ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

ULTRASOUND GUIDED AXILLARY APPROACH TO BRACHIAL PLEXUS BLOCK FOR HAND SURGRIES: COMPARISION OF MAGNESIUM SULFATE AND DEXMEDETOMIDINE AS ADJUVANT TO ROPIVACAINE.

DR. NAGELLA JAGADEESH BABU ASSOCIATE PROFESSOR
DR. BHADRI SREENIVASULU, ASSOCIATE PROFESSOR
DR. SAYA RAGHAVENDRA PRASAD, ASSOCIATE PROFESSOR
DR. THARIGONDA BALAJI, ASSOCIATE PROFESSOR
DR. VINAY, POST GRADUATE
DR. SUNIL CHIRUVELLA, PROFESSOR & HOD
Department of Anaesthesiology, Government Medical College, Putlampalli, Kadapa.

Corresponding Author:
Dr. Tharigonda Balaji
Associate Professor
Department of Anaesthesiology
Government Medical College, Kadapa
Andhra Pradesh
Email: meetdrbalaji@gmail.com

Abstract:

Background: Axillary brachial plexus block is frequently used during hand surgeries. Ropivacaine's effectiveness is increased when adjuvants are added. Dexmedetomidine and magnesium sulfate are used for peripheral nerve blocks because they increase the duration of analgesia. This study was aimed to evaluate the effects of magnesium sulphate and dexmedetomidine as adjuvants to ropivacaine for axillary brachial plexus block.

Materials and Methods: A total of 60 patients belonging to ASA grade I and II admitted for hand surgeries were randomly divided into two groups to receive either 20ml of 0.5% Ropivacaine and magnesium sulfate 100 mg (Group RM) or 20ml of 0.5% Ropivacaine along with dexmedetomidine 30 mcg (Group RD). Onset and duration of sensory and motor block was compared between the two groups.

Results: The average onset time of sensory-block in group RM was higher than group RD. The average time for initiation of motor-block was more and sensory block duration was less in RM group than in Group RD. The mean motor block duration was comparatively less in RM group. The duration of the sensory and motor blocks showed a statistically significant difference between the two study groups ($p< 0.001$). There was an insignificant alteration in hemodynamics in both Group RD and RM without any side effects.

Conclusion: Dexmedetomidine (30 mcg) as an adjuvant to 0.5% Ropivacaine in axillary brachial plexus block resulted in a faster onset of sensory and motor block and a longer duration of sensory and motor block, as well as a significant prolongation of postoperative analgesia when compared with Magnesium sulfate (100 mg) in patients undergoing hand surgeries.

Key words: Axillary brachial plexus block, magnesium sulfate, dexmedetomidine, analgesia

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

Introduction:

Regional anaesthesia is widely administered for procedures on the upper limbs. The axillary method to the brachial plexus block is well-liked for its simplicity, dependability, and safety. It is recommended for forearm and hand surgery. Ultrasonography guided blocks improve success rate and minimize complications.[1] With a safer cardiac profile than bupivacaine, ropivacaine is a brand-new long-acting amide local anaesthetic (LA) used for peripheral nerve blocks. Adjuvant supplementation increases the effectiveness of LA by accelerating the start of action, extending the duration of activity, and providing postoperative analgesia. When administered systemically, magnesium sulfate (MgSO4) has analgesic, antihypertensive, and anaesthetic sparing effects. MgSO4 is now often utilised as an adjuvant to plane blocks, other peripheral nerve blocks, and neuroaxial blocks. However, research on MgSO4 use as an adjuvant in the axillary block is quite limited.[2,3] Dexmedetomidine is a newer alpha 2 adrenoreceptor agonist and studies have shown that when it is used as an adjuvant to LA it shortens the onset and increase the duration of block, and prolong postoperative analgesia. We hypothesized that onset of sensory block is faster and duration of block is longer with Ropivacaine and Dexmedetomidine in comparison to Ropivacaine & Magnesium sulfate. The aim of the study was to compare the effectiveness of magnesium sulfate 100mg and Dexmedetomidine 30mcg as adjuvants to 0.5% ropivacaine for ultrasound guided axillary brachial plexus block in patients undergoing hand surgeries.

METHODOLOGY

After obtaining approval from institutional ethical committee clearance, the present randomized interventional double blinded study was carried out between January 2023 and August 2023 at GGH, Kadapa. Patients aged between 18years to 60years with ASA grade I & II undergoing hand surgeries were included in the study after obtaining an informed consent. Sample size was calculated by keeping two sided alpha error at 5% and power at 80%. Minimum of 23 patients were required for each group, for better validation 30 patients were included in each group. Patients with severe cardiovascular, respiratory or neurological disorders, known history of coagulation disorders and inflammatory / infective skin lesions at the site of block, pre-existing neuropathy and allergy to local anaesthetics were excluded from the study. Randomization was done using computer generated random numbers and group allocation was done using opaque sealed envelope method.

Patients in group RM received 19 ml 0.5% ropivacaine + 100 mg MgSO4 in 1 ml NS (total 20
ml).

Patients in group RD received 19 ml 0.5% ropivacaine + 30 mcg Dexmedetomidine in 1 ml NS (total 20 ml).

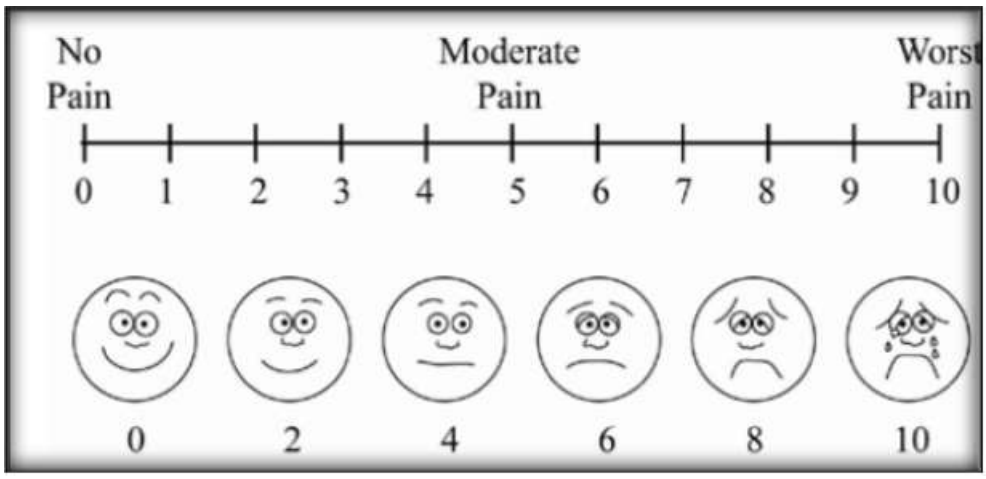
The following equipment were used for axillary brachial plexus block in our study:
• SONOSITE S II ultrasound machine with 13-6 MHz linear probe & sterile lubricating gel for the procedure. A sterile sleeve to cover the linear probe of ultrasound machine
•Disposable syringes, needles (22G,20G) and 10 cm extension tubing.

After patient's arrival into the operation theatre, patient was connected to standard ASA monitors such as pulse oximeter, ECG, non-invasive blood pressure monitor, and the

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

baseline parameters were recorded. After securing an intravenous cannula, inj. midazolam 30 mcg/kg IV was administered and ringer's lactate infusion was started. oxygen supplementation was given using Hudson's mask. Patient was placed in the supine position with ipsilateral arm abducted. Under all aseptic and antiseptic precautions, terminal nerves of brachial plexus were identified using ultrasound and a skin wheal was raised at needle insertion site using 2ml 1% lignocaine, and 5-cm, 22-gauge was inserted using in-plane approach. Needle was carefully directed and advanced under ultrasound guidance. 8 ml of the drug was deposited around the radial nerve and 15 ml of the drug was deposited around the ulnar and median nerves. Finally, 7 ml of the drug was deposited around the musculocutaneous nerve. Throughout the procedure, the patients were monitored for any adverse drug effects.
Pulse oximetry, ECG, non-invasive blood pressure (NIBP) monitoring was done. Assessment of Sensory Block sensory block onset: The time period for onset of sensory block was calculated as the time from the administration of the local anaesthetic solution to the cessation of pinprick feeling. The duration of sensory block calculated as the period from the loss of the pinprick feeling to its resolution. Duration of the sensory block was evaluated by using 25G hypodermic needle for pinprick sensation every 30min postoperatively using Visual analogue scale (VAS) [Figure 1].

Figure 1: Visual analog scale



Assessment of motor block: Onset of Motor-block:
After the local anaesthetic solution was administered, the time between, onset of the motor block and the emergence of grade 1 motor blocking was taken into consideration. Motor-block duration: duration of motor blockade was defined as the time between the onset of motor block and full recovery of motor function. Motor-block was assessed using the Bromage score for upper limb [Table 1].

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

Table 1: Bromage scale for upper limb

Grade	Criteria
Grade 0	Normal motor function with full flexion and extension of elbow, wrist and fingers
Grade 1	Decreased motor strength with ability to move the fingers only
Grade 2	Complete motor block

Assessment of duration of Analgesia:
The time period between the administration of local anaesthetic solution and the administration of first rescue analgesia was considered the duration of the analgesia. Rescue analgesia was given on patients request usually when the VAS score was 4 and above. Paracetamol 1gram IV was administered as rescue analgesia in the post-operative period.

Statistical Analysis: Data was entered in MS excel and analysis was done using SPSS 21.0 version. Data was presented as Mean and Standard deviation for continuous variables and as percentages for categorical variables. A Chi-square test was done to find out any association between categorical variables. Independent sample t test was used to compare quantitative data variables (Age, weight, onset and the duration of Motor and sensory, duration of rescue analgesia, HR, SBP, DBP, MAP) between the groups (RM, RD). A p value of less than 0.05 was considered significant.

RESULTS: All 60 patients completed the study protocol and were considered for final analysis.

Demographic data was comparable in both the groups [Table 2].

Table 2: Demographic data	**Group RM**	**Group RD**	**P value**
Gender			
Male	21 (70%)	21 (70%)	>0.05
Female	9 (30%)	9 (30%)	>0.05
Age Group (years)			
19-30 years	8 (26.7%)	8 (26.7%)	>0.05
31-40 years	10 (33.3%)	9 (30%)	>0.05
41-50 years	10 (33.3%)	11 (36.7%)	>0.05
51-60 years	2 (6.7%)	2 (6.7%)	>0.05
Mean Age (years ±SD)	38.26±9.29	38.53±9.32	>0.05
Weight (kg) Mean ± SD	62.5±9.83	63.86±8.02	>0.05

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

In Group RM, average time for the onset of sensory block was 12.37 ± 1.94 minutes, whereas in Group RD, it was 10.50 ± 1.87 minutes. The duration of sensory blockade in RM group, lasted an average of 421.50±34.14 minutes, and in the RD group, it lasted an average of 500.33 ± 41.50 minutes. In the RM group, mean time for the commencement of a motor block was 15.93 ±1.44 minutes, whereas in the RD group, it was 13.03 ±1.92 minutes. In the RM group, the average time of the motor-blockade was 309.50 ±26.70 minutes, but in the RD group, it was 341.00 ± 32.07 minutes. The average time for the initial request for rescue analgesia was 438 ± 36.58 minutes in Group RM and 533.5 ± 40.79 minutes in Group RD. In comparison to the RM group, the duration of analgesia was significantly prolonged in the RD group [Table 3].

Table 3: Comparison of sensory and motor block and time for first rescue analgesia

	Group RM (mean± SD)	**Group RD (mean± SD)**	**P value**
Onset of sensory block (min)	12.77±1.94	10.5±1.87	<0.05
Onset of motor block (min)	15.93±1.44	13.03±1.92	<0.05
Duration of sensory block (min)	421.5±34.14	500.33±41.5	<0.05
Duration of motor block (min)	309.50 ±26.70	341.0 ±32.07	<0.05
Time for requirement of first rescue analgesia (Min)	438.67 ±36.58	533.50 ±40.79	<0.05

Changes in heart rate and mean arterial pressure was comparable in both the groups.

Table 4: Comparison of heart rate between two groups

Time	**Group RM (mean± SD)**	**Group RD (mean± SD)**	**P value**
Base line	75.53± 6.88	73.10 ±4.76	>0.05
5 min	76.70± 5.98	77.60 ±7.36	>0.05
10 min	75.87 ±6.97	77.60 ±6.89	>0.05
15 min	78.90 ±7.27	77.67 ±5.96	>0.05
30 min	77.97 ±6.86	78.20± 6.60	>0.05

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

45 min	75.23 ±6.94	77.87± 7.61	>0.05
1 hr	75.43 ±7.15	77.60 ±7.88	>0.05
1 hr 15 min	75.23 ±7.00	77.83±7.68	>0.05
1 hr 30 min	75.23 ±6.62	78.33 ±6.90	>0.05
1 hr 45 min	76.53 ±6.47	77.53 ±7.45	>0.05
2 hr	75.27± 6.76	75.30 ±6.73	>0.05

Table 5: Comparison of mean arterial pressure between the two groups:

Time	**Group RM (mean± SD)**	**Group RD (mean± SD)**	**P value**
Base line	91.00±6.06	90.13± 7.33	>0.05
5 min	89.17±7.67	90.23± 5.37	>0.05
10 min	89.70 ±7.34	91.27± 6.38	>0.05
15 min	89.63 ±6.94	89.53 ±5.56	>0.05
30 min	90.20 ±7.33	88.47 ±5.61	>0.05
45 min	90.13± 6.99	89.37± 5.46	>0.05
1 hr	89.80 ±7.23	89.53± 5.54	>0.05
1 hr 15 min	90.17± 6.78	89.10± 5.54	>0.05
1 hr 30 min	90.13± 6.78	89.50±4.82	>0.05
1 hr 45 min	90.70± 6.95	88.80± 6.20	>0.05
2 hr	91.33± 6.96	89.30 ±7.00	>0.05

There were no side effects like hypotension, bradycardia and sedation reported in both RM and RD group patients (tables 4 & 5).

DISCUSSION

Several adjuvants are used for brachial plexus block for prolongation of analgesia. Newer addition to the list of adjuvants are magnesium sulfate and dexmedetomidine. Magnesium

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

sulfate is a NMDA receptor antagonist and by blocking NMDA receptors, it prevents central sensitization and abolishes hypersensitivity and produces analgesia. Dexmedetomidine is an alpha 2 adrenergic agonist which reduces release of norepinephrine and thus produces analgesia. Also, it causes analgesia by inhibition of substance P in the pain pathway.

The time for onset of sensory and motor block was prolonged in magnesium sulfate group in comparison to dexmedetomidine group and our observations are similar to observations by Shahtaheri SY et al[3] and Shukla U et al[4]. The duration of motor and sensory block was prolonged in dexmedetomidine group and similar observations were found by Shahtaheri SY et al[3] and Shukla U et al[4]. Time for first rescue analgesia was prolonged in dexmedetomidine group and similar observations were reported by Shahtaheri SY et al[3] and Shukla U et al[4].

Haemodynamic side effects like bradycardia and hypotension were not observed in our study in contrast to studies by Dar et al[5] and Khade et al[6]. This was probably because we used lesser dose of dexmedetomidine (30 mcg in comparison to 50 mcg by other studies).

CONCLUSION

Based on our findings, we conclude that the addition of Dexmedetomidine (30 mcg) as an adjuvant to 0.5% Ropivacaine in axillary brachial plexus block results in faster onset of sensory and motor block and a longer duration of sensory and motor block, as well as a significant prolongation of postoperative analgesia when compared with magnesium sulphate (100mg).

Source of support – Nil

Conflicts of interest – Nil

REFERENCES:

1. Liu SS, Ngeow J, John RS. Evidence basis for ultrasound-guided block characteristics: onset, quality, and duration. Reg Anesth Pain Med. 2010 Mar-Apr;35(2 Suppl):S26-35. doi: 10.1097/AAP.0b013e3181d266f0. PMID: 20216022.
2. Deshpande JP, Patil KN. Evaluation of magnesium as an adjuvant to ropivacaine induced axillary brachial plexus block: A prospective, randomised, double-blind study. Indian journal of anaesthesia, 2020;64(4):310–5.
3. Shahtaheri SY, Rad MT, Yazdi B, Azami M, Kamali A. Clinical Comparison of Adding Sulfate Magnesium and Dexmedetomidine in Axillary Plexus Block for Prolonging the Duration of Sensory and Motor Block: Study Protocol for a Double-blind Randomized Clinical Trial. Folia Med (Plovdiv). 2020 Mar 31;62(1):124-132. doi: 10.3897/folmed.62.e49805. PMID: 32337917.
4. Shukla U, Singh D, Yadav J, Azad MS. Dexmedetomidine and Magnesium Sulfate as Adjuvant to 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block: A Comparative Evaluation. Anesthesia, essays and researches. 2020;14(4), 572–7.
5. Dar FA, Najar MR, Jan N. Dexmedetomidine added to ropivacaine prolongs axillary brachial plexus block. *Int J Biomed Adv Res* 2013; 4:719–722.

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 1, 2024

6. Khade DAR, Makwana DJC, Jethva DNK, et al. Evaluation of effect of dexmeditomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block. *Natl J Integr Res Med* 2013; 4:122–127.