

Dexamethasone as an Adjuvant to Bupivacaine for Post Operative Pain in Supraclavicular Brachial Plexus Block

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ABSTRACT

Objective: To compare the onset of block, duration of analgesia and complications when dexamethasone is added to local anaesthetic bupivacaine in supraclavicular brachial plexus block for upper limb surgery.

Study Design: Quasi experimental study.

Place and Duration of Study: This study was conducted at the Department of Anaesthesia, PIMS, Islamabad from July 2007 to June 2008.

Materials and Methods: Total sixty patients were included in this study. 30 patients were given supraclavicular block with 0.5% Bupivacaine plus normal saline and put in Group A and remaining 30 were given 0.5% bupivacaine plus dexamethasone and put in Group B. Study inclusion criteria were surgery of upper limb, age of the patient between 20 years to 60 years and anaesthesia physical status (ASA) I, II, III. Variables recorded were onset of sensory and motor block for both groups and duration of sensory and motor block in both groups. Rescue analgesia requirement and complications were also noted in both groups.

Results: Demographically both groups were well matched .T. Test was used to compare the onset of sensory and motor block, duration of sensory and motor block and numerical pain score between the two groups. Chi-square test was used to compare rescue analgesia required and complications between the two groups. P-value less than 0.05 was considered statistically significant. The onset of motor block was similar in both groups ($p=0.82$) while onset of sensory block was earlier in dexamethasone group ($P=0.014$). The duration of sensory and motor block were significantly longer in dexamethasone group(B) than Bupivacaine group alone(A) ($P= <0.001$). Rescue analgesia required by the bupivacaine alone (A) was much earlier than dexamethasone group(B)($P= <0.001$). No serious complications were noted in both groups.

Conclusion: The addition of dexamethasone to bupivacaine 0.5% solution in supraclavicular brachial plexus block prolongs the duration of sensory and motor blockade and provides greater pain relief also it shorten the onset of sensory block but has no effect on onset of motor block.

Key Words: Supraclavicular brachial plexus block, Dexamethasone, Bupivacaine.

INTRODUCTION

Regional anaesthesia has become more popular than general anaesthesia in recent years especially for limb surgeries¹. Many studies are being done on benefits of local blocks verses general anaesthesia showing that regional blocks are associated with time efficient anaesthesia, faster recovery, fewer side effects, better analgesia and with better acceptance than general anaesthesia².

Regional anaesthesia technique used for surgery may have positive effects with less nausea, vomiting, reduced blood loss and excellent pain relief. There are many local anaesthetic techniques which can be continued in the postoperative period for postoperative analgesia i-e local infiltration of incision with long acting local anaesthetic^{3,4}. Blockade of peripheral nerves and or plexuses⁵ and continuous block techniques peripherally or centrally⁶. Brachial plexus is formed by the ventral rami of C₅-T₁. Nerve converge to form trunk, divisions and cords which are enclosed in a facial sheath. Brachial plexus anaesthesia is a technique

well suited for upper limb surgeries⁷, side effects like nausea ,vomiting ,sedation and poor pain control associated with general anaesthesia are possibly reduced with regional anaesthesia. Also the recovery time for the patient receiving Brachial plexus anaesthesia is reduced⁸. Brachial plexus block can be performed through many approaches like axillary, intersclenea, supraclavicular and infraclavicular⁹. In this study supraclavicular approach was used as it provides anaesthesia to entire limb, is easy to perform, has few complications, provide good postoperative analgesia and reduce the analgesic requirement in first 24 hrs. Inadequate post operative pain relief can delay the recovery, necessitate rehospitalization, increase the duration of hospital stay, increase health care cost and reduce patient satisfaction. A recent survey investigation of severity of pain following ambulatory surgery in 5703 patients indicated that 30% of the patients experienced moderate to severe pain post operatively¹⁰. Another study revealed 57% of patients experience moderate to severe pain following an operation in many cases¹¹. Various local anaesthetics in

different concentrations have been used to evaluate the onset of block and duration of post operative pain relief in brachial. Plexus blocks¹². Various adjuvant drugs like opioids, clonidine, midazolam, neostigmine, vasoconstrictors and buprinorphin have been evaluated in conjunction with local anaesthetics to prolong the period of analgesia and provide postoperative pain relief^{13,14}. Dexamethasone has been used in conjunction with local anaesthetic for pain relief in oral, general, ENT, ophthalmology and orthopedic surgeries¹⁵. Studies are being done in Pakistan to evaluate its role for post operative pain, nausea and vomiting¹⁶. This study was designed to evaluate the role of dexamethasone as adjuvant to bupivacaine for onset and duration of analgesia for post operative pain relief in supraclavicular block and also to observe complications associated with them. In this study we compared the role of Bupivacaine 0.5% 30 ml plus 2 ml of normal saline with Bupivacaine 0.5% 30 ml Plus Dexamethasone 8 mg 2 ml to see the onset of block, duration of analgesia and complications.

MATERIALS AND METHODS

The proposed study was a interventional, simple randomized, spanning over a period of one year was carried out at the department of Anaesthesia PIMS Islamabad. The study population included sixty patients. After approval of hospital ethical committee each patient eligible for the study as determined by inclusion and exclusion criteria was asked to give written informed consent for participation. The inclusion criteria was patients requiring upper limb surgery, ages between 20 to 60 years, Anaesthesia physical status (ASA) I, II, III. The exclusion criteria was bleeding disorders, pregnant patients, psychiatric patients, patients with sepsis and patients with history of allergy to local anaesthetic. The study drug was prepared that is 0.5% Bupivacain 30 mls pulse 2 ml of N/S Group(A) or 0.5% Bupivacain 30 mls pulse 2 ml of Dexamethasone 8 mg Group(B). On arrival in OT intravenous access with 22 G cannula was established on contralateral arm. ECG, SPO2 and BP was monitored. Patient was placed in supine position with head turned away and ipsilateral arm adducted. The interscalene groove and midpoint of clavical was identified.

After aseptic preparation of the area at a point 1.5 to 2.0 cm posterior to the mid point of clavical. A skin wheal with local anaesthetic 2% xylocain 3 ml was raised. A 22 G – 4 cm short bevel needle were placed caudally slightly in the medial and posterior direction until paraesthesia elicited in arm or hand. After the elicitation of paraesthesia and a negative aspiration of blood study drug was injected. Anaesthesia and analgesia was observed in post operative period up to 24 hrs. The assessment of onset of sensory and motor block was done every five minutes from time of

injection of drug till the block is established. Sensory block was evaluated by temperature. Testing using spirit soaked cotton on skin dermatomes C₂ – T₂ where as the motor block was assessed by asking the patient to adduct the shoulder and flex the forearm and hand against gravity. Onset of sensory block is defined as time between injection of drug and complete loss of cold perception of hand while onset of motor block is defined as time from injection of drug to complete paralysis. Patient with incomplete block were excluded. Duration of sensory block is the time interval between injection of drug and onset of pain requiring analgesia. Duration of motor block is time interval between injection of drug and complete return of motor power. Pain was noted by numerical rating pain score scale. Zero (0) defined as no pain and 10 mean worst pain possible.

Rescue analgesia pethedine 0.5 mg /kg was given when pain score was more than 04. Pain score was recorded at (0) minute, 30 minutes, 2,6,12 and 24 hrs. Complications were also noted.

RESULTS

In this study sixty patients in two groups having 30 patients each were studied independently and then compared for onset of block, duration of analgesia and complications. The mean age for patients in dexamethasone group (B) was 34.37 with standered deviation of 11.30 versus 31.50 and standered deviation of 9.91 in bupivacaine alone group(A), which are almost similar as shown 1 in (Table1). There was a significant difference in the onset time of the sensory block (15.73 = 2.92 min) in dexamethasone group(B) versus (17.97 = 4.41 min) in bupivacaine alone group(A). A p value of (p=0.04) showing that onset was early in the dexamethasone group(B) (Table 2).

Table No. 1: Distribution of cases by age

Age	Bupivacaine plus normal saline(A)		Dexamethason adjunct to Bupivacaine (B)	
	Number	%	Number	%
20 – 30	18	60.0	14	46.7
31 – 40	08	26.7	09	30.0
41 – 50	03	10.0	04	13.3
51 – 60	01	03.3	03	10.0
Total	30	100.0	30	100.0
Mean ± SD	31.50 ± 9.91		31.50 ± 9.91	

However onset time of motor blockade (7.77 = 2.64 min) in dexamethasone group (B) versus (9.13 = 3.29 min) in bupivacaine alone group (A) were not significantly different and p value of (p=0.082) showing that onset of motor block was similar in both groups (Table 2). The duration of sensory blockade (17.37 = 1.58 hrs) in dexamethasone group (B) versus (10.4 = 0.93 hrs) in bupivacaine alone group(A) showed a prolonged effect of sensory blockade with addition of dexamethasone (p=<0.001) (Table 3). Also

duration of motor blockade (8.23 ± 0.97 hrs) in dexamethasone group (B) versus (6.23 ± 0.81 hrs) in bupivacaine alone group(A) was significantly longer in the dexamethasone group ($P < 0.001$) (Table 3).

The mean of rescue analgesia required in dexamethasone group(B) was 17.57 hrs with standard deviation of 1.52 versus 10.40 hrs with standard deviation of 0.93 in bupivacaine alone group(A) was

more than seven hours later than bupivacaine alone group(B) providing prolonged post operative pain relief (Table 4).

Complications observed were two cases of horner's syndrome and one case of phrenic nerve block. No medical intervention was needed in these instances and condition resolved after 3 to 4 hours. No case of pneumothorax was observed in this study.

Table No. 2: Onset of sensory & Motor Block Comparison between Group A and B

Onset of Sensory Block					Onset of Motor Block			
Group A	Mean	SD	t value	p value	Mean	SD	t value	p value
Bupivacaine + Saline	17.97	4.41	2.311	0.024	9.013	3.29	1.770	0.082
Bupivac + Group Dexamethason	15.73	2.92			7.77	2.64		

Key: SD Standard Deviation.

Table No.3: Duration of Motor Block Sensory & Motor Comparison of Group A and B

Duration of Sensory Block					Duration of Motor Block			
Group A	Mean	SD	T value	P value	Mean	SD	t value	p value
Bupivacaine + Saline	10.40	0.93	-20.74	<0.001	6.23	0.81	-8.629	<0.001
Group B Bupivac+ Dexamethason	17.37	1.58			8.23	0.97		

Key: SD Standard deviation

Table No.4: Rescue Analgesia required Comparison between Group -A and Group-B

Group	Mean	SD	t value	P value
Group-A (Bupivacaine + Saline)	10.40	0.93	-21.97	<0.001
Group-B Bupivacaine + Dexamethason	17.57	1.52		

Key: SD Standard deviation

DISCUSSION

Brachial plexus blocks are most extensively used peripheral nerve block technique. The advantages of Brachial plexus block include less nausea, vomiting, no airway intervention and earlier discharge for out patients. The Brachial Plexus supplies all of the motor and most of the sensory function of upper limb. The supraclavicular approach blocks the Brachial plexus in the area where it is more compact, Thus it has fastest onset time of any of the arm blocks and is ideal for surgery of forearm, elbow and hand. Supraclavicular block provide postoperative analgesia of short duration even when local anaesthetic like bupivacaine is used alone. Use of Dexamethasone with Bupivacaine has been shown to reduce the overall pain scores and analgesia requirement in the post operative period without any apparent adverse effect¹⁷. Adding a steroid to local anaesthetic solution may not be indicated for all patients, for example diabetic patient may experience hyperglycemia and patient with continuing infectious process may be effected by anti-inflammatory effects of

steroids. The safety of dexamethasone use in nerve sheath may raise some concerns.

In animal experiments, repeated intrathecal injection of small dose betamethasone¹⁸ and triamcilononacetate¹⁹ did not induce spinal neurotoxicity. In one study after approximately 2000 intrathecal injection of dexamethasone (8 mg) in 200 patients for treatment of post traumatic visual disturbance, no neurological disorders were found at one month follow up²⁰. Nerve injury is a rare complication of dexamethasone injection and it usually occurs in the context of needle trauma²¹. Adverse effects with single dose of dexamethasone are probably extremely rare and minor in nature and previous studies have demonstrated that the short term (<24h) use of dexamethasone was safe²². Complications observed in this study were two cases of Horner's syndrome and one case of phrenic nerve block. All of these complications were watched carefully without any intervention and they all resolved in two to four hours. No case of pneumothorax was observed in this study. Complications of supraclavicular block of brachial plexus using compound classic and perivascular technique was studied in Iran in 320 patient over 3 years with result showing that most common complication was Horner's Syndrome 34%²³. The second most common complication was hematoma 8.8% and lastly vascular injuries 2.5%. Rate of hematoma was directly related to the number of needle punctures. It was concluded in the study that with attention to avoidance of excessive needle advancement after the beginning of paraesthesia and slow injection of drugs, the rate of failure and complications can be reduced. Our results showed that

sensory block tended to last longer as compared to motor block which agrees with the observation by de Jong et al.²⁴. These authors explained that larger motor fibers require a higher concentration of local anaesthetic than small sensory fibers. In recent years work done on supraclavicular block with dexamethasone as an adjuvant to local anesthetic shows significant increase in duration of post operative analgesia. Shrestha BR et al, compared the analgesic efficacy of local anaesthetic with and without dexamethasone in supraclavicular brachial plexus blocks²⁵. In this study brachial plexus block was done with 40 – 50 ml of local anaesthetic with 1: 200, 000 adrenaline in one group and in the other group the block was performed with the same amount of local anaesthetic with dexamethasone. The onset of action and duration of analgesia in the two groups were compared and found to be significantly increased in dexamethasone group without any unwanted effects.

The analgesic effects of corticosteroids are suspected to be mediated by their anti inflammatory or immune suppressive effects. Holte and Kehlet investigated with the strong anti-inflammatory effect of glucocorticoids following major surgeries and found that single dose of glucocorticoid inhibits the synthesis and release of Pro inflammatory and anti inflammatory mediators²⁶. The use of corticosteroid as an adjuvant to local anaesthetic for peripheral nerve block rarely has been described, and its mechanism of action is not clearly understood. The glucocorticoids cause skin vasoconstriction which is mediated by occupancy of classical glucocorticoid receptors rather than nonspecific pharmacological mechanism²⁷. One possibility of prolong local anaesthetic effect is because of systemic effects of dexamethasone. Another believes that analgesic properties of corticosteroid are the result of their systemic effect²⁸.

The concept of steroid administration to address postoperative pain is still evolving. Steroids with or without local anaesthetic agents have been administered by surgeons across various medical specialties and with the use of different methods. The ideal dose and mode of administration are yet to be determined, but there is overwhelming evidence that corticosteroid increase the efficacy of postoperative pain reduction in a manner that does not compromise patient safety. The approach is simple and inexpensive. However there is still a need for further studies to validate the use of dexamethasone with bupivacaine or similar combinations as protocols of choice for post operative analgesic.

CONCLUSION

In conclusion, the addition of dexamethasone to bupivacaine 0.5% solution in supraclavicular brachial plexus block prolongs the duration of sensory and motor blockade and provides greater pain relief, also it shorten the onset of sensory block but has no effect on

onset of motor block. Complications associated with the block and dexamethasone were also negligible. Further studies are needed to evaluate the optimal dose of dexamethasone to be used for prolonged brachial plexus block as well as the mechanism of this effect, also to evaluate any side effects associated with it.

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