Original Article

The Effect of Dexamethasone Added as an Adjuvant to Bupivacaine for Brachial Plexus Block in Upper Limb Surgeries

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ABSTRACT

Aim and Objectives: The aim of study was to evaluate the onset time, duration and analgesic efficacy of bupivacaine 0.25%, and to compared the Bupivacaine + Dexamethasone 8 mg for brachial plexus block by supraclavicular approach and Hemodynamic variables for the upper limb surgeries.

Materials and Methods: The study was a randomized single blinded study conducted on 60 patients undergoing upper limb surgeries aged between 18 to 65 years under supraclavicular brachial plexus block at Chalmeda AnandRao Institute of Medical Sciences, Karimnagar, Telangana.

Results: The mean time for onset of motor block in group B was 9.16 ± 1.34 min and in group BD was 5.40 ± 0.89 min. The mean duration of motor block in group B was 2.36 ± 1.26 hours and in group BD was 4.46 ± 0.71. The mean duration of sensory block in Bupivacaine group was 4.56 ± 3.22 hours in BD group was 6.14 ± 0.63 hours.

Conclusion: our study showed that the addition of dexamethasone 8 mg as an adjuvant to bupivacaine (0.25%) has following effects: Faster onset of sensory and motor block, longer duration of sensory and motor block.

Keywords: Upper limb surgeries, brachial plexus block, dexamethasone bupivacaine

INTRODUCTION

Bupivacaine is one of the local anaesthetics used most frequently as it has a longer duration of action varying from 3 to 8 hours. However, it has limiting factors like delayed onset, patchy or incomplete analgesia. To minimize these drawbacks many drugs like dexamethasone, neostigmine, opioids, hyaluronidase, midazolam, [1,3] etc., have been added to local anaesthetics to improve the quality and duration of action and postoperative analgesia.

Brachial plexus block provides a useful alternative to general anesthesia for upper limb surgeries. It achieve near ideal operating conditions by producing complete muscular relaxation, maintaining stable intraoperative hemodynamic condition and sympathetic block which reduces postoperative pain, vasospasm and edema.

For surgeries on upper extremities particularly in emergency surgeries regional anaesthesia has many advantages over general anaesthesia. The frequent use of pneumatic tourniquet to provide a bloodless field to during surgery makes individual nerve blocks impractical. Brachial plexus block is the answer in such a situation.

There are different approaches but the ones frequently

employed for blocking the brachial plexus include: Supraclavicular approach, infra-clavicular approach, axillary approach and inter scalene approach.

The present study is being undertaken in a randomized single blinded manner to evaluate the onset time, duration and analgesic efficacy of bupivacaine 0.25%, and compared to Bupivacaine+Dexamethasone 8mg for brachial plexus block by supraclavicular approach and Hemodynamic variables (HR, BP, O2 saturation) for upper limb surgeries.

MATERIALS AND METHODS

The study design was a randomized single blinded study was conducted on 60 patients undergoing upper limb surgeries aged between 18 to 65 years under supra clavicular brachial plexus block.

This study was conducted at Department of Anaesthesiology, Chalmeda AnandRao Institute of Medical Sciences, Karimnagar, Telangana during the period of January 2017 to December 2017.

Inclusion criteria:

- Patients with ASA class I and II
- Patients aged between 18 to 65 years
- Patients with SBP : 100-139 mm of Hg
- Patients with DBP: 60-89 mm of Hg.

Exclusion criteria:

- Patients belonging to ASA III and IV.
- Known case of hypersensitive reaction to dexamethasone and LA
- Patients with abnormal BT, CT or on anticoagulation therapy, severe anemia, hypovolemia, shock, septicemia and h/o seizures.
- Local infection at the site of proposed puncture for supraclavicular block.

Procedure

Total 60 patients posted for upper limb surgeries under supraclavicular block were assigned to two groups, each containing 30 patients.

Group A: received 38 ml, bupivacaine 0.25%+ 2ml NS.

Group B: received 38ml of mixture of bupivacaine 0.25% and +2ml of dexamethasone (8mg). All the study drugs used were preservative free. 40ml solution for 'single shot' supraclavicular brachial plexus blockade was administered.

IV line secured and patients were connected to monitors to record pulse, O2 saturation, NIBP and ECG. Premedication with inj. Midazolam 0.05 mg/kg body weight before the procedure. Drug solutions are prepared.

Patient position is supine, arms by the side and head turned to other side.

After aseptic preparation of the area, at a point 1.5 to 2.0 cm posterior and cephalad to midpoint of clavicle, subclavian artery pulsations are felt. A skin wheel is raised with local anesthetic cephalo posterior to the pulsations. 22 guage, 1.5 inches short beveled needle introduced through the same point, parallel to head and neck, in a caudal, slightly medial and posterior direction, until either paraesthesia is elicited or first rib is encountered.

After eliciting paraesthesia and negative aspiration of blood, keeping the needle in the same position the study medication was injected slowly ruling out intravascular injection intermittently.

Sensory block is evaluated by pin prick method with a 23 gauge needle. The onset time was defined as the time between injection and complete loss of pin prick sensation in C2 and T2 dermatome and temperature testing using spirit soaked cotton on skin dermatomes C2 to T2. The time when complete sensory blockade achieved was noted.

Motor block was assessed by Bromage three point score is:

0-Normal motor function with full flexion and extension of elbow, wrist and fingers,

1-decreased motor strength with ability to move fingers and/or wrist only,

2-complete motor blockade

RESULTS

Sixty (60) patients ASA I and II of either sex aged between 18-65 years, posted for upper limb surgeries under supraclavicular brachial plexus block were selected for the study. The study was undertaken to evaluate the efficacy of Dexamethasone 8mg as adjuvant to Bupivacaine (0.25%) in comparison with plain Bupivacaine (0.25%) for brachial plexus block by supraclavicular approach.

Table 1: Age distribution of study group

Age	Bupivacaine Group	Bupivacaine + Dexamethasone Group	T- Value	P-Value	Significance
≤ 30 years	7	4	0.2834	0.7780	Non significant
31 - 40 Years	13	15			
41 - 50 Years	7	11			
≥ 51 Years	3	0			
Total	30	30			
Mean ± SD	37.45±10.13	36.83 ± 6.41			

Table 2: Onset of sensory block between the study groups

Age	Bupivacaine Group	Bupivacaine + Dexamethasone Group	T- Value	P-Value	Significance
Onset of sensory block in min (Mean ± SD)	17.07 ± 2.21	10.21 ± 1.35	15.794	0.0001*	Highly Significant

Table-2 shows that unpaired' test showed that, the time for onset of sensory block in BD was significantly faster when compared to group B (P< 0.001).The mean time of onset of sensory block in group B was 17.07± 2.21minutes and 10.21± 1.35 Minutes in group BD. this difference in onset of sensory Block was statistically significant between the groups.

Table 3: Onset of motor block between the study groups

Age	Bupivacaine Group	Bupivacaine + Dexamethasone Group	T- Value	P-Value	Significance
Onset of motor block in min (Mean ± SD)	9.16 ± 1.34	5.40 ± 0.89	12.68	0.0001*	Highly Significant

Table 3 shows the mean time for onset of motor block in group B was 9.16 ± 1.34 min and in group BD was 5.40 ± 0.89 min. The statistical analysis by unpaired student' test, t' test showed that, the time for onset of motor block in group BD was significantly faster when compared to group B (P< 0.001).

Table 4: Duration of sensory block in Hrs

Age	Bupivacaine Group	Bupivacaine + Dexamethasone Group	T- Value	P-Value	Significance
Duration of sensory block in Hrs (Mean ± SD	4.56 ± 3.22	6.14 ± 0.63	-2.637	0.01	Significant

Table 4 shows patients of two groups were observed for 12 hours. Time was noted when the patient asked for rescue analgesics the mean duration of sensory block in Bupivacaine group was 4.56 ± 3.22 hours in BD group was 6.14 ± 0.63 hours.

The statistical analysis by students unpaired 't' test showed that the duration of sensory block in Bupivacaine+Dexamethasone groups was significantly longer when compared to plain Bupivacaine group (P < 0.001)

The mean duration of Motor block in group B was 2.36 ± 1.26 hours. In group BD was 4.46 ± 0.71. The statistical analysis by students unpaired't' test showed that the duration of motor block in group BD was significantly longer when compared to group B (P < 0.001).

The mean heart rate in Bupivacaine group was around 71 to 78 beats per minute. The mean heart rate in Bupivacaine –Dexamethasone group was around 78 to 79 beats per minute. There was no statistically significant difference between Bupivacaine and Bupivacaine – Dexamethasone groups in heart rate at different time intervals.

Table 5: Systolic blood pressure (mm of Hg)

Time of Assessment	Mean ± SD		T- Value	P-Value	Significance
	Bupivacaine Group	Bupivacaine + Dexamethasone Group			
0 min	114.43 ± 9.95	120.43 ± 12.58	-2.0482	0.045	Significant
5 min	116.94 ± 9.91	114.78 ± 14.81	0.663	0.509	Non significant
15 min	113.35 ± 7.27	122.47 ± 10.01	-4.03805	0.0001	Significant
30 min	112.21 ± 10.50	118.83 ± 13.42	-2.12813	0.037	Significant
60 min	116.72 ± 11.34	118.89 ± 15.49	-0.619	0.538	Non significant
2 Hrs	114.37 ± 9.17	119.22 ± 15.06	-1.504	0.139	Non significant
6 Hrs	115.05 ± 10.57	116.46 ± 11.71	-0.49	0.6254	Non significant
12 Hrs	117.83 ± 10.04	119.32 ± 12.38	-0.512	0.61	Non significant

The mean systolic blood pressure in Bupivacaine group ranged from 112.21 ± 10.5 to 117.83 ± 10.04 mm of Hg. The mean systolic blood pressure in Bupivacaine-Dexamethasone group was ranging from 119.32 ± 12.8 mm of Hg to 122.47 ± 10.01 mm of Hg at different time intervals.

The difference in systolic blood pressures at different time intervals between Bupivacaine and Bupivacaine–Dexamethasone groups were not statistically significant.

Table 6: Diastolic blood pressure (mm of Hg)

Time of Assessment	Mean ± SD		T- Value	P-Value	Significance
	Bupivacaine Group	Bupivacaine + Dexamethasone Group			
0 min	72.45 ± 6.99	78.21 ± 7.95	-2.975	0.0042	Significant
5 min	72.54 ± 6.73	81.28 ± 6.86	-4.975	0.000006	Significant
15 min	73.74 ± 7.70	77.18 ± 9.46	-1.544	0.1281	Non significant
30 min	75.62 ± 6.66	77.95 ± 6.34	-1.387	0.17	Non significant
60 min	77.47 ± 7.62	78.60 ± 6.72	-0.608	0.5454	Non significant
2 Hrs	77.89 ± 8.07	78.82 ± 5.79	-0.514	0.608	Non significant
6 Hrs	73.45 ± 7.43	77.14 ± 7.56	-1.9	0.061	Non significant
12 Hrs	75.61 ± 7.22	77.80 ± 8.60	-1.064	0.2917	Non significant

The mean diastolic pressure in Bupivacaine group was

ranging from 72.45 ± 6.99 mm of Hg to 77.89 ± 8.07 mm of Hg. It was ranging from 77.14 ± 7.56mm of Hg to 81.28 ± 6.86 56 mm of Hg in Bupivacaine -Dexamethasone group at different time intervals. There was no statistically significant difference in diastolic blood pressure between Bupivacaine and Bupivacaine –Dexamethasone groups at different time intervals.

In Bupivacaine group the mean oxygen saturation ranged from 96.06 ± 0.50 % to 98.93 ± 0.33. In Bupivacaine + Dexamethasone group the mean Oxygen saturation ranged from 98.29 ± 0.28 to 98.82 ± 0.77.

The statistical analysis by student's unpaired test showed that there was no significant difference in O2 saturation between the Bupivacaine and Bupivacaine + Dexamethasone groups (P > 0.05).

DISCUSSION

In the present study, dexamethasone is used as adjuvant in local anesthetic. Our study was a randomized, prospective, single blinded and controlled study. 60 patients posted for upper limb surgeries below elbow joint were given brachial plexus block by supraclavicular approach. The patients were randomly allocated into two groups using standard randomization code.

There were more male patients than female in both the groups. There was no significant difference regarding the sex distribution between two groups. Steroids block the transmission of impulse in nociceptive C fibers, thus when used in local anaesthetics, steroids prolong the local anaesthetic block. It has been found that the total duration of analgesia following supraclavicular brachial plexus block in the steroid group was significantly higher than in bupivacine group.

Brachial plexus block provides postoperative analgesia for upper limb surgeries. Bupivacaine is used as it has longer duration of action varying from 3-8 hours. Various adjuvant drugs like Tramadol, Dexamethasone Midazolam, Neostigmine and Hyaluronidase, clonidine have been evaluated In conjunction with local anesthetics to prolong the period of analgesia, but they were found to be either ineffective or to produce high incidence of adverse effects.

Hence, an attempt has been made to assess the efficacy of dexamethasone as an adjutant to Bupivacaine (0.25%) in brachial plexus block (supraclavicular approach) in terms of onset time, duration of analgesia. Hemodynamic variables and rescue analgesic requirements in first 12 hours.

Out of which the mean age of group B (receiving only Bupivacaine) was 37.45 ±10.13 years and the mean age of group or BD (receiving dexamethasone with Bupivacaine) was 36.83±6.41 years. Hence both age groups were comparable in regard to age.

In the present study, it was found that the onset of sensory and motor blocks was significantly faster in patients who received dexamethasone along with Bupivacaine. Onset of sensory block (10.21± 1.35 Minutes in group BD; in group B it was 17.07 ± 2.21 min). Onset of motor block (In group BD it was5.40 ± 0.89 min; group B it was 9.16 ± 1.34 min). The onset of motor block was found to be faster than the onset of sensory block in both groups.

Golwala MP et al [6] and Yadav RK et al [7] in their studies, found significantly earlier onset of sensory and motor block in the local anesthetic plus dexamethasone group than in the control group. This discrepancy may be due to differences in study methodology such as use of varying methods of block assessment, higher dose of local anesthetic, and use of adjuncts like epinephrine.

Shreshtha BR, Maharjan SK, Tabedar [4] et al study showed that onset of action was 10-30 minutes in local anesthetic group (mean 18.15 ± 4.25) and 10-20 minutes (mean 14.5 ± 2.10) in the local anesthetic plus steroid group. They found statistically significant difference between two groups.

The present study results showed that sensory block tended to last longer as compared to motor block which agrees with the observation by de Jong De et al. [1] These authors explained that large fibres require a higher concentration of local anaesthetic than small fibres.

The minimal effective concentration of local anaesthetic for large (motor) fibres is greater than for small (sensory) fibres. Thus, motor function return before pain perception and duration of motor block is shorter than the sensory block.

In the present study, the mean duration of sensory block (i.e. time elapsed from time of injection to appearance of pain requiring analgesia) was significantly higher (P <0.05) in group BD than in group B. (group BD, 6.14 ± 0.63hrs; group B, 4.56 ± 3.22 hrs).

Estebe IP et al [9] studied the effect of dexamethasone on motor brachial plexus block with bupivacaine and with bupivacaine-loaded microspheres in a sheep model and found that the incorporation of dexamethasone in bupivacaine-loaded microspheres dramatically increases the duration of action.

In a study by Yadav et al [7], the mean number of rescue analgesic doses was also lesser in Dexamethasone group than other two groups. Dexamethasone, being glucocorticoid, has emerged as a potent cortisteroid when used along with Bupivacaine. Many studies have successfully proved the usefulness of Dexamethasone as

an effective analgesic.[4, 2]

A randomized single blinded study was taken up among 60 patients posted for upper limb surgeries who were aged between 18 to 65 years in our institute. The mean age was 36.9 years in Bupivacaine and 34.7 Bupivacaine –Dexamethasone groups. There is no statistically significant difference in age between the two groups. Hence the two groups were comparable in the aspect of age.

In a similar study, the mean age in local anesthetic group was 33.8 years and in Dexamethasone group was 30.3 years in contrary to the findings of this study. The mean time of onset of sensory block was later in Bupivacaine group compared to Bupivacaine –Dexamethasone group. The mean time of onset of motor block was also lesser in Dexamethasone group than only bupivacaine group in this study. This difference was also statistically significant between the groups.

In another study, Yadav et al [7] compared three different drugs by supraclavicular brachial plexus block. However, the onset of anesthesia in Dexamethasone group was faster than other two groups of drugs.

The mean duration of sensory block in Bupivacaine group was 4 (± 6.3) hours and 5.9 (± 0.7) hours in Bupivacaine - Dexamethasone group. The mean duration of motor block in Bupivacaine group was 1.9(±0.5) hours and in Bupivacaine - Dexamethasone group was 4.3(±0.9) hours. There was statistically significant difference in duration of action between Bupivacaine and Bupivacaine – Dexamethasone groups.

The dose of dexamethasone as an adjuvant to local anaesthetics for peripheral nerve block has not been described; we used a dose of 8 mg because administration of this dose seems to be safe in adults. Adverse effects with a single dose of dexamethasone are probably extremely rare and minor in nature, and previous studies have demonstrated that short-term (< 24 hours) use of dexamethasone was safe.

The present study has shown that addition of dexamethasone to a mixture of local anaesthetics in the brachial plexus block using supraclavicular approach produced prolonged motor blockade and effective postoperative analgesia which lasted longer than that produced by local anaesthetics alone without any significant side effects. Also it is a very cost effective way of providing analgesia as the cost of one ampoule of dexamethasone is very less.

Patients do not require other analgesic drug in immediate postoperative period. Dexamethasone 8mg when added to 38 mL of Bupivacaine 0.25% for supraclavicular brachial plexus block speeds the onset of sensory and motor blocks ($P < 0.05$). The combination produces improved analgesia, resulting in a prolonged effect and reduced requirements for rescue analgesics.

CONCLUSION

In conclusion, our study showed that the addition of Dexamethasone 8mg as an adjuvant to bupivacaine (0.25%) has following effects: Faster onset of sensory and motor block, longer duration of sensory and motor block. Less number of rescue analgesics in post-op 24 hours. No significant difference in hemodynamic variables i.e., pulse rate, systolic BP, diastolic BP and O2 saturation.

CONFLICT OF INTEREST :

The authors declared no conflict of interest.

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