Original Research Paper

Volume - 12 | Issue - 04 | April - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

A COMPARATIVE STUDY OF ROPIVACAINE 0.5% WITH DEXMEDETOMIDINE AND ROPIVACAINE 0.5% WTH MAGNESIUM SULPHATE IN ULTRASOUND-GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES.

Dr. Neelam singh — Professor and Head,Department of Anaesthesiology and Critical Care Unit, Motilal Nehru Medical College, Prayagraj, U.P, India, Pin Code- 211002.

Dr. Prem Shankar Malviya — Professor, Department of Anaesthesiology and Critical Care Unit, Motilal Nehru Medical College, Prayagraj, U.P, India, Pin Code- 211002.

Dr. Shobhit Singh — Assistant Professor, Department of Anaesthesiology and Critical Care Unit, Motilal Nehru Medical College, Prayagraj, U.P, India, Pin Code- 211002.

Dr. Kirti Chauhan* — Junior Resident, Department of Anaesthesiology and Critical Care Unit, Motilal Nehru Medical College, Prayagraj, U.P, India, Pin Code- 211002. *Corresponding Author

ABSTRACT **Background:** Brachial plexus block provides a useful alternative to general anaesthesia for upper limb surgery. This study was designed to evaluate and compare the effects of Dexmedetomidine and Magnesium Sulphate as adjuvants to Ropivacaine on the quality of Ultrasound-guided supraclavicular brachial plexus block in upper limb surgeries.

Materials and Methods: In this prospective, randomized, comparative, clinical study, 90 patients of ASA physical status I and II of both gender, aged 18–60 years, scheduled for various upper limb surgeries were randomly allocated in to two groups of 45 each. Ultrasound guided block was performed using Inj Ropivacaine 0.5% 20ml. 50µg Dexmedetomidine and 150mg Magnesium Sulphate were added in the dexmedetomidine and magnesium sulphate groups respectively. Variables such as onset and duration of sensory and motor blocks and total duration of anaesthesia between the two groups were compared and complications recorded.

Results: Dexmedetomidine provided the quickest onset times and durations of both sensory block and motor block and longer duration of anaesthesia than magnesium sulphate group. Dexmedetomidine group also had higher incidence of hypotension.

Conclusion : Magnesium sulphate or dexmedetomidine are useful adjuvants to ropivacaine for supraclavicular brachial plexus block in lengthening the duration of analgesia. Dexmedetomidine provided quicker onset and longer duration of both Sensory block and Motor block and longer duration of analgesia.

KEYWORDS : Brachial plexus, Supraclavicular, Dexmedetomidine, Magnesium Sulphate

INTRODUCTION

Brachial plexus block provides a useful alternative to general anaesthesia for upper limb surgery. It results in obtaining ideal operating conditions by producing complete muscular relaxation and stable intra-operative hemodynamics.

Ultrasound guidance for Supraclavicular brachial plexus block[1] which is the most commonly used approach and provides almost complete and reliable anaesthesia.

Ropivacaine has decreased potential for the central nervous system toxicity and cardiotoxicity due to reduced lipophilicity which provides wider safety margin and prompt motor functions recover faster.[2]

Dexmedetomidine and Magnesium Sulphate have both been used as adjuvants with varying degrees of success to improve quality of block and also produce post-operative analgesia when mixed with local anaesthetic drugs.

MATERIALS AND METHODS

The prospective, randomized, comparative, double-blind, interventional, non-placebo clinical study was conducted in Swaroop Rani Nehru Hospital associated with Moti Lal Nehru Medical College, Prayagraj over a period of 1 year (June 2020 – June 2021) after approval of the institutional ethical committee, over patients of the American Society of Anesthesiologists (ASA) physical status I and II of both gender, aged 18–60 years, scheduled for various upper limb surgeries after obtaining written and informed consent from each patient. A total of 90 Patients who gave informed consent of age between 18-60 years of either sex and who belonged to ASA grade I and II were selected.

EXCLUSION CRITERIA :

1. Patient refusal
2. Patient below 18 or above 60 years
3. Infection at site of block
4. Patient with ASA Grade III or IV
5. Patient with injury to any of nerves of the upper limb
6. Patient with hemorrhagic disorder
7. Patient with a neurological disorder
8. History of allergy to any drug

Table 1 : Group Allocation

GROUP R+D	**45 patients**	Patients who received Ropivacaine 0.5% 20ml+ 50µg Dexmeditomidine 1ml+4ml NS
GROUP R+M	**45 patients**	Patients who received Ropivacaine 0.5% 20 ml + 150mg Magnesium Sulphate 1.5ml + 3.5ml NS

Anaesthesiologist, who was involved in the study process, prepared the syringes loaded with the study drugs for supraclavicular brachial plexus block and the another anesthesiologist who performed the block and observed the patient there after was unaware about the contents of the loaded syringes for the purpose of double blinding so both the anaesthesiologist who prepared the drugs and the observer who performed the block as well as assessed the results, were blinded .

All the patients underwent pre-anesthetic evaluation with complete history, physical examination, routine investigations like complete blood count and liver function tests, kidney function tests, X-ray, ECG and other relevant investigations before surgery.

All the patients were kept nil per oral for a minimum of 6-8 hours before surgery. Tablet Ranitidine 150mg and Tablet Alprazolam 0.25mg were given one night before surgery.

On arrival of patients in operation theater, fasting status, consent, and preanesthetic checkup was confirmed, and standard ASA monitors including pulse oximetry (SpO2), electrocardiography, temperature probe and noninvasive blood pressure were attached. Baseline pulse rate (PR), oxygen saturation, and blood pressure were recorded. An intravenous (IV) access was established using 20 G intravenous cannula on the nonoperative arm, and crystalloid infusion (Ringer lactate) was started . Intravenous Midazolam 0.01mg/kg was given to relieve anxiety and co-operation of the patient.The patients were placed in the supine position with head turned 30° to the opposite side and adduction of ipsilateral arm.

All the patients received brachial plexus block through the supraclavicular approach using a 8-13 MHz linear high-frequency

ultrasound transducer. Under all aseptic precautions after skin preparation, 3 ml of lidocaine 1% was injected subcutaneously at the site of injection.Transducer probe was placed in supraclavicular region to obtain best possible transverse view of the subclavian artery and brachial plexus. A 100-mm 20-gauge insulated needle attached to nerve stimulator was advanced in-plane to anesthetize each cord. Once the optimal motor response in the range of 0.3–0.5 mA was obtained, the local anesthetic solution was injected around each cord and towards the corner pocket which is present between the first rib inferiorly, subclavian artery medially, and plexus superiorly. Local anesthetic solution was injected after negative aspiration around the trunks, and spread of LA observed. Thereafter, the needle was repositioned to distribute the solution around all nerve trunks with frequent negative aspiration. The time of injection given was noted. All the patients were given supplemental oxygen via oxygen mask at 4 L/min.

The sensory block was assessed every 5 min interval till 30 min after injection, by pinprick test with a blunt 25 G hypodermic needle in the appropriate area. The onset time of sensory block is the time from injection till loss of pinprick sensation. The duration of the sensory block is defined as the duration from loss of touch sensation till it reappears. Duration of post-op analgesia is defined as time interval between start of motor movements till patient's first demand for rescue analgesia in postoperative period.

The motor block was evaluated at 5 min interval till 30 min after injection by asking the patient to move elbow, wrist, and fingers using a **3-point scale:** 0 - normal motor function with full flexion and extension of elbow, wrist, and fingers; 1 - reduced motor strength with ability to move fingers and/or wrist only; and 2 - complete motor blockade with inability to move fingers. The onset time of the motor block is the time from injection till motor strength decreased to Score 1. The time for complete motor block is the time from injection up to complete motor blockade (TCMB) with inability to move fingers (Score 2). The total duration of the motor block is duration from TCMB till ability to move fingers (Score <2).

The intraoperative vital parameters including PR, Mean arterial pressure, and SpO2 were recorded at 15-min intervals using a multi-parameter monitor and in post operative period hourly up to 24 h. Patients were followed up to 24 h postoperatively to rule out complications of nerve blockade such asnerve injury or complications if any occurs were recorded in tabular form.

STATISTICALANALYSIS :

The demographic characteristics,hemodynamics, duration of analgesia, and block failures were compared using one-way ANOVA test. Variables such as time of motor, sensory blockade and total duration of analgesia between the two groups were compared using Chi-square tests and Student-t tests whichever appropriate.Posthhoc intergroup comparisons were made using Bonferroni's correction. P<0.05 will be considered significant.

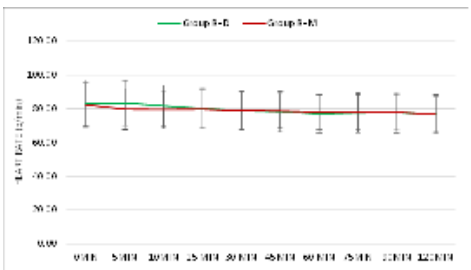
OBSERVATIONS AND RESULTS

Table 2 : Demographic Data

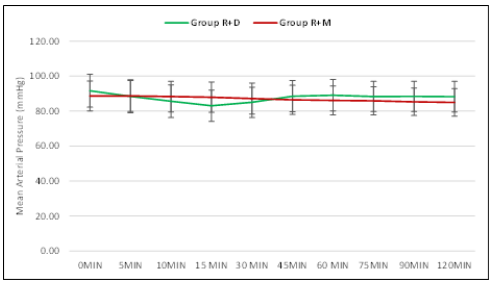
CHARACTERISTICS	GROUP R + D	GROUP R+M	P – value
AGE (years)(Mean ±SD)	36.16 ± 10.66	37.56 ± 11.83	0.557
WEIGHT (kg)) (Mean ±SD)	72.44 ± 12.45	74.24 ± 12.73	0.499
ASA (I : II)	29 : 16	30 : 15	0.824
MALE : FEMALE	24 : 21	26 : 19	0.671

SD : Standard deviation , p<0.005 is significant , ASA : American society of Anesthesiologist

Line Diagram 1 : Inter- Group Comparison Of Heart Rate



Line Diagram 2 : Inter-group Comparison Of Mean Arterial Pressure



No significant difference was found in mean MAP between the groups at any time during the procedure (p>0.05) except at 15 min where mean MAP of group R+D was significantly less than the group R+M (p=0.010).

Table 3 : Comparison Of Study Parameters Between The Two Groups

TIME PERIODS (min)	GROUP R + D	GROUP R + M	p - value
ONSET OF SENSORY BLOCK	6.58 ± 1.18	9.47 ± 1.44	<0.001*
ONSET OF MOTOR BLOCK	10.33 ± 1.57	12.64 ± 1.45	<0.001*
DURATION OF SENSORY BLOCK	640.00 ± 71.02	514.67 ± 52.85	<0.001*
DURATION OF MOTOR BLOCK	592.78 ± 83.62	457.56 ± 57.80	<0.001*
DURATION OF ANESTHESIA	820.00 ± 32.53	560.44 ± 70.64	<0.001*

*SIGNIFICANT

The mean onset of sensory block of group R+D was 6.58±1.18 while the mean onset of sensory block of R+M group was 9.47±1.44. The significant difference was found in mean onset of sensory block between the groups (p<0.001).The mean onset of motor block of group R+D was 10.33±1.57 while the mean onset of motor block of R+M group was 12.64±1.45. The significant difference was found in mean onset of motor block between the groups (p<0.001) .

The mean duration of sensory block of group R+D was 640.00±71.02 while the mean duration of sensory block of R+M group was 514.67±52.85. The significant difference was found in mean duration of sensory block between the groups (p<0.001).The mean duration of motor block of group R+D was 592.78±83.62 while the mean duration of motor block of R+M group was 457.56±57.80. The significant difference was found in mean duration of motor block between the groups (p<0.001).

The mean duration of anesthesia of group R+D was 820.00±32.53 while the mean duration of anesthesia of R+M group was 560.44±70.64. The significant difference was found in mean duration of anesthesia between the groups (p<0.001).

DISCUSSION

In our study, we observed that the addition of dexmedetomidine or magnesium sulphate into ropivacaine resulted in the early onset of sensory and motor blocks , prolonged duration of sensory and motor blocks and the prolonged duration of anaesthesia. The onset of sensory block and motor block was faster for Group RD (dexmedetomidine with ropivacaine) as compared to Group RM (magnesium sulphate with ropivacaine). The duration of sensory block and motor block and the duration of anaesthesia were longer for Group RD as compared to Group RM.

Nema *et al*[3] conducted a prospective randomized double-blind study among 60 patients found that the time of onset of sensory block was early in the dexmedetomidine group (7.20 ± 2.483 min) as compared to the control group (14.20 ± 5.229 min) and also the time of onset of motor block was early in dexmedetomidine group (11.83 ± 3.824 min) as compared to control group (21.00 ± 8.566 min) which is in concordance to our study. Also the average duration of sensory block was 310.37±66..359 and the average duration of motor block was 278.50±66.887 in dexmedetomidine group which was longer as compared to in the control group, which also goes in concordance to our study.

Das et al[4] evaluated the effect of dexmedetomidine as adjuvant in ropivacaine induced supraclavicular brachial plexus block in a prospective, double-blinded and randomized controlled study and found that the duration of sensory block (846.67 ± 102.09 min in group RD vs. 544.07 ± 55.40 min in group R) was significantly longer in the dexmedetomidine group than in the control group ($P < 0.001$). The duration of motor block (624.2 ± 200.9 min in RD group vs. 516.8 ± 155.85 min in R group) was also significantly longer in the dexmedetomidine group than in the control group ($P < 0.015$) which again is in concordance with our study. Our study is also bolstered by many studies namely Bharti ***et al.***[5] Kathuria ***et al.***[6], and In all these studies, it was observed that the time of onset for sensory and motor block was early after adding dexmedetomidine to ropivacaine in the supraclavicular block.

Mukherjee K et al[7] evaluated the effect of adding magnesium sulfate to ropivacaine for supraclavicular brachial plexus blockade and found out that the duration of sensory block was 456.21 ± 97.99 min in magnesium group as compared to 289.67 ± 62.50 min in ropivacaine group which was significantly longer in the magnesium group . The duration of motor block 366.62 ± 24.42 min in magnesium group as compared to 242.16 ± 23.86 min in ropivacaine group which was also significantly longer in the magnesium group .Similar findings were also seen in a study conducted by Malleeswaran *et al.*[8] and Ekmekci *et al*[9].

In our study, we observed that the addition of dexmedetomidine or magnesium sulphate to ropivacaine resulted in prolonged duration of anesthesia postoperatively.

Variables like the heart rate, systolic blood pressure, mean arterial pressure and oxygen saturation were noted. Before the block and after the block, every 5 minutes for the first fifteen minutes and then every 15minutes till the end of the surgery. There was slight statistical difference in the mean arterial pressure between the two groups in which group RD showed slight hypotension for the initial thirty minutes which was managed conservatively. Significantly lower blood pressure in the dexemedetomidine group was reported in a study conducted by Esmaoglu *et al.*[10] and Das *et al*[4]. Heart rate and oxygen saturation showed no statistical difference.

CONCLUSION

Dexmedetomidine or $MgSO_4$ is useful adjuvant to ropivacaine for supraclavicular brachial plexus block. Dexmedetomidine provides earlier onset of sensory and motor block as well as prolonged duration of sensory and motor blocks and duration of analgesia is longer and postoperative rescue analgesia is less as compared to patients receiving $MgSO_4$. The incidence of hypotension is higher with dexmedeto midine.

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