Original Research Paper

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# EFFICACY OF DEXMEDETOMIDINE AS AN ADJUVANT TO 0.5% BUPIVACAINE IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES: A PROSPECTIVE RANDOMISED STUDY

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**ABSTRACT** **Objective:** To compare the postoperative analgesic efficacy of dexmedetomidine with bupivacaine and bupivacaine alone in usg guided supraclavicular brachial plexus block for patients undergoing upper limb surgeries. **Methods:** A total 50 participants, belongs to ASA 1 & 2, scheduled for upper limb surgeries under supraclavicular block were randomly allocated into 2 groups
Group A: received Inj bupivacaine 0.5% 20cc+ Inj dexmedetomidine 0.8 – 1mcg/kg
Group B: received Inj bupivacaine 0.5% 20cc,
**Results:** In our study the mean time for first rescue analgesia was 13.8±2.48hrs in Dexmedetomidine group, when compared with 10.25±1.69hrs in the plane bupivacaine group, the difference of 3.56 hrs with p<0.0005 which was statistically significant. **Conclusion:** Inj Dexmedetomidine 0.8 – 1mcg/kg is a potent adjuvant in neuroxial blocks in regional anaesthesia. It provides faster onset of action, prolongs both motor and sensory blockade, prolongs post-operative analgesia with hemodynamic stability and adequate sedation when added to local anaesthetic in supraclavicular block.

**KEYWORDS :** Dexmedetomidine, Adjuvant, Supraclavicular Block

## INTRODUCTION

Regional anaesthesia indicates that the anaesthetic is restricted to site of operation [1]. Brachial plexus block, as described by Winnie in 1970[2] is a good alternative for General Anaesthesia in Upper limb surgeries if required criterias are met. That decreases post-operative complications associated with intubation. And also without much sedation provides better post-operative analgesia, this helps in early mobilization and early discharge [3].

Supraclavicular block is one of the type of brachial plexus block, simple to perform and provides dense block and wide range of distribution of block.Bupivacaine is used frequently for supraclavicular nerve block as it has long duration of action from 3 to 6 h. Adjuncts to local anesthetics for brachial plexus block may enhance the quality and duration of analgesia.[4]

Dexmedetomidine, the pharmacologically active d-isomer of medetomidine [4,[5]-1-[2,3-dimethylphenyl]-ethyl],imidazole is a highly specific and selective α2 adrenoreceptor agonist.[5] Highly selective action of dexmedetomidine on α-2 receptor (α2: α1=1620:1)[5,6,7] results in sedation and analgesia without unwanted vascular effects from activation of α1receptor and also has analgesic, sympatholytic and cardiovascular stabilizing effects.[6]

It induces sedation by inhibiting the release of noradrenaline in the locus ceruleus, thereby increasing GABA inhibitory neurons action in ventrolateral preoptic nucleus [6,7,9,10]. And also inhibits release of substance P in pain pathway at dorsal root neurons [6,7]. In addition, a reversal drug Atipamezole for the sedative effect of dexmedetomidine is also available. Local use of dexmedetomidine reduces the side effects associated with IV usage like hypertension, hypotension, nausea, vomiting and provides effective conscious sedation and analgesic property as iv usage without side effects and prolongs the duration of analgesia.

The aim is to determine the postoperative analgesic efficacy of dexmedetomidine as an adjuvant to 0.5% bupivacaine an ultrasonography guided supraclavicular block for upper limb surgeries.

## MATERIALS AND METHODS

This randomized comparative study was carried out between February 2023 and August 2023 following approval from the Institutional Ethics Committee. The study included 50 patients classified as American Society of Anaesthesiologists (ASA) physical status I and II, all of who posted for upper limb orthopaedic surgery under supraclavicular block, between 18 and 60 years of age group and provided informed consent to participate. Exclusion criteria were refusal to participate, patients with infections at the site of injection, with significant coagulopathy, having allergy to study drug, patients with motor and sensory deficit.

Patients were randomly divided into two groups of 25 using computer-generated random numbers. Group A received Inj Dexmedetomidine 1mcg/kg with inj Bupivacaine 0.5% 20ml , while Group B received the same dose of 0.5% Bupivacaine 20ml. Demographic data, including age, weight, height, body mass index (BMI), ASA grade, and relevant medical history (such as diabetes and cardiovascular disease), were collected. Additionally, all patients were preoperatively instructed on how to use the visual analogue scale (VAS) for pain assessment.

On arrival at the operating room, Non-Invasive Blood Pressure, Pulse oximetry and Electrocardiogram will be connected and the baseline Systolic, Diastolic and Mean Arterial Pressures (SBP, DBP and MAP), Heart Rate (HR) and Oxygen Saturation (SpO2) will be recorded. Intravenous access will be secured and IV fluids will be initiated.

The patient will be placed in supine position with the head turned 45 degrees to the contralateral side. A scout scan will be performed using a linear high frequency probe (12 MHz, Sonosite machine) After skin preparation and local anaesthetic infiltration of skin, the supraclavicular fossa will be scanned to locate the subclavian artery, first rib, pleura and brachial plexus cluster and also to rule out anatomical abnormalities including aberrant vasculature. Under strict aseptic precautions, ultrasound guided supraclavicular block will be performed using an in-plane approach with a conventional 2.5inch-long needle with 25 G width. If longer needles were needed, a 23 G spinal needle would be used. The Needle will be advanced from the lateral to medial in the long axis of the ultrasound beam. The needle will be advanced towards the 'corner pocket', where the lower trunk commonly lies in this area, (between the subclavian artery medially, the first rib inferiorly and the plexus superiorly) which will be the target for needle tip placement. The drugs prepared by an independent consultant and the person administering the block would be unaware of the drug combinations. If any failure of the block, then general anaesthesia (GA+CV) is considered as rescue anaesthesia of choice.

Onset of sensory block (score = 1) - It is defined as the time taken from the end of the injection to the first dull response to pinprick.

Sensory score:

1 - Normal sensations to pin prick.
2 - Blunt response to pin prick.
3 - No response to pin prick.

Onset of motor block (score = 1) - From end of injection to the onset of complete loss of the motor power. Motor block is assessed by asking

the patient to adduct the shoulder and flex the fore-arm and hand against gravity. Motor characteristics of block will be assessed using Bromage 3-point scale.

**Motor score:**
1-Normal motor functions with full flexion and extension of the elbow, wrist and fingers.
2-Decreased motor strength with ability to move fingers only.
3-Complete motor blockade with inability to move fingers.

The end of the injection will be taken as time 0. Block will be considered successful if it occurred within 30 minutes. Patients with inadequate blockade and also requiring supplementation will be excluded from the study.

Onset of sensory and motor blocks, Duration of sensory block (the time taken between injection of the drug and appearance of pain requiring analgesia). Duration of motor block (time taken between injection to complete return of motor power) will be recorded. Hemodynamic parameters: Heart rate, systolic, diastolic, mean arterial pressure and arterial oxygen saturation (SpO2) will be measured at 0, 2, 5, 10, 20, 30 min and thereafter every 15 min till the end of surgery. Intensity of pain will be evaluated using 10 cm visual analog scale (VAS) where 0 represents no pain and 10 represents worst possible pain. Rescue analgesia will be given if VAS score is ≥4 with Inj Paracetamol 1g I.V. If VAS is still ≥4 after 2hr, Inj.

Diclofenac 75mg I.M. will be given. VAS score will be recorded postoperatively at 0, 2, 6, 12, 20 and 24 h. The time for the first rescue analgesia and 24-hr analgesic consumption will be noted. Duration of analgesia will be recorded (it is the time interval between the onset of complete sensory block to the postoperative VAS score ≥4).

Any adverse effects like vomiting, pruritus, persistent paresthesia and weakness will be noted in the perioperative period. All the observations will be made by the independent observer who will be blinded to the group allocation.

## RESULT

The study included 50 patients, with 25 in Group A, received Inj Dexmedetomidine 1mcg/kg with inj Bupivacaine 0.5% 20ml, while Group B received Inj 0.5% Bupivacaine 20ml. There were no significant differences between the two groups in terms of demographic characteristics such as age, weight, and height (Table 1). Additionally, there were no statistically significant differences between the groups regarding heart rate, systolic blood pressure, or diastolic blood pressure.

**Table 1: Demographic Data Were Comparable In Both The Groups**

| PARAMETER | GROUP A(n-25) Mean ±SD | GROUP B(n-25) Mean ±SD | P-VALUE |
|---|---|---|---|
| Age (years) | 36.53±12.28 | 37.23±12.62 | 0.83 |
| Weight (kg) | 69.40±8.616 | 69.56±6.14 | 0.84 |
| Height (cm) | 168.65±8.616 | 168.25±7.880 | 0.87 |
| Heart rate (/min) | 79.04±4.2 | 78.68±3.46 | 0.261 |
| MAP (mmHg) | 76.43±5.67 | 76.91±4.58 | 0.237 |
| FEMALE<br>MALE | 10(50.0%)<br>10(50.0%) | 11(55.0%)<br>9(45.0%) | |

MAP-Mean arterial pressure

**Table 2: Onset Of Sensory Block**

| GROUP | | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|
| Onset of sensory block | Group D | 25 | 5.44 | 1.05 | 0.0005 |
| | Group B | 25 | 11.82 | 2.25 | |

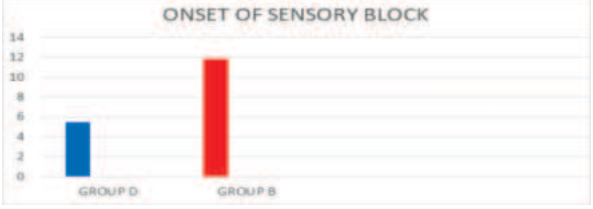


**Figure 1:** Onset Of Sensory Block

Onset of sensory block is significantly shorter in Group D compared to group B

3. ONSET OF MOTOR BLOCK

| GROUP | | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|
| Onset of motor block | Group D | 25 | 6.53 | 1.51 | 0.0005 |
| | Group B | 25 | 13.48 | 2.43 | |

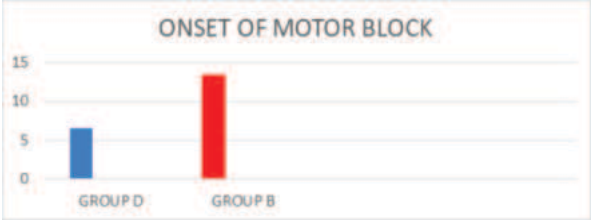


**Figure 2:** Onset Of Motor Block

Onset of motor block is significantly shorter in Group D compared to group B

4. TIME OF 1ST RESCUE ANALGESIA

| GROUP | | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|
| Time for 1st rescue analgesia | Group D | 25 | 13.81 | 2.48 | 0.0005 |
| | Group B | 25 | 10.25 | 1.69 | |

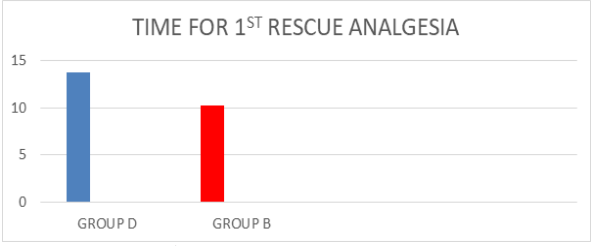


**Figure 3:** Time Of 1st Rescue Analgesia

5.VAS SCORE:

| GROUP | | | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|---|
| VAS | Immediate post op | Group D | 25 | 2.24 | 0.88 | 0.228 |
| | | Group B | 25 | 1.96 | 0.73 | |
| | 1hr | Group D | 25 | 2.52 | 0.71 | 0.055 |
| | | Group B | 25 | 2.12 | 0.73 | |
| | 2hr | Group D | 25 | 2.60 | 0.76 | 0.061 |
| | | Group B | 25 | 2.20 | 0.71 | |
| | 4hr | Group D | 25 | 2.60 | 0.76 | 0.880 |
| | | Group B | 25 | 2.57 | 0.52 | |
| | 8 hr | Group D | 25 | 2.64 | 0.76 | 0.109 |
| | | Group B | 25 | 2.92 | 0.40 | |
| | 12 Hr | Group D | 25 | 3.40 | 0.71 | 0.0005 |
| | | Group B | 25 | 4.44 | 0.51 | |
| | 16 Hr | Group D | 25 | 4.40 | 0.65 | 0.0005 |
| | | Group B | 25 | 5.52 | 0.51 | |
| | 20 Hr | Group D | 25 | 5.08 | 0.57 | 0.0005 |
| | | Group B | 25 | 5.96 | 0.54 | |
| | 24 Hr | Group D | 25 | 5.64 | 0.57 | 0.0005 |
| | | Group B | 25 | 6.52 | 0.51 | |

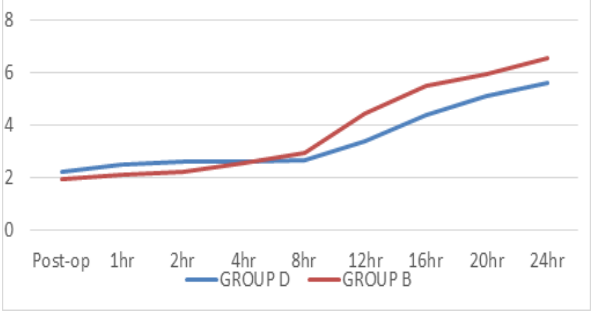


**Figure 4:** VAS SCORE

The VAS score is significantly higher in Group B compared to group D after 12 hours.

## DISCUSSION

It's a randomized comparative investigation. The dates of operation are collected between JUNE 2022–August 2023 from patients undergoing upper limb orthopaedic surgeries performed in hospitals affiliated with Bangalore Medical College and Research Institute. Once the patients' informed permission and institutional consent have been obtained, this prospective, randomized comparison study will proceed. Patients will be randomly assigned to one of two groups in this. Each group had 25 patients.

The present study aimed to evaluate the efficacy of dexmedetomidine as an adjuvant to 0.5% bupivacaine in ultrasound-guided supraclavicular brachial plexus block for upper limb surgeries. The findings indicated that the addition of dexmedetomidine significantly enhanced the analgesic effects and prolonged the duration of sensory and motor block compared to bupivacaine alone. Efficacy of Dexmedetomidine Dexmedetomidine, an α2-adrenergic agonist, has gained attention in regional anaesthesia due to its analgesic and sedative properties. In this study, patients receiving dexmedetomidine experienced a longer duration of postoperative analgesia, which is consistent with previous literature highlighting the synergistic effects of dexmedetomidine when combined with local anaesthetics. The potential mechanisms behind this prolonged effect include reduced central nervous system excitability and increased local blood flow, which may enhance the pharmacokinetics of bupivacaine.

Comparison with Previous Studies Several studies have corroborated our findings. For instance, a meta-analysis revealed that the use of dexmedetomidine as an adjunct to local anaesthetics consistently resulted in better pain control and extended duration of block. However, variability exists in the optimal dosing of dexmedetomidine and its impact on hemodynamics, which were well managed in our study. Careful monitoring of blood pressure and heart rate was crucial, as dexmedetomidine can cause transient hypotension and bradycardia, although these effects Our finding align with those of Nazia Nazir et al.[6] who found that dexmedetomidine (1mcg/kg) provides faster action, prolonged motor and sensory block, prolonged analgesia with hemodynamic stability and adequate sedation when added to local anesthetics in supraclavicular block. Similarly in our study Dexmedetomidine(1mcg/kg) added as adjuvant to bupivacaine for supraclavicular block prolonged the duration of analgesia- 13.62±2.55 hours without side effects.

Furthermore, our results are consistent with the study by Aliye Esmaoglu et al[14]. where the effect of adding dexmedetomidine to levobupivacaine for axillary brachial plexus block on 60 patients scheduled for elective forearm and hand surgery, shortens the onset time and prolongs the duration of the analgesia and the duration of postoperative analgesia.In our study Dexmedetomidine added as adjuvant to bupivacaine for supraclavicular block, shortens the onset time and prolong the duration of analgesia without significant side effects. Additionally, our results are consistent with those of Kaygusuz et al [8], they concluded that dexmedetomidine to axillary brachial plexus block shortens sensory block onset time, increases the sensory and motor block duration and time to first analgesic use, and decreases total analgesic use with no side effects. In our study Dexmedetomidine added as adjuvant to bupivacaine for supraclavicular block, shortens the onset time and prolong the duration of analgesia with no side effects.

Clinical Implications

The improved analgesia provided by dexmedetomidine could lead to reduced opioid consumption in the postoperative period, thereby minimizing opioid-related side effects such as nausea and respiratory depression. This is particularly relevant in the context of enhanced recovery after surgery (ERAS) protocols, where multimodal analgesia is a cornerstone of patient management. The findings support the use of dexmedetomidine in clinical practice, particularly for outpatient procedures where early recovery and discharge are desirable.

Limitations and Future Directions

Despite the promising results, this study has limitations that should be acknowledged. The sample size was relatively small, which may limit the generalizability of the findings. Future studies with larger cohorts and diverse surgical procedures are needed to confirm these results. Additionally, the long-term effects of dexmedetomidine on pain management and its potential effects on neurodevelopment in paediatric populations warrant further investigation.

## CONCLUSION

We came to the conclusion that the research on the addition Inj Dexmedetomidine as adjuvant, provides fastens the onset of action, prolongs both motor and sensory blockade, prolongs post operative analgesia with hemodynamic stability and adequate sedation when added to local anesthetic in supraclavicular block. These findings support the continued exploration of dexmedetomidine in regional anaesthesia, emphasizing its role in improving postoperative outcomes and patient satisfaction.

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