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Original Research Article

COMPARISON OF 0.5% ROPIVACAINE WITH MAGNESIUM SULPHATE VERSUS 0.5% ROPIVACAINE ALONE IN ULTRASOUND GUIDED BRACHIAL PLEXUS BLOCK AT A TERTIARY CARE CENTER, TELANGANA

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ABSTRACT

Background: Aim: To evaluate the effect of addition of Magnesium Sulphate to Ropivacaine in ultrasound guided supraclavicular blocks in terms of the duration of sensory and motor blockade.

Materials and Methods: 60 patients divided into 2 equal groups of 30 each, namely Group M (receiving Magnesium Sulphate) and Group N (receiving 0.9% Normal Saline as placebo). Informed consent taken from the patients. Supraclavicular block was performed under ultrasound guidance with the study drugs. The onset and duration of sensory and motor block, postoperative pain relief, VAS score, hemodynamic changes and perioperative complications were assessed.

Results: It was found that the primary objective of the study; duration of the sensory and motor block were prolonged with Ropivacaine and Magnesium Sulphate when compared to plain Ropivacaine. Post-operative analgesia was significantly prolonged in Magnesium Sulphate group, which was assessed by the VAS score. Other secondary objectives like hemodynamic variables and perioperative complications did not show any statistically significant difference among the two groups.

Conclusion: Hence Magnesium Sulphate added to local anaesthetics for ultrasound guided supraclavicular brachial plexus block provides a better postoperative analgesia.

Keywords: Brachial Plexus, Magnesium Sulphate, Supraclavicular, Ropivacaine, Hemodynamics.

INTRODUCTION

Peripheral nerve blockade is one of the components of comprehensive anaesthesia care because of its distinct advantages over central neuraxial blockade and general anaesthesia. Peripheral Nerve Blockade provides more effective analgesia with fewer side effects than opioid and other oral analgesics.[1]

In peripheral nerve blockade, the sympathetic nerves of the anaesthetized limb are blocked, leading to vasodilation, and this improves blood flow to the limb and makes microvascular surgeries easy. The anaesthetized hand or foot remains numb for many hours after surgery, thus providing excellent post-operative pain relief.[2,3]

Both deep and superficial structures in the limb are similarly anaesthetised, permitting extensive surgical exploration and repair. This contrasts with the locally injected local anaesthetic drugs, which tend to numb only the superficial structures close to the site of injection.

Brachial plexus blockade provides superior pain control with exceptional intraoperative anaesthesia as well as post-operative analgesia, eliminating the need for intra-operative opioids and minimizing the need for post-operative opioids. This results in a quicker recovery, shortened hospital stay, increased patient satisfaction as well as surgeon satisfaction and ultimately a decrease in financial burden to the patient when compared to general anaesthesia thus permitting its use in day care surgeries. Peripheral nerve blockade of upper limb includes various methods of brachial plexus block where brachial plexus is blocked at different levels.[4]

Supraclavicular block, once described as the "spinal of the arm" offers dense anaesthesia of the brachial plexus for surgical procedures at or distal to the elbow. At this point, the brachial plexus is compact, and a small volume of solution produces rapid onset of reliable blockade of the brachial plexus.[1] Historically, supraclavicular block fell out of favour due to high incidence of complications (pneumothorax, accidental intravascular injection) that occurred with paraesthesia and nerve stimulator techniques. It has seen a resurgence recently as the use of ultrasound guidance has improved safety.[5]

Ropivacaine is a long acting regional anaesthetic that is structurally related to Bupivacaine. It was developed for reducing systemic toxicity and improving relative sensory to motor block profiles.

Local anaesthetics alone for supraclavicular brachial plexus block provide good operative conditions, but have shorter duration of postoperative analgesia.[2] Local anaesthetic adjuvants have been studied previously in an attempt to prolong the duration of analgesia after peripheral nerve blockade. Hence, various adjuvants like Opioids, Clonidine, Neostigmine, Dexamethasone, Midazolam, etc., were added to local anaesthetics in brachial plexus block to achieve quick, dense, and prolonged block, but the results are either inconclusive or associated with side effects. Magnesium has been used in intravenous, intrathecal, epidural/caudal routes to improve analgesia. Its role in peripheral nerve blocks has only minimal literature, and available literature has shown mixed results. Hence, this study was designed to evaluate the efficacy of Magnesium when added to Ropivacaine in supraclavicular brachial plexus block.

Aim of the Study

To study the effect of Magnesium Sulphate when added as an adjuvant to 0.5% Ropivacaine in brachial plexus block when compared to use of plain 0.5% Ropivacaine.

Objectives

- To compare the time taken to achieve sensory blockade
- To compare the time taken to achieve motor blockade
- To compare the duration of sensory blockade
- To compare the duration of motor blockade
- Quality of Analgesia
- To evaluate the hemodynamic stability and side effects due to drugs used
- Post-operative VAS scores and use of first rescue analgesic.

MATERIAL AND METHODS

Study Design: Comparative cross sectional study

Study Tools: Ultrasound machine, Modified Bromage scale, VAS scale.

Study Subjects: Patients who fulfil inclusion criteria and undergoing upper limb surgeries in Tertiary care centre, Telangana.

Inclusion Criteria

1. Age 18 to 65 years
2. ASA Grade 1 and 2
3. Patient who give written informed consent

Exclusion Criteria

1. Patients with any known hypersensitivity or contraindication to Ropivacaine, Magnesium Sulphate.
2. Patients with a history of Coagulopathies and Systemic illness
3. Patient with infection at the site of block
4. Patients who did not give consent

Sample Size: 60 patients divided into 2 equal groups of 30 each, namely Group M (receiving magnesium sulphate) and Group N (receiving 0.9% normal saline as placebo)

Period of Study: 24 Months

Place of Study: Tertiary Care Centre, Telangana

Preoperative preparation

All the patients had undergone pre anesthetic evaluation before surgery. All systems were examined, including airway. The procedure to be carried out was explained and consent was obtained. All patients were nil per oral as per ASA guidelines.

Investigation

- Haemoglobin estimation
- Complete blood count
- Coagulation profile
- Blood sugar and serum creatinine.
- Urine-Albumin, sugar, microscopy
- Chest X-ray PA view

A total of 60 patients, divided randomly by computer allocated numbers into two equal groups. Group M receiving 23.5 ml of 0.5% Ropivacaine + 150 mg Magnesium Sulphate in 1.5ml normal saline and Group N receiving 23.5 ml of 0.5% Ropivacaine+ 1.5 ml of 0.9% Normal Saline.

Postoperative Pain Relief

Visual analogue scale assesses it. During postoperative period, the patients are monitored for pain using VAS score every 30 minutes after the end of surgery until the first 12 hours, thereafter hourly until the block had completely worn off. Rescue analgesic is given when pain score is VAS >4

Visual Analog Scale

0 – no pain.

10 – Unbearable pain and complete recovery of motor function.

RESULTS

Table 1 shows the total no of cases studied for ultrasound guided supraclavicular brachial plexus block. A total of 60 cases (100%) were divided into two groups, group M and group N each containing 30(50%) patients. Group M was given Ropivacaine with Magnesium Sulphate and group N was given Ropivacaine with Normal Saline. [Table 1]

Table 2 also shows the distribution of weight among the two groups. The mean weight in group M was 69.7 + 4.02 years and,

in group N, was 69.27 + 7.92 years. P values were 0.59 and 0.75 respectively, which are statistically insignificant. [Table 2]

Table 3 shows the gender distribution of patients among the two groups.

In group M, 22 were male patients which contributes to 73.33% and 8 were female patients which contributes to 26.67%. In group N, 23 were male patients which contributes to 76.67% and 7 were female patients which contributes to 23.33%. [Table 3]

Table 4 shows the onset of sensory blockade among the two groups. In group M, the mean onset of sensory blockade was 10.00 + 1.11mins and in group N, the mean onset of sensory blockade was 10.53 + 1.19mins.

The P value was 0.08 which is statistically insignificant. [Table 4]

Table 5 shows the onset of motor blockade among the two groups.

In group M, the mean onset of motor blockade was 11.87 + 1.07 mins.

In group N, the mean onset of motor blockade was 12.27 + 1.20 mins.

The P value was 0.18 which is statistically insignificant. [Table 5]

Table 6 shows the duration of sensory blockade among the two groups.

In group M, the mean duration of sensory blockade was 600.67 + 42.33 mins.

In group N, the mean duration of sensory blockade was 412.33 + 37.20 mins.

The P value was found to be <0.0001 and is statistically significant. [Table 6]

Table 7 shows the duration of motor blockade among the two groups. In group M, the mean duration of motor blockade was 532.00 + 37.17 mins and in group N, the mean duration of motor blockade was 375.00 + 34.01 mins. The P value was found to be<0.001 and is statistically significant. [Table 7]

Table 8 shows mean Heart rate at various time intervals among two groups. P values were statistically insignificant among two groups. [Table 8]

Table 9 shows mean SBP at various time intervals among two groups. P values were statistically insignificant among two groups. [Table 9]

Table 10 shows mean DBP at various time intervals among two groups. P values were statistically insignificant among two groups. [Table 10]

Table 11 shows mean spo2 in % at various time intervals among two groups P values were statistically insignificant among two groups. [Table 11]

Table 12 shows the VAS score at 6, 9 and12 hours and among the two groups. P values are <0.001, <0.0001 and <0.0001 respectively which are statistically significant. [Table 12]

Table 13 shows the use of rescue analgesic among the two groups, in group M it was 644.66 + 41.58, whereas in group N it was 441.33 + 46.74. P value is <0.0001 which is statistically significant. [Table13]

Table 1: Distribution of Patients among Two Groups

GROUP	NUMBER	PERCENTAGE
M- ROPIVACAINE + MGSO4	30	50
N- ROPIVACAINE+ NS	30	50
TOTAL	60	100

Table 2: Age and Weight Distribution of Patients among Two Groups

VARIABLE	ROPIVACAINE+MGSO4	ROPIVACAINE+NS	P VALUE
Age In Years	37.70 + 10.2	39.17 + 11.07	0.59
Weight (Kg)	69.7 + 4.02	69.27 + 7.92	0.75

Table 3: Gender Distribution of Patients among Two Groups

VARIABLE		ROPIVACAINE + MGSO4		ROPIVACAINE + NS	
		NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
GENDER	MALE	22	73.33	23	76.67
	FEMALE	8	26.67	7	23.33

Table 4: Time of Onset of Sensory Block among Two Groups in Minute

TIME OF SENSORY ONSET IN MIN	ROPIVACAINE +MGSO4	ROPIVACAINE+NS	P VALUE
MEAN	10	10.53	0.08
SD	1.11	1.19	

Table 5: Time of Onset of Motor Block among Two Groups in Minutes

TIME OF MOTOR ONSET IN MIN	ROPIVACAINE +MGSO4	ROPIVACAINE+NS	P VALUE
MEAN	11.87	12.27	0.18
SD	1.07	1.20	

Table 6: Duration of Sensory Block among Two Groups in Minutes

Duration of Sensory Onset In Min	Ropivacaine +Mgso4	Ropivacaine+Ns	P Value
MEAN	600.67	412.33	<0.0001*
SD	42.33	37.20	

Table 7: Duration of Motor Block among Two Groups in Minutes

Duration Of Motor Onset InMin	Ropivacaine +Mgso4	Ropivacaine+Ns	P Value
MEAN	532.00	375.00	
SD	37.17	34.01	<0.001*

Table 8: Mean Heart Rate Comparison among Two Groups at Various Time Intervals

HR PER MIN	ROPIVACAINE+MGSO4	ROPIVACAINE+NS	P VALUE
Pre Op	81.90 ± 7.42	81.07 ± 5.29	0.62
15 min	78.83 ± 11.80	82.90 ± 8.93	0.13
30 min	77.67 ± 9.61	81.73 ± 8.34	0.08
60 min	78.83 ± 8.57	80.13 ± 6.74	0.52
120 min	79.10 ± 9.44	82.37 ± 8.62	0.16

Table 9: Mean SBP (mm of Hg) Comparison among Two Groups at Various Time Intervals

MEAN SBP (mm of Hg)	ROPIVACAINE+MGSO4	ROPIVACAINE+NS	P VALUE
Pre Op	125.80 ± 12.8	129.63 ±15.78	0.31
15 min	124.70 ± 16.21	123.60 ± 13.58	0.77
30 min	118.60 ± 12.09	123.67 ± 9.33	0.07
60 min	118.10 ± 12.76	121.47 ± 7.72	0.22
120 min	116.40 ± 12.17	118.33 ± 9.66	0.50

Table 10: Mean DBP (mm of Hg) Comparison among Two Groups at Various Time Intervals

MEAN DBP mm of Hg	ROPIVACAINE+MGSO4	ROPIVACAINE+NS	P VALUE
Pre Op	75.70 ± 7.55	73.93 ± 5.15	0.10
15 min	74.57 ± 8.16	73.13 ± 6.97	0.46
30 min	72.07 ± 9.96	73.33 ± 4.42	0.52
60 min	70.67 ± 8.50	72.90 ± 4.73	0.21
120 min	70.90 ± 8.06	72.03 ± 4.79	0.51

Table 11: Spo2 % Comparison among Two Groups at Various Intervals

MEAN SPO2%	ROPIVACAINE+MGSO4	ROPIVACAINE+NS	P VALUE
Pre Op	99.6 ± 0.56	99.67 ± 0.60	0.64
15 min	99.87 ± 0.34	99.87 ± 0.34	1.00
30 min	99.90 ± 0.30	99.90 ± 0.30	1.00
60 min	99.87 ± 0.35	99.83 ± 0.38	0.67
120 min	99.87 ± 0.35	99.87 ± 0.35	1.00

Table 12: VAS Score Comparison among Two Groups at Various Intervals

VAS SCORE	ROPIVACAINE+MGSO4	ROPIVACAINE+NS	P VALUE
1 Hour	0	0	-
6 Hours	0.0 ± 0.0	0.47± 0.86	<0.001*
9 Hours	1.1 ± 0.75	3.50 ± 0.86	<0.0001*
12 Hours	3.13 ± 0.57	5.06 ± 0.69	<0.0001*

Table 13: Duration after which first rescue analgesic given among the two groups

RESCUE ANALGESIC AFTER—MINS	ROPIVACAINE +MGSO4	ROPIVACAINE+NS	P VALUE
MEAN	644.66	441.33	<0.0001*
SD	41.58	46.74	

DISCUSSION

Regional anaesthesia allows the patient to remain conscious and can avoid airway manipulation and ventilation management, less interference with the vital centres and fewer side effects. This has made regional anaesthesia, the choice of anaesthesia, especially for patients with wide range of comorbidities. In the last decade, image guided peripheral nerve block with ultrasound has become the norm of anaesthesiologists.

To increase the efficacy of peripheral nerve blocks, various adjuvants have been added. In our study, Ropivacaine was used along with an adjuvant Magnesium Sulphate in the Supraclavicular Brachial plexus block under ultrasound guidance.

This study involves a total of 60 patients, ASA I AND II, aged 18 - 65 years, admitted for various upper limb surgeries. After obtaining the institutional ethical committee clearance, patients were randomized into two groups, i.e, group M received Ropivacaine with Magnesium Sulphate and group N received Ropivacaine with plain Normal Saline. The onset and the duration of sensory and motor blockade, any hemodynamic changes intraoperatively and complications perioperatively were noted.

Demographic Data

The age distribution among the study participants was found to be 37.70 + 10.2 in group M, and 39.17 + 11.07 in group N, which was found to be statistically insignificant. The sex distribution among the patients and ASA status of the patients also showed no statistically significant difference among the two groups as assessed by the chi square test. The weight distribution among the patients was 69.7 + 4.02 in group M, and 69.27 + 7.92 in group N, which was also found to be statistically insignificant. Therefore, our study groups were equally matched demographically.

Hemodynamic Variables

Variables like the heart rate, systolic blood pressure, diastolic blood pressure and oxygen saturation were noted. Before the block and after the block, every 5 minutes for the first half an hour and then every 15 minutes until the end of the surgery. They showed no statistically significant difference.

Similarly, Arunkumar Alarasan et al,[6] in 2016, in his study of dexamethasone in low volume supraclavicular brachial plexus block consisting of 60 patients randomized in two groups – group D – received 20 ml 0.5% Bupivacaine and 8 mg Dexamethasone and group C received 20 ml 0.5% Bupivacaine and 2 ml of Normal Saline. It was found that there were no hemodynamic complications and few side effects. Our study showed the same results.

Onset of Sensory Block

In group M, the mean onset of sensory blockade was 10.00 + 1.11 minutes and in group N, the mean onset of sensory blockade was 10.53 +1.19 minutes. There was a minimal difference between the two groups, which was statistically insignificant.

Similar to our study, Taneja P et al,[7] also showed a minimal difference in the onset of sensory block where they used magnesium sulphate as an adjuvant to ropivacaine, but there was no statistical significance between the two groups($p>0.005$).

Khezri et al,[8] Malleeswaran et al,[9] and Ekmecki et al,[10] also observed similar results while performing a comparative study between Levobupivacaine with Magnesium Sulphate and plain Levobupivacaine in Femoral Nerve Block though it was statistically insignificant.

Onset of Motor Block

The mean onset of motor block was 11.87 +1.07 minutes in group M, and 12.27 + 1.20 minutes in group N, among the two groups, and the difference was minimal, which was statistically insignificant.

Similar to our study, various studies conducted by Nath et al,[11] found that the addition of magnesium did not cause statistically significant onset of motor blockade.

Similar results were observed by Khezri et al,[8] and Malleeswaran et al,[9] Ekmecki et al,[10] while performing femoral nerve block, found minimal delay in the onset of motor block in the Levobupivacaine, Magnesium group than in the Levobupivacaine group which was statistically insignificant.

Duration of Sensory Block

In our study we found that the mean duration of sensory block was 600.67 + 42.33 minutes in group M, and the mean duration of sensory block was 412.33 + 37.20 minutes in group N, and the difference was found to be statistically significant between the two groups.

Similarly, in a study conducted by Kasthuri et al. in 2014,[12] the mean duration of sensory block in the Magnesium group was 456.21 minutes, where the prolonged duration is attributed to the use of Magnesium Sulphate.

Duration of Motor Block

In our study, the mean duration of motor block was 532.00 + 37.17 minutes in group M, and 375.00 + 34.01 minutes in group N and was found to be statistically significant.

Reza Akhondzade et al,[13] also had similar results when they used Magnesium as an adjuvant to lidocaine in supraclavicular brachial plexus block, increased the duration of motor block, between the two groups.

Haghighi et al,[14] in 2014, investigated the effect of Magnesium in the Axillary brachial plexus block when added to Lidocaine in upper limb surgeries, and reported that the addition of Magnesium Sulphate to Lidocaine significantly increased the duration of motor block in comparison with the use of Lidocaine alone.

Vas Score

The VAS score at 6 hours in group M, was 0.0 ± 0.0 and the VAS score at 6 hours in group N, was 0.47+ 0.86 and was statistically significant.

The VAS score at 9 hours in group M, was 1.1 + 0.75 and the VAS score at 9 hours in group N, was 3.50 + 0.86 and was statistically significant.
The VAS score at 12 hours in group M, was 3.13 + 0.57 and the VAS score at 12 hours in group N, was 5.06 + 0.69 and was statistically significant.
Dileep Gupta,[15] also observed similar results in the VAS score and rescue analgesic was administered at VAS score >4.

Use of First Rescue Analgesic

Rescue analgesic was given after VAS score > 4.
In our study, in group M mean duration after which first rescue analgesic was given was 644.66 + 41.58 and in group N was 441.33 + 46.74 and was statistically significant.
Dileep Gupta,[15] also observed similar results in the VAS score and rescue analgesic was administered at VAS score >4.

Complications

There were no complications found in both the groups either during the surgery or for the first 24 hours after surgery. Our results are comparable with that of similar study conducted by Arunkumar Alarasan et al, where no complications were noted. However we could not follow up the patients for a longer period to note any delayed complications.

CONCLUSION

Supraclavicular approach to the brachial plexus is popularly used for upper limb surgeries. The plexus is compactly arranged here, thus providing more complete and consistent block. To prolong the duration of analgesia in order to avail maximum benefit of single shot blocks, various adjuvants have been added to local anaesthetics. Magnesium Sulphate is a promising adjuvant administered perineurally. To overcome the failure of blocks and to prevent the complications, ultrasound guidance was used. The addition of magnesium has proved to be a better adjuvant in this study, since it prolonged the duration of sensory and motor blockade significantly. Hence Magnesium Sulphate added to local anaesthetics for Ultrasound guided Supraclavicular brachial plexus block provides a better postoperative analgesia.

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