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COMPARISON OF DEXMEDETOMIDINE AND CLONIDINE (α-2 AGONIST DRUGS) AS AN ADJUVANT TO LOCAL ANAESTHESIA IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A RANDOMISED DOUBLE-BLINDED PROSPECTIVE STUDY

Anaesthesiology

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KEYWORDS

Clonidine, dexmedetomidine, supraclavicular brachial plexus block.

INTRODUCTION:

Upper limb surgeries are mostly performed under peripheral blocks such as brachial plexus block, which provides intra as well as postoperative analgesia without any systemic side effects. There has always been a search for adjuvants to the regional nerve block with drugs that prolong the duration of analgesia but with lesser adverse effects [1].

The addition of analgesic adjuncts to spinal and epidural anaesthesia enhances post operative analgesia, an observation which has stimulated research to examine whether they also have analgesic effects in the periphery[1]

Furthurmore, various methods of administration, such as epidural, intrathecal andperipheral injections have been tried either alone or in combination with another drug to prolong and intensify the analgesia[2,3,4].

The aim and objective of this study is to compare dexmedetomidine and clonidine as adjuvant to local anaesthetic agent in supraclavicular brachial plexus block with respect to onset and duration of sensory and motor block and duration of analgesia.

MATERIALS AND METHODS:

Prospective, randomized, double blinded study in RNTIICS hospital. Randomization was done by random number table.

After institutional ethical committee approval and written informed consent, 60 ASA I and II patients of either sex, 18–60 years, scheduled to undergo upper limb under supraclavicular brachial plexus block. Group C: Bupivacaine 0.25% (35 cc) + clonidine 1 µg/kg, Group D: Bupivacaine 0.25% (35 cc) + dexmedetomidine 1 µg/kg

Patients on adrenoreceptor agonist or antagonist therapy, with known hypersensitivity to local anaesthetic (LA) drugs, bleeding disorders, uncontrolled DM, pregnant, pre-existing peripheral neuropathy was excluded from study.

All received brachial plexus block (supraclavicular) approach by an experienced anaesthesiologist, using nerve locator connected to a 22 G, 50-mm-long stimulating needle. Following negative aspiration, 35ml LA with clonidine or dexmedetomidine will be injected.

Sensory block will be assessed by the pin prick at each minute after completion of drug injection

Sensory onset is to be considered when there is a dull sensation to pin prick along the distribution of any of the above-mentioned nerves.

Complete sensory block will be considered when there is complete loss of sensation to pin prick. The duration of sensory block is defined as the time interval between the end of LA administration and complete resolution of anaesthesia.

Sensory Block Will Be Graded As-
Grade 0: Sharp pin felt
Grade 1: Analgesia, dull sensation felt
Grade 2: Anaesthesia, no sensation felt.

Assessment of motor block will be carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade will be considered when there is Grade 1 motor blockade. Peak motor block will be considered when there is Grade 2 motor blockade. The duration of motor block will be defined as the time interval between the end of local anaesthetic administration and the recovery of complete motor function of the hand and forearm Motor block will be determined according to a modified Bromage scale for upper on extremities a 3-point scale[5].
Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers
Grade 1: Decreased motor strength with ability to move the fingers only
Grade 2: Complete motor block with inability to move the fingers

The block will be considered incomplete when there is no analgesia in any of the segments supplied by median, radial, ulnar and musculocutaneous nerve even after 30 min of drug injection. When more than one nerve remains unaffected, it will be considered a failed block. Patients are to be monitored for haemodynamic variables such as heart rate, blood pressure and oxygen saturation every 5 min after the block intraoperatively for 1st 30mins, 15 mins thereafter till the end of surgery and every 30 min post-operatively.

Sedation of patient will be assessed by the Ramsay Sedation Score[6]. At the end of the procedure, quality of operative conditions will be assessed according to the following numeric scale[7]:
Grade 4: (Excellent) No complaint from patient
Grade 3: (Good) Minor complaint with no need for the supplemental analgesics
Grade 2: (Moderate) Complaint that required supplemental analgesia
Grade 1: (Unsuccessful) Patient given general anaesthesia

Duration of analgesia was assessed by numeric rating scale (0-10) every 60 min till the score of 5. Side-effects (nausea, vomiting, dryness of mouth) and complications (pneumothorax, haematoma, local anaesthetic toxicity, post-block neuropathy) were noted.

Statistical Analysis

The data is analysed by SPSS version 20 software. Continuous variables are expressed as Mean ± Standard Deviation and compared across the 2 groups using unpaired t test. Categorical variables were compared using Pearson's Chi Square test for Independence of Attributes. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant and highly significant if <0.001.

Calculation Of Sample Size- Power analysis was based on the results of a previous study by Swami et al.[8] Sample size calculation was based on a population standard deviation of 1.1 with 80% power and 5% alpha error. Sample size of 5 per group required as per calculation, however 30 patients per group was included in the study.

RESULTS

Among 71patients, 2 patients declined to participate 9 patients were on beta blockers, anticoagulation drugs and had uncontrolled diabetes mellitus. The remaining 60 patients were randomly assigned to two groups.

Table 1: Comparison of duration of sensory block between two groups.

	GROUP			
	GROUP C	GROUP D		
	Mean ± Std. Deviation	Mean ± Std. Deviation	P Value	Significance
DURATION of SENSORY BLOCK(Minutes)	232.17 ± 49.40	416.87 ± 38.02	<0.001	Significant
Duration of Motor Block((Minutes)	213.34 ± 25.53	382.00 ± 37.87	<0.001	
Duration of Analgesia (Minutes)	272.34 ± 32.27	445.17 ± 45.03	<0.001	

Table 2: Comparison of quality of block between two groups.

		GROUP		Total		
		GROUP C	GROUP D		P Value	Significance
QUALITY OF BLOCK	1	1(3.33%)	0(0%)	1(1.67%)	<0.001	Significant
	2	7(23.33%)	1(3.33%)	8(13.33%)		
	3	17(56.67%)	8(26.67%)	25(41.67%)		
	4	5(16.67%)	21(70%)	26(43.33%)		
Total		30(100%)	30(100%)	60(100%)		

Comparison Of Quality Of Block Between Group C And D

There was significant side effects of nausea and dry mouth in group C as compared to group D (p<0.05). (Table 6.11-6.13, Figure 6.18-6.20).

Table 3: Incidence Of Nausea.

		GROUP		Total		
		GROUP C	GROUP D		P Value	Significance
NAUSEA	Absent	14(48.28)	24(80)	38(64.41)	0.011	Significant
	Present	15(51.72)	6(20)	21(35.59)		
Total		29(100)	30(100)	59(100)		

Table 4: Incidence Of Dry Mouth.

		GROUP		Total		
		GROUP C	GROUP D		P Value	Significance
DRY MOUTH	Absent	16(55.17)	24(80)	40(67.8)	0.041	Significant
	Present	13(44.83)	6(20)	19(32.2)		
Total		29(100)	30(100)	59(100)		

DISCUSSION

Clonidine and dexmedetomidine are both α-2 selective agonists. In addition to central actions mediated through receptors situated in the coeruleus and dorsal horn of spinal cord they also have got peripheral actions, mechanisms of which are multimodal. It is possible that they work in a similar manner and may indicate a class effect.

Agarwal et al. compared the effects of adding dexmedetomidine to a 30 ml solution of 0.325% bupivacaine in supraclavicular brachial plexus block. Onset and duration of sensory and motor block along with the duration of analgesia were the primary endpoints. Fifty patients posted for upper limb surgeries were enrolled for a prospective, randomized, double-blind, placebo-controlled trial. Patients were divided into two groups, the control group S and the study group SD. In group S (n = 25), 30 ml of 0.325% bupivacaine + 1 ml normal saline; and in group SD (n = 25), 30 ml of 0.325% bupivacaine + 1 ml (100 µg) dexmedetomidine were given for supraclavicular brachial plexus block using the peripheral nerve stimulator. Onset and duration of sensory and motor blocks were assessed along with the duration of analgesia, sedation, and adverse effects, if any. Hemodynamic parameters, like heart rate (HR), systolic arterial blood pressure (SBP), and diastolic arterial blood pressure (DBP) were also monitored.Demographic data and surgical characteristics were comparable in both the groups. The onset times for sensory and motor blocks were significantly shorter in SD than S group (P < 0.001), while the duration of blocks was significantly longer (P < 0.001) in SD group. Except for the initial recordings (at 0, 5, 10, and 15 min), heart rate levels in group SD were significantly lower (P < 0.001). SBP and DBP levels in SD group at 15, 30, 45, 60, 90 and 120 min were significantly lower than in S group (P < 0.001). In fact, when the percentage changes in HR/SBP/DBP were compared from 0-5/0-10/0-15/0-30/0-45/0-60/0-90/0-120 min in SD with S group, they came out to be highly significant (P < 0.001) in group SD. The duration of analgesia (DOA) was significantly longer in SD group than S group (P < 0.001). Except that, bradycardia was observed in one patient in the group SD, no other adverse effects were observed in either of the groups[9].

Swami et al. compared dexmedetomidine and clonidine as adjuvants to local anaesthetics in supraclavicular brachial plexus block. Duration of sensory block and motor block was 227.00±48.36 and 292.67±59.13 min, respectively, in group C, while it was 413.97±87.13 and 472.24±90.06 min, respectively, in group D. There was no statistically significant difference in onset of sensory and motor block between the two groups. The duration of analgesia (time to requirement of rescue analgesia) in group D was 456±97 min, while in group C, it was 289±62 min. Statistically, this difference was significant (P=0.001). The number of patients achieving grade IV quality (excellent) of block was higher in group D (80%) as compared with group C (40%) (P<0.05). However, they suggested further trials in future[8].

Singelyn et al. concluded that a minimum dose of clonidine (0.5mcg/kg) added to mepivacaine prolongs the duration of anaesthesia and analgesia after brachial plexus block. No added benefits were found with doses exceeding 1.5 mcg/kg[3]. Study by Swami et al. compared the adjuvant effects of the two drugs where 1mcg/kg of clonidine was added to bupivacaine[10]. Therefore we decided to use 1 mcg/kg of clonidine in our study.

Although dexmedetomidine has a α2/α1 selectivity ratio that is eight times higher than that of clonidine, an equipotent comparative study was not available at the time of our study. The dose selection was based on previous studies where dexmedetomidine and clonidine both were used in dose of 1 mcg/kg in Bier's block and supraclavicular brachial plexus block[7,10].

The results of this study shows that both the groups were comparable with respect to demographic profile. Haemodynamics were stable in all patients except significant lowering of pulse rate in patients in group D between 60 to 120 minutes and significant lowering of diastolic blood pressure in group C between 45 to 120 minutes in comparison to group D. Though in previous study[10] there was significant fall in heart rate in patients receiving dexmedetomidine, there was no significant fall in blood pressure in patients receiving clonidine. Thus our result in this respect differed from previous study. But no treatment was necessary for these haemodynamic changes and patients remained stable throughout the procedure.

The limitation of our study was that ultrasound guided brachial plexus block was not used as it was unavailable at the time of study, this could have helped to lower the dosage and volume of the local anaesthetic. The gradation for quality of block was based on a previous studies[7,10] which, again cannot be taken as an ideal scale for assessment of the block.

There was significant number of patients receiving clonidine who had side effects like nausea and dry mouth, unlike previous study[10]. However, this did not need any treatment and patients recovered without any severe complaints. These side effects were not found significantly in patients receiving dexmedetomidine. Also, we could not assess sedation in the patients as some of the patients received supplemental sedation. Although α2 agonists are known to produce sedation by central action, by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neurone by activation of α2 adrenoreceptors in the locus coeruleus[11].

Thus it is seen from our study that dexmedetomidine can be used safely with local anaesthetics in peripheral nerve block, it provides excellent analgesia and quality of block with a good safety profile, barring the concern of cost effectiveness. We would like to have future trials to determine the exact dose and unfound adverse effects on the human body.

CONCLUSION

Based on the results of the study it can be concluded that dexmedetomidine prolongs the duration of sensory and motor block and analgesia and also enhances the quality of block as compared with clonidine when used as an adjuvant to bupivacaine in peripheral nerve block.

Conflict Of Interest: There is no conflict of interest.

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