



Anaesthesiology

COMPARISON OF POTASSIUM CHLORIDE(0.2MMOLES) WITH MAGNESIUM SULPHATE(150 MG) AS AN ADJUVANT ON ONSET TIME OF SENSORY AND MOTOR BLOCK WITH USG GUIDED SUPRACLAVICULAR BLOCK IN ADULT SURGICAL PATIENTS.

Dr. Santosh Kumar Bhaskar

Associate Professor, Anaesthesiology, CMCH, Bhopal

Dr. Reetu Verma

Assistant Professor, Anaesthesiology, CMCH, Bhopal - Corresponding Author

ABSTRACT

Aim: This study was conducted to compare the effects of addition of 0.2 mmoles of KCl and 150mg of MgSO₄ as an adjuvant on the onset of motor and sensory blockade with USG guided supraclavicular block in adult surgical patients.

Material and methodology: The patients were randomly divided into 3 groups of 20 each into group A (KCl - 0.2 mmoles (1ml solution)), group B (MgSO₄-150mg (1ml solution)) and group C (Control-1 ml NS) added as adjuvant in USG guided SCB. Time of onset of sensory block(T1), motor block (T2), Time of onset of Peak sensory block(T3) and Peak motor block(T4), and side effects, if any were noted.

Observation : The onset of (T1), (T2), (T3) and (T4) was earliest in Group A KCl respectively followed by Group B MgSO₄ and last in Group C Control respectively.

Conclusion : KCl reduces the onset of sensory and motor blockade than MgSO₄, when used as an adjuvant in USG guided SCB.

KEYWORDS : USG guided SCB, adjuvant, KCl, MgSO₄

INTRODUCTION

Since the discovery of local anaesthetic drugs, the anaesthesiologists have become increasingly involved in the provision of postoperative analgesia; the need of pain relief during surgery without loss of consciousness is appreciated more, both by anaesthesiologists and surgeons.^(1,2)

In the past two decades three factors have brought about a reappraisal of regional techniques. Firstly a local block in combination with controllable sedation so that the patient stay awake during surgery and secondly realization has grown that excellent post-operative pain relief can be provided easily and in no time to the patient with an appropriate regional blockade⁽³⁾.

Ultrasound (USG)-guided supraclavicular brachial plexus block allows better visualisation of underlying structures, movement of needle and direct spread of local anaesthetic and thereby making procedure safe and effective as compared to nerve stimulator-guided technique.⁽⁴⁾

It is safe to perform USG guided Supraclavicular block using smaller volume of local anaesthetic as low as 20 ml. Several studies have added different forms of adjuvants to reduce the onset time of block and increase post operative analgesia by adding potassium chloride and magnesium sulphate as adjuvant^(5,6) thus, we undertook this study to compare the effect of potassium chloride (0.2 mmol) and Magnesium sulphate (150mg) in onset time of sensory and motor blockade when added to a mixture of 2% lignocaine with adrenaline 1:200,000 and 0.5% bupivacaine against a control group where normal saline was added.

MATERIALS AND METHODOLOGY

This study was conducted after research committee approval to compare the effects of adjuvants 0.2 mmoles of KCl (group A), 150mg of MgSO₄ (group B) and Normal saline (group C) to local anaesthetic mixture of 2% lignocaine (10ml) with adrenaline and 0.5% bupivacaine (10ml) in USG guided supraclavicular brachial plexus block, in patients undergoing elective surgeries of upper limb, medium duration (<90 min) on 60 patients of either sex, in the age range of 16-65 yrs, belonging to ASA I & II.

The patients were randomly divided into 3 groups of 20 each by a lottery method. We use ultrasound guidance whenever a supraclavicular block is performed in order to minimize the chance of vascular puncture. The ultrasound probe is placed in a transverse position just above the clavicle. The carotid artery and internal jugular vein are visualized. The subclavian artery is identified by moving the transducer laterally along the clavicle and directing the transducer toward the first rib. The brachial plexus at the level of the divisions appears as a "bag of grapes" lateral to the subclavian artery (Fig 1). The needle is inserted in-plane (parallel to the probe), and local anaesthetic

solution is injected to hydrodissect between the nerves until the tip reaches the location known as the "eight ball in the corner pocket" position, bordered by the subclavian artery medially, the first rib inferiorly, and the divisions of the brachial plexus superior laterally^(7,8) and following were noted

- Time of onset of sensory and motor block
- Time of Peak sensory and motor blockade
- Haemodynamic parameters (Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, SPO2 & Respiratory Rate) periodically.
- Side effects of addition of 0.2 mmoles of KCl and 150mg of MgSO₄, if any (nausea, vomiting, shivering, hypotension, bradycardia and respiratory depression)

The onset and spread of sensory and motor loss was assessed using scores proposed by Parris and Chambers. Sensory loss was assessed by pinprick method, using a short beveled 25 G needle as:

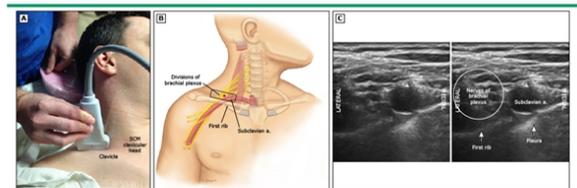
- 0 – sharp pain
- 1 – touch only
- 2 – not even touch sensation

Motor block was assessed as:

- 0 – patient was asked to move arm against resistance
- 1 – inability to move wrist elbow against resistance
- 2 – inability to move wrist and elbow against gravity
- 3 – inability to move the arm

Time in minutes to achieve effective sensory and motor blockade was recorded in each case. A close watch on each patient was kept to look for any complications during the operative procedure and in the post-operative period. At the end of the procedure all the patients were shifted to the recovery room and monitored every 15 minutes for 1st hour in Post Anaesthesia Recovery Room. Side effects if any were recorded. The observations recorded were tabulated and subjected to statistical analysis by applying SPSS software version 10.

Supraclavicular brachial plexus block



The ultrasound probe is placed in a transverse position just above the clavicle. The needle insertion site is guided by the ultrasound image, and is usually approximately where the red dot appears in the middle panel. The brachial plexus appears as a "bag of grapes" just lateral to the subclavian artery, as in the ultrasound image in the right panel. For further details, refer to the UpToDate content on supraclavicular block.

(Fig 1)

OBSERVATION AND RESULTS

Table 1: Patients characteristics in different groups

Sex	Group A (%)	Group B (%)	Group C (%)	Total (%)
Male	15 (25)	19 (31.66)	14 (23.33)	48 (80)
Female	5 (8.33)	1 (1.66)	6 (10)	12 (20)
ASA grade	Group A (%)	Group B (%)	Group C (%)	Total (%)
I	17 (28.33)	18 (30)	15 (25)	48 (80)
II	3 (5)	2 (3.33)	5 (8.33)	12 (20)
Parameter	Group A	Group B	Group C	P Value
	Mean \pm SD (n=20)	Mean \pm SD (n=20)	Mean \pm SD (n=20)	
Age (Yrs)	30.25 \pm 11.82	31.75 \pm 14.01	30.8 \pm 13.35	>0.05
Weight (Kg)	59.64 \pm 10.02	62.45 \pm 8.36	62.9 \pm 11.68	>0.05

Patients Sex, ASA status, Mean age and weight in all the three groups were comparable.

Table 2: Comparison of onset time and peak sensory Response In Study Groups

Time (min)	Group A	Group B	Group C	F Value	P Value
	Mean \pm SD (n=20)	Mean \pm SD (n=20)	Mean \pm SD (n=20)		
Onset Sensory (T1)	4 \pm 2.44	4.85 \pm 2.71	7.1 \pm 2.17	8.49	<0.01
Peak Sensory (T3)	10.7 \pm 3.51	12.15 \pm 3.70	14.45 \pm 3.01	6.10	<0.01

Onset of sensory block and peak sensory response in all the three groups were compared applying "ANOVA" test and showed statistically significant difference.

The onset of sensory block was earlier in Group A: KCl (4 \pm 2.44 mins) as compared to Group B: MgSO₄ (4.85 \pm 2.71 mins) & Group C: Control (7.1 \pm 2.17 mins). The Peak sensory response was earlier in Group A: KCl (10.7 \pm 3.51 mins) as compared to Group B: MgSO₄ (12.15 \pm 3.70 mins) & Group C: Control (14.45 \pm 3.01 mins)

Table 3: Comparison of onset time and peak motor response time in study groups

Time(min)	Group A	Group B	Group C	F Value	P Value
	Mean \pm SD (n=20)	Mean \pm SD (n=20)	Mean \pm SD (n=20)		
Onset Motor (T2)	5.95 \pm 2.43	6.9 \pm 3.16	9.7 \pm 2.51	10.24	<0.01
Peak Motor response (T4)	13.6 \pm 3.33	14.5 \pm 3.62	17.15 \pm 2.70	6.48	<0.01

Onset of motor block and peak motor response in all the three groups were compared applying "ANOVA" test and showed statistically significant difference.

The onset of motor block was earlier in Group A: KCl (5.95 \pm 2.43 mins) as compared to Group B: MgSO₄ (6.9 \pm 3.16 mins) & Group C: Control (9.7 \pm 2.51 mins). The Peak motor response was earlier in Group A: KCl (13.6 \pm 3.33 mins) as compared to Group B: MgSO₄ (14.5 \pm 3.62 mins) & Group C: Control (17.15 \pm 2.70 mins)

Table 4: Side effects in study groups

Side effects	Gr. A (n=20)	Gr. B (n=20)	Gr. C (n=20)
Nausea	2 (3.33)	2 (2.33)	3 (5)
Vomiting	2 (3.33)	3 (5)	2 (3.33)
None	16 (26.66)	15 (25)	15 (25)

DISCUSSION

Adjuvants like neostigmine⁽⁹⁾ sodium bicarbonate⁽¹⁰⁾, clonidine⁽¹¹⁾, enzyme⁽¹²⁾, buffer and carbonated solutions⁽¹³⁾, opioids have all been tried in the past for nerve block. They have been proved to enhance the onset of action and prolong the duration of the block.

It has been well established by several authors^(14,15) that peripheral NMDA receptors exist and have role in nociceptive pain. It has also been proved that magnesium sulphate as NMDA antagonist suppresses pain^(6,16).

Potassium salts were first used as adjuvants to local anaesthetics in

1912. Several authors^(5,17) conducted a study and concluded that the addition of potassium chloride to local anaesthetic solutions in order to increase the extracellular potassium and depolarize the membrane results in faster uptake of the drug by the tissues.

Hence our study compared the effect of 0.2 mmoles of potassium chloride and 150 mg magnesium sulphate as an adjuvants on onset of sensory and motor blockade in USG guided supraclavicular block.

In our study both potassium chloride and magnesium sulphate reduces the time taken for onset and peak of sensory and motor blockade significantly which is similar to studies done by Parris et al⁽¹⁸⁾ and Khosa et al⁽¹⁹⁾. Though the study by Parris was conducted on axillary block, the results were similar to our study.

The most interesting result from our study was that 0.2 mmoles of potassium chloride reduces the onset of sensory and motor blockade when compared to 150 mg of magnesium sulphate.

SIDE EFFECTS

In present study, we monitored for the following side effects.

Drowsiness, Nausea, Vomiting, Excessive sedation, Bradycardia, Hypotension and Respiratory depression. Side - effects in all the three groups were compared using "chi-square test" and there was no statistically significant difference analyzed.

There were no serious side effects in the 60 study patients. 4 patients in Group A and 5 patients in group B and group C control experienced nausea and vomiting and were treated with Inj. ondansetron 4mg I/V.

CONCLUSION:

- Thus, it is concluded that, addition of Potassium chloride in strength of 0.2 mmoles and Magnesium sulphate in strength of 150mg to a mixture of lignocaine and bupivacaine local anaesthetic solution, given by USG guided supraclavicular approach for brachial plexus block, provides faster onset of sensory and motor blockade without any major side effects, requiring any kind of intervention.

LIMITATIONS OF THE STUDY

- Since 'pain' is a subjective phenomenon associated with a wide variability of responses among the individuals, it is difficult to standardize the variable. What may be tolerable for one person may be intolerable for another. Under these circumstances, it is difficult to assess and grade the pain in the same manner and this may lead to some bias in the study.
- In our study we have given the fixed dose of the study drugs irrespective of the patient's age, weight or body surface area.

REFERENCES

- Burnham PJ; Simple regional nerve blocks for surgery of hand and forearm region. Journal of American Medical Association 1959; 169: 941-43.
- P Prithvi Raj; 'The problem of Postoperative Pain' in Postoperative Pain Management, 1st edition F. Michael Ferrante: Churchill Livingstone, New York, 1993; 01-04.
- Anibal G, Witcher T; Mixture of Local Anaesthetics Bupivacaine & Chlorprocaine. Anaesth. Analg. 1980; 59: 683.
- Duncan M, Shetti AN, Tripathy DK, Roshansingh D, Krishnaveni N. A comparative study of nerve stimulator versus ultrasound-guided supraclavicular brachial plexus block. Anesth Essays Res 2013; 7:359-64.
- Shivani V, G. Srinivas Rao, R. Pandu Naik, Mohd Azmathullah Hussain. Comparative study on the onset time and duration of brachial plexus block with addition of potassium chloride to bupivacaine versus plain bupivacaine. Asian Pac. J. Health Sci., 2016; 3 (3):24-29.
- Verma V, Rana Shelly, Chaudhary Sudarshan Kumar, Singh Jai, Verma Ravinder Kumar, Sood Saloni. A dose-finding randomised controlled trial of magnesium sulphate as an adjuvant in ultrasound-guided supraclavicular brachial plexus block. Year : 2017 | Volume: 61 | Issue Number: 3 | Page: 250-255.
- Soffer RJ, Rosenblatt MA. Teaching ultrasound-guided interscalene blocks: description of a simple and effective technique. J Clin Anesth 2007; 19:241.
- Soares LG, Brull R, Lai J, Chan VW. Eight ball, corner pocket: the optimal needle position for ultrasound-guided supraclavicular block. Reg Anesth Pain Med 2007; 32:94.
- Bone HG, Van Aken H, Booke M et al. Enhancement of axillary brachial plexus block anesthesia by co-administration of neostigmine. Regional Anesth Pain Med 2002; 25 (3): 323-4.
- Ozer H, Solak S, Oguz T et al. Alkalinization of local anesthetic prescribed for pain relief after surgical decompression of carpal tunnel syndrome. Journal of Orth Surgery 2005; 13 (3): 265-289.
- El Saied AH, Steyun MP, Anesermoino JH. Clonidine prolongs the effect of ropivacaine for axillary plexus blockade. Can. J Anaesth 2000; 47: 962-7.
- Raj PP, Text book of Regional Anesthesia. Elsevier Churchill Livingstone Philadelphia. 1st ed. 2002; 3.
- Nickel P, Bromage PR et al. Comparison of hydrochloride carbonated salts of lidocaine for epidural analgesia. Reg. Anesth 1986; 11:62.
- Kitahata LM, Taub A, Kosata Y; Lamina specific suppression of dorsal horn unit activity by Ketamine hydrochloride. Anaesthesiology 1973; 39: 37-43.

15. Coggeshall RE, Carlton SM; Ultra structural analysis of NMDA kinase receptors in unmyelinated and myelinated axons I periphery. *Journal of Neurology* 1998; 391: 78-86.
16. Iwatsu O, Takahiro V, Toshikazu T, Nada B; Peripheral administration of Ketamine hydrochloride and Magnesium sulphate produces hypoesthesia to mechanical stimuli in man. *Journal of Health science* 2002; 48(1): 69-72.
17. Okamura RK; Effects of pH adjusted lidocaine solutions on the compound action potential in intact rats sciatic nerves. *Anaesthesiology* 1987; 67: 281.
18. Parris MR, Chambers WA; Effects of addition of physiological concentration of KCl to prilocaïne & bupivacaïne. *British Journal of Anaesthesia* 1986; 58: 297.
19. Khosa DS, Thind SS, Gupta SS, Gupta HK; Effects of addition of KCl to lignocaine and bupivacaïne solution on the onset and duration of brachial plexus block. *Indian Journal of Anaesthesia* 1990; 38: 119.