Original Research Article

Effect of dexmedetomidine as an adjuvant with levobupivacaine in axillary brachial plexus block

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Abstract

Background: Brachial plexus block is more advantageous for routine as well as emergency upper limb surgery. This provides a useful alternative to general anesthesia for upper limb surgeries. Brachial plexus block provides very good intraoperative anesthesia as well as postoperative analgesia without any significant systemic side effects. **Aim of Study:** To evaluate the effect of adding dexmedetomidine as an adjuvant with levobupivacaine in axillary brachial plexus block. **Materials and Methods:** This Prospective randomized comparative observer-blinded study was conducted in 64 patients at Tirunelveli medical college and hospital in the year 2019. Group L(n = 32) – 29 ml of 0.5% Levobupivacaine + 1 ml of isotonic sodium chloride solution in axillary brachial plexus block. Group LD(n = 32) – 29 ml of 0.5% Levobupivacaine + 1 ml Of dexmedetomidine (100 mcg) in axillary brachial plexus block. **Results:** The mean onset time for a sensory block in Group LD was 9.94 minutes which was lower than Group L -10.97 minutes. This was statistically significant($p<0.05$) The mean onset time for a motor block in Group LD was 10.61 minutes which was lower than Group L -11.75minutes.This was statistically significant($p<0.05$) The meantime for a total duration of sensory block in Group LD was 720minutes which was higher than Group L -602minutes.This was statistically significant($p<0.005$) The meantime for the total duration of motor block in Group LD was 604minutes which was higher than Group L -491 minutes. This was statistically significant($p<0.05$) **Conclusion:** The addition of Dexmedetomidine (100 mcg) to Levobupivacaine(0.5%)in axillary brachial plexus block results in a shorter onset time for sensory and motor blockade. It also prolongs the duration of sensory and motor blockade and also the duration of analgesia. However dexmedetomidine use may also lead to bradycardia.
Keywords: Clonidine, Dexmedetomidine, Levobupivacaine, Ultrasound, Supraclavicular Brachial Plexus Block

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INTRODUCTION

The surgeries in the upper limb can be done either by general or regional anesthesia or by the combination of both. The regional blockade has wide application in providing surgical anesthesia and analgesia as well as in treating chronic pain syndromes.[1] regional anesthesia has several advantages in the postoperative period compared with general anesthesia, including decreased sedation, decreased nausea and vomiting, early discharge from the recovery room and a smooth transition to pain control as the block effects gradually dissipate.[2] These are the drugs that block the conduction of impulses in the electrically excitable tissues. local anesthetics provide anesthesia and analgesia by blocking the transmission of pain sensation along nerve fibers. They are classified into 1. Aminoamide group (Lidocaine, bupivacaine, levobupivacaine etc)2. Amino ester group (Chloroprocaine, procaine, tetracaine) Bupivacaine is the commonly used local anesthetic agent. It is available as a racemic mixture composed of two enantiomers, levobupivacaine, S(-) isomer and dextrobupivacaine, R(+)isomer. Levobupivacaine S(-) isomer is devoid of some of the CNS and CVS adverse effects that occur following inadvertent intravascular injection of bupivacaine.[3] So, levobupivacaine is emerging

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as an effective alternative to bupivacaine in the field of regional anesthesia.[4] Various adjuvants like morphine, fentanyl, sufentanil, dexamethasone, midazolam, ketamine, neostigmine, soda bicarbonate are added to local anesthetics.[5] Alpha 2 receptor agonists clonidine and dexmedetomidine are of new interest in regional anesthesia because of their better hemodynamic stability and longer duration of postoperative analgesia.[6] Adjuvants are administered by various routes like an epidural, intrathecal and intravenous. In our study, the adjuvant dexmedetomidine is added to levobupivacaine in axillary brachial plexus.[7]

MATERIALS AND METHODS

This Prospective randomized comparative observer-blinded study was conducted in 64 patients at Tirunelveli medical college and hospital in the year 2019. Group L(n = 32) – 29 ml of 0.5% Levobupivacaine + 1 ml of isotonic sodium chloride solution in axillary brachial plexus block. Group LD(n = 32) – 29 ml of 0.5% Levobupivacaine + 1 ml Of dexmedetomidine (100 mcg) in axillary brachial plexus block. inclusion Criteria: ASA I and II patients between 20years to 50 years of age undergoing forearm and hand surgeries of both sexes. Exclusion criteria: Patients on adrenoreceptor agonist or antagonist therapy. Suspected coagulopathy. Infection at the site of the black history of respiratory, cardiac, hepatic or renal failure. Allergy to local anesthetics and study drug. Pregnant women.

STUDY METHOD

After getting institutional ethical committee approval and written informed consent from patients, the patients were randomly allocated into two groups. Group L(n = 32) was taken as Levobupivacaine group and Group LD (n=32) as Levobupivacaine + Dexmedetomidine group. Patients were not given any premedication before the block. After insertion of an 18-gauge intravenous cannula in the contralateral arm, 5mL/kg/h infusion of Ringer Lactate solution was started. After the placement of standard anesthesia monitors, baseline measurements of heart rate (HR), noninvasive mean arterial blood pressure (MAP), peripheral oxygen saturation (Spo2), and respiratory rate were recorded before the block was performed. The axillary block was performed with the patient in the supine position with the upper arm abducted to 90°and the elbow in 90° flexion. After local preparation of the area, the axillary artery was palpated and a skin wheal was raised using 2 mL of lidocaine 2%. Neural localization was made using a nerve stimulator. The nerve stimulator was connected to a 22-gauge, 50-mm-long stimulating needle. The location of the needle was judged adequate when an output current of 0.5 mA elicited a slight distal motor response. Group L patients (n =32) were given a total 30-ml solution consisting of 29 mL levobupivacaine 0.5% with 1 mL of isotonic sodium chloride solution. Group L D patients (n =32) were given a total 30-mL solution consisting of 29 mL levobupivacaine 0.5% with a 1-mL volume of 100mcg. We followed a multi stimulation technique in all the patients of both the groups to identify the individual nerves. 7.5 mL of the local anesthetic mixture was given for each nerve after the identification of the radial, ulnar, median, and musculocutaneous nerves in each patient. During the administration of the drug, negative aspiration was done every 3.0 ml to avoid intravascular injection. The patients were excluded from the study, if there was any block failure in a nerve distribution region, even if the blockade was considered adequate for the surgery. Sensory and motor blocks of the radial, median, ulnar, and musculocutaneous nerves and HR, MAP, and SpO2 values were recorded 5, 10, 15,20, 30, 45,60, and 90minutes after the block and 1, 2, 4, 8, 12and 16hours after the end of the surgery. The onset time of the sensory block was defined as the time interval between the end of the local anesthetic injection and no response to the pinprick test (score 2) on all nerve territories. The duration of sensory block is defined as the time interval between the end of local anesthetic administration and complete resolution of anesthesia on all four nerves. The onset time of the motor block was defined as the time interval between the end of the local anesthetic injection and complete paralysis (score 0). The duration of motor block was defined as the time interval between the end of local anesthetic administration and the complete recovery of the motor function of the hand and forearm. The duration of analgesia was calculated from the end of the local anesthetic administered to the first analgesia request from the patient. Postoperatively pain was assessed by using the Visual Analog Scale (0 –10).Inj. diclofenac 75 mg i.m. was given when the Visual Analog Scale >4.

RESULTS

There were totally 4 cases of block failure, 2 in the levobupivacaine(L) group and 2 in the levobupivacaine + dexmedetomidine group(LD). They were excluded from the study. Four cases in the LD group had bradycardia which required treatment with atropine. Side effects such as nausea, vomiting, hypoxemia and hypotension were not present in both the groups.

Table 1: Comparison of age distribution between the two groups

	Mean	SD	P-value	T value
Group L	34.00	7.469	0.149	1.461
Group LD	37.167	9.229		

Table 1 shows The mean age of the L group was 34± 7.4 years and the LD group was 37.1± 9.2 years. The difference between the two groups are not statistically significant (p >o.o5)

Table 2: Comparison of duration of surgery(min)between the two groups

	Mean	SD	P-value	T value
Group L	100.167	10.462	0.752	0.317
Group LD	99.333	9.890		

Table 2 The mean duration of surgery in Group L was 100.16 minutes and the mean duration of surgery in Group LD was 99.33 minutes. The difference between the means was not statistically significant. (p>0.05)

Table 3: Comparison of baseline hemodynamic variables between the two groups

	Group L		Group LD			
	Mean	SD	Mean	SD	P-value	T value
PR	83.400	5.430	83.267	5.388	0.924	0.0985
MAP	93.500	6.474	92.900	6.375	0.719	0.362
SPO2	98.233	0.728	98.333	0.661	0.580	-0.557

Table 3 The preoperative hemodynamic variables between the two groups were comparable but not statistically significant.

Table 4: Comparison of visual analog scale between two groups

	Group L		Group LD			
	Mean	SD	Mean	SD	P-value	T value
1 Hr	1.000	0	1.000	0	1.000	0
2 Hr	1.000	0	1.000	0	1.000	0
4 Hr	2.000	0	2.000	0	1.000	0
8 Hr	3.700	0.466	2.767	0.430	0.001	8.060
12 Hr	5.467	0.571	4.000	0	0.001	14.060
16 Hr	6.133	0.681	5.100	0.305	0.001	7.580

Table 4 Group LD had lower VAS scores in the 8H,12H,16H when compared to group L. This was statistically significant (p<0.05).

Table 5: Comparison of onset time for sensory block

	Mean	SD	P-value	T value
Group L	10.970	0.539	0.001	7.366
Group LD	9.947	0.537		

Table 5 The mean onset time for the sensory block in Group LD was 9.94 minutes which was lower than Group L -10.97 minutes. This was statistically significant(p<0.005)

Table 6: Comparison of onset time for motor block

	Mean	SD	P-value	T value
Group L	11.750	0.569	0.001	7.393
Group LD	10.612	0.623		

Table:6 The mean onset time for a motor block in Group LD was 10.61 minutes which was lower than Group L -11.75minutes. This was statistically significant(p<0.05)

Table 7: Comparison of total duration of sensory block

	Mean	SD	P-value	T value
Group L	602.833	35.808	0.001	-12.037
Group LD	720.667	39.908		

Table 7 The meantime for the total duration of sensory block in Group LD was 720minutes which was higher than Group L -602minutes. This was statistically significant(p<o.o5)

Table 8: Comparison of total duration of motor block

	Mean	SD	P-value	T value
Group L	491.167	32.762	0.001	-113.000
Group LD	604.167	42.530		

Table 8 The meantime for a total duration of motor block in Group LD was 604minutes which was higher than Group L - 491 minutes. This was statistically significant(p<o.o5)

Table 9: Comparison of total duration of analgesia

	Mean	SD	P-value	T value
Group L	658.500	35.065	0.001	-18.457
Group LD	844.33	42.563		

Table 9 The total duration of Analgesia in Group LD was 844 minutes which was higher than in Group L – 658 minutes. This was statistically significant. (p<0.05).

DISCUSSION

In our study, we found that the addition of dexmedetomidine to levobupivacaine in axillary brachial plexus block shortens the onset time for sensory and motor block. It also extends the duration of sensory and motor block and also the duration of analgesia. Also, patients experience lower postoperative VAS scores in the 8H,12H,16H.[8] Our study had similar findings with the study by Obayah GM *et al* but in their study, they used levobupivacaine 0.5 % 40 ml(10ml for each nerve) along with 100 mcg of dexmedetomidine in the axillary block. We used only 7.5 ml for each nerve and also we found that the onset time for sensory and motor block was a bit longer, duration of sensory and motor block and the total duration of analgesia was a bit shorter in our study when compared to their study. [9] This may be due to the less volume of the drug (30 ml) we used in our study. Our study also shared similar findings with the study by Esmaoglu A *et al*. They used 40 ml (10 ml for each nerve) of 0.5% levobupivacaine along with 1mcg/kg of dexmedetomidine in the axillary block. We used 30 ml 0.5% levobupivacaine with 100mcg of dexmedetomidine(7.5ml for each nerve) .We found that the onset time for sensory and motor block was a bit longer, the duration of sensory and motor block and the total duration of analgesia was a bit shorter in our study when compared to their study. This may be due to the less volume of the drug (30 ml) we used in our study. In their study, no cases of bradycardia were reported but we had 4 cases of bradycardia which required treatment with atropine. The usage of clonidine in brachial plexus block with various local anesthetics yield conflicting results. It was found that clonidine prolongs the motor blockade with mepivacaine and bupivacaine but not with ropivacaine. [10]The reason for this effect may be because that ropivacaine itself had an intrinsic vasoconstrictor effect and the addition of clonidine to ropivacaine did not increase this vasoconstriction effect. Dexmedetomidine was found to be a safe and effective adjuvant in many studies on neuraxial and peripheral nerve blocks.[11] In a study by Gaumann DM *et al* clonidine or dexmedetomidine were added to lidocaine in Bier's block, and it was found that dexmedetomidine improved the quality of anesthesia and analgesia better than that of clonidine. [12]In a study by Sia Set dexmedetomidine and lornoxicam were added to prilocaine in Bier block. They reported that the addition of dexmedetomidine had shortened the sensory block onset time and prolonged the sensory block recovery time more than lornoxicam. [13] In 2 other studies by Erlacher W *et al* dexmedetomidine–lidocaine mixture was used in Bier block and was found to improve the quality of anesthesia and reduce the postoperative analgesic requirement.[14]Culebras X *et al* evaluated the effects of dexmedetomidine and clonidine in epidural anesthesia. They found that dexmedetomidine is a better neuraxial adjuvant than clonidine, to provide an early onset of sensory analgesia and also prolonged postoperative analgesia.[15]

CONCLUSION

The addition of Dexmedetomidine (100 mcg) to Levobupivacaine(0.5%)in axillary brachial plexus block results in a shorter onset time for sensory and motor blockade. It also prolongs the duration of sensory and motor blockade and also the duration of analgesia. However dexmedetomidine use may also lead to bradycardia.

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