*Original Article*

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# Efficacy of Dexmedetomidine Compared to Clonidine as an Adjuvant to Ropivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Block

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**Abstract**

*Background:* Regional block has evolved with passage of time from being a blind process to the use of ultrasound giving an "eye" to the process. Evolution of technology and pharmacology has helped anesthesiologist in many ways. α-2 receptor agonist has been used since long for precisely controlling characterstics of peripheral nerve blocks. This study was aimed to compare the efficacy of dexmedetomidineand clonidineas an adjuvant to local anesthethic in USG guided supraclavicular brachial plexus block. *Methods:* Our study included 80 ASA Grade I & II patients, scheduled for various upper limb orthopaedic surgeries and were randomly allocated into Groups RC & Group RD. Group RC received Ropivicaine 0.5% (30 cc) + Clonidine 1μg/kg and group RD received Ropivicaine 0.5% (30 cc) + Dexmedetomidine 1μg/kg. Blockcharacterstics, duration of analgesia and any complications encountered were compared. *Results:* Mean onset of sensory block in group RD and group RC was 7.525 ± 0.640 and 8.03± 0.77 minutes respectively. The mean onset of motor block in group RD was 13.97± 1.0 minutes as compared to group RC 14.5± 1.04 minutes. Mean duration of analgesia in group RD was 444.5± 50.12 minutes compared to 303.5± 36.07minutes in Group RC. *Conclusion:* Dexmedetomidineis more efficacious than clonidine as an adjunct to ropivacaine in supraclavicular brachial plexus block due to its more precise control of block characterstics with prolonged duration of analgesia post-operatively.

**Keywords**: Dexmedetomidine; Clonidine; Ropivacaine; Ultrasound; Brachial Plexus Block.

## Introduction

It has been found in various studies that regional anaesthesia techniques are potentially advantageous over general anaesthesia. In addition to potent analgesia, regional anaesthesia may lead to reduction in the stress response, systemic analgesic requirements and possibly the development of chronic pain.USG guided supraclavicular brachial plexus block is a safe and useful method for upper limb surgery and provides both intraoperative anaesthesia and postoperative analgesia without any systemic side-effects [1-2]. Ultrasound guidance increases the success rate provided that the needle is redirected to achieve uniform spread around the neural structure. The ultrasound images of the distribution of local anaesthetic have provided clinicians with visualization of successful blocks [3].

Ropivacaine is an amino-amide local anesthetic which is less cardio toxic and produces motor block which is shorter in duration [4]. he use of α-2 adrenoceptor agonist as an adjuvent in peripheral nerve blocksprolongs the analgesic and motor effects of ropivaccaine in addition to their sedative, analgesic and antihypertensive actions. Dexmedetomidine ishighly selective, specific and potent $\alpha_2$-adrenergic agonist [5-6]. It is chemically related to clonidine, but is approximately eight times more specific than clonidine for α-2 adrenoceptors. α-2agonist has been

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proven in numerous studies to prolong duration of block with increased duration of post-operative analgesia when added as an adjuvant to local anaesthetic in nerve blocks [7-8].

This study was aimed to evaluate efficacy of adding dexmedetomidine or clonidine as an adjunct to ropivacaine in USG guided supraclavicular brachial plexus block.

## Materials and Methods

After approval of Institutional Ethical Committee and written informed consent from patient, this prospective, randomized controlled clinical study was conducted on 80 adult patients belonging to American Society of Anaesthesiologists (ASA) physical status I or II and aged between 18-60 years of either sex scheduled for various orthopaedic surgeries on upper limb with USG guided supraclavicular brachial plexus block. Patients were randomly assigned by using computer generated random number to either Group RC ($n$=40) or Group RD ($n$=40). Patients in Group RC received 30 ml ropivacaine 0.5%+clonidine 1µg/kg and Group RD received 30 mlropivacaine 0.5% + dexmedetomidine 1µg/kg.

Patients with history of drug allergy, bleeding disorders, peripheral neuropathy or refusal for procedure were excluded. Any patients on medications with adrenoreceptor agonist or antagonist therapywere also excluded from our study.

During the pre-operative visit all patients were clinically examined, whole procedure was explained and 10 cm visual analogue scale (VAS) (0, no pain and 10, worst pain imaginable) was also explained. Upon arrival in operation room patient's heart rate, noninvasive systolic and diastolic blood pressure (SBP, DBP), mean arterial blood pressure (MAP), electrocardiogram (ECG) and oxygen saturation (SPO2) were monitored. The baseline vital were recorded. A vein on non-operating hand was cannulated with 18 G cannula and infusion was started with lactated Ringer's solution and was run at the rate calculated to make up for deficit plus maintenance fluid requirement.

All the patients received USG guided brachial plexus block through supraclavicular approach. Anaesthesiologists performing the block were blinded to the constituent of drug and doctors keeping records of different parameters were also unaware of group allotment. Patient was placed in supine position, with head turned opposite to the arm being anesthetized. Arm was adducted and the hand extended along the side towards the ipsilateral knee as far as possible. After disinfecting the skin, neural localization was achieved by using ultrasound guided technique using MicromaxxSonosite (USA) machine with Micromaxx ® L38e/8-13 MHz transducer being positioned in the transverse plane superior to the clavicle at approximately midpoint. Brachial plexus was seen as collection of hypoechoic oval structure lateral and superficial to brachial artery. Local skin infiltration was done with 2ml 2% lignocaine lateral to transducer to decrease the discomfort during block. Block needle was inserted under ultrasound vision till brachial plexus was reached. After negative aspiration, 2 ml of local anaesthetic was injected to assessproper needle placement and then two to three aliquots of local anesthetic mixture were injected within brachial plexus sheath at different locations to assure adequate spread according to Group allocated.

Onset of sensory block were assessed using pin prick sensation using sterile hypodermic needle at 1 minute interval after completion of drug injection.Onset of sensory block was graded as:

Grade 0 - Sharp pin felt,

Grade 1 - Analgesia, dull sensation felt,

Grade 2 - Anaesthesia, no sensation felt

Onset of Motor block was assessed using modified Bromage scale for upper extremities. Onset of motor block was graded as:

Grade 0: Normal motor function with flexion and extension of elbow, wrist and fingers,

Grade 1: Decreased motor strength with ability to move fingers only,

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

Achievement of Grade 2 motor block in modified bromage scale was considered as onset of motor block.Those patients who did not had complete anesthesia in any of the segments supplied by median, radial, ulnar or musculocutaneous nerveeven after 30 min of drug injection were excluded from the study.

Duration of sensory block was defined as time interval between completion of local anaesthetic administration and complete resolution of anaesthesia. The duration of motor block was defined as time interval between end of local anaesthetic administration and recovery of complete motor function of the hand and forearm.Assessment of sensory and motor block was carried out at every minute after completion of drug injection till complete sensory and motor block and then every 30 min after

the end of surgery until the block had completely worn off.

Vital parameters (pulse, blood pressure, respiratory rate and oxygen saturation) were observed at every 5 min interval for first 30 min, every 15 min interval intra-operatively, and at every 60 min postoperatively.

Patients were assessed for duration of analgesia as per Visual Analogue Score (VAS score) every 30 min for first 2 hours and then at hourly intervalin the postoperative period till VAS score 4. The time between the end of local anesthetic administration and first rescue analgesic administration was recorded as the duration of analgesia. Rescue analgesia was given with injection Tramadol (1mg/kg) intravenously and total requirement of rescue analgesia in first 24 hrs was noted as total dose of tramadol administered in 24hours.Patients were observed for any discomfort, nausea, vomiting, shivering, bradycardia, pain and any other side-effects.

*Statistical Analysis*

Sample size of 35 in each group was necessary as done by previous studies to detect a difference of this magnitude (40%) with 80% power in a two-tailed test at alpha error of 0.05.Keeping in view possibility of exclusion, failed block, etc. we recruited additional 10% patients. After completion of the study results were presented as mean ± standard deviation (SD) for parametric data and as percentage for non-parametric data. Datas wereanalyzed by standard statistical test using SPSS-14 (IBM Inc., Chicago, USA), using student '*t*' test and Chi-square test. P value of <0.05 wereconsidered assignificant.

## Results

Demographic profile were comparable in both groups with respect to age, weight, gender, ASA status, total duration of surgery and type of surgery and were statistically insignificant (Table 1).

Mean time for onset of sensory block in group RD and group RC were noted as 7.52 ± 0.64 minutes and 8.02 ± 0.76 minutes respectively. Mean time for onset of motor block was 13.97 ± 1.00 minutes in group RD as compared to 14.50 ± 1.03 minutes in group RC [Figure 1]. Results were statistically significant ($p< 0.05$).

Mean duration of sensory blockade were 230.52 ± 31.08 minutes and 447.35 ± 53.05 minutes in Group RC and Group RD respectively and thus was prolonged significantly in group RD as compared to Group RC.Duration of motor block extended to mean duration of 476.87 ± 56.54 minutes in group RD and for 284.90 ± 26.54 minutes in group RC [Table 2].

The mean duration of analgesia was significantly prolonged in Group RD (444.40 ± 50.12 min)when compared with Group RC (303.52 ± 36.07min). Both the differences were statistically highly significant ($p= 0.000$) [Figure 2].

Haemodynamic parameters like heart rate, blood pressure, mean atrial pressure and oxygen saturation were comparable in both groups with no statistical

**Table 1:** Demographic profile of patients

| Data/Groups | Group (RC) | Group (RD) |
|---|---|---|
| Age (years) | 33.300 ± 13.305 | 34.125 ± 14.566 |
| Sex (male:female) | 36:4 | 33:7 |
| Weight (kg) | 68.125 ± 8.861 | 67.875 ± 0.122 |
| Type of surgery-soft tissue / Bone | 16/24 | 13/27 |
| Duration of surgery (min) | 92.21 ± 22.63 | 103.32 ± 18.41 |
| ASA Grade (I/II) | 30/10 | 29/11 |

**Table 2:** Sensory and motor blockade characteristics

| Data/Groups | Group (RC) | Group (RD) |
|---|---|---|
| Onset time of sensory block (min) | 8.025± 0.768 | 7.525± 0.640 |
| Onset time of motor block (min) | 14.500± 1.038 | 13.975± 1.000 |
| Duration of sensory block (min) | 230.525± 31.089 | 447.350± 53.055 |
| Duration of motor block (min) | 284.900± 26.540 | 476.875± 56.545 |
| Duration of analgesia (min) | 303.525± 36.072 | 444.400± 50.121 |

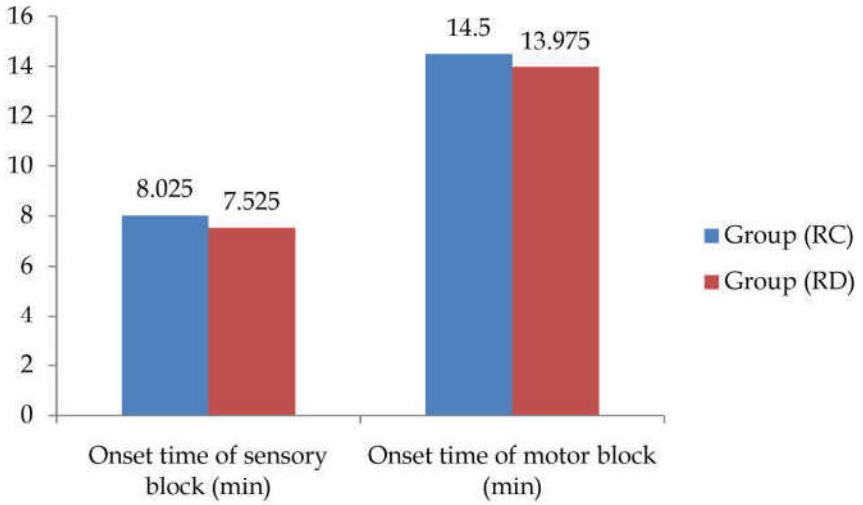


**Fig. 1:** Comparison of mean onset time of sensory block and motor block

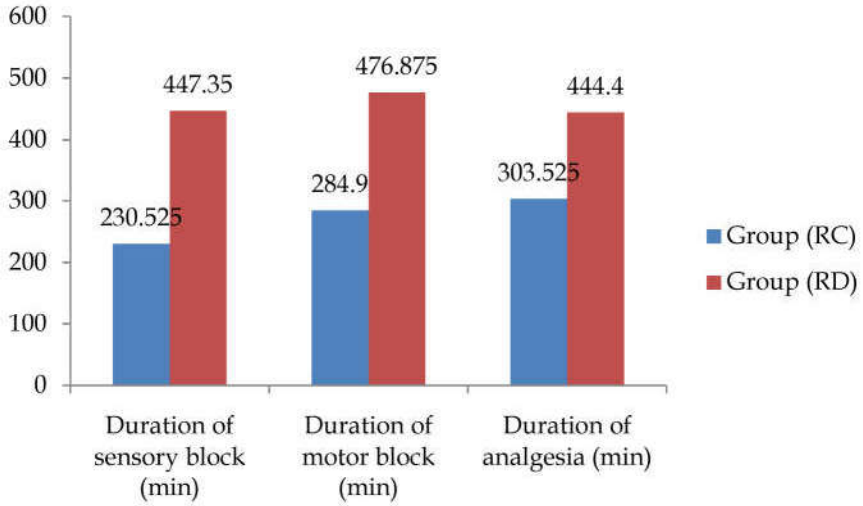


**Fig. 2:** Comparison of duration of block and analgesia

significance. Nausea was most common side effect observed in both groups with more commoner in group RD.

## Discussion

Introduction of newer aides like the use of ultrasound for peripheral nerve block has improved the efficacy, success rate and safety profile of the peripheral nerve block. Addition of alpha-2 adrenoceptor agonist to local anaesthetics improves the quality of surgical anaesthesia and effective analgesia with an added benefit of no or minimal centrally mediated side effects. There are different techniques described for supraclavicular brachial plexus block but we used ultrasound aided technique so as to reduce incidence of pneumothorax, arterial puncture and any other possible complications. Symptomatic pneumothorax occurred in 6.1% of patients as reported by Brand and Papper [9]. In 1987 Dalens B et al compared the parascalene approach with the classical supraclavicular approach in 120 children. They observed puncture of subclavian vessels five times in the classical group which was statistically significant [10]. No incidence of complications such as pneumothorax and vessel puncture occurred in our study due to use of ultrasound guidance for administration of the block. Use of ultrasound helps in accurate needle placementnear the brachial plexus, verifies correct instillation of local anaesthetic in right tissue plane and thus leads to faster onset times and longer duration of blocks.

In the present study, mean onset time for sensory block in Group RC and Group RD was 8.02±0.76 and 7.52±0.64 mins respectively and mean onset time for motor block was 13.97±1.0 and 14.50±1.03 mins in group RD and Group RC respectively. This shows that both onset of sensory and motor block were significantly faster in the dexmedetomidine group.

Results of our study corroborates with that of Ammar AS et al who also found that when dexmedetomidineshortens the onset time of both sensory and motor block when used as an adjunct to bupivacaine forinfraclavicular brachial plexus block [11]. However, Marhofer D et al showed that use of dexmedetomidine as an adjuvant in ultrasound guided ulnar nerve block with ropivacainealthough produced early onset of motor block but onset of sensory block was not affected [12].

Swami et al. also concluded that dexmedetomidine when used as adjunct with local anaesthetic in supraclavicular brachial plexus block increased the duration of sensory and motor block and duration of analgesia when compared to clonidine [13]. In study done by Rancourt MP et al. duration of sensory blockade was prolonged in patients who received dexmedetomidine with ropivacainecompared to control group for an USG guided tibial nerve block [14].

In our study duration of analgesia was found significantly greater in dexmedetomidine group as compared to clonidine group (444.40±50.12 vs 303.52 ± 36.07 minutes). Finding of the present study correlate with the study done by Esmaoglu A *et al.*, who showed that addition of dexmedetomidine to levobupivacaine prolongs duration of analgesia in axillary brachial plexus block [15].

Agarwal S *et al.* compared the postoperative analgesic efficacy of dexmedetomidine for supraclavicular brachial plexus blockade along with bupivacaine. They observed that dexmedetomidine group had longer duration of postoperative analgesia [16]. Mechanism of this analgesic action of alpha-2 adrenoceptor agonists is by direct action on peripheral nerves, its vasoconstrictive effects and centrally mediated analgesia.

The mean heart rate, blood pressure and respiratory rate were comparable and statistically insignificant in both groups. α-2 adrenoceptor agonist may lead to side effects such as hypotension, bradycardia and sedation. In our study none of the patients in any of the two groups exhibited any side effects or hemodynamic variability during the perioperative period.

## Conclusion

Therefore, we concludethat addition of dexmedetomidine as an adjuvant to ropivacaine for ultrasound guided supraclavicular brachial plexus block,not only shortens onset time for sensory and motor block but also prolongs duration of sensory and motor block with increased duration of post-operative analgesia without any side effects or procedure related complications.

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