

Comparative study of onset and duration of sensory block with magnesium sulphate and bupivacaine versus bupivacaine only in axillary brachial plexus block under ultrasound guidance

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Abstract

Background: The axillary approach is most commonly used in hand, wrist and lower forearm surgeries because it is relatively easy and has few side-effects. 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. In present study, we compared onset and duration of sensory block with magnesium sulphate and bupivacaine versus bupivacaine only in axillary brachial plexus block under ultrasound guidance. **Material and Methods:** Present study was a controlled prospective randomized study, conducted in 18-70 years age patients, ASA status I/II posted for elective forearm and hand surgeries under axillary brachial plexus block. Patients were randomly allocated in group M (30 ml 0.375 % bupivacaine + 250 mg magnesium sulphate) and group P (30 ml 0.375% bupivacaine). **Results:** In present study 30 patients each were randomly allocated group M and group P. General characteristics such as age, gender and ASA status were comparable in both groups. The onset for sensory block for group M was 9.47 ± 2.60 min, in group P was 13.57 ± 3.48 min and difference was highly significant (p value < 0.001). The mean duration of block in group M was 8.48 ± 1.64 hrs and in group P was 5.55 ± 0.86 hrs with p values < 0.001 which was highly significant. The mean value of motor blockade was graded according to Modified Bromage scale for group M was 2.56 ± 0.50 and for group P was 2.70 ± 0.47 , difference was not significant. The mean duration of demand of rescue analgesia in group M was 8.48 ± 1.64 hrs. and in Group P was 5.55 ± 0.86 hrs. with highly significant p values of < 0.001 . **Conclusion:** Magnesium sulphate with bupivacaine as compared to plain bupivacaine had early onset of sensory block, increase in duration of sensory block, better analgesia without any significant untoward side effect.

Keywords: sensory block, bupivacaine, magnesium sulphate, axillary brachial plexus block.

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INTRODUCTION

Pain is a distressing feeling often caused by intense or damaging stimuli. For all the patient undergoing surgery, intraoperative and postoperative pain is an anticipated and feared consequences. Peripheral nerve blocks not only provide intraoperative anaesthesia but also extend analgesia in the post-operative period without any systemic side-effects. A variety of approaches to the brachial plexus block have been described such as supraclavicular, axillary, interscalene etc. The axillary approach is most commonly used in hand, wrist and lower forearm surgeries

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because it is relatively easy and has few side-effects.¹ For axillary brachial plexus block ultrasound guidance continues to grow in popularity as a method of nerve localization and has the advantage of allowing real time visualization of the plexus, pleura and vessels along with the needle and local anaesthetic spread.² 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. Opioids (buprenorphine, morphine, fentanyl, tramadol), NMDA antagonists (ketamine, magnesium), GABA agonists (midazolam), adrenergic agonists (adrenaline, clonidine, dexmedetomidine),^{3,4} corticosteroids (dexamethasone),⁵ COX inhibitors (ketorolac), Ach esterase inhibitors (neostigmine) etc. were studied as adjuvants in peripheral nerve blocks. In present study, we compared onset and duration of sensory block with magnesium sulphate and bupivacaine versus bupivacaine only in axillary brachial plexus block under ultrasound guidance.

MATERIAL AND METHODS

Present study was a controlled prospective randomized study, conducted in department of anaesthesiology and Intensive Care at Indira Gandhi Medical College, Shimla. Study period was from August 2018 to July 2019 (1 year). Study was approved by institutional ethical committee

Inclusion criteria: 18-70 years age patients, ASA status I/II posted for elective forearm and hand surgeries.

Exclusion criteria: Uncontrolled hypertension and diabetes mellitus. Infection at injection site. Known hypersensitivity to local anesthetic agent. Coagulopathy. Not willing to participate Patients demographic details, examination findings, laboratory and radiological investigations were noted. Pre anaesthetic evaluation and fitness done. Fit patients were kept nil per orally for 6 hrs. before the scheduled surgery. The nature of study was explained to the patient and his attendants in their own language and written informed consent was obtained from the patient for participation in present study. Patients were randomly allocated to one of the two groups.

Group M: were given axillary brachial plexus block under ultrasound guidance with 0.375 % bupivacaine + 250 mg magnesium sulphate (total volume- 30 ml).

Group P: were given axillary brachial plexus block under ultrasound guidance with 0.375% bupivacaine (total volume 30 ml). In operation theatre, pulse rate, respiratory rate, oxygen saturation (SpO₂), noninvasive blood pressure (NIBP) and ECG were recorded. Slow intravenous injection fentanyl 50 microgram was given to all the patients before performing the axillary brachial plexus block. Axillary brachial plexus block was given under all aseptic precautions, under ultrasound guidance. Sensory block assessment was done by Hollmen's scale and motor block by modified bromage scale. Degree of motor block was graded according to modified bromage Scale for upper limb before the start of surgery.

Modified Bromage Scale

Degree 0	Absence of movements
Degree 1	Discrete movements (trembling) of muscle groups
Degree 2	Ability to move against gravity, but not against resistance
Degree 3	Strength reduction, but able to move against resistance
Degree 4	Full strength in relevant muscle groups

The duration of block was defined as the onset of block from the first rescue analgesia requirement. Mean arterial pressure (MAP), heart rate (HR) and respiratory rate (RR) were monitored in each group upto 12 hours postoperatively. Standard post-operative care was provided. All findings were entered in Microsoft excel sheet and the results were analysed with SPSS version 22. Results were evaluated using statistical test (chi-square test and independent T test). p value less than 0.05 was considered as statistically significant.

RESULTS

In present study 30 patients each were randomly allocated group M and group P. General characteristics such as age, gender and ASA status were comparable in both groups.

Table 1: General characteristics

Characteristics	GROUP M (n=30)	GROUP P (n=30)
Age (in years)	39.27 ±15.52	33.03 ±11.22
Gender - M/F	27/3	26/4
ASA I/II	22/8	23/7

The onset for sensory block for group M was 9.47 ± 2.60 min, in group P was 13.57 ± 3.48 min and difference was highly significant (p value < 0.001). The mean duration of block in group M was 8.48 ± 1.64 hrs and in group P was 5.55 ± 0.86 hrs with p values < 0.001 which was highly significant. The mean value of motor blockade was graded according to Modified bromage scale for group M was 2.56 ± 0.50 and for group P was 2.70 ± 0.47, difference was not significant. The

mean duration of demand of rescue analgesia in group M was 8.48 ± 1.64 hrs. and in Group P was 5.55 ± 0.86 hrs. with highly significant p values of <0.001 . Heart rate, mean arterial pressure, Respiratory rate was monitored in each group in intraoperative and postoperative period upto 12 hrs. and were comparable between two groups at all time intervals.

Table 2: Intra-operative and post-operative findings

Findings	GROUP M (n=30)	GROUP P (n=30)	p value
Age (in years)	39.27 \pm 15.52	33.03 \pm 11.22	
Gender - M/F	27/3	26/4	
ASA I/II	22/8	23/7	
Onset of sensory block (min)	9.47 \pm 2.60	13.57 \pm 3.48	<0.001
Duration of block (hrs)	8.48 \pm 1.64	5.55 \pm 0.86	< 0.001
Degree of block (Modified bromage scale)	2.56 \pm 0.50	2.70 \pm 0.47	0.268
Rescue analgesia (hrs)	8.48 \pm 1.64	5.55 \pm 0.86	< 0.001

Patients were observed for any side effects intraoperatively and postoperatively such as nausea, vomiting, local trauma, giddiness, bradycardia and tachycardia. In our study no patients in group M complained of nausea and 2 complained of giddiness and in group P, 2 patients complained of nausea and one of giddiness.

Table 3: Side Effects

Side effects	GROUP - M (n- 30)	GROUP P (n- 30)
Nausea	0	2 (7%)
Giddiness	2 (7%)	1 (3%)

DISCUSSION

The axillary approach to brachial plexus blockade provides satisfactory anaesthesia for elbow, forearm, and hand surgery and also provides reliable cutaneous anaesthesia of the inner upper arm including the medial cutaneous nerve of arm and inter costobrachial nerve, areas that are often missed with other approaches.⁶ In addition, the axillary approach remains the safest of the four main options, as it does not risk blockade of the phrenic nerve and it does not have the potential to cause pneumothorax, making it an ideal option for day care surgery.⁷ The role of NMDA receptor in pain transmission has long been understood. Blocking NMDA subtype of glutamate receptors reduce the afferent stimulation of spinal cord and therefore blocking the pain transmission. Magnesium sulphate has known to inhibit nociception through its NMDA receptor antagonistic properties making it a suitable adjuvant for brachial plexus block with local anaesthetic drug.⁸ In present study patients receiving 0.375 % bupivacaine with 250 mg MgSO₄ had early onset of sensory block and duration of block was prolonged as compared to the group receiving plane bupivacaine. Similar findings were noted by Verma V *et al.*⁹ Kasturi Mukherjee *et al.*,¹⁰ studied elective forearm and hand surgeries in 100 patients, randomly and in double blind fashion divided into group RM (30ml 0.5% ropivacaine plus 150mg MgSO₄) and in group RN (30ml 0.5 % ropivacaine plus 1ml NS). They noted that duration of sensory block was increased in group RM, similar to present study. While time of onset of sensory blockade was slightly increased in group RM, where as in present study onset of sensory blockade was reduced in magnesium group as compared to plain bupivacaine group. Haghghi M *et al.*,¹¹ investigated the

effect of magnesium sulphate to lidocaine to extend the duration of sensory and motor blocks of the axillary plexus in orthopedic surgeries of the upper extremities and concluded that the addition of magnesium sulphate increases the duration of motor and sensory block as compared to the use of lidocaine alone. Gunduz A, *et al.*,¹² studied the effect of the addition of magnesium in 60 patients scheduled for forearm and hand surgeries under axillary brachial plexus block. They concluded that addition of magnesium sulphate to 2% prilocaine for axillary brachial plexus block provided marked prolongation of sensory and motor blockade. In a study by Reza akhondzade *et al.*,¹³ investigated effect of adding magnesium sulfate to lidocaine on postoperative pain in upper limb surgeries by supraclavicular brachial plexus block under ultrasound guidance and concluded that postoperative VAS values at 24 hours were significantly lower in group M (lidocaine 1% +fentanyl 50 μ g + magnesium sulphate 20% 5ml) than group N (lidocaine + 50 μ g fentanyl + normal saline 5ml). Sensory and motor block onset and duration were also statistically longer in group M than in group N. Gyu Choi *et al.*,¹⁴ studied patients undergoing upper extremity surgery as 0.2% ropivacaine 20 ml with normal saline 2 ml versus 0.2% ropivacaine 20 ml with MgSO₄ 200 mg via axillary brachial plexus block just before extubation. The post-operative visual analogue scale (VAS), opioid consumption and side effects were recorded. The results of this study showed no difference in VAS scores and no statistically significant difference in opioid consumption between the two groups. Side effects were recorded and the results were similar to our study with no significant adverse effects noted between the two groups. Peripheral

nerve blocks provide intraoperative anaesthesia, extends analgesia in the post-operative period without any systemic side-effects and had advantages over general anaesthesia like avoiding airway instrumentation, polypharmacy, decreased incidence of nausea and vomiting, early mobilization and extended postoperative analgesia.¹⁵

CONCLUSION

Magnesium sulphate with bupivacaine as compared to plain bupivacaine had early onset of sensory block, increase in duration of sensory block, better analgesia without any significant untoward side effect.

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