Section: Anesthesiology

Original Research Article

# EFFECT OF DEXMEDETOMIDINE AS AN ADJUVANT TO 0.5% BUPIVACAINE IN BRACHIAL PLEXUS BLOCK

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## Abstract

**Background:** The upper extremity surgery is the most common indication of supraclavicular brachial plexus block. It is superior, provides long lasting analgesia and avoids potential side effects of general anaesthesia such as nausea, vomiting, dental trauma, sore throat, allergic reactions and intraoperative hemodynamics. The objectives of my study are: To compare the time of onset and duration of block using 0.5% Bupivacaine alone and with Dexmedetomidine as an adjuvant. To determine the hemodynamic status of patients when Dexmedetomidine is used as an adjuvant to 0.5% Bupivacaine in Brachial Plexus Block. **Materials and Methods:** We studied 64 ASA I & II patients undergoing upper limb surgeries under supra clavicular brachial plexus block done by ultrasound guidance technique. Patients were randomly allocated to two groups by lott picking method. Group B :( n-32) – 20 ml 0.5% bupivacaine + 1mL normal saline. Group BD :( n-32) – 20ml 0.5% bupivacaine + dexmedetomidine 50mcg. Patients were evaluated for sensory & motor block onset and duration, duration of analgesia, hemodynamic parameters including non-invasive blood pressure, pulse rate, saturation intra operatively and post operatively. **Result:** The onset of sensory and motor block was faster in group BD (10.31 +/- 3.79 mins and15.72 +/- 4.75 mins respectively) when compared to group B (18.44 +/- 4.43 mins and 26.25 +/- 5.95 mins respectively). Group BD showed prolonged duration of action of sensory (782.66 +/- 29.56 mins) and motor block (737.81 +/- 37.74 mins) thereby providing prolonged duration of analgesia in the postoperative period. There was a xv significant drop-in heart rate from the baseline from 10 mins and mean arterial pressure from 15 mins without causing any adverse hemodynamic instability in the study group. **Conclusion:** Dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus provides faster onset and increased duration of sensory and motor block thereby providing better postoperative analgesia without causing adverse effect to the patients.

## INTRODUCTION

The brachial plexus block is the most popular regional block for surgeries of upper limb. Brachial plexus block can be done by various approaches. Supraclavicular approach is the most favoured, fulfilling all the surgical requirements with the potential disadvantages of accidental pneumothorax and inadvertent vascular puncture.[1] "Spinal anaesthesia of upper extremity" is the term for supraclavicular approach to brachial plexus. It provides excellent anaesthesia of upper limb with rapid onset.[2]

The upper extremity surgery is the most common indication of supraclavicular brachial plexus block. It is superior, provides long lasting analgesia and avoids potential side effects of general anaesthesia such as nausea, vomiting, dental trauma, sore throat, allergic reactions and intraoperative hemodynamics fluctuations.[2]

Dexmedetomidine is an alpha2 adrenoceptor agonist, commonly used as an adjuvant to 0.5% bupivacaine to improve the quality and duration of block.[1] Dexmedetomidine, the pharmacologically active d-isomer of medetomidine, is a highly specific and selective alpha2 adrenoceptor agonist with alpha 2: alpha 1 binding selectivity ratio of 1620:1 as


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compared to 220:1 of clonidine, thus decreasing the unwanted side effects of alpha 1 receptor.

Dexmedetomidine when added to bupivacaine for supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs the duration. The significantly prolonged duration of analgesia obviates the need for any additional analgesics. The added advantage of conscious sedation, hemodynamic stability and minimal side effects makes it a potential adjuvant for nerve block.[3] Moreover, in humans, various studies have found that clonidine and dexmedetomidine to be safe and effective in various neuraxial and regional anaesthesia including intrathecal and intravenous regional anaesthesia.[4]

## MATERIALS AND METHODS

It was a Longitudinal comparative study conducted at Department of Anaesthesiology, Pushpagiri Institute of Medical Sciences and Research Centre, Tiruvalla for a after ethics clearance for a period of 18 months. Patients of age 18-65 years coming for upper limb surgeries (forearm and hand) to Pushpagiri Institute of medical sciences and research centre, Tiruvalla.

Random sampling technique was used and Sample size is calculated using mean onset of sensory block for group B and Group BD from previous study. Confidence level of 99% at power of study was 90%. The sample size obtained was 32 in each group using the following formula:

$$\text{Sample size (n)} = S_1^2 + S_2^2 \frac{[Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}]2}{\bar{x}_1 - \bar{x}_2}$$

**Inclusion Criteria**

- ASA I & II
- Age 18-65 years
- Patients undergoing forearm and hand surgeries

**Exclusion Criteria**

- Patients with neurological and neuromuscular disorders,
- Brachial plexus injury,
- Sensitive or allergic to study medication,
- Clotting disorder,
- Local infection,
- Pregnancy,
- Patient refusal.

## RESULTS

Pre-anaesthetic check-up was done on the day before surgery. An informed written consent was taken. All patients were kept fasting for 8 hours before surgery. The patients coming under the inclusion criteria were allotted into Group B (Bupivacaine) and Group BD (Bupivacaine + Dexmedetomidine) randomly using lott picking method. Group B included control group; receiving 20ml of 0.5% bupivacaine + 1 ml normal saline, and Group BD included study group receiving 20ml of 0.5% bupivacaine + 50mcg (1 ml) dexmedetomidine. The added advantage of conscious sedation, hemodynamic stability, and minimal side effects makes dexmedetomidine as a potential adjuvant for nerve blocks.[2]

The investigator was unaware of the study group and the control group. The senior consultant prepared the drug. Investigator entered the operating room after the preparation of the drug.

In the operating room, patients baseline parameters like heart rate, blood pressure and oxygen saturation were recorded. An IV line was secured and infusion of Ringer Lactate was started and patient was premedicated with Inj. Ondansetron 4mg + Inj. Midazolam 1mg iv. Under strict aseptic precaution, the supraclavicular brachial plexus block was performed in the supine position under ultrasound guidance.

Sensory and motor blocks was evaluated every 3 min within 1st 30 mins following completion of drug administration. Vitals (HR, BP, SpO2) were recorded every 5 min for 1st 30 mins and thereafter every 10mins till the end of surgery. Intraoperative need for any supplementation of anaesthesia was noted. Post-operative sensory and motor blockade and vitals were noted at 10 mins, 30 mins & 1, 2, 4, 6, 12 hrs after the end of surgery.

**Statistical Analysis:** This study was conducted with the approval of the Institutional Ethical committee. ASA 1 and 2 patients posted for upper limb surgeries were selected randomly. Collected data were compiled to statistical analysis using SPSS software.

As per [Table 1] the age ranged from 18-65 years. Mean (SD) age of the study group was 43.3 (13.9) and that of the control group was 38.2(13.9) years. The difference in age between the two groups was not statistically significant (p = 0.08). There was no difference in the male: female ratio between the two groups

As per [Table 2] the onset of sensory and motor blockade was studied among the two groups and was found that there is statistically significant difference between the study group and control group. Onset of sensory and motor block in study group was faster when compared to control group. The duration of sensory and motor blockade was studied among the two groups and was found that there is statistically significant difference between the study group and control group (p value < 0.05). Duration of sensory and motor block in study group was longer when compared to control group.

As per [Table 3] The heart rate among the two groups were studied and came to conclusion that there is no much significant difference in heart rate among the study group and control group. However, there is a slight reduction in the heart in the study group without hemodynamic instability.

As per [Table 4] mean arterial pressures was compared among the two groups and found that there is a significant reduction in mean arterial pressure in


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the study group after 20mins without causing instability to patient.

As per [Table 5] systolic Blood Pressure among the two study groups were compared and came to conclusion that there is a significant reduction in systolic blood pressure but it didn't cause any instability to patient.

As per [Table 6] Diastolic Blood Pressure among the two study groups were compared and came to conclusion that there is a significant reduction in diastolic blood pressure without causing instability to patient.

As per [Table 7] comparison of saturation among the two groups was done and found that there is no statistically significant difference among the study group and control group.

**Table 1: Age distribution of study participants in the two groups**

| Age in groups (in years) | Study groups n (%) | Control group n (%) |
|---|---|---|
| <=30 | 10 (31.3) | 12(37.5) |
| 31-45 | 5 (15.6) | 7(21.9) |
| 46-65 | 17(53.1) | 13(40.6) |
| Total | 32 | 32 |
| Mean (SD) | 43.3(14.0) | 38.2(13.9) |
| Median (min – max) | 47.5(23-65) | 42.0(19-65) |

**Table 2: Onset of blockade and Duration among 2 groups**

| Variable | Study group Mean+/- SD | Control group Mean +/-SD |
|---|---|---|
| Onset of sensory blockage (min) | 10.31 +/- 3.79 | 18.44 +/- 4.43 |
| Onset of motor blockage (min) | 15.72 +/- 4.75 | 26.25 +/- 5.95 |

*Mann-Whitney U test *p value = 0.000 *significant

**Table 3: Heart rate among study and control group**

| Variable | Study group Mean +/- SD | Control group Mean +/- SD |
|---|---|---|
| HR baseline | 75.06 | 74.78 |
| HR 5 min | 71 | 73.91 |
| HR 10 min | 67.66 | 74.19 |
| HR 15 min | 66.22 | 73.41 |
| HR 20 min | 63.95 | 72.63 |
| HR 30 min | 62.59 | 72.94 |
| HR 40 min | 62.22 | 72.34 |
| HR 50 min | 61.44 | 72.81 |

*Mann Whitney U test *p value = 0.98 * not significant

**Table 4: Comparison of mean arterial pressure among two groups**

| Variable | Study group Mean +/- SD | Control group Mean +/- SD | P value |
|---|---|---|---|
| MAP baseline | 91.03 +/- 19.45 | 93.16 +/-11.6 | 0.63 |
| MAP 5 min | 91.09 +/- 10.70 | 93.63 +/- 10.9 | 0.50 |
| MAP 10 min | 88.37 +/- 10.41 | 93.97 +/-11.5 | 0.088 |
| MAP 15 min | 87.34 +/- 10.23 | 93.47 +/- 11.1 | 0.041 |
| MAP 20 min | 85.47 +/- 11.07 | 93.63 +/- 10.6 | 0.006 |
| MAP 30 min | 83.88 +/-11.04 | 92.53 +/- 11.0 | 0.003 |
| MAP 40 min | 83.12 +/-10.15 | 92.75 +/- 10.8 | 0.001 |
| MAP 50 min | 83.41 +/-9.94 | 92.91 +/- 10.7 | 0.002 |

**Table 5: Comparison of systolic blood pressure among two groups**

| Variable | Study group Mean +/- SD | Control group Mean +/- SD | P value |
|---|---|---|---|
| SBP baseline | 130.37 +/-17.72 | 124.62 +/- 16.11 | 0.32 |
| SBP 5 min | 125.81 +/- 16.95 | 124.66 +/- 15.84 | 0.83 |
| SBP 10 min | 122.19 +/-17.23 | 126.09 +/- 16.41 | 0.30 |
| SBP 15 min | 119.59 +/-17.03 | 126.47 +/- 17.57 | 0.12 |
| SBP 20 min | 117.06 +/- 16.90 | 126.03 +/- 16.33 | 0.03 |
| SBP 30 min | 115.19 +/- 17.05 | 124. 97 +/- 17 | 0.02 |
| SBP 40 min | 114.03 +/- 16.35 | 125.72 +/- 16.9 | 0.008 |
| SBP 50 min | 114.72 +/- 16.06 | 126.12 +/- 17.10 | 0.011 |

**Table 6: Diastolic blood pressure comparison**

| Variables | Study group Mean +/- SD | Control group Mean +/- SD | P value |
|---|---|---|---|
| DBP baseline | 77.94 +/- 7.6 | 78.72 +/-10.79 | 0.96 |
| DBP 5 min | 75.41 +/-8.33 | 79.31 +/- 10 | 0.23 |
| DBP 10 min | 73.22 +/- 7.2 | 78.94 +/-10.76 | 0.03 |
| DBP 15 min | 72.12 +/- 7.9 | 78.59 +/-10.26 | 0.02 |
| DBP 20 min | 70.41 +/- 9.63 | 79.06 +/- 9.67 | 0.001 |
| DBP 30 min | 69.59 +/- 9.63 | 76.63 +/- 9.7 | 0.007 |
| DBP 40 min | 68.72 +/- 8.2 | 77.56 +/- 9.35 | 0.001 |


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| | | | |
|---|---|---|---|
| DBP 50 min | 69.19 +/- 8.6 | 77.72 +/- 0.22 | 0.001 |

**Table 7: SpO2 comparison among two groups**

| Variable | Study group Mean +/- SD | Control group Mean +/- SD |
|---|---|---|
| SpO2 baseline | 98.44 +/- 0.75 | 99.25 +/- 2.6 |
| SpO2 5 min | 98.53 +/- 0.95 | 98.69 +/- 1 |
| SpO2 10 min | 98.44 +/- 0.91 | 98.72 +/- 0.7 |
| SpO2 15 min | 98.44 +/- 0.98 | 98.63 +/- 0.87 |
| SpO2 20 min | 98.41 +/- 1 | 98.72 +/- 0.81 |
| SpO2 30 min | 98.47 +/- 0.95 | 98.75 +/- 0.8 |
| SpO2 40 min | 98.59 +/- 0.83 | 98.72 +/- 0.9 |
| SpO2 50 min | 98.56 +/-0.8 | 98.84 +/- 0.8 |

## DISCUSSION

In this study, we aimed at finding the onset and duration of sensory and motor blockade when used with bupivacaine alone and when an adjuvant like dexmedetomidine is combined with bupivacaine in supraclavicular brachial plexus block.

A study conducted by Aksu et al,[5] found that there is no difference between sensory and motor block and analgesia among the groups who received 30ml 0.33% bupivacaine and 15ml 0.33% bupivacaine with 1mcg/kg dexmedetomidine. This might be due to the usage of lesser volume of drug in the study group. However, in our study there was a significant difference in sensory and motor block and analgesia among the two groups.

Gupta et al,[6] found that ED50 dose of bupivacaine for supraclavicular block is not dependent on the concentration. Bharti et al,[7] did a comparative study with ropivacaine 0.75% and 2% lidocaine with adrenaline with and without dexmedetomidine 1mcg/kg and found that onset time for motor block was shortened whereas in our study using 0.5% 20ml bupivacaine with 50mcg dexmedetomidine found that onset of motor as well as sensory block was faster when compared to the control group without dexmedetomidine. Similar study was also done by Mistry et al,[8] with ropivacaine. Hemodynamic parameter was studied by Das et al,[9] using ropivavaine with dexmedetomidine and concluded that dexmedetomidine does not cause significant hemodynamic instability which was similar in our study using bupivacaine and dexmedetomidine.

Study conducted by Biswas et al,[10] used 35ml levobupivacaine with dexmedetomidine 100mcg using a nerve stimulator whereas in our study we used 20ml bupivacaine using USG guidance. Bisui et al,[11] in his study, used 28ml 0.5% levobupivacaine with 0.75mcg/kg dexmedetomidine and said that the onset of sensory and motor block was shortened and duration was prolonged. This suggests that ultrasound guidance require lesser volume of drug.

Saric et al,[12] studied on the effect of age on minimum volume of local anaesthetic for ultrasound guided supraclavicular brachial plexus block and concluded that a reduced minimum effective anaesthetic volume for usg guided in elderly patients. In our study we had an age criteria, hence we didn't find a volume reduction in elderly patients.

Tripathi et al,[13] and Hamed et al,[14] studied among clonidine and fentanyl respectively with dexmedetomidine as an adjuvant to bupivacaine and found that duration of analgesia was better with dexmedetomidine rather than clonidine / fentanyl and dexmedetomidine improves the quality of anaesthesia. Similar result was found in our study that dexmedetomidine improved the quality of anaesthesia/ analgesia as an adjuvant to bupivacaine.

Avula et al,[15] used 75mcg dexmedetomidine with 0.5% bupivacaine for USG guided subclavian perivascular brachial plexus block to study the onset and duration of block and came to the conclusion that it shortens the onset and prolongs the duration of block. Whereas in our study we used 50mcg dexmedetomidine with 0.5% bupivacaine and obtained a similar result to Avula et al. thus we conclude that 50mcg dexmedetomidine is sufficient to fasten the onset and prolong the duration of blockade.

Boghdadly et al,[16] did a systematic review and meta-analysis and came to a conclusion that dexmedetomidine enhances the sensory, motor and analgesic block characteristics when compared to clonidine. Therefore among the alpha 2 agonist, dexmedetomidine is the best as an adjuvant.

## CONCLUSION

From the current study, we conclude that 0.5% 20ml bupivacaine when combined with dexmedetomidine 50mcg produces faster onset in sensory and motor blockade and also prolongs the duration of action, thereby producing adequate analgesia for the patient in the postoperative period without requiring additional dose of analgesics.

## REFERENCES


1. Mistry T ,Mangal V, Sharma G , Agarwal A. Assessment of variation in dept of brachial plexus using ultrasound for supraclavicular brachial plexus block in patients undergoing elective upper limb surgery. Indian J Anaesth 2016;60:393-7.
2. Hadzic A. Supraclavicular Brachial Plexus Block. Hadzic's Peripheral Nerve Blocks and Anatomy for Ultrasound Guided Regional Anaesthesia. 2nd Edition. New York, USA: McGraw Hill 2012; 167 – 174, 361 – 368
3. Agarwal S, Agarwal R, Gupta P. Dexmedetomidine prolongs the effect of Bupivacaine in supraclavicular brachial plexus block. J.Anaesthesiol Clin Pharmacol.2014;30(1):36 - 40.
4. Tripathi A,Sharma K,Somvanshi M,Samal RL. A comparative study of clonidine and dexmedetomidine as an adjuvant to




ISSN (O): 2687-5365; ISSN (P): 2753-6556

Bupivacaine in supraclavicular brachial plexus block. J.Anaesthesiol ClinPharmacol 2016;32:344-8.
5. Aksu R, Bicer C. Addition of dexmedetomidine to bupivacaine in supraclavicular brachial plexus block. Clin Invest Med. 2017 Jun 26;40(3):E111-E116.
6. Gupta PK, Hopkins PM. Effect of concentration of local anaesthetic solution on the $ED_{50}$ of bupivacaine for supraclavicular brachial plexus block. Br J Anaesth. 2013 Aug;111(2):293-6.
7. Bharti N, Sardana DK, Bala I. The Analgesic Efficacy of Dexmedetomidine as an Adjunct to Local Anesthetics in Supraclavicular Brachial Plexus Block: A Randomized Controlled Trial. Anesth Analg. 2015 Dec;121(6):1655-60. doi: 10.1213/ANE.0000000000001006. PMID: 26496366.
8. Mangal V, Mistry T, Sharma G, Kazim M, Ahuja N, Kulshrestha A. Effects of dexmedetomidine as an adjuvant to ropivacaine in ultrasound-guided supraclavicular brachial plexus Block: A prospective, randomized, double-blind study. J Anaesthesiol Clin Pharmacol. 2018 Jul-Sep;34(3):357-361.
9. Das B, Lakshmegowda M, Sharma M, Mitra S, Chauhan R. Supraclavicular brachial plexus block using ropivacaine alone or combined with dexmedetomidine for upper limb surgery: A prospective, randomized, double-blinded, comparative study. Rev Esp Anestesiol Reanim. 2016 Mar;63(3):135-40. English, Spanish.
10. Biswas S, Das RK, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: a randomized double blind prospective study. Ethiop J Health Sci. 2014 Jul;24(3):203-8.
11. Bisui B, Samanta S, Ghoshmaulik S, Banerjee A, Ghosh TR, Sarkar S. Effect of Locally Administered Dexmedetomidine as Adjuvant to Levobupivacaine in Supraclavicular Brachial Plexus Block: Double-blind Controlled Study. Anesth Essays Res. 2017 Oct-Dec;11(4):981-986.
12. Pavičić Šarić J, Vidjak V, Tomulić K, Zenko J. Effects of age on minimum effective volume of local anesthetic for ultrasound-guided supraclavicular brachial plexus block. Acta Anaesthesiol Scand. 2013 Jul;57(6):761-6.
13. Tripathi A, Sharma K, Somvanshi M, Samal RL. A comparative study of clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2016 Jul-Sep;32(3):344-8
14. Hamed MA, Ghaber S, Reda A. Dexmedetomidine and Fentanyl as an Adjunct to Bupivacaine 0.5% in Supraclavicular Nerve Block: A Randomized Controlled Study. Anesth Essays Res. 2018 Apr-Jun;12(2):475-479
15. Avula RR, Vemuri NN, Puthi S. Ultrasound-Guided Subclavian Perivascular Brachial Plexus Block Using 0.5% Bupivacaine with Dexmedetomidine as an Adjuvant: A Prospective Randomized Controlled Trial. Anesth Essays Res. 2019 Oct-Dec;13(4):615-619.
16. El-Boghdadly K, Brull R, Sehmbi H, Abdallah FW. Perineural Dexmedetomidine Is More Effective Than Clonidine When Added to Local Anesthetic for Supraclavicular Brachial Plexus Block: A Systematic Review and Meta-analysis. Anesth Analg. 2017 Jun;124(6):2008-2020.


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