

# Study of sedation levels and adverse effects axillary brachial plexus block with magnesium sulphate and bupivacaine

Priyanshu Sharma<sup>1</sup>, Richi Chauhan<sup>2</sup>, Ambika Negi<sup>3\*</sup>

<sup>1,2</sup>Department of Anaesthesia, Civil Hospital Theog, Shimla, Himachal Pradesh, INDIA.

<sup>3</sup>Department of Anaesthesia DDU Zonal Hospital Shimla, Himachal Pradesh, INDIA.

Email: [priyanshusharma27@gmail.com](mailto:priyanshusharma27@gmail.com)

## Abstract

**Background:** Addition of adjuncts not only decreases onset of block but also prolong the effect of local anaesthetics to provide adequate and long post-operative analgesia. Many authors have reported that magnesium is associated with a reduced analgesic requirement and less discomfort in the postoperative period. We intended to study the sedation levels and adverse effects axillary brachial plexus block with magnesium sulphate and bupivacaine. **Material and Methods:** Present prospective, observational study was conducted in 15-70 years age patients of either gender, ASA I/II, posted for elective forearm and hand surgeries under axillary brachial plexus block. **Results:** During study period 30 patients were considered for present study. Mean age was  $39.27 \pm 15.52$  years. Male (90%) predominance was noted. Most patients were ASA grade I (73%). In present study mean onset of sensory block was  $9.47 \pm 2.60$  min and mean duration of block was  $8.48 \pm 1.64$  hours. According to modified bromage scale mean degree of block was  $2.56 \pm 0.50$ . Rescue analgesia was required after  $8.48 \pm 1.64$  hours. Sedation score was assessed by using the Modified observer's assessment of alertness/sedation scale (MOAAS) for 12 hrs. after 0 min i.e. time from the start of the surgery. Score was given from 0 to 5. At 30-60 min maximum patients had score of 3, after 90 min score for maximum patients was 4 and score was 5 after 4 hrs. 7% patients complained of giddiness. No patient had nausea, vomiting, local trauma and bradycardia /tachycardia. **Conclusion:** Sedation scores were assessed using MOAAS and at 30-60 min maximum patients had score of 3, after 90 min score for maximum patients was 4 and score was 5 after 4 hours. Minor adverse effects were noted. **Keywords:** sedation levels, axillary brachial plexus block, magnesium sulphate, bupivacaine.

## \*Address for Correspondence:

Dr Ambika Negi, Department of Anaesthesia DDU Zonal Hospital Shimla, Himachal Pradesh, INDIA.

Email: [ambikanegi88@gmail.com](mailto:ambikanegi88@gmail.com)

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## INTRODUCTION

Peripheral nerve blocks provide intraoperative anaesthesia and also extend analgesia in the post-operative period without any systemic side-effects. One of the most commonly used peripheral nerve block is brachial plexus

block which has an advantage over general anaesthesia like avoiding airway instrumentation, polypharmacy, decreased incidence of nausea and vomiting, early mobilization and extended postoperative analgesia.<sup>1</sup> A variety of approaches to the brachial plexus block have been described such as supraclavicular, axillary, interscalene etc. The axillary approach for brachial plexus block is most commonly used in hand, wrist and lower forearm surgeries because it is relatively easy and has few side-effects.<sup>2</sup> Addition of adjuncts not only decreases onset of block but also prolong the effect of local anaesthetics to provide adequate and long post-operative analgesia. Magnesium, the second most abundant intracellular cation (second to potassium), has been identified for its antinociceptive effects in animal and human models of pain<sup>3</sup> and for its role in providing postoperative analgesia due to its harmless nature. Many authors have reported that

magnesium is associated with a reduced analgesic requirement and less discomfort in the postoperative period.<sup>4,5</sup> We intended to study the sedation levels and adverse effects axillary brachial plexus block with magnesium sulphate and bupivacaine.

**MATERIAL AND METHODS**

Present prospective, observational study was conducted in patients posted for forearm and hand surgeries under axillary brachial plexus block. Study was conducted in department of anaesthesiology and intensive care at Indira Gandhi medical college, Shimla, during August 2018 to July 2019. Institutional ethical committee approval was taken.

**Inclusion Criteria:** 15-70 years age patients of either gender, ASA I/II, posted for elective forearm and hand surgeries.

**Exclusion Criteria:** Infection at injection site, coagulopathy, uncontrolled hypertension and diabetes mellitus. Difficult positioning. Known hypersensitivity to local anesthetic agent, Not willing to participate.

The study was explained and written informed consent was obtained from the patients for participation in the study. Patient details (demographic, medical history, examination findings, investigations) were noted. Anaesthetically fit

patients were posted for surgery. Patients were kept NBM 6 hours before the surgery. Standard monitors were attached for pulse rate, respiratory rate, oxygen saturation (SpO<sub>2</sub>), blood pressure and ECG monitoring. All patients received slow intravenous injection fentanyl 50 microgram before performing the axillary brachial plexus block. Patients were positioned supine with the arm abducted, forearm supinated and elbow flexed with the hand either behind or above the head avoiding excessive abduction obscuring axillary artery and veins and limiting proximal spread of the local anaesthetic. Under all aseptic precautions axillary brachial plexus block under ultrasound guidance with 0.375 % bupivacaine + 250 mg magnesium sulphate (total volume- 30 ml) was given. Sensory block assessment was done by Hollmen's scale and motor block by modified bromage scale. Postoperative pain assessment was done by VAS (visual analogue scale) every 30 minutes for first 2 hours and then 2 hourly for next 10 hours. Onset of sensory block, degree of motor block, duration of block were noted. Patients were observed for any side effects intraoperatively and postoperatively such as nausea, vomiting, local trauma, giddiness, bradycardia and tachycardia. Sedation scoring was assessed by using the Modified observer's assessment of alertness/sedation scale.

**Modified Observer's Assessment of Alertness/Sedation Scale (MOAAS)**

LEVEL	RESPONSE
5.	Responds readily to name spoken in normal tone
4.	Lethargic response to name spoken in normal tone
3.	Response only after name is called loudly and/or repeatedly
2.	Response only after mild prodding or shaking
1.	Response only after painful trapezius squeeze
0.	No response after painful trapezius squeeze

All findings were noted in proforma, entered in Microsoft excel sheet and analysed in form of descriptive statistics (mean ± SD, percentages).

**RESULTS**

During study period 30 patients were considered for present study. Mean age was 39.27 ±15.52 years. Male (90%) predominance was noted. Most patients were ASA grade I (73%).

**Table 1: General characteristics**

General characteristics	Mean ± SD/ No. of patients (percentages)
Age (in years)	39.27 ±15.52
Gender	
MALE	27 (90%)
FEMALE	3 (10%)
ASA grade	
I	22 (73%)
II	8 (27%)

In present study mean onset of sensory block was 9.47 ±2.60 min and mean duration of block was 8.48 ± 1.64 hours. According to modified bromage scale mean degree of block was 2.56 ± 0.50. Rescue analgesia was required after 8.48 ± 1.64 hours.

**Table 2:** Intra-operative and post-operative findings

Intra-operative and post-operative findings	Mean $\pm$ SD
Onset of sensory block (min)	9.47 $\pm$ 2.60
Duration of block (hrs)	8.48 $\pm$ 1.64
Degree of block (Modified bromage scale)	2.56 $\pm$ 0.50
Rescue analgesia (hrs)	8.48 $\pm$ 1.64

Sedation score was assessed by using the Modified observers assessment of alertness/sedation scale (MOAAS) for 12 hrs. after 0 min i.e. time from the start of the surgery. Score was given from 0 to 5. At 30-60 min maximum patients had score of 3, after 90 min score for maximum patients was 4 and score was 5 after 4 hrs

**Table 4:** Sedation score

	0 min	30 min	60 min	90 min	4 hrs	6 hrs	8 hrs	10 hrs	12 hrs
Score 0	0	0	0	0	0	0	0	0	0
Score 1	0	0	0	0	0	0	0	0	0
Score 2	0	0	1	0	0	0	0	0	0
Score 3	0	17	17	4	0	0	0	0	0
Score 4	4	7	9	21	22	7	0	0	0
Score 5	25	6	4	5	8	23	30	30	30

In our study 7% patients complained of giddiness. No patient had nausea, vomiting, local trauma and bradycardia /tachycardia

**Table 4:** Side Effects

Side Effects	No. of patients (percentages)
Giddiness	2 (7%)

## DISCUSSION

Ultrasound guided axillary brachial plexus block is a safe and reliable anaesthetic technique for forearm and hand surgeries. It provides ideal surgical conditions with stable haemodynamics, postoperative pain relief and help early ambulation. Real time ultrasound has become gold standard to localize the peripheral nerve or nerve plexus, helps in accurate needle placement and verification of local anaesthetic spread in the appropriate tissue planes. Although the mechanism of analgesia produced by magnesium is not fully understood, many authors have reported that magnesium is associated with less postoperative discomfort and reduced analgesia requirement via different roots of administration. Most of these studies have investigated systemic and neuraxial administration of magnesium whereas peripheral nerve block studies with magnesium are rare.<sup>6,7,8</sup> The primary hypothesis for the analgesic properties of magnesium on peripheral nerves is the surface charge theory by Akutagawa *et al.*,<sup>9</sup> which showed that modulation of the external magnesium concentration bathing a nerve bundle resulted in enhancement of the nerve blockade due to local anesthetics. Mert *et al.*,<sup>10</sup> reported that a high concentration of divalent ions (Magnesium and Calcium) attracted by the negative charges of the outer membrane surface affected sodium channel gating and could cause hyperpolarization. If the nerve fiber is hyperpolarized it is more difficult to achieve the threshold level resulting in nerve conduction block. Another possible mechanism for the analgesic

action of magnesium is the voltage-dependent antagonism of NMDA receptors, leading to the prevention of central sensitization from peripheral nociceptive stimulation and a decrease in acute pain after tissue injury. In several investigations showing effective analgesia due to magnesium sulphate, magnesium was administered via the intravenous or neuraxial route where analgesic effect through NMDA receptors could have been the possible mechanism.<sup>11</sup> However, involvement of NMDA receptors in peripheral blocks is less certain as seen in study by Lee *et al.*,<sup>12</sup> reporting no enhancement of the duration of interscalene nerve block when ketamine, the NMDA antagonist, was added to ropivacaine. The dose used in our study was in accordance with the study by Varsha V *et al.*,<sup>5</sup> where they compared two doses of magnesium sulphate (125 mg and 250 mg) as an adjuvant with bupivacaine in USG guided supraclavicular brachial plexus block and found that 250 mg magnesium has greater efficacy with respect to onset and duration of sensory block without any toxicity with this dose. Sedation score was assessed by using the Modified observers assessment of alertness/sedation scale (MOAAS) for 12 hrs. after 0 min, i.e. time from the start of the surgery. In present study till 60 min maximum patients had a sedation score of 3 this may be due to 50microgram fentanyl given by us to all the patients before the block. Similar sedation scores were noted by Lee *et al.*<sup>12</sup> Lee *et al.*<sup>12</sup> enrolled 66 patients undergoing arthroscopic rotator cuff repair and performed interscalene nerve block with 0.5% bupivacaine 20 ml with

epinephrine (1: 200, 000) plus either 10% magnesium sulphate 2 ml (magnesium group) or normal saline 2 ml (saline group). Sedation was assessed on a four-point scale at 4, 8, 12 and 24 hr. postoperatively and no statistically significant difference between the magnesium and saline groups in relation to sedation score was found. Patients were evaluated for any side effects after the block such as local trauma, nausea, vomiting, bradycardia, tachycardia, giddiness etc. In group M no patient complained of nausea and 2 complained of giddiness whereas out of 30 patients in group M, 1 patient complained of nausea and 2 out of 30 complained of giddiness. In the study by Gyu choi *et al.*,<sup>13</sup> where the effect of postoperative brachial plexus block was noted by adding MgSO<sub>4</sub> to ropivacaine and the side effects were recorded and the results were similar to our study with no significant adverse effects noted. Al Refaey K, *et al.*<sup>14</sup> randomized 90 patients into three groups, control group (C group), bupivacaine group (B group), and bupivacaine and magnesium group (M group). In this study there was a significant lower incidence of postoperative nausea and vomiting in magnesium group (32% for C group, 6% B group, 7% M group, P < 0.004) as compared to control and plain bupivacaine group. In patients undergoing orthopedic upper limb surgeries, unrelieved post-operative pain not only result in immediate distress to the patient but also predisposes patient to development of chronic pain by central sensitization of nervous system causing exacerbation of acute nociceptive pain and resulting in allodynia and hyperalgesia along with chronic pain syndrome.<sup>15</sup> Regional anaesthesia techniques provide important advantages over general anaesthesia including excellent pain control, reduced side-effects, and short stay in the post-anaesthesia care unit.

## CONCLUSION

Sedation scores were assessed using MOAAS and at 30-60 min maximum patients had score of 3, after 90 min score for maximum patients was 4 and score was 5 after 4 hours. Minor adverse effects were noted. Early onset of sensory block, increase in duration of sensory block, better analgesia was noted with magnesium sulphate with bupivacaine.

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