Clonidine as an Adjuvant to Ropivacaine in Supraclavicular Brachial Plexus Block: A Randomised Double Blinded Prospective Study

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ABSTRACT

Introduction: Peripheral nerve blocks usually use adjuvants to local anesthetics to enhance the quality and duration of analgesia. The present study was aimed to compare the onset and duration of sensory and motor blockade of 0.5% Ropivacaine alone or in combination with Clonidine during supraclavicular block for upper limb orthopedic surgeries.

Material and Methods: 60 adult ASA grade1 and 2 patients scheduled for upper limb surgeries were randomized to receive either 30 ml of 0.5% Ropivacaine + 0.6ml saline (Group R) or 30 ml0.5% Ropivacaine and0.6 ml (100µg) of Clonidine (Group RC) in supraclavicular block. Onset and duration of sensory and motor blockade, duration of analgesia, postoperative pain score, and analgesic requirement were compared. The hemodynamic variability, sedation, respiratory adequacy and any other adverse effects were also recorded.

Result: The Clonidinegroup of patients showed an increase in the duration of sensory loss from 676 min to 885 min, motor blockade from 470 min to 770 min, and analgesia from 793 min to 912 min.There was no statistically significant difference in the onset of sensory and motor blockade between the two groups. No adverse effect of Ropivacaine and Clonidine was reported.

Conclusion: Clonidine (100µg) as adjuvant to Ropivacaine, for supraclavicular brachial plexus blockade, prolongs sensory and motor blockade and post operativeanalgesia, without and increased incidence of side effects.

Key words: Clonidine, Ropivacaine, supraclavicular block**.**

INTRODUCTION

Clonidine, has partial agonist activity at α-2 adrenergic receptor, and has been used as an adjuvant to Ropivacaine for regional anaesthesia.[1,2] The use of α-2 adrenoceptor agonist as an adjuvant is a new addition to their clinical application, besides antihypertensive use.[3]

Clonidine, when combined with a local anaesthetic, has been found to extend the duration of nerve block.[4] this action of α-2 adrenergic agonist is due to attenuation of inflammatory response, vasoconstriction and centrally mediated analgesia.[5] Supraclavicular brachial plexus block is the most common used technique of anaesthesia for forearm and arm orthopedic surgeries in our setup**.** Ropivacaine is an aminoamide local anesthetic preparedas pure "S" enantiomer. This single enantiomer composition and the lower lipid solubility have produced a drug with less cardiotoxicity than bupivacaine. It is prepared as a plain solution withoutepinephrine due to its unique intrinsic vasoconstrictoractivity. Unlike the other amide local anesthetics there appears to be no prolongation of action with the addition of epinephrine.[6,7] It is still not known that how Clonidine exerts its anti-nociceptive action, there are numerous theories, and a number clinical studies have shown that clonidine when used in combination with local anaesthetics can prolong the duration of analgesia,[8] including when injected into peripheral nerve sheaths.[9] Clonidine is better than epinephrine in enhancing the duration of plexus blockade when used in combination with bupivacaine, besides avoiding the potential risks of epinephrine.[10,11]

The present study was aimed to study the effect of Clonidine (100µg) as an adjuvant to Ropivacaine (0.5%) on the onset and duration of sensory and motor blockade in supraclavicular block for upper limb orthopedic surgeries.

MATERIAL AND METHODS

This prospective double- blinded randomized clinical study was conducted on 60 ASA 1 AND 2 grade patients aged between 20 and 55 years of either gender, undergoing arm and forearm orthopedic surgeries under supraclavicular plexus block. Approval from the Institutional Ethical Committee and written informed consent from all the patients were taken.Patients with a history of pre-existing cardiac or pulmonary diseases, peripheral neuromuscular disease, bleeding or coagulation disorder, allergy to local anaesthetic amides, or refusal to technique were excluded from the study. Patients with medical history of adrenergic drugs, psychotropic medications, or patients receiving chronic analgesic drugs were also excluded from the study. Patients were randomized according to computer generated number into two equal groups of 30 patients each to receive either 30 ml of 0.5% Ropivacaine with 0.6 ml normal saline (Group R),or 30 ml of 0.5% Ropivacaine with 0.6 ml (100µg) of Clonidine (Group RC) for supraclavicular brachial plexus block. The local anaesthetic solutions were prepared according to a random number table by an anaesthetic staff not involved in the study. After securing an intravenous access with an 18 G intracath, RL fluid was started at the rate of 4 mL/kg/hour in all patients, and continuous monitoring of pulse rate, oxygen saturation, ECG, non-invasive BP was started. The anaesthetist performing the block was blinded to the treatment group. All observations were carried out by a single investigator

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who was blinded to the treatment group. The supraclavicular plexus block was performed by the classic approach using a single nerve stimulator (Plexygon, VYGON, Padova, Italy) technique. The injection site was infiltrated with 1 ml of lidocaine 2% subcutaneously. Brachial plexus location was achieved by using a nerve locater (Plexygon, VYGON, Padova, Italy), and connected to a 22 G, 50-mm long stimulating needle(Braun Stimuplex Melsungen, Germany).The location end point was a distal motor response (flexion or extension at interphalengeal joints, wrist or elbow) with an output lower than 0.5 mA (t=0.3ms;*f* = 2 Hz).During injection negative aspiration was performed every 5 ml to avoid intravascular injection. Sensory block was assessed by the pin prick method. Sensory blockade was assessed every minute after administration of the drug. The assessment was done in the dermatomal areas corresponding to the all four nerves (median nerve, radial nerve, ulnar nerve, and musculocutaneous nerve), and it was continued till the completion of the sensory blockade. A dull sensation to pin prick was taken as onset of sensory blockade, whereas full loss of sensation to the pin prick was taken as completion of sensory blockade.

Sensory block was graded as-

Grade 0: Sharp pin felt.

Grade 1: Analgesia, dull sensation felt.

Grade 2: Anaesthesia, no sensation felt.

Motor blockade was assessed every minute till its completion. Grade 1 motor block was taken as onset, whereas Grade 2 motor block was taken as peak motor blockade.

Modified Bromage scale for upper extremities was used in determining the level of motor blockade.[12]

Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers.

Grade 1: Decreased motor strength with ability to move the fingers only.

Grade 2: Complete motor block with inability to move the fingers.

Failure of analgesia in the dermatomal areas of any of the above mentioned nerves even after 30 min of drug administration was considered as incomplete block, and patients were given intravenous fentanyl (1 µg/kg) and midazolame (0.02 mg/kg). A failed block was considered when more than one nerve was unaffected. In case of failed block the case was abandoned and the block was converted to general anaesthesia.

Haemodynamic parameters were monitored every 30 min after the block, and every 60 min postoperatively. Ramsay sedation score was used to assess the sedation.[13]

After completion of the operation, the quality of the operative conditions were assessed as following,[14]

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

An anesthesiologist not involved in the study, assessed the patients perioperatively. Duration of analgesia was assessed with Visual analog scale of 0 to 10. The numeric rating scale was recorded post-operatively every 60 min till the score of 5. The rescue analgesia was given in the form of inj. diclofenac sodium (1.5 mg/ kg) intramuscularly at the Neumeric Rating Scale of 5 and the time of administration was noted. The duration of sensory block was defined as the time interval between the end of local anaesthetic administration and the complete resolution of anaesthesia on all nerves. The time interval between the end of local anaesthetic administration and the complete recovery of motor function was taken as the length of the motor block.

STATISTICAL ANALYSIS

The data was analyzed by Microsoft®Office Excel® 2007. Unpaired t-testwas applied for demographic data, haemodynamic parameters, onset and duration of sensory and motorblockade and duration of analgesia.Fisher exacttest was applied for assessment of quality of block.*P*-value was considered significant if <0.05 and highly significant if <0.001.

RESULT

A total of 60 patients were randomly assigned to one of the two groups.The demographic data i.e. age, gender, weight, and the type of the surgery were comparable in both the groups [Table 1] (p>0.001)

Data are presented as mean±SD or absolute numbers, FA =Fore arm; ASA American Association of Anesthesiologist

The baseline haemodynamic parameters were comparable in both the groups. Relatively lower pulse rate were recorded in the Group RC, but pulse rate was never lower than 60 beats/min. The systolic and diastolic blood pressures were comparable between the Groups. The respiratory rate, and peripheral oxygen saturation were comparable between the groups. There was no incidence of breathing difficulty, use of accessory muscles, or a drop in saturation below 95%, indicating pneumothorax, or diaphragmatic palsy.

Onset of sensory block [Group RC (2.33±0.99); Group R (2.46±0.89)], and motor block [Group RC (2.4±1.10); Group R(2.86±1.22)], were faster in Group RC than in Group R, but the difference was not statistically significant [Table 2]. Time to complete sensory effect [Group R (15.26±3.57); Group RC (16.2±3.67)], and motor block [Group R (18.96±5.42); Group RC (19.7±5.58)] were faster in the Group R, but the difference was not statistically significant [Table 2]. Duration of sensory block [Group RC (885±57.81); Group R (676±48.46)],and motor block [Group RC (770±38.90); Group R(470±38.9)], were longer in the Group RC, and the difference were statistically very significant. The total duration of analgesia [Group RC (912±75.82); Group R (793±75.40)], were longer in the Group RC, and the difference was statistically very significant.

Data/groups	Group(R)	Group(RC)
Age(years)	32±10.5	33±8.7
Sex(male:female)	18:12	17:13
Weight(kg)	57.2±9.8	62.8±6.8
Region of surgery Arm/FA	14/16	18/12
ASA grade(I/II)	12/18	13/17

Table-1: Demographic profile of patients

Parameters	Group R	Group RC	P value
Onset of sensory block	2.46±0.89	2.33±0.99	>0.05
Onset of motor block	2.866±1.22	2.4±1.10	>0.05
Time to complete sensory effect	15.26±3.57	16.2±3.67	>0.05
Time to complete motor block	18.96±5.43	19.7±5.58	>0.05
Duration of sensory block	676±48.46	885±57.8	<<<0.001
Duration of motor block	470±38.9	770±38.9	<<<0.001
Total duration of analgesia	793±75.4	912±75.8	<<<0.001

Table-2: Onset and duration of sensory and motor block and total duration of analgesia

DISCUSSION

The supraclavicular brachial plexus block is the most popular brachial plexus block in our institute, for the orthopedic surgeries in arm, elbow, and forearm surgeries.The use of peripheral nerve stimulator technique for brachial plexus block improves the success rate and the quality of anaesthesia. The central actions of Clonidine are mediated through α2 adrenoceptors, which are situated at locus coeruleus and dorsal horn of spinal cord. But, specific peripheral effects of Clonidine appear to be less obvious because α2 adrenoceptors are not present on the axon of the normal peripheral nerve.[15] The proposed mechanism of action of Clonidine as adjuvant to local anaesthetics in peripheral nerve blocks are, centrally mediated analgesia, α 2 adrenergic receptor mediated vasoconstriction, attenuation of inflammatory response and direct action on peripheral nerve.[16]

Dalle *et al*. proposed that Clonidine by hyperpolarizing through Na/K pump, increases the threshold for action potential, hence blockade of conduction.[17]

In our study we compared the addition of Clonidine (100µg) to Ropivacaine in supraclavicular brachial plexus block.The result of our study shows that all patients in both groups were comparable with respect to demographic profile, duration of surgery and type of surgery. Haemodynamic parameters were comparable in both the groups, the addition of 100µg of Clonidine doesn't cause much change in the haemodynamic parameters, though pulse rate was slower in the Clonidine group (Group RC), but it was never below 60/minute.Our study demonstrates that the sensory block lasts longer than the motor block and the duration of analgesia is longest, and addition of Clonidine to the Ropivacaine enhances the quality of anesthesia and analgesia and decreases the amount of the post operativerescue analgesia requirement. These findings are in consistent with the other studies.[18] Motor fibers are larger as compared to sensory fibers; hence these fibers require larger concentration of the local anesthetics that is why duration of motor block is shorter than that of sensory block.[19] Regarding VAS Score for the assessment of pain, only after 10 hours, the difference in score was statistically significant and the score was always better in the Clonidine group. (Group R 4.0±1.6; Group RC 1.2±0.8)

Conclusion:

Our study support the use of Clonidine as an adjuvant to Ropivacaine in supraclavicular brachial plexus block, as it increases the duration of sensory block, motor block, duration of analgesia and overall VAS Score, hence improving the qualities of both anaesthesia and postoperative analgesia. The addition of 100µg of Clonidine doesn't cause any haemodynamic or sedative complication

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