Original Article

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Effect of Dexmedetomidine as an adjuvant to Ropivacaine in Supraclavicular Brachial Plexus Block

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Abstract

Aims: A study was performed to evaluate the effect of dexmedetomidine added to ropivacaine on Supraclavicular brachial Plexus block characteristics, postoperative analgesia, haemodynamics and sedation.

Methods: Sixty patients, of ASA grade I & II of either sex, aged 21 to 60 years, who were undergoing various bony orthopaedic surgeries on the upper limb under supraclavicular brachial plexus block were randomly allocated in to two equal groups of 30 patients each to recieve 29 ml ropivacaine 0.75% plus 1ml saline (group R) and 29 ml ropivacaine 0.75% plus dexmedetomidine 1µg/kg body weight in 1ml saline (group RD) in supraclavicular brachial plexus block. Onset and duration of sensory blocks and motor blocks, duration of analgesia, perioperative haemodynamic parameters, VAS and sedation scores were assessed.

Results: Both groups were comparable with regard to demographic data. The onset of sensory and motor block were significantly earlier in group RD as compared to group R. Duration of motor block and analgesia were significantly longer in group RD as compared to group R. Sedation score were significantly higher in group RD. Though HR, NIBP and Respiratory rate were significantly decreased in group RD, however all patients remained haemodynamically stable.

Conclusion: Dexmedetomidine (1µg/kg) is a good adjuvant to ropivacaine (0.75%) has faster onset, early and prolonged duration of sensory and motor blockade and increased duration of analgesia, with arousable sedation in supraclavicular brachial plexus block for upper limb surgeries.

Keywords: Dexmedetomidine, Ropivacaine, supraclavicular block.

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Introduction

The use of peripheral nerve block for orthopaedic surgery has increased during the last few decades, with increasing demand for post operative pain relief, early & efficient rehabilitation, with reduce morbidity and mortality.[1] Brachial plexus block is a popular and widely employed regional anaesthesia technique for upper limb surgery which avoids unwanted effect of general anaesthesia. It is an excellent alternative for hemodynamic compromised & too ill patients. Supraclavicular brachial plexus block provides satisfactory surgical condition like complete motor & sensory block.[2] Brachial plexus block, is blocked at the level of distal trunk/division.

Besides all local anaesthetics bupivacaine[3] is more frequently used, because of its higher potency and prolonged duration of action. but disadvantage of cardiotoxicity, especially with inadvertent injection into subclavian artery. A long acting local anaesthetic drug, ropivacaine[4] was approved for clinical use in 1996. Ropivacaine is an amino-amide local anaesthetic (LA) effective for both intraoperative anaesthesia and post-operative analgesia. For peripheral nerve blockade, ropivacaine is comparable to bupivacaine and levobupivacaine.[5] However, the lower lipid solubility of ropivacaine gives greater sensory and motor differential blockade and reduces the potential for CNS and cardiotoxicity. Many techniques are used to improve the quality of brachial plexus block like adding an adjuvant, use of ultra sound guided block[6] or insertion of a catheter.[7] In order to avoid catheter complications, adding an adjuvant would be our choice for prolonging the duration of nerve block.

Alpha-2-adrenergic[8] agonists were chosen for their sedative, analgesic, antihypertensive and antiemetic properties along with decreased requirement of local anaesthetics drugs. Dexmedetomidine[9] a selective alpha-2 agonist, with affinity eight times that of clonidine, also has been shown to prolong the sensory and motor duration when added as an adjuvant to local anaesthetic in peripheral nerve block. Thus it is worthy to evaluate the effect of addition of dexmetomidine as adjuvant to Ropivacaine for supraclavicular brachial plexus block.

Materials and Method

After obtaining institutional ethical committee approval patients were explained about the anaesthesia technique and written informed consent was taken. this randomized double blind study was conducted on sixty patients of ASA grade I and II, aged between 21 and 60 years, of either sex, who were undergoing various bony orthopaedic surgeries on the upper limb under supraclavicular brachial plexus block. All the patients were considered otherwise healthy and not have any other medical treatment. Patients were kept NBM for 6-8 hours prior to surgery.

An IV line was secured in the unaffected limb and ringer lactate was started. Standard monitorings were applied using multiparameter monitor and preoperative baseline readings for heart rate, NIBP, pulse oximetry, ECG were recorded. The patients were randomly divided into two group 30 patients in each. Before the procedure, visual analogue scale (VAS) on 0-10 cm was explained to the patient. The supraclavicular block was performed at Midclavicular point, external jugular vein and subclavian artery pulsation were identified.

About 2cm above the midclavicular point just lateral to subclavian artery pulsation, a 24 gauge 1.5 inches short beveled needle was introduced and directed caudal and medially until paraesthesia was encountered, Group R (n=30) received 0.75% Ropivacaine 29 ml + 1ml saline Group RD (n = 30) received 0.75% Ropivacaine 29ml + 1µg/kg of Dexmedetomidine with1ml saline. Sensory block was assessed by the pin prick method at every 1 minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve, Sensory onset was defined as a dull sensation to pin prick, Complete sensory block was considered as complete loss of sensation to pin prick, Duration of sensory block defined as Ropivacaine administration to complete resolution of anesthesia, block will be graded as Grade 0:Sharp pin felt, Grade 1: Analgesia, dull sensation felt, Grade 2: Anaesthesia, no sensation felt.

Table 1: Modified Bromage scale.

Grade	Criteria
0	No motor block
1	Unable to raise extended legs
2	Unable to flex knee
3	Unable to flex ankle and foot

Onset of motor blockade, Peak motor block, and. Duration of motor block was determined at each 1 minute according to a modified Bromage scale for upper extremities on a 3-point scale (Table 1). The block was considered incomplete when any of the segments supplied by median, radial, ulnar and

musculocutaneous nerve did not have analgesia even after 30 min of drug injection. In this case, general anaesthesia was given. Hemodynamic variables such as heart rate, blood pressure, respiratory rate and oxygen saturation were recorded at 0 min, 5 min, 10 min, 20 min, 30 min and then every 30 min after the block intraoperatively and every 30 min post-operatively. Sedation of the patients was assessed by Ramsay Sedation Score. All patients were observed for postoperative analgesia.

Pain intensity was measured using a 10 cm Visual Analogue Scale (VAS) on 0 to 10 points (0=no pain and 10=worst pain), VAS was recorded post-operatively every 30min till the score of 4 or >4. The rescue analgesia was given in the form of inj. Paracetamol 15mg/kg IV at the visual analogue scale ≥4 and the time of administration were noted. All patients was observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma & ropivacaine toxicity and treated with appropriate measures. All data were tabulated and analyzed and results were expressed as mean ± standard deviation. All observations were analysed using Student t-test and Chi square test. P-value <0.05 was considered statistically significant.

Results

The demographic data were comparable between the two groups (Table 1). The onsets of the sensory block and motor block were significantly earlier in group RD as compared to group R (Table. 2).

Table 2: Patients variables.

Parameters	Group R	Group RD
Age (years)	32.36±8.55	31.16 ±7.44
Weight (kg)	67.16±5.93	66.90±6.07
Sex (M:F)	24 : 06	25 : 05
Onset of sensory block (min)	13.6±2.47	9.53±2.65
Onset of motor block (min)	19.43±3.95	11.46 ±2.98
Duration of sensory block (min)	303.33±39.52	441.66±74.07
Duration of motor block (min)	278.66±44.77	407.33±53.09
Duration of analgesia (min)	344 ±52.06	685.33±90.02

Values are Mean±SD or number ; p <0.05 significant.

Onset and peak of sensory & motor blockade was faster in group RD as compare to group R. Duration of sensory & motor blockade was longer in group RD than in group R. Prolonged duration of analgesia was observed in group RD than Group R (Table 3). In 24 hr post block period consumption of rescue analgesic was significantly lower in RD group than in group R. Sedation was higher in group RD than group R.

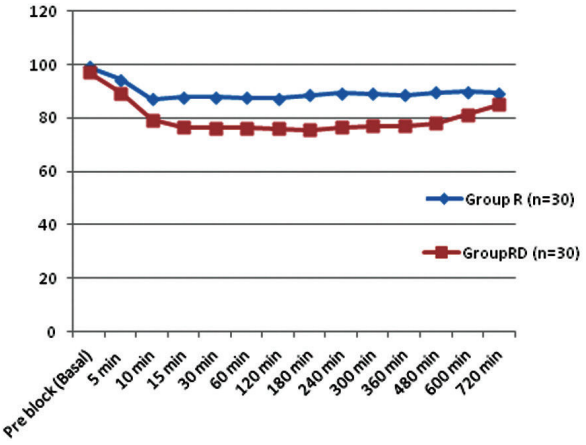

Fig. 1: pulse rate per min.

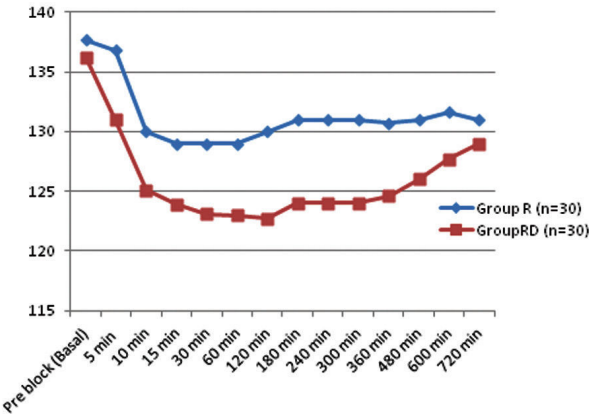

Fig. 2: Systolic Blood pressure (mmHg).

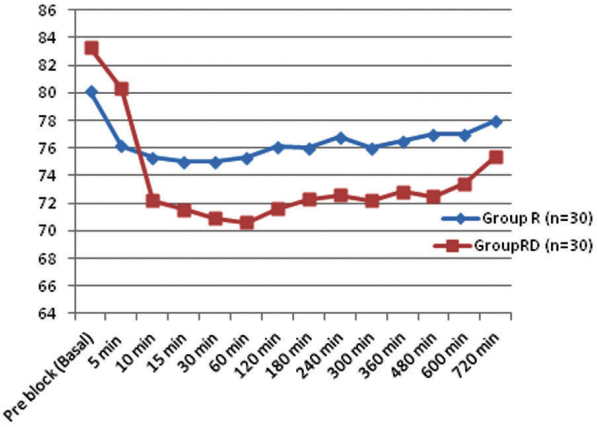

Fig. 3: Diastolic blood pressure (mmHg).

The VAS score was more decreased and remained significantly at low level in group RD as compared to group R after the block & difference was statistically significance (P<0.05) fall in pulse rate, SBP, DBP and respiratory rate was much more in

RD group than R group and remained significantly low (P<0.05). Hemodynamical stability was seen in both groups but patients in group RD were more stable than group R. No significant side effects or complications were seen in both groups.

Table 3: Sedation Score.

Time	Group R		Group RD	
	mean	SD	mean	SD
Pre block (Basal)	1.06	0.24	1.03	0.18
Post block at				
5 min	1.8	0.4	1.96	0.17
10 min	2	0	2.2	0.44
15 min	2	0	2.53	0.49
30 min	2	0	2.53	0.49
60 min	2	0	2.5	0.5
120 min	2	0	2.3	0.45
180 min	2	0	2.13	0.33
240 min	2	0	2.1	0.2
300 min	2	0	2	0
360 min	2	0	2	0
480 min	2	0	2	0
600 min	2	0	2	0
720 min	2	0	2	0

Discussion

Alpha-2 adrenergic agonists like dexmedetomidine have property to produce analgesia and sedation when used as an adjuvant in regional anaesthesia. The faster onset of action of local anaesthetics, rapid establishment of both sensory and motor blockade, prolonged duration of analgesia and stable cardiovascular parameters makes these agents a very effective adjuvant in regional anaesthesia.

The results of our study indicate that Dexmedetomidine when added to Ropivacaine 0.75% prolongs the duration of sensorimotor blockade and duration of analgesia perioperative sedation in brachial plexus supraclavicular block by blocking the hyperpolarization-activated cation (Ih) current, α2-adrenoceptor agonist enhances hyperpolarization and inhibits subsequent action potentials.

In the present study, onset time of sensory and motor blocks were significantly earlier in patients who received dexmedetomidine as adjuvant. Similar results were reported by Nema et al (2014)[10] where the onset was earlier in dexmedetomidine group and the result was statistically significant. prolonged duration of analgesia with prolong sensory and motor block with addition of dexmedetomidine in brachial plexus block was also found by Bharti et al (2015)[11] Santosh et al (2016)[12] and vinit et al (2017)[14] in their studies.

Effectiveness of dexmedetomidine as sedation scores were significantly higher as it produced good sedation in significant number of the patients result of our study correlates with Sharma et al (2016).[13] They found better sedation scores in dexmedetomidine group and 24 hr post block period consumption of rescue analgesic was significantly lower in RD group than in group R, where Mean consumption of rescue analgesic in RD group & R group was 2±0.06 & 3.3±0.6 respectively and difference was statistically highly significant (P>0.0001) Nema et al (2014)53 also found that the cumulative analgesia consumption in 24 hr was significantly reduced.

Decrease in pulse rate, SBP, DBP and respiratory rate in both groups, but in RD group much decrease in pulse rate, SBP, DBP and respiratory rate as compared to R group supposed to be due to systemic absorption of dexmedetomidine from the site of drug administration which cause low sympathetic state[13], better control over pain (low VAS score) & sedation. The result of our study coincides with Bharti et al (2015)[11] and Sharma et al (2016).[13] They found that there is a significant decrease in mean pulse rate, SBP, DBP and respiratory rate in patients receiving dexmedetomidine as an adjuvant to local anaesthetics in femoral nerve block. Side effect profile of the dexmedetomidine was favourable as none of the patient in RD group had profound deep sedation or respiratory depression.

Conclusion

We conclude that dexmedetomidine is a good adjuvant in supraclavicular brachial plexus block for upper limb surgeries has faster onset, early and prolonged duration of sensory and motor blockade and increased duration of analgesia, without any significant side effects.

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