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RESEARCH ARTICLE
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COMPARATIVE EFFICACY AND SAFETY OF ROPIVACAINE WITH MAGNESIUM SULPHATE AND PLAIN ROPIVACAINE IN ULTRASOUND GUIDED SUPRACLAVICULAR BLOCKS FOR UPPER LIMB SURGERIES.

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Abstract:
Background: Postoperative pain management is a crucial part of patient care for surgeries involving the upper limbs. A popular technique for providing both postoperative analgesia and regional anaesthesia is a supraclavicular plexus block guided by a peripheral nerve stimulator. Recent research has demonstrated that the analgesic effect of ropivacaine can be enhanced by the addition of magnesium sulphate. Ropivacaine is a piperidinecarboxamide-based amidetype local anaesthetic (amide caine) in which (S)-Npropylpipecolic acid and 2,6-dimethylaniline are combined to form the amide bond.
The aim of the study was to compare the efficacy and safety of addition of magnesium sulfate with Ropivacaine versus plain Ropivacaine under ultrasound guided supraclavicular plexus block for patients undergone upper limb surgeries. It was a randomized prospective study conducted at tertiary Care Hospital - "Prasad Institute of Medical Sciences", Banthra, Lucknow, UP, India.
A total of 50 patients, aged 18 to 60 years, both sexes were divided randomly by computerized allocated numbers into two equal groups. Group-A received 20 ml of 0.75% Ropivacaine + 0.5 ml (250 mg) Magnesium sulphate whereas Group-B received 20 ml of 0.75% Ropivacaine + 0.5 ml Normal saline. These patients were posted for elective upper limb surgeries. This study was primarily compared the efficacy of supraclavicular plexus block in both the groups in terms of the duration of sensory block and Motor block, quality of analgesia, total duration of analgesia, perioperative hemodynamic, VAS score 0, 2,4,6,12,24 hours and complications.
Result: In group-A, the mean duration of Sensory blockade was 432.82± 8.16 minutes and in group-B was 274.93± 6.43 minutes, the P value was <0.001 and was statistically significant. VAS score at 6 hours in group-A, was 0.86± 0.61 and 1.97± 1.79 in group-B and the P value was <0.001, which was also found statistically significant. The patients those who received Ropivacaine & Magnesium Sulphate (318.32 ± 6.17 min) had significantly longer duration of Motor block than patients who received Ropivacaine alone (239.87 ± 5.98 min). Requirement of first Rescue Analgesia was delayed in group-A (578.16 ±18.72 minutes) as compared to group- B (396.76±21.12 minutes) and the P value

was <0.001 and was statistically significant. Perioperative, postoperative hemodynamics was not significant for both the groups.
Conclusion: 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 Ropivacaine for ultrasound guided supraclavicular plexus block provided better postoperative analgesia and also reduced the requirement of rescue analgesic in postoperative period. Large sample size with multicentric study is required to establish the above results accurately.

Keywords: Analgesia, Magnesium Sulphate, Motor Block, Ropivacaine, Sensory Block.

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 postoperative 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. Peripheral nerve blockade of upper limb includes various methods of brachial plexus block where brachial plexus is blocked at different levels [4].

Supraclavicular plexus 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 [5-6]. 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 [7].

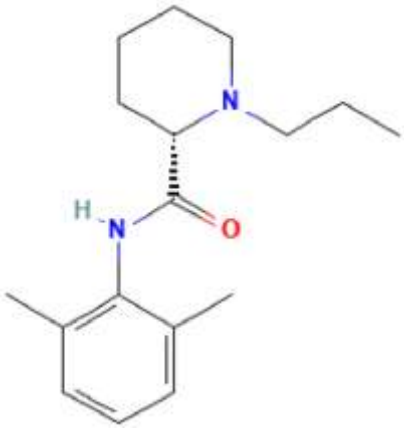
Regional anesthesia is a newer emerging technique used as a safer and effective method for various surgical procedures including upper limb surgery. It can prolong the duration of analgesia during surgery and assist with post-operative pain management. Supraclavicular block is a cost effective and safest technique with the advantages of ideal operating conditions and effective post–operating analgesia. Ultrasound guided (USG) supraclaviclar blocks allows the better view of underlying structures, positioning, needle movement and direct spread of local anesthetic. It also thereby making the procedure a safe and effective as compared to nerve stimulator guided technique [8-9]. As local anesthesia is safe, inexpensive and itshas been always a concern on the duration of anesthesia and post operative requirement of analgesics. Hence in the modern era of medicine perineural adjuvant came into picture to enhance the earlier onset action and prolonge defficacy. Magnesium sulphate by the virtue of NMDA receptors antagonist property [10-11] has been established as an adjuvant to local anesthetics inneuraxial blocks, peripheral nerve blocks [12] and transverses abdominal blocks [13]. It can also be used as an adjuvant in supraclavicular blockswith good encouraging results; still its consensus to be attained.

Brachial plexus blockade provides superior pain control with excellent intraoperative anaesthesia as well as post-operative analgesia, eliminating the need for intraoperative opioids and minimizing the need for post-operative opioids [14]. This results in 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. Supraclavicular plexus block offers dense anaesthesia of the brachial plexus for surgical procedures at or distal to the elbow [15].

Ultrasound guided supraclavicular plexus blocks allows the better view of underlying structures, positioning, needle movement and direct spread of local anaesthetic. It also thereby making the procedure a safe and effective as compared to nerve stimulator guided technique [16].

Ropivacaine: (S)-ropivacaine is a piperidinecarboxamide-based amidetype local anaesthetic (amide caine) in which (S)-Npropylpipecolic acid and 2,6-dimethylaniline are combined to form the amide bond. Ropivacaine is an aminoamide local anesthetic drug marketed by Astra Zeneca under the trade name Naropin. It exists as a racemate of its S- and R-enantiomers, although the marketed form is supplied only as the purified S-enantiomer [23].

Chemical Formula: $C_{17}H_{29}ClN_2O_2$ [(2S)-N-(2,6-dimethylphenyl)-1-propylpiperidine-2-carboxamide]



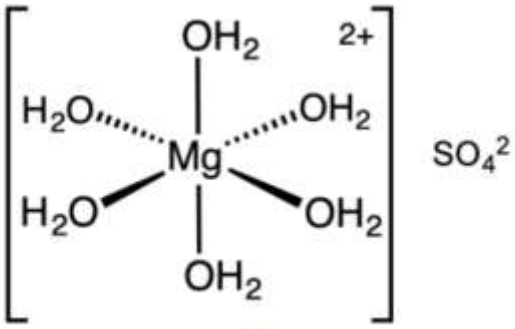
Chemical Structure:

It is one of the recently synthesized long-acting local anaesthetic which belongs to the amide group. It mediates its effects via the blockade of sodium channels. When compared to Bupivacaine, it is less lipophilic and hence it is associated with minimal cardio vascular and central nervous system effects [23].

Magnesium Sulphate:

Magnesium sulphate or magnesium sulphate is a chemical compound, a salt with the formula MgSO4, consisting of magnesium cations Mg2+ (20.19% by mass) and sulphate anions SO2 (4-). It is a white crystalline solid, soluble in water. Magnesium sulphate is usually encountered in the form of a hydrate MgSO4 ·nH2O, for various values of n between 1 and 11. The most common is the heptahydrate MgSO4 ·7H2O, [17] known as Epsom salt, which is a household chemical with many traditional uses, including bath salts. [18]. Magnesium sulphate is used both externally (as Epsom salt) and internally. The main external use is the formulation as bath salts, especially for foot baths to soothe sore feet. Such baths have been claimed to also soothe and hasten recovery from muscle pain, soreness, or injury [19]. Health effects of magnesium sulphate that have been proposed include improvement of treatment resistant depression [20] and as an analgesic for migraine and chronic pain [18]. Magnesium sulphate has also been studied in the treatment of asthma, preeclampsia, and eclampsia. Internally, magnesium sulphate may be administered by oral, intramuscular or intravenous routes.

Chemical Structure: [23]



Magnesium sulfate hexahydrate

It has anti-nociceptive effects due to regulation of calcium influx into the cell and antagonism of N-methyl Daspartate (NMDA) receptors.[5] Magnesium has been used in intravenous, intrathecal, epidural/caudal routes to improve analgesia.[6] In animal models of pain, calcium channel antagonists have been demonstrated to provide analgesia and in chronic pain situations, they synergistically potentiate opioid-induced antinociception [23].

Thus, it can be emphasized that Magnesium Sulphate can be a good adjuvant to Ropivacaine in supraclavicular brachial plexus block. 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.

Therefore, the present study was carried out to compare the effectiveness of 0.75% Ropivacaine with 0.5ml (250 mg) Magnesium sulphate and 0.75% Ropivacaine with Normal Saline in ultrasound guided brachial plexus block for upper limb surgeries.

Materials & Methods

Materials:

Study Site: The was conducted at OT-Complex, Prasad Institute of Medical Sciences, Junab Ganj, Sarai Sahjadi, Banthra, Lucknow, Uttar Pradesh, India.

Study Design: Prospective randomized comparative study.

Study Period: 24 Months, March 2023 to March 2025, after obtaining approval from institutional ethical committee.

Study population: Patients undergoing elective upper limb surgeries.

Sample Size: Sample size was calculated at 80% study power and alpha error 0.05 assuming standard deviation of 30.25 min duration of sensory block as found in reference studies [6]. For minimum detectable difference of 25 min in mean duration of sensory block between the group, 25 patients in each group were required as sample size. Formula was used for sample size calculation as follow:

$$n = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 \times \sigma^2}{(M_1 - M_2)^2}$$

Where, n = sample size Z1-α/2 = 1.96, Z1- β = 0.84, σ (assumed standard deviation) = 30.25 mmHg (M1-M2) = 25 mmHg

Inclusion Criteria:

1. Age group 18-60 years
2. ASA [American Society of Anaesthesiologists] physical status I, II of both sexes.
3. Elective surgery of upper extremity, < 3hrs duration
4. Patient who gave informed written consent was included in this study.

Exclusion Criteria:

1. ASA III, IV patients

2. Patients with coagulopathies, brachial plexus neuropathies, severe bronchopulmonary disease and patients with diabetes.
3. Patients with haemodynamic instability.
4. Neurological deficits involving brachial plexus (Peripheral neuropathy).
5. Local infection at the injection site.
6. Psychiatric illness
7. Patient refusal, allergy to Ropivacaine
8. Not meeting the inclusion criteria
9. Pregnant women

Methods:

After obtaining institutional ethical committee approval and getting informed consent from the patients were fasted overnight had been sited 18G Venlo iv fluids started were given xylocaine test dose and hooked on to routine monitors in OT (ASA I, II) who were undergoing elective upper limb surgeries (hand, elbow and forearm). The Patients were randomly allocated by computerized allotment slot of Ropivacaine with magnesium Group-A and Ropivacaine only Group-B. All study patients were administered USG guided supraclavicular block with (0.75%) Ropivacaine 20ml + 0.5 ml MgSO4 (250 mg) and 20 ml of (0.75%) Ropivacaine +0.5 ml Normal saline.

Ropivacaine: It was developed after bupivacaine was noted to be associated with cardiac arrest, particularly in pregnant women. Ropivacaine was found to have less cardio toxicity than bupivacaine in animal models. Ropivacaine hydrochloride is a local anaesthetic belonging to the amino amide group. The name Ropivacaine refers to both the racemate and the marketed S- enantiomer. Ropivacaine HCl is chemically described as S- [-]-1- propyl-2,6- ipecoloxylidide hydrochloride monohydrate. Ropivacaine blocks the generation and conduction of nerve impulses, presumably by increasing the threshold for electrical excitation in the nerve, by slowing the propagation of nerve impulse, and by reducing the rate of rise of the action potential. Ropivacaine is extensively metabolised in the liver and excreted in the urine. The mean half-life is 1.8 ± 0.7 hrs. After intravascular administration and 4.2±1 h after epidural administration. Ropivacaine is indicated for regional anaesthesia and acute pain management. Contraindication: hypersensitivity to amide group which is rare.

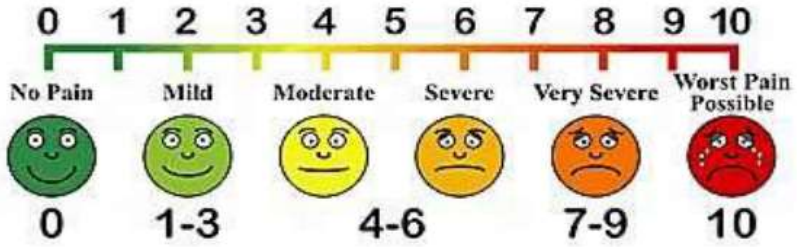
Magnesium sulphate: It is an inorganic salt with the formula MgS04.7H20. Magnesium is the second most plentiful cation of the intracellular fluids. It is essential for the activity of many enzyme systems and plays an important role with regard to neurochemical transmission and muscular excitability.

Technique: For the supraclavicular block, patient is positioned by lying flat with head turned to 40 degrees to opposite side and arm by side of patient. After painting and draping the ultrasound probe of 10-15 MHZ is used to visualize the brachial plexus. The ultrasound probe is positioned in supraclavicular fossa and moved laterally in order to locate subclavian artery. Once the artery is visualized the area lateral and superficial to it is explored until plexus is visualized as honeycomb appearance. The first rib and pleura should be seen clearly. The needle is entered by the in-plane technique. Distinct pop is felt and seen when sheath is entered. Then assistant is asked to aspirate and inject the local anaesthetic. The spread of local anaesthetic can be immediately visualized by USG. The VAS score, hemodynamic, demand analgesia was followed for 24 hours.

Procedure undergone includes wound debridement, exploration, flap cover, open reduction and internal fixation (ORIF) and SSG.

Parameters studied include intraoperative, postoperative hemodynamic, onset of sensory and motor block, duration of block, any complication, intraoperative, postoperative VAS score, time for postoperative demand (rescue) analgesia and no of analgesia required in 24 hours.

VAS Score:


0 1 2 3 4 5 6 7 8 9 10
No Pain
Mild
Moderate
Severe
Very Severe
Worst Pain Possible
0
1-3
4-6
7-9
10

The pulse rate, blood pressure, ECG, oxygen saturation (SpO2) and respiratory rate were noted at 0 minute, thereafter every 5 minutes for the initial 15 minutes, then every 30 minutes till 3 hrs., then every hourly up to 2 hours and then every 2 hourlies up to 16 hours in post-operative period. Visual Analogue Score (VAS) was measured every hour after the end of surgery for first 12 hrs. Inj. diclofenac sodium 1.5 mg/kg IV was administered when VAS ≥ 4 and time for first rescue analgesia was noted. This study was primarily compared the efficacy of supraclavicular block in both the groups in terms of the Duration of sensory block and Motor block, quality of analgesia, complications, total duration of analgesia.

Assessment:

- 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 sensory onset was tested by using spirit swab**.**

❖ **Duration of The Sensory Block:**

The length 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

- 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-A].

Table-A: 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 with inability to move fingers

Statistical analysis:

Data was entered and analysed in Micro soft excel. Categorical variables were compared using the Chi-square test or Fisher's exact probability test; continuous variables compared using unpaired t-test or Mann Whitney U test. SPSS (26.1) was also used.

Result:

A total of 50 patients, aged 18-60 years, both sexes, of ASA grade -1 and II were divided equally into two groups by computer randomized allotted number, who were undergone elective upper limb surgeries. Group-A was received 20 ml (0.75%) Ropivacaine with 0.5 ml Magnesium Sulphate (250 mg) and group-B received 20 ml (0.75%) Ropivacaine with 0.5 ml Normal Saline as an adjuvant in ultrasound guided supraclavicular brachial plexus block. Both the groups were compared among age, sex and ASA grade, BMI and weight which were found statistically insignificant (Table-1).

Table-1: Baseline characteristics of participants

Parameters		Group-A, n=25		Group-B, n=25		P Value
		Male	Female	Male	Female	
Age (Years)	18-30	2 (8%)	1 (4%)	1 (4%)	1 (4%)	0.0762
	31- 40	8 (32%)	5 (20%)	9 (36%)	6 (24%)	
	41-50	4 (16%)	3 (12%)	2 (8%)	4 (16%)	
	51-60	1 (4%)	1 (4%)	2 (8%)	0 (0%)	
ASA-Grade	G-I	11 (44%)		13 (52%)		0.341
	G-II	14 (56%)		12 (48%)		
BMI		22.68± 2.56		21.98±3.22		0.81
Weight (Kg)		67.14±5.86		66.92±4.66		0.76

Figure-1: Baseline characteristics of participants

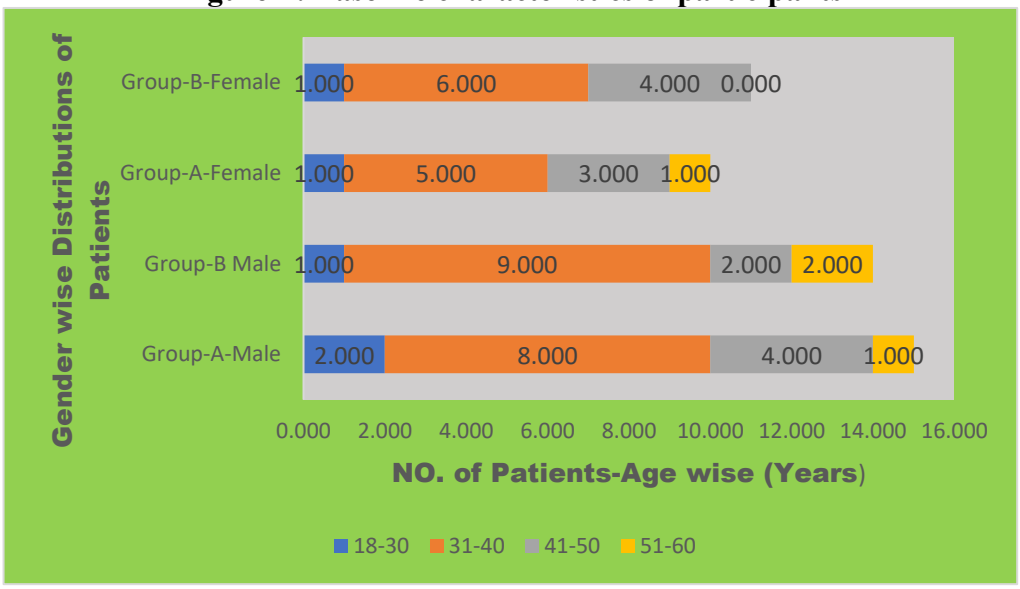


Table-2: Distribution of patients on the basis of Surgical Positions in two groups.

Diagnosis-Positions	Group-A	Group-B	P value
bb Forearm	5 (20%)	4 (16%)	0.05
Rdius	6 (24%)	5 (20%)	
Ulna	1 (4%)	2 (8%)	
Contracture Release	3 (12%)	2 (8%)	
Crush Injury	2 (8%)	3 (12%)	
Flexor Injury	1(4%)	2 (8%)	
Galazzei	1 (4%)	1 (4%)	
Forearm Injury	1 (4%)	0 (0%)	
Raw area	4 (16%)	4 (16%)	
Tendon Injury	1(4%)	2(8%)	

Table-3: Comparison of Mean Heart Rate among Two Groups at Various Time Intervals.

Variables		Ropivacaine + $MgSO_4$ (Group-A)	Ropivacaine + Normal Saline (Group-B)	P value
Heart Rate/ Min				
Pre-OP		82.11± 6.34	81.76±7.31	0.63
OP	15 Min	79.81±9.41	82.88±8.76	0.33
82.32	30Min	78.75±9.22	81.04±7.68	0.07
	60NMin	79.66±8.92	80.97±8.53	0.53
	120Min	80.03±9.54	82.33±7.89	0.17

Figure-2: Comparison of Mean Heart Rate among Two Groups at Various Time Intervals.

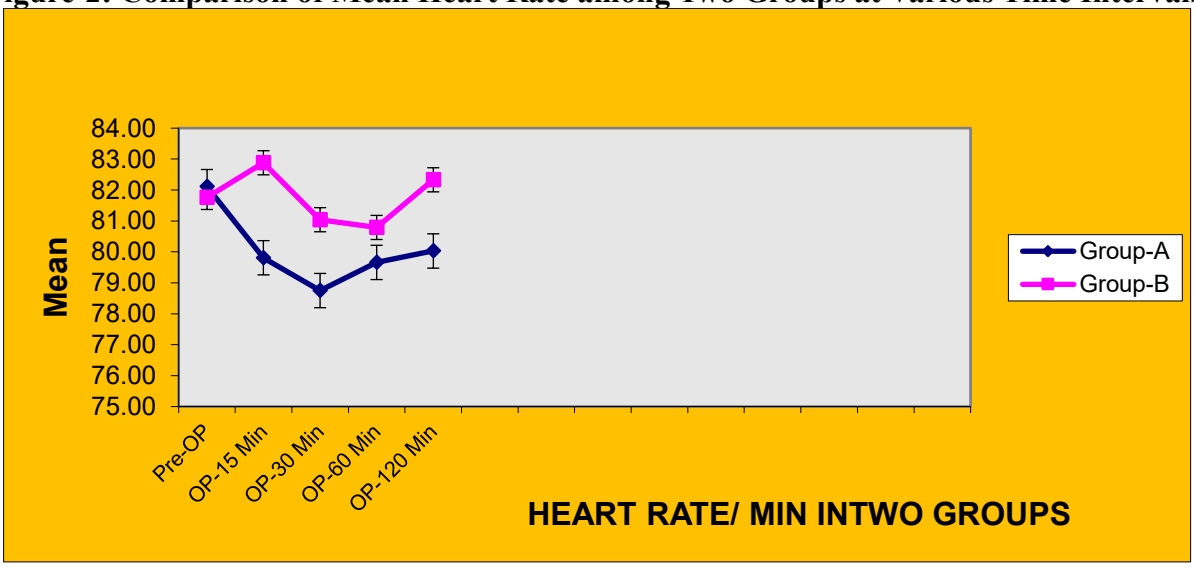


Table- 4: Mean SBP (mm of Hg) Comparison among Two Groups at Various Time Intervals

Variables		Ropivacaine + $MgSO_4$ (Group-A)	Ropivacaine + Normal Saline (Group-B)	P value
Mean SBP (mm of Hg)				
Pre-OP		126.18± 12.34	128.76±11.31	0.32
OP	15 Min	124.81±9.41	125.88±8.76	0.73
82.32	30Min	120.75±9.22	123.04±7.68	0.07
	60NMin	119.66±8.92	121.97±8.53	0.44
	120Min	117.03±9.54	118.33±8.89	0.50

Table-5: Mean DBP (mm of Hg) Comparison among Two Groups at Various Time Intervals

Variables		Ropivacaine + $MgSO_4$ (Group-A)	Ropivacaine + Normal Saline (Group-B)	P value
Mean DBP (mm of Hg)				
Pre-OP		75.31± 7.34	74.76±6.31	0.11
OP	15 Min	74.81±8.51	73.88±7.76	0.42
82.32	30Min	73.75±7.28	73.04±6.68	0.53
	60NMin	71.66±7.87	72.97±4.53	0.23
	120Min	70.17±8.52	71.38±5.89	0.67

Table-6: Spo2 % Comparison among Two Groups at Various Intervals

Variables		Ropivacaine + $MgSO_4$ (Group-A)	Ropivacaine + Normal Saline (Group-B)	P value
Mean SPO2%				
Pre-OP		99.61± 0.34	99.76±0.31	0.61
OP	15 Min	99.88±0.41	99.88±0.73	1.03
82.32	30Min	99.95±0.22	99.89±0.64	1.07
	60NMin	99.86±0.97	99.97±0.31	0.63
	120Min	99.63±0.51	99.87±0.19	1.10

In group A, the mean systolic BP was 122.55±5.11 mmHg and in group B, the mean systolic BP was 124.40±4.23 mmHg with a P value was 0.412 which was statistically insignificant. The diastolic BP, pulse rate, spo2 were found not significant.

Table-7: VAS Score Comparison among Two Groups at Various Intervals

Variables		Ropivacaine + $MgSO_4$ (Group-A)	Ropivacaine + Normal Saline (Group-B)	P value
VAS Score				
Pre-OP		0	0	-
OP	1 Hour	0.00	0.00	0.00
82.32	6 Hour	0.86±0.61	1.37±1.29	0.001
	9 Hour	1.16±0.72	3.47±0.59	0.001
	12 Hour	4.99±0.55	5.03±0.78	0.00

Table-7, illustrating that the VAS score at 6 hours in group-A was 0.86±0.61and the VAS score at 6 hours in group-B was 1.37±1.29 and the P value was <0.001, which was statistically significant. The VAS score at 6 hours in group-A, was also shown that those patients did not have pain. The VAS score at 9 hours in group A, was 1.16±0.72 and the VAS score at 9 hours in group-B, was 3.47±0.59 and the P value was <0.001, which was statistically significant. The VAS score at 12 hours in group A, was 4.99±0.55 and the VAS score at 12 hours in group B, was 5.03±0.78 and the P value was not applicable, since the values were almost same. In group A, the time at which rescue analgesic given was 578.16±18.72 minutes and in group B, the time at given was 396.76±21.12 minutes and the P value was <0.001 and was statistically significant. The rescue analgesic usage for 24 hours in group A, was 150 ± 0.0 mg of Inj. Diclofenac sodium and the rescue analgesic usage for 24 hours in group B, was 215 ± 25.63 mg and was statistically significant. The usage of rescue analgesic was lesser in the magnesium group-A which was attributed to the prolonged duration of sensory block by magnesium.

Table-8: Comparison of surgical parameter between two groups

Variables	Ropivacaine + $MgSO_4$ (Group-A)	Ropivacaine + Normal Saline (Group-B)	P value
Duration of Surgery (Min)	93.55± 24.87	94.23±26.77	0.891
Time to onset of Sensory Block (Min)	5.35±0.83	6.11±0.32	0.001
Duration of Sensory Block (Min)	432.82±8.16	274.93±6.43	0.001
Time to onset of Motor Block (Min)	11.34±0.62	11.96±0.81	0.032
Duration of Motor Block (Min)	318.32± 6.17	239.87±5.98	0.001
Requirement of Analgesia (Min)	578.16±18.72	396.76±21.12	0.001
Total Rescue Analgesis used	150±00 mg Diclofenac	215 ± 25.63 mg Diclofenac	0.001

Table-8, illustrating that the mean duration of surgery was also comparable between Ropivacaine group-B (94.23 ± 26.77min) and Ropivacaine & Magnesium Sulphate group-A (93.55± 24.87 min). The mean time to onset of Sensory block was significantly shorter in Ropivacaine & Magnesium Sulphate group-A (5.35 ± 0.83 min) than Ropivacaine group (6.11 ± 0.32 min). Patients who received Ropivacaine & Magnesium Sulphate were having (432.82 ± 8.16 min) longer duration of Sensory block than patients who received Ropivacaine alone (274.93 ± 6.43 min). The time to onset of Motor block was significantly longer in patients who received Ropivacaine alone (11.96 ± 0.81 min) than patients those who received Ropivacaine & Magnesium Sulphate (11.34 ± 0.62 min). Patients who received Ropivacaine & Magnesium Sulphate were having (318.32 ± 6.17 min) significantly longer duration of Motor block than patients with Ropivacaine alone (239.87±5.98 min). Requirement of first Rescue Analgesia was delayed in Ropivacaine & Magnesium Sulphate group-A (578.16±18.72 min) as compare to Ropivacaine group-B (396.76±21.12 min).

In the present study the sample size was very small hence, large sample size with multicentric study is required to establish the above results accurately.

Discussion:

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 [21]. For upper limb procedures, the decision to use a peripheral nerve stimulator-guided supraclavicular plexus block is important because it may provide better pain management without having the systemic adverse effects that are frequently connected to general anaesthesia. Given the increasing amount of evidence bolstering the use of adjuvants to improve analgesia, the choice to look into the possibility of adding magnesium sulphate as an adjuvant to ropivacaine is followed in this study [9, 22, 24]

Numerous clinical studies have shown that giving magnesium during general anaesthesia lowers the need for anaesthesia and the number of analgesics used after surgery. Ropivacaine is less neurotoxic and cardiotoxic than other aminoamides, such as bupivacaine. Ropivacaine causes a shorter-lasting and less severe motor block than bupivacaine, allowing for speedier mobilisation and discharge [10]. A study advocated that although there was a slight delay in the onset time of sensory and motor blockade, adding 150 mg of magnesium sulphate to ropivacaine 0.50% in supraclavicular brachial plexus block resulted in a longer duration of sensory and motor blockade and a reduced need for rescue analgesics [5]. Conversely, a study observed positive results when magnesium sulphate was used as an adjuvant, showing both a quicker start and a longer duration of motor and sensory anaesthesia [17]. Similarly, a study also advocated that postoperative analgesia was enhanced by adding 250 mg MgSO4 and 2 mg.kg 1 ketamine to 0.5% ropivacaine as opposed to ropivacaine alone. In the setting of supraclavicular brachial plexus block, MgSO4 demonstrated superiority in terms of block features and a lower frequency of adverse effects [18]. A study compared the dexmedetomidine and MgSO4 as adjuvants to ropivacaine respectively and subsequently observed that while both were helpful, dexmedetomidine offered prolonged analgesia, an earlier onset of sensory and motor block, and a longer duration of block. The investigation also emphasised variations in adverse event patterns, wherein dexmedetomidine demonstrated a greater frequency of bradycardia, sedation, and hypotension [19]. According to a study, the volume of 0.5% ropivacaine utilised in ultrasound-guided supraclavicular brachial plexus block decreased from 35 mL to 20 mL, which led to a 21% reduction in the length of analgesia. This highlights the significance of determining the lowest effective ropivacaine volume needed to achieve a full sensory and motor block with the least amount of IV analgesia needed [20]. In a study as adjuvants to ropivacaine, examined dexmedetomidine and clonidine and discovered that dexmedetomidine produced a noticeably longer duration of postoperative analgesia and an earlier sensory block. The combination of ropivacaine and dexmedetomidine showed promise in this trial, especially for orthopaedic surgeries [21].

The purpose of this present study was to examine how well magnesium sulphate works with ropivacaine to prevent post-operative analgesia following upper limb procedures. A thorough research approach to address the critical problem of postoperative pain management in patients undergoing upper limb procedures was outlined in the study protocol that was being presented. Effective postoperative pain management is vital due to its significant influence on patient outcomes, recovery, and the healthcare system as a whole. Through a comparison of the two anaesthesia approaches' efficacy and safety, this study protocol was aimed to give clinicians evidence-based counselling and shed light on the advantages of mixing magnesium sulphate with ropivacaine. By doing this, the study desired to improve patient satisfaction, lower healthcare costs, accelerate recovery, and optimise patient outcomes.

In Present study, mean time of onset of sensory and motor block in group A was significantly shorter (5.35±0.83 min & 11.34±0.62 min respectively) than group B (6.11±0.32 min & 11.96±0.81 min respectively). This was comparable to a study [17] whose time of onset of sensory block was 14.9 ± 2.02 min vs 11.98 ± 1.08 min and time of onset of Motor block was 31.12 ± 2.47 min v/s 22.7 ± 1.01 min. A few similar studies [6,24] observed quicker onset of sensory and motor block when MgSO4

was added to bupivacaine and levobupivacaine respectively. A study [11] investigated the effect of magnesium in a Bier block and reported that the onset of sensory and motor analgesia was faster in the magnesium group than in the placebo group. Similar findings for duration of sensory block and motor block were also observed in a study (Sensory block: 526.32 ± 10.34 min v/s 403.78 ± 14.62 min; Motor block: 428.76 ± 12.76 min v/s 296.16 ± 16.41 min). Requirement of first rescue Analgesia was delayed in group RM (467.7 ± 11.79 min) as compare to group RN (373.53 ± 3.40 min) [22]. These observations was also correlated with other similar study [21] in which time to first rescue analgesic prolonged from 377.67 ± 73.31 min to 491.00 ± 100.22 min and also similar toa study [5] whose post op analgesia increased from 379.79 ± 145.52 min to 461.71 ± 152.57 min.The mean difference in pulse rate, SBP, DBP, MAP, SpO2, and RR was comparable and no change was observed during preoperative, induction, intra-operative and post-operative time in both the groups in present study. These observations were correlated with a study [4] with no statistically significant difference in intra-operative parameters namely pulse, systolic blood pressure and diastolic blood pressure between two groups.

A study compared the effect of adding intrathecal magnesium sulphate to bupivacaine fentanyl spinal anaesthesia and magnesium with 0.9% sodium chloride in the patients undergoing lower limb surgery,in their study was concluded as that the magnesium had delayed onset of sensory and motor blocks, but prolonged the duration of spinal anaesthesia [12]. A study was conducted in Cairo in 2008, intra-articular injections of bupivacaine with magnesium resulted in longer periods of analgesia (Duration) when compared with the control group that received a placebo. [9]. Two similar studies reported that the addition of magnesium sulphate prolonged time duration of an epidural analgesia [10,11]. A study also reported that the magnesium sulphate prolongs the duration of supraclavicular brachial plexus block [13]. A study demonstrated that onset and duration of both sensory a motor block was not significant statistically [2]. A similar study also demonstrated that sensory and motor block durations were prolonged the duration of Group BM1 as compared to BM 0.5 and B (P = 0.00) where the earlier one where they used magnesium sulphate as adjuvant [5]. A study described that the onset time of the sensory and motor block duration and time to first analgesic use was significantly longer and the total need for rescue analgesics was lower in group RM (P = 0.026) than group RN [17].

In the present study, complication like nausea, vomiting, sedation and respiratory depression were not noticed in either of the groups. A study [17] observed two patients of vomiting in B group while no patients in A group suffered from vomiting. In another study [4] only two patients in A group and three patients in B group had nausea while Hypotension occurred only in five patients in B group and two patients in A group but the difference was statistically insignificant.

Although the present study has great potential, there was difficulties, such as finding patients, adhering to protocol, possible variation in surgical techniques, and ethical issues. Careful management of these obstacles is necessary to guarantee the validity and generalizability of the study.

A study advocated that the Ropivacaine was a safe, long acting of anaesthesia. It was used along with an adjuvant magnesium sulphate which was cheaper and devoid of side effects [6]. Magnesium as an adjuvant enhances the analgesic properties of established analgesics. It blocks the NMDA receptors in the CNS; it exerts its effect. The primary hypothesis for the analgesic properties of magnesium on peripheral nerves is surface charge theory. A study showed that modulation of the external magnesium ion concentration bathing a nerve bundle resulted in enhancement of the nerve blockade due to local anaesthetics [2]. Magnesium sulphate added to local anaesthetics for ultrasound guided supraclavicular brachial plexus block provides better postoperative analgesia, various studies also proved the same [6,17-23].

The present study may be summed up as the study protocol offered a methodical and well-organized research strategy that tackled an important clinical concern in anesthesiology. This research has the potential to greatly improve postoperative pain management and, in turn, improve patient care in the setting of upper limb procedures by comparing the efficacy and safety of two anaesthetic approaches.

To Attained this goal, required meticulous protocol execution, ethical standards observance, and in-depth data analysis were done.

Conclusion:

Addition of 0.5 ml (250 mg) Magnesium sulphate to Ropivacaine (0.75%) solution in ultrasound guided supraclavicular brachial plexus block for upper limb surgeries speed up the onset of both sensory and motor blockade. It also lengthened the duration of sensory and motor blockade and reduced the requirement of rescue analgesic in postoperative period. The quality of block was enhanced as the duration of analgesia was significantly prolonged and thus it was one of the potential adjuvants for local anaesthetics in peripheral nerve blocks.

Hence, the study was summarized as the Magnesium sulphate was a cheap promising adjuvant, when combined with Ropivacaine in USG guided supraclavicular block. The magnesium has proved to be a better adjuvant in this study, since it prolonged the duration of sensory and motor blockade significantly (up to 9 hours) in the present study. After 12 hours there was no difference in sensory and motor block between the two groups as demonstrated by VAS score. No serious adverse effects were noted in this study. In the present study the sample size was very small hence, large sample size with multicentric study is required to establish the above results accurately.

Conflict of Interest: - Nil

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