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Original Research Article.

Addition of Methylprednisolone to Local Anaesthetics in Brachial Plexus Block (Supraclavicular Approach): A Randomised Double Blind Study

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ABSTRACT

Introduction: Various additives have been added in brachial plexus block with local anaesthetics to increase their duration. We performed a randomised prospective double blind study to evaluate the effect of methylprednisolone added to lidocaine and bupivacaine on the onset and duration of anaesthesia.

Method: 60 patients with ASA physical status 1 and 2 with age 18 to 60 years undergoing elective upper arm surgery below elbow were randomly allotted to receive either 20 ml (0.5%) bupivacaine + 10 ml lidocaine (2%) + 40 mg (1ml) methylprednisolone or 20 ml (0.5%) bupivacaine + 10 ml lidocaine (2%) +1ml normal saline. Block was performed under nerve stimulator guidance. Onset and duration of motor and sensory blockade was done.

Results: Onset of sensory and motor blockade (4.5 ± 1.43 minutes vs 7.81 ± 1.42 minutes and 9.03 ± 2.48 mins vs 11.27 ± 2.86 mins) respectively was significantly more rapid in methylprednisolone group. The duration of sensory and motor blockade (911 ± 112.4 mins vs 396.83 ± 64.28 mins and 456.5 ± 79.4 mins vs 225 ± 49.39 mins) respectively were significantly longer in methylprednisolone group.

Conclusion: Addition of methylprednisolone to brachial plexus block speeds the onset and prolongs the duration of sensory and motor blockade.

Keywords: Brachial Plexus Block, Duration, Local Anaesthetics, Methylprednisolone, Supraclavicular Approach.

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INTRODUCTION

Prolonging the duration of sensory and motor blockade for regional anaesthesia is often desired for completing prolonged surgeries and post-operative analgesia. Various adjuvants like fentanyl, clonidine etc. have been used for this purpose. Corticosteroids like dexamethasone have been studied for brachial plexus block.1-3 Since supraclavicular block is most commonly used brachial plexus block in our institute, we used methylprednisolone in our study. Methylprednisolone has been used in treatment of back pain and neuropathic pain.4,5 The aim of our study was to evaluate the effect of methylprednisolone 40 mg added to 20 ml bupivacaine (0.5%) + 10 ml lignocaine (2%) on the onset time and duration of sensory and motor blockade.

MATERIALS AND METHODS

This study was carried out at Mata Channan Devi Hospital, New Delhi after obtaining written informed consent, approval from the Hospital Ethics Committee and 60 patients were enrolled in the study. All patients were posted for upper extremity surgeries below elbow and received brachial plexus block by supraclavicular approach.

The study is a randomised, prospective, double blinded controlled study. Patients with ASA grade I, II & aged between 18 to 60 years of either sex, presenting for upper limb surgery were included in study. Patient refusal , ASA grade III or upwards , age more than 60 years or less than 18 years of either sex, pregnancy, neuropathy of the surgical limb, known hypersensitivity to the study drugs(methylprednisolone, bupivacaine, lignocaine) were excluded from study.

Randomisation was done by a computer generated table of random numbers and a total of 60 patients were divided into 2 groups (n = 30):

Group A: Inj. Lignocaine 2% (10ml) + bupivacaine 0.5% (20ml) + methylprednisolone 40 mg (1ml) perineural in brachial plexus block (supraclavicular approach)

Group B: Inj. Lignocaine 2% (10ml) + bupivacaine 0.5% (20ml) + normal saline (1 ml) perineural in brachial plexus block. (supraclavicular approach)

An anaesthesiologist not involved in performance or collection of data prepared all the local anaesthetic mixture and adjuvant drugs and labelled them using computer generated random number. Methylprednisolone was used and collected in separate 2ml syringe or normal saline in 2ml syringe. Total volume of solution used in both groups was 31 ml. All patients were kept 6 hours of fasting prior to surgery; Tablet Alprazolam (0.25 mg) was used as a premedication to be given on night previous to the surgery. In the operation theatre, IV access was secured with 18 g cannula and ringer lactate was started. Standard monitors (ECG, NIBP, pulse oximeter) were connected to patient. Oxygen at the rate of 4 l/min administered through face mask along with sedation using intravenous midazolam 0.02 mg/kg.

The brachial plexus block via supraclavicular approach was carried out after thorough explanation of the procedure and under strict aseptic condition the patient was asked to be in the dorsal recumbent position without a pillow, arms at his/her sides and head turned to the side opposite to the one being blocked. Small pad was placed below bilateral shoulders. Area of interest was aseptically cleaned and draped. The operator stood on the side to be blocked at the head end. With the patient in the above described position and the shoulder down, the lateral (posterior) border of the sternocleidomastoid (SCM) muscle was identified and followed distally to the point where it met the clavicle. The point of needle entrance was about 1 in (2.5 cm) lateral to the insertion of the SCM in the clavicle or one “thumb breadth” lateral to the SCM. Palpation of the subclavian artery at this site confirms the landmark. Skin wheal was raised at this site with 2% lignocaine. We used a nerve stimulator (Innervator) with a 22 g insulated needle to perform this technique. The needle was inserted in posterior, caudal and medial direction until the desired response was obtained. If the desired response was obtained, the drug solution was injected.

Following measures were recorded during the study

1. Time of sensory onset: It was defined as the time from injection to onset of analgesia.
2. Time of motor onset: It was defined as the time from injection to the inability of the patient to move his/her fingers or raise their hand.
3. Duration of motor and sensory blockade: It was defined as complete recovery of motor function in all nerve distribution and return of first post-operative pain respectively.

All the patients were evaluated for 24 hours of anaesthesia and were assessed for any new onset of neurological impairment. The above assessments were carried out by the principal investigator who was blinded to the drugs administered in the plexus block. In the case of inadequate or patchy block, the block was supplemented with general anaesthesia and were excluded from the study.

Sample size calculation was done based on previous study where onset of sensory and motor blockade was 13.4±2.8 and 16±2.7 respectively. It was estimated that a minimum of 27 patients in each group would be required to have a 90% power of detecting a 3 min difference in onset with 95% confidence interval. Statistical analysis was performed with SPSS for windows with $p<0.5$ considered to be significant

Table 1: Demography

Patient characteristics	Methylprednisolone group	Control group
Age	43.23±15.82	41.43±14.43
Weight	64.83±7.49	66±7.81
Sex(F/M)	11/19	10/20
Duration of surgery(min)	132.73±82.29	116.2±57.70

Table 2: Sensory and Motor Blockade

ONSET OF SENSORY BLOCK	MEAN	SD	P' VALUE	REMARKS
GROUP A (n=30)	4.533333	±1.432	p<0.0001	SIGNIFICANT
GROUP B (n=30)	7.816869	±1.426		
ONSET OF MOTOR BLOCK				
GROUP A (n=30)	9.033333	±2.484	p=0.0020	SIGNIFICANT
GROUP B (n=30)	11.26667	±2.86		
DURATION OF SENSORY BLOCK: ANALGESIA TIME				
GROUP A (n=30)	911.6667	±112.4	p< 0.0001	SIGNIFICANT
GROUP B (n=30)	396.8333	±64.28		
TOTAL MOTOR DURATION				
GROUP A (n=30)	456.5	±79.4	p<0.0001	SIGNIFICANT
GROUP B (n=30)	225	±49.39		

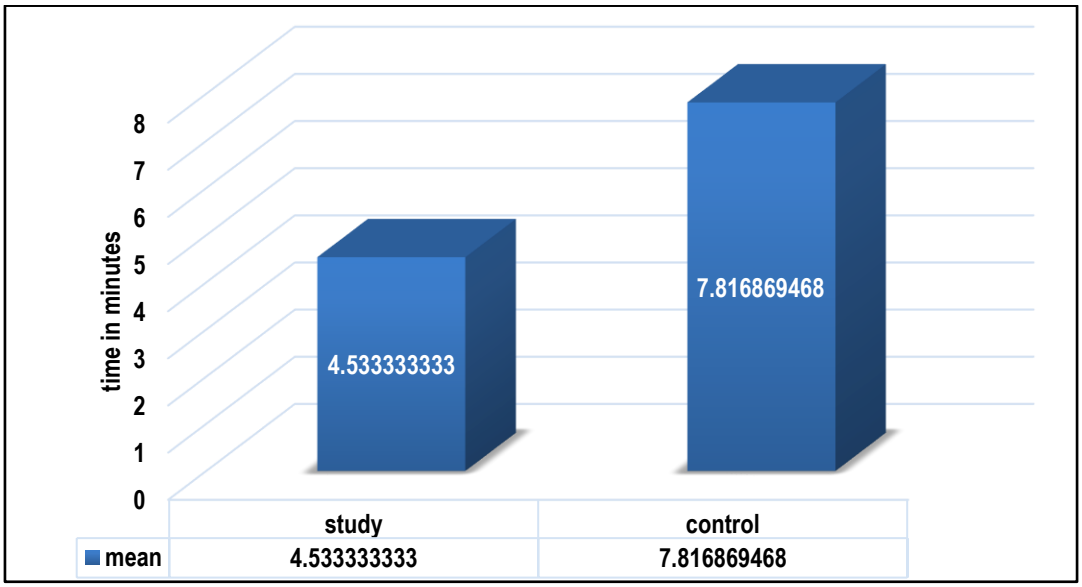

Figure 1: Onset of Sensory Block

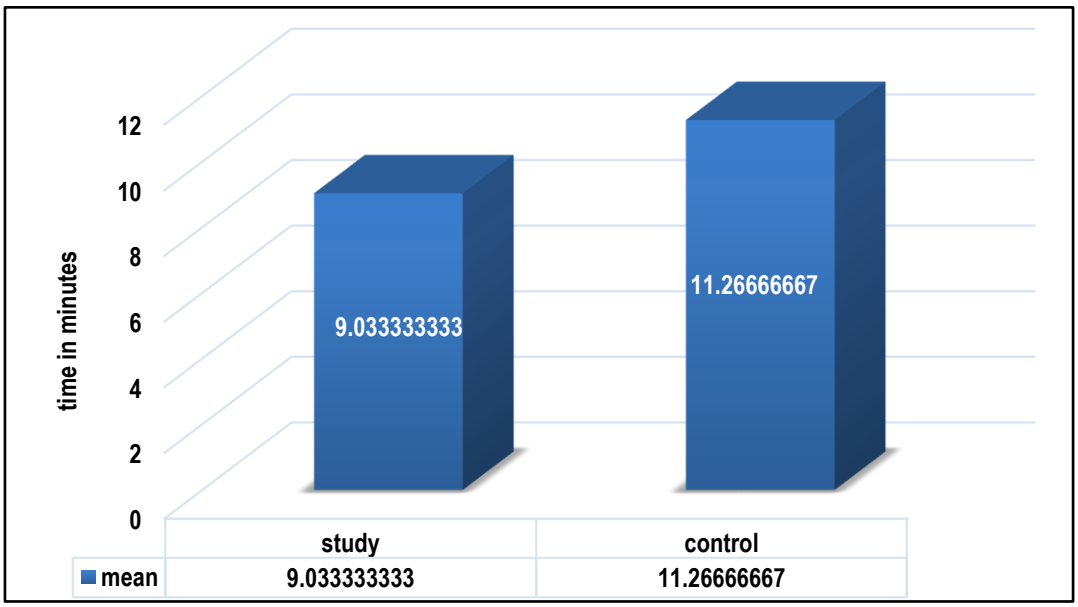

Figure 2: Onset of Motor Block

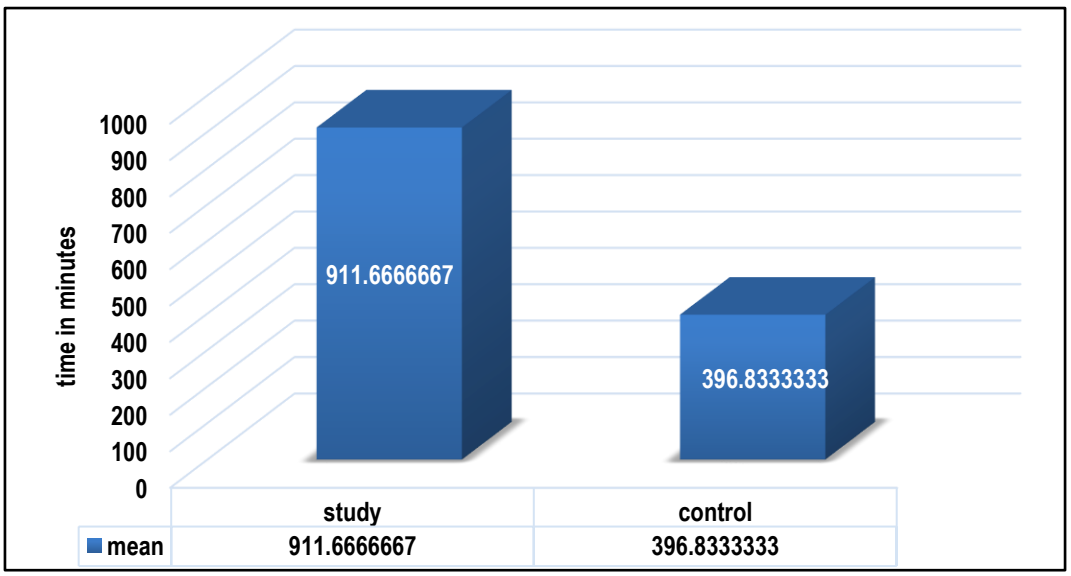

Figure 3: Analgesic Time

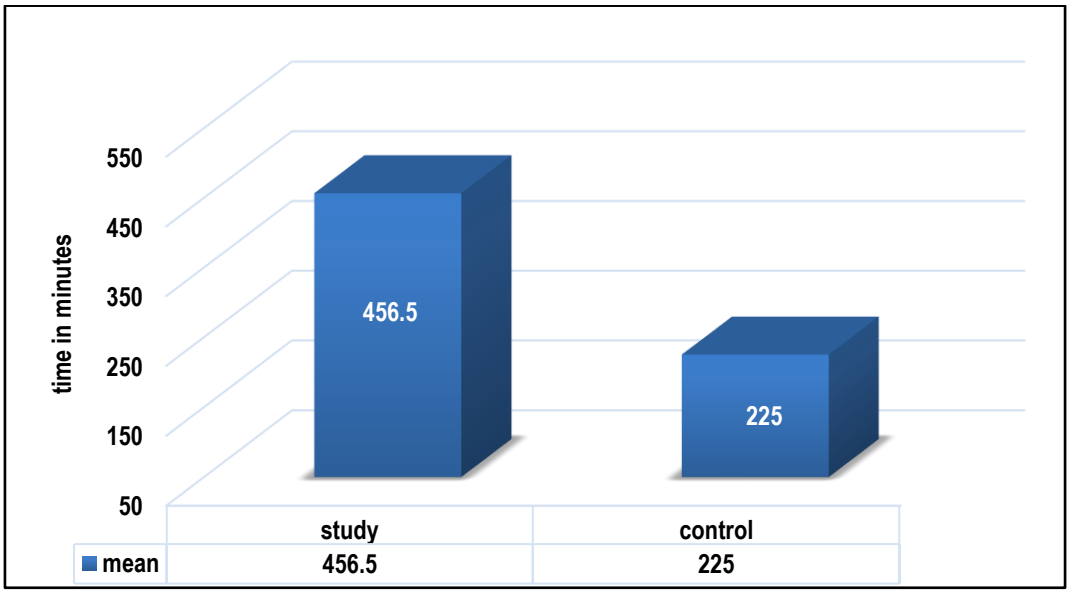

Figure 4: Motor Duration

RESULTS

The groups were comparable with respect to patient age, sex, weight and duration of surgery.

The onset of sensory and motor blockade were significantly more rapid in methylprednisolone group (4.5 ± 1.43 minutes vs 7.81 ± 1.42 minutes and 9.03 ± 2.48 mins vs 11.27 ± 2.86 mins) than in the control group. The duration of sensory and motor blockade were also significantly longer in methylprednisolone group (911 ± 112.4 mins vs 396.83 ± 64.28 mins and 456.5 ± 79.4 mins vs 225 ± 49.39 mins) respectively than in control group. There were no side effects or complications observed in any group. Intra operative and post-operative vitals were stable.

DISCUSSION

Our study showed that addition of 40 mg methylprednisolone to lignocaine and bupivacaine for supraclavicular brachial plexus block results in a significantly shorter onset time and a prolonged duration of sensory and motor blockade. The mechanism of action of methylprednisolone is commonly attributed to its anti-inflammatory action. These are mediated via classic glucocorticoid receptor and are local effects rather than systemic. Action on glucocorticoid receptor alters functioning of ion channels or produce lactic acidosis in nerve cell leading to extended action of local anaesthetics.[6,7] Several studies have shown that addition of steroids to local anaesthetics effectively and significantly prolongs the duration of analgesia out of which Dexamethasone[8,9] has been studied the most and very few studies have been carried out using methylprednisolone.[10,11] H Evren Eker[12] et al found peripheral nerve block with 80 mg methylprednisolone plus 0.5% lidocaine provides effective relief in the treatment of neuropathic pain. Stan T[13] et al concluded that sensory analgesia and motor block was significantly longer in the methylprednisolone group via axillary approach for brachial plexus block. Based on inferences and due need to further research on all these studies, we decided to use methylprednisolone as steroid adjuvant to local anaesthetic in brachial plexus block via supraclavicular approach and also developing a perineural steroid alternative to dexamethasone. This route has never been used for methylprednisolone.

CONCLUSION

In conclusion, addition of methylprednisolone 40 mg to local anaesthetics in supraclavicular block results in faster onset and prolonged duration of surgery. Further studies are required for elucidating the precise mechanism of action of methylprednisolone.

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