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Original Research Article

Effect of dexamethasone as an adjuvant with bupivacaine in ultrasound guided single shot supraclavicular brachial plexus block in upper extremity surgeries- a prospective randomized study

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ABSTRACT

Background: Supraclavicular brachial plexus block is a good alternative to general anesthesia in surgeries of elbow, forearm, wrist and hand. The aim of this study was to assess the effect of dexamethasone as an adjuvant with bupivacaine in supraclavicular brachial plexus block in upper limb surgeries.
Methods: This study was carried out on 60 adult patients of both sexes planned for upper limb surgery during the period from May 2015 to Jan 2016 after approval by the institutional Ethical Committee. Inclusion criteria were American Society of Anesthesiologists physical Status I-II and age between 18 and 50 years. Patients were randomly allocated to two groups of 30 patients each [group I (bupivacaine alone) and group II (bupivacaine + dexamethasone)]. Group I received 30ml of 0.5% bupivacaine with 2ml normal saline while group II received 30ml of 0.5% bupivacaine with 2ml (8mg) dexamethasone for supraclavicular brachial plexus block. Statistical analysis was performed with SPSS for Windows (SPSS Inc., Chicago, IL, USA), version 16.0. For analysis of demographic data and comparison of groups, χ^2, unpaired Student's t-test and Mann-Whitney U-test were performed. Power of significance p-value of <0.05 was considered to be statistically significant. We evaluated onset, quality and duration of sensory and motor block along with side effects if any.
Results: The mean onset of sensory and motor block in Group I and II was statistically insignificant. The duration of motor and sensory block was significantly prolonged in Group II than in Group I. There were no statistically and clinically significant differences in respiratory and hemodynamic parameters.
Conclusions: We conclude that dexamethasone as an adjuvant in supraclavicular brachial plexus block prolongs the duration of motor and sensory block with insignificant side effects.

Keywords: Analgesia, Brachial plexus block, Bupivacaine, Dexamethasone

INTRODUCTION

Supraclavicular brachial plexus block is a good alternative to general anesthesia in surgeries of elbow, forearm, wrist and hand.[1] Brachial plexus blockade in fact reduces the pain, but due to short duration, the challenge remains to increase the duration of analgesia with decreasing side effects.[2] Adjuncts to local anesthetics for brachial plexus block may enhance the quality and duration of analgesia.[3] Different additives have been used to prolong regional blockade and shorten the onset times of blocks. Additives such as opioids, clonidine, verapamil, midazolam etc. were added to local anesthetics, but the results are either inconclusive or

associated with side-effects.[4] Perineural injection of steroids have been used to improve analgesia with no evidence suggesting neuritis when given in low concentration.[5] The aim of this study was to assess the effect of dexamethasone as an adjuvant with bupivacaine in supraclavicular brachial plexus block in upper limb surgeries.

METHODS

This is a prospective randomized controlled observer-blinded study carried out on 60 adult patients of both sexes planned for upper limb surgery during the period from May 2015 to January 2016 after approval by the institutional Ethical Committee. Inclusion criteria were American Society of Anesthesiologists physical status I-II and age between 18 and 50 years. Exclusion criteria were known allergy to amide local anesthetic agents, coagulation disorders, ASA physical status of more than II, history of a major psychiatric disorder, significant pre-existing systemic disease (diabetes mellitus, neurological ailments), history of drug abuse and current narcotic drug use. Patients were randomly allocated to two groups of 30 patients each [group I (bupivacaine alone) and group II (bupivacaine + dexamethasone)]. Group I received 30ml of 0.5% bupivacaine with 2ml normal saline while group II received 30ml of 0.5% bupivacaine with 2ml (8mg) dexamethasone for supraclavicular brachial plexus block. Randomization was achieved by computer generated random number table and numbers were kept equal by means of permuted randomization. Patients were provided with complete information about the techniques of anesthesia and analgesia. All included participants were asked to take part in the study after admission and a written informed consent was obtained from each patient.

After shifting the patient inside operation theatre, drug solution for infusion was prepared by anesthesiologist not involved in the study according to randomization. The observer who collected the intra-operative data was blinded to the drug solution administered. On arrival in the operating room, routine monitoring devices were attached and baseline pulse, non-invasive blood pressure, continuous ECG and pulse oximetry were recorded. IV line was secured with 18G IV cannula on opposite side and injection RL started. Oxygen was administered via a Hudson mask at a rate of 5l/min. Patient was put in semi-sitting position (the head of the bed raised about 45°) with head tilted to the opposite side of injection site. The skin was cleaned with chlorhexidine solution. The ultrasound transducer [high frequency linear 13-6 MHz, 38mm broadband linear array (SonoScape SSI 6000 China)] was inserted into a sterile sheath. A thin layer of sterile gel was placed between the draped ultrasound transducer and the skin. Probe is applied parallel to the clavicle in the supraclavicular fossa. At this location, the subclavian artery is seen beating above the first rib; it cannot be compressed as opposed to the vein. The rib is bright and pleura are seen on each side of the rib. The brachial plexus is lateral to the subclavian artery with honeycomb appearance. A volume of 2ml lignocaine 2% was infiltrated subcutaneous before the block. A 20-G cannula is advanced in plane under direct visualization toward the plexus sheath till its puncture and start injecting the drug. The injected volume gently expands the connective tissue surrounding the nerves, which is called hydro dissection. This allows a clear path for the needle, decreasing the chance of nerve damage by the needle. Another injection is given at the angle between the first rib and the subclavian artery after redirecting the needle. Aspiration done every 3-5mL during injection to prevent vascular injection. Group I received 30ml of 0.5% bupivacaine with 2ml normal saline while group II receives 30ml of 0.5% bupivacaine with 2ml (8mg) dexamethasone.

We evaluated onset, quality and duration of sensory and motor block along with side effects if any. Sensory and motor blockade of radial, median, musculocutaneous and ulnar nerves were recorded at 10, 30, 60, 90 and 120 min, and every 30 min thereafter. Sensory block of each nerve was assessed by pinprick and compared with the same stimulation on the opposite hand. Pain was assessed by using visual analogue pain scale (VAS) between 0 and 10 with '0'representing no pain and '10' representing the worst imaginable pain.

Motor block of each nerve was evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and pronation of forearm and flexion of elbow in supination (musculocutaneous nerve). Motor block of each nerve was quantified using modified Lovett rating scale (LRS) (Table 1).

Table 1: Modified Lovett rating scale.

Grade	Degree of motor block
6	Normal muscular force
5	Slight reduction of muscular force
4	Pronounced reduction of muscular force
3	Slightly mobility impairment
2	Pronounced mobility impairment
1	Almost complete paralysis
0	Complete paralysis

The onset of sensory and motor blockade was defined by the time interval between injection of study drug to complete loss of pin prick perception and complete paralysis (grade 0), respectively in all nerve distributions. The duration of sensory blockade was defined by the time interval between complete loss of pin prick perception and appearance of pain requiring analgesia. The duration of motor blockade was defined as the time interval between complete motor paralysis (grade 0) to the complete return of motor power (grade 6). The patients were blinded as to the mixture used or group allocation. Heart rate, arterial pressure, respiratory rate and oxygen saturation were recorded just before the block and at

regular intervals thereafter. Patients were observed for any side effects and complications. When the patient first complained of pain after operation, intramuscular (IM) injection diclofenac sodium 1.5 mg/kg was given.

Statistical analysis

Sample size calculation was performed before patient recruitment. Statistical analysis was performed with SPSS for Windows (SPSS Inc., Chicago, IL, USA), version 16.0.

For analysis of demographic data and comparison of groups, χ^2, unpaired Student's t-test and Mann-Whitney U-test were performed. Power of significance p-value of <0.05 was considered to be statistically significant.

RESULTS

The demographic parameters such as age, weight and other surgical characters showed insignificant differences between the two groups (Table 2).

Table 2: Demographic and surgical parameters.

		No. of cases	Group 1	Group 2	P-value	Remarks
Age		30	39.9±13.5	41.4±14.69	0.5120	Not significant
Weight		30	64.63±7.499	66.65±7.31	0.2570	Not significant
Duration of surgery			30.33±6.66	29.7±5.559	0.8132	Not significant
Pulse	Pre-op		77.3±6.152	79.63±5.295	0.1960	Not significant
	Intra-op		78.43±6.361	79.73±5.420	0.3934	Not significant
	Post-op		79.43±4.500	80.33±4.929	0.0794	Not significant
Systolic blood Pressure	Pre-op		122.3±1.172	121.4±1.031	0.206	Not significant
	Intra-op		127.0±5.576	125.7±4.635	0.5104	Not significant
	Post-op		125.6±6.322	124.3±4.865	0.6180	Not significant
Diastolic blood pressure	Pre-op		79.55±4.904	80.83±5.478	0.5953	Not significant
	Intra-op		77.27±3.930	79.63±5.295	0.0984	Not significant
	Post-op		81.43±5.380	81.13±6.224	0.0615	Not significant
Mean blood pressure	Pre-op		94.93±7.748	94.37±4.038	0.8688	Not significant
	Intra-op		94.17±3.239	96.43±5.817	0.0970	Not significant
	Post-op		96.07±3.965	95.87±5.144	0.0565	Not significant

The mean onset of sensory block in group II (28.20±3.02 min) was faster than group I (30.33±5.31 min) but was statistically insignificant (P>0.05) (Table 3).

Table 3: Onset of sensory block.

Group	Group I	Group II	p-value
Mean	30.33	28.20	>0.05
SD	5.31	3.02	
SEM	0.97	0.55	
N	30	30	

The duration of sensory block in group II and group I were 1085.73±234.23 minutes and 322.37±138.37 minutes respectively (Table 4).

Table 4: Duration of sensory block.

Group	Group I	Group II	p-value
Mean	322.37	1085.73	< 0.0001
SD	138.37	234.23	
SEM	25.26	42.76	
N	30	30	

This difference of analgesia was found to be statistically significant (p-value<0.005). There was no difference in mean onset of motor block in group I and group II but the duration of motor block in group II (1085.73±234.23 min) was significantly prolonged than in group I (322.37±138.37 min) (Table 5 and Table 6).

Table 5: Onset of motor block.

Group	Group I	Group II	P-value
Mean	38.77	38.70	<0.05
SD	4.26	4.25	
SEM	0.78	0.78	
N	30	30	

There were no statistically and clinically significant differences in respiratory and hemodynamic parameters. No nerve injury was seen in either group. Side effects like pneumothorax, hematoma, signs and symptoms for local anesthetic toxicity, nausea, bradycardia, and hypotension were not significant in between the study groups.

Table 6: Duration of motor block.

Group	Group I	Group II	P value
Mean	352.33	510.00	<0.0001
SD	91.60	125.36	
SEM	16.72	22.89	
N	30	30	

DISCUSSION

Ultrasound guided single shot supraclavicular brachial plexus block is a safe and reliable technique of modern anesthesia in upper limb surgeries. It has relatively low number of local and systemic complications and helps early ambulation.[6] Supraclavicular plexus block with bupivacaine, in fact reduces the pain but due to shorter duration of analgesia, the challenge remains to improve the quality and duration of analgesia.[2] Different drugs have been used as adjuvant to achieve quick, dense and prolonged block.[7] Various adjuvants such as tramadol, neostigmine, clonidine, dexamethasone, etc., were tried to enhance the duration of analgesia in supraclavicular brachial plexus block.[8-10] They improve analgesia, reduces systemic side effects and reduce total dose of local anaesthetic required.

In this study we assessed the effect of addition of dexamethasone to bupivacaine and compared its effects with bupivacaine alone. The major finding of our study is that the time of administration of rescue analgesic, duration of sensory and motor block showed significant increase in group II than in group I. The mean onset of sensory and motor block was not significantly altered by addition of dexamethasone. Steroids used alone in regional blocks do not produce the blockade. However dexamethasone prolongs duration of block through local action mediated through glucocorticoid receptors. Steroids might exert this effect by altering the function of potassium channels in the excitable cells; bind to intracellular receptors and modulate nuclear transcription.[11,12]

Dexamethasone produces analgesia by blocking pain signal transmission in nociceptive c-fibers, suppressing ectopic neural discharge and by inhibiting the action of phospholipase A2.[13]

Movafegh et al in their study found that addition of dexamethasone to local anaesthetic (lignocaine) prolongs duration of analgesia significantly without any change in onset time as was found in present study.[14] While in study of Shrestha et al they found that addition of dexamethasone as adjuvant to mixture of local anesthetics in supraclavicular block had significant early onset and longer duration of analgesia.[15]

Vieira et al in their study found no significant reduction in onset of sensory and motor blockade in dexamethasone group compared to control group. They performed ultrasound guided interscalene brachial plexus block in 88 patients scheduled for shoulder arthroscopy using 20 ml of the local anaesthetic mixture with dexamethasone adjuvant.[16]

Shaikh et al evaluated the use dexamethasone 8mg as an adjuvant to bupivacaine and concluded that addition of 8mg dexamethasone to bupivacaine 0.25% solution in supraclavicular brachial plexus block prolongs the duration of sensory and motor blockade, reduces the requirement of rescue analgesic in postoperative period but has no effect on the onset time of sensory and motor block.[17]

The addition of dexamethasone to mepivacaine for ultrasound-guided supraclavicular brachial plexus block in patients undergoing upper-limb surgery provides a longer duration of postoperative analgesia when compared to brachial block performed with 0.5% levobupivacaine alone.[2] Another study reported that using ultrasound-guided single-shot supraclavicular blockade with low-dose dexamethasone in a mixture with levobupivacaine results in prolonged analgesia duration and less analgesic use compared with levobupivacaine alone in patient of upper extremity surgery.[18]

Trabelsi et al conducted ultrasound-guided supraclavicular brachial plexus block in 60 patients undergoing upper extremity surgery using 15ml of 2% lidocaine plus 2ml of adjuvant (8mg dexamethasone, 100mg tramadol, 2ml saline). They too found a significant prolongation of duration of analgesia with dexamethasone group (1110 min) compared to tramadol group (240 min).

Nerve injury is a rare complication of dexamethasone injection and it usually occurs in the context of needle trauma and when used in high dose.[20] It was not seen in present study also.

CONCLUSION

In conclusion, dexamethasone when used as an adjuvant in supraclavicular brachial plexus block improves quality, and prolongs the duration of motor and sensory block. It also extends the analgesia period.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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