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Comparision of Bupivacaine and Bupivacaine with Dexamethasone Combination in Brachial plexus Block by Supraclavicular Approach

Ramakrishna Shatagopam[1], P Anand Vijaya Bhasker[2]

[1,2]Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, 500003, India.

Abstract

Introduction: As an alternative to general anesthesia, for upper limb surgeries, brachial plexus block is a popular approach. This type of block avoids the untoward effects of general anesthesia including upper airway instrumentation and thus prevents the consequences as shown by the available literatures. *Aim:* To compare 0.5% bupivacaine with normal saline and 0.5% bupivacaine with Dexamethasone (8 *mg*) in brachial plexus block by supraclavicular approach. *Materials and Methods:* This study was a single blinded, randomized study which was taken up among 70 patients aged between 18 to 65 *years* of ASA I and II posted for upper limbs. They were randomly divided into two equal groups where first group received 28 *ml* of Bupivacaine + 2 *ml* NS and second group received 28 *ml* of Bupivacaine + 2 *ml* Dexamethasone (8 *mg*) by supra clavicular approach. *Results:* Between the mean ages of two groups, there was no statistically significant difference. In Bupivacaine group, the mean time for onset of sensory block was 17.4 (± 3.5) *min* and in Bupivacaine dexamethasone group was 11.8 (± 2.7) *min* ($p < 0.05$). The mean time for onset of motor block in Bupivacaine group was 8.5 (± 4.4) *min* and in Bupivacaine dexamethasone group was 6.4 (± 1.8) *min* ($p < 0.05$). Both the differences were statistically significant ($p < 0.05$). The mean duration of sensory block in Bupivacaine group was 2.03 (± 1.4) *hours* and in Bupivacaine dexamethasone group was 5.85 (± 0.84) *hours* ($p < 0.05$). The mean duration of motor block in Bupivacaine group was 2.48 (± 0.59) *hours* and in Bupivacaine dexamethasone group was 6.97 (± 0.47) *hours* ($p < 0.05$). In Bupivacaine dexamethasone group patients required only 1 rescue analgesic dose. Rescue analgesic requirement in Bupivacaine group was higher ($p < 0.05$). No significant difference in hemodynamic variables i.e., pulse rate, systolic BP, diastolic BP and O_2 saturation. *Conclusion:* In brachial plexus block, addition of dexamethasone to bupivacaine produced faster and longer duration of block and less number of rescue analgesics in post-op 24 *hours*.

Keywords: Bupivacaine; Dexamethasone ; Brachial plexus Block.

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Introduction

A popular approach for upper limb surgeries is brachial plexus block as an alternative to general anesthesia. To achieve ideal operating conditions by producing muscular relaxation, maintaining stable intra-operative hemodynamic condition and sympathetic block which reduces post-operative pain, vasospasm and edema, this type of anesthesia is helpful.[1] The untoward effects of general anesthesia including upper airway instrumentation is avoided by this type of block and thus prevents

Corresponding Author: P Anand Vijaya Bhasker, Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, 500003, India.

E-mail: drparbhasker2003@yahoo.co.in

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the consequences. It is effective in terms of cost and performance, margin of safety, along with good post-operative analgesia. Consistent and easiest method for anesthesia and post-operative pain management is supraclavicular block.[2] Bupivacaine is the local anesthetic used most frequently as it has a duration of action which is longer varying from *3* to *8 hours*. Delayed onset, patchy or incomplete analgesia are the limiting factors. Many drugs like Neostigmine, Opioids, Hyaluronidase, Midazolam, Clonidine, Dexamethasone etc., have been added to local anesthetics to improve the quality and duration of action and post-operative analgesia and to minimize these drawbacks.[3] The steroids have shown to decrease the inflammation and also have shown analgesic effects. Reduction of inflammation by inhibition of Phospholipase A^2 is caused after administration of steroids and also blocks the transmission in nociceptive C–fibers to reduce the pain. Membrane injury and edema by generating inflammatory mediators was induced by phospholipase A^2. For liberation of arachidonic acid leading to the production of prostaglandins and leukotrienes, phospholipase A^2 enzyme is used. Small neurons are sensitized by these enzymes and they enhance pain generation by abnormal conduction and intraneural edema. Dexamethasone is a very potent and selective glucocorticoid. It is used as anti-inflammatory and immunosuppressant. Potency of dexamethasone is about *40 times* that of Hydrocortisone. For treatment of many inflammatory and autoimmune conditions, clinical uses of dexamethasone was used but to treat patients suffering from neuropathic pain, Complex Regional Pain Syndromes (CRPS), glucocorticoid are also used. So, steroids have anti-inflammatory as well as analgesic effects.[4] Hence, this study was taken up to assess the efficacy of Dexamethasone as an analgesic especially for upper limb surgeries.

Materials and Methods

This study was a single blinded study which was taken up among 70 patients aged between *20* and *68 years* undergoing upper limb surgeries in Mamata General and Super Specialty Hospital, Khammam, during *October 2013* to *September 2015*. Ethical clearance was obtained by Institutional Ethical review committee. An informed, written consent was obtained from all the patients.

Inclusion Criteria was that all patients with ASA class I and II, aged between *20* and *68 years* posted for upper limb surgeries.

Exclusion Criteria was known case of hypersensitive reaction to local anesthetic, with abnormal BT, CT or on anticoagulation therapy, severe anemia, hypovolemia, shock, septicemia and h/o seizures, for supraclavicular block, local infection at the site of proposed puncture.

Routine blood and urine investigations done along with Chest *X*-ray, ECG, HIV, HBsAg screening. Written informed consent was obtained. Intravenous access with a *20 gauge* IV cannula on the contralateral upper limb under aseptic techniques. Study consisted of control group (Group I) received *28 ml*, bupivacaine 0.5% + *2 ml* NS. Study group (Group II) received *28 ml* bupivacaine 0.5% + *2 ml* Dexamethasone (*8 mg*). Pre-anesthetic checkup would be done and all the patients were informed about the procedure. IV line was secured and patients would be connected to monitors to record pulse, O_2 saturation, NIBP and ECG. Before the procedure, pre-medication with inj Midazolam *0.05 mg/kg* body weight was administered. Patient lies supine, arms by the side and head turned to other side. At a point *1.5* to *2.0 cm* posterior, after aseptic preparation of the area, and cephalad to midpoint of clavicle, pulsations of subclavian artery is felt. Cephalo-posterior to the pulsations, a skin wheel is raised with local anesthetic. Until either paresthesia is elicited or first rib is encountered, introduction of a *22 guage*, 1.5 inches short beveled needle was done through the same point, parallel to head and neck, in a caudal, slightly medial and posterior direction. The needle would be moved over the first rib until paresthesia is elicited in the arm or hand, if the rib is encountered. The study medication would be injected slowly ruling out intravascular injection intermittently, after eliciting paresthesia and negative aspiration of blood, keeping the needle in the same position. By pin prick method with a *23-gauge* needle, sensory block is evaluated. The time between injection and complete loss of pin prick sensation in C_2 and T_2 dermatome and temperature testing using spirit soaked cotton on skin dermatomes C_2 to T_2 is called as onset time. The time when complete sensory blockade achieved would be noted. The motor block was assessed by using bromage three point score which 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 with inability to move fingers. The time of motor blockade was noted. The time elapsed between the injection of drug and complete loss of cold perception of the hand, while onset of the motor blockade was defined as the time elapsed from injection of drug to complete motor

block is called the time of onset of sensory block. During the surgery, heart rate, non-invasive blood pressure and oxygen saturation were monitored. The time elapsed between the injection of drug and appearance of pain requiring analgesia is called duration of sensory block and duration of motor block was also recorded.

The data thus obtained was compiled and analyzed using Statistical Package for Social services. (SPSS *vs* 18). Quantitative data was analyzed by using student '*t*' test. Qualitative data was analyzed using Chi–square test. A *p* - value of less than 0.01 was considered as statistically significant.

Results

About 70 patients of ASA I and II who had upper limb surgeries were considered in this study as study subjects. They were randomly divided into two equal groups where first group received *28 ml* of Bupivacaine + *2 ml* NS and second group received *28 ml* of Bupivacaine + *2 ml* Dexamethasone (*8 mg*) by supraclavicular approach, shows in Table 1.

Table 1: Age distribution of the study group

Age groups	Bupivacaine group n (%)	Bupivacaine Dexamethasone group n (%)	Total n (%)
Less than 30 years	10 (28.6)	9 (25.7)	19 (27.1)
31–40 years	13 (37.1)	21 (60.0)	34 (48.6)
41–50 years	8 (22.9)	0	8 (11.4)
51 years and above	4 (11.4)	5 (14.3)	9 (12.9)
Total	35 (100)	35 (100)	70 (100)
Mean ± SD	37.7 ± 12.8	35.6 ± 8.8	37.8 ± 9.7

T value = 0.988 *p* = 0.419 students unpaired *t* test NS-not significant

Age groups were similar the groups were comparable in age.

The mean time of onset of sensory block in Bupivacaine group was *17.4 minutes* and *11.8 minutes* in Bupivacaine – Dexamethasone group. This difference in onset of sensory block was statistically significant between the two groups. The mean time of onset of motor block in this study in Bupivacaine group was *8.5* (± *4.4*) *minutes* and the mean time of onset of motor block in Bupivacaine – Dexamethasone group was *6.4* (± *1.8*) *minutes*. This difference in onset of motor block was statistically significant between the two groups, shown in Table 2.

The mean duration of sensory block in Bupivacaine group was *2.03* (± *1.4*) *hours* and in Bupivacaine – Dexamethasone group was *5.85* (± *0.84*) *hours*. There was statistically significant difference in duration of sensory block between Bupivacaine and Bupivacaine – Dexamethasone groups. The mean duration of motor block in Bupivacaine group was *2.48* (± *0.59*) *hours* and the mean duration of motor block in Bupivacaine – Dexamethasone group was *6.97* (± *0.47*) *hours*. There was statistically significant difference in duration of motor block between Bupivacaine and Bupivacaine – Dexamethasone groups. The patients of Bupivacaine group had received *2.5* (± *0.5*) *doses* and the patients of Bupivacaine – Dexamethasone group received *1.4 mean doses* of rescue analgesic. The difference in receiving the mean doses of rescue analgesic was statistically significant between the Bupivacaine and Bupivacaine – Dexamethasone groups. The mean heart rate in Bupivacaine group was around 77 to 79 beats per minute. The mean heart rate in Bupivacaine – Dexamethasone group was around *79* to *80 beats per minute*. There was no statistically significant difference between Bupivacaine and Bupivacaine – Dexamethasone groups in Heart rate at different time intervals. The mean systolic blood pressure in Bupivacaine

Table 2: Onset of sensory and motor block between the study groups

Groups	Bupivacaine group	Bupivacaine – Dexamethasone group	t value*	*p* - value, Sig
Onset of sensory block in min Mean ± SD	17.4 (± 3.5)	11.8 (± 2.7)	14.897	0.001, Sig
Onset of motor block in min Mean ± SD	8.5 (± 4.4)	6.4 (± 1.8)	12.669	0.001, Sig

Table 3: Mean time of onset of sensory and motor block in the study groups

Groups	Bupivacaine group	Bupivacaine – Dexamethasone group	t value*	*p* - value, Sig
Duration of sensory block in hrs Mean ± SD	2.03 (± 1.4)	5.85 (± 0.84)	13.26	0.001
Duration of motor block in hrs Mean ± SD	2.48 (± 0.59)	6.97 (± 0.47)	28.9	0.0001

group ranged from *115.4 ± 6.4 mm of Hg* to *115.6 ± 7.1 mm* of *Hg*. The mean systolic blood pressure in Bupivacaine – Dexamethasone group was ranging from *119.8 ± 10.7 mm of Hg* to *120.3 ± 12.1 mm of Hg* at different time intervals. There was no statistically significant difference in systolic blood pressure between Bupivacaine and Bupivacaine – Dexamethasone groups at different time intervals. The mean diastolic pressure in Bupivacaine group was ranging from *74.2 ± 5.8 mm of Hg* to *76.6 ± 7.7 mm of Hg*. It was ranging from *77.0 ± 6.9 mm of Hg* to *79.2 ± 7.7* in Bupivacaine – Dexamethasone group at different time intervals. There was no statistically significant difference in diastolic blood pressure between Bupivacaine and Biscayne – Dexamethasone groups at different time intervals.

The oxygen saturation was ranging from *98.7 ± 0.8 percent* to *99.9 Percent* in Bupivacaine group and it was ranging from *98.6 ± 0.7 percent* to *98.9 ± 0.6 percent* in Bupivacaine – Dexamethasone groups. The difference between the oxygen saturation was not statistically significant between Bupivacaine and Bupivacaine – Dexamethasone groups, shown in Table 3.

Discussion

For prolongation of analgesic effects, dexamethasone has emerged as a potent corticosteroid when used along with Bupivacaine. However, the studies are scanty to evaluate the efficacy of Bupivacaine alone and when used in combination with corticosteroids like Dexamethasone.[4] Hence, this study was undertaken to evaluate the efficacy of Bupivacaine with Dexamethasone.

About 37.1% of the patients in Group I and 60.0% of the patients in Group II belonged to *31–40 years* age group. The mean age of patients posted was *37.7 ± 12.8 years* in Bupivacaine and *35.6 ± 8.8 years* in Bupivacaine – Dexamethasone groups. There was no statistically significant difference in age between the two groups. Majority of the patients in this study belonged to *31–40 years* in both the groups. In a study by Sheshtha *et al*. in Nepal in 2003, the mean age was *25.5 ± 12.02 years* in local anesthetic group and *28.05 ± 16.1* in Dexamethasone groups.[5] In a similar study, the mean age in local anesthetic group was *33.8 years* and in Dexamethasone group was *30.3 years*.[6] In our study, the mean time of onset of sensory block in Bupivacaine group was *17.4 minutes* where as it was *11.8 minutes* in Bupivacaine – Dexamethasone (study) group. The mean time of onset of sensory block was late in Bupivacaine group compared to Bupivacaine – Dexamethasone group. Our study is comparable to the study done by Shreshtha *et al*., in which the mean onset of action was *18.15 ± 4.25 minutes* in group which received local anesthetic with adrenaline while it was *14.5 ± 2.1 minutes* in the group which received local anesthetic with dexamethasone.[5] However, the mean onset of sensory anesthesia was slightly lesser in this study in contrary to findings of Shrestha *et al*.[5] In another study, Yadav *et al*. compared the effect of adrenaline, neostigmine and dexamethasone (three different drugs) by supraclavicular brachial plexus block.[3] However, the onset of anesthesia in Dexamethasone group was faster than other two groups of drugs which is comparable to our study. In a study by Islam *et al*., the onset of sensory block was also lesser in Dexamethasone group than the plain local anesthetic group.[7] Thus, the observation of our study shows that addition of dexamethasone to bupivacaine decreases the onset time of analgesia. In our study, the mean duration of sensory block in Bupivacaine group was *2.03* (± *1.4*) *hours* and *5.85* (± *0.84*) *hours* in Bupivacaine–Dexamethasone group. A similar study in Nepal found that the duration of action of the local anesthetic as *3.16 hours* in local anesthetic group and *12.75 hours* in steroid group.[8] In a study by Shreshtha *et al*., the mean duration of post-operative analgesia was around *16 hours* in a group who received Bupivacaine with Dexamethasone and its was around *8 hours* in Bupivacaine–Tramadol group.[5] This shows that the addition of steroid to certainly prolongs the duration of anesthesia and also produces earlier onset of action. This might be due anti-inflammatory effect of Dexamethasone. It has also been proved in many studies that the addition of Dexamethasone to local anesthetic prolongs the duration of action. our study shows similar results when compared with other studies done previously which again proves that dexamethasone prolongs the duration of analgesia. In our study, the mean time of onset of motor block was lesser in Group II *i.e*., Bupivacaine – Dexamethasone group (*6.4 mins*) than in Group I *i.e*., bupivacaine group (*8.5 mins*). This difference was statistically significant between the two groups. Yadav RK *et al*. reported a little early onset of motor blockade with dexamethasone. Pathak RG *et al*. did not find significant reduction of motor blockade time.[3] This might be due to usage of adrenalized xylocaine along with bupivacaine and dexamethasone. But they found a significant prolongation of motor blockade with dexamethasone. Shrestha BR *et al*. (2007) in their study found a significant early onset in motor blockade when dexamethasone was added to a

mixture of 2% lignocaine and 0.5% bupivacaine.[5] Our study correlates with the study done by Yadav RK and Shrestha BR.[3,5] Birdar PA *et al*. (2013) studied the effect of admixture of lidocaine 2% and dexamethasone on onset and duration of sensory and motor blockade.[9] They concluded that onset of sensory and motor blockade was more rapid in dexamethasone group. It correlates our study but in which bupivacaine was used instead of lidocaine with dexamethasone. Estebe JP, Le Corre *et al*. in 2003 stated in their study that dexamethasone alone did not produce any motor block.[10] When added to plain bupivacaine without pH correction, complete motor block could not be obtained. With corrected pH, addition of dexamethasone to plain bupivacaine seemed to delay the onset of motor block and did not prolong its duration. In our study correction of pH was not done in both the groups. But the results were encouraging with addition of *8 mg* dexamethasone to *28 ml* of 0.5% bupivacaine. The mean duration of motor block in Bupivacaine group was *2.48* (± *0.59*) *hours* and in Bupivacaine – Dexamethasone group was *6.97* (± *0.47*) *hours*. There was statistically significant difference in duration of action between Bupivacaine and Bupivacaine – Dexamethasone groups. Tandoc MN *et al*. did a study in 2011 at University of Buffalo.[11] They compared 0.5% bupivacaine with dexamethasone *4 mg* and *8 mg* as an additive to bupivacaine. Their results showed that duration of motor blockade was significantly prolonged in patients receiving dexamethasone. Pathak RG *et al*. in 2012 conducted a study with the aim to compare effect of addition of dexamethasone to local anesthetic in brachial plexus block.[12] They concluded addition of dexamethasone significantly prolongs the duration of analgesia and motor block. This observation is comparable to our study. Vieira PA *et al*. (2010) also concluded that addition of dexamethasone prolonged both sensory and motor blockade in interscalene block with bupivacaine.[13] In our study, the mean numbers of rescue analgesic doses were lesser in Dexamethasone group than Bupivacaine alone group significantly. Our study correlates the study done by Yadav *et al*. 3 where the mean number of rescue analgesic doses was also lesser in Dexamethasone group than other two groups. Tandoc MN *et al*. also reported that post-operative analgesic consumption was significantly low in patients who received dexamethasone along with bupivacaine.[11] Vieira PA *et al*. concludes in their study that addition of dexamethasone to bupivacaine-epinephrine-clonidine combination in interscalene block significantly reduces the use of opioids post-operatively.[13] In our study, the mean heart rate in Bupivacaine group was around slightly higher in Dexamethasone group than the local anesthetic group. There was no statistically significant difference between the pulse rates of the Dexamethasone group than local anesthetic group. The mean systolic and diastolic pressure was also almost similar in both the groups within normal limits. The mean oxygen saturation also not varied much in both the groups. In summary, the hemodynamic responses are crucial in maintenance of patient during anesthesia. However, the Bupivacaine has already proved its safety especially when used as local anesthetic in supraclavicular block. Since, the hemodynamic responses were similar, the study concludes that the Bupivacaine – Dexamethasone combination is also safer to use in supraclavicular block. The adverse effects were not reported in both the groups in this study.

Conclusion

In brachial plexus block, addition of dexamethasone to bupivacaine produced faster onset of sensory block and motorblock, longer duration of sensory block and motor block. Dexamethasone to bupivacaine has 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 O_2 saturation.

References

1. Bazin JE, Massoni C, Bruelle P, *et al*. The addition of local anesthetics in brachial plexus block: The comparative effects of morphine, buprenorphine and sufentanil. Anesthesia. 1997;52:858–62.
2. Singam A, Buprenorphine as an adjuvant in supraclavicular brachial plexus block, IJBAR. 2012;03(07):571–75.
3. Yadav RK, Sah BP, Kumar P, *et al*., Effectiveness of addition of neostigmine or dexamethasone to local anesthetic in providing peri-operative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. Kathmandu University Medical Journal. 2008;6(1):302–9.
4. Pham – Dang C, Gunst J, Gouin J, *et al*., A novel supraclavicular approach to brachial plexus block, Anesth Analg. 1997;85:111–16.
5. Shrestha BR, Mahajan SK, Shrestha G, *et al*., Comparative study between tramadol and dexamethasone as an admixture to bupivacaine in supraclavicular brachial plexus block. J Nepal Med Assoc. 2007;46(168):158–64.

6. Vincent CJ, Editor. Principles of Anesthesiology, 3rd edition. Philadelphia: Lea and Febiger; 1993.
7. Islam SM, Hossain MHMD, Maruf AA. Effect of addition of Dexamethasone to local anesthetics in supraclavicular brachial plexus block. JAFMC Bangladesh. 2011;7(1):11–14.
8. Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular brachial plexus block with and without dexamethasone: A comparative study. Kathmandu Univ Med J (KUMJ). 2003 Jul-Sep;1(3):158–60.
9. Biradar PA, Kaimar P, Gopalakrishna K. Effect of dexamethasone added to lidocaine in supraclavicular brachial plexus block: A prospective, randomized, double-blind study. Indian J Anesth 2013;57:180–84.
10. Estebe JP, LeCorre P, Clément R, *et al*. Effect of dexamethasone on motor brachial plexus block with bupivacaine and with bupivacaine: Loaded microspheres in a sheep model. Eur J Anaesthesiol. 2003 Apr;20(4):305-10.
11. Tandoc MN, Fan L, Kolesnikov S, *et al*. Adjuvant dexamethasone with bupivacaine prolongs the duration of interscalene block: A prospective randomized trial. J Anesth. 2011;25(5):704–9.
12. Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without dexamethasone: A comparative study. International Journal of Scientific and Research Publications. 2012 December;2(12):1–7.
13. Vieira PA, Pulai I, Tsao GC, *et al*. Dexamethasone with bupivacaine increases duration of analgesia in ultrasound: Guided interscalene brachial plexus blockade. Eur J Anesthesiol. 2010 Mar;27(3):285–88.