Original Research Paper

Volume-9 | Issue-8 | August - 2019 | PRINT ISSN No. 2249 - 555X

Anaesthesiology

A COMPARATIVE STUDY OF DEXMEDETOMIDINE AND CLONIDINE AS AN ADJUNCT TO 0.5 % BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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ABSTRACT 120 ASA I and II patients scheduled for upper limb surgeries under supraclavicular brachial plexus block were divided into two equal groups in a randomized, double-blinded fashion. Group C received clonidine 50 µg and Group D received dexmedetomidine 50 µg added to bupivacaine 0. 5% 25 ml. Results: Onset of motor block was faster in Group C while onset of sensory block was comparable .The durations of sensory and motor block were 225+/-50.34 and 287+/-65.74 min, respectively, in Group C, whereas they were 400+/-100.86 and 482+/-84.56min, respectively, in Group D. The duration of analgesia was 292.78+/-67.45 min, significantly less in Group C compared to 492.24+/-108.45min in Group D (P < 0.001). The quality of anesthesia was significantly better in dexmedetomidine group compared to clonidine group (P < 0.001).Conclusion: Dexmedetomidine is the better adjuvant for supraclavicular block when compared to clonidine.

KEYWORDS : dexmedetomidine, clonidine, supraclavicular block

INTRODUCTION

Supraclavicular brachial plexus block is the one most common regional anesthetic technique for upper limb orthopedic surgeries. Among the numerous adjuvants used for block α-2 adrenoreceptor agonists have been extensively used. They provide improved quality of anaesthesia as well as sedation and reduces drug requirement in post operative period.

Clonidine, an imidazoline, α-2 adrenoreceptor agonist, has been extensively studied as an adjuvant to local anesthetic in peripheral nerve blocks[1,2,3]. Relatively newer drug dexmedetomidine has α 1:2 sensitivity of 1:1600 which is 8 times that of clonidine[4].

We attempted to compare fixed amounts these drugs for supraclavicular block along with bupivacaine to assess the better drug in regards to onset and duration of the block, and the quality of analgesia.

MATERIALS AND METHODS

After obtaining the Institutional Ethics Committee's approval and written informed consent, One hundred and twenty patients of American Society of Anesthesiologists Grade I and II of either sex, aged 18–45 years who were scheduled for below elbow orthopedic surgeries were selected. Patients with history of clotting disorders, local infections, cardiac, respiratory, hepatic and/or renal disorders, pregnant patients, patients known to be sensitive or allergic to study medications and patients on adrenoreceptor agonist or antagonist therapy were excluded from the study. Procedure was explained well before the procedure. Study design is prospective randomized and double blinded.

The patients were randomly divided into two groups of sixty patients each. Patients in Group C ($n = 60$) received 25 ml of bupivacaine 0. 5% with 50 µg clonidine and those in Group D ($n = 60$) received 25 ml of bupivacaine 0. 5% with 50 µg dexmedetomidine under ultrasound guidance with strict asepsis after monitoring baseline heart rate (HR), noninvasive blood pressure, and SpO_2 and 1 mg midazolam administration. Vital parameters (pulse, arterial pressures, 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: Sharp pin felt
Grade 1: Analgesia, dull sensation felt
Grade 2: Anaesthesia, no sensation felt.

Motor block was assessed using a modified Bromage scale[2]
Grade 3 = extension of elbow against gravity
Grade 2 = flexion of wrist against gravity
Grade 1 = finger movement
Grade 0 = no movement

Postoperatively, sensory and motor blockade and vitals parameters were noted at 10 min, 30 min and 1, 2, 4, 6, and 12 h after the end of surgery. The onset of sensory block was defined as the time from injection of local anesthetic till no response to pinprick test whereas onset time of motor block was defined as the time between injection and motor paralysis. The duration of sensory block was considered as the time interval from complete sensory block till first postoperative pain, and the duration motor block was defined as the time interval between the complete paralysis and complete recovery of motor function. Postoperative pain levels were assessed by 10 cm visual analog scale (VAS) from 0 (no pain) to 10 (severe pain). Injection tramadol 50 mg administered intramuscularly, as rescue analgesic, when VAS reached >4. The time between the end of local anesthetic administered and the first analgesic request was recorded as the duration of analgesia. Side effects comprised hypotension (a 20% decrease), bradycardia (HR <50 beats/min), hypoxemia (SpO_2<90%), or nausea and vomiting. At the end of surgery, the quality of anesthesia was assessed according to a numeric scale[5]

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.

The data were analyzed by Student's *t*-test and Chi-square test. A $P < 0.05$ was considered statistically significant.

RESULTS

One hundred and twenty five patients posted for upper limb surgeries were assessed for suitability to enroll in the study. Five patients were excluded as they were found to be on beta blockers Patient demographics were similar in each group [Table 1]

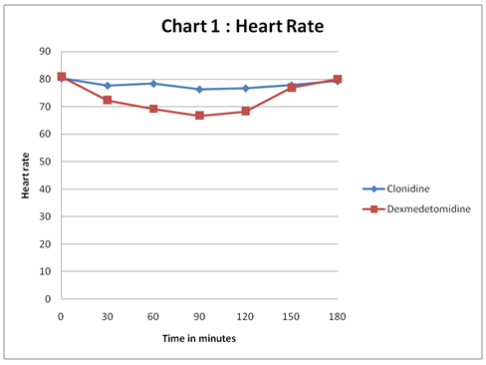
TABLE 1

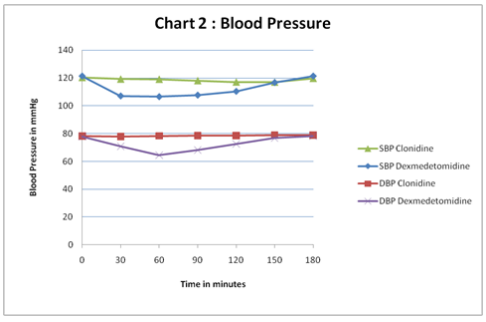
	Group C	Group D	P value
Age in years	30.72+/-12.09	34.5+/-11.72	
Sex (M:F)	42:18	37:23	
Weight in kg	62.1+/-8.2	60+/-9.1	
Onset of sensory block in minutes	2.28+/-1.25	1.96+/-1.28	0.1685
Onset of motor block in minutes	3.45+/-1.65	4.32+/-2.01	0.0108
Duration of sensory block in minutes	225+/-50.34	400+/-100.86	<0.0001
Duration of motor block in minutes	287+/-65.74	482+/-84.56	<0.0001
Duration of analgesia in minutes	292.78+/-67.45	492.24+/-108.45	<0.0001

Although sensory block onset time were shorter in Group D than in Group C, the difference was statistically insignificant, while onset of motor block was significantly faster in Group C than in Group D. Duration of the sensory block, motor block and analgesia were all significantly longer in Group D [Table 1].

The baseline haemodynamic parameters were comparable in both groups. Significantly lower pulse rate was observed at 60, 90 and 120 minutes, in Group D as compared with Group C [Chart 1] (P<0.001) and it never fell below 60/minutes. Systolic blood pressure were found

to be significantly lower than baseline from 30 to 120 min in Group D when compared to Group C (Chart 2) (P<0.001). Diastolic blood pressure followed a similar trend and remained lower in Group D even after 150 minutes. No treatment was required for this fall in blood pressure. The haemodynamic parameters were comparable at the end of 180 minutes.





None of the patients required any supplementary drugs or sedation.85% in Group D and 75% in Group C had grade 4 quality. Rest had some discomfort in the beginning but did not require medication.

TABLE 2

Quality of analgesia	Group C	Group D
Grade 4	45(75%)	51(85%)
Grade 3	15(25%)	9(15%)
Grade 2	0	0
Grade 1	0	0

None of the patients experienced an episode of hypotension, bradycardia, or hypoxemia that required treatment during either intraoperative or postoperative period. Side effects such as drowsiness, nausea, and vomiting were not seen in any patient in the two groups.

DISCUSSION

In the study we compared fixed volume and fixed concentration of drugs in demographically similar groups ie, 25 ml of 0.5% bupivacaine with 50 µgs of clonidine and dexmedetomidine. Onset of sensory block was comparable in both the groups whereas motor block was faster for clonidine. Dexmedetomidine offered a longer sensory and motor block along with longer analgesia and better patient satisfaction.

Adjuvants are used in peripheral nerve blocks to improve their quality, including epinephrine, α-2 adrenoreceptor agonists, opioids. Addition of α-2 adrenoreceptor agonists to local anesthetic agents in peripheral nerve blocks improving the quality the anesthesia and prolonged the duration of analgesia is well described in numerous studies [6,7,8,9]

Popping et al. in their meta analysis of randomized trials showed that the beneficial effect of clonidine on the duration of analgesia was observed with all tested local anaesthetics. They observed that the prolongation of motor block was higher when clonidine was added to bupivacaine as compared with ropivacaine. The least effect was noted with prilocaine[10]

Yoshitomi *et al.*[11] found that addition of clonidine or dexmedetomidine to lignocaine enhances local analgesic effect. They postulated that improved analgesic effect of clonidine and dexmedetomidine was mediated through α-2 adrenoreceptors. Since α-2 adrenoreceptors are not present on the axon of the normal peripheral nerve its action is less obvious. The direct action of clonidine on the nerve can be explained on the basis of a study conducted by Dalle et al. They proposed that clonidine, by enhancing activity-dependent hyperpolarisation generated by the Na/K pump during repetitive stimulation, increases the threshold for initiating the action potential causing slowing or blockage of conduction[12]. Kosugi et al. examined the effects of various adrenoceptor agonists including dexmedetomidine, tetracaine, oxymetazoline and clonidine, and also an α2 adrenoceptor antagonist (atipamezole) on compound action potential (CAP) recorded from frog sciatic nerve, and found that CAPs were inhibited by α2 adrenoceptor agents so that they are able to block nerve conduction[13].

Bajwa *et al.*[14] had compared the dexmedetomidine and clonidine in epidural anesthesia and concluded that dexmedetomidine is a better neuraxial adjuvant compared with clonidine for providing an early onset of sensory analgesia and prolonged postoperative analgesia. However, El-Hennawy *et al.*[8] found no difference in duration of analgesia between either dexmedetomidine or clonidine when added to bupivacaine during pediatric caudal anesthesia. Dexmedetomidine is approximately 8 times more selective toward the α-2 adrenoreceptors than clonidine[2]. Our observations corroborate this fact, and shows dexmedetomidine to be more effective in supraclavicular brachial plexus block and also caused a more pronounced fall in heart rate and blood pressure. Some studies reported the incidence of bradycardia and hypotension with α-2 adrenoreceptor agonists.

Since the procedure was done under ultrasound guidance volume was relatively lower volumes were sufficient to provide the block. And visualization of the spread of the drug ensured proper placement.

CONCLUSION

Our observation showed dexmedetomidine to be an attractive option as an adjuvant for supraclavicular nerve block when compared to clonidine providing longer duration brachial plexus nerve block and post operative analgesia while maintaining the hemodynamic stability and avoiding side effects

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

Conflicts of interest

There are no conflicts of interest.

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