

Supraclavicular Brachial Plexus Block with and without Dexamethasone as an Adjuvant to local anaesthetics: A Comparative Study

Pradeep Dhumane* and Nilofar Shakir

Department of Anesthesia, Government Medical College, Nagpur, Maharashtra, India - 440001

*Correspondence Info:

Dr. Pradeep Dhumane

Taylors lane, Chhaoni,

Nagpur-440013, Maharashtra.

E-mail: sachinhiradeve@gmail.com

Abstract

Aim and Objectives: To assess the effect of dexamethasone on onset and duration of anaesthesia as well as duration of analgesia when added to local anaesthetic solution for supraclavicular brachial plexus block.

Methods: A randomized comparative study included total 60 patients of either sex, age between 18-70 years belonging to ASA Grade I and II undergoing elective or emergency surgeries of upper limb under supraclavicular brachial plexus block. Patients were randomly divided in group A (40 ml volume of lignocaine 2% with adrenaline (1:200000) + 0.5% bupivacaine) and group B (40 ml volume of lignocaine 2% with adrenaline (1:200000) + 0.5% bupivacaine with dexamethasone 8 mg). The onset and duration of sensory and motor block as well as duration of analgesia in the two groups were compared and any complications of the procedure were noted.

Result: Group B had early onset and prolonged duration of sensory and motor block as well as prolonged duration of analgesia as compared to group A. None of the patients had bradycardia, hypotension or any other side effects.

Conclusion: We concluded that addition of 8 mg dexamethasone to local anaesthetics in supraclavicular brachial plexus block reduces the time to onset of sensory and motor blockage and prolonged duration of postoperative analgesia.

Keywords: Dexamethasone, Lignocaine, Bupivacaine, Supraclavicular Brachial Plexus Block.

1. Introduction

The brachial plexus block for upper limb surgery has proved to be a safer and effective method of regional anaesthesia. But it is a common observation that surgeries on upper limb are still being performed mainly under general anaesthesia despite unanimous consensus toward regional anaesthesia, due to one or the other reasons [1]. 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.

Local anesthetics alone for supraclavicular brachial plexus block provide good operative conditions but have shorter duration of postoperative analgesia. This problem can be overcome by using long acting local anesthetics like bupivacaine or ropivacaine or by using adjuvant in regional anaesthesia. Adjuvant added to brachial plexus block should prolong the analgesia, without occurring systemic side effect, prolong motor block and should also reduced the total dose of local anesthetic [2-6]. Various studies have investigated several adjuvant including opioids, clonidine, verapamil, neostigmine, hyaluronidase, bicarbonate added to local anesthetics in brachial plexus block to achieve quick, dense

and prolonged block, but the results are either inconclusive or associated with side effects [7,8]. Steroids have powerful anti-inflammatory as well as analgesic property. They relieve pain by reducing inflammation and blocking transmission of nociceptive c-fibres and by suppressing ectopic neural discharge [9]. Some study demonstrated the analgesic effect of systemic corticosteroid in combination with bupivacaine [10-12].

Dexamethasone is a very potent and highly selective glucocorticoid. Various studies have been done using dexamethasone 8 mg as an adjuvant to local anaesthetics mixture in brachial plexus block resulting in variable effects on onset but prolonged duration of analgesia [12-21] and motor block [13,17,18,21]. In this context the present study has been undertaken to evaluate the efficacy of dexamethasone in the onset of sensory and motor blockade as well as duration of analgesia.

2. Materials and Methods

After obtaining institutional ethical committee approval and patients written informed consent, the study was conducted in 60 patients of either sex, aged between 18 to 70 years, ASA grade I and II, posted for elective and emergency

forearm surgeries. As most of the orthopaedic surgeries are of uncertain duration, we targeted for more than 3 hours duration of surgery. Patients with uncontrolled medical problems, infection at the site of block, having bleeding tendencies, history of adverse reaction to local anaesthetic and dexamethasone, pregnant patients and having inability to give informed consent were excluded from the study. A detailed pre-anaesthetic evaluation including history and a thorough physical and systemic examination and all relevant investigations were done for all the patients. Patients were randomly assigned to groups A and group B. Group A received brachial plexus block with 40 ml volume of lignocaine 2% with adrenaline (1:200000) + 0.5% bupivacaine and group B received 40 ml volume of lignocaine 2% with adrenaline (1:200000) + 0.5% bupivacaine with 8 mg dexamethasone. Total dose of the mixture did not exceed the recommended dose as per body weight. NBM status was confirmed.

On operation table, multipara monitors were applied to the patient and baseline parameters like pulse rate, blood pressure, respiratory rate, SpO₂ were recorded. Intravenous line was secured with 18 G intracath and infusion of IV fluid was started. After all aseptic precaution, block was performed in supine position with head turned away from the side to be blocked and upper limb to be anesthetized was adducted and extended along the side toward the ipsilateral knee as far as possible. Interscalene groove was identified and landmark was confirmed by palpation of the subclavian artery where a mark was made approximately 1.5 to 2.0 cm posterior to the mid-clavicle point. About 2 cm above the midclavicular point a 22 G 1.5 inch needle was introduced and directed just lateral to subclavian artery pulsation caudal, slightly medial and posterior direction until a paraesthesia or motor response was elicited or the first rib was encountered. 2-3 ml of drug was injected rapidly after aspiration. After this, 40 ml of local anaesthetics with or without dexamethasone were injected in this area. All patients were sedated with midazolam 0.05 mg/kg body weight.

After the procedure patients were taken for surgery and after the onset of analgesia surgery was started. Time of injection of local anaesthetics and onset of sensory and motor block were noted. Duration of analgesia was measured by interviewing the patient in the postoperative ward. Vital parameters as pulse rate, blood pressure, respiratory rate and oxygen saturation were recorded at 5, 10, 15, 30, 45, 60, 90, 120 minutes 4, 6, 12, 18, 24 hours. Patients were monitored routinely and any untoward effects were noted intra and postoperatively. Postoperatively if patient complain of pain injection diclofenac sodium 3 cc (75 mg) IM given as rescue analgesic to relieve pain and vomiting treated with injection ondansetron 4 mg.

2.1 Statistical Analysis

All results were expressed in Mean±Standard Deviation (SD) or percentage as applicable. The various data

including hemodynamic parameters, respiratory rate, SpO₂, duration of analgesia were calculated and compared with baseline values within each group using unpaired t-test. A 'P' value <0.05 was taken as significant.

3. Observations and Results

Demographic characteristics and duration of surgery were comparable in both the groups and difference was not statistically significant ($p>0.05$), (Table 1).

Table- 1: Demographic Data and Duration of Surgery

| Variable | Group A | Group B | P Value |
|---------------------------|---------------|--------------|---------|
| Age (years) | 39.5 ± 10.27 | 38.25 ± 8.73 | 0.428 |
| Weight (kgs.) | 59.8 ± 8.55 | 58.25 ± 6.67 | 0.052 |
| Sex (Male/Female) | 20/10 | 18/12 | 0.050 |
| Duration of surgery (min) | 103.8 ± 41.45 | 96.5 ± 46 | 0.6825 |

The onset of sensory and motor block occurs earlier in group B as compared to group A. The difference in onset of blocks between two groups was statistically highly significant ($p=0.01$). Duration of sensory and motor blockade was longer in group B and shorter in group A. The difference in duration of sensory block between groups was statistically highly significant ($p=0.003$) but difference in duration of motor block was statistically not significant ($p>0.05$). The 12-hour postoperative pain score was also lower in group B, (Table 2).

Table 2: Showing the block characteristics and postoperative pain score

| Characteristics | Group A | Group B | p-value |
|---------------------------------|------------|-------------|---------|
| Onset of sensory block (min) | 18.45±3.51 | 13.8±2.78 | P=0.01 |
| Onset of motor block (min) | 19.65±5.64 | 11.55±5.16 | P<0.05 |
| Duration of sensory block (hrs) | 6.75±0.96 | 8.2±1.67 | P=0.003 |
| Duration of motor block (hrs) | 6.1±0.96 | 6.75±0.91 | p>0.05 |
| Postoperative pain score | 66.5±10.77 | 42.65±14.64 | p<0.05 |

Pulse rate, blood pressure, oxygen saturation were monitored throughout the surgery and also postoperatively. All values were within normal range. There was no statistically significant difference between the mean preoperative, intraoperative and postoperative values. Thus the vitals were well maintained in all the patients.

Two patients from group A had arterial puncture during the procedure. All patients were monitored 24 hours postoperatively and no other complication was encountered in any patient, this incidence was statistically insignificant. All these two patients came out well without any residual damage.

4. Discussion

Regional anesthesia has been increasing in popularity in recent years; this is mainly because of the fact that the regional anesthesia techniques can be utilized for analgesia not only during the operative period, but during the postoperative period as well and avoids complications of general anaesthesia. Now a day brachial plexus block is an easy and relatively safe procedure for upper limb surgery and

having distinct advantages over general and intravenous regional anesthesia. Also it was advantageous in those patients in whom general anaesthesia is contraindicated or very risky with simple technique to use, wide applications with, relative contraindications and consistent results prompted anaesthesiologist all over the world to practice it. There are multiple approaches by which brachial plexus block can be given depending upon the site of surgery. The most frequently used techniques are axillary, infraclavicular, supraclavicular and interscalanae.

We had selected supraclavicular approach to brachial plexus block. Supraclavicular brachial plexus block is widely employed regional nerve block to provide anaesthesia and analgesia for the upper extremity surgery. However it provides a rapid, dense and predictable anesthesia of the entire upper extremity in the most consistent manner of any brachial plexus technique. It is the most effective block for all the portions of the upper extremity and is carried out at the "division" level of the brachial plexus; with high volume the "trunk" level of the plexus may also be blocked in this approach [2,3,22].

Local anesthetics alone for supraclavicular brachial plexus block provide good operative conditions but have shorter duration of postoperative analgesia. So various drugs like opioids, clonidine, neostigmine, Midazolam, etc. were used as adjuvant with local anesthetics in brachial plexus block. Various authors [22,23] recommended the use of mixture of lignocaine and bupivacaine for brachial plexus block in order to provide rapid onset and prolong duration of action and reduce toxicity but not enough duration for elective postoperative analgesia. In the present study we use dexamethasone as an adjuvant to local anaesthetics. The addition of dexamethasone effectively produced earlier onset of action and significantly prolong the duration of analgesia as well [14]. This effect is mediated via glucocorticoid receptor. When dexamethasone alone used in regional block, the blockade is not produce. Dexamethasone might bring about this effect by altering the function of potassium channel in excitable cells [24]. In the present study we have evaluated the effect of 8 mg dexamethasone used as an adjuvant to local anaesthetics in supraclavicular brachial plexus block, on the onset time and duration of sensory and motor block as well as on the duration of analgesia.

Onset of sensory and motor block in group B i.e. group received mixture of lignocaine, bupivacaine and dexamethasone which was faster than group A i.e. group received mixture of lignocaine and bupivacaine. It was observed that addition of dexamethasone as an adjuvant to local anesthetics for brachial plexus makes sensory and motor onset earlier than plain local anaesthetic agent used. It may be due to synergistic action of dexamethasone with local anaesthetics on blockage of nerve fibres. Our finding correlated with different studies [13,14,16,25]. In current study, longer duration of sensory and motor blockade was

seen in group B than group A. The block prolonging effect may be due to its local action on nerve fibres and a systemic one [26]. We observed that sensory block last longer as compared to motor block which was the same as observed as by De Jong *et al* [27].

Duration of postoperative analgesia in group A was 195 min and in group B was 418 min. there was significant difference in total duration of postoperative analgesia in between group A and group B. total duration of postoperative analgesia in group B was longer than group A. Similar results were observed by Shrestha BR *et al* [13], Golwala MP *et al* [14], Islam SM *et al* [25]. The number of patient who required rescue analgesics and mean number of supplemental analgesics required were also significantly lower in group B. Surgeons were asked to evaluate both groups in relation to intraoperative condition of sensory analgesia, muscle paralysis, bloodless operative field and duration of postoperative analgesia. Their responses were recorded as good, moderate and poor. On analysis 50% cases in group A surgeons judged technique as good, 43% as moderate and 6% as poor. In group B, 84% as good, 16% as moderate. Chi square value for both groups is 8.506 at two degree of freedom and $p=0.018$ which was highly significant.

There was no statistically significant difference was found between two groups with respect to pulse rate, blood pressure, respiratory rate and oxygen saturation. As per surgical requirement tourniquet was applied on the arm to be operated patients were repeatedly assessed about discomfort caused by tourniquet and response was recorded. 6 patients in group A and 1 patient in group B had tourniquet discomfort. No patients experienced pain so severe that required any additional analgesia. After applying Fischer exact test, the value is 1.028 which was showing that there was no statistically significant difference was found regarding tourniquet discomfort between group A and group B. We found no statistically significant difference with respective to intra and postoperative complications.

5. Conclusion

From the observations of the present study, it is obvious that the technique of mixing dexamethasone with local anesthetics (lignocaine + bupivacaine) in supraclavicular block can be performed safely and successfully in the patients for upper limb surgery. Also current study revealed that the addition of dexamethasone to local anesthetics in supraclavicular brachial plexus block provide good intraoperative anesthesia, prolong postoperative analgesia and markedly reduces consumption of analgesics in first 24 hours without any adverse effect.

Acknowledgement

We sincerely thank the department of anaesthesiology, surgery, other staff of operation theatre and administration of Government Medical College, Nagpur, Maharashtra, for permission to study and providing facility to carry out the work.

References

- [1] Nguyen HC, Fath E, Wirtz S, Bey T. Transscalene brachial plexus block: A new posterolateral approach for brachial plexus block. *Anesth Analg* 2007; 105:872–875.
- [2] Lanz E, Theiss D, Jankovic D. The extent of blockade following various techniques of brachial plexus block. *Anesth Analg* 1983; 62:55-58.
- [3] Urmev W: Upper extremity blocks, in Brown D (ed): Regional anesthesia and analgesia. Philadelphia, W. B. Saunders Company, 1996; 254-278.
- [4] Kulenkampff D, Persky M. Brachial plexus anesthesia. Its indications, technique and dangers. *Ann Surg* 1928; 87:883-891.
- [5] Labat G: Regional anesthesia. Its technique and clinical application. Philadelphia, W. B. Saunders Company, 1922.
- [6] Vester-Andersen T, Christiannsen C, Hansen A, Sorensen M, Meisler C. Interscalene brachial plexus block: area of analgesia, complications and blood concentrations of local anesthetics. *Acta Anaesthesiol Scand* 1981; 25:81-84.
- [7] Wakhlo R, Gupta V, Raina A, Gupta SD, Lahori VU. Supraclavicular plexus block: Effect of adding tramadol or butorphenol as an adjuncts to local anesthetics on motor and sensory block and duration of postoperative analgesia. *J Anaesth Clin Pharmacol* 2009; 25(1):17-20.
- [8] Lalla RL, Anant S, Nanda HS. Verapamil as an adjunct to local anaesthetic for brachial plexus block. *MJAFI* 2010; 66:22-24.
- [9] Bezon HT, Epidural steroids IN: Raj PP, editor. Pain medicine, a comprehensive review. UK: Mosby Publication 1999; 259-263.
- [10] Glasser RS, Knego RS, Delashaw JB, Fessler RG. The perioperative use of corticosteroids and bupivacaine in the management of lumbar disc disease. *J Neurosurg* 1993; 78:383-387.
- [11] Mirzai H, Tekinl, Allincak H, Perioperative use of corticosteroids and bupivacaine combination in lumbar disc surgery, a randomized controlled trail. *Spine* 2002; 27:343-346.
- [12] Castillo J, Curley J, Hotz J *et al*. Glucocorticoids prolong rat sciatic nerve blockade in vivo from bupivacaine microsphere. *Anesthesiology* 1996; 85:1157-1166.
- [13] Shrestha BR, Maharjan SK, Shrestha S, Gautam B, Thapa C, Thapa PB *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.
- [14] Golwala MP, Swadia VN, Dhimar AA, Sridhar NV. Pain relief by dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block. *J Anaesth Clin Pharmacol* 2009; 25(3):285- 8.
- [15] Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular brachial plexus block with and without dexamethasone - A comparative study. *Kathmandu University Medical Journal* 2003; 1:158-160.
- [16] Yadav RK, Sah BP, Kumar P, Singh SN. Effectiveness of addition of neostigmine or dexamethasone to local anaesthetic in providing perioperative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. *Kathmandu University Medical Journal* 2008; 6(23):302-309.
- [17] Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. *Anesth Analg* 2006; 102:263–267.
- [18] Vieira PA, Pulai I, Tsao GC, Manikantan P, Keller B, Connelly NR. Dexamethasone with bupivacaine increases duration of analgesia in ultrasound-guided interscalene brachial plexus blockade. *Eur J Anaesthesiol* 2010; 27(3):285-288.
- [19] Parrington SJ, Donnell DO, Chan VWS, Shreves DB, Subramanyam R, Qu M, *et al*. Dexamethasone added to mepivacaine prolongs the duration of analgesia after supraclavicular brachial plexus blockade. *Reg Anesth Pain Med* 2010; 35:422-426.
- [20] Cummings KC, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems JJ, *et al*. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. *Br J Anaesth* 2011; 107(3): 446-453.
- [21] Tandoc MN, Fan L, Kolesnikov S, Kruglov A, Nader ND. Adjuvant dexamethasone with bupivacaine prolongs the duration of interscalene block: a prospective randomized trial. *J Anesth* 2011; 25(5):704-709.
- [22] Moore D: Supraclavicular approach for block of the brachial plexus, in Moore D(ed): Regional block. A handbook for use in the clinical practice of medicine and surgery, 4th ed. Springfield, Charles C Thomas Publisher, 1981; 221-242.
- [23] Bromage PR and Gertel M. Improved Brachial Plexus Blockade with Bupivacaine Hydrochloride and Carbonated Lidocaine. *Anesthesiology* 1972; 36:479-487.
- [24] Attardi B, Takimoto K, Gealy R *et al*: Glucocorticoids induced upregulation of a pituitary K⁺ channel mRNA in vitro and in vivo. *Receptor channels* 1993; 1:287-293.
- [25] Islam SM, Hossain MHMD, Maruf AA *et al*. Effect of addition of dexamethasone to local anesthetics in supraclavicular brachial plexus block. *JAFMC, Bangladesh*, 2011; 7(1).
- [26] Baxendale BR, Vater M, Lavery KM: Dexamethasone reduces pain and swelling following extraction of third molar teeth. *Anaesthesia* 1993; 48: 961-964.
- [27] De Jong RH, Wagman IH, Physiological mechanisms of peripheral nerve block by local anesthetics. *Anesthesiology* 1963; 24:684-727.