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Adenosine and Magnesium Sulphate Vs Bupivacaine in Infraclavicular Infusion for Upper Limb Surgeries and Post-Operative Analgesia: A Prospective Study

Ravi Gurbani

Associate Professor, Department of Anaesthesia, Pacific Medical College and Hospital, Udaipur, Rajasthan.

ABSTRACT

Background: *Brachial plexus piece has reformed the field of regional anesthesia for upper limb surgeries. Infraclavicular subcoracoid approach gives complete block without significant difficulties.* ***Aim:*** *To compare the additives adenosine and magnesium sulphate with bupivacaine in infraclavicular infusion for upper limb surgeries and postoperative analgesia.*

Methods*: This Prospective study was done at the Department of Anaesthesiology, Pacific Medical College and Hospital, Udaipur, Rajasthan. Around 30 patients scheduled for elective unilateral upper limb surgeries involving distal arm/ elbow/ forearm/hand divided into two groups A (n-15) and B (n-15) randomly. Group A - adenosine 6mgs with 28 ml 0.5% bupivacaine bolus followed by infusion of 0.25% bupivacaine 28ml with 6mgs of adenosine (2ml) at a rate of 5ml/hr. Group B - magnesium sulphate 75 mgs (in 2ml) with 28ml of 0.5% bupivacaine bolus followed by infusion of 0.25% bupivacaine 28ml with 75mgs of magnesium sulphate (in 2ml) at a rate of 5ml/hr in USG guided placement of infraclavicular catheter.*

Results*: Result s showed that Group A had a faster Onset time of sensory and motor block and faster recovery when compared to group B. Group A needed more rescue analgesia than group B. Though Group B had a higher incidence of sedation and vomiting than group A, it was not significant.*

Conclusions*: The addition of magnesium sulphate as an additive to bupivacaine in brachial plexus block may be a better choice when prolonged postoperative analgesia is required.*

Keywords: *Bupivacaine, Adenosine, Magnesium Sulfate, Brachial plexus block.*

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Corresponding Author
Dr. Ravi Gurbani, Associate Professor, Department of Anaesthesia, Pacific Medical College and Hospital, Udaipur, Rajasthan.

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INTRODUCTION

The infraclavicular brachial plexus block (ICB) is designed to deposit anesthetic high in the plexus, achieving anesthesia of the hand, forearm, elbow, and distal arm .[1] Adenosine is a metabolic intermediate that is involved in nearly all aspects of cell function, including neurotransmission and signal transduction inside the body. Adenosine has an important role in the central and peripheral mediation of pain. Adenosine A1, A2A, A2B, and A3 receptors were detected in the spinal cord. The A1 receptor plays an important role in spinal anti nociception whereas the role of the A2A, A2B, and A3 receptors is still vague. A2A and A3 receptors mediate pain transmission peripherally, whereas the A1 receptor seems to have a central anti-nociceptive effect.[2] Magnesium is the fourth most plentiful cation in the body and the second most plentiful intracellular cation after potassium. Anti-nociceptive effects of magnesium are due to regulation of calcium influx into the cell and antagonism of the N-methyl D-aspartate (NMDA) receptors. Many clinical investigations like Dogru et al[3] and Choi et al[4] have

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demonstrated that Mg administration in peripheral nerve plexus block has prolonged the analgesic effect and reduced postoperative analgesic consumption. Though magnesium has an analgesic property, it has not been studied well as an adjuvant to bupivacaine in infraclavicular brachial plexus block. The aim of this study to compare the additives adenosine and magnesium sulphate with bupivacaine in infraclavicular infusion for upper limb surgeries and postoperative analgesia.

METHODS

This prospective comparative study was undertaken on 30 enrolled patients at Department of Anaesthesiology, Pacific Medical College and Hospital, Udaipur, Rajasthan. 15 patients in each groups belonging to 20 to 50 years of age with weight less than 70kgs from both gender and ASA status 1 and 2 are included. After securing an intravenous line and Boyles machine check, multichannel monitor connected to read pulse rate, NiBp, Spo2, emergency drugs ready, patient sedated with Inj. Midazolam 2 mgs iv., Inj. ondansetron 4mgs iv, Inj. Ranitidine 50mgs iv. After scout scanning block performed under strict aseptic precautions.

Observation: Sensory (using pinprick test, 3 point score) and motor (using modified Bromage scale, 3 point score) blockade assessed every two minutes after the block From time of completion of block to the complete loss of sensation (anaesthesia) of all the four nerves (radial, ulnar, median, musculocutaneous) is noted as sensory onset time and loss of finger movements is motor onset time. Recovery is regained of all sensations in all areas of four nerves as sensory and all movements of fingers as motor recovery. Visual analog score, sedation (Ramsay sedation score), nausea and vomiting score, need for rescue analgesics and postoperative complications were observed. Unsuccessful block requiring general anesthesia are excluded from the study. Pain in postoperative ward managed with iv paracetamol 1gm (if VAS>4) and Inj. Fentanyl (if VAS>6).

RESULTS

No difference observed in Age, Gender, Height, Weight and Duration of surgery. Pulse rate, NIBP, SpO2 didn't show any statistical difference between groups. Complete sensory block occurred at 8 minutes in group A and in group B the complete block occurred at 10 minutes. There was a statistically significant difference at 8 and 10 minutes between the two groups regarding onset time. Group A (P value=0.045) had an earlier onset than group B (P value=0.006). Group A recovered from sensory effect at 40 hours and group B at 44 hours completely. There was a statistically significant difference .Group A (P value 0.006) recovered earlier than group B (P value=0.002). Complete motor block occurred at 10 minutes in group A and group B took 14 minutes for complete motor block. There was a statistically significant difference between two groups at 10 minutes (P value 0.006) and 14 minutes (P value=0.006). Group A recovered completely at 28 hours and group B at 32 hours. Group A (P value=0.002) and group B (P value=0.093) and it is statistically significant. There is a significant difference in pain (VAS) score from 4 minutes (P value <0.001) to 14minutes (P value 0.001) and from 28hrs (P value <0.0001) to 48 hrs (p value =0.011). Group A had pain relief at 8 minutes and B had at 10 minutes and group B had better pain score for prolonged time (44 hours) than group A (40 hours). Regarding sedation there was no statistically significant difference between two groups. Regarding nausea and vomiting score there was no statistically significant difference between two groups noted. Group B had more duration of analgesia (44 hours) than group A (40 hours) Group B needed lesser amount of rescue analgesics. No complications observed in both groups intraoperatively and postoperatively. Long term complications not observed due to patient poor compliance in follow up.

DISCUSSION

Infraclavicular subcoracoid brachial plexus block is deposition of local anaesthetic at the cord level where all the nerves supplying upper limb lie in a compact manner to get anaesthetized completely without much complications than other approach when performed under ultrasound guidance.[1] The deposition of local anaesthetics alone cannot give prolonged duration of analgesia. Hence addition adjuvants are practiced. Here we added adenosine and magnesium sulphate as adjuvant and compared the effects of both drugs. Fukunga et al.[5] and Gan et al.[6] studied the pain reducing effect of adenosine

In major surgeries by acting on adenosine receptors and found to be a good non-opioid analgesic in perioperative setting. Dogru et al, Choi et al.[3] used magnesium sulphate in their study and found magnesium sulphate gives postoperative analgesia by blocking NMDA receptors. The demographic profile is not statistically significant in our study as stated in Gunduz et al study and hemodynamic parameters also not showed any statistically significant difference between two groups.[7] The sensory and motor onset time is early in group A than in group B. Recovery from sensory and motor effect is faster with group A than group B. Khaleed et al in their study concluded that adenosine has shorter onset time, lower mean VAS score over 48 hours.[8] Ekmeckzi et al found the delayed onset and prolonged duration of analgesia when magnesium is given in femoral nerve block.[9] Magnesium sulphate gives prolonged duration of analgesia and better pain scores than adenosine in our study. Dogru et al and Choi et al used magnesium in brachial plexus block and found prolonged analgesia and better pain scores.[3,4] Kasturi et al.[10] in supraclavicular route, Lee et al in interscalene route and Gunduz et al[7] in axillary route in their study concluded the delayed onset and prolonged analgesic action and motor blockade of magnesium when used in brachial plexus block. The decreased duration of analgesic action of adenosine is due to rapid metabolism is stated in studies of Apan et al.[11] and Khaleed et al.[8] They need continuous infusion for prolonged effect. Group B needed less rescue analgesics.

Lee et al[12] study also got the same result. Khaleed et al in his study claimed 48 hrs of good VAS score with infusion of 10ml/hr of adenosine 12mgs for two hours.[8] We infused for six hours at a rate of 5ml/hr with 6mgs of adenosine. Sensory effect lasted for 44 hours. Sedation score; nausea and vomiting score did not show much difference between the two groups. Choi etal in their study has observed no significant difference regarding the same.[13]

CONCLUSION

Continuous infusion of adenosine when compared to magnesium sulphate has shorter onset time for both sensory and motor blockade and recovers earlier from both effects. The magnesium sulphate takes a little longer time for its onset but gives prolonged duration of analgesia and better pain score postoperatively. Hence the addition of magnesium sulphate as an additive to bupivacaine in brachial plexus block may be a better choice when prolonged postoperative analgesia is required.

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