

Effects of Dexamethasone as an adjuvant to local anaesthetic in brachial plexus block through supraclavicular route

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Abstract

Background: Supraclavicular brachial plexus block is most commonly preferred anaesthesia for upper limb orthopaedic surgeries. Various adjuvants to local anaesthetics were studied to prolong the duration of analgesia of brachial plexus block. In the present study we used dexamethasone(8mg) as an adjuvant to bupivacaine in supraclavicular brachial plexus block and studied its effect on onset and duration of sensory and motor block. **Material and Methods:** 70 patients of ASA I & II status were randomly divided in to two groups of 35 patients each. Patients in group A received 0.25% bupivacaine(38 ml) plus dexamethasone 8 mg(2 ml) making a total volume of 40 ml(care was taken not to exceed the maximum drug dosage). Patients in group B received 0.25% bupivacaine (38 ml) plus 0.9% normal saline(2 ml) making a total volume 40 ml. Time for onset of sensory and motor block, duration of analgesia and duration of motor block were noted. **Results:** Time for onset of sensory block (15.5 ± 0.26 mins) in group A was significantly earlier than onset of sensory block (20.6 ± 0.2 mins) in group B. Time for onset of motor block (25.4 ± 0.19 mins) in group A was also significantly earlier than group B (30.5 ± 0.2 mins). Duration of motor block was also statistically highly significant in both the groups. (p value < 0.001). It was 315.6 ± 4.97 min in group A and 153.6 ± 2.9 min in group B. Duration of sensory block was longer in group A which was 485 ± 5.45 mins, while in group B it was 212.7 ± 2.1 mins. There was statistically highly significant difference for duration of sensory block between 2 groups. (p value < 0.001). **Conclusion:** Addition of dexamethasone to bupivacaine in supraclavicular brachial plexus block results in significantly early onset and prolonged duration of sensory and motor block without any significant side effects.

Key Word: Dexamethasone.

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Received Date: 05/01/2019 Revised Date: 19/02/2019 Accepted Date: 12/03/2019

DOI: <https://doi.org/10.26611/1015938>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
14 March 2019

INTRODUCTION

Brachial plexus block is the most commonly preferred anaesthetic technique for upper limb surgeries. It has its own advantages by avoiding untoward effects of general

anaesthetic drugs and upper airway instrumentation. Various approaches of brachial plexus block are interscalene, supraclavicular and axillary, but the supraclavicular approach is the easiest and most consistent method for anaesthesia and perioperative pain management in surgeries below the shoulder joint.¹ Single injection technique of brachial plexus block is limited by pharmacological duration and therapeutic index of local anaesthetic. To prolong brachial plexus block analgesia beyond the pharmacological duration of local anaesthetic needs either placement of indwelling catheter or addition of adjuvant drugs. Indwelling catheter technique is very effective and provide pro-long analgesia but its utility is limited by technical challenges with placement, secondary failure rate, difficulties with catheter removal and rarely infection.^{2,3,4} Many investigations were done

How to cite this article: Shital Halvadia, Dhara Patel, Shobhana Gupta. Effects of Dexamethasone as an adjuvant to local anaesthetic in brachial plexus block through supraclavicular route. *MedPulse International Journal of Anesthesiology*. March 2019; 9(3): 190-195. <http://medpulse.in/Anesthesiology/index.php>

for mixing of local anaesthetic with adjuvant drugs to prolong analgesia from nerve blocks. Drugs like vasoconstrictors(adrenaline), α 2agonist(clonidine,dexmedetomidine), benzodiazepines (midazolam), opioids(fentanyl, tramadol)and corticosteroid (dexamethasone)are frequently used adjuvants.^{5,6,7} They all act by different mechanism of action like local vasoconstriction limiting systemic uptake, direct effect on peripheral nerves or act systemically by anti-inflammatory effects. Clonidine and dexmedetomidine when used as an adjuvant to local anaesthetic for brachial plexus block prolongs duration of analgesia but it is associated with side effects like sedation, hypotension and bradycardia.^{5,6}while use of midazolam is associated with increased risk of respiratory depression.⁷ Glucocorticoids have potent anti-inflammatory and analgesic property. Dexamethasone is a very potent and highly selective glucocorticoid with analgesic property. It produces anti-inflammatory action by inhibition of phospholipase A2.It prolongs block duration by reducing ectopic neuronal discharge and increasing activity of inhibitory potassium channelson nociceptive C-fibers or by vasoconstriction via glucocorticoid receptors which decreases systemic absorption of local anaesthetic.^{8,9,10,11} In this study, we used 8 mg of dexamethasone as an adjuvant to 0.25% of 38 ml bupivacaine in supraclavicular brachial plexus block for elective orthopaedic surgeries of lower arm, forearm and hand. We studied onset and duration of sensory and motor block and any side effects.

MATERIALS AND METHODS

After getting approval from the institutional ethical committee this prospective, double blind, randomised study was conducted from July 2018to December 2018 in GMERS Medical College and civil hospital, Gandhinagar. Patients of ASA classI and II, either sex, aged 18- 60 years, undergoing upper limb orthopaedic surgeries were taken. Patients having history of uncontrolled hypertension, cerebrovascular diseases, ischemic heart disease, arrhythmia, COPD, local skin site infection, acid peptic diseases, peripheral neuropathy, any kind of bleeding disorders and patients having allergy to local anaesthetic agents were excluded from the study. Pre anaesthetic check-up was done before surgery. Procedure was explained and Patients were taught how to express degree of pain on visual analogue scale (VA),0-10 scale,(0=no pain,10=most severe pain). The patients were advised overnight fasting. Informed and written consent was taken. Total 70 patients were recruited for the study and randomly assigned into Group-A, Group-B by using chit method in which a box was made having 2 chits of each groups with 1:1 ratio. Group A received 0.25% bupivacaine(38 ml) plus dexamethasone 8 mg(2

ml) making a total volume of 40 ml(care was taken not to exceed the maximum drug dosage).Group B received 0.25% bupivacaine (38 ml) plus 0.9% normal saline(2 ml) making a total volume 40 ml. The preparation of the drugs was carried out by the anaesthesiologist not involved in the study and both patient and the anaesthesiologist collecting data were remained blind from the preparation of drug. In the operating room all patients were monitored for ECG, NIBP and SpO₂.Baseline heart rate, blood pressure, SpO₂ were recorded. IV line was secured on the contralateral hand. Inj. Rantac 1mg/kg and inj. ondanesetron 0.08mg/kg as premedication was given to all patients. Supraclavicular brachial plexus block was performed under strict aseptic and antiseptic precaution with the patients in supine position and head turned to the opposite side with the help of 23G 1.5 inch needle. The needle was inserted just lateral to subclavian artery in posterior and caudal direction until paresthesia and/or pulsation and/or rib was encountered. Total 40 ml of drug of either study group was injected after negative aspiration for blood and air. Patients were observed vigilantly for any complications and toxicity of the drugs injected. After injection of the drug, the following parameters were studied: The onset of sensory block: Time taken from injection to onset of analgesia in each of the peripheral nerve distribution(ulnar, radial, medial and musculocutaneous) was assessed by pinprick using blunt end of a 24 G needle at 0,2,5,10,15,20 and 30 min.Sensory block was graded according to the following scale.

Scale	Criteria
0	No block(normal sensation)
1	Partial block(decreased sensation)
2	Complete block(no sensation)

²Onset of motor block: It is defined as the time from injection to the inability of the patient to move fingers or to raise hand. It was assessed at 0,2,5,10,15,20,30 and 40mins interval. Motor block was assessed by following motor function:

- Flexion at the elbow(musculocutaneous nerve)
- Extension of elbow and wrist.(radial nerve)
- Opposition of thumb and index finger.(median nerve)
- Opposition of thumb and small finger(ulnar nerve)

Motor block was graded according to following scale

Scale	Criteria
0	No block(full muscle activity)
1	Partial block(decreased muscle activity)
2	Complete block(no muscle activity)

³Duration of analgesia was assessed during and after the procedure. Analgesia was considered satisfactory if the patient did not complain of any pain or discomfort. Postoperative pain assessment was carried out at the interval of 15mins.30 mins, 60mins and 120mins.Pain assessment was done by visual analogue scale. Rescue analgesic injection Diclofenac sodium 1.5mg/kg was given if VAS was more than 3.Time of giving first rescue analgesic was noted.

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Visual Analogue Scale VAS (0–10cm)

0 No pain

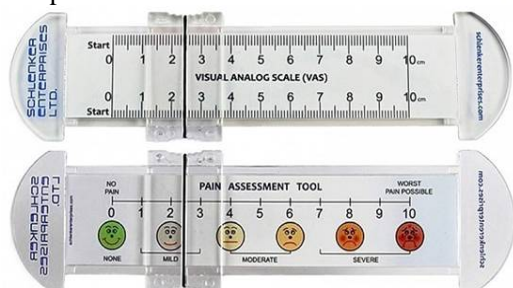
2

4

6

8

10 Worst pain



⁴Duration of motor block was assessed intra-operatively and postoperatively every hourly by asking the patients to move their fingers and to see whether the elbow flexion could be done against gravity or not. Time of any motor activity was recorded as time of cessation of motor effect.

⁵Possible complications of brachial plexus block such as pneumothorax, hematoma, signs and symptoms of local anesthetic toxicity (tingling, numbness, brady cardia, hypotension) was observed and treated if any. If the effect of brachial plexus block was not satisfactory or surgery was unduly prolonged it was supplemented with general anaesthesia and the case was excluded from the study.

Statistical Analysis: The data were assessed by the principal investigator who was blinded to the drugs administered and patients selection.Data were analysed using open EPI info software. 70 participants fulfilling inclusion criteria during the study period of six months were included in the study. Results were expressed as Mean and standard deviation (SD) or number or percentage. Analysis of data between groups were performed using one way analysis of variance (ANOVA) followed by Tukey’s multiple post-hoc test. The p value<0.05 was considered statistically significant and p value<0.001 was considered highly significant.

RESULTS

Table 1: Demographic Data

	Group A	Group B	P value
Age(years)	39.42±12.21	41.36±9.5	>0.05
Gender(M/F)	29/6	28/7	>0.05
Weight(Kg)	54.57±8.22	54.62±7.12	>0.05
ASA I/II	30/5	31/4	>0.05

Table 2: Baseline Vitals

	Group A	Group B	P value
HR(/min)	82.1±4.15	82.9±4.21	>0.05
MAP(mm Hg)	92.6±2.77	92.8±2.45	>0.05
SPO2(%)	99.0±0.00	99.0±0.00	>0.05

Table 3: Characteristics of motor and sensory block (mins)

	Group A	Group B	P value
Time for onset of sensory block(mins)	15.5±0.26	20.6±0.2	<0.0001
Time for onset of motor block(mins)	25.4±0.19	30.5±0.2	<0.0001
Duration of sensory block(mins)	485±5.45	212.7±2.1	<0.0001
Duration of motor block(mins)	315.6±4.97	153.6±2.9	<0.0001

Table 4: HR

TIME	HR	
	Group A	Group B
T0	83.2	83
T1	80.9	81.5
T5	76.9	77.2
T10	74.8	73.8
T15	76.8	75.2
T30	77.2	77.5
T45	77.4	76.0
T1 hr	77.4	76.8
Tend of surgery	77.7	76.5
Post op 15 min	78.4	77.9
30 min	78.3	77.2
60 min	76.2	76.6
90 min	77.9	77.4
120 min	77.7	77.5

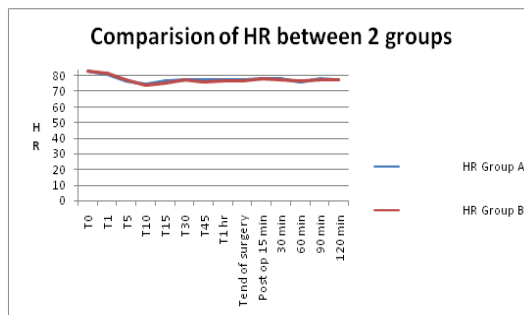


Figure 1: Comparison of HR between 2 Groups

Table 5: Mean blood pressure

Time	MBP(mm Hg)	
	Group A	Group B
T0	93.3	92.0
T1	89.8	90.2
T5	86.9	87.4
T10	85.1	86.5
T15	85.2	84.4
T30	86.2	85.3
T45	86.5	85.8
T1 hr	87.5	86.5
Tend of surgery	87.7	86.8
Post op 15 min	87.5	86.9
30 min	87.5	87.0
60 min	87.5	87.2
90 min	87.6	87.2
120 min	87.6	87.2

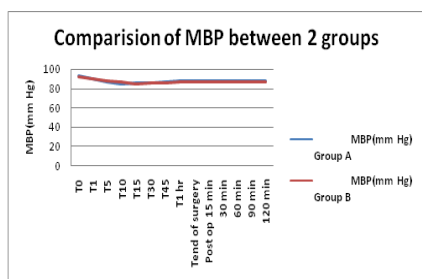


Figure 2: Comparison of MBP between 2 groups

RESULTS

Total 70 patients in both the groups of our study were comparable with respect to age, sex, weight and ASA physical status as shown in table-1. Hemodynamic parameters like heart rate, blood pressure and SPO2 were comparable between both the groups at baseline, intraoperative and postoperative as per table-2 and figure 1&2. Time for onset of sensory block was 15.5 ± 0.26 mins in group A and 20.6 ± 0.2 mins in group B. Onset of sensory block was earlier in group A than group B which was statistically highly significant (p value < 0.001) as per table-3. Time for onset of motor block was 25.4 ± 0.19 mins in group A as compared to group B in which it was 30.5 ± 0.2 mins. Onset of motor block was also earlier in group A as compared to group B which was statistically highly significant (p value < 0.001). Duration of motor block was also statistically highly significant in both the groups. (p value < 0.001). It was 315.6 ± 4.97 min in group A and 153.6 ± 2.9 min in group B. Duration of sensory block was longer in group A which was 485 ± 5.45 mins, while in group B it was 212.7 ± 2.1 mins. There was statistically highly significant difference for duration of sensory block between 2 groups. (p value < 0.001). There was no any incidence of side effects like seizures, bradycardia, hypotension, dysrhythmia, pneumothorax and horner's syndrome in both the groups.

DISCUSSION

Regional anaesthesia is a boon in the patient care due to simple technique, preservation of consciousness, no airway instrumentation and adequate postoperative analgesia. Supraclavicular brachial plexus block is the most popular regional anaesthesia technique for surgeries of upper extremity. Local anaesthetic alone for brachial plexus block provide good operative conditions but have limited duration of action. So various adjuvants like adrenaline, opioids, clonidine, dexmedetomidine, midazolam were used along with local anaesthetics to prolong the duration of sensory and motor blockade.^{5,6,7} Dexamethasone as an adjuvant to local anesthetic in brachial plexus block prolongs the duration of block without producing any significant side effects.⁸ Dexamethasone is a very potent and highly selective glucocorticoid with analgesic property. It produces anti-inflammatory action by inhibition of phospholipase A2. It prolongs block duration by reducing ectopic neuronal discharge and increasing activity of inhibitory potassium channels on nociceptive C-fibers or by vasoconstriction via glucocorticoid receptors which decreases systemic absorption of local anaesthetic.^{8,9,10,11} In our study, we used 8 mg of dexamethasone as an adjuvant to 0.25% of 38 ml bupivacaine in supraclavicular brachial plexus block in the elective orthopaedic surgeries below upper arm. Group A patients received 0.25% bupivacaine (38 ml) plus dexamethasone 8 mg (2 ml) making a total volume of 40 ml (care was taken not to exceed the maximum drug dosage) and Group B patients received 0.25% bupivacaine (38 ml) plus 0.9% normal saline (2 ml) making a total volume 40 ml. Demographic data were comparable between 2 groups of our study which is similar to the study of Ritu Baloda *et al*, Ashem Jack Meitei *et al* and B T Arish *et al*.^{12,13,14} In our study results of mean HR and mean MAP at baseline, intraoperative and postoperative time were comparable between two groups which is found similar to the study of Ritu Baloda *et al*, B T Arish *et al*, Choi *et al* and Shreshtha *et al*.^{12,14,15,16} Time for onset of sensory block was 15.5 ± 0.26 minutes in group A, which was significantly earlier than group B in which it was 20.6 ± 0.2 mins. Time for onset of motor block was 25.4 ± 0.19 minutes in group A, which was also significantly earlier than group B in which it was 30.5 ± 0.2 mins. Our results were similar to results observed by Shreshtha *et al*, Islam *et al*, and Engineer SR *et al*.^{16,17,18} However study by Movafegh A *et al* who used dexamethasone as adjuvant to lignocaine found no difference in onset time of sensory and motor block.¹⁹ The early onset of action may be due to synergistic action of dexamethasone with local anaesthetic on blockage of nociceptive C fiber transmission. Duration of sensory blockade was prolonged significantly in group A

(485±5.45mins) than group B (212.7±2.1mins). Duration of motor block was also significantly prolonged in group A (315.6±4.97min) than group B (153.6±2.9min). Corticosteroids causes skin vasoconstriction leading to prolonged duration of action of local anaesthetics. Our results were similar with the study conducted by Taludkar *et al*, Shaikh MR *et al*, Pathak RG *et al*, Noss C *et al*.^{20,21,22,23} No any complications like pneumothorax, intravascular injection of drug, neurotoxicity, cardiotoxicity were noted in any patients of our study. Shrestha *et al*, concluded that addition of dexamethasone leads to significantly faster onset of action and prolonged duration of analgesia without any significant side effects.¹⁶ Taludkar *et al* showed prolonged duration of effective analgesia with 0.25% bupivacaine 38ml and dexamethasone 2ml compared to control group.²⁰

LIMITATIONS

We did not use ultrasound for performance of brachial plexus block due to unavailability at our institution during study period. We did not follow up the patients for more than 3 months for chronic neurological effect of Dexamethasone.

CONCLUSION

We conclude that addition of dexamethasone to bupivacaine in supraclavicular brachial plexus block for upper limb orthopaedic surgeries produces early onset of sensory and motor block and prolongs the duration of sensory and motor block without producing any significant side effects.

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Source of Support: None Declared
Conflict of Interest: None Declared

