VOLUME-7, ISSUE-6, JUNE-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Anaesthesiology

# DEXMETOMIDINE AS ADJUVENT TO BUPIVACAINE IMPROVES POSTOPERATIVE ANALGESIA IN BRACHIAL PLEXUS BLOCKADE

**Dr Ashwini Patel** Assistant Professor Department of Anaesthesiology G.M.C. Chindwara

**Dr. Mona Bhalavi*** Assistant Professor Department of Anaesthesiology G.M.C. Chindwara
*Corresponding Author

## ABSTRACT

**Background** The purpose of this study was to evaluate the effect of the addition of 50 microgm dexmetomedine to 20 ml of bupivacaine on postoperative analgesic effects of brachial plexus block in forearm surgery.

**Methods** In 40 patients scheduled for forearm surgery, BPB was preoperatively performed with 20 ml of 0.5% bupivacaine under the guidance of a nerve stimulator. Patients were randomly allocated to receive the same volume of normal saline (Group I), 50 microgm of dexmetomidine (Group II),. A blind observer recorded total analgesic consumption, complication, and patient satisfaction using a visual analogue scale at 0, 6, 12 hours after the operation.

**Results** All patients had successful BPB and excellent analgesic effects less than VAS 4 up to discharge time. VAS in Group II at 6 h and 12 h was statistically much lower than in Group I . There were no differences in total analgesic consumption, , complications, and patient satisfaction.

**Conclusion** We conclude that the addition of 50 microgm of dexmetomedine to 20 ml of 0.5% bupivacaine in BPB showed improvement of postoperative analgesia for forearm operation without any specific complications.

**KEYWORDS** : Analgesia; Brachial Plexus Blocks ;dexmetomedine ; Bupivacaine

## INTRODUCTION

Regional anaesthesia has gained much popularity in outpatient orthopaedic surgery. Brachial plexus block (BPB) is one of the most commonly used and most clinically applicable nerve block techniques, particularly for forearm surgery and post-surgery pain control.It has been reported that BPB in forearm surgery with low dosages of bupivacaine showed significant postoperative analgesic effects. Increasing duration of local anaesthetic action is desired for prolongation of postoperative patient comfort, as well as decreasing perioperative opioid consumption and subsequent side effects. A number of adjuvant medications have been used in an attempt to prolong regional blockade.

Dexmedetomidine, is a selective α2-adrenoceptor agonist that is used as an adjuvant mixed with local anesthetics during regional anesthesia. Although several studies have described effects of dexmedetomidine on peripheral nerve blocks, to date there is limited knowledge available on the impact of dexmedetomidine adjunct to bupivacaine in brachial plexus block. This study was designed to test the efficacy of adding dexmedetomidine to bupivacaine during placement of brachial plexus blockade .For single-shot techniques, various local anesthetic (LA) mixtures can be used to prolong local anesthesia duration, and epinephrine, bicarbonate, neostigmine, opioids, and clonidine are frequently used for this purpose. As well as delaying absorption by vasoconstriction, epinephrine is the agent added most often to the LA, which is known to have α-2 adrenergic mechanism that works directly on the spinal cord to suppress pain, but caution is required when adding epinephrine to patients with risk factors such as hypertension and ischemic heart problems.

Therefore, we conducted BPB on patients undergoing forearm surgery using 20 ml 0.5% bupivacaine with added 50 microgm dexmetomidine and investigated postoperative analgesic effects.

## MATERIALS AND METHODS

The study was conducted in the Department of Anaesthesiology . The study subject were selected from patients admitted in orthopedic wards. The study was approved by the Hospitals Ethics Committee and was conducted on 40 American Society of Anesthesiologists 1,2 patients over the age of 18 who were undergoing forearm surgery.

**Study Design** Prospective, nonrandomized study and outpatient treatment.

**Inclusion Criteria** The study population consisted of all the adult patients over the age of 18 who were undergoing forearm surgery. The purposes of this study and the risks and complications that may come from the procedure were explained to subjects and their consent was obtained.

**Exclution criteria :**Patients unable to cooperate, diabetics, expectant mothers, patients with coagulation difficulties, those sensitive to local anesthesia, patients with severe chronic pulmonary disease, neurological deficiencies at the site of operation or neuropathy, infections at the site of block, drug or alcohol abusers, and those with a medical history of chronic pain were excluded from the study.

Patients were randomly allocated into two groups and BPB was preoperatively performed under the guidance of nerve stimulator using 20 ml of 0.5% with identical dosages of different additives. Group I (n = 20) was administered with 1 ml of normal saline solution, 50 microgm of dexmetomidine injection was administered to Group II (n = 20].

Noninvasive monitoring of blood pressure, pulse oxymetry and electrocardiograms were attached to all patients immediately after arrival into the operating room, and their initial vital signs were measured. BPB was conducted after IV injection of midazolam 1-3 mg and fentanyl 25-50 µg. The patient was laid in a supine position with the head turned away from the side to be blocked.

A doctor blinded to the study groups visited the patients and used the verbal numerical rating scale (VAS: 0 = no pain, 10 = most severe pain imaginable) to evaluate and record pain starting with immediately after recovery room arrival as 0 , 6, 12 later. When VAS was more than 4 and the patient requested analgesic, ketorolac was IV injected or opioid IM injected and recorded, and patients were evaluated whether they exhibited complications such as neurological disabilities, nausea, vomiting, or respiratory difficulties.

## OBSERVATION TABLES

**TABLE 1 PATIENT CHARACTERISTICS**

| PARAMETERS | GROUP 1 | GROUP 2 | P Value |
|---|---|---|---|
| AGE[YEARS] | 33.73+_12.09 | 32.67+-5.64 | NS |
| WEIGHT [Kg] | 58.4+_4.3 | 60.65+-3.67 | NS |
| GENDER[M/F] | 12/8 | 13/7 | NS |

| | | | |
|---|---|---|---|
| **TYPE OF SURGERIES a)# olecranon b)# lower end humerus c)#radius ulna** | **5 7 8** | **6 5 9** | |

**TABLE 2 SENSORY AND MOTOR BLOCK ONSET TIME, BLOCK AND ANALGESIA DURATIONS**

| | GROUP 1 | GROUP 2 | P Value |
|---|---|---|---|
| **Onset time of sensory block (in min)** | **2.33+-1.21** | **1.77+-1.28** | **0.083** |
| **Onset time of motor block (in min)** | **3.87_+1.78** | **4.65_+2.46** | **0.162** |
| **Duration of sensory block(in min)** | **227.3+_48.36** | **413.9_+87.31** | **0.001[sig]** |
| **Duration of sensory block(in min)** | **292.54_+40.6** | **472_+65.4** | **0.001[sig]** |
| **Duration of analgesia(in min)** | **289.67+_62.5** | **456.21+_97.99** | **0.001[sig]** |

Duration of sensory block was 227.00±48.36 min in Group 1 as compared with 413.97±87.31 min in Group 2. Statistically significant longer duration of sensory block was observed in Group 2 (P=0.001).

## RESULTS

There were no significant differences in age, height, weight, sex, ASA PS, time taken for surgery and anesthesia, and type of surgery among the three groups . Patients from all three groups showed excellent analgesic effects with VAS lower than 1 point up to 6 h after surgery.

Values are expressed as mean ± SD or numbers. Group I: 1 ml normal saline as an adjuvant to 10 ml of 0.5% bupivacaine for brachial plexus blockade, Group II: 1 ml of 50 mg dexamethasone as an adjuvant to 10 ml of 0.5% bupivacaine for brachial plexus blockade. There were no significant differences among the groups.VAS measured at 12, 24 after surgery showed that of Group II scored 0.3, 2.4, 1.1 points, which was notably lower compared to Group I (2.6, 3.7, 2.9 points) . However, both the groups exhibited excellent analgesic effect with lower than 4 points in VAS measured up to 24 hours after surgery, and the amount of additional analgesic used was not significantly different. All nerve blocks were recovered within 24 hours, and all patients were satisfied with no complaints of complications or side effects.

Duration of sensory block and motor block was 227.00±48.36 and 292.67±59.13 min, respectively, in group 1, while it was 413.97±87.13 and 472.24±90.06 min, respectively, in group 2. There was no statistically significant difference in onset of sensory and motor block between the two groups. The duration of analgesia (time to requirement of rescue analgesia) in group 2 was 456±97 min, while in group 1, it was 289±62 min. Statistically, this difference was significant (P=0.001). The number of patients achieving grade IV quality (excellent) of block was higher in group 2 (80%) as compared with group 1 (40%) (P<0.05).

## STATISTICAL ANALYSIS

SPSS (version 17.0, Chicago, IL, USA) was used for statistical analysis and continuous variables were noted as mean ± standard deviation, VAS as mean ± standard error and analyzed using ANOVA. Categorical variables were noted in number of patients (%) and analyzed using chi-squared and Fisher's exact test. A P value of < 0.05 was considered statistically significant.

## DISCUSSION

Brachial plexus block is an appropriate approach for distal arm and forearm surgeries. Local anesthetic adjuvant agents are used to improve the quality of nerve blocks. The purpose of this study was to examine the effects of dexmedetomidine and ketorolac as local anesthetic adjuvants on the onset and duration of infraclavicular brachial plexus block under ultrasound guide technique.For single-shot techniques, various local anesthetic (LA) mixtures can be used to prolong local anesthesia duration, and epinephrine, bicarbonate, neostigmine, opioids, and clonidine are frequently used for this purpose. As well as delaying absorption by vasoconstriction, epinephrine is the agent added most often to the LA, which is known to have α-2 adrenergic mechanism that works directly on the spinal cord to suppress pain, but caution is required when adding epinephrine to patients with risk factors such as hypertension and ischemic heart problems.

Several authors in various studies have worked on adding adjuvents in brachial plexeus block . Damien B, Murhy CJ et al added novel analgesic adjuvants for brachial plexus block and did a systemic review. Axelsson K, Gupta A. et al in similar studies added local anaesthetic adjuvants and studied neuraxial versus peripheral nerve block and current opinion in Anesthesiology.[1,2]

Vieira PA et al added dexamethasone with bupivacaine which increases duration of analgesia in ultrasound-guided interscalene brachial plexus blockade. Dexamethasone has been shown to prolong the duration of postoperative analgesia when given as an adjunct for peripheral nerve blocks. This was based on pain, recovery of sensation and strength in the arm. Variables measured included demographics, timed pain intensity measurements, postoperative analgesic consumption, duration of analgesia and patient satisfaction.It was seen that Dexamethasone prolonged median sensory (1457 vs. 833 min, P < 0.0001) and motor (1374 vs. 827 min, P < 0.0001) blockade compared with the control.So it was concluded that the addition of dexamethasone to a bupivacaine–epinephrine–clonidine interscalene block prolongs sensory block and reduces opioid use.[3]

Swami SS et al did comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block .It was a randomised double-blind prospective study .Alpha-2 agonists are mixed with local anaesthetic agents to extend the duration of spinal, extradural and peripheral nerve blocks. They compared clonidine and dexmedetomidine as an adjuvant to local anaesthetic agent in supraclavicular brachial plexus block with respect to onset and duration of sensory and motor block and duration of analgesia.Sixty ASA I and II patients scheduled for elective upper limb surgeries under supraclavicular brachial plexus block were divided into two equal Onset and recovery time of sensory and motor block, duration of analgesia and quality of block were studied in both the groups.Dexmedetomidine when added to local anaesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia. The time for rescue analgesia was prolonged in patients receiving dexmedetomidine. It also enhanced the quality of block as compared with clonidine.[4]

Alireza Mirkheshti Asadollah Saadatniaki et al studied effects of dexmedetomidine versus ketorolac as local anesthetic adjuvants on the onset and duration of infraclavicular brachial plexus block .. Dexmedetomidine and ketorolac are two different types of adjuvants, which have been used in some studies.The purpose of this study was to examine the effects of dexmedetomidine and ketorolac as local anesthetic adjuvants on the onset and duration of infraclavicular brachial plexus block under ultrasound guide technique.In a clinical trial study, 111 ASA class I and II patients who were candidates for elective distal arm and forearm surgeries under ultrasound guided infraclavicular brachial plexus block divided into three 37 patient groups. Sensory and motor onset blocks, duration of sensory and motor blocks and first time to analgesic request and hemodynamic parameters were all recorded.Sensory block duration in dexmedetomidine group was significantly longer than ketorolac and placebo groups (both Ps < 0.001). Motor block duration in dexmedetomidine group was significantly longer than ketorolac and placebo groups (both Ps < 0.001). Time to first

analgesic request after the procedures was longer in ketorolac compared to dexmedetomidine and placebo groups (P = 0.016, P < 0.001 respectively), but it was longer in dexmedetomidine compared to placebo group (P = 0.003). Their study showed that dexmedetomidine had better effects on sensory and motor block duration and motor block onset in comparison with ketorolac, as lidocaine adjuvants in infraclavicular brachial plexus block were present in both protocols. However, the first time to analgesic request by ketorolac was longer than dexmedetomidine.[5]

Ammar AS, Mahmoud KM.did a prospective randomized controlled trial on ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery .Sixty adult patients were divided into 2 equal groups of 30 subjects each. Following brachial plexus nerve block parameters were assessed: block success rate, sensory onset time and duration, motor block onset time and duration, analgesic pain scores using the verbal rating scale (VRS) for pain, duration of analgesia, and amount of supplemental intravenous (IV) morphine required.There was a statistically significant shorter time to onset of sensory blockade (13.2 vs 19.4 min, P=0.003), longer duration of sensory block (179.4 vs 122.7 min, P=0.002), shorter onset time to achieve motor block (15.3 vs 22.2 min, P=0.003), longer duration of motor block (155.5 vs 105.7 min, P=0.002), lower VRS pain scores, prolonged analgesia (403 vs 233 min, P=0.002), and lower morphine rescue requirements for 48 h after surgery (4.9 (0–8.0) vs 13.6 mg (4.0–16.0) mg, P=0.005). So the conclution was (1) enhancement of onset of sensory and motor blockade, (2) prolonged duration of analgesia, (3) increases duration of sensory and motor block, (4) yields lower VRS pain scores, and (5) reduces supplemental opioid requirements .[6]

Kaygusuz K et al studied effects of adding dexmedetomidine to levobupivacaine in axillary brachial plexus block .In this study, the authors aimed to investigate the effects of adding dexmedetomidine to levobupivacaine for an axillary brachial plexus block. A total of 64 patients were enrolled. Demographic data, mean arterial pressure (MAP), heart rate (HR), peripheral oxygen saturation (Spo2), sensory and motor block onset times and block durations, time to first analgesic use, total analgesic need, intraoperative verbal analog scale, postoperative visual analog scale (VAS) data, and side effects were recorded for each patient. There were no significant differences in patient and surgery characteristics between the 2 groups Bradycardia, hypotension, hypoxemia, nausea, vomiting, and any other side effects were not seen in any patients.It was concluded in study that adding 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. [7]

Biswas S et al worked on dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block It was a randomized double blind prospective study. Apha-2 agonists are combined with local anesthetics to extend the duration of regional anesthesia. The authors evaluated the effect of combining dexmedetomidine with levobupivacine with respect to duration of motor and sensory block and duration of analgesia.Duration of motor and sensory block and time to first rescue analgesia were recorded. Sensory and motor block durations were longer in group LD as compared to L (P<0.01). Duration of analgesia was significantly longer in group LD as compared to group L (p<0 .05).They concluded dexmedetomidine added to levobupivacaine in supraclavicular brachial plexus block prolongs the duration of block and the duration of postoperative analgesia. Adding dexmedetomidine to bupivacaine during the placement of an ICB provides: (1) enhancement of onset of sensory and motor blockade, (2) prolonged duration of analgesia, (3) increases duration of sensory and motor block, (4) yields lower VRS pain scores, and (5) reduces supplemental opioid requirements.

**References**


1. Damien B, Murhy CJ, Cartney VW. Novel analgesic adjuvants for brachial plexus block: A systemic review. Anesth Analg. 2000;90:1122-8.
2. Axelsson K, Gupta A. Local anaesthetic adjuvants: neuraxial versus peripheral nerve block. Current Opinion in Anesthesiology. 2009 Oct 1;22(5):649-54.
3. Vieira PA, Pulai I, Tsao GC, Manikantan P, Keller B, Connelly NR. Dexamethasone with bupivacaine increases duration of analgesia in ultrasound-guided interscalene brachial plexus blockade. European Journal of Anaesthesiology (EJA). 2010 Mar 1;27(3):285-8.
4. Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian journal of anaesthesia. 2012 May;56(3):243.
5. Mirkheshti A, Saadatniaki A, Salimi A, Rasi AM, Memary E, Yahyaei H. Effects of dexmedetomidine versus ketorolac as local anesthetic adjuvants on the onset and duration of infraclavicular brachial plexus block. Anesthesiology and pain medicine. 2014 Aug;4(3).
6. Ammar AS, Mahmoud KM. Ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. Saudi journal of anaesthesia. 2012 Apr;6(2):109.
7. Kaygusuz K, Kol IO, Duger C, Gursoy S, Ozturk H, Kayacan U, Aydin R, Mimaroglu C. Effects of adding dexmedetomidine to levobupivacaine in axillary brachial plexus block. Current therapeutic research. 2012 Jun 1;73(3):103-11.
8. Biswas S, Das RK, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: a randomized double blind prospective study. Ethiopian journal of health sciences. 2014;24(3):203-8.