

Supraclavicular brachial plexus block with and without dexamethasone - A comparative study

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Abstract

To compare the analgesic efficacy of local aesthetic with and without dexamethasone in supraclavicular brachial plexus block. **Methods:** 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 anaesthetic with 1:200,000 adrenaline and in the other group the block was performed with the same amount of local anaesthetics 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. **Results:** The two groups were comparable in respect to age, sex, and weight. There was significant faster onset of action and prolonged duration of analgesia in the dexamethasone group than in the other group. There were no complications. **Conclusion:** Addition of dexamethasone for brachial plexus block significantly prolongs the duration of analgesia without any unwanted effects.

Brachial plexus block is popular for upper limb surgeries. This avoids the untoward effects of general anaesthetic drugs and upper airway instrumentation. Various approaches to the brachial plexus have been described but the supraclavicular approach is the easiest and most consistent method for anaesthesia and perioperative pain management in surgery below the shoulder joint.

Steroids have anti-inflammatory as well as analgesic effects. They relieve pain by reducing inflammation and by blocking transmission in nociceptive c-fibres¹.

They decrease inflammation by inhibiting the action of phospholipase A_2 . Phospholipase A_2 has been found to induce membrane injury and oedema by generating inflammatory mediators. Phospholipase A_2 is the enzyme responsible for liberation of arachidonic acid leading to the production of prostaglandins and leukotrienes. These mediators sensitize small neurons and enhance pain generation by abnormal conduction and intraneural edema¹.

Steroids produce analgesia by blocking transmission in nociceptive c-fibres and suppressing ectopic neuronal discharge. Local application of methylprednisolone has been found to block transmission in c-fibres but not in

a and B fibres¹. The effect was reversible, suggesting a direct membrane action of steroids.

Supraclavicular brachial plexus block is an excellent technique in experienced hands. There is an incidence of pneumothorax (1-6%). Hemothorax, Horner's syndrome and phrenic nerve block are potential complications².

Methods

After approval from the hospital ethics committee, informed consent was obtained from patients. Necessary counselling and advice about the procedure and complications which may be encountered were explained to the patients. Each group had twenty patients of ASA I-III, age ranging from 12 year to 77 years and almost equal number of males and females (male: female 7:13 in steroid group and 8:12 in control group).

As most of the orthopaedic surgeries are of uncertain duration, we targeted for more than 3 hours duration of surgery. A mixture of lidocaine 2% with 1:200,000 adrenaline and bupivacaine 0.5% for a total volume of 40-50 ml of local anaesthetic was used. Total dose of the mixture did not exceed the recommended dose as per body weight. Dexamethasone 4-8mg was added to the local anaesthetic solution in the steroid group.

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Supraclavicular brachial plexus block was performed in the supine position with the head turned to opposite side and the arms extended and pulled towards the knee. The midclavicular point, external jugular vein and subclavian artery pulsation were identified. About 2 cm above the midclavicular point a 22 G 1.5 inch needle was introduced and directed just lateral to subclavian artery pulsation caudad and medially until paraesthesia was encountered. 40-50 ml of local anaesthetics with or without dexamethasone were injected in this area. All patients were sedated with midazolam 0.05-0.1 mg/kg body weight. Intercosto-brachial nerve was blocked with 5.0 ml of 0.5% bupivacaine to avoid tourniquet pain. Patients were monitored routinely and any untoward effects were also noted.

After the procedure patients were taken for surgery and after the onset of analgesia surgery was started. Time of onset of analgesia and time of injection of local anaesthetics were noted. Duration of analgesia was measured by interviewing the patient in the postoperative ward. Analgesia was given when patients complained of pain.

The age of patient, onset of analgesia and duration of analgesia were noted in both groups and data analyzed in Pentium III version with SPSS programme. The data was analyzed with "the independent samples t-test." This was significant if the p-value is <0.05.

Results

Patients were of comparable age and sex group. The age ranged from 12-60 years (mean 25.5 ± 12.02) in local anaesthetic group and 12-77 years (mean 28.05 ± 16.10) in dexamethasone group. There was no significant statistical difference in age group ($p > 0.05$). Male and female ratio was also almost similar in both groups (12:8 in local anaesthetic group and 13:7 in LA + steroid group).

Onset of action was 10-30 minutes in local anaesthetic group (mean 18.15 ± 4.25) and 10-20 minutes (mean 14.5 ± 2.10) in the local anaesthetic + steroid group. Statistical analysis revealed a significant difference between the two groups ($p < 0.05$).

Regarding the duration of action the local anaesthetic group had an analgesia time of 2.30 – 4.0 hours (mean 3.16 ± 0.48) and in the steroid group 8.0 – 24 hours (mean 12.75 ± 5.33). Statistical analysis revealed a significant difference ($p = 0.00$).

During our study, there was no failure in procedure, no unwanted effects of drugs and no complications.

Discussion

Brachial plexus block is an easy and relatively safe procedure for upper limb surgery. A combination of lidocaine and bupivacaine has both rapid onset and 3-4 hours of block, which is sufficient for most upper limb surgeries but not enough duration for elective postoperative analgesia.

Addition of 4-8 mg of dexamethasone effectively and significantly prolongs the duration of analgesia as well as producing earlier onset of action. The early onset of action in steroid group is due to the synergistic action with local anaesthetics on blockage of nerve fibres^{3, 4}. The block prolonging effect of dexamethasone is due to its local action and not a systemic one³. This effect is mediated via glucocorticoid receptors. When steroid alone is used in regional blocks, the blockade is not produced. Steroids might bring about this effect by altering the function of potassium channels in the excitable cells^{5, 6, 7, 8}. In our study, the average duration of analgesia was 12 hours with dexamethasone, but only 4 hours with local anaesthetics and adrenaline.

Conclusion

The randomized comparative study of brachial plexus block with local anaesthetics, with and without dexamethasone has revealed that postoperative analgesia has been found to be significantly prolonged in the dexamethasone group and can be used safely.

References

1. Honorio T. Benzon, Epidural Steroids. In P. Prithvi Raj. Pain medicine, a comprehensive review. Mosby publications 1999 Page 259 – 263
2. John E. Tetzlaff. Peripheral nerve blocks. In Clinical Anaesthesiology. Edited by G. Edward Morgan Jr., Maged S. Mikhail, Michael J. Murray, 3rd edition, 2002 Page 289 – 290.
3. Dräger Christiane, Benziger David, Gao Feng, Berde Charles B., Prolonged intercostal nerve blockade in sheep using controlled release of bupivacaine and dexamethasone from polymer micro spheres. *Anaesthesiology*: 89,969 – 979, 1998
4. Castillo Jenny, Curley Joanne, Hotz Joyce, Uezono Megumi, Tigner Joseph, Chasin Mark, Wilder Robert, Langer Robert, Berde Charles: Glucocorticoids prolong rat sciatic nerve blockade in vivo from bupivacaine micro spheres. *Anaesthesiology*: 85:1157-66, 1996

5. Attali B, Latter H, Rachamim N, Garty H: A corticosteroid-induced gene expressing an "IsK-like" K⁺ channel activity in *Xenopus* oocytes. *Proc Natl Acad Sci USA* 92:6092-6, 1995
6. Takimoto K, Levitan ES: Glucocorticoid induction of Kv1.5 K⁺ channel gene expression in ventricle of rat heart. *Circ Res* 75:1006-13, 1994
7. Pennington AJ, Kelly JS, Antoni FA: Selective enhancement of an A type potassium current by dexamethasone in a corticotroph cell line. *J Neuroendocrinol* 6:305-15, 1994
8. Attardi B, Takimoto K, Gealy R, Severns C, Levitan ES: Glucocorticoid induced up-regulation of a pituitary K⁺ channel mRNA in vitro and in vivo. *Receptors Channels* 1:287-93, 1993