

Comparative study between dexmedetomidine and dexamethasone as an adjuvant to levobupivacaine for supraclavicular brachial plexus block in patients undergoing upper limb surgeries



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ABSTRACT

Background: Brachial plexus block (BPB) is widely used nowadays in patients undergoing upper limb surgery. Levobupivacaine is one of the best local anesthetics in the current scenario in this field. Both dexmedetomidine (DM) and dexamethasone (DX) are commonly used local anesthetic adjuvants in BPB to enhance blocking effects. In anaesthesiology, there is always a search for a better alternative. **Aims and Objectives:** In this study, we investigated the effect of DM and DX as adjuvants to levobupivacaine on the quality of supraclavicular BPB. **Materials and Methods:** A prospective, double-blind, randomized controlled intervention study (superiority trial) was done involving 60 patients aged 20–60 years, randomly allocated into two equal groups (group S-DM group-Patients were received Injection 0.25% Levobupivacaine 2 mg/kg body weight + Inj. DM 1 mcg/kg body weight + distilled water [total volume 30 mL] and group C-DX group-Patients received Inj. 0.25% Levobupivacaine 2 mg/kg + Inj. DX 0.1 mg/kg body weight + Distilled water [total volume 30 mL]). The scores of the modified Gormley and Hill scale and the modified Bromage scale were recorded along with hemodynamic parameters. Pearson's Chi-square test, Mann-Whitney U-test, one-way ANOVA, Kaplan–Meier survival analysis, and Z-test were used for statistical analysis. **Results:** The onset of motor block was shorter in group-S patients (14.2667 ± 1.0807 [min]) compared to group-C (15.9333 ± 1.5742 [min]), and the duration of motor block was higher in group-S (708.5667 ± 4.2644 [min]) compared to group-C patients (682.3667 ± 20.0095 [min]) ($P < 0.001$). **Conclusion:** DM is a better alternative to DX when added to levobupivacaine for decreasing the onset of sensory and motor block and increasing the duration of supraclavicular BPB.

Key words: Levobupivacaine; Dexmedetomidine; Dexamethasone; Supraclavicular brachial plexus block; Peripheral nerve stimulator

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INTRODUCTION

Peripheral nerve block has taken patient care in anaesthesia to a whole new level. One can extend patient care in the form of extended postoperative analgesia; ensure patient compliance with physiotherapy, and encourage the early mobilization of patients with stable hemodynamic variables.

Various studies have shown that dexmedetomidine (DM) prolongs the duration of sensory and motor block and provides a very good analgesia when used as an adjuvant to local anesthetics (LA) for nerve blocks. The anesthetic and analgesic requirements are reduced substantially because of their analgesic properties and augmentation of LA effects, as they cause hyperpolarization of nerve tissues by altering

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transmembrane potential and ion conductance at locus coeruleus in the brain stem. Steroids have powerful anti-inflammatory as well as analgesic properties. Perineurally injected steroids are reported to influence postoperative analgesia. The effect of dexamethasone (DX) on prolonging the block duration has been observed in animal and human studies. Brachial plexus block (BPB) is one of the easiest, safest, and most commonly performed peripheral nerve blocks in the day-to-day practice of anesthesia. We chose the supraclavicular approach for BPB as the narrowest part of the plexus is located there, and anesthesia will be rapid, dense, and predictable for the entire upper limb. BPB can be used as a substitute for general anesthesia for upper-limb surgeries. By mitigating the stress response and using minimal anesthetic drugs, it provides intraoperative analgesia along with prolonged postoperative pain relief.¹ Varied approach to brachial plexus blockade exist, namely the interscalene, supraclavicular, infraclavicular, and axillary approaches. With the quick onset of dense anesthesia of the upper limb, supraclavicular BPB block is considered the “spinal of the arm.”

Continuous efforts have been made to enhance the outcomes of the block by adding infinite adjuncts to LAs. DX as an adjuvant to perineural LA augments peripheral nerve block analgesia.² DM, an alpha-adrenergic agonist, when mixed with LAs for BPB, facilitates better anesthesia and analgesia.³ The chase for essential adjuvants with the most benefits and minimal side effects continue.

The results of these studies are discordant and call for a more direct comparison between the two adjuncts. The primary outcomes were the onset and duration of sensory and motor blocks. Secondary outcomes were duration of analgesia, total analgesic consumption in 24 h postoperatively, quality of the block, and complications.^{4,5}

In this study, we have chosen DM along with DX to evaluate their onset time, duration of sensory-motor blocks, and comparison between demographic characters.

Aims and objectives

To compare between Dexmedetomidine and Dexamethasone as an adjuvant to Levobupivacaine for Supraclavicular BPB.

1. To compare Onset and Duration of Sensory Block
2. To compare Onset and Duration of Motor Block.

MATERIALS AND METHODS

This is a prospective, double-blind, randomized controlled intervention study (superiority trial) and was conducted in the Department of Anaesthesiology at Bankura Sammilani Medical

College, Bankura, with the permission of the Institutional Ethics Committee. The patients undergoing elective upper limb surgeries under supraclavicular BPB in orthopedic surgery rooms were selected as the study population.

Patients were selected after thorough pre-anesthetic assessments and investigations. 60 patients were divided into two groups, group S and group C, with 30 cases in each group by matching the patient's age, sex, Mallampati score, and American Society of Anesthesiology (ASA) grading (I or II). Patient allocation in the arms was done using the method of randomization by lottery.

Group S: DM group: patients received Injection 0.25% Levobupivacaine 2 mg/kg body weight+Injection DM 1 mcg/kg body weight+distilled water (total volume: 30 mL).

Group C: DX group: patients received Injection 0.25% Levobupivacaine 2 mg/kg+Injection DX 0.1 mg/kg body weight+distilled water (total volume: 30 mL).

Inclusion criteria

The patients between 20 and 60 years old, belonging to ASA grades I and II, who were scheduled for elective upper limb surgeries under BPB, were included.

Exclusion criteria

Those unwilling patients of ASA classes III, IV, and V who had infection at the injection site, had disorders of coagulopathies, and had hypersensitivity to any of Bupivacaine, DX, or DM were excluded from the study.

Age, sex, weight, and height of the patient, time of onset of sensory block, and duration of sensory block were the variables studied.

Written informed consent was obtained from the willing participants after a proper explanation of the study procedure and expected outcome in their own vernacular language.

Randomization

Patients were allocated into two groups by a method of randomization called as lottery method.

Pre-operative assessment

On the day before surgery, each patient was attended to and examined properly for preoperative counseling and a repeat anesthetic check-up. A pre-anesthetic evaluation was performed on each patient, including a detailed history, a thorough physical examination, and relevant preoperative investigations. The nature and procedure of the study were explained to the patients. All patients underwent preoperative fasting for 6–8 h before surgery. Patient's Preparation- The day before surgery, Tablet Alprazolam (0.25 mg) was given at bedtime, and on the day of surgery,

Tablet Pantoprazole (40 mg) and Tablet Domperidone (10 mg) were given. On arrival in the operation room, ASA-standard monitors were attached. SpO₂, ECG, and heart rate were monitored continuously, and non-invasive recordings of systolic, diastolic, and mean arterial pressure were taken. An IV line was started with Ringer's Lactate solution after inserting an 18G cannula.

Procedure

The study drug was prepared by an anesthesiologist who was not involved in the study. The patient was asked to lie supine, and his head was turned to the contralateral side. An interscalene groove was identified, and the site was cleaned with povidone iodine solution. A superficial skin wheal was made one finger breadth above the clavicle in the interscalene groove with 0.5% lignocaine. A 5 cm insulated nerve stimulator needle was attached to a nerve stimulator, and the current to be delivered was set at 2.0 mA with a pulse width of 100 μ s. The needle direction was almost perpendicular, with a slight inclination towards the contralateral nipple, and a desired response in the form of a muscle twitch of the fingers was sought. Once the desired response was attained, the current was reduced to 0.5 mA, and the drugs were injected after negative aspiration for blood before injecting the drugs in aliquots of 3 mL to a total volume of 30 mL. All the observations were recorded in the attached proforma for subsequent statistical analysis.

Relevant investigations were included: complete blood count, serum urea, serum creatinine, serum glucose random, and liver function tests with enzymes.

Sensory blockade was assessed by the pinprick method at a 5 min interval after completion of the block. Blocks of the median and ulnar nerves were assessed by testing the palmar surfaces of the index and little finger, respectively, and the dorsal surface of the thumb was used to test blocks of the radial nerve.

The grading of sensory block was done as follows: grade 0: normal sensation to pin prick. Grade 1: Dull sensation to pinprick Grade 2: No sensation felt. The onset of sensory block is defined as the time interval between drug administration and the onset of grade 1 sensory block in the hand (3 nerve distributions). The full sensory block is defined as the complete loss of sensation to a pinprick.

Motor block was assessed using the Bromage score: Score 0: normal motor function with full extension and flexion of the elbow, wrist, and fingers; score 1: decreased motor strength with the ability to move fingers only or the wrist only; score 2: complete motor block with the inability to move the elbow, wrist, and fingers. The onset of motor block is the time between completion of local anesthetic injection

and complete paralysis, and the duration of motor block was taken as the time interval from complete paralysis to complete recovery of motor function. The block was considered a failed block when at least two of the four nerves (radial, median, ulnar, and musculocutaneous) were not affected even after 30 min after performing the block. Parameters observed were the time of onset and duration of sensory block.

For statistical analysis, data were analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA).

Pearson's Chi-square test, Mann-Whitney U-test, one-way ANOVA, Kaplan-Meier survival analysis, and Z-test were used for statistical analysis. A P<0.05 was considered significant.

RESULTS

The distribution of mean age and weight in kg within groups were not statistically significant (Table 1).

The distribution of sex within groups was not statistically significant (P=1.0000).

Two groups were comparable in terms of hemodynamic changes (systolic, diastolic, and mean arterial pressure, as well as heart rate).

The time taken for the onset of sensory block (min) in group S was shorter than in group C, and the difference was statistically very significant (P<0.001) (Table 2).

The time taken for the onset of motor block (Min) in group S was shorter than in group C, and the difference was statistically very significant (P<0.001) (Table 3).

The duration of sensory block (min) in group S was longer than in group C, and the difference was statistically very significant (P<0.001) (Table 4).

The duration of motor block (min) in group S was longer than in group C, and the difference was statistically very significant (P<0.001) (Table 5). Distribution of Mean Bromage score at 0,5,10,15,20,25,30 within Groups were not statically significant (p>0.05) (Figure 1).

Two groups were comparable regarding adverse effects (nausea and vomiting).

Table 1: Comparison of demographic characteristics between groups

Age and weight	Group-C	Group-S	P-value
Age	39.6333±9.2531	40.0333±10.9118	0.8788
Weight	65.8933±4.2152	65.5600±4.5229	0.7688

Table 2: Association between onset of sensory block (min): Group

Onset of sensory block (min)	Number	Mean	SD	Minimum	Maximum	Median	P-value
Group-C	30	13.2333	1.6333	10.0000	15.0000	13.0000	<0.001
Group-S	30	11.2000	1.1265	10.0000	13.0000	11.0000	

SD: Standard deviation

Table 3: Association between onset of motor block (min) within groups

Onset of motor block (min)	Number	Mean	SD	Minimum	Maximum	Median	P-value
Group-C	30	15.9333	1.5742	13.0000	18.0000	16.0000	<0.001
Group-S	30	14.2667	1.0807	13.0000	16.0000	14.0000	

SD: Standard deviation

Table 4: Association between duration of sensory block (min) within groups

Duration of sensory block (min)	Number	Mean	SD	Minimum	Maximum	Median	P-value
Group-C	30	718.233	25.7504	680.0000	760.0000	708.500	<0.001
Group-S	30	753.566	5.2172	745.0000	760.0000	754.000	

SD: Standard deviation

Table 5: Association between duration of motor block (min) within groups

Duration of motor block (min)	Number	Mean	SD	Minimum	Maximum	Median	P-value
Group-C	30	682.366	20.0095	640.0000	712.0000	677.000	<0.001
Group-S	30	708.566	4.2644	701.0000	715.0000	709.000	

SD: Standard deviation

DISCUSSION

Regional anesthesia of the upper extremity has a wide range of clinical applications, and it does have several advantages over general anesthesia for orthopedic surgery. These advantages include reduced recovery time, decreased postoperative opioid administration, and improved postoperative pain. These advantages have led to widespread acceptance of a variety of regional nerve blocks.

A thorough pre-anesthetic assessment and investigations were done before selecting patients. 60 patients were divided into two groups, group S and group C, with 30 cases in each group by matching the patient's age, sex, Mallampatti score, and ASA grading (I or II).

Kaur et al.,⁵ observed a similar onset of sensory block in groups DM (D) and DX (X). Group D showed early onset and a longer duration of motor block compared to group X. DM as an adjuvant prolongs the duration of block and postoperative analgesia compared to DX with minimal or negligible adverse events.

In our study, we found that the onset of sensory block in group S (11.20 ± 1.13 min) and in group C (13.23 ± 1.63 min). The P-value between the two groups is <0.001 , which signifies

that the difference is statistically very significant. Thus, our study differs from the above study. The onset of motor block in group S (14.26 ± 1.08 min) and in group C (15.93 ± 1.57 min). The P-value between the two groups is <0.001 , which signifies that the difference is statistically very significant. These findings are similar to the study done by Kaur et al.⁵

Alzeftawy and Elmoradmb⁶ observed that DX and DM, when added to the local anesthetic mixture in the peribulbar block for vitreoretinal surgeries, provided a safe and effective block with prolonged duration and decreased the requirements of postoperative analgesia, with better quality for the DM group regarding the fast onset of the block and reduced IOP.

Hamada et al.,⁷ found that the addition of DM to bupivacaine prolongs the time of both sensory and motor block and analgesia duration longer than DX, but the onset of both sensory and motor block was shorter when DX was added to bupivacaine.

In our study, we found that the duration of sensory block is greater in group S (753.56 ± 5.21 min) than in group C (718.23 ± 25.74 min). The P-value between two the groups is <0.001 , which signifies that the difference is statistically very significant. The duration of motor block in Group S (708.56 ± 4.26 min) and in Group C (682.36 ± 20.00 min). The P-value between the two groups is <0.001 , which signifies that the difference is statistically very significant. These

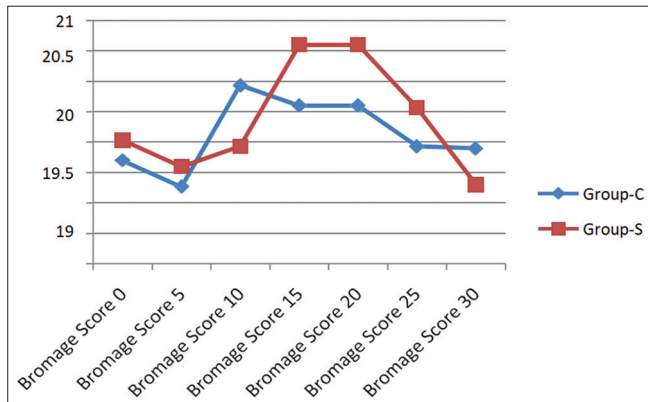


Figure 1: Association between Bromage score at different time interval: Group

findings are similar to the above study, but the onset of both sensory and motor blocks was shorter with DM in our study.

Neman⁸ found that the time of onset of sensory and motor block was significantly less in group DM as compared to group DX ($P < 0.05$). The duration of the sensory and motor block as well as the duration of postoperative analgesia was significantly longer in group DM as compared with group DX ($P < 0.05$), but there was no statistically significant difference between the two groups with respect to the heart rate, mean arterial pressure, and SpO_2 .

Singh et al.,⁹ observed that when DM and DX were added to ropivacaine, the onset of sensory and motor block and block duration were faster than in the ropivacaine group. These findings correlate with our study.

Hemodynamics and adverse effects are comparable between the two groups.

Limitations of the study

1. As this is a single-center study with a relatively small sample size, it may have bias
2. We were unable to assess sedation and analgesia.

CONCLUSION

DM is a better alternative to DX when added to levobupivacaine for decreasing the onset of sensory and motor block and increasing the duration of supraclavicular brachial plexus.

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REFERENCES

1. Bruce BG, Green A, Blaine TA and Wesner LV. Brachial plexus blocks for upper extremity orthopaedic surgery. *J Am Acad Orthop Surg.* 2012;20(1):38-47. <https://doi.org/10.5435/JAAOS-20-01-038>
2. Pani N, Routray SS, Mishra D, Pradhan BK, Mohapatra BP and Swain D. A clinical comparison between 0.5% levobupivacaine and 0.5% ropivacaine with dexamethasone 8 mg combination in brachial plexus block by the supraclavicular approach. *Indian J Anaesth.* 2017;61(4):302-307. https://doi.org/10.4103/ija.IJA_509_16
3. Ping Y, Ye Q, Wang W, Ye P and You Z. Dexmedetomidine as an adjuvant to local anesthetics in brachial plexus blocks: A meta-analysis of randomized controlled trials. *Medicine (Baltimore).* 2017;96(4):e5846. <https://doi.org/10.1097/MD.0000000000005846>
4. Verma NK and Ranjan A. A clinical comparison of dexmedetomidine and dexamethasone as adjuvant to ropivacaine in supraclavicular brachial plexus blocks for upper arm surgeries. *Int J Adv Res Biol Sci.* 2016;3:56-61.
5. Kaur M, Lakhani A and Hashia AM. Comparative study between dexamethasone and dexmedetomidine in supraclavicular block. *Int J Adv Med.* 2018;5:57-61.
6. Alzeftawy AE and El Morad MB. Dexamethasone compared to dexmedetomidine as an adjuvant to local anesthetic mixture in peribulbar block for vitreo retinal surgery. A prospective randomized study. *Anesth Essays Res.* 2018;12(2):359-365. https://doi.org/10.4103/aer.AER_224_17
7. Hamada MH, Ibrahim WM and Ashiry MA. Comparative study between dexmedetomidine and dexamethasone as an adjuvant to bupivacaine in ultrasound guided supraclavicular brachial plexus block in upper limb surgeries. *Egypt J Hosp Med.* 2019;75(6):3060-3069.
8. Nema N. Comparative study of dexmedetomidine versus dexamethasone as an adjuvant for supraclavicular brachial plexus block. *Glob J Res Anal.* 2019;8(5):39-40.
9. Singh N, Gupta S and Kathuria S. Dexmedetomidine vs dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicular brachial plexus block. *J Anaesthesiol Clin Pharmacol.* 2020;36(2):238-243. https://doi.org/10.4103/joacp.JOACP_176_19

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SS- Definition of intellectual content, implementation of study protocol, review manuscript; **DG-** Design of study, statistical analysis and interpretation; **SuJS-** Literature survey, data collection, data analysis; **SR-** Manuscript preparation, editing, and manuscript revision.

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