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Research Article

EFFECT OF CLONIDINE ON BLOCK CHARACTERISTICS WHEN USED AS AN ADJUVANT TO 0.75% ISOBARIC ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A DOUBLE BLINDED CONTROLLED COMPARATIVE STUDY

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ABSTRACT

Background: Postoperative pain increases risk in patients with hypertension, coronary artery disease. Various adjuvants has been used to prolong the duration sensory block.**Methods**: This double blinded, randomized, controlled comparative study included 60 patients of either sex, ASA-I&II, 18-55 year age undergoing elective upper limb surgery who were randomly allocated into two groups (40 each): Group R-0.75% isobaric Ropivacaine 19 ml plus Normal Saline (1ml) and Group RC- 0.75% isobaric Ropivacaine 19 ml plus clonidine 150µg (1ml). Supraclavicular brachial plexus block was given by landmark technique. Onset and duration of sensory and motor blockade were recorded. P-value <0.05 considered statistically significant. **Results**: The mean time for onset of sensory block in group RC and R were 5.30± 1.02 min and 10.83± 1.05 min, respectively. The mean time for onset of motor block in group R was 13.87± 1.33 min versus 7.87± 1.33 min in group RC (p< 0.001). The mean duration of sensory block in group RC was significantly longer (11.42± 0.6 hours) when compared to group R (8.01± 0.64 hours).The mean duration of motor block in group RC was 10.10± 0.68 hours versus 6.69±0.65 hours group R (p < 0.001). No significant adverse effect occurred in any group. **Conclusions:** we concluded that, the addition of Clonidine to Ropivacaine (0.75%) in supraclavicular block significantly fastens onset of sensory and motor block along with significant longer duration of sensory and motor block without any significant adverse effects.

INTRODUCTION

Effective pain management in orthopaedic surgeries relieves suffering and leads to earlier mobilization, fewer pulmonary and cardiac complications, a reduced risk of deep vein thrombosis, faster recovery with less likelihood of the development of neuropathic pain, shortened hospital stay and increased patient satisfaction. The supraclavicular brachial plexus block (SCBPB) is often called as "spinal anaesthesia of the upper extremity" because of its ubiquitous application for upper extremity surgery. It is a safe alternative[1]to general anaesthesia (GA), using newer local anaesthetics (LA) and newer adjuvant drugs for successful conduct of block. Due to unique pharmacologic properties and fewer side effects, ropivacaine is being preferred by anaesthesiologists nowadays. Ropivacaine is a long acting amide with a safer cardiac profile[2] Its lower lipid solubility causes greater sensory and motor differential blockade.[3]Its penetration to large myelinated motor fibres is lesser, resulting in a differential blockade with relatively reduced motor blockade. Addition of various adjuncts to LA increases the efficacy and duration of block while minimizes the systemic adverse effects along with a reduction in total dose of LA. Adjuvants like epinephrine,[4] bicarbonate,Clonidine,[5] neostigmine[6], dexamethasone,[7]opioids[8] and hyaluronidase[9] have been used.Clonidine, an imidazolineα-2 adrenergic agonist mainly used as an anti-hypertensive agent, produces sedation, analgesia, and sympatholysis. It is also known to produce anti-nociception and enhance the effect of local anaesthetics when given intrathecally, epidurally and in peripheral nerve blocks by modulating pain pathways. It produces sedation through acting on locus ceruleus where highest density of alpha-2 receptors are present. We studied the onset time of sensory and motor block, duration and analgesic efficacy of clonidine-ropivacaine

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combination in compare toropivacaine (0.75%) alone for brachial plexus block by supraclavicular approach.

MATERIAL AND METHODS

After approval from institutional ethical committee and proper written informed consent from participants, a prospective, double blinded, randomized, controlled comparative study was done on 60 patients of either sex, ASA-I&II, 18-55 year age and 50-80 kg weight undergoing elective orthopaedic upper limb surgery. Patient having infection at injection site, convulsion history, allergy to study drug, any acute or chronic illness and neuropathy were excluded. By using chit in box method, patients were randomly allocated into two groups (40 patient in each): Group R-0.75% isobaric Ropivacaine 19 ml plus 1 ml of 0.9% Normal Saline (NS) and Group RC- 0.75% isobaric Ropivacaine 19 ml plus clonidine 150µg (1ml) (Total Volume = 20ml in each group).As patient enters the operative room, fasting status and consent were confirmed. After reassuring the patient, standard monitoring were applied. Base line ECG, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), respiratory rate (RR) and oxygen saturation (SPO2) were recorded. IV line secured using 18 G cannula and inj. Ringer Lactate started. After proper explanation of technique and positioningsupraclavicular brachial plexus was located.Patient lies supine, arms by the side and head turned slightly to the other side. The interscalene groove and mid-point of clavicle were identified. After aseptic preparation of area, at a point 1.5 to 2.0cm posterior and cephalad to mid point of clavicle, subclavian artery pulsations are felt. A skin wheel is raised with local anaesthetic just cephalo-posterior to the pulsations. A 22 gauge, 5 cm needle, mounted on a 20 ml syringe, passed through the same point, parallel to the head and neck and caudally, slightly medial and posterior direction. After eliciting paraesthesia and negative aspiration of blood, the study medication injected.A brief massage for one minute at the injection site performed to facilitate even drug distribution. Sensory block was evaluated by temperature testing using spirit soaked cotton on skin dermatomes C_4 to T_2. Motor block was assessed by asking the patient to adduct the shoulder and flex the forearm against gravity. Onset of sensory block was defined as the time elapsed between injection of drug and complete loss of cold perception of the hand, while onset of motor blockade was defined as the time elapsed from injection of drug to complete motor block. Haemodynamic parameters and sedation score were documented every 5 min for first 30 min and thereafter every 15 min till the completion of surgery. Duration of surgery was defined as time taken from skin incision to skin closure. All patients monitored up to 24 hours post-operatively. Any adverse perioperative events comprising of hypotension (>20% fall in mean arterialpressure), bradycardia (heart rate <50 beats/min), hypoxemia (spo2 <92%), nausea, vomiting, sedation, respiratory depression and complications like pneumothorax, haematoma, local anaesthetic toxicity and post-block neuropathy were noted and managed accordingly. Bradycardia was managed with inj. Atropine 0.6mg IV stat. Hypotension was managed with fluid and inj. mephentermine 6mg IV boluses.

Hypoxemia was managed with oxygen supplementation by oxygen face mask at the rate of 5 l/min. Heart rate, non-invasive blood pressure and O2 saturation were also monitored. Duration of sensory block (the time elapsed between injection of drug and appearance of pain requiring analgesia) and duration of motor block (the time elapsed between injection of drug and complete return of muscle power) we rerecorded. Inj. Diclofenac sodium given as rescue analgesic when patients complain of pain.

Statistical analysis

Statistical analysis was performed with Statistical Package of Social Science software version 20.0(SPSS Inc. Chicago, IL, USA).Quantitative data were analysed by student't' test and qualitative data were analysed by Chi-square test.P value < 0.05 considered statistically significant.

RESULTS

Demographic variables, baselinehaemodynamic parameters and preoperative sedation score were comparable in both groups (Table 1).

Table 1 Demographic variables

Parameter	Group- R	Group RC	P- value
Age (Years) (Mean±SD)	33.87±9.86	33.67±11.59	0.943
Weight (Kg) (Mean±SD)	63.84±10.88	63.62±11.32	0.832
Sex (Male/Female) (%)	73.33/26.67	76.66/23.67	0.723
ASA grade I/II (%)	80/20	76.7/23.3	0.754
Duration of surgery (min) (Mean±SD)	67.48±1.07	67.83±1.12	0.643

The block characteristics are depicted in Table 2. The mean time for onset of sensory block in group RC was 5.30± 1.02 min (significantly faster, P< 0.001) in comparison to group R (10.83±1.05 min). The mean time for onset of motor block was significantly faster in group RC (7.87± 1.33 min. versus 13.87± 1.33 min in group R, p< 0.001).The mean duration of sensory block in group RC (11.42± 0.6 hours) was statistically significantly longer when compared to group R (8.01± 0.64 hours) (P < 0.001).The mean duration of motor block in group RC was 10.10± 0.68 hours and the group R was 6.69± 0.65 hours. The difference between duration of motor block was also statistically significant (P < 0.001) (Table-2).

Table 2 Block characterstics

Parameter	Group- R	Group RC	P- value
Time for onset of sensory block (min)	10.83±1.05	5.30± 1.02	P < 0.001
Time for onset of motor block (min)	13.87± 1.33	7.87± 1.33	P < 0.001
Duration of sensory block (hours)	8.01± 0.64	11.42± 0.6	P < 0.001
Duration of motor block (hours)	6.69± 0.65	10.10± 0.68	P < 0.001

student unpaired 't' test

As shown in figure 1-3, Haemodynamic parameters (HR, SBP,DBP, SpO2) in both the groups were comparable. None of the patient had bradycardia or hypotension. No respiratory depression or hypoxemia occurred in any patients in both the groups.

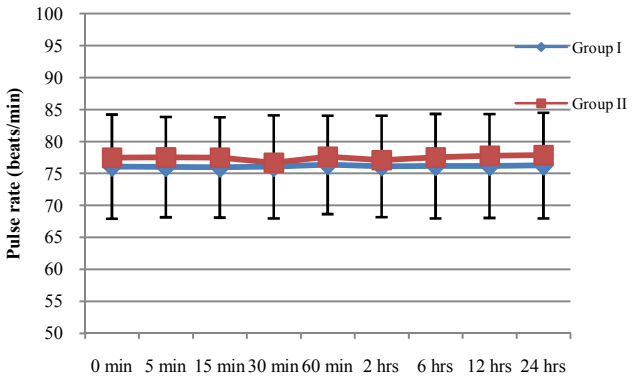

Fig 1 Pulse Rate (beats/min)

Group-I: Ropivacaine
Group II: Ropivacaine + Clonidine

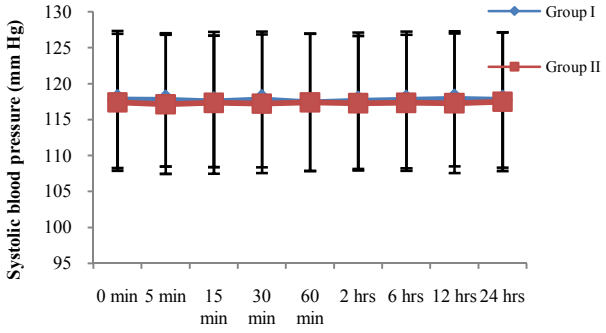

Fig 2 Systolic blood pressure (mmHg)

Group-I :Ropivacaine
Group – II: Ropivacaine + Clonidine

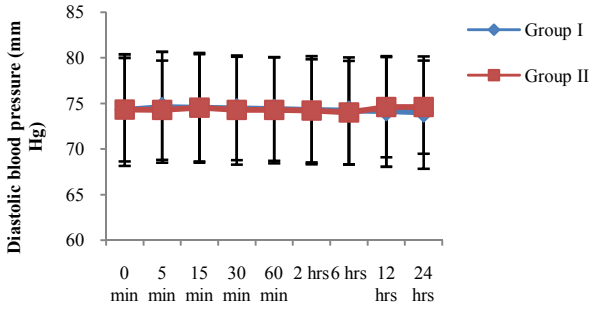

Fig 3 Diastolic blood pressure (mmHg)

Group-I :Ropivacaine
Group – II: Ropivacaine + Clonidine

Sedation occurred in 24 (80%) patients of clonidine group but all were responding to verbal command while no sedation observed in control group. No other adverse effects occurred in any patient of either group.

DISCUSSION

Brachial plexus block provides postoperative analgesia of short duration, even when a long acting local anaesthetic like ropivacaine is used without adjuncts. Various adjuvant drugs like Opioids, Neostigmine and Hyaluronidase[9] have been evaluated in conjunction with local anaesthetics to prolong the period of analgesia, but they were found to be either ineffective or to produce an unacceptably high incidence of adverse effects. Clonidine as adjuvant, is known to produce anti-nociception and to enhance the effect of local anaesthetic by action on α2 adrenergic receptors found in peripheral nerves. We assessed the effect of Clonidine as an adjuvant to ropivacaine (0.75%) in supraclavicular brachial plexus block. We found that the onset of sensory and motor blocks was significantly faster in clonidine group. This may be due to a local direct action of Clonidine and its synergistic action with that of local anaesthetics. Our results were inline of a similar study done by Rohan B *et al*[10] who observed that clonidine shorten the onset of sensory and motor block and significantly prolonged the duration of analgesia. SiddarthSrban *et al*[11] and Giovanni Cucchiaro *et al*[12] also concluded with the similar results while studying efficacy of clonidine added to ropivacaine in brachial plexus block. In our study mean duration of sensory block (i.e. time elapsed from time of injection to appearance of pain requiring analgesia) and motor block were prolonged in clonidine group. Mean duration of sensory block was longer as compared to motor block which agrees with the observation by de Jong *et al*.[13] The prolonged analgesia in Group RC could be due to the action of Clonidine by inhibiting action potential of A & C fibers in peripheral nerves as demonstrated by Gaumann *et al*.[14]The minimal effective concentration of local anaesthetic for large (motor) fibres is greater than for small (sensory) fibres. Casati *et al*[15] added clonidine to ropivacaine in sciatic femoral nerve block for foot surgery and found that addition of clonidine to 0.75% Ropivacaine prolongs the duration of postoperative analgesia with only a slight and short lived increase in degree of sedation and no hemodynamic adverse effects. Masuki *et al*[16] suggested Clonidine may produce local vasoconstriction resulting in a delayed absorption of local anaesthetic and block prolongation. Butterworth *et al*[17]found Clonidine to produce tonic and phasic block of nerve conduction in rat sciatic nerve fibers by directly binding to Alpha-2 adrenergic receptors on presynaptic peripheral nerves to modify neuronal excitability. Bernard *et al*[18] evaluated effects of adding 30-300 mcg Clonidine to local anaesthetic for brachial plexus block and found it is hemodynamically safe up to 150 mcg.

CONCLUSION

We conclude that Clonidine (150µg) as an adjuvant to Ropivacaine (0.75%) in supraclavicular brachial plexus block fasten the onset of sensory and motor block along with significant increase in duration of sensory and motor block without any haemodynamic instability or any significant adverse effect. Limitation of our study was that we did not included extreme age group and high risk patients and results are not applicable to these population.

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