

## Impact of Dexmedetomidine on Bupivacaine in ultrasound-guided supraclavicular brachial plexus block in forearm surgeries

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**Abstract:** *Background and Aims:* Many adjuvants have been used with local anesthetics to enhance the analgesic duration of brachial plexus block. Our study aimed to evaluate the effect of Dexmedetomidine as an adjuvant to Bupivacaine in USG-guided supraclavicular Brachial plexus block (BPB). *Methods:* A randomized double-blinded study carried on 60 patients with ASA physical status I and 2, undergoing forearm surgeries. In group B, Bupivacaine 0.5% 2mg/kg administered and in group BD, patients were administered 2mg/kg of Bupivacaine 0.5% with Dexmedetomidine 1 µg/kg under ultrasound-guided supraclavicular BPB. The onset of sensory and motor blockade as well as duration of analgesia was recorded. The VAS score was noted before block, just after block, and then every 5 minutes until initial 20 minutes thereafter every half hour till first 24 hours. The time to first rescue analgesic, total analgesic consumption, side effects, and haemodynamic variables were recorded. *Result:* Dexmedetomidine group showed, statistically significant prolonged analgesia, delayed time for first rescue analgesic demand and less analgesic consumption in first 24 hours post- surgery compared to control group. Both groups showed no haemodynamic variations. *Conclusion:* Current study showed that addition of Dexmedetomidine to Bupivacaine improves the quality of Supraclavicular Brachial plexus block in terms of prolonged duration of analgesia.

**Keywords:** Dexmedetomidine, Adjuvant, Bupivacaine, Analgesia, Ultrasound-Guided, Brachial Plexus Block.

### Introduction

Regional blocks are safe and effective techniques in several upper limb surgical procedures. This technique has several benefits over general anesthesia such as no of pain during operation, attenuation postoperative pain and analgesic dose, without any hemodynamic variations, and better patient's comfort [1]. Supraclavicular brachial plexus block is a commonly perform in upper limb surgeries [2]. A single dose of local anesthetic agent encompasses a restricted extend of block, so various adjuvants like opioids are added to enhance their analgesic effect, however, due to the various side effects of these drugs, such as respiratory depression, apnoea and hypoxia leads efforts to seek out best choices continue [3-4].

Dexmedetomidine is highly selective alpha-2 adrenergic receptor agonists used as a short-term sedation and analgesic agent in intensive care units (ICUs) and in operation theaters. Bupivacaine is long acting local anesthetic used

in epidural anesthesia and subarchnoid block and in various peripheral nerve blocks [5]. Addition of adjuvants like Dexmedetomidine to local anesthetic enhances the efficacy of various blocks and better control of postoperative pain thus aid in early ambulation of patients [6-9]. So that our study aimed to evaluate the impact of adding Dexmedetomidine to Bupivacaine in Ultrasound guided Supraclavicular brachial plexus block in patients posted for forearm surgeries in terms of onset, duration of block, the first rescue analgesic time, and total analgesic consumption in first 24 hours as well as hemodynamic parameters and the side effects.

### Material and Methods

After approval from the Institute's Ethics Committee and informed consent 60 patients with ASA class I and II, aged 18-50 years undergoing forearm surgery were enrolled for this study. Patients with cardiovascular and

liver disorders, sensitivity to study drugs, opioids and need for general anesthesia during surgery were excluded from the study. After explaining the block procedure and VAS pain scoring system to the patient, premedications Injection midazolam (0.05 mg/kg) and injection fentanyl (1µg/kg) were administered intravenously. The 60 patients were randomly allocated into two groups, B or BD. The group B patients 2 mg/kg of Bupivacaine 0.5% and the BD group received 2 mg/kg of Bupivacaine 0.5% with Dexmedetomidine (1 µg/kg) administered in total volume of 30 ml.

Supraclavicular block was performed using the HITACHI ALOKA F37 ultrasound machine with linear high frequency transducer the brachial plexus is visualize at the level between trunks and divisions by anesthesiologist who is blind of groupings and syringe contents. After local infiltration at the site of needle insertion, a 50 mm, 22G sterile needle (Stimuplex®, B. Braun, Germany), was inserted under real time ultrasound guidance and after confirmation of tip of needle near the brachial plexus, the solution was injected and spread of drug was noted.

In order to avoid intravascular injection frequent aspiration and injection technique was used. The research assistant, who was not aware of these aspects, completed the form including sensory and motor block and pain evaluation. The sensory block was confirmed with pin prick test in sensory dermatomes related to median, ulnar, radial nerves, and musculocutaneous nerves using 3-point scale. Modified Bromage scale,

- Score (0): No movement.
- Score (1): Discrete movements (trembling) of muscle groups.
- Score (2): Ability to move against gravity, but not against resistance.
- Score (3): Reduced strength, but able to move against resistance.
- Score (4): Full muscle strength in relevant muscle groups.

It was used to confirm the onset of motor blocked. After the onset, sensory and motor blocked recorded every 5 minutes during the first 30 minutes, then every 10 minutes until the next 30 minutes and there after every 15 minutes. The spontaneous movements of the limb and pain to

pin prick is recorded as the end motor and sensory block respectively. The time period between the onset and the end of the sensory and motor block was noted as duration of sensory and motor block. After the completion of surgical procedure, the patient was shifted to the recovery room, where research questionnaire was completed and further assessment of the duration of sensory and motor block was continued in the recovery room.

To evaluate the severity of pain, a visual analogue scale (VAS) was used (0: no pain and 10: the worst pain). The VAS score was noted before block, just after block, and then every 5 minutes until initial 20 minutes thereafter every 30 minutes during surgical procedure. If the patient having VAS score more than 3, 1µg/kg Fentanyl was administered and if VAS was higher than 5 with failed block, patient would be converted to general anesthesia and was excluded from the study. During surgical procedure, NIBP, Heart rate, and SPO2 were recorded every 15 minutes.

The first rescue analgesic request time and total analgesic consumption during first 24 hours post-operative period were recorded. Patients were observed for any side effects during and after operation for first 24 hours. The quantitative data was analyzed using Chi-square and independent t-test and qualitative data is represented as number (percentage). The significance level of these tests was  $P > 0.05$  statistically insignificant,  $p < 0.05$  statistically significant. Data analysis was conducted using SPSS V. 19.

## Results

A 60 patients undergoing forearm surgery equally allocated into two groups Group B (Bupivacaine), Group BD (Bupivacaine with Dexmedetomidine). No patients experience hypotension and bradycardia. Table no.1 shows no statistically significant difference between Group B and Group DB with respect to demographic variables.

Table 2 indicates statistically significant difference between the study groups with respect to block characteristics.

Demographic Data	Group B (n = 30)	Group BD (n = 30)	P-Value
Age	32.87 ± 10	34.11 ± 13.9	0.6936
Weight	72.39 ± 6.98	69.62 ± 8.78	0.1816
Height	172.88 ± 8.52	172.89 ± 8.25	0.9968

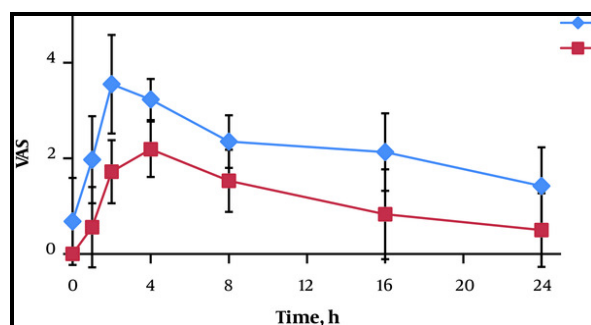
Values are mean ± SD

Parameter	Group B	Group BD	P-Value
Onset of sensory block (min)	15.66 ± 4.11	13.35 ± 2.22	0.0089
Sensory block Duration (min)	110.73 ± 12.38	154.03 ± 20.26	< 0.0001
Onset of motor block (min)	19.61 ± 5.33	16.82 ± 1.77	0.0086
Motor block Duration(min)	90.55 ± 16.20	140.27 ± 19.45	< 0.0001
First rescue analgesic time (min)	45.16 ± 10.44	128.32 ± 15.50	< 0.0001
Total analgesic consumption (mg)	76.94 ± 20.55	35.20 ± 19.35	< 0.0001

Values are mean ± SD.

Statistically significant difference was observed between two groups in the VAS pain scores following post-surgery (P < 0.001) (Figure 1).

**Fig-1:** Comparison of VAS between two groups, Group B, Bupivacaine (blue line); Group BD, Bupivacaine with Dexmedetomidine (red line)



Patient's haemodynamic parameters (heart rate, SpO2, systolic and diastolic blood pressures) in each group were stable over time and the two groups showed no significant difference in the average variations of these parameters. Patients were monitored for any adverse effects.

### Discussion

Our study showed that addition of Dexmedetomidine in Supraclavicular Brachial plexus block significantly increases the duration of analgesia as well as shortened the onset of block compared to the Bupivacaine group that having agreement with earlier studies [10-11]. The distinction with respect to onset of block between two groups could also be because pharmacodynamics properties of local anesthetics used. The result of current clinical trial was consistent with result of the Gandhi R et al, Esmooglu A et al, where they used Bupivacaine and Levobupivacaine respectively. The initial rescue analgesic time in the Dexmedetomidine group was significantly longer than the Bupivacaine group in our study, which shows agreement with Esmooglu et al [11] which was a double-blind randomized trial conducted on patient undergoing forearm surgery under axillary brachial plexus block.

Their study also showed that time for first rescue analgesic in levobupivacaine with Dexmedetomidine (100 µg) group is far longer than the levobupivacaine group, which was also confirmed by the findings of Das et al [12] in their randomized, double-blind study on patients posted for forearm surgery performed under supraclavicular Brachial plexus block. They used ropivacaine in control groups and Dexmedetomidine with ropivacaine in treatment groups. They showed that the onset of sensory and motor block in the Dexmedetomidine group was shorter than the control group; however, the difference was not significant. The duration of the sensory and motor block was considerably lengthened than the control group.

Study by Kenan K et al [13] showed that addition of dexmedetomidine to axillary brachial plexus block shortened the sensory block onset time, increased sensory, motor block duration and time for initial analgesic use, reduced total analgesic use with no adverse reactions. Akhondzadeh R et al [14] also showed that addition of Dexmedetomidine to lidocaine in ultrasound-guided supraclavicular brachial plexus block increases the duration of block, reduce the onset time, which is also consistent with our study.

Agarwal S et al [15] in their study found that dexmedetomidine when added to bupivacaine for Peripheral Nerve Stimulator-Guided supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs its duration. The significantly prolonged duration of analgesia obviates the need for any additional analgesics in post-operative period. The superadded benefits of conscious sedation, better haemodynamic status, and least adverse effects confirmed that dexmedetomidine is a potential adjuvant for regional blocks.

The results of our study showed that Dexmedetomidine significantly increases sensory and motor block duration in regional block. In previous studies, where they used the combination of long-acting drugs compared with moderate-acting drugs demonstrated prolongation of duration; however, change in dose, route of administration, and localization technique did not show any difference in results and all studies pointed to longer duration of sensory and motor block [14-19].

Nallam SR [20] investigated the effects of adding Dexmedetomidine in two different doses (50 µg and 100 µg) to 0.5% levobupivacaine in supraclavicular Brachial plexus block in forearm surgery and Study by Chandni Sinha and et al [21] compared the two different doses of dexmedetomidine (1 µg/kg and 2 µg/kg) added to levobupivacaine in ultrasound-guided Supraclavicular brachial plexus block. Both the studies observed that block in terms of duration is same in both groups, however incidence of bradycardia and hypotension increased with higher dose. Our study showed no incidence of adverse effects which could be attributed to the dose used (Dexmedetomidine 1 µg/kg). Therefore, a lower dose of dexmedetomidine added to 0.5% bupivacaine is better balance between block effectiveness and its safety.

## Conclusions

The Dexmedetomidine with Bupivacaine will lead to enhance efficacy of Brachial Plexus Block in terms lengthening the duration of sensory and motor block as well as attenuating the onset. Moreover, the initial analgesic request time was prolonged and the consumed analgesic decreased, which consequently decreased the intensity of pain.

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**Cite this article as:** Bijapur MB, Kudligi AA, Sanjeev B, Shaik A, Sankangoudar G. Impact of dexmedetomidine on bupivacaine in ultrasound-guided supraclavicular brachial plexus block in forearm surgeries. *Al Ameen J Med Sci* 2019; 12(1):22-26.

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