Original Research Article

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Comparative study of ropivacaine alone versus ropivacaine with dexamethasone in supraclavicular brachial plexus block

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ABSTRACT

Background: Brachial plexus block is often used either as an adjuvant to general anesthesia (GA) or as a sole anesthesia modality. Supraclavicular brachial plexus block is preferred for its rapid onset, reliable anesthesia and as a safe technique for any surgery in the upper extremity that does not involve the shoulder. We have attempted to undertake this study to compare the haemodynamic, sensory and motor effects of the anaesthetic effect of Ropivacaine alone and Ropivacaine along with Dexamethasone in Supraclavicular Brachial Block in upper limb surgery.

Methods: The total duration of surgery was also comparable in both groups. The onset of the sensory and the motor block in bother the groups were similar to each other with no statistical difference, but there was a very high significance in the duration of both sensory and motor block within both the groups.

Results: The total duration of surgery was also comparable in both groups. The onset of the sensory and the motor block in bother the groups were similar to each other with no statistical difference, but there was a very high significance in the duration of both sensory and motor block within both the groups.

Conclusions: Dexamethasone added to ropivacaine in supraclavicular brachial block for upper limb surgery significantly shortens the onset time and prolongs the duration of sensory and motor blocks without producing sedation in patients.

Keywords: Dexamethasone, Ropivacaine, Supraclavicular brachial block

INTRODUCTION

Pain is an unpleasant effect associated with significant psychological and physiological changes during surgery and post-operative period. Regional anaesthetic techniques have specific advantages either for standalone anaesthesia or as analgesic supplements for intraoperative and postoperative care. Brachial plexus block is often used either as an adjuvant to general anesthesia (GA) or as a sole anesthesia modality. Brachial plexus blockade

for ambulatory upper-limb surgery can significantly reduce pain and nausea, allowing for faster discharge.¹

Various approaches of brachial plexus block have been used for upper limb surgeries, such as Interscalene approach, Supraclavicular approach, Infraclavicular approach and Axillary approach.² Supraclavicular brachial plexus block is preferred for its rapid onset, reliable anesthesia and as a safe technique for any surgery in the upper extremity that does not involve the shoulder. This is mainly because it is a highly effective analgesia

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with a good motor blockade, the patient is normally awake, provides extended post-operative analgesia. There is early ambulation and resumption of oral feeding, with no airway manipulation and minimal use of drugs thereby avoiding post-operative nauseas and vomiting.

For a long time, various local anaesthetics alone or with combination of adjuvants have been used to prolong the post-operative analgesic effect. Bupivacaine has been in use for a long time now and has been well established as a long acting regional anesthetic but is often associated with cardiotoxicity in high concentrations or when administered intravascularly.³ Ropivacaine, a long-acting amide local anaesthetic related structurally to bupivacaine, has been used for supraclavicular block in upper limb surgery. It provides pain relief with less motor blockade and is less cardiotoxic than bupivacaine, which makes it a more suitable agent for supraclavicular brachial plexus block.4 However, it does not very effective for post-operative analgesia.

Thus, adjuvants include Epinephrine, Clonidine, Opioids, Ketamine and Midazolam have been used along with ropivacaine, to prolong the anaesthetic effect with limited success. Dexamethasone, a glucocorticoid, appears to be more effective in prolonging the duration of analgesia from interscalene block using Ropivacaine, than with Ropivacaine alone. Since there is little literature of the effectiveness of Ropivacaine alone and Ropivacaine along with Dexamethasone in Supraclavicular Brachial Block in upper limb surgery in our area, we have attempted to undertake this study to compare the haemodynamic, sensory and motor effects of the two.

METHODS

This prospective randomized single-blinded controlled comparative study was conducted by the Department of Anesthesiology at MNR Medical college from February 2014 to December 2015. A total 60 patients belonging to ASA grade I and II of either sex with age between 18-60 years posted for various elective upper limb surgery were included into the study. Patients with age less than 18 years and above 60 years, with ASA grade III, IV or V, patients who were using gabapentin, pregabalin, tricyclic antidepressant, serotonin-norepinephrine reuptake inhibitor, tramadol on daily basis, those who were hypersensitivity to amide local anesthetics or with a history of hypersensitivity to dexamethasone were excluded from the study.

After the clearance from the Institutional Ethical committee and after obtaining the informed consent from all the patients in the study, they were randomly assigned to one of the two groups. The assignments of the patients into the two groups were done based on the computergenerated table of random numbers by simple randomization method. The patients in the Group R were administered with 28ml of 0.5% of inj Ropivacaine alone

+ 2ml saline and Group RD were given 28ml of 0.5% of inj Ropivacaine with 2ml of 8mg Dexamethasone.

On admission into the hospital, routine examination for the general condition of the patient, height, weight and age of the patient was noted. Pre-anaesthetic evaluation was done on the evening before surgery for all the patients. Detailed examination of the Cardiovascular and the respiratory system was done as well as the surface anatomy where the block was going to be given. Blood was collected for routine examinations such as Haemoglobin estimation, complete blood picture, fasting and post prandial blood sugars, blood urea and creatinine levels. ECG and X ray of chest was taken and Urine examination for albumin, sugar and microscopy was also done for all the patients under study.

All patients were premeditated with I.V 1 mg Midazolam 20 minutes before giving the block. The patients were connected with monitor to record heart rate (HR), noninvasive measurement of systolic blood pressure (SBP), diastolic blood pressure (DBP), continuous electrocardiogram (ECG) monitoring and haemoglobin oxygen saturation (SpO2). The baseline systolic BP, diastolic BP and heart rate were recorded. The site of injection was shaved and disinfected. The injection site was infiltrated with 1 ml of lidocaine 2% subcutaneously. A nerve stimulator was used to locate the brachial plexus. The location end point was a distal motor response with an output lower than 0.6 mA. During injection, negative aspiration was performed after every 6.5-7.0 ml to avoid intravascular injection.

Sensory and motor block along with monitoring of vitals was determined every 5 minutes in first 30 minutes and then every 15 minutes during 1st hour followed by every second hourly for 24 hours. Any hypersensitivity reaction for the drugs, evidence of pneumothorax, and other adverse events were also monitored. To evaluate duration sensory block and motor block, patients were asked to inform the time when incisional discomfort as a sensation of pain began and also the time when full power returned to the shoulder. In the post-operative period, when the patient complained of pain at the operative site, Injection Diclofenac 75 mg I/M was given. Patients were followed up for 24 hrs for any side effects. Data were expressed as mean values±standard deviation/standard percentages (%), and numbers (n). The statistical analysis was performed using Windstar Version 9.2. t-tests were used to analyze differences between the two groups.

RESULTS

Minimum age recorded in our study was 20 years and maximum age was 59 years. The mean age of patient in group R was 38.333 ± 11.615 years while the mean age of patient in group RD was 34.700 ± 9.377 years. The P value was 0.187 which signifies that the two groups were comparable with regards to age. Mean weight of patients in group-R was 62.966 ± 9.349 kgs and in group-RD, it

was 64.800±8.243kgs, while, the mean height of patients in group-R was 158.500±5.157cms while those in group-RD was 159.666±3.853 cms (Table:1). In Group R, 56.67% patients were male and the remaining 43.33% cases were female. In Group II, 46.67% cases were male, and 53.33% cases were female. Difference between them was comparable in both groups.

Table 1: Demographic profile of patients.

Parameters	Group R	Group RD	P value	
	Mean ± Sd	Mean ± SD		
Age in years	38.333±11.615	34.700±9.377	0.187	
Weight in kgs	62.966±9.349	64.800±8.243	0.423	
Height in cms	158.5±5.157	159.6±3.853	0.325	

Out of the 30 patients in the Group R, 17 (56.67%) were males and 13 (43,33%) were females. In the RD group,

14 were males (46.67%) and 16 were females (53.33%), although this was no significant. The ASA grade in the two groups was similar to each other with 17 from each group belonging to ASA grade I and 13 to ASA grade II (Table:2).

The total duration of surgery was also comparable in both groups with mean duration in group R 101.633 ± 31.012 mins and group RD being 100.000 ± 35.306 mins. In group R, the onset of sensory block was 15.133 ± 1.676 min and 15.333 ± 2.509 min in group RD, showing that there was no significant difference in the speed of the sensory block of ropivacaine with dexmedetomidine and ropivacaine alone. The time taken for the complete paralysis of the upper limb was 13.966 ± 2.747 min in Group R and 17.700 ± 2.718 min in group RD again showing no significance. Duration of motor blockade was longer in group RD (862.000 ± 27.937 min) compared to group R (455.500 ± 27.428 min) and this difference was statistically significant.

Table 2: Comparison of sex and ASAPS in two groups.

Groups	Sex		ASAPS	
	Male	Female	I	II
Group R (n=30)	17	13	17	13
	56.67%	43.33%	56.67%	43.33%
Group RD (n=30)	14	16	17	13
	46.67%	53.33%	56.67%	43.33%
P Value	0.446		1.000	

Duration of sensory blockade was longer in group RD (1011.667 ± 25.405 min) compared to group R (508.833 ± 32.047 min) and this difference was statistically significant. In the postoperative period, patients were given i.m injection diclofenac 75 mg as rescue analgesic when they started feeling pain and the time and dose of

such requirement was recorded. The total number of diclofenac doses required in 24 Hrs in Group R was more (2.733 ± 0.450) as compared to Group RD (1.400 ± 0.498) . The difference was statistically significant (P=0.000) (Table: 3). Thus, in the present study we observed that the requirement of rescue analgesia was more in Group R as compared to Group RD.

Table 3: Comparison of duration of surgery.

Parameter	Group R	Group RD	P value	
r at ameter	Mean ± SD	Mean ± SD		
Duration of surgery (In Min)	101.633±31.012	100.000±35.306	0.849	
Onset of Sensory block (In Min)	15.133±1.676	15.333±2.509	0.262	
Onset of motor block (In Min)	13.966±2.747	17.700±2.718	0.431	
Duration of sensory block (In Min)	508.833±32.047	1011.667±25.405	0.000	
Duration of motor block (In Min)	455.500±27.428	862.000±27.937	0.000	
Total number of rescue injections in 24 hours	2.733±0.450	1.400±0.498	0.000	

DISCUSSION

A variety of receptors mediate anti-nociception on peripheral sensory axons. The peripheral administration of appropriate drugs (Adjuncts) may have analgesic benefit and reduce systemic adverse effects. To improve perioperative analgesia, a variety of adjuncts such as opioids, verapamil, neostigmine and tramadol have been administered concomitantly with local anaesthetics into the brachial plexus sheath.

Many drugs have been used as adjuvants to local anaesthetic agents to prolong the duration of peripheral nerve blocks. Dexamethasone is known for its anti-inflammatory, immunosuppressive, and antiemetic properties, these corticosteroids exert their effects by inhibition of phospholipase A 2 as well as changes in cell function induced by glucocorticoid receptor activation. Although these drugs are associated with sign if can't toxicity when administered in large doses for long periods. 6.7

The mechanism involved for the extended analgesic effect of dexamethasone is attributed to their action locally on nociceptive C-fibres (via glucocorticoid receptors) to increase the activity of inhibitory potassium channels, thus decreasing their activity.^{8,9} Various authors recommended the use of mixture of lignocaine and bupivacaine for brachial plexus block in order to provide rapid onset and prolong duration of action and reduce toxicity but not enough duration for elective postoperative analgesia. 10,11 Dexamethasone in some studies, effectively produced earlier onset of action and significantly prolong the duration of analgesia, which is mediated via glucocorticoid receptor. dexamethasone alone used in regional block, the blockade does not occur. 12 Dexamethasone is proposed to bring about this effect by altering the function of potassium channel in excitable cells.8

In our study, we observed that onset time was 15.133±1.676 min in group R and 15.333±2.509 min in group RD. (P value>0.05) showing that ropivacaine with dexamethasone does not provide faster sensory block than ropivacaine alone. This is in accordance to a study by Cummings et al, who compared ropivacaine mixed with dexamethasone and bupivacaine mixed with dexamethasone. Similar observation was made by Casati et al who worked on brachial plexus block performed with Ropivacaine or Mepivacaine in 60 healthy patients undergoing elective upper limb surgery.

In the present study, the onset of motor block was earlier in study group of dexamethasone having the mean value of 18.700±2.718min and in comparison, the control group had a mean value of 17.966±2.747min. which is statistically significant (p>0.05). Similar observations were made by Parrington et al, conducted a study on 45 adult patients undergoing elective hand or forearm surgery under supraclavicular brachial plexus blockade and were randomized to receive either 30mL mepivacaine 1.5% plus dexamethasone 8 mg (4 mg/mL), or 30mL mepivacaine 1.5% plus 2 mL normal saline15. Casati et al also reported similar results. The duration of the motor block and sensory block was highly significant in the present study, which was also reported in similar studies by Cummings et al and Movafegh et al.

CONCLUSION

Dexamethasone in a dose of 8mg added to ropivacaine in supraclavicular brachial block for upper limb surgery significantly shortens the onset time and prolongs the duration of sensory and motor blocks without producing sedation in patients. Total number of rescue analgesics required in postoperative period is also less with use of Dexamethasone as an adjuvant to Ropivacaine.

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Ethical approval: The study was approved by the

institutional ethics committee

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