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A CLINICAL COMPARISON BETWEEN 0.5%BUPIVACAINE AND 0.5%BUPIVACAINE DEXAMETHASONE (8MG) COMBINATION IN BRACHIAL PLEXUS BLOCK BY SUPRACLAVICULAR APPROACH

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ABSTRACT

Aim: To study the onset and duration of sensory and motor blockade. **Introduction**: Brachial plexus block provide a useful alternative to general anaesthesia for upper limb surgeries. Bupivacaine is one of the most frequently used local anaesthetic which has longer duration of action of 3 to 8 hours but has drawbacks of delayed onset and patchy analgesia. Dexamethasone is very potent glucocorticoid with very good anti-inflammatory and analgesic activity. **Materials and methods**: A prospective, randomised single blinded study was undertaken in patients posted for upper limb surgeries under supraclavicular block. 60 patients with ASA class I and II were randomly grouped into two groups. Group I received 30ml bupivacaine0.5% and Group II received combination of 28ml bupivacaine0.5% and 2ml dexamethasone 8mg. 30ml solution is used for a single shot blockade of supraclavicular brachial plexus. **Results**: Group II patients had faster onset of action and prolonged duration of action. **Discussion:** Addition of dexamethasone 8mg to bupivacaine0.5% speeds the onset of sensory and motor blockade, prolongs the duration thus provides better analgesia and reduces the requirements of rescue analgesics. **Conclusion**: Combination of bupivacaine0.5% and dexamethasone 8mg has significantly faster onset and prolonged duration of action.

KEYWORDS: Brachial plexus, bupivacaine, dexamethasone.

INTRODUCTION

Brachial plexus block is a popular approach for upper limb surgeries as an alternative to general anesthesia. This type of anesthesia mainly helps in to achieve ideal operating conditions by producing muscular relaxation, maintaining stable intraoperative hemodynamic condition and sympathetic block which reduces postoperative pain, vasospasm and edema.[1]

The available literature has also shown that this type of block mainly avoids the untoward effects of general anesthesia including upper airway instrumentation and thus prevents the consequences of it. It has also been shown that it is attractive due to its effectiveness in terms of cost and performance, margin of safety, along with good postoperative analgesia.[2] Variety of approaches of brachial plexus block have been described in the literature. However supraclavicular block is a consistent and easiest method for anesthesia and post operative pain management.[3, 4, 5]

Bupivacaine is one of the most frequently used local anesthetic 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 Neostigmine, Opioids, Haluronidase, Midazolam, Clonidine, Dexamethasone etc., have been added to local anesthetics to improve the quality and duration of action and postoperative analgesia.[3]

The steroids have been shown to reduce the inflammation and also have shown analgesic effects. The pain relief after administration of steroids is due to reduction of inflammation by inhibition of Phospholipase A2 and also blocks the transmission in nociceptive C – fibers to reduce the pain.[11] Phospholipase A2 has been found to induce membrane injury and edema by generating inflammatory mediators. It is the enzyme responsible for liberation of arachidonic acid leading to the production of prostaglandins and leukotriones. They also sensitize small neurons and enhance pain generation by abnormal conduction and intraneural edema.[12]

Dexamethasone is a very potent and highly selective glucocorticoid. Basically it is used as anti-inflammatory and immunosuppressant. Its potency is about 40 times that of hydrocortisone. Clinical Uses of Dexamethasone

are for treatment of many inflammatory and autoimmune conditions but Glucocorticoid are also used to treat patients suffering from neuropathic pain and complex regional pain syndromes (CRPS). So, steroids have anti-inflammatory as well as analgesic effects.3 Many studies have successfully proved the usefulness of Dexamethasone as an effective analgesic.[11,12,13,14]

However the studies are scant in this part of the country about the analgesic efficacy of the Dexamethasone. Hence this study was taken up to assess the efficacy of Dexamethasone as an analgesic especially for upper limb surgeries.

OBJECTIVES

The study of adding dexamethasone (8mg) to bupivacaine (0.5%) in brachial plexus block for upper limb surgeries has the following objectives.
To evaluate the
- Onset of sensory and motor blockade
- Duration of sensory and motor blockade
- Haemodynamic variables (HR, BP, O2 saturation)
- Number of rescue analgesics in postoperative 24 hours.
- Compare the above effects with that of 0.5% bupivacaine in brachial plexus block for upper limb surgeries.

REVIEW OF LITERATURE

Supraclavicular brachial plexus block provides safe, effective, low cost anesthesia with good postoperative analgesia. It has the advantage of being suitable alternative to general anesthesia, in producing reliable and complete anesthesia for upper limb surgeries, in high risk patients who might not tolerate general anesthesia. Several studies have been done to evaluate the exact technique and the efficacy of various adjuvants which can be safely and effectively used to produce appropriate desired level of anesthesia without much morbidity and medication related complications.[17,18,19]

A prospective, randomized, double blinded study was conducted to evaluate the postoperative analgesia following supraclavicular brachial plexus block with Dexamethasone or Tramadol as an admixture to bupivacaine in an upper limb surgery. 60 patients with ASA I and II undergoing upper limb surgery were randomly allocated to two groups with one receiving dexamethasone 8 mg and the other receiving Tramadol 2mg/kg as admixture to bupivacaine. The mean duration of postoperative analgesia in the Dexamethasone group was 1028.00 minutes while in the tramadol group it was 453.17 minutes. Thus Dexamethasone with local anaesthetic prolongs postoperative analgesia significantly than Tramadol ($P<0.05$) when used as admixture to local anaesthetic in brachial plexus block in upper extremity surgery.[13]

Various local anaesthetic agents are used for brachial plexus block, comparing effectiveness of addition of Dexamethasone versus Neostigmine to Lignocaine, adrenaline admixtures for Brachial plexus block in providing perioperative analgesia. Ninety patients were randomized in three groups and were received 24ml of study drugs. The group A [Lignocaine with adrenaline (1.5%)], groupB [Lignocaine with adrenaline (1.5%)] +500µg Neostigmine, and group C (Lignocaine with adrenaline (1.5%) +4mg Dexamethasone) for brachial plexus block through supraclavicular approach. The observed parameters were onset of analgesia, completion of sensory and motor blockade, Duration of analgesia, Surgeon's score, side effects, number of supplemental analgesics doses and Visual analogue scale (VAS) score for pain in 12 hour of post-operative period. Mean onset of analgesia 4.6 ± 1.1, 4.4 ± 0.8, 3.8 ± 1.8 mins in group A, B and C respectively and the Mean onset of motor blockade were 7.7 ± 2.0, 7.0 ± 1.8, 6.0 ± 2.1 mins in group A,B and C respectively. Similarly Mean Complete sensory block in 10.6 ± 3, 10.4 ± 2.5, and 8.9 ± 2.2mins and Mean complete motor block in 17.3 ± 4.3, 17.2 ± 4.0 and 14.7 ± 3.5 mins in group A, B and C respectively were achieved. Duration of analgesia was 176.5 ± 53.5, 225.7 ± 53.3 and 454.2 ± 110.7 mins in group A, B and C respectively. Duration of analgesia in group C was statistically significant in comparison with other groups. The number of mean analgesic requirement by group C (0.9±0.4) was significantly (p-0.005) lower. The mean VAS was significantly lower in group C in 12 hours post-operatively. The onsets of action, duration of analgesia were better in dexamethasone group and also need less number of rescue analgesics requirement.[3]

A prospective study was conducted to compare the analgesic efficacy of local aesthetic with and without dexamethasone in supraclavicular brachial plexus block. Forty patients undergoing arm, forearm and hand surgeries were randomly selected. The forty patients were divided in two groups of 20 each. In-group one, a brachial plexus block was done with 40-50 ml of local anesthetic with 1:200,000 adrenaline and in the other group the block was performed with the same amount of local anesthetics with dexamethasone. The onset of action and duration of analgesia in the two groups were compared and any complications of the procedure were noted. Statistical analysis was done using the independent sample t-test. The two groups were comparable in respect to age, sex, and weight. There was significant faster onset of action (18.15±4.25 v/s 14.5±2.1, $p<0.05$) and prolonged duration (3.16±0.48 v/s12.75±5.33, $p=0.00$) of analgesia in the dexamethasone group than in the other group. There were no complications. Addition of dexamethasone for brachial plexus block significantly prolongs the duration of analgesia without any unwanted effects.[12]

Sixty American Society of Anaesthesiologist's physical status I and II patients undergoing elective hand, forearm and elbow surgery under brachial plexus block were

randomly allocated to receive either 1.5% lidocaine (7 mg/kg) with adrenaline (1:200,000) and 2 ml of normal saline (group C, n=30) or 1.5% lidocaine (7 mg/kg) with adrenaline (1:200,000) and 2 ml of dexamethasone (8 mg) (group D, n=30). The block was performed using a nerve stimulator. Onset and duration of sensory and motor blockade were assessed. The sensory and motor blockade of radial, median, ulnar and musculocutaneous nerves were evaluated and recorded at 5, 10, 20, 120 min, and at every 30 min thereafter. Two patients were excluded from the study because of block failure. The onset of sensory and motor blockade (13.4±2.8 vs. 16.0±2.3 min and 16.0±2.7 vs. 18.7±2.8 min, respectively) were significantly more rapid in the dexamethasone group than in the control group (P=0.001). The duration of sensory and motor blockade (326±58.6 vs. 159±20.1 and 290.6±52.7 vs. 135.5±20.3 min, respectively) were significantly longer in the dexamethasone group than in the control group (P=0.001). Addition of dexamethasone to 1.5% lidocaine with adrenaline in supraclavicular brachial plexus block speeds the onset and prolongs the duration of sensory and motor blockade.[9]

MATERIALS AND METHOD

A randomized single blinded study was taken up among 60 patients aged between 18 to 65 years undergoing upper limb surgeries in Bapuji and C G Hospitals attached to JJM Medical College. Ethical clearance was obtained before Institutional Ethical review committee. An informed, bilingual and written consent was obtained from all the patients.

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 local anesthetic.
- 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.

The patients who satisfied the inclusion and exclusion criteria were divided into two groups of 30 patients each. All the patients underwent pre anesthetic check up.

- Control group – Group I : 30 subjects receive 30ml Bupivacaine 0.5%
- Study group – Group II: 30 subjects received 28ml of mixture of Bupivacaine 0.5% and + 2ml Dexamethasone (8mg).

The patients were also subjected for detailed laboratory work up including complete heamogram and urine routine. Patients were also subjected for HIV and HBsAg, Chest X ray and ECG examination. Patients were kept nil oral overnight and kept in supine position in the operation table with arms by the side and head turned to other side. With all aseptic precautions sublcavian artery pulsations were felt at a point 1.5 to 2.0 cm posterior and cephalad to midpoint of clavicle. A skin wheel is raised with local anesthetic cephalo posterior to the pulsations. A 22 gauge, 1.55 inches short beveled needle is introduced through the point located parallel to head and neck in a caudal and slight medial and posterior direction until either paraestehsia is elicited or first rib is encountered. If rib is felt by the needle, it should be moved over the first rib until paraesthesia is elicited in the arm or hand. After paraesthesia is elicited and encountering the negative aspiration of blood, the needle should be kept in same position and the medication under study was injected slowly by ruling out the intravascular injection intermittently. The onset of anesthesia was evaluated by the pin prick with a 23 gauze needle. The time of onset was defined as the time between injection and complete loss of pin prick sensation in C2 and T2 dermatomes. The temperature was tested by using the spirit soaked cotton on the skin dermatomes from C2 to T2. The time of onset of complete sensory blockade was recorded.

The motor block was assessed by using Bromage three point score [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 of onset of sensory block was defined as 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 the motor block.

Diclofenac sodium intra muscular injection was used as rescue analgesic whenever patients complained of pain. The numbers of rescue analgesics in 24 hours of post – operative period were also recorded.

The patients were also monitored for any side effects or complications. The data thus obtained was complied and analysed using Statistical Package for Social services. (SPSS vs 18). Quantitative data was analysed by using student‘t’ test. Qualitative data was analysed using Chi – Square test. A p value of less than 0.05 was considered as statistically significant.

RESULTS

	Bupivacaine Group n (%)	Bupivacaine – Dexamethasone Group n (%)	t value	p value
Age Groups				
Less than 30 years	8 (26.7)	7 (23.3)		
31 - 40 years	13 (43.3)	21 (70.0)		
41 - 50 years	7 (23.3)	0		
51 years and above	2 (6.7)	2 (6.7)		
Total	30 (100)	30 (100)		
Mean ± SD	36.9 ± 10.4	34.7 ± 7.1	0.986	0.328
Onset of sensory block in mins *Mean ± SD*	16.7 ± 2.1	10.3 ± 1.4	13.921	< 0.001
Onset of motor block in mins *Mean ± SD*	8.6 ± 1.2	5.6 ± 0.7	11.997	< 0.001
Duration of sensory block in hours *Mean ± SD*	4.0 ± 6.3	5.9 ± 0.7	- 1.7	> 0.05
Duration of motor block in hours *Mean ± SD*	1.9 ± 0.5	4.3 ± 0.9	- 14.868	< 0.001
No. of RA in 24 hours *Mean ± SD*	2.5 ± 0.5	1.3 ± 0.4	9.693	< 0.001

DISCUSSION

Brachial plexus block has been emerged as a popular technique among the anesthetists for upper limb surgeries. This type of anesthesia avoids the untoward effects of general anesthesia like complications related to upper airway instrumentation. The research has also shown that this approach is attractive approach and effective in terms of cost, performance, margin of safety and also provides good post operative analgesia.[2] Many approaches of brachial plexus block have been described and the available literature has consistently shown that supra clavicular block is superior and easiest method for anesthesia and post operative pain management.[3]

Several drugs have been tried as anesthetics in brachial plexus block and bupivacaine has been consistently used for its longer duration of action. However, the bupivacaine is condemned for its delayed inset, patchy or incomplete analgesia. Many drugs are in turn used to treat the side effects of bupivacaine also make the drug more effective for surgery and post operative analgesia.[4] 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, 5, 11,12] However, the studies are scant to evaluate the efficacy of Bupivacaine alone and when used in combination with corticosteroids like Dexamethasone. Hence this study was undertaken in this part of the country to evaluate the efficacy of it. 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 CGH and BH of Davanagere.

The mean *age* of patients posted was 36.9 years in Bupivacaine and 34.7 in Bupivacaine – Dexamethasone groups. There no statistically significant difference in age between the two groups. Hence the two groups were incomparable in the aspect of age. 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, 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 in contrary to the findings of this study.[12] 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 local anesthetic group in this study. This difference was also statistically significant between the two groups. In a study by Shreshtha et al, the mean onset of action was 18.15 ± 4.25 minutes while it was 14.5 ± 2.1.5 However, the mean onset of sensory anesthesia was slightly lesser in this study in contrary to findings of Shreshtha et al. In another study, Yadav et al compared three different drugs by supraclavicular brachial plexus block. However, the onset of anesthesia in Dexamethasone group was faster than other two groups of durgs.[3] In a study by Islam et al, the onset of sensory block also lesser in Dexamethasone group than the plain local anesthetic group.[12] The mean *duration of sensory block* in Bupivacaine group was 4 (± 6.3) hours

and 5.9 (± 0.7) hours in Bupivacine – 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. A similar study in Nepal[5] 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.[5] In a study by Shreshtha et al[11], the mean duration of post operative analgesia was around 16 hours in a group who received Bupivacaine with Dexamethasone and its was around 8 hour in Bupivacaine – Tramadol group. 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. However, another study also noted that the mean duration of analgesia was more in Dexamethasone group than plain anesthetic group.[12] The *mean numbers of rescue analgesic* doses were lesser in Dexamethasone group than Bupivacaine alone group significantly. In a study by Yadav et al, the mean number of rescue analgesic doses was also lesser in Dexamethasone group than in other two groups.[3] 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. But it was within normal limits. The *mean systolic and diastolic pressure* was also almost similar in both the groups within normal limits except after 2 hours. 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 also safer to use in supraclavicular block.

The *adverse effects* were not reported in both the groups in this study. This study has shown that addition of 4 – 8 mg of Dexamethasone effectively and significantly prolongs the duration of analgesia also by producing early onset of action. This study has also shown that the early onset of action in steroid group can be attributed to synergistic action with local anesthetic on blockage of nerve fibers. The prolongation of duration of block is the local effect of steroid than the systemic action. The effects are mainly mediated by glucocorticoid receptors. The blockade is not produced by the action of steroid alone. Hence it should be used in addition to a local anesthetic.

CONCLUSION

Supraclavicular approach of brachial plexus block has been popular technique in delivery of anesthesia in patients undergoing upper limb surgeries. The elegancy in the technique helps in safe delivery anesthesia and also assures prolonged analgesia by preventing the side effects of general anesthesia. Steroids are commonly used nowadays along with local anesthetics due to their anti inflammatory and analgesic effects. Dexamethasone being a potent corticosteroid is becoming popular for the regional blocks. This study has made an effort to compare the Bupivacaine alone with Bupivacaine – Dexamethasone. The study is methodologically elegant since it is randomized controlled study. However, one cannot rule out bais since it is single blind study. Hence the results cannot be generalized. But this study has shown the *beneficial effect of addition of steroid* to a local anesthetic in terms of *onset and duration of anesthesia*. The further research with calculation of sample size is needed to study the beneficial or adverse effects of addition of steroids along with local anesthetics for producing the blockade.

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