Original Article

Comparative Study of Clonidine and Dexmedetomidine as an Adjuvant with Ropivacaine in Supraclavicular Brachial Plexus Block for Upper Limb Surgery

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ABSTRACT

Background: Among alpha 2 adrenergic agonists the role of Clonidine as an adjuvant to local anaesthetics to prolong duration of block is extensively studied but effect of Dexmedetomidine as an adjuvant to local anaesthetics in brachial plexus block is not much investigated.

Aim: To compare effects of Clonidine and Dexmedetomidine with inj. Ropivacaine 0.5% in brachial plexus block with regard to block characteristics, post operative analgesia, hemodynamic stability and complications.

Materials and Methods: 50 patients of ASA gr I and II undergoing upper extremity surgeries were selected and randomized to receive Clonidine(group RC) or Dexmedetomidine(group RD) with inj. Ropivacaine 0.5% 30 ml in supraclavicular brachial plexus block .Onset and duration of sensory and motor blockade, duration of post operative analgesia, hemodynamic parameters and adverse effects were compared.

Results: Significant difference was observed in relation to duration of sensory block 346.8(±74.54) minutes in group RC and 540 (±56.12) min in group RD, duration of motor block 386.4(±67.82) min. and 586.8 (±55.51) min. respectively. Duration of post operative analgesia 372(±70.86) min in group RC and 559 (±55.40) min in group RD. No significant difference was observed in onset of sensory block which is 11.92(±2.55) min in group RC and 11.36(±2.14) min in group RD and onset of motor block which is 18.56(±2.12) min in group RC and 17.28(±2.70) min in group RD.

Conclusion: The duration of sensory motor blockade and post operative analgesia was significantly prolonged by Dexmedetomidine with inj Ropivacaine in brachial plexus block without significant hemodynamic alterations.

Key words: brachial plexus block, adjuvant, alpha-2 agonists, Clonidine, Dexmedetomidine

INTRODUCTION

Peripheral nerve blocks have assumed a prominent role in modern anaesthesia practice as they provide ideal operative conditions and excellent post operative analgesia without any sedation or systemic side effects [1]. Various adjutants with local anaesthetics are being studied and used for prolongation of intra and post operative analgesia in brachial plexus block for upper limb surgeries [2].

Ropivacaine is a newer amide local anaesthetic with a high pKa and low lipid solubility has gained popularity as it is less cardio toxic and has a significantly higher threshold for central nervous system toxicity than bupivacaine [3]. Recently, alpha 2 agonists have been studied as adjutants to local anaesthetics in regional anaesthetic techniques for their efficacy to enhance the quality and duration of analgesia with fewer side effects [4]. Among two alpha 2 agonists, Clonidine and Dexmedetomidine, Clonidine is very well known and studied. But Dexmedetomidine is newly emerging and highly selective but not studied much especially in brachial plexus block. We have conducted this study to do comparative evaluation of these Clonidine and Dexmedetomidine with respect to efficacy to prolong the duration of block, effects on hemodynamic parameters and complications.

MATERIAL AND METHODS

The hospital ethical committee approved the prospective, double-blinded randomized study and a written informed consent from all the patients was obtained. Fifty adult patients of physical status ASA

grade I and II, aged between 20-50 years, of either sex, scheduled for upper limb surgeries were selected for the study and divided randomly in to two groups, group RC and group RD. Patients of ASA grade III and IV, peripheral neuropathy or motor weakness, infection at the site of injection, hypersensitivity to any of study drug, abnormal coagulopathy, psychiatric disorders, on cardiac drugs were excluded from the study.

Pre operative examination and all routine investigations were done on the previous day of surgery. All patients pre-medicated with inj. Glycopyrrolate 0.04 mg/kg i.v., inj Ondansetron 0.08 mg/kg i.v. and inj. Midazolam 0.02 mg/kg i.v. And inj. Ringer lactate started intravenously. In the operation theatre base line parameters recorded included heart rate (HR), non invasive blood pressure (NIBP), electrocardiogram (ECG) and oxygen saturation (SpO_2).Brachial plexus block was performed by supraclavicular approach using peripheral nerve stimulator in all patients by the same anaesthesiologist who was blinded to the composition of LA mixture. The local anaesthetic solution was prepared by random number table by an anaesthetist not involved in the study. Patients in group RC received inj. Ropivacaine 0.5% 30 ml+inj. Clonidine 1 mcg/kg +inj. DW 5 cc and patients of group RD received inj. Ropivacaine 0.5% 30 ml+inj. Dexmedetomidine. 1 mcg/kg +inj. DW 5 cc.

The sensory dermatome level of analgesia of the upper extremity was assessed by pin prick test along the distribution of each nerve using a 3-point scale of pain (2-sharp pain, 1-blunt pain, 0-no pain) and compared to same stimulation on contra lateral arm. Motor weakness was assessed by hand grip and movement at elbow, wrist and fingers, using a modified Bromage scale (grade 0-normal motor function with full flexion and extension of elbow, wrist and fingers, grade 1-decreased motor power with ability to move fingers only, grade 2-complete motor block with inability to move fingers) [5].Patients were assessed every 5 min. until desired surgical anaesthesia has occurred. Duration of sensory and motor blockade was assessed every hour till the recovery of sensations.

Hemodynamic parameters recorded from the time of injection every 15 min. in first hr, then every 30 min. for further 2 hours and then every 2 hours till the need of rescue analgesia. The incidence of side effects like bradycardia, hypotension, nausea, vomiting, respiratory depression and desaturation was also recorded.

Post operative pain was assessed using visual analog scale (VAS) (0-no pain to 10-worst excruciating pain) every hour till block lasted [5].The end point of the study was time from performance of the block to the onset of pain as determined by VAS score of 4 or more .Rescue analgesia was provided with inj. Diclofenac sodium 75 mg i.v.

RESULTS

There was no statistically significant difference between the demographics (age, sex, and ASA grade) and baseline vitals (HR, SBP, DBP, and Baseline $Sp0_2$) of the two groups [table 1]. No significant difference was observed in onset of sensory block which is 11.92(±2.55) min. in group RC and 11.36(±2.14) min. in group RD and onset of motor block which is 18.56(±2.12) min in group RC and 17.28(±2.70) min in group RD.

Table 1: Patient demographic profile

Variable	Group RC	Group RD
Age(Years) (Mean±SD)	37.28	35.4
Sex(M:F)	13:12	14:11
ASA(I/II)	17:8	17:8

ASA=American Society of Anaesthesiologists

Table 2: Comparison of Block Characteristics in Both Groups (In Minutes)

Variable	Group RC	Group RC	P value
Onset of sensory block(min)	11.92(±2.55)	11.36 (±2.14)	0.4045
Onset of Motor Block (min)	18.56(±2.12)	17.28(±2.70)	0.0684
Duration of sensory block(min)	346.8(±74.54)	540 (±56.12)	<0.0001
Duration of motor block(min)	386.4(±67.82)	586.8 (±55.51)	<0.0001
Duration of analgesia(min)	372(±70.86)	559 (±55.40)	<0.0001

Significant difference was observed in relation to duration of sensory block 346.8(±74.54) minutes in group RC and 540 (±56.12) min in group RD, duration of motor block 386.4(±67.82) min. and 586.8 (±55.51) min. respectively. Duration of post operative analgesia 372(±70.86) min. in group RC and 559 (±55.40) min. in group RD [Table 2].

No difference was noted in the hemodynamic parameters (mean HR, SBP, DBP, and Sp02) before giving block, throughout the surgery and post operatively Heart rate remained slightly on lower side but never gone below 60 in either group. Other side effects like hypotension, nausea, vomiting, respiratory depression, desaturation, were not observed in any patient of either group during the first 24 hrs in the post operative period.

DISCUSSION

Four mechanisms have been proposed, which are centrally mediated analgesia, alpha 2 adrenoceptor mediated vasoconstrictive effects, attenuation of the response and direct action on the peripheral nerves [5].

Brachial plexus blocks provides excellent anaesthesia and post operative analgesia for upper limb surgeries and it also avoids the complications of general anaesthesia like airway manipulation, post operative nausea-vomiting, respiratory depression, delayed recovery etc. Supraclavicular brachial plexus blocks provides good operative conditions as well as has a rapid onset, predictable and dense anaesthesia along with high success rate but have a shorter duration of post- operative analgesia[6]. Hence, various drugs such as opioids, Clonidine, Neostigmine, Dexamethasone, and Midazolam etc. were used as adjuvant with local anaesthetics in brachial plexus block, to achieve quick, dense and prolonged block, but results either inconclusive or associated with side effects [6]. Anjan Das et al compared effect of Dexmedetomidine as adjuvant in Ropivacaine induced supraclavicular brachial plexus block. Their results are Dexmedetomidine with Ropivacaine hastens onset of sensory and motor blockade and prolongs the duration of sensory and motor blockade as well as post operative analgesia [6].

Systemic review of various adjutants for brachial plexus blocks indicate that alpha 2 agonists have greater analgesic benefit with minimal adverse effects [7].

Clonidine was initially used for its antihypertensive properties. The central actions are mediated through alpha 2 adrenoceptor, which are situated at locus coeruleus and dorsal horn of spinal cord [8].

Dexmedetomidine is eight times more selective alpha 2 adrenoceptor agonist than clonidine. So it is possible that they work in a similar manner and may indicate a class effect. SS Swami et al compared Dexmedetomidine and Clonidine as an adjuvant to 0.25% bupivacaine in supraclavicular brachial plexus block and observed that Dexmedetomidine when added to local anaesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia. There is no statistically significant difference in onset of sensory and motor blockade [9].
Don Sebastian et al compared the effects of Clonidine and Dexmedetomidine as adjuvant to Ropivacaine in supraclavicular brachial plexus block on sixty patients scheduled for upper limb surgeries. They observed that Dexmedetnine when added to supraclavicular brachial plexus block had faster onset, greater duration of sensory and motor block and also, the duration of analgesia than Clonidine [10]. Ropivacaine is selected as local anaesthetic agent as it has similar properties to bupivacaine but with lower lipid solubility so has greater safety margin and reduced systemic toxicity. Alpha agonists are chosen for their sedative, analgesic, antihypertensive and antiemetic properties along with reduced requirement of drugs [10].

Marhofer et al studied the effect of Dexmedetomidine when added to Ropivacaine in USG guided ulnar nerve block and found that there is 60% of prolongation of ulnar nerve block [11].

Saumya Biswas et al evaluated the effect of combining Dexmedetomidine with Levobupivacaine with respect to duration of sensory and motor block and duration of analgesia. They found that sensory and motor block duration were longer when Dexmedetomidine added as an adjuvant. Duration of analgesia was also significantly longer with addition of Dexmedetomidine [12].

In the present study, we had compared the effect of Clonidine and Dexmedetomidine as an adjuvant to inj. Ropivacaine 0.5% 30 ml in a supraclavicular brachial plexus block for upper limb surgery on the onset and duration of sensory and motor blockade, duration of post operative analgesia, hemodynamic parameters and incidence of side effects. We have observed that Dexmedetomidine significantly prolongs the duration of sensory and motor blockade and duration of post operative analgesia but there is no statistically significant difference in the onset of sensory and motor blockade between two groups. Most authors also reported the same.

Hemodynamic parameters remained stable throughout the surgery and post operatively. Bradycardia observed in few patients but HR not gone below 60 and did not require any intervention. Adverse effects like hypotension, nausea, vomiting, respiratory depression, and desaturation were not observed in any patient of either group during the first 24 hrs in the post operative period.

CONCLUSION

Dexmedetomidine when added to Ropivacaine in supraclavicular brachial plexus block has significantly longer duration of sensory and motor blockade and duration of post operative analgesia than Clonidine without significant adverse effects. So, Dexmedetomidine is better adjuvant than

Clonidine in supraclavicular brachial plexus block for upper limb surgeries.

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