prepared, was injected in increments after negative aspiration for blood and air. Sensory block was assessed by pin prick method using 24G hypodermic needle, every minute till peak effect occurs. Patient was asked to answer questions and grading of sensory effect was done as follows-

**Grade-0:** Normal sensation (Sharp pain felt)

**Grade-1:** Blunted sensation (Dull sensation or slight heaviness)

**Grade-2:** No pain perception (State of anaesthesia)

Motor block of each nerve was evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and pronation of forearm and flexion of elbow in supination (musculocutaneous nerve). Motor block was assessed by using following grading scale as described by Bromage.

**Grade – 0:** Normal muscle tone with full flexion and extension of elbow, Wrist and fingers.

**Grade – 1:** Decreased motor strength (with weak grip) i.e Paresis.

**Grade – 2:** Complete motor block with inability to move the fingers.

Onset of motor block was considered when there was Grade 1 blockade. Time to peak motor effect was considered when there was Grade 2 blockade. Success rate of block was assessed at 30 minutes after drug injection and was graded as: Complete: When all segments supplied by median, radial, ulnar and musculocutaneous nerves had analgesia or anaesthesia. Incomplete: when any of the segments supplied by median, radial, ulnar and musculocutaneous nerves did not have analgesia or anaesthesia. Failed: When more than one nerve remained unaffected. General anaesthesia was administered to patient in case of incomplete or failed blocks and these patients were excluded from the study. The onset time of sensory and motor blockade was defined as the time between the last brachial injection of local anaesthetic to the total abolition of pinprick response and complete paralysis, respectively, in all nerve distributions. The duration of sensory block was defined as the time interval between brachial injection of local anaesthetic and the first postoperative pain. The duration of motor block was defined as the time interval between the local anaesthetic administration and complete recovery of motor function in all nerve distributions. Heart rate, arterial pressure, respiratory rate and oxygen saturation were recorded just before the block and at regular intervals thereafter. Patients were observed for any side effects and complications. When the patient first complained of pain after operation, intramuscular (IM) injection diclofenac sodium 1.5 mg/kg was given. Data obtained in above mentioned fashion were properly tabulated. All the qualitative and quantitative data were analysed by using chi square test and unpaired t-test respectively. Results were expressed as Mean ± SD. ‘P’ values <0.05 were taken as statistically significant and values < 0.001 were taken as highly significant.

**RESULTS**

Two patients were excluded from the study because of unsuccessful blockade. The groups of patients were comparable with respect to patient age, weight, gender ratio and duration of surgery. The onset of sensory and motor blockade were statistically not
significant. The duration of sensory and motor blockade were also significantly longer in the dexamethasone group (10.17±1.13 vs. 6.5±0.6 hrs and 8.35±0.81 vs. 7.42±0.78 hrs, respectively) than in the control group (P=0.001). (Fig. 1, 2) There were no side effects or complications observed in either group. Intraoperative and postoperative patient vital parameters such as heart rate, blood pressure and oxygen saturation were stable. Total mean duration of post operative analgesia in group RD-21.3hrs and in group R-10.24hrs (Fig.3) which is statistically highly significant and thus reducing total rescue analgesic requirement in 24hrs. (Table-1)

**DISCUSSION**

Our study showed that addition of 8 mg of dexamethasone to 0.5%Ropivacaine for supraclavicular brachial plexus block results in a significantly prolonged duration of sensory, motor blockade and post operative analgesia. Previous studies show that dexamethasone shortens the onset time of sensory and motor block which is in contrast to the our study in which there was no difference in the onset of sensory and motor block among groups. The dose of Ropivacaine used in our study is the maximum recommended dose in blocks. The rationale of using Ropivacaine is that it is a relatively new amide type long acting, pure enantiomer-S-type used for surgery and post operative pain relief. At high doses it produces surgical anaesthesia and at lower doses produces analgesia with limited and non progressive motor block and less cardioactive compared to Bupivacaine. Peripheral nerve blocks with local anaesthetics provides excellent operating conditions with good muscle relaxation but the duration of analgesia is rarely maintained for more than 4-6 hours even with the long acting local anaesthetics (Bupivacaine, Ropivacaine and levo-Bupivacaine). So there had been search for a method, which can provide longer duration of analgesia without the above side effects and inconvenience to the patient. Perineural injection of steroids are reported to influence post-operative analgesia. Various steroids has been used for this purpose, but dexamethasone having a potent anti-inflammatory property without any mineralocorticoid activity and thus was found to be safer and devoid of potential side effects. Dexamethasone is a 9α-derivative synthetic glucocorticoid with highly potent anti-inflammatory property, 25-30 times as potent as hydrocortisone and without any mineralocorticoid activity. The mechanism of blockade prolonging effect of Dexamethasone is not clearly understood. The probable mechanism of action are:

1. The block prolonging effect may be due to its local action on nerve fibres and not a systemic one. The effect might be mediated via glucocorticoid receptors. When steroids alone was used in regional blocks the blockade is not produced. Steroids might bring about this effect by altering the function of potassium channels in excitable.

2. Local application of Methylprednisolone has been found to block transmission in c-fibres but not in a and b fibres. The effect was reversible, suggesting a direct membrane action of steroids.

3. Corticosteroids cause skin vasoconstriction on topical application. The vasoconstriction effects of topical steroids are mediated by the

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**Table 1: Rescue analgesic requirement in 24 hours**

<table>
<thead>
<tr>
<th>No. of doses</th>
<th>Group RD (no of pts)</th>
<th>Group R (no of pts)</th>
<th>Intergroup p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10 (33.3%)</td>
<td>0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>1</td>
<td>18 (60.0%)</td>
<td>0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>2</td>
<td>2 (6.7%)</td>
<td>18 (60%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>12 (40%)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
occupancy of classical glucocorticoid receptors rather than by non-specific pharmacological mechanisms. According to traditional theory of steroid action, steroids bind to intracellular receptors and modulate nuclear transcription. The exact mechanism of prolonged duration of analgesia when Dexamethasone is used as an adjuvant to local anaesthetic mixture is uncertain. Proposed possible theories are attributed to anti-inflammatory property and its local action on nerve fibres. Thus addition of Dexamethasone decreased the total number of rescue analgesic requirement in first 24 hours and prolonged the duration of analgesia.

CONCLUSION
In conclusion, addition of dexamethasone (8 mg) to Ropivacaine 0.5% in supraclavicular brachial plexus block results in prolonged duration of sensory and motor blockade and duration of post operative analgesia. Further studies are required to elucidate the precise mechanism of action of dexamethasone.

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REFERENCES
9. Dr. Sridhar N.V, Dr. M.P. Golwala, (M.D.,D.A.) Dr. V.N. Swadia, Dr. Aditi; Pain Relief By Dexamethasone as An Adjuvant To Local Anaesthetics In Supraclavicular Brachial Plexus Block. J anesth Clinical Pharmacology 2009; 25(3) :285-288.
12. Ali Movafegh, MD, Mehran Razazian, MD, Fatememeh hajimaohamandi, MD, and Alipasha Meyseaine, MD, Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade Anaesth Analg 2006;102:263-7