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A Comparative Study of Anaesthetic Properties of Ropivacaine alone and in Combination with Clonidine for Supraclavicular Brachial Plexus Block in Patients Undergoing Upper Limb Surgeries

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Abstract: ***Background And Aims: Regional Anaesthesia Is A Recommended Technique For Upper And Lower Limb Surgeries With Better Postoperative Profile. In this Hospital Based Randomized Double Blind Interventional Study, We Compared the Effects of Adding Clonidine to Ropivacaine in Supraclavicular Brachial Plexus Block. Onset of Sensory and Motor Block Along With Duration Of Analgesia Were The Primary End Points. Material and Methods: After Obtaining Ethical Committee Approval, A Hospital Based Randomized Double Blind Interventional Study Was Conducted On 134 Patients With ASA Grade 1 And 2 In The Age Group 20 To 50 Years, Posted For Up per Limb Surgeries. Divided Randomly Into Two Groups, Group A Will Receive 0.5% Ropivacaine 24 Ml(120 Mg) + 6.0 Ml Normal Saline (Total Volume 30 Ml) And Group B Will Receive 0.5% Ropivacaine 24 Ml(120 Mg) + 0.5Ml (75µg) clonidine Diluted With 5.5 Ml With Normal Saline (Total Volume 30 Ml) For Supraclavicular Brachial Plexus Block. Onset of Sensory And Motor Block Along With Duration Of Analgesia And Adverse Effects Monitored, Hemodynamic Parameters Like Heart Rate (HR), Systolic Arterial Blood Pressure (SBP) And Diastolic Arterial Blood Pressure (DBP) Were Also Monitored. Results: Demographic Data And Surgical Characteristics Were Comparable In Both Groups. The Onset Time Of Sensory And Motor Blocks Were Significantly Shorter In Group B Than Group A (P< 0.001), Duration Of Analgesia Was Significantly Longer In B Groups Than Group A (P<0.001). Conclusion: Clonidine Added As An Adjuvant To Ropivacaine For Supraclavicular Brachial Plexus Block Significantly Shortens The Onset Time And Prolongs The Duration Of Analgesia.***

1. Introduction

The taxonomy committee of international association for the study of Pain (IASP) defines pain as “An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage[1].” Inadequate pain control, apart from being inhuman, may result in increased morbidity or mortality. Effective Management of postoperative pain relieves suffering and leads to earlier mobilization, shortened hospital stay, fewer pulmonary and cardiac complications, a reduced risk of deep vein thrombosis, faster recovery with less likelihood of the development of neuropathic pain, reduced cost of care and increased patient satisfaction[2].

- Regional anesthesia is the administration of local anesthetic agents and adjuvants to specific anatomic areas, resulting in a combination of motor and sensory blockade. Regional anesthesia can be divided into central blocks and peripheralblocks based on the proximity of the infiltration site to the spinal cord. Brachial plexus block is a peripheral block commonly used in both inpatient and outpatient settings for upper extremity surgery and in postoperative rehabilitation[3]. Brachial plexus nerve blocks used are supraclavicular, infraclavicular, interscalene and axillary. The type of brachial plexus block used depends on the type and magnitude of the surgery as well as patient characteristics and preferences. Peripheral nerve blocks not only provide intraoperative anesthesia but also extend analgesia in the postoperative period without major systemic side effects by minimizing stress response and using minimal anesthetic drugs.
- Regional anesthesia of the upper extremity has several clinical applications and is reported to have several advantages over general anesthesia . These advantages, such as improved postoperative pain, decreased postoperative opioid administration, and reduced recovery time, have led to widespread acceptance of a variety of regional nerve blocks.
- Local anesthetics alone for supraclavicular brachial plexus block provide good operative conditions but have shorter duration of postoperative analgesia. Hence in recent years it has gained popularity with addition of various adjuncts to local anaesthetic solution in an attempt to increase its efficacy and duration while minimizing systemic adverse effects along with a reduction in total dose of local anaesthetic used. Adjuncts like opioids[4], clonidine[5], dexamethasone[6], midazolam[7] etc. have been injected concomitantly with local anaesthetic solution in brachial plexus block to achieve quick, dense, and prolonged block, but the results are either inconclusive or associated with side effects.
- The local anaesthetic Ropivacaine has been proposed to inhibit Na+ channels indirectly by making the resting potential less negative. Ropivacaine exerts its main anaesthetic action on myelinated nerve axons by a direct modification of Na+ channels[8].
- Alpha-2 agonists are mixed with local anaesthetic agents to extend the duration of spinal, extradural and peripheral nerve blocks. Clonidine (alpha-2 agonist) when added to local anaesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia[9].
- The present study was conceived to examine the effect of adding Clonidine as an adjuvant to local anaesthetic Ropivacaine 0.5% for institution of Supraclavicular Brachial Plexus block

Kumkumgupta et al (2014) have studied Clonidine as an adjuvant for ultrasound guided supraclavicular brachial plexus block for upper extremity surgeries and observed that clonidine 30 µg in 19.8 mL of 0.75% ropivacaine significantly enhanced the quality of supraclavicular brachial plexus block for upper extremity surgeries by a faster onset and prolonged duration of sensory and motor blockade with enhanced duration of post-operative analgesia[10].

QE ALI et al (2014) have studied Efficacy of clonidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. The addition of 75 µg of clonidine to ropivacaine for brachial plexus block prolongs motor and sensory block and analgesia without significant side effects[11].

KN Patil et al (2015) have Studied Clonidine as an adjuvant to ropivacaine-induced supraclavicular brachial plexus block for upper limb surgeries. Clonidine as an adjuvant to ropivacaine significantly enhances the quality of supraclavicular brachial plexus block by faster onset, prolonged duration of sensory and motor block and improved postoperative analgesia, without associated adverse effects at the dose used[12].

AIM

To evaluate the effects of CLONIDINE as an adjuvant to ROPIVACAINE in comparison to plain ROPIVACAINE for supraclavicular brachial plexus block in patients undergoing upper limb surgery.

1) To determine difference in Onset time of Sensory and Motor Block in both group.
2) To determine difference in Duration of Analgesia in both group.

2. Materials and Methods

The study was conducted in the Department of Anesthesiology, S.M.S Medical College and attached hospitals, Jaipur. Hospital based randomized double blind interventional study.

The study population was divided into two groups. Each group was consist of 67 patients (n=67/group).

- Group A received 0.5% Ropivacaine 24 ml(120 mg) + 6.0 ml Normal Saline (Total volume 30 ml)
- Group B received 0.5% Ropivacaine 24 ml(120 mg) + 0.5 ml(75µg) Clonidine diluted with 5.5 ml with normal Saline(Total volume 30 ml)

Inclusion Criteria:

- Patients of either sex
- Age group between 20 and 50 years
- Body weight 50 to 70 kg.
- Patients belonging to ASA class I and II
- Patients undergoing upper limb surgeries of duration 1-4 hours in elective theatre

Exclusion Criteria:

- Patients not willing to participate in the study
- Uncooperative patients
- Local pathology at the site of injection or disability limiting the performance of block
- History of convulsion, allergy to the drug used, bleeding disorder, severe neurological deficit
- Patient with history of respiratory, cardiac, hepatic or renal disease (necessitating classification in ASA Class III or above)
- Inadequate block necessitating institution of general anaesthesia for continuation of surgical procedure

1) Assessment:

Patient satisfying inclusion criteriawere selected.Fasting status, PAC, Informed written consent checked.Pre-operative vitals (BP,PR, RR,SpO2, ECG) wererecorded. I.V. line will be secured, I.V. Fluid started. Patient did not receive any premedication. However perioperative sedation was achieved by using inj. Midazolam 1 mg iv. The patient was placed in the supine position, with the head turned away and the ipsilateral arms adducted. The interscalene groove and mid-point of the clavicle and subclavian artery was identified. After aseptic preparation of the area, at a point 1.5 to 2.0 cm posterior to midpoint of the clavicle a skin wheal was raised with a local anesthetic (lignocaine 2% plain).

The nerve was located using a nerve locator connected to a 22 G, 50-mm long stimulating needle.The end point of the location in median nerve area was a distal motor response with an output lower than 0.5 mA, following negative aspiration 30 ml of solution containing local anaesthetic combined with placebo or clonidine injected. A 5 min compression at injection site was performed to facilitate an even drug distribution. After performance of nerve block patients was evaluated for onset of sensory block every 2 minute. The sensory block was assessed by pin prick with 25 gauge needle.

Heart rate, non-invasive blood pressure and SPO2 and sedation score were measured every 5 minutes for 10 minutes and thereafter every 10 minutes. Postoperatively heart rate, noninvasive blood pressure and pain and motor power & sedation score were recorded at 0 min, 30 min, 1hr, 3hrs, 6hrs, 12hrs 18hrs and 24hrs.Postoperatively time of return of complete sensory and motor power will be recorded and rescue analgesic (InjDiclofenac 75 mg IV) will be administered at VAS score >3 and the time will be noted.Side effects and complications if any.

2) Observation and Results

The age, body weight, height and ASA status difference was not significant in the 2 groups. Duration of surgery was also comparable in the two groups with no significant difference. The Observations are presented as Mean ± Standard Deviation or as Percentages as is applicable.

Table 1: Mean Onset of Sensory Block (Mean ± SD) (95% confidence interval)

	Group A (n=67)		Group B (n=67)		P value
	Mean	SD	Mean	SD	
Sensory Block (Minutes) (Confidence interval)	12.74 (12.22-13.27)	2.197	8.22 (7.83-8.62)	1.640	<0.0001

Table 1, show the mean onset of sensory block along with standard deviation and 95% confidence interval. The mean onset of sensory block for Group A was 12.74 ± 2.197 (min) and for Group B was 8.22 ± 1.640 (min) and the difference was found to be statistically significant ($p < 0.0001$).

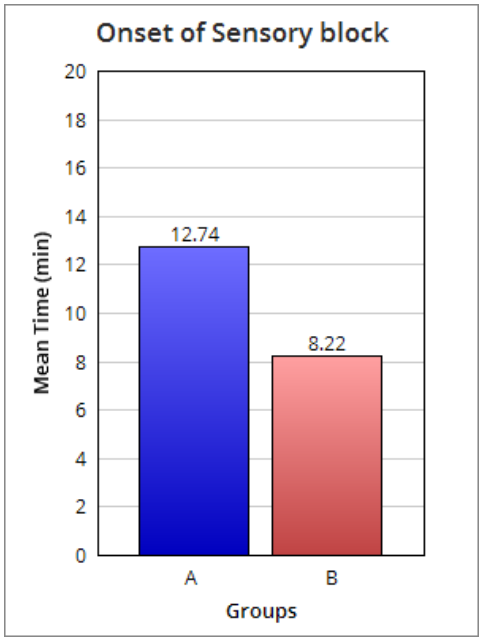

Figure 1: Onset of Sensory Block

Table 2: Mean Onset of Motor Block (Mean ± SD) (95% confidence interval) in each Group

	Group A (n=67)		Group B (n=67)		P value
	Mean	SD	Mean	SD	
Motor Block (minutes) (Confidence interval)	15.28 (14.81-15.76)	1.975	10.89 (10.45-11.34)	1.859	<0.0001

Table 2, shows the mean onset of motor block with standard deviation and 95% confidence interval. The mean onset of motor block for Group A was 15.28 ± 1.975 (min) and for Group B was 10.89 ± 1.859 (min) and the difference was found to be statistically significant between the groups ($p < 0.0001$).

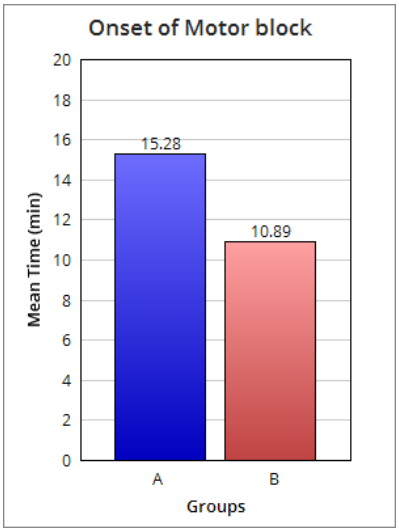

Figure 2: Onset of Motor block in each Group

Table 3: Duration of analgesia [Mean ± SD] (95% confidence interval)

	Group A (n=67)		Group B (n=67)		P value
	Mean	SD	Mean	SD	
Duration of analgesia (minutes) (Confidence interval)	457.53 (446.77-468.30)	44.952	692.61 (683.58-701.64)	37.712	<0.0001

Table 3, shows The mean duration of analgesia in Group A was 457.53 ± 44.952 (min) and in Group B was 692.61 ± 37.712 (min) that was found to be statistically significant between the groups ($p<0.05$).

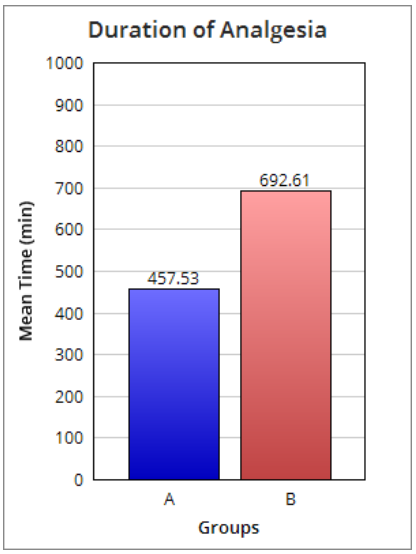

Figure 3: Duration of Analgesia in each group

3. Discussion

It is well recognized that the postoperative pain is most often being under treated. The mixing of analgesics with local anesthetics for regional anesthesia provides a better alternative. Although many drugs (morphine, nalbuphine, clonidine, vasoconstrictors like epinephrine and phenylephrine) have been used as an adjuvant to local anesthetics but high incidence of side-effects (respiratory depression, sedation, cardiovascular instability, nausea-vomiting, pruritus, and urinary retention) and relatively ineffectiveness resulted in reluctance to administer these drugs.

Clonidine is a partial agonist for alpha-2 adrenoreceptors. It increases both sensory and motor block of local anaesthetics mechanisms are centrally mediated analgesia, alpha-2 adrenoreceptors mediated vasoconstriction, attenuation of inflammatory response and direct action on peripheral narve[13].

This randomized comparative interventional study included 134 Patients (age 20-50 years) who underwent elective surgery of upper limb in the orthopaedic department. The patient selected in the present study belonged to ASA grade – I and II.

In our study mean onset of sensory block was 8.22 ± 1.640 min in clonidine group and 12.74 ± 2.197 min in control group, and mean onset of motor block was 10.89 ± 1.859 min in clonidine group and 15.28 ± 1.975 min in control group. It was significantly earlier in clonidine group as compare to control group. ($p< 0.05$)

Our observations were similar with the study of K N Patil et al[12] they found that the onset of sensory and motor block was earlier in clonidine group as compared to control group. Similar results were obtained by Daniel M Poppinget al[14] who observed that clonidine significantly shortens the time of onset of sensory and motor block.

In our study, we observed that duration of analgesia was 692.61 ± 37.712 min in clonidine group and 457.53 ± 44.952 min in control group which was statistically significant between the groups ($p < 0.05$).

Our observations were similar with the study of K N Patil et al[12] they found that the duration of analgesia was prolonged in clonidine group as compared to control group. The result can be explained by its highly lipid solubility, easily crosses the blood brain barrier to interact with alpha-2 adrenergic receptors at both spinal and supraspinal sites within the CNS producing its analgesic effect, thus potentiating the local anaesthetic and analgesic effect of ropivacaine[15]. Similar results were obtained by Kumkumguptaet al[10], Sushmitachakraborty et al[16] and Sirohiya et al[17] they observed that Clonidine significantly prolonged the duration of analgesia.

4. Conclusions

From our study, we conclude that the addition of 75mcg clonidine as adjuvant to 0.5% Ropivacaine for supraclavicular brachial plexus block shortens the onset time of sensory and motor blocks. The significantly prolonged duration of analgesia, the time to request of first postoperative rescue analgesia is significantly longer on addition of Clonidine. The added advantage of hemodynamic stability and minimal side effects makes it a potential adjuvant for nerve blocks.

5. Limitations

Further studies with large sample sizes are warranted to validate these findings.

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