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A Comparative Clinical Study on the Efficacy of Ropivocaine 0.75% With and Without Dexmedetomidine in Upper Limb Surgeries Using USG Guided kupraclavicular Brachial Plexus Block

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ABSTRACT
Local anaesthestics when used in peripheral nerve blocks cause reversible inhibition of nerve impulse (conduction blockade) in nerves thus producing sensory and motor impulses appropriate for anaesthesia during different surgeries. Bupivacaine is an established long-acting local anaesthetic commonly used for upper extremity nerve blocks. The study population were randomly divided into 2 groups with 30 subjects in each group using shuffled opaque sealed envelopes containing the name of the group and patient was asked to choose an envelope. The envelopes were opened by a senior anaesthesiologist who was assigned to prepare the test drugs and was not involved with the study. In our study we found that adding 50mcg of dexmedetomidine to 19 ml of ropivacaine 0.75% for USG guided supraclavicular BPB shortens the sensory and motor block onset time, prolongs sensory and motor block duration and duration of analgesia with no side effects.

INTRODUCTION

Regional anaesthetic techniques have specific advantages both for standalone anaesthesia or as analgesic supplements for intraoperative and postoperative care.

Upper extremity regional anaesthesia is the most common form of peripheral nerve blocks which are routinely practiced by anaesthesiologists[1]. Brachial plexus blockade is a time-tested technique for upper limb surgeries. Among the various approaches of brachial plexus block, supraclavicular approach is considered easiest and most effective. Supraclavicular approach consistently provides anaesthesia for upper arm, elbow and forearm. The first supraclavicular brachial plexus block was performed by Kulenkampff in 1912. Supraclavicular block approaches the brachial plexus where relatively compact trunks/divisions track under clavicle and over first rib. The classical approach using paraesthesia technique is a blind technique and may be associated with higher failure rate and injury to the nerves and surrounding structures[2]. To avoid some of these problems use of peripheral nerve stimulator was started which allowed better localization of the nerve/plexus. However, this technique may not be fool proof with persistent risk of injury to surrounding structures, especially vascular structures, nerves and pleura leading to pneumothorax.

The application of ultrasound technique for exact localization of nerves/plexus has revolutionized the regional anaesthesia field where in ultrasound probes with suitable frequencies have been successfully tried. Ultrasound for supraclavicular brachial plexus block has improved the success rate of block with excellent localization as well as improved safety margin[3].

Local anaesthestics when used in peripheral nerve blocks cause reversible inhibition of nerve impulse (conduction blockade) in nerves thus producing sensory and motor impulses appropriate for anaesthesia during different surgeries[4].

Bupivacaine is an established long-acting local anaesthetic commonly used for upper extremity nerve blocks. But bupivacaine just like all amide local anaesthetics associated with cardiotoxicity when used in high concentration or inadvertent intravascular injection. Ropivacaine is a long-acting amide local anaesthetics. Ropivacaine is less lipophilic than bupivacaine therefore it is less likely to produce CNS toxicity and cardiotoxicity[4].

Though long-acting local anaesthetics are available for peripheral nerve blocks, the length of analgesia when single anaesthetic drug used for PNB may not sufficient. So the practice of adding additional agent has evolved to prolong the duration of analgesia and these agents are known as adjuvants[5].

Drugs from different classes have been used as adjuvants, such as opioids, NSAID'S, alpha 2 agonists etc. [150] They exhibit synergistic effect when combined with local anaesthetic. Use of adjuvants prolongs the analgesia and eliminates the need for continuous catheter.

Among all available adjuvants alpha 2 adrenergic receptor agonist shows benefits of sedation, analgesia, cardiovascular stabilizing effect and reduced dose requirement of local anaesthetics[6]. Clonidine and dexmedetomidine are known alpha 2 adrenergic receptor agonists which are used compared as adjuvants for peripheral nerve blocks. Compared to clonidine, dexmedetomidine as adjuvant with local anaesthetics shows faster onset and prolonged duration of analgesia[6].

The current study is designed to test hypothesis that dexmedetomidine when used as adjuvant to ropivacaine in supraclavicular brachial plexus block shortens sensory and motor block onset time, enhances duration of sensory and motor block, duration of analgesia.

MATERIALS AND METHODS

The study was conducted on 60 subjects aged between 18-60 years ASA 1 and 2 undergoing elective upper limb surgeries involving lower arm, elbow, forearm.

Inclusion Criteria:

- All ASA grade I and grade II patients between 18-60year age group.

Exclusion Criteria:

- All ASA grade III and IV patients.
- Diabetes and Hypertension.
- Cardiovascular, respiratory and neurological disorders.
- Obesity (BMI>30kg/m2).
- Drug allergy and allergic to Ropivacaine, Dexmedetomidine.
- Patient with preexisting neuropathies and myopathies.
- Patients who need general anaesthesia.
- Patients not willing to give consent for Supraclavicular brachial plexus block.
- Patients with local infection at injection site and untreated pneumothorax.

The study population were randomly divided into 2 groups with 30 subjects in each group using shuffled opaque sealed envelopes containing the name of the group and patient was asked to choose an envelope. The envelopes were opened by a senior anaesthesiologist who was assigned to prepare the test drugs and was not involved with the study.

- **Group RN:** Ropivacaine 0.75% (19ml) + 1ml NS.
- **Group RD:** Ropivacaine 0.75% (19 ml) +Dexmedetomidine 50 mcg (0.5 ml) + 0.5 ml NS.

Pre-anaesthetic evaluation done on the evening day before the surgery. A routine pre-anaesthetic examination was conducted assessing:

- General condition of the patient
- Airway assessment by Mallampatti grading.
- Nutritional status and body weight of the patient.
- A detailed examination of Cardiovascular system.
- A detailed examination of Respiratory system.

A detailed written informed anaesthetic consent was obtained from all the subjects volunteering for the study.

RESULTS AND DISCUSSIONS

Time to sensory onset was significantly faster in group RD than group RN (8.67±1.26 vs 10.53±1.67 min). The mean duration of sensory blockade was found to be significantly increased in patients of group RD compared to group RN (1094±80.79 vs 606.67±43.65 min). The mean duration of analgesia in group RD was 1177.67±68.36 min while in group RN it was 791.07±28.14 min (table -2). Time to motor block onset was also found to be significantly faster in group RD compared to group RN (12.20±1.64 vs 15.18±1.851 min). The mean duration of motor blockade was found to be significantly larger in group RD compared to group RN (911.67±52.92 vs 517±48.75 min).

In our study we found that adding 50mcg of dexmedetomidine to 19 ml of ropivacaine 0.75% for USG guided supraclavicular BPB shortens the sensory and motor block onset time, prolongs sensory and motor block duration and duration of analgesia with no side effects. Time of sensory onset was significantly faster in group RD than group RN (8.887±1.26 min vs 10.53±1.67 min) ($p<0.001$). The mean duration of sensory block with group RD was 1094±80.79 min, in group RN it was about 606±43.65 min ($p<0.001$). The time to motor block onset in group RD was about 12.20±1.648 min, where as in group RN it was about 15.43±1.851 min ($p<0.001$). The mean duration of motor block in group RD was about 911±52.920 min where as in group RN it was about 517.20±48.754 min ($p<0.001$). Duration of analgesia in group RD is 1177.67±68.364 min and in group RN it's about 791.07±28.144 min ($p<0.001$).

Onset of Sensory Block: In our study it was found that onset of sensory block was significantly faster in group RD 8.887±1.26 min compared to group RN 10.53±1.67 min ($p<0.001$). This is comparable to study by esmaoglu[7] showed that adding dexmedetomidine 100 mcg to 40 ml of 0.5% levobupivacaine prolongs axillary

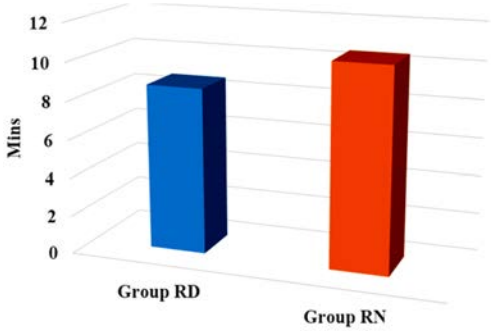

Fig. 1: Comparison of mean onset of sensory block among two groups

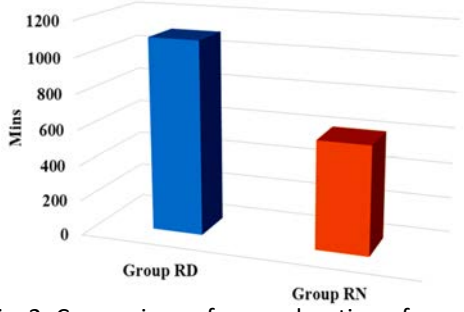

Fig. 2: Comparison of mean duration of sensory block among two groups

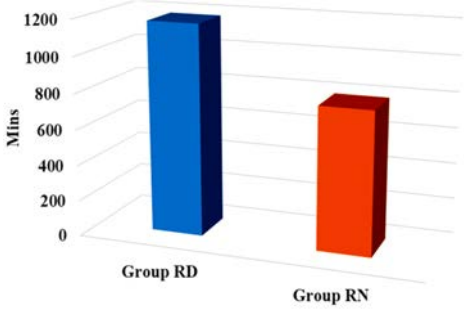

Fig 3: Comparison of mean duration of analgesia among two groups

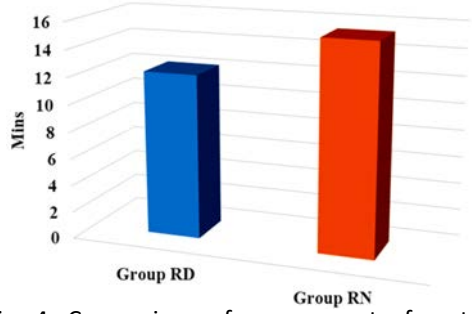

Fig. 4: Comparison of mean onset of motor block among two groups

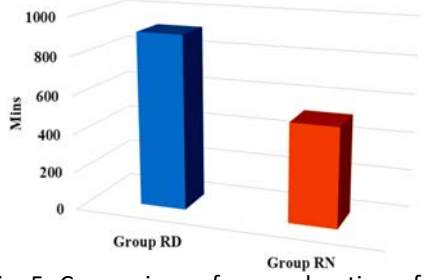

Fig. 5: Comparison of mean duration of motor block among two groups

Table 1: Sensory block characteristics

	RN (Mean ± SD)	RD (Mean ± SD)	p-value
Sensory onset (min)	10.53±1.67	8.67±1.269	<0.001
Sensory duration(min)	606.67±43.655	1094.00±80.798	<0.001
Duration of analgesia(min)	791.07±28.144	1177.67±68.364	<0.001

Table 2: Onset and duration of motor block

	RN (Mean ± SD)	RD (Mean ± SD)	p-value
Motor onset (min)	15.43±1.851	12.20±1.648	<0.001
Motor block duration (min)	517.20±48.754	911.67±52.920	<0.001

BPB duration. They showed that dexmedetomidine fastened the onset of sensory block i.e., 9.03±1.15 min, which was 10.46±1.30 min in control group. Gerhard Fritsch *et al.* in 2014 in their RCT compared effect of addition of dexmedetomidine 150 mcg to 0.5% ropivacaine for ultrasound guided interscalene BPB over plain 0.5% ropivacaine they observed that dexmedetomidine group showed significantly faster onset of time for sensory block compared to control group[8]. Kathuria *et al.* in their study on dexmedetomidine as adjuvant to ropivacaine in supraclavicular block demonstrated that perineural dexmedetomidine fastened the sensory block onset (9.75±4.23 min) compared to control group (22.20±8.62 min) (p<0.001)[9].

D. marhofer *et al.* in their study on dexmedetomidine as an adjuvant i.v and perinueral to ropivacaine 0.75% compared against plain ropivacaine in ulnar nerve block shown that there was no statistically significant difference in sensory onset between groups[10].

Onset of Motor Block: In our study we found that adding 50mcg of dexmedetomidine to 19 ml of ropivacaine 0.75% for USG guided supraclavicular BPB shortens the motor block onset time. The time to motor block onset in group RD was about 12.20±1.648 min, where as in group RN it was about 15.43±1.851 min (p<0.001). Similarly, Esmaoglu *et al.* in 2010 showed that adding dexmedetomidine 100 mcg to 40 ml of 0.5% levobupivacaine fastened the motor block onset time. Motor block onset time was 9.50±1.04 min in dexmedetomidine group vs 11.10±1.24 min in control group. Gerhard Fritsch *et al.* in 2014 in their RCT compared effect of addition of dexmedetomidine 150 mcg to 0.5% ropivacaine for ultrasound guided interscalene BPB over plain 0.5% ropivacaine and they concluded that addition of dexmedomidine showed rapid increase in motor onset when compared with control group[8]. Kathuria *et al.* in their study on dexmedetomidine as adjuvant to ropivacaine in supraclavicular block found that perineural dexmedetomidine reduced the time of motor block onset (18.75±6.37 min) compared to control group (39.05±16.38 min) (p<0.001)[9].

Duration of Sensory Block: In our study we found that the mean duration of sensory block with group RD was 1094±80.79 min, in group RN it was about 606±43.65 min (p <0.001). Similarly, Esmaoglu *et al.* in their study showed that adding dexmedetomidine 100 mcg to 40 ml of 0.5% levobupivacaine prolonged duration of sensory block which was 887±66.23 min in dexmedetomidine group and 673±73.77 min in control group[7].

Gerhard Fritsch *et al.* in their RCT compared effect of addition of dexmedetomidine 150 mcg to 0.5% ropivacaine for ultrasound guided interscalene BPB over plain 0.5% ropivacaine and they concluded that addition of dexmedetomidine significantly increased duration of sensory block in first 14 hours[8]. Kathuria *et al.* in their study dexmedetomidine as adjuvant to ropivacaine in supraclavicular block found that addition of perineural dexmedetomidine (789.45±187.72 min) significantly increased sensory block duration compared to control group (451.60±113.36 min) (p <0.001)[9].

Duration of Motor Block: In our study we found that adding 50mcg of dexmedetomidine to 19 ml of ropivacaine 0.75% for USG guided supraclavicular BPB increased motor block duration. The mean duration of motor block in group RD was about 911±52.920 min where as in group RN it was about 517.20±48.754 min (p<0.001). Esmaoglu *et al.* observed that duration of motor block was increased in dexmedetomidine group to 773±67.62 min, which was 575±65 min in control group[7]. Similarly Gerhard Fritsch *et al.* in their study found significant increase in duration of motor block during first 14 hour in dexmedetomidine group[8]. kathuria *et al.* in their study on dexemedetomidine as adjuvant to ropivacaine in supraclavicualr block showed that perineural dexmedetomidine increased motor block duration (754.60±180.50 min) compared to control group (387.85±129.31 min) (p<0.001)[9].

Duration of Analgesia: In our study we found that adding 50mcg of dexmedetomidine to 19 ml of ropivacaine 0.75% for USG guided supraclavicular BPB increased duration off analgesia. Duration of analgesia in group RD is 1177.67±68.364 min and in group RN it's about 791.07±28.144 min (p<0.001). Similarly, Esmaoglu *et al.* in their study found duration of analgesia was 1008.69±164.04 min in dexmedetomidine group and it was 887.14±260.82 min in control group[7]. Gerhard Fritsch et al. in their study found that addition of dexmedetomidine to ropivacaine increased the duration of block and postoperative analgesia[8]. D. marhofer et al. in their

study on dexmedtomidine as adjuvant to ropivacaine observed that profound prolongation of ulnar nerve block with perineural administration of dexmedetomidine with ropivacaine by around 60%[10]. Kathuria *et al.* in their study on dexmedetomidine as adjuvant to ropivacaine in supraclavicular block found there was increased duration of analgesia with perineural dexmedetomidine (967.55±310.50 min) compared to control group (536.75±251.19 min) ($p<0.001$)[9].

Postoperative Analgesia: In our study we have found that there was statistically significant lower mean postoperative VAS score in group RD at 6th hour, 10th hour, 12th hour, 14th hour compared to group RN. Ammar *et al.* used dexmedetomidine with bupivacaine and compared it with plain bupivacaine 0.25% in supracalvicualar plexus block and demonstrated lower VAS pain scores and reduction in supplemental opioid requirements[11]. Similar observations were also seen in study by H. kaur *et al.* in 2015, they observed that postoperative VAS score was less in patients who received mixture of 0.25% levobupivacaine +dexmedetomidine + 1% lignocaine at 6th hour, 12th hour, 24th hour when compared patients who received 0.25% levobupivacaine + 1% lignocaine[12].

CONCLUSION

From the observations of this study, we come to conclusion that perineural dexmedetomidine (50 mcg) as adjuvant to ropivacaine 0.75% in USG guided supraclavicular brachial plexus block produces.

Significantly faster onset sensory and motor blockade and prolonged duration of sensory and motor blockade.

Also provides prolonged duration of analgesia when compared to plain 0.75% ropivacaine.

Significant hemodynamic stability by keeping heart rate lower and lower diastolic blood pressure.

Significant postoperative analgesia and reduced need for rescue analgesics in postoperative period.

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