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A PROSPECTIVE, RANDOMIZED, DOUBLE-BLIND STUDY OF EFFECTS OF DEXMEDETOMIDINE AS AN ADJUVANT TO ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES.

Anaesthesiology

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ABSTRACT

Aims & Objectives: This study was to evaluate the effect of addition of dexmedetomidine on the onset and duration of analgesia in patients undergoing upper limb surgeries under supraclavicular brachial plexus block.

Material And Methods: Ninety patients of electiveupper limb surgeries under ultrasound-guided supraclavicular brachial plexus block were randomized into two groups. GroupR (n = 45) received 25 mL 0.5% ropivacaine and 1 mL normal saline, and Group RD (n = 45) received 25 mL 0.5% ropivacaineand 1 mcg/kg of dexmedetomidine. Patients were observed for onset and duration of sensory and motor blockade, duration of analgesia, postoperative pain, hemodynamic stability and adverse effects.Results on continuous measurements are presented as mean ± standard deviation and compared usingStudent's unpaired t-test and categorical measurements are presented in number (%) and compared using Chi-square test.

Results: Onset of sensory and motor block in Group R (10.0±2.1and 14.21±2.5min) was higher than those in Group RD (7.5±2.8 and 11.23±2.3 min; P = 0.009 for sensory and P < 0.001 for the motor block). Duration of sensory and motor block in GroupR (401.8±86.6and 344.9±76.9min) was shorter than those in Group RD (625.6±165.2and 540.9±144.0 min; (P < 0.001).The duration of analgesia in Group R (411.0 ± 91.2 min) was shorter than that in Group RD (705.77±178.4 min; P < 0.001).The incidence of bradycardia and hypotension was higher in Group RD than in Group R (P < 0.001).

Conclusion: Adding of dexmedetomidine to 0.5% ropivacaine in supraclavicular brachial plexus block hastens the onset of sensory and motor block, significantly prolongs the duration of analgesia.

KEYWORDS

Dexmedetomidine, Ropivacaine, Brachial plexus block

INTRODUCTION

Various adjuvantsincluding opioids, midazolam, magnesium sulfate, dexamethasone, have been added to local anesthetics to increase the efficacy and duration of blocks, extending analgesia in the postoperative period, while minimizing systemic adverse effects along with a reduction in the total dose of local anesthetic used. Dexmedetomidine is a selective α2 adrenoceptor agonist, which has higher affinity to α2 receptors compared to clonidine. [1] In humans, dexmedetomidine has shown to prolong the duration of block and postoperative analgesia when added to local anesthetic in various regional blocks [2] Dexmedetomidine has been studied in brachial plexus block as a sole agent or in comparison with other adjuvants concomitantly with localanesthetic solution[3]Ropivacaine has a long duration of action, with similar pharmacology to bupivacaine but a wider safety margin.[4] The optimal dose of dexmedetomidine as adjuvant in nerve blocks is still to be determined. The present study was conceived to examine the effect of adding dexmedetomidine as an adjuvant to 0.5% ropivacaine for supraclavicular brachial plexus block in patients undergoing upper limb orthopedic surgeries. Study was conducted to evaluate the duration of analgesia, the time of onset and duration of sensory and motor blockade, and side-effect.

METHODOLOGY

After approval from Institutional Ethical Committee, this prospective randomized double-blind study was conducted at our institution and informed consent, 90 adult patients, age group 20-50 year, ASA I and II physical status scheduled to undergo elective upper limb surgery under ultrasound-guided supraclavicular brachial plexus block were enrolled.Patients who had local pathology at the site of injection, pre-existing peripheral neuropathy of upper limb, suspected brachial plexus injury, history of any systemic disease, convulsion, known hypersensitivity to the study drugs, bleeding disorders, patients on adrenoreceptor agonist or antagonist therapy, alcohol or drug abusers, pregnant women, and psychiatric patients were excluded from the study. Routine monitors NIBP, pulse oximetry, ECG were connected. Baseline blood pressure, heart rate and respiratory rate were noted. Peripheral I.V. line was secured with 18 G cannula. Patients were randomized into two groups R and RD of 45 patients each using sealed envelope technique. Group R (*n* = 45) received 25 mL of 0.5% ropivacaine + 1 mL saline, and Group RD(*n* = 45) received 25 mL of 0.5% ropivacaine + 1 mcg/kg dexmedetomidine.The patients were placed in a supine position, with the head turned away and the ipsilateral arm adducted. Skin was prepared with 10% povidone-iodine solution. All the patients received USG guided subfascial intra-cluster subclavian perivascular brachial plexus block by an experienced anesthesiologist.Sensory block was assessed by pinprick test at each minute after completion of drug injection in the dermatomal areas corresponding to the median nerve, ulnar nerve, radial nerve, and musculocutaneous nerve till complete blockade. Sensory block was assessed by a 3 - point scale: 0 - normal sensation, 1 - loss of sensation of pinprick (analgesia), 2 - loss of sensation of touch (anesthesia). Onset time was defined as the time interval between the end of LA administration and complete sensory block (score 2). Duration of sensory block was defined as the time interval between the end of LA administration and the complete resolution of anesthesia (score 0).

Motor blockade was assessed by modified Bromage scale (MBS) for the upper limb. [5, 6] Motor block onset time was defined as the time interval between the end of total LA administration and complete motor block (MBS score 2). Duration of motor block was defined as the time interval from the onset to the recovery of complete motor function (MBS score 0).

Patient's perception of pain was assessed using VAS (0–10), with 0 being no pain at all and 10 being the worst pain imaginable. [7] VAS score was measured at 6 h, 12 h, and 18 h.

Intraoperative sedation was determined with the Ramsay sedation scale. [8]Intraoperative, heart rate, noninvasive blood pressure, and SpO2 were monitored throughout the procedure and also during the postoperative period. Total duration of analgesia was defined as the time from commencement of block to the patient's first request for rescue analgesic (VAS >4). VAS 4 or >4 will be given diclofenac 75 mg intramuscularly as rescue analgesia.

The statistical analysis of data was done by using standard statistical software (SPSS) evaluation version 20. Data were expressed as either mean and standard deviation or numbers and percentages.

Demographic data was analyses using unpaired Student's t-test (for comparison of parameters among groups). Comparison was carried out using Chi-square ($\chi 2$) test with a P value reported at 95% confidence level. In the above tests, a $P < 0.05$ was accepted as indicating statistical significance.

RESULTS

We recruited 45 participants in each group but 5 cases were excluded from our study due to inadequate nerve block, and converted to general anesthesia. Thus, final data analysis was performed on 85 patients (Group R = 43 patients, Group RD = 42 patients). There was no significant difference in the demographic data of the patients in between the 2 groups (p>0.05) (**Table 1**).

Table 1: Demographic Data (Mean ± S.D)

Variables	Group R (n=43)	Group RD (n=42)	P
Age	31.35±8.065	30.93±6.589	0.79
Gender (M/F)	34/9	35/7	0.74
Weight (kg)	61.67±6.664	60.36±6.413	0.35
ASA Grade (I/II)	33/10	34/8	0.95
Duration of Surgery (min)	92.0±38	101.3±39.35	0.354

Table 2: Block Onset And Duration Between Groups

Time	Group R (n=43)	Group RD (n=42)	P
Onset of sensory block (min)	10.0±2.1	7.5±2.8	0.008
Onset of motor block (min)	14.21±2.5	11.23±2.3	<0.001
Duration of sensory block (min)	401.8±86.6	625.6±165.2	<0.001
Duration of motor block (min)	344.9±76.9	540.9±144.0	<0.001
Duration of analgesia (min)	411.0±91.2	705.77±178.4	<0.001
Total analgesic consumption (mg)	127.33±34.8	59.66±30.6	<0.001

Table 2and **Figure 1** showed that sensory and motor block onset was shorter in group RD (7.5±2.8min and 11.23±2.3 min) compared to group R (10.0±2.1min and 14.21±2.5 min) ($P<0.001$) and durations of sensory as well as motor block were significantly prolonged in the group receiving dexmedetomidine (625.6±165.2 min and 540.9±144.0 min) as compared to group R (401.8±86.6 min and 344.9±76.9 min) and the duration of analgesia was significantly longer in group RD (705.77±178.4 min) than group R (411.0±91.2 min). The difference between the two groups was statistically significant ($P<0.001$).

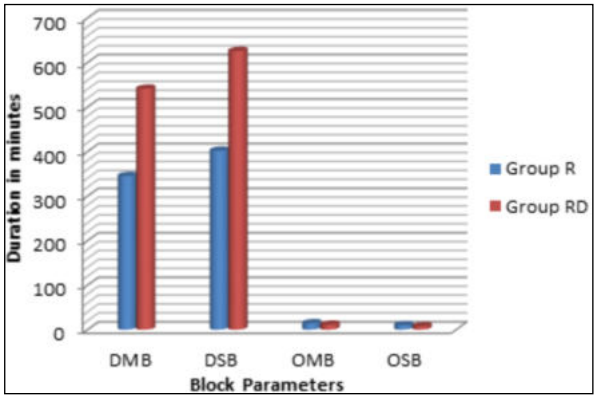

Figure 1: Block Characteristics

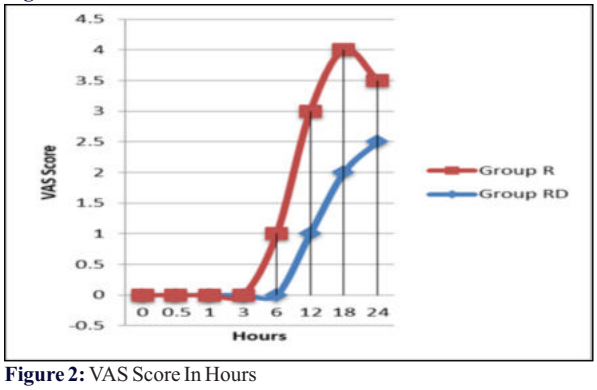

Figure 2: VAS Score In Hours

There was higher sedation score in Group RD from 20 minutes to 120 minutes which was statistically significant ($P < 0.05$). Patients in Group RD had zero VAS score for a longer duration than Group R. Comparison of mean VAS scores between the two groups was statistically significant up to 12 hours ($P<0.001$)[**Figure 2**].

Five patients in group RD developed hypotension were managed with inj. ephedrine 5 mg and one patient had bradycardia managed with inj. atropine 0.3-0.5 mg. There were no other side effects such as nausea and vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, or respiratory depression.

DISCUSSION

The result of the present randomized controlled trial clearly suggests that addition of dexmedetomidine as an adjuvant to ropivacaine for USG-guided supraclavicular brachial plexus block prolongs the duration of analgesia as well as sensory and motor block. In our study, we have observed that addition of dexmedetomidine significantly shortened the onset of sensory and motor block. This observation well matches with Kathuria *et al*. [9]

Das *et al*. [10]who found that onset of sensory as well as motor blockswere earlier in dexmedetomidine group though the differences were not statistically significant but duration of motor and sensory block was also significantly prolonged by addition of dexmedetomidine to ropivacaine.

The mean duration of analgesia (demand of first rescue analgesia) in dexmedetomidine-ropivacaine group was significantly longer than duration in ropivacaine only group, which is supported by the study done by Bharti*et al*. [11]

All our study findings fulfilled the study objectives and proved the effect of addition of dexmedetomidine prolonged the onset and duration of analgesia with low VAS score, better hemodynamic values, less doses of analgesic requirement on post-operative period and minimal adverse events in patients undergoing upper limb surgeries under supraclavicular brachial plexus block.

CONCLUSION

Addition of dexmedetomidine (1 mcg/kg) to 0.5% ropivacaine for USG-guided supraclavicular brachial plexus block is highly effective in hastening the onset and prolonging the duration of anesthesia and analgesia. So, the patient remains comfortable in the postoperative period without any potential side-effects.

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