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Original Research Article

Comparison of 0.5% levobupivacaine alone and 0.25%levobupivacaine with 50mcg Dexmedetomidine for post-operative analgesia in Ultrasound guided Supraclavicular Brachial Plexus Block for Upper limb Surgeries

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Abstract

Background & Methods: The aim of the study is to compare 0.5% levobupivacaine alone and 0.25%levobupivacaine with 50mcg Dexmedetomidine for post-operative analgesia in Ultrasound guided Supraclavicular Brachial Plexus Block for Upper limb Surgeries. All patients will receive ultrasound guided supraclavicular brachial plexus block by an experienced anaesthesiologist. Under aseptic precautions, a skin wheal will be raised with local anaesthetic cephalo-posterior to subclavian artery pulsations. Ultrasound machine is prepared and with clavicle as landmark, a high frequency linear probe is positioned. Brachial plexus is identified as honey combing structure in the area lateral to subclavian artery. The needle is inserted from lateral side of probe and advanced inside by in plane technique till the plexus is visualized. After negative aspiration, 25ml of prepared drug is injected.

Results: Our study compared 25 patients in each group, the demographic profile was comparative and no significant difference was noted. Onset of sensory block in group L was 8.61±2.01 mins, and LD group was 5.40±1.34 mins. Onset of motor block group L was 11.64±2.13 and group LD was 9.04±0.96 mins. Duration of Sensory block in group L was 477.02±60.15 and group LD was 719.48±60.45 mins. Duration of Motor block in group L was 305±32.52 and group LD was 481.93±60.90. Time of rescue analgesia in group L was 723.13±114.42 and group LD was 967.51±121.48 mins. All block characteristics have significant p value.

Conclusion: We conclude that when 50mcg of dexmedetomidine is added to 0.25% levobupivacaine, it prolonged the duration of post-operative analgesia when compared to 0.5% levobupivacaine alone. Addition of 50mcg dexmedetomidine to levobupivacaine also helped to reduce the total dose of levobupivacaine in Supraclavicular Brachial Plexus Block.

Keywords: levobupivacaine, dexmedetomidine, analgesia, ultrasound, supraclavicular, brachial, limb & surgeries.

Study Design: Randomized control trial.

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1. INTRODUCTION

With the introduction of ultrasonography, newer and safer local anesthetics, and adjuvants, regional anesthesia has become the most accepted and useful technique for upper-limb surgeries. Supraclavicular Brachial Plexus Block being the easier approach as the plexus lies more superficial above clavicle, and further, the use of ultrasound in supraclavicular brachial plexus block improved the success rate of block with excellent localization and improved safety margin.[1]

Kulenkampff in Germany performed the first supraclavicular block in 1911, reportedly on himself which was later modified as Winnie block.[2] Currently, levobupivacaine with favorable clinical profile and lesser cardiotoxicity when compared with racemic bupivacaine is being favored local anesthetic for regional block. Adjuvant drugs are often added to local anesthetics for several reasons.[3] The α-receptor agonist dexmedetomidine was found to fasten the onset time, prolong the duration of action of local anesthetics, and increase the quality of analgesia in a regional block.[4] Dexmedetomidine is being used for regional anaethesia, i.v. sedation, and analgesia for intubated and mechanically ventilated patients in intensive care units. Its usage as an adjuvant in central neuraxial blocks has also been mentioned.[5] Its use in peripheral nerve blocks has recently been described. However, the reports of its use in supraclavicular brachial plexus block is limited.[6] Hence, this study was designed to explore the effects of low-dose dexmedetomidine as adjuvant to levobupivacaine in USG-guided supraclavicular brachialplexus block for elective upper-limb surgeries. It was hypothesized that addition of dexmedetomidine 0.5 mcg per kg to levobupivacaine will improve the onset and duration of supraclavicular brachial plexus block[7].

Regional anaesthesia is the recommended technique for upper and lower limb surgeries with better postoperative profile. Considerable research has been conducted over years in order to determine the ideal local anaesthetic (LA) drug. An ideal drug should have a fast sensory onset, differential offset, with an earlier offset of motor than sensory blockade, enabling early ambulation/movements with prolonged analgesia1[8].

Currently, levobupivacaine (S(−)-enantiomer of bupivacaine) with favourable clinical profile and lesser cardiotoxicity when compared with racemic bupivacaine is being favoured LA for regional block[9]. Dexmedetomidine, an α2-receptor agonist, with α2/α1 selectivity 8 times than that of clonidine has also been reported to improve the quality of intrathecal and epidural anaesthesia when used along with LA as adjuvant.

In our current prospective, randomized, double-blind study we evaluated the effectiveness of the addition of dexmedetomidine to levobupivacaine for supraclavicular brachial plexus block[8].

Primary objective: To compare the duration of postoperative analgesia between 0.5% levobupivacaine alone and 0.25%levobupivacaine with 50mcg Dexmedetomidine.

Secondary objective: To compare whether addition of dexmedetomidine 50mcg to levobupivacaine will help to reduce the total dose of levobupivacaine required for supraclavicular brachial plexus block.

2. MATERIAL AND METHODS

50 adult patients of either sex, in the age group 18-65 years posted for upper limb surgeries under supraclavicular brachial plexus block at SIMS & RH, Tumkur under the assistance of Dept. of Anaesthesiology and satisfying the inclusion and exclusion criteria will be included in the study. Patients will be divided into two groups of 25 each by computer generated closed envelope technique.

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Group L received 0.5% Levobupivacaine 25ml alone and group LD received 0.25% Levobupivacaine with 50mcg of dexmedetomidine (total-25ml)
Blinding: Both the patient and anaesthesiologist will be unaware of the drug being injected. The study drugs will be prepared in an unlabelled syringe by a nurse, and the drugs will be used for giving supraclavicular brachial plexus block.
Following completion of injection, the needle is withdrawn and antiseptic pressure dressing is applied at the site of puncture
Post-operative analgesia was assessed by Visual Analog Scores (VAS) (i.e. 0 =no pain, 10 =worst imaginable). Pain was assessed serially at 30 min, 60 min, 6 hrs, 12 hours and 24 hours after surgery.
Injection diclofenac sodium 75 mg intravenously was administered when VAS score was ≥5. The time between the end of local anesthetic administration and first rescue analgesic administration was recorded as the duration of analgesia. Total amount of diclofenac sodium used in first 24 hrs period postoperatively was noted.

Inclusion criteria:

- Patient aged between 18-65years.
- American Society of Anaesthesiologists (ASA) grade I & II.
- Patients with BMI (body mass index) of >18 or <30 kg/m2.

Exclusion criteria:

- Patient with infection at site of injection.
- Patient with pre-existing neuromuscular disorders.
- Pregnancy and lactation.
- Patients on alpha blockers or beta blockers.
- Patients with bleeding disorders or patients on anticoagulants.

Sample size: The sample size estimation will be done using the following formula where n is the sample size

$$n \geq \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \left(\sigma_1{}^2 + \frac{\sigma_2^2}{r}\right)}{(\mu_1 - \mu_2)^2}$$

where n is the sample size
Alpha (α) =0.05
Beta (β) =0.2
Mean in group 1 (μ1) =8.93
Standard deviation in group 1 (σ1)= 1.74
Mean in group 2 (μ2) = 7.73
Standard deviation in group 2 (σ2) =2.2
Ratio (Group 2 / Group 1) =1

3. RESULT

Table No. 1: Demographic Characters

Variables	Group L	Group LD	P Value
Age	36.5±11.21	37.53±10.18	-
Gender (male:female)	20:05	08:18	-
ASA grade (I:II)	19:6	19:6	-
Weight (kg)	58.5±5.35	60.57±6.99	0.074
BMI	22.41±1.95	22.53±2.67	0.083
Duration of Surgery	1.59±0.50	1.53±0.45	0.027

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Table No. 2: Variables

Variables	Group L	Group LD	P Value
Sensory block onset(mins)	8.61±2.01	5.40±1.34	0.047
Motor block onset(mins)	11.64±2.13	9.04±0.96	0.011
Sensory block duration (mins)	477.02±60.15	719.48±60.45	0.038
Motor block duration (mins)	305±32.52	481.93±60.90	0.043
Time for first rescue analgesia (mins)	723.13±114.42	967.51±121.48	0.022

Our study compared 25 patients in each group, the demographic profile was comparative and no significant difference was noted. Onset of sensory block in group L was 8.61±2.01 mins, and LD group was 5.40±1.34 mins. Onset of motor block group L was 11.64±2.13 and group LD was 9.04±0.96 mins. Duration of Sensory block in group L was 477.02±60.15 and group LD was 719.48±60.45 mins. Duration of Motor block in group L was 305±32.52 and group LD was 481.93±60.90. Time of rescue analgesia in group L was 723.13±114.42 and group LD was 967.51±121.48 mins. All block characteristics have significant p value.

Table No. 3: Heart Rate at different interval of time

Variables	Group L	Group LD	P Value
01 Hr	83.7±1.2	81.8±2.4	0.028
03 Hrs	83.4±4.4	84.7±3.3	0.613
06 Hrs	85.2±3.7	85.9±2.9	0.442
12 Hrs	83.6±2.9	84.4±3.5	0.047
24 Hrs	84.8±3.1	85.9±3.6	0.039

Table No. 4: Distribution of complications

Variables	Group L	Group LD
Bradycardia	00	02
Hypotension	01	01
Nausea/Vomiting	00	01
Arrhythmia	00	00
Convulsion	00	00
Respiratory depression	01	00
Patchy block	00	00
Pneumothorax	00	00

4. DISCUSSION

In our study, we observed that the addition of dexmedetomidine to levobupivacaine although significantly prolonged the onset time for both sensory and motor block but it also prolonged the offset time for both sensory and motor block[10]. Therefore, the duration of post-operative analgesia was also prolonged. Additionally, there were no significant haemodynamic fluctuations or complications with the addition of dexmedetomidine.

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The onset, spread, duration, and quality of anaesthesia depends upon the type of local anaesthetic agent, concentration, dose, volume, and physical modifications. Levobupivacaine is the S-enantiomer of bupivacaine and has less neural and cardiac toxicity than bupivacaine. Hence, is currently the closest to the ideal neural blocking agent; however, a large volume of drug is required for adequate block[11].

There are many adjuvants that are widely used like clonidine, fentanyl, tramadol, midazolam, ketamine, verapamil, etc. Dexmedetomidine has peripheral analgesic action and thereby can potentially increase the onset and duration of sensory and motor block as well as analgesia. In the present study, it was observed that addition of dexmedetomidine hastened the onset and prolonged the duration of sensory and motor blockade and DOA. Among the various adjuvants studied, dexmedetomidine prolongs the duration of sensory and motor blockade[12]. The mechanism by which alpha2-adrenergic receptor agonists produce analgesia and sedation is not fully understood that it is likely to be multifactorial. Peripherally, alpha2-agonists produce analgesia by reducing release of norepinephrine and causing alpha2-receptor-independent inhibitory effects on nerve fiber action potentials.[13] Centrally, alpha2-agonists produce analgesia and sedation by inhibiting substance P release in the nociceptive pathway at the level of dorsal root neuron and by activating alpha2-adrenoceptors in the locus ceruleus.[14-16]

In our study, when dexmedetomidine was added to 0.25% levobupivacaine the time for first rescue analgesia was prolonged. This reduced requirement of rescue analgesic in the groups receiving adjuvant in first 24 h postoperative period is because of extended duration of sensory block[17]. These results are tantamount to previous studies using dexmedetomidine, however, explicit comparisons are arduous because of the heterogeneity of local anaesthetic mixtures and adjuvant used, multiple diverse techniques studied, and disparate means of assessing block duration[18].

5. CONCLUSION

We conclude that when 50mcg of dexmedetomidine is added to 0.25% levobupivacaine, it prolonged the duration of post-operative analgesia when compared to 0.5% levobupivacaine alone. Addition of 50mcg dexmedetomidine to levobupivacaine also helped to reduce the total dose of levobupivacaine in Supraclavicular Brachial Plexus Block.

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