VOLUME - 12, ISSUE - 02, FEBRUARY - 2023 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anaesthesiology

COMPARISON OF MAGNESIUM SULFATE AND KETAMINE WITH ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT The aim of this study was to evaluate the effect of MgSO4 and ketamine on the duration of analgesia in brachial block. Magnesium sulfate (MgSO4) and ketamine block peripheral nociception mediated via N-methyl-D-aspartate receptors. One hundred and five adult patients were randomly divided into three groups: Group I = 27 mL of 0.5% ropivacaine; Group II = 27 mL of 0.5% ropivacaine + 250 mg MgSO4; and Group II = 27 mL of 0.5% ropivacaine + 2 mg.kg−1 ketamine. Normal saline was added to make a total volume of 30 mL and compared sensorimotor blockade, quality and duration of postoperative analgesia, and adverse effects.The duration of analgesia was significantly longer in Group II compared to Group I and Group III. Intervention groups had lower postoperative visual analog scores at 8, 12, and 24 h compared to the control group. Sedation, nystagmus, and hallucinations were observed in Group III. The addition of MgSO4 to ropivacaine in supraclavicular brachial plexus block prolongs the duration of analgesia and improves the quality of postoperative analgesia with lesser incidence of side effects when compared to ketamine.

KEYWORDS :

INTRODUCTION

Supraclavicular brachial plexus block is a safe and inexpensive anesthetic technique for upper limb surgeries it provide good operating condition and good post operative analgesia. Since the duration of postoperative analgesia is often a limiting factor, many adjuvants, such as tramadol, morphine, fentanyl, epinephrine, α_2 agonists, dexamethasone, neostigmine, midazolam, ketamine, and sodium bicarbonate, have been used along with local anesthetics to this end. These are often associated with adverse effects. n understanding of pain mechanisms points to the role of central sensitization and NMDA receptor activation by excitatory amino acid transmitters in postsurgical pain. $MgSO_4$ an NMDA receptor antagonist in the central and peripheral nervous system, has been evaluated as an adjuvant in the perioperative analgesic management and was found to decrease the intraoperative and postoperative analgesic consumption. Ketamine is also a noncompetitive NMDA receptor antagonist commonly used for its analgesic and anesthetic effect. It also possesses central, regional, and local anesthetic properties, and recent clinical applications include its use as an adjunct in caudal block. It has also been used in pectoral nerve block, axillary block, and supraclavicular block with contradicting results. The effect of the study drugs on the onset and duration of sensorimotor blockade was also assessed.

MATERIALS AND METHODS

A total of 105 adult patients (20–60 years) of either sex, ASA grade I or II, scheduled for elective upper limb surgery were included. Patients with peripheral neuropathy or motor weakness, infection at the injection site, pneumothorax, diaphragmatic palsy, known allergy to the drugs used, bleeding disorders, uncooperative, or not able to understand the visual analog scale excluded from the study. Preoperative assessment including a detailed history and general and systemic examination was performed a day before surgery. Patients were weighed, and routine laboratory investigations were done. The study protocol, procedure of brachial plexus block, and VAS (0–10) was explained to the patient, and an informed written consent was obtained. All the patients were given tablet alprazolam 0.5 mg orally the night before surgery and were kept fasting overnight. The patients were reassessed in the preoperative holding area and randomly assigned to one of the three study groups according to computer-generated random number slips enclosed in 105-sealed opaque envelopes. To conceal the group allocation, the sealed envelope was opened just before

the block performance. To ensure blinding, an independent anesthesiologist not involved in the data collection prepared the drug solution according to the assigned group. Group I patients received 27 mL of 0.5% ropivacaine alone, Group II patients were given 27 mL of 0.5% ropivacaine with $MgSO_4$ (250 mg), and for patients in Group II, ketamine (2 $mg.kg^{-1}$) was added to 27 mL of 0.5% ropivacaine. Normal saline was added to all the solutions to make a total volume of 30 mL. The procedure was performed by another anesthesiologist who was not aware of the composition of the drug solution. In the operating room, intravenous (i.v.) access was secured and injection midazolam 0.5–1 mg was given HR,MAP and oxygen SpO_2were recorded at the baseline and then every 10 min till the end of the surgery. Supraclavicular brachial plexus block was performed using a peripheral nerve stimulator. Sensory block assessment was done on a 4-point scale (1 – full sensation [sharp, same as control area]; 2 – weak sensation [sharp, less than control area]; 3 – light touch [can feel something, but not sharp]; and 4 – no sensation) in the distribution of median, radial, ulnar, and musculocutaneous nerves, every 2 min for 20 min after drug injection. The sensory block of Grade ≥3 was considered acceptable for surgery to proceed, and the time taken to achieve this was taken as the onset of sensory block.Motor blockade was evaluated using a 3-point scale (Grade 0 – normal motor function, ability to move arm; Grade 1 – decreased motor strength with ability to move fingers only; and Grade 2 – complete motor block with inability to move elbow, wrist, and fingers). The onset of motor block was taken as the time elapsed between drug injection and development of complete motor block (Grade = 2). The block was considered inadequate if a patient moved the arm or felt pinprick sensation even after 30 min of performing block. Single nerve sparing was treated with local infiltration or peripheral nerve block.

Quality of postoperative analgesia was evaluated at 2 Hrly till 24 h after the surgery using the VAS. Rescue analgesia in the form of injection diclofenac 75 mg i.v. was given on patient's demand. Duration of analgesia was defined as the time from the performance of block to the first rescue analgesic.

Statistical Analysis

Statistical analysis was performed using SSPS, Mean and standard deviation were used to represent the average and typical spread of values. The precision of estimates was shown as 95% confidence limits. Categorical data were expressed as frequency (%).Chi-square test was used for nonparametric data and ANOVA for parametric data.

RESULTS

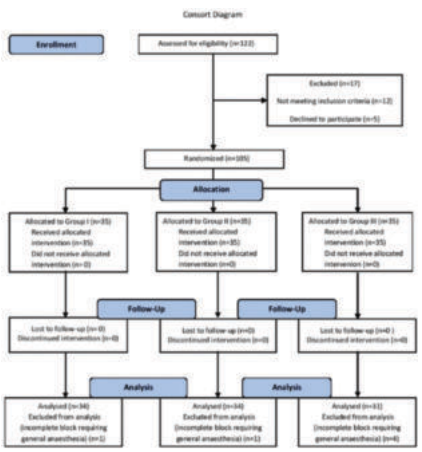


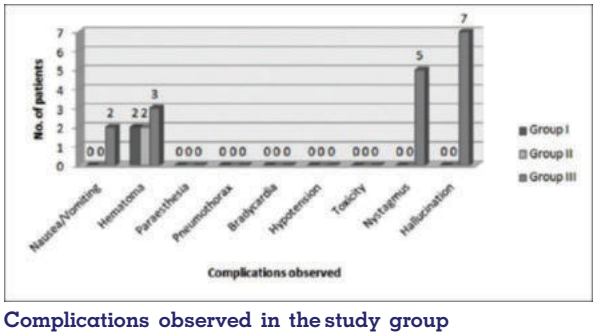
Figure 1

Table1 Effect of the study drugs on block characteristics

Variable	Group I (n=34)		Group II (n=34)		Group III (n=31)		P		
	Mean±SD	CI	Mean±SD	CI	Mean±SD	CI	I versus II	I versus III	II versus III
Onset of sensory block (min)	15.61±1.39	15.13-16.10	15.65±1.62	15.09-16.21	15.64±1.27	15.17-16.11	0.993	0.997	0.999
Onset of motor block (min)	20.26±1.69	19.67-20.85	21.11±1.52	20.58-21.63	21.00±1.26	20.53-21.46	0.056	0.129	0.950
Duration of sensory block (h)	5.35±0.58	5.14-5.55	7.18±1.02	6.83-7.53	5.16±0.65	4.92-5.39	<0.001*	0.590	<0.001*
Duration of motor block (h)	4.51±0.70	5.14-5.55	5.67±0.72	6.83-7.53	4.14±0.59	4.92-5.39	<0.001*	0.078	<0.001*
Duration of analgesia (h)	6.76±0.92	6.44-7.08	8.78±0.97	8.44-9.12	7.1±0.89	6.75-7.41	<0.001*	0.361	<0.001*

Table 2 Effect of the study drugs on analgesia for the first 24 h of postoperative period

Postoperative duration (h)	Visual analog score (mean±SD)			P		
	Group I (n=34)	Group II (n=34)	Group III (n=31)	I versus II	I versus III	II versus III
0	0.0±0.0	0.0±0.0	0.0±0.0			
2	0.0±0.0	0.0±0.0	0.0±0.0			
4	0.14±0.35	0.0±0.0	0.0±0.0	0.012*	0.012*	1.000
6	1.71±0.62	1.05±0.23	1.48±0.50	<0.001*	0.122	0.001*
8	3.54±0.61	1.94±0.80	3.08±0.56	<0.001*	0.014*	<0.001*
12	4.80±0.67	3.30±0.79	3.90±0.96	<0.001*	<0.001*	0.005*
24	6.08±0.61	5.08±0.95	5.11±0.75	<0.001*	<0.001*	0.987



Complications observed in the study group

CONCLUSIONS

The addition of $MgSO_4$ to ropivacaine in supraclavicular brachial plexus block significantly prolongs the duration of analgesia. $MgSO_4$ improves the quality of postoperative analgesia. However, among the two study drugs ($MgSO_4$ and ketamine), $MgSO_4$ proved superior in terms of block

characteristics (duration of sensory and motor blockade and duration of analgesia) and lesser incidence of side effects when used as an adjuvant to ropivacaine in supraclavicular brachial plexus block.

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