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Original Research Paper

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COMPARATIVE EVALUATION OF DEXMEDETOMIDINE AND HYALURONIDASE AS ADJUVANT TO 0.5% BUPIVACAINE PLAIN IN LANDMARK GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

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ABSTRACT

BACKGROUND AND AIMS: Various additives are mixed with local anaesthetic agents to increase the quality of block in regional anaesthesia. We compared Dexmedetomidine and Hyaluronidase as an adjunct to bupivacaine (0.5%) in supraclavicular brachial plexus block with respect to the onset and duration of sensory and motor block and duration of analgesia.

MATERIAL AND METHODS: Sixty American Society of Anaesthesiologists Grades I and II patients scheduled for various orthopaedic surgeries of the upper limb under supraclavicular brachial plexus block were divided into two equal groups in a randomized, double-blind manner. Patients were assigned randomly to one of the two groups. In Group D (n = 30), 10 ml of 0.5% bupivacaine plus 1 ml (100 μg) Dexmedetomidine and in Group H (n = 30), 10 ml of 0.5% bupivacaine plus 1 ml (150 IU) hyaluronidase were given. The onset and duration of sensory and motor block, duration of analgesia, and quality of anaesthesia were studied in both the groups.

RESULTS: There was statistically significant difference in the onset of sensory and motor block in both the groups. The durations of sensory and motor blocks were 502.66 ± 43.78 and 557.67 ± 38.83 min respectively, in Group H, whereas they were 535.9 ± 43.78 and 558.40 ± 38.83 min, respectively, in Group D. The duration of analgesia was 525.33 ± 42.99 min, significantly less in Group H compared to 610.20 ± 42.89 min in Group D ($P < 0.001$). The quality of anaesthesia was significantly better in dexmedetomidine group compared to hyaluronidase group ($P < 0.001$).

CONCLUSION: The addition of dexmedetomidine prolongs the durations of sensory and motor block and duration of analgesia and improves the quality of anaesthesia as compared with hyaluronidasee when injected with bupivacaine in supraclavicular brachial plexus block.

KEYWORDS : Dexmedetomidine, Hyaluronidase, Supraclavicular Brachial Plexus Block

INTRODUCTION

Supraclavicular brachial plexus block is a common regional anaesthetic technique used to provide anaesthesia and analgesia for upper limb surgery.

Dexmedetomidine, is highly selective and specific α2 adrenergic agonist, having analgesic, sedative, antihypertensive and anaesthetic-sparing effects[2] produces manageable hypotension and bradycardia but lacks respiratory depression. It has been extensively studied as an adjuvant to local anaesthetic agents. Dose range 0.5–2 μg/kg has been used in various studies.[3]

Hyaluronidase depolymerises hyaluronic acid, a major component of extracellular matrix. It accelerates onset and improves quality of anaesthesia for subcutaneous infiltration blocks by increasing spread and dispersion of local anaesthetics.[4-6]

MATERIAL AND METHODS

After the Institutional Ethics Committee's approval and written informed consent, this prospective randomized study was conducted on sixty patients of ASA Grade I and II of either sex, aged 20-40 yrs scheduled for upper limb orthopaedic surgeries. Patients known to be sensitive or allergic to study medication, history of cardiac, respiratory, hepatic, renal disorders, clotting disorders and pregnant women were excluded. Details of procedure were fully explained to patient during preoperative visit.

Patients were randomly divided into two groups of thirty patients each. Patients in Group D (n = 30) received 10 ml of bupivacaine 0.5% with 1 ml (100 μg) dexmedetomidine and Group H (n = 30) received 10 ml of bupivacaine 0.5% with 1 ml (150 IU) hyaluronidase. All patients were fasted for 6–8 hours before surgery. Inside operating room, IV access secured with wide bore cannula in non-operative arm and infusion of lactated ringer started. Patients were premedicated with inj. ondansetron 4 mg, ranitidine 50 mg via drip and midazolam 2 mg intravenously. Supplemental oxygen provided via nasal prongs @ 4 L/min. Baseline heart rate (HR), non-invasive blood pressure (NIBP) and SpO_2 were recorded prior to block. Under all aseptic precautions, the supraclavicular brachial plexus block was performed in the supine position.

Sensory and motor blocks were evaluated every 2 min within first 30 min following completion of drug administration. Vital parameters (pulse, blood pressure, respiratory rate and SpO_2) were recorded every 5 min for first 30 min and thereafter every 10 min till the end of surgery.

Sensory block was assessed by pinprick test and graded as
Grade 0-no sensation felt
Grade 1-dull sensation felt
Grade 2-sharp pain felt.

Motor block was assessed using modified Bromage scale as,
3-extension of elbow against gravity
2-flexion of wrist against gravity
1-finger movement
0-no movement.

Onset of sensory block was defined as time from injection of local anaesthetic till no response to pinprick test and **onset of motor block** was defined as time between injection and motor paralysis. **Duration of sensory block** was considered as time interval from complete sensory block till first postoperative pain, and **duration motor block** was defined as time interval between complete paralysis and complete recovery of motor function. Postoperative pain levels were assessed by visual analogue scale (VAS) from 0 (no pain) to 10 (severe pain).

Time between end of local anaesthetic administered and first

analgesic request was recorded as **duration of analgesia.**

Adverse events comprised hypotension (mean arterial pressure <20% from baseline), bradycardia (HR <50 bpm), hypoxemia (SpO_2<90%), nausea and vomiting. At the end of surgery, the quality of anaesthesia was assessed according to a numeric scale[7]

4- Excellent: no complaint from patient
3- Good: minor complaint with no need for supplemental analgesia
2- Moderate: complaint which required supplemental analgesics
1- Unsuccessful: Patient was given general anaesthesia.

Data were analyzed by Student's *t*-test and Chi-square test. *p value* < 0.05 was considered statistically significant.

RESULTS

The demographic data were comparable in each group [Table 1]. Although sensory and motor block onset times were shorter in Group D than in Group H, the difference was statistically significant [Table 2].

Table 1:

Variables	Group D	Group H
Age(years)	**37.83±11.28**	**38.03±11.25**
Weight(Kg)	**57.93±7.36**	**56.47±7.80**
Sex Ratio(M:F)	**22:8**	**20:10**
Type of surgery		
·lower end humerus	**6**	**5**
·radius/ulna/both	**10**	**11**
·hand	**4**	**4**

Sensory and motor block durations were significantly prolonged in Group D compared to Group H (P < 0.001). The duration of analgesia was significantly longer in group D than in group H (P < 0.001) [Table 2].

Table 2:

Variables	Group D	Group H
Onset of sensory block(min)	**9.17 ± 1.262**	**13.8 ± 4.621**
Onset of motor block(min)	**12.63 ± 2.189**	**15.6 ± 6.300**
Duration of sensory block(min)	**535.90 ± 43.78**	**502.66 ± 43.78**
Duration of motor block(min)	**558.40 ± 38.83**	**557.67 ± 38.83**
Duration of analgesia(min)	**610.20 ± 42.89**	**525.33 ± 42.99**

Baseline hemodynamic parameters were comparable in both groups [Figures 1 and 2]. Although there was significant fall in mean pulse rate and blood pressure in dexmedetomidine group, no treatment was required. HR and arterial pressure were comparable during the study period in both groups. The quality of anaesthesia was found significantly better in patients who received dexmedetomidine (P < 0.05).

Figure 1: Comparison of pulse rate.

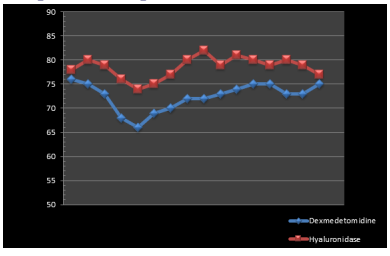
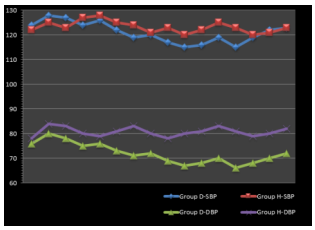


Figure 2:
Comparison of blood pressures.
SBP: Systolic blood pressure
DBP: Diastolic blood pressure



None of the patients experienced hypotension, bradycardia, or hypoxemia that required treatment. Drowsiness, nausea and vomiting were not seen in any patients.

DISCUSSION

We compared addition of dexmedetomidine (100 μg) and hyaluronidase (150 IU) as an adjuvant to bupivacaine in supraclavicular brachial plexus block. The onset time for both sensory and motor blocks using dexmedetomidine in bupivacaine was faster than hyaluronidase. Dexmedetomidine provided longer duration of motor & sensory blocks, prolonged duration of analgesia and better quality of anaesthesia.

It was reported in various studies that the addition of α-2 adrenoreceptor agonists to local anaesthetic agents in peripheral nerve blocks improved quality of anaesthesia and prolonged duration of analgesia[8,9,10,11]

Yoshitomi *et al*[12] found that addition of dexmedetomidine to lignocaine enhances local analgesic effect. Two different sciatic nerve rat models, Brummett *et al*[13] found that dexmedetomidine added to bupivacaine significantly prolonged the duration of analgesia.

The mechanism by which α-2 adrenoreceptor agonist produces analgesia and sedation is likely to be multifactorial.[14] Peripherally they produce analgesia by reducing release of nor epinephrine[15] and causing α-2 receptor-independent inhibitory effect on nerve action potentials.[16] Centrally, α-2 adrenoreceptor agonists produce analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of α-2 adrenoreceptors in locus coeruleus.[17] α-2 adrenoreceptors are coupled via a pertusis toxin-sensitive G protein to potassium ion channel and results in an increase potassium ion channel conductance.[18]

Furthermore, the block was conducted via the landmark-guided technique without the use of a nerve stimulator or ultrasound guidance, which may have led to the relatively lower block success rate for radial nerve compared with that in our study.

Reports of adverse effects associated with hyaluronidase are rare.[19] No adverse effects were seen with hyaluronidase in present study.

CONCLUSION

Our study demonstrated that addition of dexmedetomidine to bupivacaine in supraclavicular brachial plexus block prolonged the duration of analgesia and improved quality of anaesthesia as compared to hyaluronidase with hemodynamic stability and lack of side effects, thus making dexmedetomidine an attractive choice for adjuvant to bupivacaine in supraclavicular brachial plexus block.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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