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Effect of Adding Dexmeditomidine to Levobupivacaine in Supraclavicular Brachial Plexus Block- A Randomized, Controlled Study

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Introduction

Background and Aims: Various drugs are used with local anaesthetics for upper limb surgeries and postoperative analgesia. We experimented the effect of addition of dexmedetomidine with levobupivacain in supraclavicular brachial plexus block with respect to onset & duration of sensory and motor blockade and duration of analgesia.

Material and Methods

A total of 60 patients of ASA grade I and II, aged 18-60 yrs of either sex scheduled for upper limb surgeries under supraclavicular brachial plexus block were divided into 2 equal groups in a randomized pattern. Patients in group L (n = 30), received 30 ml of 0.5% levobupivacaine with 1ml normal saline (control) and in group LD (n = 30), received 30 ml of 0.5% levobupivacaine with 1 ml (100µg) dexmedetomidine. The onset and duration of sensory and motor block & duration of analgesia were analyzed in both groups. Statistical analysis done with SPSS 17 software and p value <0.05 taken as significant.

Results

The mean time of onset of sensory & motor blockade were 12.43±2.56 min and 17.96±3.05 min in group L and 8.13±2.51 min &12.13 ± 2.89 in group LD respectively. The durations of sensory and motor block were 660.16 ± 44.28 and 535.33 ± 50.66 min respectively in group L, whereas they were 930.66 ± 48.02 and 811.83±52.08 min respectively in group LD. The duration of analgesia was 728.86 ± 45.12 min in group L compared to1159.8 ± 56.84 min in group LD (p < 0.001). There was statistically significant difference present in onset and duration of sensory and motor blockade and duration of analgesia between 2 groups.

Conclusion

Addition of dexmedetomidine in supraclavicular brachial plexus block with levobupivaicane decrease the onset of sensory and motor block and increase the duration of sensory and motor block with prolonged duration of analgesia .

Keywords: Dexmedetomidine, Supraclavicular Brachial Plexus Block, Levobupivacaine

Introduction

Peripheral nerve blocks are obtaining popularity in anaesthesia clinical practice and can be used in different variety of surgical anaesthesia, for surgical procedures and postoperative pain management.

Supraclavicular approach is carried out at the level of trunks of brachial plexus.[1] It is the most effective block

for all portion of upper extremity. The plexus is blocked where it is compact maximum[2] i.e. at the middle of brachial plexus, resulting in homogenous spread of anaesthetic drug throughout the plexus with a fast onset and almost complete block.[3]

Halsted an American surgeon performed brachial plexus block with a solution of cocaine under direct exposure.[4] Kulenkampff performed the first percutaneous supraclavicular brachial plexus block using 10 ml 2% novocaine solution with adrenaline.[5]

Bupivacaine, a racemic mixture of the 2 stereo enantiomers dextrobupivacaine and levobupivcaine, frequently used as local anesthetic for brachial plexus anaesthesia because it offers the advantage of providing a long duration of action and a favourable ratio of sensory to motor block.[6,7]

However, with clinical use, it was noted that using the racemic mixture of bupivacaine resulted in central & cardiac nervous system toxic effects in some patients[6,8] which were related to the dextrobupivacaine enantiomer.[7]

Levobupivacaine is the S(-) isomer of racemic bupivacaine. As compared to bupivacaine it has less cardiotoxicity[9,10] and its duration of anaesthesia & pharmacology are similar to bupivacaine.[10]

A variety of perineural adjuvants[11] including buprenorphine,[12] clonidine,[13] dexamethasone,[14] magnesium,[15] and midazolam[16,17] have been used to prolong the duration of analgesia with varying degree of success.

Dexmedetomidine is a highly selective agonist at α_2 adrenoceptor which has been shown to have both analgesic & sedative effects[18, 19.] Dexmedetomidine has shown to increase the duration of block and postoperative analgesia when added to local anaesthetic in different regional blocks.[20-23]

This study was designed to evaluate the hypothesis that adding of dexmedetomidine with levobupivacaine in supraclavicular brachial plexus block enhanced the duration of sensory and motor block, duration of analgesia and quality of block.

Material and method

This prospective, randomized, placebo controlled, double blind study was carried out after approval of ethical committee. Sixty patients of ASA grade I & II**,** age group 18 to 50 years of either sex admitted for upper limb surgeries were included for study. Patients with hepatic dysfunction, renal dysfunction, bleeding disorder, progressive neurological disorder, on treatment with α adrenergic antagonist, history of arrhythmias and labile hypertension, pregnant and lactating patients & patients with known history of allergy to local anaesthetic of amide type were excluded from study.

Preanaesthetic checkup of these patients were done with complete history, general examination and systemic examination. Routine investigations like complete blood count, blood urea, serum creatinin, blood sugar, chest X ray and ECG were done.

After obtaining written informed consent patients were subsequently randomized into 2 groups of 30 each by slip in a box technique.

1. Group L (n=30) : 30 ml of 0.5% Levobupivacaine with 1 ml normal saline. (Control)
3. Group LD (n=30) : 30 ml of 0.5% Levobupivacaine with 100 mcg Dexmedetomidine (1ml).

O arrival in operation theatre an intravenous line was secured in unaffected limb and riger lactate solution was started. Various monitoring devices like NIBP, Pulseoxymeter, 3 lead ECG were connected and basal readings were recorded.

Patients were lying down in supine position with the head turned to contra lateral side and the arms were extended and pulled towards the knee.

The midclavicular point, external jugular vein and subclavian artery pulsation were identified. Under all aseptic precautions & after local infiltration of 2% lidocaine 2 ml, a 22G 1.5 inch needle was introduced 2 cm above the mid-clavicular point directed just lateral to subclavian artery pulsation, caudad and medially until paresthesia was elicited. After negative aspiration of blood, the study drug was injected.

After the drug was administered, the following parameters were recorded. Pulse rate (PR), systolic blood pressure (SBP)& diastolic blood pressure (DBP) were noted at 0, 5, 10, 15, 20, and at 30 min interval up to 90 min and then every hour till 750 min.sensory block onset was considered as time interval between injection of drug and complete loss of sensation as analysed by pinprick sensation.

Motor block was evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and flexion of the elbow in supination and pronation of the forearm (musculocutaneous nerve). Measurements were performed using a modification of the Lovett rating scale[24].

Grade 6 : Normal muscular force

Grade 5 : Slightly reduced muscular force

Grade 4 : Pronounced reduction of muscular force

Grade 3 : Slightly impaired mobility

Grade 2 : Pronounced mobility impairment

Grade 1 : Almost complete paralysis

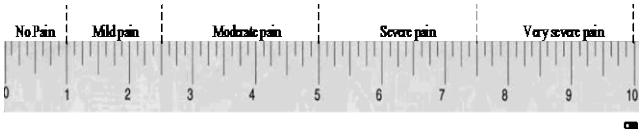
Grade 0 : Complete paralysis

Motor block onset defined as the time elapsed from injection of drug to complete motor block. Assessment was done at every 1 min interval from the time of injection of test drug until the block was established. Only patient with complete motor block (grade 0) were included in study and equal number of new cases were added to complete the study.

The time interval between local anaesthetic administration and appearance of pain requiring rescue analgesia is defined as duration of sensory block.

A visual analogue score scale was used to assessed postoperative pain. It consisted of a 10 cm horizontal scale with gradations marked as ‘0’means no pain at all and ‘10’means unbearable pain.

VAS score rating:[25]



VAS score was analysed every 30 min in the postoperative period till the conclusion of study.

Duration of motor block defined as time interval between injections of the drug to complete recovery of motor power (grade 6)

Sedation was assessed on the basis of **Chernik** sedation score[26].

0 - Completely awake

1 - Sleeping but responding to verbal command

2 - Deep sleeps but arousable

3 - Deep sleep not arousable

Careful watch was kept for complications such as nausea, vomiting, bradycardia, tachycardia, hypertension, hypotension, haematoma, headache, convulsions and respiratory distress. After recording observations statistical analysis was carried out using independent student's t-test by SPSS V.17 software. p value <0.05 taken as significant.

Results : Both groups were comparable for age, weight and male:female ratio and statistically insignificant (p>0.05). There was male predominancy in both groups.

Table- 1: Demographic profile of 2 groups.

S.no.	Parameters	Group L		Group LD	
		Mean	±SD	Mean	±SD
1.	Age (yrs)	37.96	14.79	36.63	12.70
2.	Weight (kgs)	66.30	8.85	63.10	4.28
3.	Sex (M:F)	21:9		21:9	

Table 2: Comparison of study parameters between two groups.

Parameters	Group L		Group LD		
	Mean	±SD	Mean	±SD	P value
Onset time of sensory blockade (min)	12.43	2.56	8.13	2.51	0.00
Duration of Sensory blockade(min)	660.16	44.28	930.66	48.02	0.00
Onset time of motor blockade(min)	17.96	3.05	12.13	2.89	0.00
Duration of motor blockade (min)	535.33	50.66	811.83	52.08	0.00
Time of Rescue Analgesia (in min)	728.86	45.12	1159.8	56.84	0.00

This table shown the onset time of sensory blockade (mean ±SD) which was 12.43±2.56 min in group L and 8.13±2.51 min in group LD. Mean (±SD) of sensory blockade duration was 660.16±44.28 min in group L and 930.66±48.02 min in group LD. Onset time (Mean ±SD) of motor blockade was 17.96±3.05 min and 12.13±2.89 min in group L and LD respectively. Duration of motor blockade (mean ±SD) was 535.33±50.66 min in group L and 811.83±52.08 min in group LD. Time of rescue analgesia was 728.86±45.12 min in group L and 1159.8±56.8 min in group LD. The difference was highly significant ($p<0.001$) between 2 groups in respect of onset of sensory and motor blockade. Duration of sensory and motor blockade were increased in group LD. Duration of analgesia was prolonged in group LD as compared to group L ($p<0.001$).

Table 3: Sedation Score between 2 groups

Sedation Score	Group L		Group LD	
	n	%	n	%
0	30	100	3	10
1	0	0	7	23.33
2	0	0	20	66.66
3	0	0	0	0

Basal haemodynamic records were comparable in both groups. Pulse rate was lower significantly up to 390 min and blood pressure was lower up to 450 min in group LD after that the difference was insignificant.

In group L none of the patient had sedation while in group LD 66.66% patients had sedation of grade 2 and 23.33% patients had sedation of grade 1. No complication was found in group L while in group LD 4 patients had bradycardia. For treatment inj. atropine 0.6 mg was given IV to these patients.

Discussion

Supraclavicular blocks are performed at the level of the brachial plexus trunks. Here almost the entire sensory, motor and sympathetic innervations of upper extremities are carried in just three nerve structures (trunks), confined to a very small surface area. Consequently, typical features of this block include rapid onset, predictable and dense anaesthesia along with its high success rate. Various long acting drugs have been used in these procedures. Levobupivacaine is a S isomer of bupivaicane which has

lesser cardiac toxicity than bupivaicaine. Dexmedetomidine was first proposed as an adjuvant capable of prolonging duration of sensory and motor block produced by nerve block by Memis and colleagues.[20] Compared with clonidine, dexmedetomidine has an α_2:α_1 adrenoceptor ratio of approximately 1600:1 (seven to eight times higher than clonidine).[27]

In this study we evaluated the effect of dexmedetomidine as an adjuvant with levobupivacaine hydrochloride in supraclavicular brachial plexus block.

Findings of our study shown that there was rapid onset of sensory and motor blockade with adding of dexmedetomidine in levobupivacaine. Similar results were found by Kaygusuz K et al[28], Ammar and Mahmoud[29], Dar FA et al[30] and Agarwal S et al[31]. In our observations duration of sensory and motor blockade were prolonged in group LD as compared to group L. Ammar and Mahmoud[29] found that adding dexmedetomidine to bupivacaine significantly prolonged the duration of sensory(122.7±15.2 min vs179.4±14.4 min respectively) and motor blockade (105.7±16.2 min vs 155.5±15.8 min respectively) and similar findings were observed in our study. Our observations are supported by Dar FA et al[30], Zhang YU et al[32] and Gandhi R et al[33].Duration of analgesia was longer in group LD as compared to control group . This may be because peripheral alpha 2 agonist produces analgesia by reducing the release of norepinephrine leading to alpha 2 receptors independent inhibitory effect on nerve fibre action potentials. Our results are in accordance with study of Kaygusuz K et al[28], Esmaoglu A et al[22] , Swami SS et al[34] & Tandon N et al[35].Our results showed that heart rate and blood pressure was significantly lower in group LD. These are supported by Esmaoglu A et al[22] and Dar F A et al[30]. In group L none of the patient had sedation, while in group LD 66.66% patients had sedation of grade 2 and 23.33% patients had sedation of grade 1. Results are supported by Ammar and Mahmoud[29] & Swami S S et al[34]. No complication was found in control group while in group LD 4 patients have bradycardia. These are in accordance with findings of Esmaoglu A et al[22].

Conclusion

Addition of dexmedetomidine to levobupivacaine fastens the onset of sensory & motor blockade, prolongs the sensory and motor blockade duration and prolongs the time for rescue analgesia. Although it produces sedation it is an effective alternative to other drugs as an adjuvant in supraclavicular brachial plexus block.

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