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THE EFFICACY OF ADDING DEXMEDITOMEDINE TO ROPIVACAINE IN AXILLARY NERVE BLOCK IN FOREARM SURGERIES.

Orthopedics

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ABSTRACT

Background: This study was undertaken to evaluate the efficacy of Ropivacaine alone and in combination with Dexmedetomidine in the axillary block. Addition of Dexmedetomidine to Ropivacaine for peripheral nerve blocks has shown to improve the efficacy of Ropivacaine by prolonging the duration of analgesia.

Materials and Methods: 60 patients belonging to American Society of Anesthesiologists physical status I and II scheduled for elective forearm and/or hand surgeries were randomly allocated into one of the two groups to receive either 30ml of 0.5% Ropivacaine and 1 ml normal saline (Group R) and 30ml of 0.5% Ropivacaine and 1 µg/kg Dexmedetomidine
diluted to 1 ml with normal saline (Group RD).

Results: We noticed early onset of sensory and the motor block in Group RD. Duration of sensory block in Group RD and R was 650.25±85.50min and 460.45±50.30 min respectively which was clinically significant ($P < 0.001$). Duration of motor block in Group RD and R were 690.76±75.50 min and 540.60±65.38 min and was clinically significant. Duration of analgesia in Group RD and R were 730.50±98.68 min and 580.60±80.50 min and was clinically significant. There was a significant alteration in hemodynamics in Group RD when compared to Group R without any side effects.

Conclusion: Dexmedetomidine as an adjuvant to ropivacaine provides faster onset of anesthesia and longer duration of analgesia. It offers reliable, effective mode of anesthesia with prolonged postoperative analgesia for forearm and/or hand surgeries.

KEYWORDS

Dexmedetomidine; Ropivacaine; Axillary Nerve block

INTRODUCTION:

Peripheral nerve blockade is an integral part of comprehensive anesthetic care. Regional anesthesia techniques provide important advantages including excellent pain control, reduced side-effects, and shortened stay in the post anesthesia care unit. Brachial plexus block is used in upper limbsurgeries to provide regional anesthesia. Various approaches are interscalene supraclavicular, infraclavicular, and axillary. Axillary approach to the brachial plexus block is popular because of its ease of accessibility, safety, and reliability. It is indicated in surgeries involving forearm and hand.

Ropivacaine is a new long-acting amide local anesthetic (LA) with safer cardiac profile than bupivacaine used for peripheral nerve blocks[1,2]. It provides sensory as well as a motor blockade. Addition of adjuvant improves the efficacy of LA by hastening the onset of action, prolonging the duration of action, and postoperative analgesia[3-5].

Dexmedetomidine is a selective alpha 2 adrenoreceptor agonist, which is used as an adjuvant to LAs. It is assumed to hasten the onset of action, prolong the duration of action, and postoperative analgesia[6]

The aim of the study was to compare the effects of ropivacaine with and without dexmedetomidine in axillary brachial plexus block in terms of the onset of sensory and motor block, duration of sensory and motor block, and duration of analgesia.

MATERIALS AND METHODS:

After obtaining approval from Institutional ethical commitee and informed consent, 60 ASA physical status I–II patients aged 20-60years scheduled for elective forearm and hand surgery under axillary block were enrolled in a prospective, double-blind controlled trial.

Exclusion criteria were patient refusal for the block, patients on anticoagulants or with bleeding disorders, those with severe respiratory disease, neurological disorders, cardiac arrhythmias, advanced heart block and/or severe ventricular dysfunction. Patients receiving adrenoreceptor agonist or antagonist therapy, sedatives or antipsychotics and those with a history of hepatic or renal failure and pregnant and lactating women, those with allergy to study drugs, local infection at the injection site were excluded.

The study was conducted in two groups of 30 patients each. They were randomized and divided into two groups in a double-blind fashion using computer generated random number table.

Group R patients ($n = 30$)received 30 mL of 0.5% ropivacaine + 1 mL normal saline.

Group D patients ($n = 30$) received 30 mL of 0.5% ropivacaine + 1 µg/kg dexmedetomidine.The local anaesthetic solution was prepared by an anaesthetist not involved in the study. Patients were not premedicated before the block. After insertion of a 20-gauge IV cannula in the nonoperated arm, a Ringer lactate infusion started. After standard anesthesia monitoring, baseline measurements of heart rate (HR), noninvasive arterial blood pressure, peripheral oxygen saturation (SpO_2), and respiratory rate were recorded before the block was performed.The anesthetist performing the block was blinded to the treatment group. All observations were carried out by a single investigator who was also blinded to the treatment group. Axillary blockade was performed with the patient in the supine position with the upper arm abducted 90°.After preparation of the area, the axillary artery was palpated and a skin wheal was injected using 2 mL of lidocaine 2%. Nerve localization was achieved using a nerve stimulator (Stimuplex, Braun, Germany) connected to a 22-gauge, 50-mm-long stimulating needle.We have used ropivacaine 0.5% of 20 ml ampoule (Ropin®, Neon Laboratories, Mumbai, India) . Dexmedetomidine (Dextomid®, Neon Laboratories, Mumbai, India) of 100 µg/ml strength of 1 ml ampoule was used to maintain uniformity.

The time of administration of the drug was noted. HR, SBP,DBP, MAP, SpO2 were noted every 5 min (min) for the first 30 min and every 15 min for next 1½ h and every hour later on till regression of sensory block.

Sensory block was assessed by pinprick (20 G hypodermic needle) test in respective dermatomal distribution of nerves using a 3-point scale:

- 0 = Normal sensation
- 1 = Loss of sensation to pinprick
- 2 = Loss of sensation to touch

Motor block was evaluated by thumb abduction for radial nerve, thumb adduction for ulnar nerve, thumb opposition for median nerve, and flexion of elbow for musculocutaneous nerve on a 3-point scale:

- 0 = Normal motor function

- 1 = Reduced motor strength but able to move fingers
- 2 = Complete motor block.

Onset of motor blockade was considered when there is Grade 1 motor blockade. Peak motor block was considered when there is Grade 2 motor blockade. The duration of motor block was defined as the time interval between the end of local anesthetic administration and the recovery of complete motor function of the hand and forearm. After LA injection, measurements of onset, duration of sensory and motor blockade and vital parameters (pulse, blood pressure, SPO2) was carried out every 5 min until 30 minutes. Postoperatively motor and sensory blockade and vitals of the patient was noted half hourly till the block completely wears off.

STATISTICALANALYSIS:

Statistical analysis was done using SPSS software 16.0 from the department of community medicine. All values are expressed as mean + standard deviation. Chi-square test was used for proportions in qualitative data and Student's unpaired t-test was used for Quantitative data. P<0.05 was considered statistically significant.

RESULTS:

There was no significant difference in the patient characteristics including age, gender, weight and duration of surgery as summarized in [Table 1].

Onset of sensory and motor blockade was significantly faster in Group B compared to Group A [Table 2]. Duration of analgesia and duration of sensory and motor blockade were also prolonged in Group D compared to GroupR [Table 2].

The hemodynamic variables were comparable between the two groups during the study intervals except that intraoperatively four patients in dexmedetomidine group developed hypotension (13%), which was managed with a fluid bolus ,and two patients had bradycardia (3%), which was managed by inj atropine. There was statistically significant difference between the two groups in the incidence of these side effects ($P < 0.001$). There were no other side effects such as nausea and vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, or respiratory depression in any of the patients.

Table-1: Demographic data

	GROUP R(n=30)	GROUP RD(n=30)
AGE(Years)	35.67±16.67	40.76 ±14.54
GENDER(M/F)	17/13	15/15
WEIGHT(Kgs)	56.80 ±6.780	58.20 ±7.60
DURATION(Mins)	80.765 ±10.89	85.76 ±12.90

Table-2: Characteristics of blockade

	GROUP R	GROUP RD	p-value
Onset of sensory block(min)	22.5±4.60	15.10±5.80	0.002
Onset of motor block(min)	24.10±5.80	16.80±4.20	0.000
Duration of sensory block(min)	460.45±50.30	650.25±85.50	0.001
Duration of motor block(min)	540.60±65.38	690.76±75.50	0.000
Duration of Analgesia(min)	580.60±80.50	730.50±98.68	<0.001

DISCUSSION:

Our study demonstrated that addition of an alpha agonist like dexmedetomidine to ropivacaine resulted in prolonged duration of analgesia postoperatively. It also showed that there were early onset and prolonged duration of sensory and motor blocks. By increasing the duration of analgesia with a single block, we could achieve a longer duration of postoperative analgesia without significant clinical side-effects.

Dexmedetomidine, a highly selective, α2-adrenergic agonist has analgesic, sedative, anaesthetic sparing effects when used in systemic route and it is approximately eight-times more selective towards the α2 adrenoceptor than clonidine. Animal studies have proven the combination of dexmedetomidine with ropivacaine to be safe and neuro- protective. The use of dexmedetomidine decreases inflammation around peripheral nerves, thereby decreasing the potential for peripheral nerve injury[7] Brummett *et al*. showed that dexmedetomidine enhances duration of bupivacaine anesthesia and analgesia when used for sciatic nerve block in rats without any damage to the nerve[7].

In human beings, the beneficial effects of adding dexmedetomidine to local anesthetics during regional anesthesia and some peripheral nerve blockade procedures have proved to be efficacious for the surgical patients. The results of our study corroborate with study conducted by Esmaoglu et al. Dexmedetomidine was added to levobupivacaine for axillary brachial plexus block and showed that it shortens the onset time of both sensory and motor block, prolongs the duration of block and the duration of post-operative analgesia.The results of our study corroborate with this study.

Swami et al. concluded that dexmedetomidine(1 μg/kg) compared to clonidine(1 μg/kg) when added to local anesthetic (35cc, bupivacaine 0.25%) in supraclavicular brachial block enhanced the duration of sensory and motor block and also the duration of analgesia[8].

Abdallah and Brull did a systemic review and meta-analysis on facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block[9]

Addition of dexmedetomidine to bupivacaine during infraclavicular brachial plexus block under ultrasound guidance was studied where there was early onset of sensory and motor blockade, with prolonged analgesia and prolonged duration of sensory and motor block similar to our study.

Addition of dexmedetomidine to bupivacaine for greater palatine nerve block has demonstrated that increased duration of analgesia (22 ± 1.7 h) can be achieved, which is identical to that in our study[10]

In another study by Zhang et al. reported prolonged sensory and motor blockade duration in patients who received dexmedetomidine (50 μg) in 40 ml of 0.33% ropivacaine when compared to control group for axillary brachial plexus blockade[11]. However, dexmedetomidine was also associated with an increased incidence of side effects such as bradycardia, hypertension, and hypotension.

In another study, adding dexmedetomidine to ropivacaine for posterior tibial nerve block under ultrasound guidance had prolonged duration of sensory blockade (21.5 vs. 16.2 h); mean pairwise difference 5.3 h similar to the present study but with higher incidence of hypotension and bradycardia[12].

CONCLUSION:

Dexmedetomidine as an adjuvant to ropivacaine provides quicker onset of anesthesia and longer duration of analgesia. It offers convenient, simple, effective mode of anesthesia with favorable hemodynamic stability, and postoperative analgesia for forearm and/or hand surgeries.

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