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Dexmedetomidine As Adjuvant To Ropivacaine in Brachial Plexus Block-A Dose Response Study

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ABSTRACT

Aims and Objectives: To assess effect different doses of dexmedetomidine with ropivacaine on prolongation of blocks.Post operative analgesia. and effect on haemodynamic parameters.

Methods - Prospective, randomized study of 90 patients in three groups each comprising of 30 patients. Patients belonging to ASA I & II of age 20-60 yrs. Group R-0.75% Rovivacaine 19ml+NS 1ml=20 ml Group RD1-0.75% Ropivacaine 19ml+25ug dexmedetomidine to =20 ml Group RD2-0.75% Ropivacaine 19ml+50 ug dexmetomidine to =20ml Through supraclavicular approach with the aid of a nerve stimulator, by using a 22 G short beveled, insulated 25 mm stimulating needle. Onset of block, duration of analgesia, side effects , and level of sedation was observed and recorded.

Results: Mean time for post operative analgesia was significantly longer in dexmetomidine(50) group (9.6 hours) than in the ropivacaine group (3.55 hours). (p-value<0.01). Heart rate and blood pressure compared at 30 minute and 45 minute intervals were significantly less in dexmetomedine group. (p-value < 0.05). Bradycardia and hypotension did not require any therapeutic intervention. Dexmetomedine group patients were found to be more sedated than control group.

Conclusion: Adding dexmetomedine 25 µg and 50 µg to ropivacaine prolongs the duration of brachial plexues anaesthesia and analgesia. It is safe and is likely to be as effective as higher doses of ropivacaine without severe adverse effects.

KEYWORDS Dexmetomedine , ropivacaine, brachial plexues.

Introduction: Brachial plexus block is a very popular mode of anaesthesia for various limb surgeries. This approach is attractive due to its effectiveness in terms of cost and performance, margin of safety along with good post operative analgesia. It is carried out at the level of trunks of brachial plexus. Ropivacaine is a long-acting amide local anesthetic with a potentially improved safety profile when contrasted to bupivacaine [1,2]. Human trials have demonstrated less cardiac depression and fewer central nervous system effects when ropivacaine is used. The fact that ropivacaine may offer less cardiac and neurologic toxicity with intravascular injection suggests a potential clinical advantage of this drug during neural blockade when large volumes of local anesthetic are required.A variety of adjuvant has been studied for brachial plexus blockade including opiods and non opiod agents.Alpha2 adrenergic agonist added to L.A. solution for improving efficacy of block during surgery and reducing the onset time and extending post operative analgesia in spinal, extradural and peripheral nerve block. Dexmedetomidine has shown greater affinity as alpha2 agonist than Clonidine. Dexmedetomidine when added to ropivacaine for regional anaesthesia demonstrate that addition of .25 and 0.5 milligram/kilogram dexmedetomidine improves quality of anaesthesia and intraopertive as well postoperative analgesia without causing side effect.

Materials and Methods:After obtaining clearance from the ethical committee of the hospital,study was undertaken in department of anaesthesiology ,peoples medical college and hospital in routine and emergency orthopaedics department The study group includes American society of Anaesthesiology (ASA) grade I and II both gender and age group between 18-60 years, undergoing upper limb surgery. After obtaining informed consent and institutional approval 90 patients will be selected for this study. After taking history, physical examination and all routine investigation were done. Before performing the procedure venous cannnula 18 gauze will be secured in opposite hand and routine monitors like pulse oximetry, non invasive blood pressure, electrocardiogram attach. Vital parameters like pulse rate, blood pressure, resp rate, saturation will be recorded 10 min prior to procedure and before block placement and every 5 min thereafter for 30 min, after that every 10min till the procedure is over.Onset of block, duration of analgesia, haemodynamic changes,side effects and level of sedation will be observed and recorded. All patients will be observed in post anaesthesia care unit and time of first analgesic requirements will be recorded. 90 patients in three groups each comprising of 30 patients. Through supraclavicular approach with the aid of a nerve stimulator, by using a 22 G short beveled, insulated 25 mm stimulating needle.

TABLE 1: DISTRIBUTION OF GROUPS

Group R	0.75% Rovivacaine 19ml+NS 1ml=20 ml	n=30
Group RD 1	0.75% Ropivacaine 19ml+25ug dexmedetomidine to =20 ml	n=30

Group RD 2	0.75% Ropivacaine 19ml+50 ug dexmedetomidine to =20ml	n=30

TABLE 2 : DEMOGRAPHIC DATA

Para meters	Group R Mean ± SD	Group RD 1 Mean ± SD	Group RD 2 Mean ± SD
Age yr	46.2 ± 13.65	45.6 ± 10.2	42.2 ± 9.99
Weight (kgs)	62.3 ± 6.78	59.7 ± 8.57	63.9 ± 10.77
Height in cm	136.2 ± 10.78	140.3 ± 9.25	139.7 ± 10.94

- Assessment
- Sensory block- by alcohol swab
- Motor block Bromage three point scale:

Grade 0-normal motor function with full flexion & extension of elbow, wrist & fingers.
Grade 1-decreaes motor strength with ability to move fingers & or wrist only.
Grade 2-complete motor blockage with inability to move fingers

The degree of sedation was evaluated by using the University of Michigan Sedation (UMSS) of 0 to 4

- O-awake and alert
- 1-minimally sedated/Sleepy, response to conversion or sound
- 2-Moderaterly sedated, easily aroused by tactile stimulation or simple verbal command
- 3-Deeply sedated, aroused by significant stimulation.
- 4-could not aroused.

OBSERVATION TABLE

There were no differences in age, weight, gender, or ASA classification among the groups(table 2). The mean onset time of motor block (loss of shoulder abduction) and sensory block (by pinprick) is depicted in table 3 . In all three groups, mean onset time of sensory block was <6 min. The onset of motor and sensory block was not statistically different among the groups. Potential differences in these times among groups are demonstrated by the 95% confidence intervals for the pairwise differences, which are shown in . Pairwise confidence intervals all have a range <4 min, which indicates that any undetected differences are likely to be small. All patients with a successful block had loss of pinprick sensation over the dermatomes of the deep cervical plexus (C2-4) before skin incision. In addition, there were no adverse events in the three groups requiring intervention by the anesthesia team. The times until first oral narcotic, onset of incisional discomfort, and return of full sensation of the shoulder are presented in . Full sensation of the shoulder occurred at times similar to onset of incisional discomfort. The largest difference observed was for return of shoulder sensation, when comparing 0.5% bupivacaine and 0.75% ropivacaine. As indicated by the confidence intervals, this difference could be as small as -1.8 or as large as 7.0 h. The duration of motor block was 5.2 ± 0.78 hrs in Group R, 8.3 ±1.25 hrs in Group RD 1, 8.8 ± 1.76hrs in Group RD 2, (p<0.0001)

Table 3: SENSORY AND MOTOR BLOCKAGE ONSET AND DURATION OF ACTION OF THE DRUGS

Para meters	Group R Mean ± SD	Group RD 1 Mean ± SD	Group RD 2 Mean ± SD	ANOVA
Onset sensory (min)	5 ± 0	5 ± 0	5 ± 0	NS
Onset motor (min)	11 ± 2.10	11.5 ± 2.41	11.5 ± 2.41	0.0857
Duration sensory (hrs)	6.2 ± 0.78	9.3 ± 1.25	9.7 ± 1.94	0.0001
Duration motor (hrs)	5.2 ± 0.78	8.3 ±1.25	8.8 ± 1.76	0.0001
Rescue analgesia (hrs)	7.2 ± 0.78	10.3 ± 1.25	10.7 ± 1.94	0.0001
VAS at recovery	5.8 ± 0.78	4.6 ± 0.69	4.4 ± 0.51	0.0001

Statistical analysis:- Descriptive statistics for onset and duration were produced, including mean +/- SD. Standard normal theory was used to calculate 95% confidence intervals for pairwise differences between each pair of local anesthetic concentrations. These intervals convey the statistical significance (confidence intervals that do not include zero imply significance at the 0.5 level) as well as the variability in measures. The P value was calculated by ANOVA test and P value of less than 0.001 was considered significant and P value less than 0.0001 was considered highly significant.

Results: There were no differences in age, weight, gender, or ASA classification among the groups. The onset of motor and sensory block was not statistically different among the groups. Potential differences in these times among groups are demonstrated by the 95% confidence intervals for the pairwise differences.All variables were calculated and the P value was calculated by ANOVA test and P value of less than 0.001 was considered significant and P value less than 0.0001 was considered highly significant. . The duration of motor block was 5.2 ± 0.78 hrs in Group R, 8.3 ±1.25 hrs in Group RD 1, 8.8 ± 1.76hrs in Group RD 2, (p<0.0001,highly significant).Resque analgesia was required at around 6-7 hrs in ropivacaine alone with VAS scores reaching >6 whereas resque analgesia in RD 2 group was at >10 hrs and VAS scores were also <5.The sedation score was measured by using the University of Michigan Sedation (UMSS) of 0 to 4 was never above 2 in even high dose of dexmetomidine.

Discussion:

The selection of the optimal long-acting local anesthetic and concentration for brachial plexus block must take into consideration the available anesthetics, the time to onset, duration of blockade, and side effects of each drug and dose. A drug that has a fast onset, long duration, and minimal toxicity profile could be an advantage. Introduced recently, ropivacaine offers an alternative to bupivacaine for long-acting neural blockade. A variety of adjuvant has been studied for brachial plexus blockade including opiods and non opiod agents.Alpha2 adrenergic agonist added to L.A. solution for improving efficacy of block during surgery and reducing the onset time and extending post operative analgesia in spinal, extradural and peripheral nerve block. Dexmedetomidine has shown greater affinity as alpha2 agonist that Clonidine, Dexmedetomidine when added to ropivacaine for intravenous regional anaesthesia demonstrate that addition of .25 and 0.5 milligram/kilogram dexmedetomidine improves quality of anaesthesia and intraopertive as well postoperative analgesia without causing side effect.

A study by Amany S. Ammar, Khaled M Mahmoud, used 30ml of 0.33% bupivacaine as control & 30ml of 0.33% bupivacaine with 0.75microgm/kg dexmed in "Ultrasound-guided single injection infraclavicular brachial plexus block using Bupivacaine alone on combined with dexmedetomidine for pain control in upper limb surgery and concluded that Dexmedetomidine- enhance the onset of sensory and motor blockage, Prolonged duration of analgesia, yields lower VRS pain scores, reduced supplement opioid requirements[3]. Supraclavicular brachial plexus block with 0.75% ropivacaine and with additives tramadol, Fentanyl did a comparative pilot study by Ravi Madhusudhana, Krishna Kumar, Ramesh kumar, Somasekharam Potli, Dinesh Karthik, Manu Kapil and concluded that Ropivacaine showed advantages over bupivacaine for axillary brachial plexus block[4]. Because no statistical difference were found between the two ropivacaine groups, we therefore conclude that 0.75% does not add benefit and that 0.5% ropivacaine should be used to perform axillary brachial plexus blocks.

A study by Swami SS, KeniyaVM, LadiSD used clonidine 1 microgm/kg & dexmed 1 microgm/kg added to bupivacaine 0.25%(35cc)" Comparison of dexmedetomidine and Clonidine (alpha2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia. Madhusudhana R, Kumar K, Kumar R, Potli S, Kapil M. Supraclavicular brachial plexus block with 0.75% ropivacaine

and with additives tramadol, fentanyl–a comparative pilot study. [4]This study also compared three drugs via ANOVA test of significance and onset and duration of sensory and motor block .Time for resque analgesia was also noted .our study is similar to above in many respects. Clonidine added to bupivacaine enhances and prologs analgesia after brachial plexus block via a local mechanism in healthy volunteers Hutschala D Mascher H. schmetterer L, Klimscha W Fleck T Eichler HG et al [5]Analgesic effects of low-dose ropivacaine for interscalene brachial plexus block for outpatient shoulder surgery: a dose-finding study. Krone SC, Chan VW, Regan J, Peng P, Poate E M, McCartney C, Miniaci A.[6]. 0.75% and 0.5% ropivacaine for axillary brachial plexus block: a clinical comparison with 0.5% bupivacaine Bertini L, Tagariello V, Mancini S, Ciaschi A, Posteraro CM, Di Benedetto P, Martini Oand found Ropivacaine showed advantages over bupivacaine for axillary brachial plexus block[7]. Hickey R, Hoffman J, Ramamurthy S compared ropivacaine 0.5% and bupivacaine 0.5% for brachial plexus block [8]. Because there is statistical differences between the two groups, we therefore conclude that 0.75% ropivacaine along with dexmetomidine 50 is very effective in prolonging the analgesia and post op narcotic requirement in brachial plexues surgeries. . Aho MS, Erkola OA, Scheinin H, Lehtinen AM, Korttila KT studied effect of intravenously administered dexmedetomidine on pain after laparoscopic tubal ligation.[9] The sedation score was measured by using the University of Michigan Sedation (UMSS) of 0 to 4 was never above 2 in even high dose of dexmetomidine. Our study was also similar to the above studies and the results obtained were in close association with their results.

CONCLUTION: In conclusion, there was no clinical difference in onset and sedation among 0.5% ropivacaine, 0.5% ropivacaine with dexmetomidine 25, and 0.5% ropivacaine with dexmetomidine 50 when injected in equal volumes for brachial plexus block. The fact that increasing the concentration of dexmetomidine from 0.25 to 0.5% improved the duration suggests that the higher doses of dexmetomidine could be used without increasing much of its side effects . Because ropivacaine in addition to dexmetomedine 50 has a potentially improved profile compared with ropivacaine alone, it may offer an advantage.

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