Original article

Comparision of Dextmedomedin & Clonidine as an adjuvant to 0.25% Bupivacaine in surpaclavicular brachial plexus block using nerve locator ":A randomised double-blind prospective study

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Abstract

Introduction: Supraclavicular brachial plexus block is the preferred regional anaesthesia for upper limb surgeries. Various adjuvants are being used with local anesthetics (bupivacaine) to prolong intraoperative and postoperative analgesia .Dexmedetomidine is a highly selective, specific and potent $\alpha_2$adrenergic agonis almost seven to ten times more selective to α_2 receptors and shorter duration of action compared to clonidine.

Objectives: To compare the onset and duration of sensory and motor block ,duration of postoperative analgesia, and adverse effects of dexmedetomidine and clonidine

Methods: sixty patients of ASA class I & II posted for upper limb surgeries (orthopaedic and plastic) were enrolled for a prospective, randomized, double-blind trial. Group D received dexmedetomidine 1 µg/kg and Group C received clonidine 1 µg/kg added to bupivacaine 0.25% (35 cc). Onset and duration of sensory and motor blocks were assessed along with the duration of analgesia, sedation, and adverse effects, if any.

Results: Demographic data and surgical characteristics were comparable in both the groups. Duration of sensory block and motor block was 436.1±16.33 and 498±22.94min, respectively, in group D, while it was 221.23±8.04 &285.67±5.38min, respectively, in group C. Also There was statistically significant difference in onset of sensory and motor block between the two groups with group D 2.67 ± 0.58 & 4.79 ± 0.61min respectively , in group C 4.19±0.55 & 6.94 ± 0.72 min. The duration of analgesia in group D was 442.90±14.92min, while in group C, it was 228.13±7.68min . The time for complete block in group D was 20.87±3.18 min & in group C 28.2±1.77 min found to be statistically significant .

Conclusion: Dexmedetomidine had faster onset of sensory and motorblock, achieved complete block faster ,had increased duration of sensory and motor blockade and prolonged post-operative analgesia as compared to clonidine.

Key words: Adjuvant, Clonidine, dexmedetomidine, supraclavicular block

Introduction:

Brachial plexus block is one of the peripheral nerve blockade which has been used for surgeries of upper limb because of many advantages over general anaesthesia like effective analgesia with good motor blockade, awake patient, extended postoperative analgesia, early mobilization, no airway manipulation, and decreased incidence of side effects .[1] The nerve stimulation technique with nerve locator makes use of an electric current to elicit motor nerve stimulation and confirm the proximity of the needle to the desired nerve with a

good success rate in nerve blocks . Various adjuvants to local anesthetics were used to prolong analgesia with variable results and advantages.[3] . Clonidine, an α2 adrenergic agonist has sedative, analgesic, perioperative sympatholytic with cardiovascular stabilizing effects and has been tried in combination with local anaesthetic drugs to enhance regional anesthesia.[4,5]

The present study was aimed to test the hypothesis that dexmedetomidine produces faster onset of sensoryblock , motor block and prolonges post operative analgesia when added as an adjuvant to bupivacaine 0.25% in supraclavicular brachial plexus block compared with clonidine.

Material and Method :

After ethical committee approval and written informed consent, a double-blind randomized prospective clinical study was carried out on 60 American Society of Anaesthesiologist (ASA) Grade I and II patients of either sex, aged 18–60 years, undergoing various orthopaedic and plastic surgeries on the upper limb by nerve locator guided supraclavicular brachial plexus block. Patients with a history of pre-existing cardiac or pulmonary diseases, peripheral neuromuscular diseases, bleeding or coagulation disorders, allergy to local anaesthetic , refusal to technique were excluded from the study. Any patient taking medications with psychotropic or adrenergic activities and patients receiving chronic analgesic therapy other than simple analgesics were also excluded from the study. The study was conducted in two groups of 30 patients each. The patients were randomly distributed into two groups using computer generated random table . Group C: bupivacaine 0.25% (35 cc) + clonidine 1µg/kg Group D: bupivacaine 0.25% (35 cc) + dexmedetomidine 1 µg/kg. The local anaesthetic solution was prepared by an anaesthetist not involved in the study. On arrival in the operation room, baseline heart rate, blood pressure and oxygen saturation were recorded. An intravenous line was secured in the unaffected limb and Ringer's lactate was started. The anesthetist performing the block was blinded to the treatment group. All observations were carried out by a single investigator who was also blinded to the treatment group. Brachial plexus was approached by supraclavicular route by using nerve locator (PIEXYGON, Italy) using 22G,50mm long stimulation needle (Locoplex, VYGON, France).A clear motor twitch of all fingers was taken as end motor response. As soon as we observed the twitch the current strength was decreased to 0.5 mA with continued observation of twitch. Even at 0.5 mA current when we got a satisfactory twitch of all fingers, the simulator was turned off. The block was performed using local anesthetic mixture according to Group C or Group D .If the finger twitch disappeared on decreasing the current strength, needle position was adjusted by one to two millimetres in such a way as to elicit the twitch response and again the procedure was repeated. After negative aspiration for blood, solution containing anaesthetic mixture was injected with intermittent aspiration. Sensory blockade was tested using pin prick method along the dermatomal areas of median nerve, radial nerve, ulnar nerve and musculocutaneous nerve.

Sensory block was graded as-Grade 0: Sharp pin felt,

Grade 1: Analgesia, dull sensation felt,

Grade 2: Anaesthesia, no sensation felt.

Sensory block accessement was done using pinprick method at each minute after completion of drug injection. Sensory onset was considered when there was dull sensation to pin prick (Grade 1) along the distribution of any of the above mentioned nerves. The duration of sensory block was defined as the time interval between the end of

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local anesthetic administration and the complete resolution of anesthesia on all nerves.

Motor block was assessed by using modified Bromage Scale for upper extremities on a 3-point scale.

Grade 0 : Normal motor function with full flexion and extension of elbow ,wrist and fingures Grade 1: Decrease motor strength with ability to move the fingures only

Grade 2 : Complete motor block with inability to move the figures,

the assessment of motor block was done at each minute till complete motor block after drug injection by the same observer . The onset of motor block was considered when there was Grade 1 block and complete motor block was considered when there was Grade 2 block respectively. The block was considered failed when there was no analgsia in any of the segments supplied by median, radial,ulnar and musculucutaneous nerve , general anaesthesia was administered to this patients and they were excluded from the study group .The duration of motor block was considered as the time interval between the end of local anaesthetic administration till the complete recovery of motor function of the hand and forearm . Duration of analgesia was assessed using standard VAS (Visual analogue scale) 0 to 10. The numeric rating scale was recorded postoperatively every 30 minutes till the numeric score was 5, those patients who had numeric score 5 were given rescue analgesia in the form of Inj Diclophenac sodium (1.5mg) intramuscular and the time of rescue analgesia given postoperatively was recorded. After LA injection, vital parameters (pulse, blood pressure, SPO2) were monitored every 15 min intraoperatively . Postoperatively motor and sensory blockade and vitals of the patient were noted half hourly till the block completely wears off.

Statistical analysis:

The data was analysed by SPSS version (Statistical Package for Social Sciences) software. Unpaired t-test was applied for demographic data, hemodynamic parameters, onset and duration of sensory and motor blockade and duration of analgesia.

Results:

Both the groups were comparable for their demographic data of age, weight as shown in table 1. In our study population total males and females were 28 & 32 respectively. Out of them in group D – 15 males & 15 females were enrolled. In group C- 13 males and 17 females were included. According to the ASA classification grade I & II patients in group D were 17 & 13 respectively and in group C were 18 & 12 respectively .

Table 1: Patients characteristics

Parameters	**Group D (Mean ± SD)**	**Group C (Mean ± SD)**	**P Value`14**
Age (Years)	39.87±4.58	40.7±5.34	0.5207
Weight (Kg)	56.80±7.62	56.63±7.71	0.9318
Sex (M/F)	15/15	13/17	

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The lower pulse rate was observed at 60, 90,105 and 120 min, but not less than 60 beats/min, in Group D as compared with Group C which required no medication to control it as seen in fig1. Systolic blood pressure were found to be significantly lower than baseline from 60 to 120 min in Group D (but not less than 100mm Hg) as compared with Group C . Diastolic blood pressures were found to be significantly lower than baseline from 60 to 120 min in Group D (but not less than 66 mm Hg) as compared with Group C . No treatment was required for this fall in blood pressure as shown in fig 2.

Table 2 : Sensory and motor blockade characteristics.

Parameter/groups	Group D	Group C	P value
Onset of sensory block (min)	2.67±0.58	4.19±0.55	<0.001
Onset of motor block (min)	4.79±0.61	6.94±0.72	<0.001
Time to establish complete block (min)	20.87±3.18	28.2±1.77	<0.001
Duration of sensory block (min)	436.1±16.33	221.23±8.04	<0.001
Duration of motor block (min)	498.03±22.94	285.67±5.38	<0.001
Duration of analgesia (min)	442.9±14.92	228.13±7.68	<0.001

Duration of sensory block and motor block was 436.1±16.33 and 498.03±22.94min, respectively, in group D, while it was 221.23±8.04 &285.67±5.38min, respectively, in group C. Also There was statistically significant difference in the onset of sensory and motor block between the two groups with group D 2.67±0.58 & 4.79±0.61 respectively , in group C 4.19±0.55 &6.94±0.72 minutes respectively . The duration of analgesia in group D was 442.90±14.92min, while in group C, it was 228.13±7.68 min which was statistically significant . The time required to establish complete block in group D is 20.87±3.18 min & in group C 28.2±1.77 min. This difference was found to be statistically significant as shown in Table 2. Duration of analgesia was assessed using standard VAS and the requirement of rescue analgesic in group D is early as compaired in group C as shown in fig 3.

Fig.1

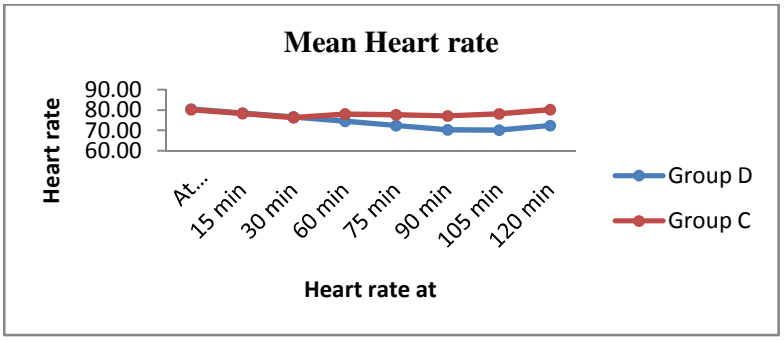

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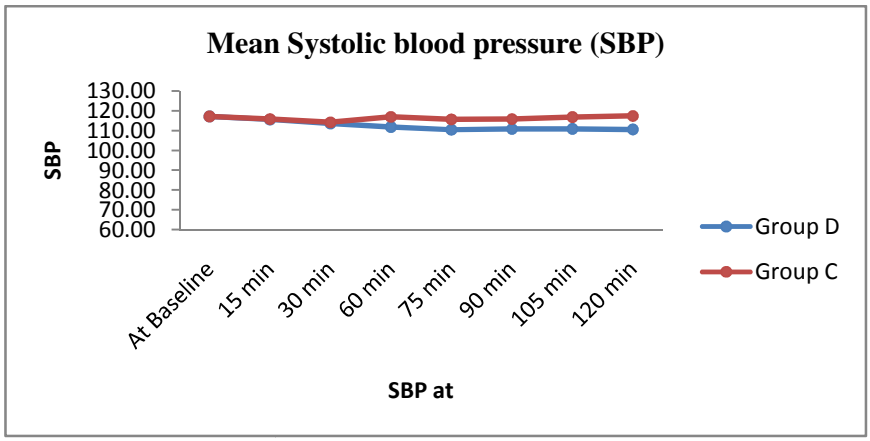
Fig .2



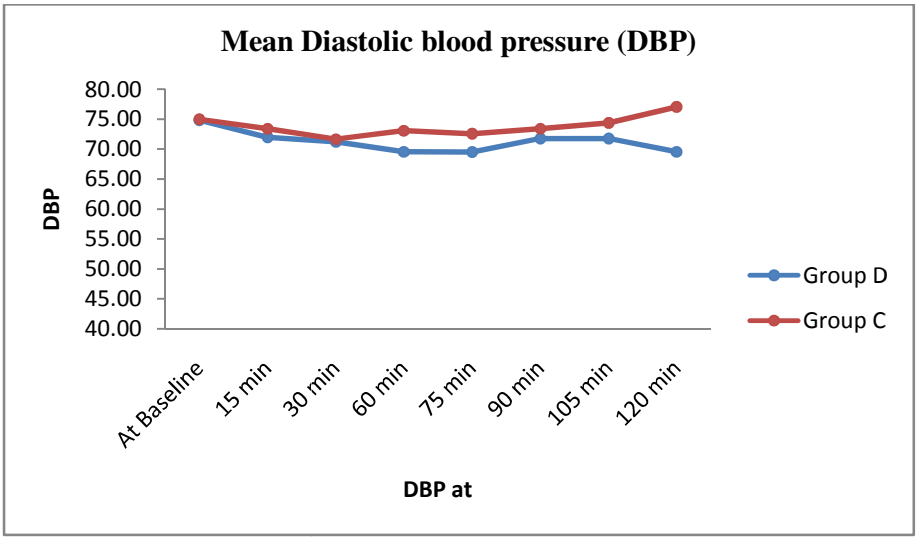
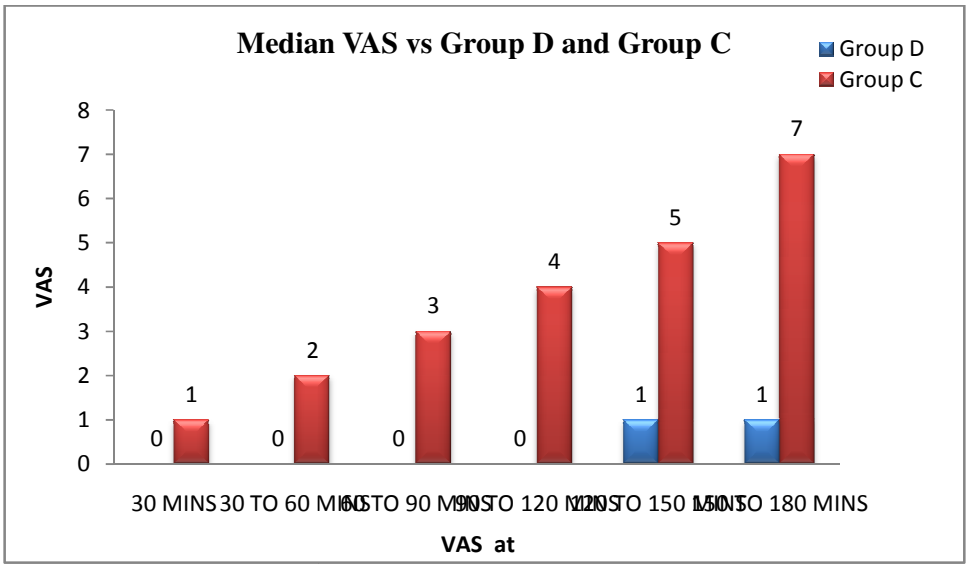


Fig .3



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Discussion:

Nerve locator guided supraclavicular brachial plexus block is a safe, reliable anaesthetic technique for upper limb surgery with less complications. Supraclavicular brachial plexus block is a very popular mode of anaesthesia for various upper limb surgeries, due to its effectiveness in terms of cost and ease of performance, margin of safety and good post-operative analgesia.

We compared dexmedetomidine and clonidine (α2- agonists) as an adjuvant to bupivacaine in supraclaviular brachial plexus block, and found that there was a significantly increased duration of sensory and motor blockade in the dexmedetomidine group than in the clonidine group without any adverse effects. Also there was significant difference in onset of sensory and motor block in both the groups. Clonidine affects mainly synaptic adrenergic receptors in peripheral nerve block techniques. It mainly achieves this by four mechanisms i) centrally mediated analgesa ii) α2-adrenoceptor mediated vasoconstrictive effects iii)attenuation of the response and iv) direct action on the peripheral nerve[6].Dexmedetomidine, a highly selective α2-adrenergic agonist, has analgesic, sedative, anaesthetic sparing effects when used in systemically [7] and it is approximately eight-times more selective towards α2 adrenoceptors than clonidine. Many studies done on animals showed the combination of dexmedetomidine with ropivacaine to be safe and neuro-protective. As dexmedetomidine decreases inflammation around peripheral nerves, thereby decreasing the potential for peripheral nerve injury[8]. In human beings also addition of dexmedetomidine to local anaesthetics during regional anaesthesia and peripheral nerve blocks has proved to be beneficial for patients [9].

Esmaoglu *et al.* added dexmedetomidine to levobupivacaine for axillary brachial plexus block and showed that it shortens the onset time of both sensory and motor block, prolongs the duration of block and the duration of post-operative analgesia. [9] Sandhya Agarwal et al. In another study, when dexmedetomidine added to bupivacaine for supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs their duration. [10] The significantly prolonged duration of analgesia obviates the need for any additional analgesics This may be because peripheral a2 agonist produces analgesia by reducing release of nor epinephrine, leading to α 2 receptor-independent inhibitory effects on nerve fiber action potentials.[7,8] The results of our study corroborate with this study .

A meta analysis done by Popping et al. found that the prolongation of motor block was higher when clonidine was added to bupivacaine as compared with ropivacaine [11]. All the above studies correlated with our study findings. No patient in any of the groups exhibited significant side effects or hemodynamic variability during the preoperative period.

Swami et al. concluded that dexmedetomidine compared to clonidine when added to local anaesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia. But the difference in the onset of sensory & motor block was not significant statistically. [5]. But in our study we found the onset of sensory and motor in dexmedetomidine compaired with clonidine group was statistically significant.

Zhang et al. reported prolonged duration sensory and motor blockade in patients who received dexmedetomidine (50 μg) in 40 ml of 0.33% ropivacaine when compared to control group for axillary brachial plexus block [12].

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However, dexmedetomidine was also associated with an increased incidence of side effects such as bradycardia, hypertension, and hypotension.

None of the patients in Group D required sedation intraoperatively and they were comfortable throughout the surgery with arousable sedative effects. This can be explained on the basis that some amount of systemic absorption of drug could be present.[13] As α2 agonists produce sedation by central action, they produce inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of α2 adrenoreceptor in locus coeruleus.[14] The limitation of our study was that we did not use ultrasound-guided blocks because of unavailability which could have helped us to lower dosages and volumes of local anaesthetic. We would like to conclude from this study that dexmedetomidine can be safely used with local anaesthetic in peripheral nerve blocks, however, further trials to determine the exact dose and effect of neurotoxicity on the human nerve are required with larger number of patients .

Conclusion:

Dexmedetomidine as an adjuvant to 0.25% bupivacaine compared to clonidine for upper extremity surgeries under nerve locator guided supraclavicular brachial plexus block has a definite advantage for enhancement of onset ,duration of sensory and motor blockade profile and post-operative analgesia without any hemodynamic variations and adverse events.

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