

## **A Comparative Study Between 0.50% Bupivacaine And 0.50% Bupivacaine with Dexmedetomidine For Supraclavicular Brachial Plexus Block**

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### **Abstract**

**Introduction:** Post-operative analgesia plays an important role in the prevention of post-operative complications in the high risk group like IHD, COPD. Single shot nerve blocks have limited duration of sensory and motor blocks, whereas usage of continuous nerve blocks with placement of catheters is restricted due to financial constraints, which is overcome by adding adjuvants to local anaesthetics which prolongs the sensory and motor blocks.

**Aims And Objectives:** The aim of the study was to compare the safety and efficacy of adding 50 µg Dexmedetomidine to 0.50% Bupivacaine in onset of block, duration of sensory block and motor block, requirement of opioid analgesics, backup analgesia in postoperative period and incidence of postoperative vomiting.

**Materials And Methods :** 60 patients belonging to ASA I and ASA 2 status of age group between 18-60 years scheduled for elective upper limb surgeries were selected for this prospective randomized double blinded comparative study. They were randomly divided by sealed envelope technique into 2 groups. Group C (Control group), where patients received 30 mL of 0.50%

Bupivacaine with 2 mL of normal saline and Group D (Dexmedetomidine group), where patients received 30 mL of 0.50% Bupivacaine with 50 µg of dexmedetomidine for supraclavicular block in patients scheduled for upper limb surgeries. Inj. Midazolam 1 mg given IV before block to reduce the anxiety, Inj pentazocine given IV before starting of surgery as an Intraoperative analgesic at the dose of 0.60mg/kg.

**Results:** There was no significant difference in onset of block between two groups. Duration of motor block and sensory block is significantly prolonged in group D than group C. Postoperative backup and opioid analgesic requirement is significantly lower in group D compared to group C. Incidence of postoperative vomiting is significantly lower in group D compared to group C.

**Conclusions:** Addition of Dexmedetomidine as an adjuvant to Bupivacaine for supraclavicular brachial plexus block significantly prolongs the duration of sensory and motor block in patients undergoing upper limb surgeries. Addition of Dexmedetomidine to local anaesthetics is remarkable, safe and cost effective method of providing postoperative analgesia in the absence of brachial plexus catheters. Requirements of opioid

analgesic and backup analgesic, postoperative vomiting were significantly lower in Dexmedetomidine group compared to group C.

**Keywords:** Bupivacaine, Dexmedetomidine, Adjuvant, Supraclavicular Brachial Plexus Block

### **Introduction**

Upper limb surgery is one of the most commonly performed orthopaedic procedures. Any surgical procedure is not without pain and one of the main aim of the Anaesthesiologist is to provide good operating conditions and effective postoperative analgesia.

Supraclavicular brachial plexus block is one of the regional anaesthesia techniques that is employed as an alternative to general anaesthesia for surgery of upper limbs. This technique involves injecting local anaesthetic agents in close proximity to the brachial plexus, temporarily blocking the sensation and ability to move the upper extremity. The subject can remain awake during the surgical procedure and can be sedated or even fully anaesthetized if necessary. Of various local anaesthetics commonly used are Lignocaine, Bupivacaine and Ropivacaine. Lignocaine use is restricted for its short duration of action. Ropivacaine known for its higher cost . Bupivacaine can be safely used as it has longer duration of action. But it has limited duration of action and analgesic effects. Therefore, adding an adjuvant analgesic is an alternative to prolong the analgesic duration and to decrease the potential risk of side effects of local anaesthetics by reducing the dose of local anaesthetics.

There has been a lot of renewed interest in the usage of additive drugs that prolong the duration of analgesia postoperatively to produce effective pain relief to patients without producing much haemodynamic changes. Many adjuvants have been added in the effort to prolong the duration of local anaesthetics like Epinephrine, Butorphanol tartrate, Dexamethasone, Tramadol,

Buprenorphine, Verapamil, Methylprednisolone, Clonidine, Dexmedetomidine<sup>[1]</sup>. Of all the adjuvants, Dexmedetomidine has shown promising results and is completely devoid of complications<sup>[2]</sup>. Dexmedetomidine action have been shown to be dose dependent and peripherally mediated. The present study had been undertaken to evaluate the onset time, duration of sensory and motor block, postoperative analgesic duration, incidence of vomiting, requirements of rescue and backup analgesia in first 24 hours with 0.50% Bupivacaine along with 50 µg of Dexmedetomidine combination compared to 0.50% Bupivacaine for brachial plexus block by supraclavicular approach.

### **Material And Methods**

This study was conducted in the Department of Anaesthesiology, J.L.N.M.C.H BHAGALPUR after obtaining approval from Institutional Ethics Committee. Informed consent was taken from the patients. The study was conducted over a period of 9months. Only those who gave wilful written consent were included in the study; 60 patients of age groups 18 to 60 years undergoing upper limb surgery under supraclavicular brachial plexus block were enrolled in a prospective, randomized, double-blind, placebo-controlled trial. Patients were randomly allocated in this double blind study (Using a sealed envelope technique) into two groups, each group containing 30 patients. Group C-received 30 mL of 0.50% Bupivacaine plus 2 mL of normal saline. Group D-received 30 mL of 0.50% Bupivacaine plus 50 µg of Dexmedetomidine. Inclusion Criteria ASA class 1 and 2 age group between 18 to 60 years consenting patients. Exclusion Criteria Unwilling patients, ASA class 3, 4 and 5, infection at the site of injection, presence of coagulopathies, hypersensitivity to Bupivacaine and Dexmedetomidine. Patients with a history of significant neurological, psychiatric, neuromuscular, cardiovascular, pulmonary,

renal, hepatic disease, alcoholism or drug abuse, pregnancy or lactating women patients with morbid obesity, diabetes, peripheral vascular disease and patients receiving adrenoceptor agonist or antagonist therapy or chronic analgesic therapy. On the day before surgery, patients were explained about the procedure to be undertaken and the benefits and risks involved in the procedure. All the patients were explained about the Visual Analogue Scale (VAS) and made well conversant with it. All the patients were instructed to remain in fasting state from 9 pm onwards and Tab. Alprazolam 0.5 mg given orally as an anxiolytic. After arrival of patients in the operation theatre, they were allotted C and D groups by sealed envelope technique. Patient is secured with 18G Cannula on the opposite hand to be operated and maintenance fluid Dextrose normal saline is started. Patient is monitored with multichannel monitor for NIBP, Pulse rate, SPO<sub>2</sub>, temperature and 3 lead ECG. Inj. Midazolam 1 mg given intravenously before block to reduce the anxiety and discomfort during the block. Pentazocine given IV before starting of surgery as an intraoperative analgesic at the dose of 60 µg/kg. All the resuscitation equipment and the general anaesthesia equipment are kept ready in case of complications and block failure. The patients were administered either normal saline or dexmedetomidine according to their group category mixed with 0.50% Bupivacaine. Procedure: The patient is placed in a supine position with the head turned away from the side to be blocked. The arm to be anaesthetized should be adducted and the hand should be extended along the side toward the ipsilateral knee as far as possible. The midpoint of the clavicle should be identified and marked. The posterior border of the sternocleidomastoid can be palpated easily when the patient raises the head slightly. The palpating fingers can then roll over the belly of the anterior scalene muscle into

the interscalene groove, where a mark should be made approximately 1.5 to 2.0 cm posterior to the midpoint of the clavicle. Palpation of the subclavian artery at this site confirms the landmark<sup>[3,4]</sup>. After appropriate preparation and development of a skin wheal, the anaesthesiologist stands at the side of the patient facing the patient's head. A 22-gauge, 4 cm needle is directed in a caudad, slightly medial and posterior direction until a paraesthesia or motor response is elicited or the first rib is encountered. Paraesthesia or motor response of the arm is elicited. After elicitation of paraesthesia 30 mL of 0.50% Bupivacaine mixed with 2 mL of normal saline is injected in Group C and 30 mL of 0.50% Bupivacaine mixed with 50 µg of dexmedetomidine injected in Group D. Strict vigilance is kept for the complications of supraclavicular block like intravascular injury and pneumothorax is 0.5% to 6%. Other complications include frequent phrenic nerve block (40% to 60%), Horner's syndrome (ptosis, miosis, anhidrosis) and neuropathy. The presence of phrenic or cervical sympathetic nerve blockade normally requires only reassurance. Although nerve damage can occur, it is uncommon and usually self-limited<sup>[5,6]</sup>. Onset time of block (Time for surgical anaesthesia) is defined as the time gap between the completion of local anaesthetic injection to pinprick discrimination. Postoperatively, all the patients were shifted to the recovery room ICU. For first 24 hours. Patients were assessed for pain, nausea and vomiting. Postoperative pain<sup>[7,8]</sup>. assessed with Visual Analogue Scale (VAS) score of 0-10 (0=no pain, 10=worst imaginable pain). VAS scores >4 were treated with Inj. Diclofenac sodium 75 mg intramuscularly. If analgesia is still inadequate after 30 minutes, Inj. Pentazocine 30 mg intravenous given. The total administered doses of Diclofenac sodium and of Pentazocine during the first 24 hours was recorded. Time for the first analgesic requirement was noted Duration of

postoperative analgesia was defined as the time between last suture application and requirement for first rescue analgesic at VAS score >4. Patients were monitored throughout the study period for evidence of feeling of pain during surgery and acceptance of the procedure. Sensory block was assessed by the pinprick method. Assessment of sensory block was done at each minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade. Sensory onset was considered when there was a dull sensation to pinprick along the distribution of any of the abovementioned nerves. Complete sensory block was considered when there was complete loss of sensation to pinprick<sup>[9,10]</sup>. Sensory Block was Graded as • Grade 0: Sharp pain felt. • Grade 1: Analgesia, dull sensation felt. • Grade 2: Anaesthesia, no sensation felt. Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade was considered when there was Grade 1 motor blockade. Peak motor block was considered when there was Grade 2 motor blockade. Motor block was determined according to a modified Bromage scale for upper extremities on a 3-point scale:

- Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers.
- Grade 1: Decreased motor strength with ability to move the fingers only.
- Grade 2: Complete motor block with inability to move the fingers.

The block was considered incomplete or failed block when patient did not have analgesia even after 30 min. of drug injection<sup>[9,10]</sup>. Patient was monitored for haemodynamic variables such as heart rate, blood pressure and oxygen saturation every 5 min. after the block intraoperatively and every 60 min. postoperatively.

Assessment of blood loss was done and fluid was administered as per the loss. Duration of surgery was noted. The intra- and post-operative assessment was done by another anaesthesiologist who was unaware of the drug used. Patients were assessed for duration of analgesia as per a numeric rating scale of 0 to 10. The numeric rating scale was recorded post-operatively every 60 min. till the score of 4.

The rescue analgesia was given in the form of Inj. Diclofenac sodium (1.5 mg/kg) intramuscularly at the VAS  $\geq$ 4 and the time of administration was noted. All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, haematoma, local anaesthetic toxicity and post-block neuropathy in the intra- and post-operative periods. Comparison between two groups was done by using student's t-test. P value 0.05 was considered insignificant.

### Results

There is no significant difference with respect to age, gender and duration of surgical procedure in two groups (Table1). The anaesthesia technique is similar in two groups.

Parameters	Group C	Group D
Age (Years)	44.78±13.54	44.54±14.67
Gender (M:F)	18:12	17:13
Height (cm)	164.10±6.76	165.8±5.68
Weight (kg)	55.76±8.45	57.87±7.67
Duration of Surgery (Minutes)	54.34±21.56	55.14±22.45

Table 1: Demographic Profile The onset of action of supraclavicular block had no significant difference between two groups.

Parameters	Group C	Group D	P Value
Time for Onset	9.89± 7.86	9.72± 4.76	0.9196

of Action of Supraclavicular Block(min)			
Duration of motor block(min)	174.38±69.38	434.76±96.38	<0.0001
Duration of sensory block(min)	145.67±31.67	286.56±52.74	<0.0001
Time for Onset of Pain in the Postoperative Period(min)	174.38±69.38	434.76±96.38	<0.0001

Table 2: Time for Onset and duration of Supraclavicular Block

The onset time of sensory block was slightly earlier in the dexmedetomidine group than in the control group ( $P=0.9196$ ) [Table 2]but . There was no significant difference in onset of block between two groups

Duration of motor block is significantly higher in group D compared to group C[Table 2].

Duration of sensory block is significantly higher in group D compared to group C. Duration of Sensory Block Time for onset of pain in the postoperative period is significantly prolonged in group D compared to group C[Table 2]. Both mean heart rate(figure1) and mean arterial pressure(figure2) were similar in postoperative patients and no significant difference between them.

Parameters	Group RD	Group R	P value
Vomiting	2	4	0.204
Haematoma	2	3	0.125
Bradycardia	4	1	0.344

Table 3: Comparison of side effects

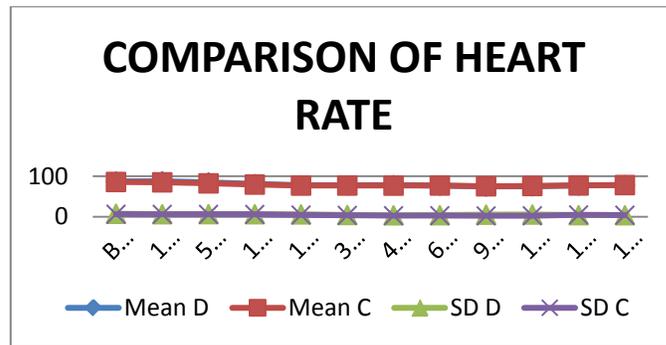


Figure 1: Comparison of Heart Rate

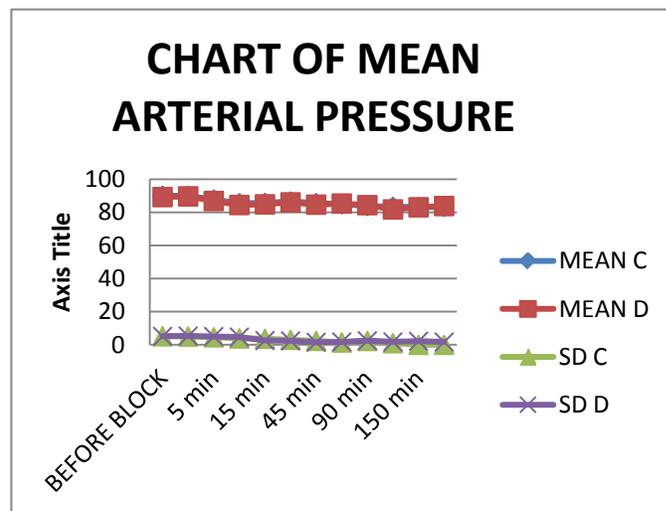


Figure 2: Comparison of Mean Arterial Pressure

### Discussion

Supraclavicular brachial plexus block is one of the most common regional anaesthesia technique for upper limb surgeries. A wide variety of intrathecal adjuvants have been added to local anaesthetics for achieving high quality intraoperative and postoperative analgesia with minimal acceptable side effects.

The aim of present study is to investigate whether the addition of Dexmedetomidine as an adjuvant to Bupivacaine for supraclavicular brachial plexus block increases the quality, duration and efficacy of intraoperative and postoperative analgesia. Dexmedetomidine, the pharmacologically active dimer of medetomidine is a highly specific and selective  $\alpha_2$  adrenoceptor agonist with  $\alpha_2:\alpha_1$  binding selectivity ratio

of 1620:1 as compared to 220:1 for clonidine, thus decreasing the unwanted side effects of  $\alpha_1$  receptors<sup>[11-13]</sup>. Sensory block, motor block, duration of analgesia was much prolonged than control group. In patients with high risk factors for surgery under general anaesthesia, regional anaesthesia by using supraclavicular brachial plexus block has been used as ideal alternative. By adding an adjuvant to local anaesthetics prolongs the duration of analgesia. Advantages of adding adjuvant to local anaesthetic include prolongation of sensory block, motor block, delayed onset of pain in the postoperative period, low dosage administration of opioid analgesics in the postoperative period and lower incidence of postoperative vomiting<sup>[14,15]</sup>. In our study, the surgeries varied from midshaft of humerus to lower end fractures of radius, ulna and fingers. No major complications were encountered in our study. To conclude in view of profound postoperative analgesia, delayed onset of pain in postoperative period, low dosage requirement of opioid, lower incidence of postoperative vomiting, lower rate of complications along with early ambulation and discharge makes supraclavicular block with local anaesthetic with adjuvant an ideal alternative anaesthesia technique to General anaesthesia in selected group of patients with high risk factors for General anaesthesia.

### Conclusion

Addition of Dexmedetomidine as an adjuvant to Bupivacaine for supraclavicular brachial plexus block significantly prolongs the duration of sensory and motor block. It decreases dose of postoperative Diclofenac and opioids requirements. • It decreased incidence of postoperative nausea and vomiting. • It prolongs the time to the first request of an analgesic. • It has no relevant impact on the time to achieve complete sensory or motor block. Addition of Dexmedetomidine as an adjuvant to Bupivacaine for supraclavicular brachial plexus block

used in our study is safe to use and have no side effects and cost effective method of providing postoperative analgesia.

### References

1. Asok Kumar Buvanendran, Jeffrey S Kran. Useful adjuvants for postoperative pain management. *Best Practice & Research Clinical Anaesthesiology* 2007;21(1):31-49.
2. Yoshitomi Tatsushi, Kohjitani Atsushi, Maeda Shigeru, et al. Dexmedetomidine enhances the local anaesthetic action of lidocaine via an  $\alpha$ -2a adrenoceptor. *Anaesth Analg* 2008;107(1):96-101.
3. Denise J Wedel, Terese T, Horlocker, et al. In: Miller Ronald D. Miller, Miller, Anaesthesia, Newyork; Churchill L Livingstone 7th edition:1640-1643.
4. Ban CH Tsui, Richard W Rosenquist, Peripheral Nerve Blockade, et al. *Clinical Anaesthesia*, Philadelphia, Lippincott Williams & Wilkins 6th edition:968 -977.
5. Brull R, McCartney CJ, Chan VW, et al. Neurological complications after regional anaesthesia: contemporary estimates of risk. *Anaesth Analg* 2007;104(4):965-74.
6. Myers RR, Kalichman MW, Reisner LS, et al. Neurotoxicity of local anaesthetics: altered perineurial permeability, edema, and nerve fiber injury. *Anesthesiology* 1986;64(1):29-35.
7. Amany S Ammar, Khaled M Mahmoud. Ultrasoundguided 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 J Anaesth* 2012;6(2):109-114.
8. Obayah GM, Refaie A, Aboushanab O, et al. Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia after cleft palate repair. *Eur J Anaesthesiol* 2010;27(3):280-4.

9. Brummett CM, Norat MA, Palmisano JM, et al. Perineural administration of dexmedetomidine in combination with bupivacaine enhances sensory and motor blockade in sciatic nerve block without inducing neurotoxicity in rat. *Anaesthesiology* 2008;109(3):502-11.
10. Saadawy I, Boker A, Elshahawy MA, et al. Effect of dexmedetomidine on the characteristics of bupivacaine in a caudal block in paediatrics. *Acta Anaesthesiol Scand* 2009;53(2):251-6.
11. Sarita S Swami, Varshali M Keniya, Sushma D Ladi, et al. Comparison of dexmedetomidine and clonidine ( $\alpha_2$  agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: a randomised double-blind prospective study. *Ind J Anaesth* 2012;56(3):243-9.
12. Swami SS, Keniya VM, Ladi SD, et al. Comparison of dexmedetomidine and clonidine ( $\alpha_2$  agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: a randomized double-blind prospective study. *Ind J Anaesth* 2012;56(3):243-9.
13. Kosugi T, Mizuta K, Fujita T, et al. High concentrations of dexmedetomidine inhibit compound action potentials in frog sciatic nerve without  $\alpha_2$  adrenoceptor activation. *Br J Pharmacol* 2010;160(7):1662-76.
14. El-Hennawy AM, Abd-Elwahab AM, Abd-Elmaksoud AM, et al. Addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children. *Br J Anaesth* 2009;103(4):617.
15. Esmaglu A, Yegenoglu F, Akin A, et al. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anaesth Analg* 2010;111(6):1548-51.