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A COMPARISON OF DEXMEDETOMIDINE AND BUPRENORPHINE AS AN ADJUVANT WITH 0.5% BUPIVACAINE IN PERIPHERAL NERVE STIMULATOR (PNS) GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK- A PROSPECTIVE DOUBLE BLINDED RANDOMIZED CLINICAL STUDY

Anaesthesiology

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ABSTRACT

Background And Aims: We compared the block quality and characteristics between dexmedetomidine versus buprenorphine as an adjuvant to bupivacaine in Peripheral nerve stimulator guided supraclavicular brachial plexus block. The quality of block by dexemetomidine was found to be better than buprenorphine and thus has opioid sparing action. Duration of sensory and motor block along with duration of analgesia were the primary outcomes studied. **Methods:** Total 80 patients of either sex, 40 patients in each group presenting for upper limb surgeries Each participant fulfilling our inclusion criteria then included. **Results:** In our study group D represents the group that received dexemotomidine while group B represents the group that received buprenorphine Mean duration of sensory block in group D was (704.05± 123.16) min and in group B it was (543.25 ± 60.14) min while mean duration of motor block in Group D (& (662.05± 121.83) was longer than Group B (397.50±56.51) and Duration of analgesia in Group D (782.88 ±115.44) was also longer than Group B (636.25±53.62).The results were statistically significant. **Conclusion:** Dexmedetomidine I dose of 1ug/kg prolongs the duration of sensory and motor blockade and duration of analgesia as compared with buprenorphine when used as an adjuvant to 0.5%bupivacaine in supraclavicular brachial plexus block, with no major adverse side effects.

KEYWORDS

Dexmedetomidine; Buprenorphine; Brachial plexus block; Peripheral nerve stimulator.

INTRODUCTION

Supraclavicular brachial plexus block provides anesthesia intraoperatively for surgeries in upper limb around the elbow, forearm and hand. It also provides analgesia in the postoperative period, shortens the patient recovery time and circumvents the major undesired side effects of general anesthesia and protect the organs.[1] Various adjuvants like opioids and non opioid agents like alpha agonist along with local anesthetics have been used in brachial plexus block to achieve quick, thick and prolonged intraoperative block with further better postoperative pain relief.[2]Dexmedetomidine is a highly selective alpha-2 adrenoreceptor agonist., used as an adjuvant to local anesthetic in regional blocks has shown to prolong the duration of block and postoperative analgesia in various studies.[3,4] Buprenorphine is a highly potent semisynthetic agonist–antagonist opioid is known to provide a longer period of postoperative analgesia than other opioids in brachial plexus block.[5,6]This study compares the effect of dexmedetomidine and buprenorphine added to increased dose of bupivacaine i.e 0.5% in peripheral nerve stimulator supraclavicular brachial plexus block. The primary outcome was to compare the duration of the sensory and motor blockade, and duration of analgesia. Secondary outcomes included time to onset of sensory and motor blockade, sedation score, complications and side effects.

MATERIALS AND METHODS

A comparative two group randomized clinical study was conducted after the approval of hospital ethical committee, patients were explained about the procedure and drugs. Informed written consent was taken from all the patients. Sample size formula $N=\frac{(r+1)(Z_{1-\frac{\alpha}{2}}+Z_{1-\beta})^2\sigma^2}{nd^2}$ calculation was done based on study by Vinod CN et al titled A Clinical Comparative Study of Dexmedetomidine and Buprenorphine as an Adjuvant to 0.5% Bupivacaine for Peripheral nerve stimulator guided Supraclavicular Brachial Plexus Block1outcome variable on motor block for a two randomized groups with minimum mean difference of 12 and standard deviation of 20.3,90% statistical power and at 5% level of significance, the sample size of 60 (30 in each group), was calculated clinical study. To account for losses,attrition we included eighty (40 in each group) patients. Eighty ASA 1 and ASA 2 patients who were scheduled for elective upper limb surgeries under peripheral nerve stimulator guided supraclavicular brachial plexus block were randomly divided into two equal groups. Group D (n=40), received 30 ml 0.5% bupivacaine + 1 ml (1mcg/kg) dexmedetomidine and Group B (n=40), received 30 ml 0.5% bupivacaine + 1 ml (3mcg/kg) buprenorphine. Patients with ASA III and ASA IV physical status,MPC4, with coagulopathy or on anticoagulants and other known contraindications were excluded. Duration of sensory, motor blockade and analgesia were assessed along with onset of sensory and motor blockade, hemodynamics and side effects among the two groups. Patient was placed in supine position.A pillow was placed below the shoulder to make landmarks prominent. The head was turned 35 to 45 degree away to the contralateral side. The arm to be anaesthetized was adducted. The midpoint of the clavicle was identified and marked. By asking the patient to raise his head slightly the posterior border of sternocleidomastoid was palpated. The palpating fingers were rolled over the belly of the anterior scalene muscle into the interscalene groove, where a mark was made approximately 1.5 to 2.0cm posterior to the midpoint of clavicle and around 1finger breadth above the clavicle. Palpation of the subclavian artery at this site confirmed the landmark. Under aseptic precautions brachial plexus block was performed by using peripheral nerve locater..The 25mm long 22G stimulating insulated needle was connected to nerve locator. A skin wheal was raised with 2% Lignocaine solution. Nerve locator was started at 2 mili ampere and 1 Hz frequency. The stimulating needle was inserted at the point of entry above the midpoint of clavicle in the caudal-posterior- medial (CPM) direction. Needle was advanced behind palpating finger until any of the following evoked motor responses was elicited at current of 0.5mA like fore arm- extensors- brachioradialis, wrist extensors and hand –flexors or extensors of fingers.Disappearance of contractions after giving local anesthetic solution further confirmed correct placement.During injection negative aspiration was confirmed after every 5 to 7ml to avoid intravascular injection. Following injection, the area was massaged and head high position was given so as to help the solution track along the plexus. The onset of sensory blockade was defined as time taken from the completion of injection of drug till the patient did not feel the pin prick. Sensory block was assessed by pin prick with 23G hypodermic needle in skin dermatomes C5-T1 once in every 2 min for initial 30 min and then after every 30 min till patient regained normal sensations. Sensory block was graded into three: Grade 0- Normal response to pin prick. Grade 1- Analgesia, dull sensation felt. Grade 2- Anesthesia, no sensation felt.12 Duration of sensory blockade was defined as time taken from the onset of sensory blockade till the patient feels pin prick. Onset of motor blockade was defined as the time taken from the injection of the drug till the patient develops loss of movement in ipsilateral upper limb. Quality of motor block was assessed at the same interval and graded using modified Bromage scale for upper extremities. Duration of motor blockade was de ned as time taken from the onset of the motor blockade till complete recovery of motor function of the hand and forearm. Sedation was assessed to the patients after administration of drugs every 30 min in first two hours then every 2 hours till 6 hours postoperative using modified Ramsay sedation scale. Pain was assessed using Visual analog scale (VAS 0-10; 0= no pain, 10= worst pain imaginable), every

hourly postoperatively. At VAS score of 4, rescue analgesia (inj. diclofenac sodium 75 mg I.M.) was given. Duration of analgesia was the time between complete sensory block to the time of first rescue analgesia. All patients were observed for any side effects like nausea, vomiting, bradycardia, respiratory depression, hypotension, pruritis and urinary retention. All patients were monitored intraoperatively with continuous heart rate, ECG, Spo2& Respiratory rate Whereas systolic blood pressure, diastolic blood pressure, mean arterial pressurewas monitored immediately after block , every 5 min for 1 hr, then every 10 min till 3 hr , and then half hourly and also at the end of surgery. However VNRS and Ramsay sedation score was monitored immediately after block and thereafter every 30 minintraoperatively and also postoperatively.

Statistical Analysis

The data obtained was coded and analyzed using SPSS version 25. Continuous variables were expressed as mean±SD values, qualitative data was expressed as frequency and percentages. Association between qualitative data was assessed with Pearson chi square test and between continuous variables was assessed using independent t test.P value< 0.05 was considered as significant. Results were graphically represented.

RESULTS

In our study the demographic profile of age,gender of patients, weight and ASA status of the patients between the 2 groups were comparable.The duration of surgery and ASA status between the 2 groups were also comparable. (Table 1)

Mean duration of sensory block in group D was (704.05± 123.16) min and in group B it was (543.25 ± 60.14) min while mean duration of motor block in Group D (& (662.05± 121.83) was longer than Group B (397.50±56.51) and Duration of analgesia in Group D (782.88 ±115.44) was also longer than Group B (636.25±53.62).Thus both drugs, buprenorphine and dexmedtomidine produce prolongation of sensory and motor block. However mean time to achieve complete block and mean duration of block was statistically significantly prolonged in dexmeditomidine group as compared to buprenorphine group. Also both Buprenorphine and dexmedetomidine have been found to have favourable effect on duration of postoperative analgesia . Significant prolongation of duration of analgesia was seen with dexmedetomidine as compared to buprenorphine.None of the patients in any group required intraoperative supplementation with analgesia or general anesthesia during the surgical procedure. (Table 2)

Both Buprenorphine and dexmedetomidine when used in the doses mentioned above did not produce hemodynamic instability and respiratory depression. However buprenorphine is hemodynamically more stable than dexmedetomidine in supraclavicular brachial plexus block as one patient in dexmedetomidine study group developed bradycardia (pulse rate<60/min) which was transient and treatable. (Figure 1)While nausea was seen in (7.5%), pruritus and vomiting in 5% cases each in buprenorphine group.. There were no other side effects such as hypotension pneumothorax, Horner's syndrome, phrenic nerve palsy or respiratory depression in any of the patients preoperatively, intraoperatively and postoperatively. . (Figure 2).

Table 1: The Demographic Data And Surgical Characteristics

PARAMETERS	Dexmedetomidine	Buprenorphine	P value
Male	30	33	0.586
Female	10	7	
WEIGHT(kgs)	62.7 ± 7.11	60.07 ± 5.99	0.073
AGE (years)	37.17 ± 10.64 (mean +/-SD)	36.27 ± 12.19 (mean +/-SD)	0.726
ASA I	28	27	0. 809
ASA II	12	13	
Mean Duration of Surgery in min	151.25 ± 44.21 (mean +/-SD)	140.75 ± 26.9 (mean +/-SD)	0.203

Table 2: The Characteristics Of Block

	(mean +/-SD)	(mean +/-SD)	P value
Time to achieve complete sensory blockade (min)	11.55+/-1.63	10.20+/-1.20	<0.001
-Duration of sensory blockade(min)	704.05+/-123.16	543.25+/-60.14	<0.001
Time to achieve complete motor blockade (min)	14.58+/-1.82	13.43+/-1.41	0.002
Duration of motor blockade (min)	662.05+/-121.83	397.50+/-56.51	<0.001
Duration of postoperative analgesia (min)	782.88+/-115.44	636.25+/-53.62	<0.001

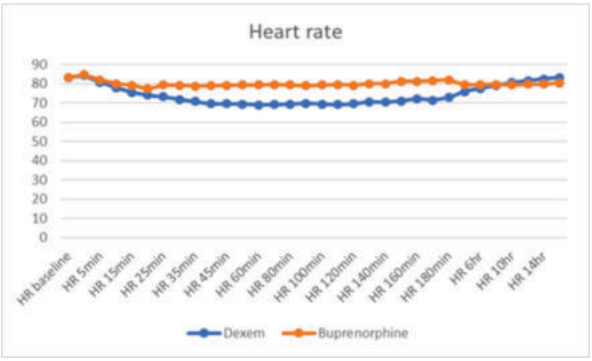

Figure 1: Comparison Of Heart Rate Between Two Groups

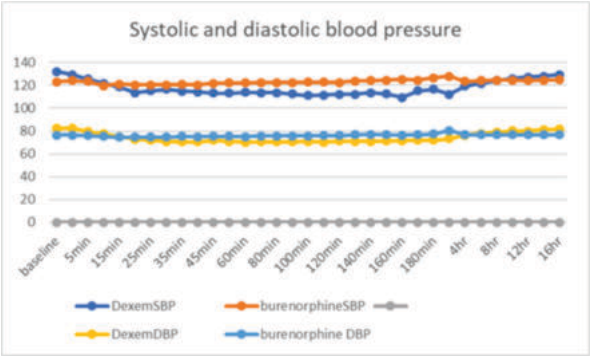

Figure 2: Comparison Of Systolic And Diastolic Between Two Groups

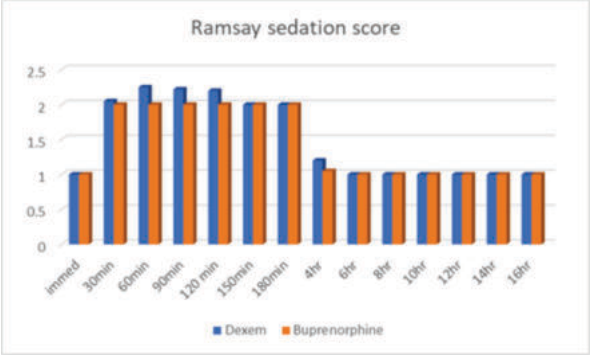

Figure 3: Comparison Of Ramsay Sedation Score (RSS) Between Two Groups

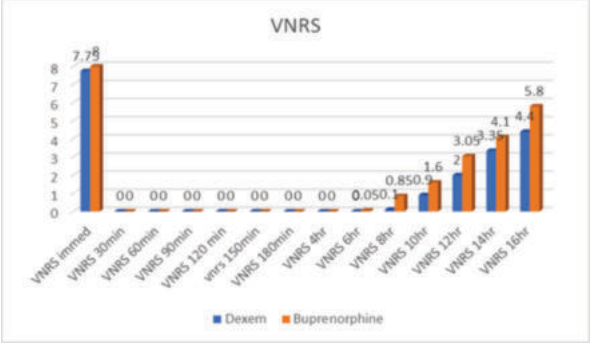

Figure 4: Comparison Of Visual Numeric Rating Scale(vnrs) Between Two Groups

The mean Ramsay sedation score in patients who were given Dexmedetomidine had significant higher Ramsay sedation scores compared to patients who were given buprenorphine in the

intraoperative period and postoperatively up to 4 hrs. (figure 3) All patients were arousable and none of them developed any complications.The mean VNRS score in patients immediately after the anaesthesia was significantly ($p<0.05$) lower in the Dexmedetomidine group compared to the Buprenorphine group and the mean VNRS postoperatively at 8 hr, 10 hr, 12 hr, 14 hr, and 16 hrs was significantly higher in the buprenorphine group compared to the dexmedetomidine group.(figure 4)

DISCUSSION

Brachial plexus nerve block has been used as ideal alternative to general Anesthesia. The advantages of brachial plexus block is better intraoperative and postoperative analgesia, minimal anesthetic drugs, and early discharge. Local anesthetics alone for supraclavicular brachial plexus block provides good operative conditions but have a shorter duration of postoperative analgesia. Hence various drugs such as opioids, alpha 2 receptor agonists, dexamethasone, midazolam, magnesium sulphate etc were used as adjuvant with local anesthetics in brachial plexus block to achieve fast, dense, prolonged block and duration of analgesia postoperatively. In this randomised comparative clinical study, we compared dexmedetomidine and buprenorphine as an adjuvant to bupivacaine in peripheral nerve stimulator supraclavicular brachial plexus block. In study by Vinod C N et al it is seen that there were no significant difference in between the two groups for age, gender, body weight, and duration of surgery as seen in our study.[1] The onset time of sensory and motor block was found to be comparable in both the groups The duration of sensory and motor blockade was significantly longer in dexmedetomidine as compared to buprenorphine. Duration of analgesia was significantly longer in dexmedetomidine than buprenorphine findings similar to our study..Swami et al.in study concluded that dexmedetomidine when added to bupivacaine 0.25% in supraclavicular brachial plexus block increased the duration of sensory and motor blockade and also the duration of analgesia which is similar to our study[7] In study by Lalwani et al it is seen that dexmedetomidine as an adjuvant to bupivacaine 0.375% was studied to see for onset of sensory and motor blockades, duration of sensory and motor blockades, duration of analgesia, and side effects in patient undergoing arm and forearm surgeries, and it was found that dexmedetomidine is a good adjuvant to local anesthetic agents as its addition to bupivacaine, hastens the onset, and prolongs duration of sensory and motor blockades with prolonged postoperative analgesia without any adverse effects.[8] The results were similar to that seen in Agarwal S et al study where dexmedetomidine was added to bupivacaine and sedation was assessed using modified Ramsay sedation score and where patients who received dexmedetomidine had higher sedation score.[9] In study by Vinod C N et al it is seen that the hemodynamic parameters (HR, BP and MAP) were comparable in both the groups with no statistical significance. One patient in dexmedetomidine had bradycardia, treated with inj atropine 0.6 mg IV and two patients in buprenorphine had vomiting as observed in our study. No other major side effects were observed in any group similar findings similar to our study. In Sinha C,et al study it is seen that a lower dose of 1 µg/kg dexmedetomidine added to 0.5% levobupivacaine as adjuvant to bupivacaine in supraclavicular block resulted in faster action, prolonged motor and sensory block, prolonged analgesia with hemodynamic stability and adequate sedation.[10] In Vinod CN et al study it is seen that modified RSS for dexmedetomidine group was 2/6 seen in 13 patients compared to buprenorphine where it was 1/6 seen in only 6 patients as seen in our study where sedation score was higher in dexmedetomidine group Nallam SR et al study concluded that the 100 µg dose of dexmedetomidine in brachial plexus block speeds the onset and prolongs the duration of sensorimotor blockade and analgesia, but with higher frequency of bradycardia and sedation.[11]

CONCLUSION

From our study it is conclude that dexmedetomidine prolongs the duration of sensory and motor blockade and duration of analgesia as compared with buprenorphine when used as an adjuvant to bupivacaine in peripheral nerve stimulator guided supraclavicular brachial plexus block with no adverse side effects.

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