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Clinical Comparison Between 0.5% Bupivacaine and 0.5% Bupivacaine- Dexamethasone 8Mg Combination in Brachial Plexus Block by Supraclavicular Approach

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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 intra-operative 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 instrumentations 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] However, supraclavicular block is a consistent and easiest method for anesthesia and postoperative pain management.[3-5] Bupivacaine as a local anesthesia 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 neostigmine, opioids, hyaluronidase, midazolam, clonidine, dexamethasone etc. have been added to local anesthetics to improve the quality and duration of action and postoperative analgesia.[6-10] 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 A_2 and also blocks the transmission in nociceptive C – fibers to reduce the pain.[11] Phospholipase A_2 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 leukotrienes. It also sensitizes small neurons and enhances pain generation by abnormal conduction and intraneural edema.[12] Dexamethasone is very potent and highly selective glucocorticoid. 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).

AIMS AND OBJECTIVES

This study evaluated the onset of sensory and motor blockade; duration of sensory and motor blockade; haemodynamic variables; number of rescue analgesics in postoperative 24 hours and compared the above effects with that of 0.5% bupivacaine in brachial plexus block for upper limb surgeries.

MATERIAL AND METHODS

This study was a randomized single blinded study taken up among 60 patients aged between 18 to 65 years undergoing upper limb surgeries in National Institute of Medical Sciences, Jaipur (Rajasthan). Sample Size calculation was based on onset of Sensory and motor blockade. The sample size 30 per group was calculated from an effect size of 0.833, a power of 90%, an α of 0.05 where the standard deviation of two groups was 3 min. Patients with ASA class I and II; aged between 18 to 65 years; SBP : 100-139 mm of Hg; DBP: 60-89 mm of Hg were included. The patients were subjected to detailed pre anesthetic checkup (PAC). 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 raised with local anesthetic cephalo posterior to the pulsations. A 22 gauge, 1.55 inches short beveled needle introduced through the point located parallel to head and neck in a caudal and slight medial and posterior direction until either paresthesia elicited or first rib encountered. If rib felt by the needle, it moved over the first rib until paresthesia elicited in the arm or hand. After paresthesia elicited and encountering the negative aspiration of blood, the needle was 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 C_2 and T_2 dermatomes. The temperature was tested by using the spirit soaked cotton on the skin dermatomes from C_2 to T_2. 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. Heart rate, non invasive blood pressure and oxygen saturation were monitored during the surgery. Duration of sensory block which was the time elapsed between the injection of drug and appearance of pain requiring analgesia and duration of motor block was also recorded. 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.

Statistical Methods

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous vari-

ables are presented as mean ± SD, and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups was performed using Student's t test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. P<0.05 was considered statistically significant.

RESULTS

In the present study, a total of 14 males and 16 females in bupivacaine group and 19 male and 11 female in bupivacaine – dexamethasone group studied (p >0.05 Not significant). The mean age of patients who received Bupivacaine was 36.9 years and in Bupivacaine – Dexamethasone was 35.80 years (p=0.632, Not significant). The mean time of onset of sensory block in Bupivacaine group was 16.7 minutes and 10.3 minutes in Bupivacaine – Dexamethasone group with significant difference (p <0.001). (Figure I about here).

The mean time of onset of motor block in Bupivacaine group was 8.6±1.2 minutes and in Bupivacaine – Dexamethasone group was 5.6±0.7 minutes with significant difference (p <0.001). (Figure 2 about here). Similarly mean duration of sensory block in Bupivacaine group was 2.4±0.7) hours and in Bupivacine – Dexamethasone group was 5.9±0.7 hours with significant difference (p <0.001). (Figure 3 about here).

The mean duration of motor block in Bupivacaine group was 1.9±0.5 hours and in Bupivacaine – Dexamethasone group was 4.82±0.9 hours with statistically significant difference (p <0.001) (Figure 4 about here).

With regard to number of rescue analgesic doses used in 24 hours, Bupivaciane group had received 2.46±0.5) doses and Bupivacaine – Dexamethasone group received 1.3 mean doses of rescue analgesic with significant difference (p <0.001) (Figure 5 about here).

The mean heart rate in Bupivacaine group was around 76-78 bpm. The mean heart rate in Bupivacaine – Dexamethasone group was around 78-79 bpm with no significant difference among two groups at all time intervals ranging from 5 minutes to 24 hours (p >0.05) (Figure 6 about here).

The mean systolic blood pressure in Bupivacaine group ranged from 114.1±8.8 mmHg to 115.2±9.4 mmHg. The mean systolic blood pressure in Bupivacaine – Dexamethasone group was ranging from 119.3±12.8 mm of Hg to 120.9±13.1 mm of Hg at different time intervals with no significant difference at all time intervals except systolic blood pressures after 2 hours till 24 hours. The mean diastolic pressure in Bupivacaine group was ranging from 75.7±6.5 mmHg to 76.9±6.6 mmHg. It was ranging from 77.5±7.3 mmHg to 78.7±7.6 in Bupivacaine – Dexamethasone group at different time intervals with no significant difference (p >0.05).

The oxygen saturation was ranging from 98.3±0.5 percent to 99.0 percent in bupivacaine group and it was ranging from 98.3±0.5 percent to 98.7±0.5 percent in Bupivacaine – Dexamethasone groups. The difference between the oxygen saturation was not statistically significant between Bupivacaine and Bupivacaine–Dexamethasone groups in most of the time intervals except at 5 mins, 60 mins, 6 hours and 24 hours after injection of the anesthetic (Figure 7 about here).

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] Several drugs have been tried as anesthetics in brachial plexus block and Bupivacaine was consistently used for its longer duration of action. However, the bupivacaine is condemned for its delayed onset, 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 corticosteroid when used along with bupivacaine. Many studies have successfully proved the usefulness of dexamethasone as an effective analgesic.[4,5,11,12]

The mean age of our patients was 36.9 years in Bupivacaine and 34.7 in Bupivacaine–Dexamethasone group (p >0.05, NS). 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 group.[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 (p <0.001). 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 drugs.[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 (p <0.001). 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 postoperative 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. 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 other two groups.[3]

The mean heart rate in Bupivacaine group was around slightly higher in Dexamethasone group than the local anesthetic group (p >0.05). 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, this 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 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 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 technique in patients undergoing upper limb surgeries is safe in delivery anesthesia and assures prolonged analgesia by preventing the side effects of general anesthesia. Dexamethasone being a potent corticosteroid is becoming popular for the regional blocks. This study has proved the beneficial effect of addition of steroid to a local anesthetic in terms of onset and duration of anesthesia. We further recommend that 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.

Figure 1

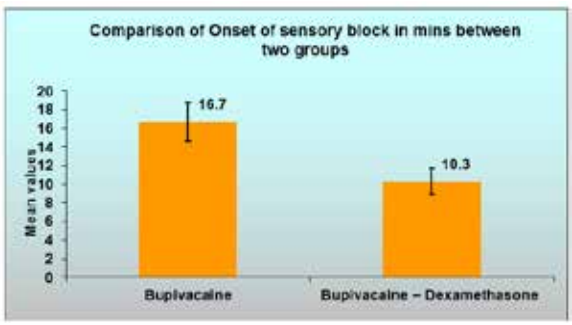


Figure 2

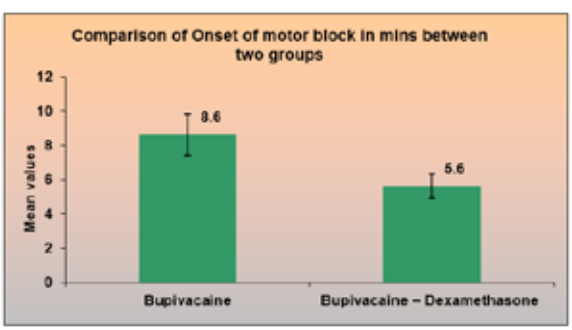


Figure 3

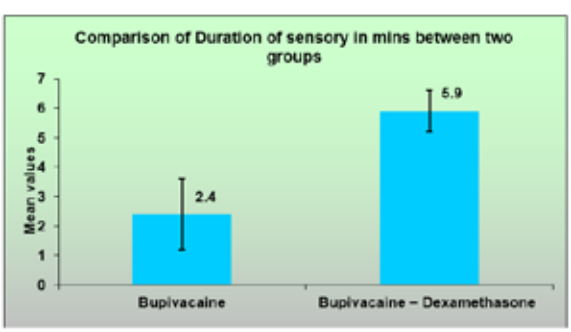


Figure 4

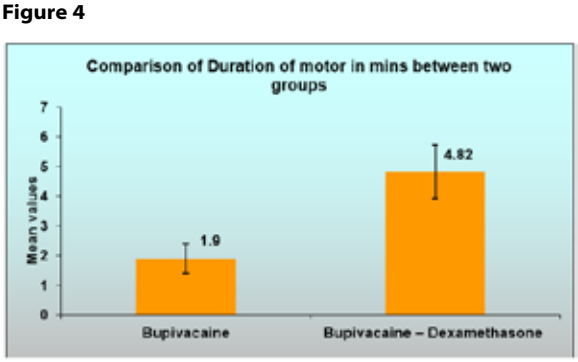


Figure 5

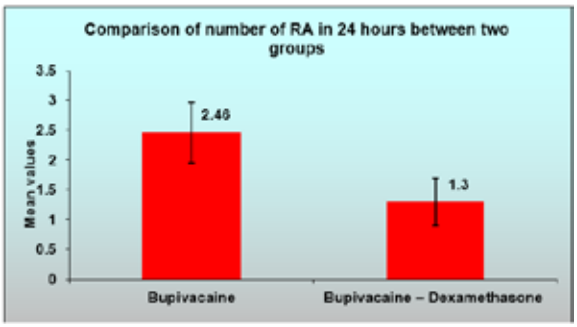


Figure 6

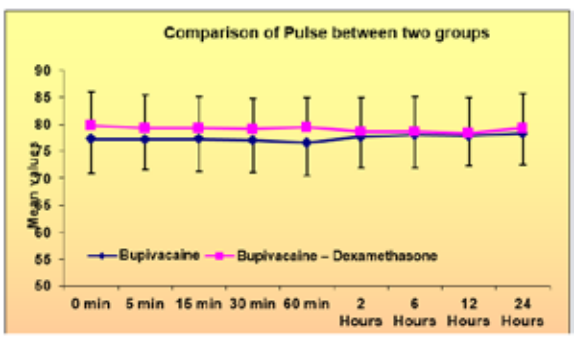
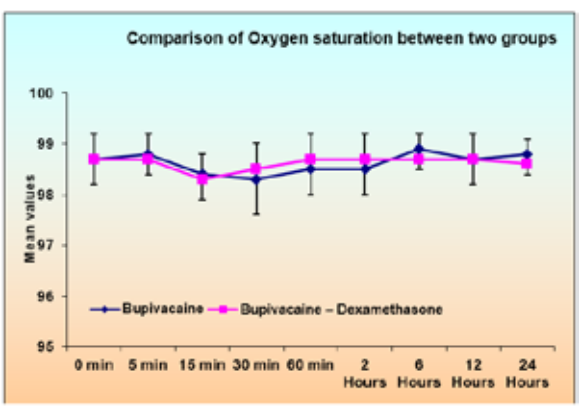


Figure 7



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