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A Comparative Study of Efficacy Between 0.5% Ropivacaine Versus 0.5% Ropivacaine with Clonidine in Supraclavicular Brachial Plexus Block

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Abstract: ***Background and Aims: An ultrasound-guided blockade of peripheral nerves is a recent approach for accurate and better-quality nerve blocks, and it lowers block failure and prevents procedure related complications. Supra-clavicular brachial plexus block provides ideal anaesthesia for the upper limb surgeries during surgery by reducing stress response. The aim of the study was to compare the Efficacy of 0.5% Ropivacaine versus 0.5% Ropivacaine with Clonidine in Supra-clavicular Brachial Plexus Block. Materials and Methods: In a prospective randomized control study, 80 adult patients in age group of 18-60 years. Each patient was randomly assigned to one of the two groups of 40 patients each, Group-R patients undergoing supra-clavicular brachial plexus block with Inj. Ropivacaine (0.5%) - 20ml and in Group-RC with Ropivacaine (0.5%) - 20ml + Inj. Clonidine 0.5 mcg/kg in 2ml Normal Saline. The groups were compared regarding the quality of sensory and motor blockade and duration of post-operative analgesia. Results: There was a significant early onset and duration of sensory and motor block and analgesia in Group RC compared to R (p<0.001). No significant side effects were noted. Conclusion: The addition of 0.5 mcg/kg of Clonidine to 0.5% Ropivacaine in ultrasound guided supra-clavicular brachial plexus block confers a significant advantage over plain Ropivacaine in terms of duration of analgesia, quality of blockade and need for rescue analgesia.***

Keywords: 0.5% Ropivacaine, Clonidine, Supraclavicular Brachial Plexus Block, Motor Block, 0.5 % Bupivacaine, Ultrasonography, Modified Lovett's grading, "In-plane" approach.

1. Introduction

Supra-clavicular brachial plexus block which provides ideal anaesthesia for the upper limb surgeries during surgery by reducing stress response. The drug which is most frequently given in this approach is 0.5% bupivacaine, a long-acting local anaesthetic, which can cause cardiotoxicity if used in high concentrations or mistakenly delivered intravenously[1,2,9]. It benefits from a favourable ratio of sensory to motor neural block and long duration of activity. Bupivacaine, an amide group local anaesthetic is largely metabolised in the liver by conjugation with glucuronic acid, can cause cardiac and CNS damage in some patients [9]. After comparing Ropivacaine to Bupivacaine, a long-acting amide local anaesthetic was created, When, compared to Bupivacaine [9], it has a potential safety profile, Ropivacaine has a less lipophilic effect and is less likely to penetrate thick myelinated fibres. Both the drugs are pipecoloxylidides [1,9]. Pure S (-) enantiomer ropivacaine exhibits a higher level of motor and sensory differentiation [(1,2,9)]. Instead of acting on Aβ fibres,it acts on the Aδ and C nerves, which transmit pain.A number of studies demonstrate that ropivacaine has less harmful effects on the heart and CNS.

Adjuvant medicines may help with the quality, timing, and the duration of the block in addition to reducing need for post-operative analgesia and systemic adverse effects. Opioids are frequently used in addition to local anaesthetics to enhance and intensify effects of anaesthesia by interacting with opioid receptors on nerve terminals. Aside from respiratory depression, fentanyl can cause vomiting. Clonidine, an imidazole with a specific alpha 2 adrenergic agonist boost the effects of local anaesthetics on inhibiting C fibre or spinal action and local vasoconstriction brought on by retrograde axonal transport by reducing the onset time, increasing the block's efficacy and extending post-operative analgesia[1,2]. Clonidine with certain alpha 1 agonist properties, when coupled with local anaesthetic solution, it produces prolonged peripheral nerve block [1, 2, 3]. An ultrasound-guided blockade of peripheral nerves is a recent approach for accurate and better-quality nerve blocks, and it lowers block failure and prevents procedure related complications. Additionally, it speeds up block execution and lessens the likelihood of problems including pneumothorax and neuropathy. So, we decided to evaluate and compare the efficacy in 0.5% Ropivacaine and 0.5% Ropivacaine with Clonidine 0.5 mcg/kg in supra-clavicular brachial plexus block.

2. Materials and Methods

After obtaining Institutional Human Ethical Committee approval and written informed consent, a prospective randomized control study was carried out on 80 adult patients in age group of 18-60 years belonging to ASA I and II scheduled to undergo elective upper limb procedures were

chosen. All the patients were assessed and those with normal clinical, haematological, biochemical and radiological parameters were selected. Written and Informed was taken from all the patients. The study was conducted in PES Institute of Medical Sciences and Research, Kuppam, 40 patients in each group between Dec 2020 to June 2022. Group-R Patients undergoing supra-clavicular brachial plexus block with Inj. Ropivacaine (0.5%) - 20ml and Group RC Patients undergoing supra-clavicular brachial plexus blockInj. Ropivacaine (0.5%) - 20ml + Inj. Clonidine 0.5 mcg/kg in 2ml Normal Saline. The exclusion criteria included patient refusal, patients with skin infection at injection site, sepsis, pregnancy, upper limb neurological deficit, bleeding disorders or patient on anti-coagulant therapy, patients with ASA grade III, IV and patients with known hypersensitivity to Clonidine & Local Anaesthetics.

Techniques used with High frequency (more than 10 MHz) linear ultrasound probe. Patients were assessed preoperatively and procedure was explained to patients. Assessment of pain using VRS- Verbal Rating Scale intraoperatively, and VAS (Visual analogue scale) postoperatively.

On arrival of patient in operating room, monitors were connected. Monitors include pulse oximetry, NIBP and ECG and baseline vital signs were recorded. An intravenous access was obtained in opposite arm. Patients were not given any premedication. Patient after proper positioning with supine, the head turned Patient is made to lie supine with a small pillow below head and neck and turned head to the side opposite to that to be blocked. Scout scan will be performed using a linear high frequency probe over the supraclavicular area to rule out anatomical abnormalities including aberrant vasculature. USG probe is cleaned and patient's skin preparation done with povidone iodine and draped with sterile towel. Needle angle is maintained at 0-45˚.

"In-plane" approach is used for block. Needle is inserted initially in superficial plane until the needle is visualized on the scan. Once hyperechoic line is seen, it is inserted towards brachial plexus and placed in the corner pocket. Throughout the procedure needle tip was traced. After careful negative aspiration, local anaesthetic 1-2ml was injected to see spread thereby confirming needle tip position. Then, by adjusting needle position, drug is deposited all around brachial plexus.

Vital signs monitoring: Non-invasive blood pressure and heart rate was measured every 1 minute for the first 10 minutes and every 5 minutes thereafter throughout the intra operative period. SPO2 and respiratory rate were monitored continuously. For statistical purposes, they were documented at 1, 5, 10, 15, 30 minutes and every 30 minutes till 2 hours and every 2 hours thereafter.

Sensory blockade and analgesia were assessed by spirit cotton swab along the Ulnar, Radial & Median nerve distribution and graded according to
0 – Normal response to pinprick
1 - Dull response to pin prick(onset)
2 – No response to pin prick (peak)
By having the patient do forearm flexion and arm abduction, the beginning of the motor block was assessed by modified Lovett's grade.

The data will be entered into MS Excel 2007 version and further analysed using SPSS 20 the data were expressed as calculating mean ± Standard Deviation. The numerical data will be analysed using "t-test", The categorical data will be analysed using Chi square test and "p" <0.05 will be considered as statistically significant.

3. Result

Demographic profiles in both the group were comparable. the mean time in onset of sensory blockade in Group R is (7.5±1.1) minutes and Group RC is (6.3±1.5) minutes (p<0.0001). Mean time of onset of motor blockade in Group R is (13.2±1.8) minutes and in Group RC is (10.9±1.5) minutes (p<0.001). The mean duration of sensory blockade in Group R is (5±0.4) hours, in Group RC is (11.3±1.1) hours (p<0.001). mean duration of motor blockade in Group R was (4.5±0.3) hrs, in Group RC was (9.7±1.1) hours (p<0.001). mean duration of analgesia in Group R is (5.4±0.6) hours, in Group RC is (12.8±1.3) hours (p<0.001).

Table 1: Demographic profile of the patient in both groups

Variable	Group				t value	'p' value	Sig*
	Group R		Group RC				
	Mean	SD	Mean	SD			
Age	34.4	13.9	39.8	13.2	1.7664	0.0812	NS
Height	169.6	9.3	167.9	8.2	0.8121	0.4192	NS
Weight	67.8	15.1	67.2	11.7	0.1910	0.8490	NS
Male	29	72.5	28	70.0	0.0610	0.805	NS
Female	11	27.5	12	30.0			

*P<0.05 statistically significant

Table 2: Sensory and motor Characteristics in both groups

Variable	Group				t value	'p' value	Sig*
	Group R		Group RC				
	Mean	SD	Mean	SD			
Onset of Sensory Blockade (Min)	7.5	1.1	6.3	1.5	4.0329	0.0001*	HS
Onset of Motor Blockade (Min)	13.2	1.8	10.9	1.5	5.997	<0.001*	S
Duration of Sensory Blockade (H)	5.0	0.4	11.3	1.1	33.47	<0.001*	S
Duration of Motor Blockade (H)	4.5	0.3	9.7	1.1	28.14	<0.001*	S
Duration of Analgesia (H)	5.4	0.6	12.8	1.3	31.988	<0.001*	S
First rescue of Analgesia Requirement (H)	7.1	0.8	13.1	1.0	29.21	<0.001*	S*

*P<0.05 statistically significant

Pulse rate was significantly low in group RC compared to group R at 20min, 25min, 30 min, 1hr, 2hrs, 4 hrs and 8hrs were 81.8 vs 76.1, 81.2 vs 75.1, 82.3 vs 74.8, 83.6 vs 74.8, 83.7 vs 76.1, 87.9 vs 76.4 and 88.5 vs 78.0 respectively with p-values 0.0188, 0.0096, 0.0015, 0.0002, 0.0013, <0.001 and <0.001 which is statistically significant but not clinically.

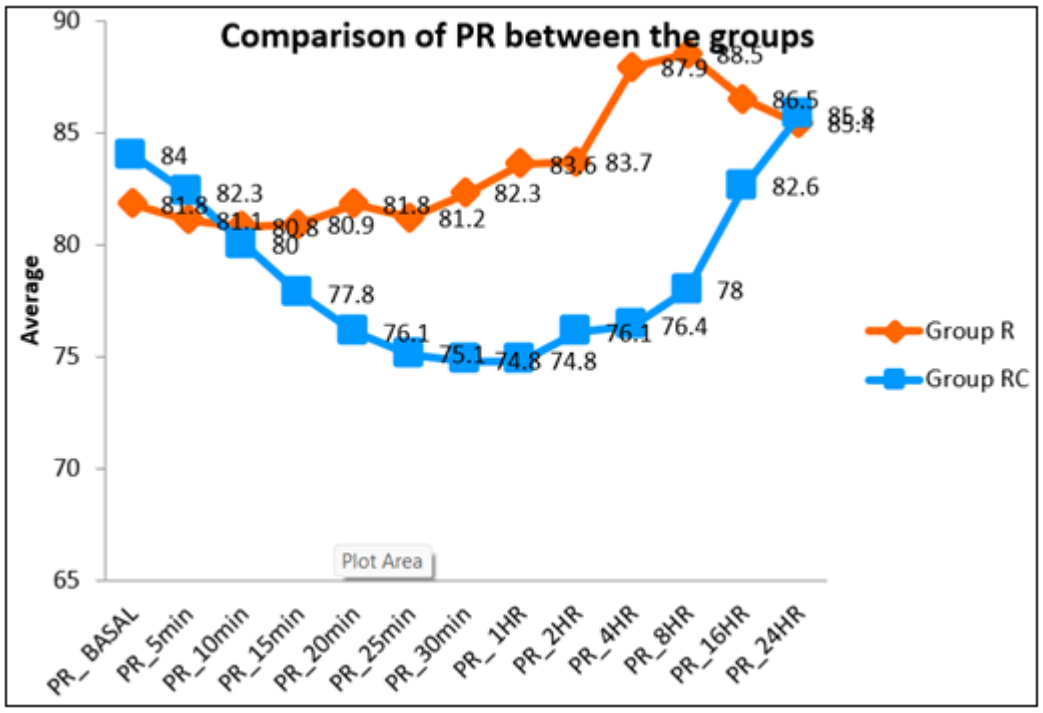

Figure 1: Line Diagram showing Pulse rate between group R and group RC both intra and post operatively

VAS score was significantly low in group RC compared to group R at 4 hrs and 8 hrs. with mean VAS score of 0.5 vs 0 and 2.9 vs 0.4 and respectively with p-value of <0.001 which is statistically significant. the mean time at which first rescue analgesic given in group R is 7.1 hours while in Group RC, the mean time is 13.1 hours (p<0.05).

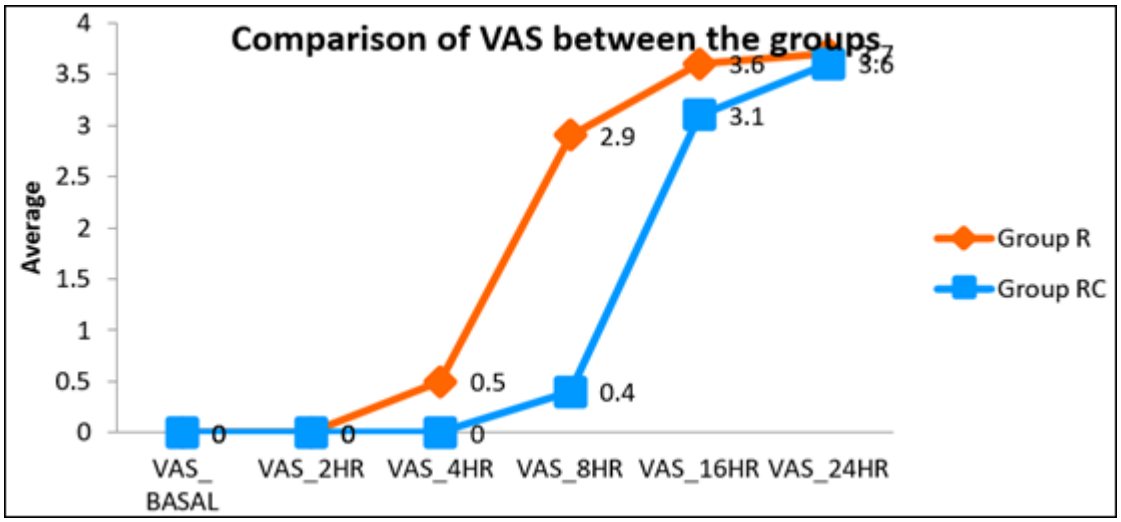

Figure 2: Line Diagram showing visual analogue score (VAS) in group R and group RC both intra and post operatively

4. Discussion

In this study, the supra-clavicular brachial plexus block performed using an ultrasoundguided technique that offers real-time imaging guidance during needle advancement and local anaesthetic spread, enhances block quality and success rate, lowers local anaesthetic dose, and avoids complications like intravascular injection and unintentional pneumothorax[34].

Since Ropivacaine, a long-lasting anaesthetic, is a pure S (-) enantiomer as compared to bupivacaine, it has a lower lipophilicity and is less likely to enter big myelinated Aβmotor fibres, which leads to a more moderate motor blockade. Reduced risk for cardiotoxicity and CNS toxicity is due to reduced lipophilicity of ropivacaine drug[5].

There are number of adjuncts that can be used to both shorten the onset of block time and duration of block be prolonged. Drugs that are used as adjuncts to brachial plexus

block such as epinephrine, dexamethasone, clonidine, and opioids.

Opioid analgesics have no benefit for minimising side effects[5].

In brachial plexus block, the addition of clonidine, an alpha 2 agonist, to local anaesthetic prolongs the motor block and sensory block and analgesia without increasing the risk of side effects. Hence, in brachial plexus block clonidine has been used in present study as an adjuvant[1].

The result in our study, shows that the mean onset of sensory block in Group R is 7.5 minutes and group RC is 6.3 minutes which is statistically significant. The mean onset of motor block in Group R is 13.2 minutes and group RC is 10.9 minutes which is statistically significant. The mean duration of sensory block in Group R is 5 hours and group RC is 11.3 hours which is statistically significant. The mean duration of motor block in Group R is 4.5 hours and group RC is 9.7 hours which is statistically significant. The mean duration of analgesia in Group R is 5.4 hours. Mean duration of analgesia in Group RC is 12.8hours which is statistically significant. Pulse rate was significantly low in group RC compared to group R. There was a significant low pulse rate was observed from 20 minutes till 8 hours in group RC, but was not clinically significant and did not require any. No significant changes in Blood pressure, Respiratory rate and spo2 respectively. The mean time at which first rescue analgesic given in group R is 7.1 hours in group RC, the mean time is 13.1 hours which is statistically significant. In our study, number of patients who require rescue analgesia doses in the form of paracetamol, group R, 40 patients required first dose of rescue analgesia within 7 to 8 hours where in group RC all 40 patients required only 1 dose of rescue analgesia after 12 to 13 hrs of initial bolus of study drug and the p value is <0.001 which is statistically significant. In our study, none of the patients in the two groups showed side effects like constipation, confusion, hypotension, bradycardia, sedation, disturbed sleep.

5. Conclusion

From our study, we conclude that, addition of 0.5 mcg/kg of Clonidine to 0.5% Ropivacaine in ultrasound guided supra-clavicular brachial plexus block confers a significant advantage over plain Ropivacaine in terms of duration of analgesia, quality of blockade and need for rescue analgesiawithout any side effects and complications.

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