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A Comparative Study of Ropivacaine and Ropivacaine with Clonidine during Interscalene Brachial Plexus Block in Upper Arm Surgeries: A Prospective Randomized Double Blinded Study

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Abstract
Background*: Pain is the most distressing aspect of any type of surgery. Analgesic multimodalities have been used but are fraught with side effects that limit their usefulness. The peripheral nerve blocks used for upper arm surgeries provide analgesia by themselves but only for a limited period. Various adjuvants have been added to local anaesthetic agents in an effort to prolong this duration. Clonidine added to ropivacaine in peripheral nerve blocks has been found to increase its efficacy by improving the analgesia. This study evaluates the effects of ropivacaine to its combination with clonidine in the interscalene nerve block.*
Aims: *To study the advantages of adding clonidine to ropivacaine over ropivacaine alone in the interscalene nerve block*
Settings and Design: *Prospective, double blind, randomized, comparative study.*
Materials and Methods: *80 patients in the age group of 18-60 yrs in ASA Gr I & II undergoing elective shoulder surgery were enrolled for the study and were randomly allocated into one of the two groups to receive either 30 ml of 0.5% ropivacaine and (Group R) 30 ml of 0.5% ropivacaine and 50µg clonidine (Group RC).*
Results: *There was a significant early onset of motor, sensory block and increase duration analgesia in Group RC. Duration of motor block in Group RC was 461.2±42.5min and in Group R was 391.6±37.44 min and was clinically significant. Clinically significant difference was found in the Sensory block duration which was 443±37.3min in Group RC vs. 371.8±34.34 min in Group R (P < 0.001). Duration of analgesia in Group RC was 520.8±34.2 min and that in Group R was 440.02±41.8 min and was clinically significant. There was no significant alteration in hemodynamic in Group RC when compared to Group R without any side effects except significant sedation seen in group RC in postoperative period.*
Conclusion: *clonidine as an adjuvant to ropivacaine provides early onset of anesthesia, longer duration of analgesia. It offers effective mode of anesthesia as well as postoperative analgesia for upper arm and/or shoulder surgeries.*
Keywords: *Inter Scalene Block ; clonidine; peripheral nerve block; ropivacaine*

I. Introduction

Control of pain after shoulder procedures has been a tough task for both anaesthesiologists and orthopaedic surgeons. In order to improve analgesia and early mobilization, interscalene approach to the brachial plexus is often used, either alone or with general anaesthesia. The use of an ISB as the sole anaesthetic technique[i] provides anaesthesia for surgery as well as analgesia post-operatively, without any systemic side-effects[ii] as found with other modes of analgesia including opioids and NSAIDS. However, analgesia is short-lived necessitating search for ideal adjuvant to local anaesthetics that improves the efficacy of LA by hastening the onset, prolonging the duration, and postoperative analgesia with lesser adverse effects.[iii] Adjuvants including epinephrine[iv], clonidine,[v] and midazolam[vi] have met with limited success. However, clonidine was found to be effective in a small number of preclinical[vii] and clinical[viii] studies. Clonidine, a 2-imidazoline-derivative, is a centrally-acting α2-adrenergic agonist, its analgesic effect are mediated entirely via pre and postsynaptic α2

adrenergic receptor that block nociceptive transmission. It also has local anaesthetic effect when applied to peripheral nerve and is frequently added to local anaesthetic to prolong sensory and motor block.

Ropivacaine is an amino amide local anaesthetic, which is similar in structure to bupivacaine but is less toxic to the cardiovascular and central nervous system than bupivacaine. It belongs to the pipecoloxylidides and has a propyl group on the piperidine nitrogen atom compared to bupivacaine, which has a butyl group. Ropivacaine causes reversible inhibition of sodium channels along with dose-dependent inhibition of potassium channels blocking nerve conduction.[ix] Being less lipophilic than bupivacaine, Ropivacaine penetrates large myelinated motor fibres (Aβ fibres) to a lesser extent and therefore, blocks pain-transmitting A β and C nerves more selectively.

II. Material and Method

After obtaining Institutional Ethics Committee clearance, 80 Adults patients, of age 18 and 60 years, categorized as American Society of Anesthesiologists (ASA) physical status I, II, undergoing shoulder and upper arm surgeries in our institute from January 2014 to June 2015, were randomized by computer into two groups. Patients, weighing <50 kg, age less than 18 years and more than 60 years, known history of allergy to study drugs, pregnant patients and with significant blood coagulation disorders, infection at the site of the block , and patient with peripheral neuropathy were excluded. After preanaesthetic evaluation and obtaining informed consent, all patients were kept nil per oral, premedicated with tablet diazepam 10 mg at 6 am in morning, and injection ranitidine 50 mg 30 minutes before surgery. Preoperative baseline values of systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and heart rate (HR) were noted. Limb to be operated was positioned.

Under all aseptic precautions, ISB was performed by a block technique (nerve stimulator or ultrasound) as per the discretion of the attending anaesthesiologist. A 5-cm, 23-gauge short-beveled peripheral nerve stimulator needle was introduced in both block techniques. In the ultrasound technique the study drug was injected after identification of the nerve roots/trunks as hypoechoic structures between the anterior and middle scalene muscles at the level of the cricoid cartilage through an in-plane posterior approach. The needle position was readjusted as necessary to ensure appropriate spread during the injection. In the nerve stimulation technique, the block needle was introduced by following Winnie's landmarks[x] and study drug injected only after obtaining contraction in a group of muscles distal to the deltoid with a threshold stimulation <40 nC (i.e., 1 mA; pulse width, 40μs).

Group R received 30 ml of 0.5% ropivacaine and Group RC received 30 ml of 0.5% ropivacaine plus 50μg clonidine, according to the group allocated by computer generated random table. To maintain blinding, an anaesthesiologist not involved in the study prepared the Drug combinations.

The time of administration of the drug was noted. HR, SBP, DBP, MAP were noted every 5 minutes for the first 30 minutes and every 15 minute for next 1½ h and every hour later on, till regression of sensory block. Sensory block was assessed by pinprick test in respective dermatomal distribution of nerves using a 3-point scale, Grade 0: Sharp pin felt; Grade 1: Analgesia, dull sensation felt; Grade 2: Anaesthesia, no sensation felt.

Modified Bromage scale for upper extremities was used to determine Motor block[xi] ; 0 − normal motor function with full extension and flexion of elbow, wrist, and fingers; 1 − decreased motor strength, with ability to move only fingers; 2 − complete motor block with inability to move elbow, wrist, and fingers. Grade 1 motor blockade was considered the onset and Grade 2 motor blockade for complete block. Motor block was evaluated every 5 minutes till complete motor blockade after drug injection.

Surgical anesthesia was taken as the complete loss of cold sensation at the C5-6 skin dermatomes and an inability to abduct the arm at the shoulder and flex the forearm against gravity at elbow joint. If the block was not complete 45 min after the injection, it was considered as 'failed block'.

The sedation score was evaluated every 1 hour interval till 8 hours postoperatively, considering the time of giving the premedication as zero. Intra-operative anxiety was treated with midazolam 2 mg.

Duration of analgesia was assessed as per visual analogue scale of 0 to 10. It was recorded post-operatively every 1 hour interval till 8 hours. The rescue analgesia in the form of inj.paracetamol intravenously was given at the visual analogue scale of 5 and the time of administration was noted. The duration of sensory block was noted as the time interval between the end of local anaesthetic administration and the complete resolution of anaesthesia. The recovery of complete motor function of the hand and forearm from the time of administration of study drug was taken as the duration of motor block. Adverse events (hypotention, bradycardia, sedation, nausea and vomiting, shivering, pruritus etc) were recorded during operation and recovery. Hypotension (systolic blood pressure of <100 mm Hg) was treated by increasing the rate of infusion of intravenous crystalloid and vasoactive drugs were used on further requirement. Bradycardia (Heart rate <60 beats/min) was treated with intravenous atropine. Respiratory depression, defined as Respiratory Rate < 8 breaths per min or SpO2 < 95% was treated by oxygen supplementation and respiratory support as required.

2.1. Statistical analysis.

Results were expressed by standard methods , as mean ± standard deviation. Chi-square test was applied for demographic data and haemodynamic parameters. Onset and duration of sensory and motor blockade and duration of analgesia was analyzed by unpaired t- test. Statistical analysis was performed by SPSS (VERSION 20.0). P-value was considered significant if <0.05 and highly significant if<0.001.

III. Results

Demographic details (table 1) in both the groups were comparable. The difference in onset of sensory block, the onset of motor block and onset of surgical anaesthesia (table 3) was not significant (P value 0.261 , 0.0079 , 0.0963 respectively) on other hand, duration of sensory block, duration of the motor block, and duration of analgesia between two groups was significant ($P \leq 0.001$) (table 4**).** Postoperative analgesia was found to be better in group RC as shown by VAS scores (table 5). No significant side effects were noted between the groups.

Table 1 Demographic Data

Variables	**Group A**	**Group B**	**T value**	**P-Value**
Age (Year)	32±6.4	32.7±6.02	0.503	0.615
Height (cm)	163±8.4	164.5±7.9	0.822	0.413
Weight (Kg)	62.2±6.4	61.8±7.2	0.262	0.793
BMI (Kg/M^2)	23.6±3.3	22.9±2.7	1.038	0.302
Surgery Duration	89±11.8	87±13.8	0.696	0.488

Table 2. Physical status Distribution

Physical status	**Group A**	**Group B**	**P-Value**
ASA I	27	31	0.4531
ASA II	13	9	
Total	40(100%)	40(100%)	

Table 3: Onset Block Characteristics in group A and group B

Variables	Group A Mean ±SD	Group BMean ±SD	T-Value	P-Value
Onset of sensory block (min)	11.3±5.20	10.1±4.25	1.130	0.261
Onset of motor block (min)	14.72±2.37	13.47±1.67	2.7268	0.0079
Onset of Surgical Anesthesia	18.32±3.18	17.22±2.64	1.6833	0.0963

Table 4: Characteristics of duration of sensory and motor block in group R and group RC, also depicting total duration of post-operative analgesia.

	Group A	Group B	T Value	P value
Duration of Sensory Block(min)	371.8±34.34	443±37.3	8.88	<0.001
Duration of Motor Block (min)	391.6±37.44	461.2±42.5	7.77	<0.001
Duration Of Analgesia (min)	440.02±41.8	520.8±34.2	9.45	<0.001

Table 5. Showing VAS score between groups

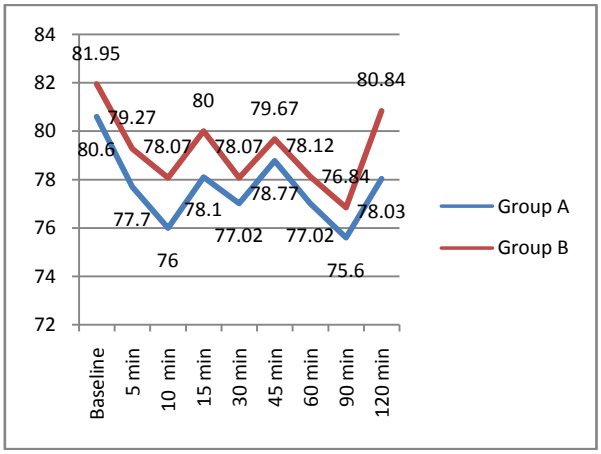
VAS Score	**Group R**		**Group RC**		**T value**	**P value**
	Mean	**SD**	**Mean**	**SD**		
Immediate post op	0.00	0.00	0.00	0.0	-	-
1 hr	0.00	0.00	0.00	0.00	-	-
2 hr	1.00	0.50	0.72	0.45	2.102	.039
3 hr	1.8	0.63	1.00	0.0	8.204	<.001
4hr	2.4	0.62	1.15	0.36	10.693	<.001
6hr	2.8	0.54	1.87	0.68	6.323	<.001
8hr	3.6	0.63	2.3	0.64	9.077	<.001

Table no 6. Showing sedation score between groups

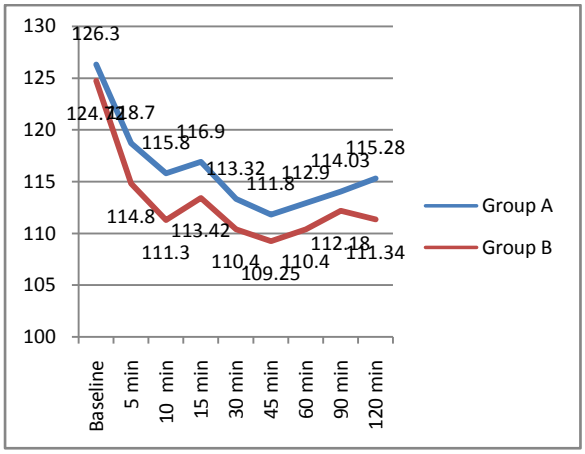
Sedation score	**Group A**		**Group B**		**T value**	**P value**
	Mean	**SD**	**Mean**	**SD**		
Immediate post-op	1.85	.6	2.9	.36	9.4907	<.001
1 hr	1.2	0.42	2.40	0.54	-10.786	<.001
2 hr	1.20	0.39	1.82	0.38	-7.335	<.001
3 hr	1.1	0.34	1.5	0.50	-3.724	<.001
4hr	1.1	0.28	1.17	0.38	-1.131	.262
6hr	1	0.15	1.11	0.30	-2.308	.024
8hr	0.6	0.49	1.00	0.000	-4.837	<.001

HEMODYNAMIC PARAMETERS

The HR, SBP, DBP, and mean blood pressure were compared using independent Student's t–test and were not significant in both intra and post operative periods.



Showing intraop pulse rate between groups



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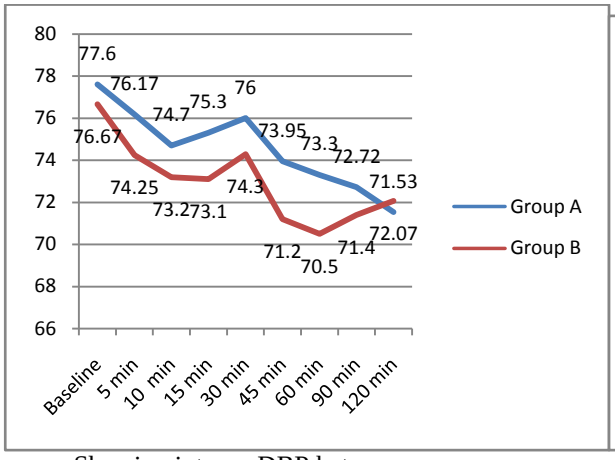
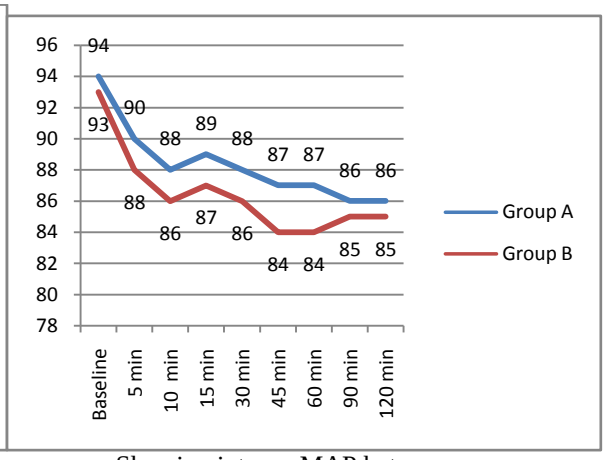


Showing intraop DBP between groups



Showing intraop MAP between groups

IV. Discussion

In our study we found that clonidine 50µg added to ropivacaine 0.50% provides considerable therapeutic benefit with fewer side effects. The duration of both sensory and motor blockade as well as the duration of analgesia was significantly increased. Addition of clonidine resulted in more intraoperative hemodynamic stability but was not found to be statistically significant. Clonidine induced sedative effect was also seen in some of the patients. Both clonidine and ropivacaine did not cause any major side effects.

In our study, the onset of sensory and motor block was shortened by addition of clonidine to ropivacaine but was not statistically significant. In a meta-analysis of randomized trials by Popping et al.[xii], clonidine significantly hastened the onset in 5 out of 11 for sensory block and in 2 out of 7 for motor, demonstrating a lot of heterogeneity. Gabriel and Gordin found no significant change in the onset with the addition of clonidine to bupivacaine.[xiii] In a study, Patil KN et al reported shortened time by addition of clonidine to ropivacaine.[xiv] Similar results were also noted by Singh and Aggarwal [xv] in their study.

The mean duration of sensory block in clonidine group RC was prolonged significantly ($p < 0.001$) as compared to plain ropivacaine in group R. These findings are consistent with previous studies (El Saied et al[xvi], Giovanni and Arjuman Ganesh[xvii], Eledjam et al[xviii]). This is also consistent with two more of the trials performed as reported by Bernard JM et al**Error! Bookmark not defined.** and Singelyn FJ et al.[xix]

The mean duration of motor block and sensory block in clonidine group was longer than in ropivacaine group ($p < 0.001$) El Saied et al,[xvi] Chakraborthy et al[xx] and Popping et al[xii] had found similar results. The duration of analgesia in clonidine group was significantly longer than Ropivacaine group alone (p value <0.001). VAS scores were found to be highly significant ($p<0.001$) at all points post operatively till 8hrs.

Other studies by El Saied et al [xvi], Casati A et al[xxi], Giorgio Danelli et al [xxii], Chakraborthy et al[xx] were also consistent with our findings. In the meta-analysis by Popping et al.[xii], in 13 out of 17 comparisons duration of analgesia was found to be significantly prolonged.

All hemodynamic parameters were comparable, although after giving block the mean heart rate was lower in the clonidine group as compared to plain ropivacaine group at all time intervals, but was statistically insignificant. Only one case of bradycardia was found in the clonidine group. Sinelyn, FJ. et al[xxiii] and Murphy, D.B et al[xxiv] did not find any significant hemodynamic changes.

The combination of ropivacaine with clonidine showed a significant difference in sedation score. Chakraborty et al [xx] evaluated the effect of clonidine added to bupivacaine in brachial plexus block for orthopaedic procedures on upper limb and concluded that addition of a small dose of clonidine to 0.5% bupivacaine significantly prolonged sedation.

The sample size in our study was relatively small, further studies to with a larger population size are suggested. Using ropivacaine or clonidine as per body weight would have made the dosing more uniform. The plasma levels of clonidine should have been measured to exclude the systemic effects of the drug. Another concern is that though prolongation of motor blockade by higher dose of clonidine is useful for long duration surgeries, but is not suitable in outpatient surgeries where early mobilization is desirable.

V. Conclusion

Clonidine increases the duration of sensory and motor blockade and prolongs the duration of analgesia when added to ropivacaine in interscalene block with minimal hemodynamic effects and other side effects.

References

[1]. Hadzic A, Williams BA, Karaca PE, et al. For outpatient rotator cuff surgery, nerve block anesthesia provides superior same-day recovery over general anesthesia. Anesthesiology 2005;102:1001-7.
[2]. Khanduri KC; Regional anaesthetic techniques for orthopaedic surgeries. Med J Armed Forces India, 2008; 64:109.
[3]. Damien B, Murhy, Collin JL, Cartney, Vincent WS; Novel analgesic adjuvants for brachial plexus block. A systemic review. Anesth Analg., 2000; 90: 1122-1128.
[4]. Chawda PM, Sharma G. A clinical study comparing epinephrine 200µg or clonidine 90µg as adjuvants to local anaesthetic agent in brachial plexus block via supraclavicular approach. J Anaesthesiol Clin Pharmacol. 2010;26:523–7.
[5]. Duma A, Urbanek B, Sitzwohl C, 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.
[6]. Jarbo K, Batra YK, Panda NB. Brachial plexus block with midazolam and ropivacaine improves analgesia. Can J Anaesth 2005;52:822-6.
[7]. Colombo G, Padera R, Langer R, Kohane DS. Prolonged duration local anesthesia with lipid-protein-sugar particles containing ropivacaine and clonidine. J Biomed Mater Res A 2005;75:458-64.
[8]. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Clonidine added to lidocaine prolongs axillary brachial plexus blockade. Anesth Analg2006;102:263-7.
[9]. McClure J H. Ropivacaine .British journal of anaesthesia.1996; 76: 300- 307.
[10]. Winnie, A. P. Interscalene brachial plexus block. Anesth. Analg.1970; 49:455-466.
[11]. Kohli S, Kaur M, Sahoo S, Vajifdar H, Kohli P; Brachial plexus block: Comparison of two different doses of clonidine added to bupivacaine.J Anaesthesiol Clin Pharmacol. 2013; 29(4): 491-495.
[12]. Popping DM, Elia N, Marret E, Wenk M, Tramèr MR. Clonidine as an adjuvant to local anesthetics for peripheral nerve and plexus blocks: A meta-analysis of randomized trials.Anesthesiology. 2009;111:406–15.
[13]. Gabriel JS, Gordin V. Alpha 2 agonists in regional anesthesia and analgesia. Curr Opin Anaesthesiol. 2001;14:751–3.
[14]. Patil KN, Singh ND. Clonidine as an adjuvant to ropivacaine-induced supraclavicular brachial plexus block for upper limb surgeries. Journal of Anaesthesiology, Clinical Pharmacology. 2015;31(3):365-369. doi:10.4103/0970-9185.161674.
[15]. Singh S, Aggarwal A. A randomized controlled double-blinded prospective study of the efficacy of clonidine added to bupivacaine as compared with bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries. Indian J Anaesth. 2010;54:552–7.
[16]. El Saied Ah, Styen MP, Ansermino JM. Clonidine prolongs the effect of ropivacaine for axillary brachial plexus blockade. Can J Anesth 2000; 47: 962-7.
[17]. Giovanni Cucchiaro, Ganesh Arjun. The effects of clonidine on postoperative analgesia after peripheral nerve blockade in children. Anesth Analg 2007; 104: 532-7.
[18]. [xviii] Eledjam JJ, Deschodt J, Vie EJ, Lubrano JF, Charavel P, d'Athis F, ducailan J. Brachial plexus block. Can J Anaesth 1991;38:870-5.
[19]. Singelyn FJ, Gouverneur JM, Robert A. A minimum dose of clonidine added to mepivacaine prolongs the duration of anesthesia and analgesia after axillary brachial plexus block. Anesth Analg. 1996;83:1046–50.
[20]. 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.
[21]. 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;67:407–12.
[22]. Giorgio Danelli M. Nuzzi, P.F. Salcuni. Does clonidine 50 □ g improve cervical plexus block obtained with ropivacaine 150 mg for carotid endarterectomy? A randomized, double-blinded study. Journal of Clinical Anaesthesia 2006;18:585-88.
[23]. Sinelyn, FJ et al. A minimum dose of clonidine added to mepivacaine prolongs the duration of anaesthesia and analgesia after axillary brachial plexus block. Anaes Analg 1996; 83: 1646-50.
[24]. Murphy DB et al. Noval analgesia adjuncts for brachial plexus block. A systemic review. Anaesth Analg 2000: 2000; 1122-1128.