A STUDY TO EVALUATE THE EFFECT OF ADDING CLONIDINE TO ROPIVACAINE FOR AXILLARY PLEXUS BLOCKADE

JAISWAL RAJMALA [1], BANSAL TEENA *[2], MEHTA SANDEEP [3], AHLAWAT GEETA [4]

[1]Professor, [2]* Senior Resident, [3]Medical Officer, [4]Associate Professor- Department of Anaesthesiology & Critical Care Pt. B.D. Sharma University of Health Sciences, Rohtak (Haryana) India. Email: aggarwalteenu@rediffmail.com

ABSTRACT

Aims and objectives- The present study was undertaken to evaluate the effect of adding Clonidine to Ropivacaine for axillary plexus blockade.
Material and methods- A total of 60 adult patients having physical status grade I or II according to American Society of Anaesthesiologists (ASA) undergoing hand or forearm surgery under axillary plexus blockade using nerve stimulator were included in the study. Patients were randomly allocated to one of the two groups. Each group consisted of 30 patients.
Group 1 patients received 35 ml of Ropivacaine 0.5 % + 1 ml of normal saline.
Group 2 patients received 35 ml of Ropivacaine + 1 ml of clonidine (150 μg).
Sensory block, motor block and sedation were assessed every 5 minutes for 30 minutes. Postoperatively assessment was done every 15 minutes till complete regression of sensory and motor block.
Results- Mean sensory onset time in patients of group 1 was 26.48 ± 7.88 min and in patients of group 2 was 26.55 ± 8.06 min, which was insignificant statistically. Patients of group 1 had a mean motor onset time 35.51 ± 10.4 min and patients of group 2 had a mean motor onset time 37.06 ± 14.19min, the difference being statistically comparable. Mean duration of sensory block in patients of group 1 was 422 ± 163.10 min and in patients of group 2 was 438 ± 133.93 min, which was statistically comparable. Patients belonging to group 1 had a mean duration of motor block 404 ± 160.60 min and patients belonging to group 2 had a mean duration of motor block 388 ± 151.63 min, which was statistically comparable.
Conclusion- Addition of Clonidine (150 μg) is of no benefit in the onset and duration of axillary plexus block.

Keywords: Ropivacaine, Clonidine, axillary plexus blockade, hand or forearm surgery

INTRODUCTION

Peripheral nerve blockade has become an essential and growing part of anesthesia. It offers an excellent alternative for patients who are hemodynamically compromised or too ill to tolerate general anesthesia. In addition very good postoperative analgesia can also be provided.[1, 2]

The axillary brachial plexus block is a popular nerve block for elbow, forearm, wrist and hand surgery. Axillary approach to brachial plexus blockade has the advantage of being performed away from the pleura and neuraxial structures, so it is ideal of obtaining block with a minimum of discomfort, complications and side effects. [3,4]

Ropivacaine is an amino amide local anaesthetic, which is structurally similar to bupivacaine. The decreased cardiovascular and central nervous system toxicity makes ropivacaine interesting alternative to bupivacaine in procedures requiring large doses of local anesthetic.[5]In order to have early onset and prolonged duration of peripheral nerve block, certain drugs have been added to local anesthetics. Clonidine is one such drug that appears to have a distinct benefit when administered as an adjuvant without major side effects.[6, 7]

Only few studies are available regarding use of ropivacaine with adjuvant clonidine for modification of block but with equivocal results. Hence the present study was planned to evaluate the effect of adding clonidine to ropivacaine in axillary plexus blockade.

MATERIAL AND METHODS

The present prospective, randomized, controlled, double blind study was conducted in the Department of Anaesthesiology and Critical Care, Pt. B.D.Sharma Postgraduate Institute of Medical Sciences, Rohtak from 2008-2011 after obtaining approval from the institutional research/ ethical committee.

Sixty patients in the age group of 20-60 years, of either sex, weighing 40-70 kilograms, belonging to American Society of Anesthesiologists (ASA) physical status I or II, scheduled for hand or forearm surgery were included in the study after written informed consent.

Patients with diseases of the nervous system & cardiovascular system, psychiatric disorders, bleeding disorders, hypersensitivity to local anesthetics, any abnormality in the local area and chronic drug abuse were excluded.

Preanaesthetic checkup and relevant investigations were performed. No premedication or sedation was given. Prior to the procedure, linear visual analogue scale (VAS) on 0-10 cm. was explained to the patient for the assessment of pain where 0 denotes no pain and 10 denotes worst pain imaginable. Patients were then randomly assigned to one of the two groups of 30 patients each. Randomisation was done by computer generated numbers.

Group 1 (n=30)   Patients received 35 ml of ropivacaine (0.5%) + 1 ml of normal saline

Group 2 (n =30)   Patients received 35 ml of ropivacaine (0.5%) + 1ml (150μg) clonidine.

The block was performed by the anesthesiologist who also recorded the observations. The study drugs were prepared by a fellow anesthesiologist who was unaware of the study hypothesis.

Technique

In the operating room standard monitors were attached and intravenous cannula was inserted on contralateral arm. Basal heart rate, blood pressure and peripheral arterial oxygen saturation (SpO_2) were recorded and monitored throughout the procedure. The brachial plexus in the axilla was blocked by a single injection method using nerve stimulator. Patient was placed in supine position. The arm to be blocked was abducted at 90^0, with forearm flexed and externally rotated. Under all aseptic conditions, after palpating the axillary artery, a 22gauge, 5 cm long, short-beveled, teflon- coated nerve stimulator needle was inserted adjacent and superior to it high in axilla at 30 to 40 degree angle aimed toward midpoint of

clavicle. Initially, the nerve stimulator (Stimuplex-DIG, B. Braun, German) was set to a pulse duration of 0.15 ms, current intensity of 1 mA & frequency of 2 Hz to localize proximity to plexus by observing the muscle stimulations in the forearm and hand. Further, the needle was advanced and current intensity decreased until the visible muscle stimulation remained present at 0.5mA. At this point whole drug solution was injected as per the group allocation and the needle was removed.

Compression to the neurovascular sheath was maintained for five minutes following performance of the block to minimize distal spread of the drug. The patient's arm was kept elevated on the pillow over the chest for at least thirty minutes prior to the surgery.

Sensory block, motor block and sedation were assessed every 5 minutes.[8]

Sensory block

Sensory block was assessed every five minutes for thirty minutes on a 3 point scale for pain using pinprick with 25 gauge needle.

1= sharp sensation
2= blunt sensation
3= no sensation

Motor block

Motor block was assessed every five minutes for thirty minutes by modified Bromage Scale.

3= extension of elbow against gravity
2= flexion of wrist against gravity
1= finger movement
0= no movement

Sedation was scored using four point scales.

1= awake
2= drowsy but responsive to command
3= very drowsy but responsive to pain
4= unresponsive

Onset of sensory block was defined as time from injection till disappearance of pain by pinprick test (pinprick=3). **Onset of motor block** was defined as time between injection and motor paralysis distal to injection site (modified Bromage Scale=0). **Readiness for surgery** was defined as complete sensory and motor block in surgical territory (pinprick test=3 and modified Bromage scale =0). **Duration of sensory block** was defined as the duration from onset of sensory block till complete regression of sensory block (pinprick test 3 to 1). **Duration of motor block** was defined as the duration from onset of motor block till the complete regression of motor block (modified Bromage Scale 0 to 3).

In case of pain during surgery, supplementary intravenous analgesia with 1µgkg^{-1} of fentanyl was given. Further, if the patient still felt pain it was treated as a **failed block** and general anaesthesia was administered. Patients of failed block were excluded from statistical analysis.

At the end of surgery, patient was transferred to the post anesthesia care unit for further observation and management.

Post operative observations

- Patient was assessed every fifteen minute till the complete regression of sensory block.
- Patient was assessed every fifteen minute till the complete regression of motor block
- Patient was assessed every fifteen minute till fully awake (sedation score =1).
- When VAS equals 4, all the patients received injection diclofenac 75 mg intramuscular and time was recorded and the study ended here.

Statistical analysis

The values were expressed as mean ± 1 S.D. For nominal data student t test and chi square test were used.

OBSERVATIONS

The study included 60 patients belonging to ASA physical status I or II. Patients belonging to group 1 had a mean duration of surgery 79.41 ± 24.07 min and patients belonging to group 2 had a mean duration of surgery 99.48 ± 52.70 min. In group 1 male to female ratio was 4:1 and in group 2 this ratio was 5:1. When using Chi-square test, sex distribution in both the groups was statistically comparable.

Mean sensory onset time in patients of group 1 was 26.48 ± 7.88 min and in patients of group 2 was 26.55 ± 8.06 min, which was insignificant statistically.

Table 1: Showing mean onset of sensory block in group 1 & 2

	Sensory onset in min (Mean ± S.D.)	p value
Group-l (n=29)	26.48 ±7.88	0.973 >0.05)
Group-2 (n=29)	26.55 ±8.06	

Patients of group 1 had a mean motor onset time 35.51 ± 10.4 min and patients of group 2 had a mean motor onset time 37.06 ± 14.19 min, the difference being statistically comparable.

Table 2: Showing mean onset of motor block in group 1 & 2

	Motor onset in min (Mean ± S.D.)	p value
Group-l (n=29)	35.51 ± 10.4	0.637 (>0.05)
Group-2 (n=29)	37.06 ± 14.19	

Patients belonging to group 1 had a mean duration of sensory block 422 ± 163.10 min and patients belonging to group 2 had a mean duration of sensory block 438 ± 133.93 min. When using student t test, mean duration of sensory block was statistically comparable.

Table 3: Showing mean duration of sensory block in group 1 & 2

	Duration of sensory block in min (Mean± S.D.)	p value
Group-l (n=29)	422 ± 163.10	0.68 (>0.05)
Group-2(n=29)	438 ± 133.93	

Patients belonging to group 1 had a mean duration of motor block 404 ± 160.60 min and patients belonging to group 2 had a mean duration of motor block 388 ± 151.63 min. When using unpaired t test, mean duration of motor block was statistically comparable.

Table 4: Showing mean duration of motor block in group 1 & 2

	Duration of motor block in min (Mean ± S.D.)	p value
Group-l (n=29)	404 ± 160.60	0.708 (>0.05)
Group-2 (n=29)	388 ± 151.63	

DISCUSSION

The axillary brachial plexus block is a popular nerve block for elbow, forearm, wrist and hand surgery. The use of peripheral nerve stimulator for brachial plexus block is known to improve success rate. In the present study, technique used to block axillary brachial plexus was single injection by peripheral nerve stimulation. We adopted a single injection method to reduce the risk of neural complication. Partridge et al suggested that, the risk of neural complications should rise with increased number of injections. [9] In our study the overall success rate was good as only one case in each group had failed blockade. This failure could be attributed to inter patient variations in the anatomy of brachial plexus sheath because in spite of good visible motor contractions, no anaesthetic effect was produced. The functional anatomical variation has been reported by Thompson et al. [10]

In the present study in group 1 mean onset time of sensory block was 26.48 ± 7.88 minutes (Table 1) and mean onset of motor block was 35.51 ± 10.4 minutes (Table 2) . Mean duration of sensory

block and motor block in patients of group 1 was 422 ± 163.10 minutes and 404 ± 160.60 minutes respectively (Table 3 and 4). Hickey et al also observed that mean onset time of analgesia ranged from 12.0 ± 10.7 to 19.7 ± 32.2 minutes as observed in different dermatome and mean motor onset time ranged from 9.1 ± 16.5 to 41.7± 45.8 minutes. However, mean duration of sensory blocks ranged from 9.2 ± 4.2 to 10.7 ± 2.6 hours as observed in different dermatome and mean duration of motor block ranged from 8.0 ± 3.0 to 10.8 ± 2.7 hours. The difference in duration of sensory block in present study and study conducted by Hickey et al might be due to difference in sensory duration end point determinant. In present study group sensory block duration was taken when patient felt pinprick sensation in any one dermatome while in Hickey et al study it was upto individual dermatomes. The difference in duration of motor block might be due to motor duration endpoint used to determine duration was different in both groups. In study of Hickey et al motor endpoint was paralysis of shoulder, however in present study it was paralysis of finger as most of cases had.[11]

Sensory onset time was 16.37 ± 3.6 minutes in study conducted by Bertini et al, in which the earlier onset of sensory block might be due to injecting of 32 ml of drug (0.5%) in 4 divided doses in close proximity to each nerve whereas in present study the whole volume of drug was injected at single site.[12]

A study was conducted by El Saied et al, where sensory onset time in each nerve distribution of ropivacaine 0.75% (40ml) alone group ranged from 14.1 ± 0.7 to 24.6 ± 1.7 minutes. In group where ropivacaine 0.75% (40 ml) along with clonidine 150 μg was used, sensory onset time ranged from 13.6 ± 1.0 to 27.7 ± 2.5 minutes in different nerve distribution. No difference was noted for sensory onset time in two groups. Mean motor onset time for motor blockade in ropivacaine alone group was 16.3 ± 1.4 minutes while in ropivacaine with clonidine group was 17.9 ± 1.7 minutes, the difference being statistically insignificant. The results of present study in regards to onset of sensory block and motor block in two groups are in agreement with study of El Saied et al. [8] In present study when clonidine was used in a dose of 150 μg along with ropivacaine (in patients of group 2), it did not result in change in sensory onset time. The mean sensory onset time of ropivacaine alone group was 26.48 ± 7.88 minutes and of ropivacaine along with clonidine was 26.55 ± 8.06 minutes (Table 1), the difference being statistically insignificant. Mean onset of motor block was also similar in both the groups in present study (Table 2). In ropivacaine alone group it was 35.51 ± 10.4 minutes and in ropivacaine along with clonidine it was 37.06 ±14.19 minutes (Table 2). The result of our study are in concordance to study trial of Erlacher et al. [13, 14]

Chakraborty et al evaluated the effect of clonidine added to bupivacaine in supraclavicular brachial plexus block for upper limb orthopaedic procedures. They concluded that addition of a small dose of clonidine to 0.5% bupivacaine significantly prolonged the duration of analgesia without producing any clinically important adverse reactions other than sedation. [15] Duma et al compared the effects of clonidine added to levobupivacaine and bupivacaine on axillary brachial plexus block as well as the effectiveness of levobupivacaine alone compared with bupivacaine alone. They concluded that clonidine as an adjuvant to the long lasting local anaesthetics bupivacaine and levobupivacaine in axillary brachial plexus block exerts an uncertain & inconsistent effect, resulting in a lack of predictability & no significantly prolonged duration of action. [6] Sia et al conducted a study to determine whether clonidine has analgesic effects when administered into the brachial plexus sheath and concluded that the administration of clonidine does not prolong the onset of postoperative pain. [16]

We did not see any evidence of cardiovascular or central nervous system toxicity with a dose of 175 mg of ropivacaine in age group of 20 to 60 years. Heart rate, blood pressure, respiratory rate and oxygen saturation were not changed significantly in our study which is similar to the findings of study conducted by El Saied et al and Erlacher et al. [8, 13]

The lack of prolongation of anaesthetic effects of clonidine when combined with ropivacaine has been postulated by Erlacher et al in

2000 and 2001. [13,14] Clonidine is an alpha 2 adrenergic agonist with a weak alpha 1 agonist activity and may produce local vasoconstriction by stimulating vascular smooth muscle alpha receptors. Studies have been performed in volunteers to determine the effect of ropivacaine compared with bupivacaine and lidocaine on cutaneous blood flow after injection of 0.1ml. Both bupivacaine and lidocaine produced vasodilatation in human skin but ropivacaine decreased skin blood flow. [5] As ropivacaine has intrinsic vasoconstricting properties not mediated by an activation of alpha 2-adrenorecptors, this could had explained why the addition of clonidine did not result in any benefit. [17] However, El Saied et al reported extended duration of sensory and motor blockade would be due to synergistic mechanism of action in combination with local anesthetic ropivacaine.[8] No significant changes in hemodynamic variables, side effects and sedation were seen in our groups.

CONCLUSION

Ropivacaine in dose of 175 mg has profound effect on brachial plexus block with no concomitant side effects. 35 ml of 0.5% is adequate to perform surgery in elbow, forearm and hand while maintaining hemodynamic parameters. Addition of clonidine (150 microgram) is of no benefit in the onset and duration of block. We suggest that pure ropivacaine 0.5% is sufficient for long lasting axillary block by single injection with peripheral nerve stimulator for performing elbow and below elbow surgery.

REFERENCES

1. Denise J. Nerve Block. In: Miller RD, editor. Miller's Anesthesia.7th ed. Philadelphia: Churchill Livingstone; 2009. pp. 1639-49.
2. Morgan GE, Mikhail MS, Murray MJ, editors. Peripheral nerve blocks. In: Clinical Anaesthesiology. 4th ed. New York: McGraw Hill; 2008. pp. 324-337.
3. De Jong CRH. Axillary block of the brachial plexus. Anesthesiology 1961;22:215- 25.
4. Schroeder LE, Horlocker TT, Schroeder DR. The efficacy of axillary block for surgical procedures about the elbow. Anesth Analg 1996; 83: 747-51.
5. Bansal T, Hooda S. Ropivacaine- a novel and promising local anaesthetic drug. Asian J Pharm Clin Res 2012; 5: 13-5.
6. Duma A, Urbanek B, Sitzwohl C, Kreiger A, Zimpfer M, Kapral S. Clonidine as an adjuvant to local anaesthetic axillary brachial plexus block: a randomized, controlled study. Br J Anaesth 2005; 94:112-6.
7. Eisenach JC, Kock MD, Klimscha W. α_2-adrenergic agonists for regional anesthesia. Anesthesiology 1996; 85: 655-74.
8. El Saied AH, Steyn MP, Ansermino JM. Clonidine prolongs the effect of ropivacaine for axillary plexus blockade. Can J Anaesth 2000;47:962-7
9. Partridge BL, Katz J, Benirschke K. Functional anatomy of the brachial plexus sheath: Implications for anesthesia. Anesthesiology 1987; 66: 743-7.
10. Thompson GE, Brown DL. The common nerve blocks. In: Nunn JF, Utting JE, Brown BB, editor. General Anesthesia.5th ed. London: Butterworths; 1989.pp. 1068-9.
11. Hickey R, Rowley CL, Candido KD, Hoffman J, Ramamurthy S, Winnie AP. A Comparative Study of 0.25% ropivacaine and 0.25% bupivacaine for brachial plexus block. Anesth Analg 1992; 75: 602-6.
12. Bertini L, Tagariello V, Mancini S, Ciaschi A, Posteraro CM, Benedetto PD et al. 0.75% and 0.5% ropivacaine for axillary brachial plexus block: a clinical comparison with 0.5% bupivacaine. Reg Anesth Pain Med 1999; 24: 514-8.
13. Erlacher W, Schuschnig C, Orlicek F, Marhofer P, Koinig H, Kapral S. The effects of clonidine on ropivacaine 0.75% in axillary perivascular brachial plexus block. Acta Anaesthesiol Scand 2000; 44: 53-7.
14. Erlacher W, Schuschnig C, Koinig H, Marhofer P, Melischek M, Mayer N, et al. Clonidine as adjuvant for mepivacaine, ropivacaine and bupivacaine in axillary, perivascular brachial plexus block. Can J Anaesth 2001; 48: 522-5.
15. Chakraborty S, Chakrabarti J, Mandal MC, Hazra A, Das S. Effect of clonidine as adjuvant in bupivacaine-induced

supraclavicular brachial plexus block: A randomized controlled trial. Indian J Pharmacol 2010; 42 : 74-7.

16. Sia S, Lepri A. Clonidine administered as an axillary block does not affect postoperative pain when given as the sole analgesic. Anesth Analg 1999; 88: 1109-12.

17. Ishiyama T, Dohi S, Iida H. The vascular effects of topical and intravenous α_2-adrenoceptor agonist clonidine on canine pial microcirculation. Anesth Analg 1998; 86: 766-72.