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# Comparison of Ropivacaine with Clonodine Versus Ropivacaine alone in Supraclavicular Block: A Randomised Study

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**Abstract**

*Introduction:* Ropivacaine is a new local anesthetic agent with minimal cardiovascular toxicity. Various adjuvant have been tried with local anesthetics to prolong post operative analgesia, clonidine is one such drug. The aim of our study was to evaluate the effect of adding clonidine to ropivacaine on brachial plexus block characteristics, post operative analgesia and complications. *Materials and methods:* A controlled prospective clinical study was carried out among 60 patients of either gender belonging to ASA I and II undergoing upper limb surgeries. Patients were randomly allocated to either of the 2 groups of 30 each. Group- R received: Inj. Ropivacaine 35 ml (0.75%) +Inj. Normal saline 1 ml. Group-RC received Inj. Ropivacaine 35 ml (0.75%) +inj. Clonidine 1 ml (150 µg). *Results:* The mean time for Onset of the sensory block was 10.06 ± 35.43 minutes in group-R and 11.86 ± 65.21 minutes in group-RC ($P<0.05$). The mean time for Onset of the motor block was 11.96 minutes in group-R and 13.93 minutes in group-RC ($P >0.5$). The total duration of sensory block was 10.03 ± 1.1 hours in group R and 13.96 ± 0.69 hours in group RC, the $p < 0.01$. The total duration of post operative analgesia was 11.62 hours in group R and 14.57 hours in group RC, the p value being $< 0.001$. *Conclusion:* Thus we conclude from our study that addition of Clonidine 150 µgm to ropivacaine in supraclavicular brachial plexus block improves post operative analgesia without any side effects.

**Keywords:** Ropivacaine; Clonidine; Supraclavicular; Sensory; Motor etc.

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## Introduction

Regional anesthesia enables site-specific, long-lasting, and effective anesthesia and analgesia. Peripheral blockade remains a well-accepted component of comprehensive anesthetic care. Skillful application of peripheral neural blockade broadens the anesthesiologist's range of options in providing optimal anesthetic care. It can be used as surgical anesthetic, or as a supplement to provide analgesia and muscle relaxation along with general anesthesia, or as the initial step in the provision of prolonged postoperative analgesia.

Optimal pain relief with minimal side effects after surgery can have a major impact on patient outcome including patient satisfaction and earlier mobilization which is the need of the hour. Halsted was the first to block the brachial plexus [1], he did not use a percutaneous technique. George Crile 13 years later used to surgically expose the roots

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and then inject each nerve directly. G. Hirschel [2] produced the first percutaneous brachial plexus block in 1911 through an axillary approach since then brachial plexus block remains a popular technique till today.

Supraclavicular brachial plexus block provides anaesthesia for surgeries around elbow, forearm and hand. As it provides dense block and also relieves tourniquet pain, this technique was chosen for upper limb surgeries in our study. Though few potential complications like pneumothorax, injury to vessels, hematoma are described with this technique, it can be minimized with proper technique and strict vigilance.

Peripheral nerve blocks with local anaesthetics provides excellent operating conditions but the duration of analgesia is rarely maintained for more than 4-8 hrs, even with the longest acting local anaesthetic bupivacaine. The search for a replacement for bupivacaine began in the 1980s. Ropivacaine was first tested in 1988 and appeared to have many of the blocking characteristics of bupivacaine but was much less toxic [3]. Ropivacaine was the first synthetically produced local anesthetic that was a single enantiomer, and for that reason was predictably less toxic.

Ropivacaine is a novel alternative to bupivacaine, the well known CVS & CNS adverse effects of bupivacaine seems to be less with ropivacaine. Many experimental studies on the animals have shown the safety profile [4]. Studies have shown that adjuvants like fentanyl, tramadol, Clonidine, midazolam butorphanol, dexamethasone etc. when added to the local anaesthetic mixture in peripheral nerve blockade [5] markedly prolonged the duration of analgesia.

Clinical studies have shown that alpha2 adrenergic agonists were able to prolong the duration of action of local anaesthetics and produce analgesia after epidural and intrathecal administration. Recent reports also pointed out that Clonidine, an alpha2 agonist, may have benefited patients when it was injected at peripheral nerve sites. After femoral nerve blocks with either lidocaine or bupivacaine, the analgesia obtained with Clonidine lasted longer than analgesia obtained with epinephrine [6]. Thechoice of local anaesthetics affects the efficacy of Clonidine. Dose-dependent prolongation of Clonidine admixed with mepivacaine or lidocaine is well established, but its ability to increase analgesic duration after brachial plexus blocks with long-acting local anaesthetics is less clear [7].

*Aims of Study*

The aim of this study was to compare between Ropivacaine 35 ml (0.75%) with that of Ropivacaine 35 ml (0.75%) with clonidine 150 microgram in brachial plexus block through supraclavicular approach, on following parameters.

1. Onset time & peak effect time for sensory block.
2. Onset time & peak effect time for motor block.
3. Vital Parameters like Pulse rate, Blood Pressure and $SpO_2$.
4. Duration of sensory & motor block.
5. Post-operative analgesia.
6. Side effects and Complications if any.

## Materials and Methods

After getting clearance from institutional ethical committee, A controlled prospective clinical study was carried out on 60 patients of either sex undergoing various orthopedic surgeries of upper limb under supraclavicular brachial plexus block using a mixture of Local anaesthetic agent ropivacaine with addition of clonidine 150 micrograms at S.N. Medical collegel, between the academic years 2011-2012.

Surgeries around elbow, forearm and hand were included in the study. The patients included in the study belonged to ASA physical status I and II. Patients in the age group of 20-70 years were included in the study.

### *Pre Requisites*

*Pre-anaesthetic check up*

All patients underwent a thorough pre-anaesthetic checkup which included history taking, general and systemic examination patients were included and excluded based on the below mentioned criterias.

*Inclusion Criteria*

a) Age Group: 20-70 yrs of Either Sex

b) Weight 50-80 Kgs

c) ASA Physical Status I & II

d) Both Planned & Emergency Upper Limb Surgeries

*Exclusion Criteria*

a) Uncooperative, Unwilling & Not able to Understand VAS Procedure

b) Known Hypersensitivity to LA

c) Bleeding Disorders or Patient is on Anticoagulants

d) Pregnant Women

e) Any Major Illness

f) Patients with Neuromuscular Disorder

The procedure was explained to the patients and written informed consent was taken. All patients were kept nil by mouth for at least 8 hours. An intravenous line was secured with an intravenous cannula in the unaffected limb and 5% dextrose normal saline was started. Inj. glycopyrrolate 0.2 mg, inj. Ondansetron 4 mg and inj.ranitidine 150 mg was given intravenously as pre-medication. Pulse oximeter, non invasive blood pressure cuff and ECG electrodes were applied. Baseline pulse rate, blood pressure, and respiratory rate were recorded. Patients were randomly allocated to either of the 2 groups of 30 each. Randomisation was done by computer based randomization technique. Group- R: inj. Ropivacaine 35 ml (0.75%) +Inj. Normal saline 1 ml

Group-RC: inj. Ropivacaine 35 ml (0.75%) +inj. Clonidine 150 micrograms (1 ml)

***Position and Procedure***

The patient was made to lie in supine position with both the arms adducted and straight. Head was turned away from the side to be blocked. Anaesthetist stood at the head end of the patient, facing towards patients foot end. With all aseptic and antiseptic precautions, pulsation of subclavian artery was palpated with thumb of one hand at 1 cm above the mid- point of clavicle and the point of maximum pulsation was marked. Then a 24G $1^{1/2}$ inch short fine needle was attached to 10 cc syringe filled with 3 cc distilled water and was held in other hand in a pen holding fashion. Distilled water was taken to detect inadvertent apical pleural puncture.

The subclavian artery was displaced medially, the needle was introduced just lateral to artery at about 80 degree to skin, 1 cm above clavicle. Then needle was walked anteriorly and posteriorly on the $1^{st}$ rib and the patient was asked for feeling tingling at the elbow and fingers (paresthesia). Once the patient felt paresthesia, suggestive that needle is near the nerve bundle, 36 ml of drug mixture was given after careful aspiration. Return of anaesthetic solution from same needle also confirms presence of needle with in sheath. Immediately after drug injection, massage was done for 3 minutes for even distribution of drug.

***Monitoring***

*Sensory block* - was assessed by pin prick method. (Done with tip of 24 g needle)

*1. Sensory onset:* was considered, when there was dull sensation to pin prick along the distribution of the respective nerves.

Grade-0: Anaesthesia - no sensation felt

Grade-1: Analgesia- dull sensation felt

Grade-2: Sharp pain felt

Assessment of sensory block was done at 0 min, 1 min, 2 min, 3 min, 4 min, 5 min, 6 min, and 6.5 min till 15 minutes after completion of drug injection in skin areas corresponding to median nerve, radial nerve, ulnar nerve and musculo- cutaneous nerve.

*2. Peak effect time:* interval from injection of the drug to the loss of deep & severe pain stimulation.

*Motor block* was determined according to a modified Bromage scale for upper extremities.

0 = able to move normally

1 = inability to move wrist and / or elbow without resistance

2 = inability to lift wrist and / or elbow i.e. against resistance

3 = inability to move entire arm

Assessment was carried out by the same observer at 0 min, 1 min, 2 min, 3 min, 5 min, 6 min, 8 min, and 10 min and 15 min after drug injection.

Individual nerves can be tested by their area of distribution

Grade – 0: Complete paralysis

Grade – 1: Paresis

Grade – 2: Normal muscle force.

*1. Onset of motor block:* was considered when there was Grade-0 motor blockade.

*2. Peak effect time:* time interval from injection of drug to the complete motor blockade.

Patients who had incomplete analgesia were not included in the study.

*Intra-operatively:* Patients were monitored for hemodynamic variables Assessment of blood loss was done and fluid was administered as per the loss. Duration of surgery was noted.


*Post-operatively*

Pulse, blood pressure, respiratory rate, consciousness, and response were noted. Patients were examined for duration of analgesia as per Visual Analogue Scale (VAS). VAS score is the most commonly used methods of assessing acute pain and its relief. VAS is a 10 cm line which is marked as shown Above.

The patients were asked to make a vertical mark on the line to indicate the intensity of their pain and Visual Analogue Scale was scored by measuring from the left side, how far the patient marked towards the maximum pain end. This number was then used to compare changes in pain level. Score on Visual Analogue Scale was recorded post operatively at every 2 hours till VAS score of ≥ 5, when rescue analgesia was given in the form of Inj. Diclofenac Sodium 1.5 mg/ kg Intramuscularly and time of Rescue analgesia was noted.

All the patients were observed for incidence of any side effects and complications like nausea, vomiting, Pneumothorax, hematoma, local anaesthetic toxicity and post block neuropathy in the Intra and post-operative period.

*Statastical analysis:* All the quantitative and qualitative data were analysed by using chi square test and unpaired t test. Results were expressed as mean ± standard deviation. p value <0.05 was considered to be statistically significant and values <0.001 were taken as highly significant.

## Results

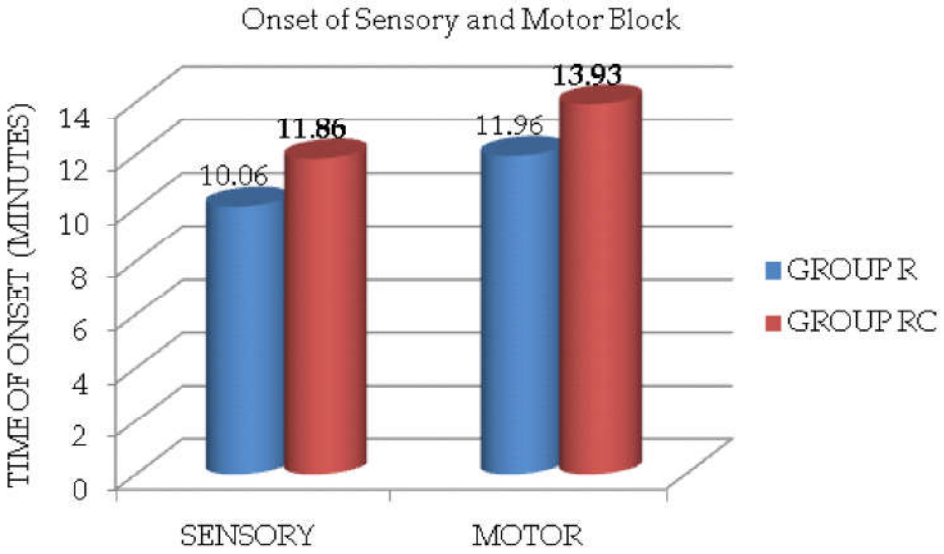
Our study was carried out in the Department of Anaesthesiology, Medical College and S.S.G. Hospital, Vadodara to evaluate and compare the effects of ropivacaine (0.75%) with clonidine versus roipivacaine alone in elective and emergency upper limb surgeries.

The mean age of patients was 36.13 ± 12.44 years in Group RC and 41.43 ± 12.88 years in Group R . The ratio of Male to Female was 21:9 in Group RC and 21:9 in Group R. The mean weight of patients was 56.83 ± 4.22kg in Group RC and 57.06 ± 3.75 kg in Group R.

Thus both the groups were comparable to each other without significant difference with p >0.05.

**Table 1:** ASA Physical Status of Patients

| ASA Status | Group R | Group RC | P value |
|---|---|---|---|
| I | 25 (83.33%) | 27 (90%) | >0.05 |
| II | 5 (16.67%) | 3 (10%) | >0.05 |
| Total | 30 (100%) | 30 (100%) | |



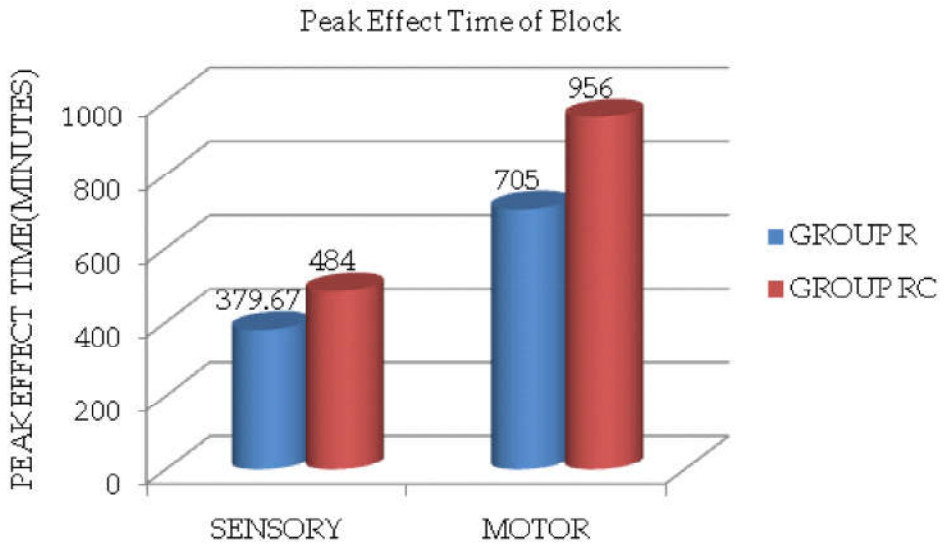

**Graph 1:** Time taken for onset of sensory and motor block

**Table 2:** Nature and Duration of Surgery

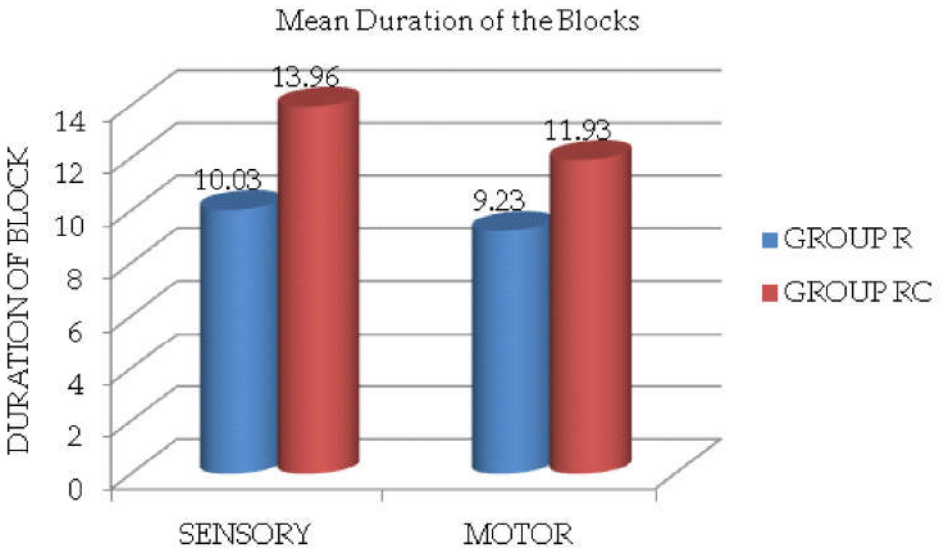
| | Group R | Group RC | P value |
|---|---|---|---|
| Planned | 28 (93.33) | 29 (96.66%) | >0.05 |
| Emergency | 2 (6.67%) | 1 (3.34%) | >0.05 |
| Total | 30 (100%) | 30 (100%) | |
| Total duration of surgery in min. (Mean ± SD) | 65.33 ± 25.36 | 68.17 ± 25.48 | >0.05 |

**Table 3:** Types of Surgeries Performed

| Surgeries | Group – R | Group – RC |
|---|---|---|
| Open reduction and internal fixation | 10 (33.33%) | 18 (60%) |
| Closed reduction with or without internal fixation | 19 (63.34%) | 10 (33.34%) |
| Implant extraction | 0 | 01 (3.33%) |
| Excision (Radial head) | 01 (3.33%) | 01 (3.33%) |




**Graph 2:** Peak Effect Time of Sensory and Motor Block (Minutes)



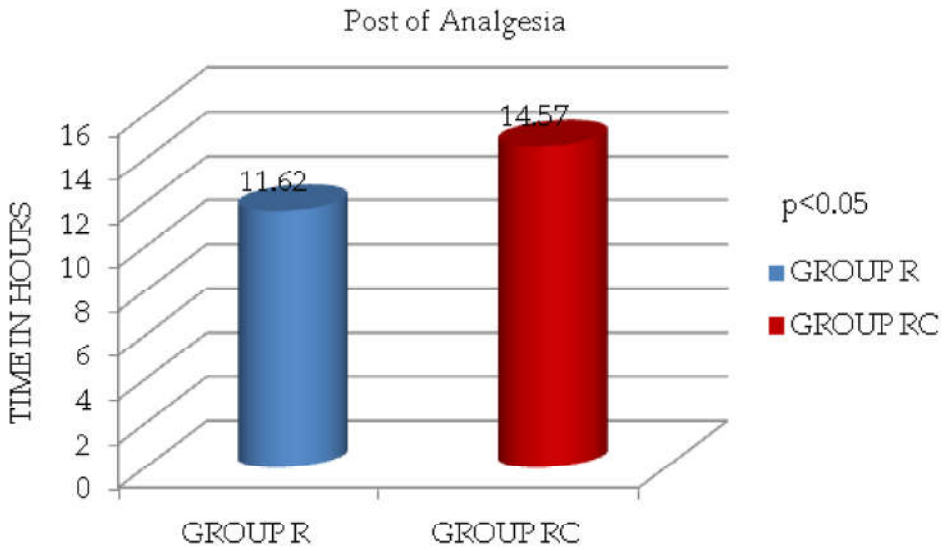

**Graph 3:** Duration of the Block.

**Table 4:** Changes in Mean Pulse Rate

| Time | Pulse rate /min (Mean ± SD) | | P value |
|---|---|---|---|
| | Group R | Group RC | |
| Pre - operative | 88.67 ± 7.88 | 88.67 ± 7.88 | >0.05 |
| Intra - operative | 80.47 ± 9.61 | 83.47 ± 7.98 | >0.05 |
| Post - operative | 88.33 ± 6.97 | 86.13 ± 6.79 | >0.05 |

**Table 5:** Changes in the Mean Blood Pressure

| Time | Blood Pressure in mm. Hg (Mean ± SD) | | | | P value |
|---|---|---|---|---|---|
| | Group R | | Group RC | | |
| | Systolic | Diastolic | Systolic | Diastolic | |
| Pre - operative | 126 ± 11.6 | 78.33 ± 6.48 | 127 ± 12.9 | 81 ± 6.07 | >0.05 |
| Intra - operative | 114.6 ± 12.62 | 72.73 ± 6.99 | 121.33 ± 11.67 | 75.33 ± 5.07 | >0.05 |
| Post - operative | 120 ± 7.88 | 76.67 ± 5.47 | 122.67 ± 8.68 | 79 ± 3.05 | >0.05 |




**Graph 4:** Total Duration of Analgesia

There was no significant change in oxygen saturation and respiratory rate amongst the 2 groups in the peri – operative period.

None of the group patients had any complications.

## Discussion

Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Alleviation of pain remains one of the most vital duty of anaesthetist.

Pain relief after upper limb surgeries can be achieved by various methods which include

1) Parenteral administration of opioid and non-opioid Analgesics.

2) Continuous infusion of Local anaesthetics and

3) Non-Pharmaceutical methods like TENS

But all these are associated with high incidence of side effects like nausea, vomiting, respiratory depression, pruritus etc.

Studies have shown that addition of several adjuncts like neostigmine, opioids, dexamethasone, hyaluronidase, tramadol to local anaesthetic mixture in peripheral nerve blocks prolongs the duration of analgesia, but the results have been inconclusive because of associated side effects or doubtful efficacy [8-13].

Perineural injection of alpha2 agonists is reported to influence post op analgesia [14]. This study demonstrated that, when Clonidine was added to ropivacaine and injected into the brachial plexus sheath, it resulted in longer analgesia than ropivacaine alone. However, it was difficult to define the exact duration of analgesia following ropivacaine with clonidine. Indeed, we relied on our Patients tolerance to pain to define the end

of analgesia, and this end-point varied markedly among patients. Nevertheless, these results are in agreement with those obtained by Saied et al., using Clonidine with ropivacaine in brachial plexus block. The mechanism of action for such a potentiation of analgesia remains controversial and poorly understood [15].

After taking ethical committee clearance and written consent, We studied 60 patients and randomly divided them into 2 groups, group I patients were given ropivacaine 0.75% (30 ml) and group II patients were given ropivacaine 0.75% (30 ml) with clonidine (150 microgram). All patients were randomly selected according to sex, age, weight. Mean age was 41.43±12.88 years in group R & 36.13 ± 12.44 years in group RC, both groups were comparable with respect to age (p value > 0.05, not significant). Mean weight was 57.06 ± 3.75 kgs & 56.83 ± 4.22 kgs in group R&RC respectively, both groups were comparable with weight (p value >0.05, not significant). ASA grading & sex ratio were also comparable. The type of surgeries included were all the upper limb surgeries which could be accomplished under supraclavicular approach and hence shoulder surgeries were excluded. Maximum number of surgeries were of radius & ulna repair. Duration of surgery were comparable in both the groups.

We found that the mean onset of sensory blockade was 10.06 minutes in group R and it was 11.86 minutes in group RC, so sensory onset is delayed by adding clonidine, which was statistically significant (p value<0.05).

The mean time for sensory onset was similar with Vaghadia et al. and Casati et al. In both the studies it was around 10 min [16-17].

The sensory onset with group R & R.C is not similar with saied et al in which it was around 20 min for both the groups.and francois et al. [18] study showed adding clonidine quickens the onset. Our study showed the delayed onset with clonidine group which may be related to the difference of approach & technique.The onset time for sensory block with clonidine group was delayed in casati et al. (2001) [19] which was similar to our study. Wolfgang et al. [20] showed that sensory onset time was around 10 min in most of the patients with ropivacaine which was similar with our study but in their study adding clonidine did not change the onset time which is not in accordance with our study.

The mean onset time of motor blockade was 11.86 min in group R & 13.93 min in group RC. The difference in onset is statistically significant (p value -.0034, significant), where in clonidine delays the onset of motor blockade which is not similar with Saied et al., Francois et al., but it is similar with casati et al.

In Vaghadia et al. the onset of motor blockade with ropivacaine varied between 10-14 mins which is similar with our study where in motor blockade started around 12 min in ropivacaine group. Bertini et al. showed that time for readiness for surgery was 14.5 min in ropivacaine group which is not in accordance with our study [21].

In our study it was found that mean duration of motor blockade 9.23 hrs in Group R & 11.93 hrs in group RC, which is statistically significant. (p value-<0.0001, highly significant.) the duration of postop analgesia was 11.62 hrs in group R & 14.57 hrs in group RC which is highly significant. (p value-<0.0001). Casati et al. showed in their study that motor blockade duration with ropivacaine was 10 hrs which is similar with our study. In Bertini et al. the duration of motor blockade was 8 hrs which is slightly less than our study , they have used the axillary approach which may be the reason for the varied results.

Wolfgang et al. showed the duration of motor block was around 11 hrs with ropivacaine group and duration by adding clonidine was slightly more which is not statistically significant. In our study we found that duration of motor blockade was improved with clonidine which is not in accordance with the above study. The duration of motor blockade with clonidine was same as that of our study.

Saied et al. showed the prolongation of motor blockade and enhanced postop analgesia with addition of clonidine. In their study motor block improved from 9 hrs to 12 hrs, and analgesia from 10 hrs to 14 hrs. This is similar with our study wherein postop analgesia improved by 3 hrs and motor blockade improved by 2.7 hrs.

Francois et al showed that adding clonidine to ropivacaine improves postop analgesia & motor blockade which is in accordance with our study. Casati et al. in their study on major nerve block showed that prolongation of post op analgesia occurs by adding clonidine and the duration was around 11 hrs which is similar to our study [22].

The longer duration of motor blockade & postop analgesia in clonidine group could be due to the direct action of clonidine on nerve fibre conduction, specifically C and A delta fibres. However, this would require high local concentrations and would not explain why clonidine alone injected into the nerve sheath failed to produce prolonged

analgesia. The action of clonidine would then more likely be via a synergistic mechanism of action in combination with the local anesthetic resulting in the prolonged effect. This is probably the only mechanism that would explain the extended duration of both the sensory and motor blockade. What is certain is that clonidine has mixed α1 and α2 agonist effects at both pre and postsynaptic receptors as well as effects on a number of other specific receptors. Its mechanism of action and effects, therefore, are likely to be compound and complex [23-26].

Our results showed that sensory block tended to last longer as compared to motor block which agrees with the observation by de Jong et al. These authors explained that large fibres require a higher concentration of local anaesthetic than small fibres. The minimal effective concentration of local anaesthetic for large (motor) fibres is greater than for small (sensory) fibres. Thus, motor function return before pain perception and duration of motor block is shorter than the sensory block [24-25].

Group R & RC showed no significant hemodynamic changes intraoperativly or post operatively. This is similar with Saied et al. and vaghadia et al. and wolfing et al. and in T. satsume, convulsions had occurred with clonidine in axillary approach [26-29].

## Conclusion

Thus we conclude from our study that, the ropivacaine when used in concentration of 0.75% (35 ml) with Clonidine 150 µgm delays the onset of sensory & motor blockade while improving the post op analgesia significantly without producing any clinically significant side efects.

## References


1. Halstead W.S. Surgical papers by William Stuward Halstead Baltimore, John Hopkins Press, 1924; Volume 1: 37-39.
2. Hirschel G, Anesthesia of the brachial plexus for operations on the upper extremity. Med Wochenschr. 1911;58:1555-56.
3. Akerman B, Hellberg IB, Trossvik C. Primary evaluation of the local anaesthetic properties of the amino amide agent ropivacaine, Acta Anaesthesiol Scand 1988;32:571–8.
4. Andre casetti. Marco bacierello: enantiomeric local anaesthetics, can ropivacaine and levobupivacaine improve our practice, current drug therapy, Can J anesth. 2006;1:85-89.
5. Damien B. Murphy, Colin J.L. McCartney, and Vincent W.S. Chan. Novel Analgesic Adjuncts for Brachial Plexus Block: A Systematic Review, Department of Anaesthesia and Pain Management, Toronto Western Hospital University Health Network, Toronto, Canada.
6. Gaumann D, Comparison between clonidine and epinephrine admixture to lidocaine in brachial plexus block; Anesth Analg. 1992 Jul 01;75(1):69-74.
7. Acalovschi I, Bodolea C, Manoiu C. Spinal anesthesia with meperidine, Effects of added alpha-adrenergic agonists: Epinephrine versus clonidine. Anesth Analg. 1997;84;1333–39.
8. Bone HG, Van Aken H, Brooke M, Burkle H. Enhancement of axillary brachial plexus block anesthesia by coadministration of neostigmine. Reg Anesth Pain Med. 1999;24:405–10.
9. Wajima Z, Shitara T, Nakajima Y, et al. Continuous brachial plexuses Infusion of butorphanol-mepivacaine mixtures for analgesia after upper extremity surgery. BJA 1997;78:83-85.
10. Raffa RB, Friderich E, Reiman W. Opioid and non opioid components independently contribute to the mechanism of action of tramadol, an atypical opioid analgesic. J Pharmacol Exp Ther. 1992;260:275-85.
11. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus block. Anesth Analg. 2006;102:263-267.
12. Keeler JF, Simpson KH, Ellis FR, Kay SP. Effect of addition of hyaluronidase to bupivacaine during axillary brachial plexus block. Br J Anaesth. 1992; 68:68–71.
13. Kapral S, Goolann G, Walt B, et al. Tramadol added to mepivacaine prolongs the duration of an axillary brachial plexus blockade. Anesth Analg. 1999;88: 853-56.
14. Elliott S, Eckersall S, Fligelstone L, et al.: Does the addition of clonidine affect duration of analgesia of bupivacaine in inguinal hernia repair surgery Br J Anaesth. 1997;79:446–49.
15. A.H.El Saied, M.P Stein A and J. M ansermino, Can j of anesth. 2000;47:962-967.
16. Himat Vaghadia, Vincent Chan, S. Ganapathy. A multicentre trial of ropivacaine 7.5 mg.m1-1 vs bupivacaine 5 mg.m1-1 for supra clavicular brachial plexus anesthesia can j anesth. 1999;46:946-51.
17. Andre casetti, Marco bacierello: enantiomeric local anaesthetics, can ropivacaine and levobupivacaine improve our practice;current drug therapy. 2006;1: 85-89.
18. Francois meurant, Emille colling, Jo welter. Clonidine prolongs the effect of ropivacaine for

axillary brachial plexus block. Can J anaesth. 2000;47:962-7.

19. Casati A, Magistris L, Beccaria P, Cappelleri G, Aldegheri G, Fanelli G. Improving postoperative analgesia after axillary brachial plexus anesthesia with 0.75% ropivacaine. A double-blind evaluation of adding clonidine. Minerva Anestesiol. 2001 May; 67(5):407-12.
20. Wolfgang Erlacher, Christoph Schuschnig, Herbert Koinig Peter Marhofer, Matthias Melischek, Nikolaus Mayer and Stephan Kapral; Clonidine as adjuvant for mepivacaine, ropivacaine and bupivacaine in axillary, perivascular brachial plexus block; Can j of anesth. 2001;48:522-29.
21. Laura Bertini M.D., Vincenzo Tagariello M.D., Stefania Mancini M.D., Alma Ciaschi M.D., et al. 0.75% and 0.5% ropivacaine for axillary brachial plexus block: A clinical comparison with 0.5% bupivacaine. Regional Anesthesia and Pain Medicine. 1999;24:514-518.
22. Sakonju I, Maeda K, Maekawa R, Maebashi R, Kakuta T, Takase K. Zhonghua Yi Xue Za Zhi, Relative nerve blocking properties of bupivacaine and ropivacaine in dogs undergoing brachial plexus block using a nerve stimulator. 2008;88(15):1046-50.
23. Gaumann DM, Brunet PC, Jirounek P. Clonidine enhances the effect of lidocaine on C fiber action potential. Anesth Analg. 1992;74:719–25.
24. Butterworth JF IV, Strichartz GR. The alpha 2 adrenergic agonists clonidine and guanfacine produce tonic and phasic block of conduction in rat sciatic nerve fibers. Anesth Analg. 1993;76:295–301.
25. 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.
26. De Jong RH, Wagman IH. Physiological mechanisms of peripheral nerve block by local anesthetics. Anesthesiology. 1963;24:231-34.
27. T. Satsumae, M. Tanaka, S. Saito and S. Inomata, Convulsions after ropivacaine 300 mg for brachial plexus block; BJA; 2008;101(6):860-62.
28. Dhir S, Ganapathy S, Lindsay P, Athwal GS. Case report: ropivacaine neurotoxicity at clinical doses in interscalene brachial plexus block. Can J Anaesth. 2007 Nov;54(11):912-6.
29. Gentili ME, Deleuze A, Estèbe JP, Lebourg M, Ecoffey C. Severe respiratory failure after infraclavicular block with 0.75% ropivacaine: a case report. J Clin Anesth. 2002 Sep;14(6):459-61.

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