Original Paper

EFFECT OF ADDITION OF DEXAMETHASONE TO LOCAL ANAESTHETICS IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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Abstract

Introduction: **Many-a-time local anaesthesia appears as a very effective alternative of general one. Different additives have been used to prolong regional blockade.**

Objective: **This prospective study designed to evaluate the effect of dexamethasone added to local anaesthetics on the onset and duration of supraclavicular brachial plexus block.**

Methods: **Sixty adult patients undergoing various orthopaedic surgeries on forearm and around the elbow under supraclavicular brachial plexus block were selected and divided into 2 groups of 30 each. In group-A patients received 35 ml of mixture of lignocaine 2%, bupivacaine 0.5% while in group-B patients received the same amount of local anaesthetics with dexamethasone (8 mg). The onset of sensory and motor block and duration of analgesia in two groups were compared and development of complications were observed.**

Result: **The two groups were comparable in demographic data. The mean onset time of sensory block was 11.64±2.19 minutes in group A and 9.89±1.97 minutes in group B and difference was statistically significant ($p<0.05$). Onset of motor block was 13.32±0.98 minutes in group A and 11.09±1.28 minutes in group B and difference was statistically significant ($p<0.05$). There was markedly prolonged duration of analgesia in group-B, 11.87± 0.53 hours compared to group-A, 3.43±0.49 hours. The result was statistically highly significant ($p<0.001$). Both the groups had high success rate (>90%). The incidence of complication was low in both the groups.**

Conclusion: **Addition of dexamethasone as an adjuvant to local anaesthetics in brachial plexus block results in significantly early onset and markedly prolonged duration of analgesia without any unwanted effects.**

Key words: **Supraclavicular block, analgesia, local anaesthetics, dexamethasone**

Introduction

Brachial plexus block is a versatile and reliable regional anaesthetic technique with multiple applications. Now-a-days, it is a suitable alternative to general anesthesia in certain patients. It is a block of roots, divisions and cords, first performed by Halsted in 1884[1]. The supraclavicular block of the brachial plexus has many advantages over other approaches to brachial plexus block[2,3,4]. It has the reputation of providing most complete and reliable anesthesia for upper limb surgery. It is performed at the trunk level where the plexus is presented most compactly. This anatomic compactness is responsible for complete and reliable anesthesia. Another advantage is that it can be performed with the patient's arm in any position to provide excellent anesthesia for elbow, forearm and hand surgery[5].

Local anaesthetics alone provide analgesia for not more than 4-8 hours. Increasing the duration of local anesthetic action is often desirable because it prolongs surgical anesthesia and analgesia. Different additives have been used to prolong regional blockade. Vasoconstrictors can be used to vasoconstrict vessels, thereby reducing vascular absorption of the local anesthetic. Additives like opioids, clonidine, verapamil etc were added to local anaesthetics, but the results are either inconclusive or associated with side effects[6-8]. Steroids when used intrathecally are reported to cause arachnoiditis but there is no evidence suggesting any neuritis when steroids are used in low concentration in peripheral nerve blocks. Steroids have powerful anti-inflammatory as well as analgesic property. Perineural injection of steroids is reported to influence post operative analgesia. They relieve pain by reducing inflammation and blocking transmission of nociceptive C-fibres and by suppressing ectopic neural discharge[9]. Some studies have demonstrated the analgesic effect of local spinal and systemic corticosteroids in combination with bupivacaine[10,11]. Dexamethasone microspheres have been found to prolong the block duration in animal and human studies and adding methyl prednisolone to local anesthetic increases the duration of axillary brachial block[12-15].

With this background, this study was carried out to evaluate the efficacy of dexamethasone as an adjuvant to mixture of local anaesthetics in supraclavicular brachial

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plexus block. Onset of sensory and motor blockade and duration of analgesia were observed.

Materials and Methods

This prospective study was performed at Combined Military Hospital (CMH), Dhaka in one calendar year from January 2009 to December 2009. After departmental approval and obtaining written informed consent from the patients, 60 American Society of Anaesthesiologist (ASA) physical status I or II patients of either sex, aged 18-60 years scheduled for elective or emergency orthopaedic surgeries of upper limb under supraclavicular brachial plexus block were included in this study. Patients with history of uncontrolled diabetes, renal and liver diseases, circulatory instability, pregnant women, and peptic ulcer disease, those with allergy to local anaesthetics and on long term steroid therapy were excluded from the study.

Patients were distributed into 2 groups of 30 each. In Group-A patients received 15 ml of lignocaine 2%, 15 ml of bupivacaine 0.5% while in Group-B patients received injection dexamethasone 2 ml (8 mg) in addition to the above mixture. Total volume was made to 35 ml by adding distilled water in both the groups. On arrival to the operating room, multi-para monitor was attached and the initial pulse, blood pressure (BP), respiratory rate, SpO2 was recorded as pre-block values. A 20 gauge IV cannula was inserted in a peripheral vein in the contra lateral arm. After appropriate patient positioning and strict aseptic and antiseptic precautions midclavicular point, external jugular vein and subclavian artery pulsation were identified. About 2 cm above the midclavicular point just lateral to subclavian artery pulsation, a 24 gauge 1.5 inch needle was introduced and directed caudal and medially until paraesthesia was encountered, when 35 ml of local anaesthetics with or without dexamethasone was injected in this area. After the procedure patients were taken for surgery. Time of onset of sensory block and onset of motor block were noted. Patients were monitored routinely and any untoward side effects were also noted. Duration of analgesia was measured by interviewing the patient in the postoperative ward. Analgesia was given when patients complained of pain. All results were expressed in mean+standard deviation (SD) or percentage as applicable. Statistical analyses were carried out using Statistical Package for Social Science (SPSS) for Windows Version 13.0. Results were considered statistically significant where p value was less than 0.05.

Results

Patient's demographics were similar and fairly comparable in both groups and differences were statistically not significant (table-I). Operating conditions were pronounced satisfactory by the surgeon concerned in all the cases. Duration of surgical procedure was shown in Table-II. Duration was similar in both groups and differences were statistically not significant.

Table- I: Characteristics of patient

Characteristics	Group A (n=30)	Group B (n=30)	p value
Age (years)	033.80±6.12	030.31±4.73	p>0.05
Body weight (Kg)	059.10±7.21	059.71±8.74	p>0.05
Height (cm)	155.25±3.49	153.65±4.04	p>0.05
Sex			
Male (number)	20(66.66%)	19(63.34%)	p>0.05
Female(number)	10(33.34%)	11(36.66%)	p>0.05
ASA physical status			
I (number)	17(56.66%)	18(60.00%)	p>0.05
II (number)	13(43.44%)	12(40.00%)	p>0.05

Table -II: Duration of surgery in two groups

Groups	Duration of surgery (in minutes)	p value
Group A (n=30)	80.75±10.49	p>0.05
Group B (n=30)	81.88±11.12	

Table -III: Comparison of quality of block in two groups

Quality of block	Group A (n=30)	Group B (n=30)	p value
Onset of sensory block (min)	11.64±2.19	09.89±1.97	p<0.05
Onset of motor block (min)	13.32±0.98	11.09±1.28	p<0.05
Total duration of analgesia (hour)	03.43±0.49	11.87±0.53	p<0.001

Table -IV: Incidence of side effects during block in two groups

Side effects	Group A (n=30)	Group B (n=30)	p value
Horner's syndrome	12(40%)	10(33.33%)	p>0.05
Dyspnoea or chest discomfort	02(6.66%)	01(03.33%)	p>0.05
Recurrent laryngeal nerve block	01(3.33%)	02(06.66%)	p>0.05
Inadequate block	01(3.33%)	01(03.33%)	p>0.05

The qualities of block in two groups were shown in Table III. Onset of sensory as well as motor blocks were early in group B and was statistically significant (p<0.05) too. Duration of analgesia was markedly prolonged in group-B and was statistically highly significant (p< 0.001). Horner's syndrome was observed as the main trouble in both the groups (Table-IV). Similar complications were observed in two groups and there were no statistically significant differences in complications. Inadequate block was observed in one patient in either groups and were managed with incremental intravenous analgesics. No serious complications like pleural puncture, pneumothorax or any other cardiorespiratory side effects were observed during the procedure.

Discussion

Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries. A combination of lignocaine and bupivacaine provided better operating conditions but the duration of analgesia is rarely maintained for more than 4-6 hours. Addition of steroid to local anaesthetics effectively and significantly prolongs the duration of analgesia as well as producing earlier onset of action[16]. Steroids are very potent anti-inflammatory and immunosuppressive agents. Perineural injection of steroid is reported to influence post-operative analgesia. Epidural steroids were used for treatment of back pain and sciatica[9]. Various steroids has been used for this purpose, but dexamethasone a 9a-derivative synthetic glucocorticoid is preferred because of its highly potent anti-inflammatory property, about 25-30 times as potent as hydrocortisone and without any mineralocorticoid activity. Thus was found to be safer and devoid of potential side effects.

Pre-operative administration of dexamethasone by oral and intravenous routes has been shown to reduce overall pain scores and analgesic requirements in the postoperative period without any adverse effects in various oral and general surgical procedures[17]. Dexamethasone is also known to reduce post-operative nausea and vomiting. The possible mechanism of analgesic and antiemetic actions are due to anti-inflammatory property of Dexamethasone[18,19].

In reported study significantly early onset of sensory and motor block was noticed in group-B compared to group-A ($p<0.05$). The early onset of action might be due to synergistic action of dexamethasone with local anaesthetics on blockage of nerve fibres. The duration of pain relief (postoperative analgesia) was markedly prolonged in group-B (11.87±0.53 hours), while it was only 3.43± 0.49 hours in group-A ($p<0.001$). This results similar to findings of study of Shrestha BR et al[20]. Author reported onset of action of 10-30 min (mean 18.15±4.25 min) in local anaesthetic group and 10-20 min (mean 14.15±2.10 min) in local anaesthetic+steroid group, while duration of analgesia was 2.30-4 hours (mean 3.16±0.48) in local anaesthetic group and 8-24 hours (mean 12.75±5.33) in local anaesthetic+steroid group.

Preliminary works demonstrated that addition of corticosteroid microspheres to local anaesthetics prolonged the duration of blockade of peripheral nerves[14]. It has been reported that intercostal injection of dexamethasone containing bupivacaine microcapsules produces prolonged duration of anaesthesia and analgesia in healthy human volunteers[14]. These authors believed that there was a causative relationship between the suppression of inflammation and the remarkably longer duration action. Few preliminary studies reported that steroids significantly prolong the duration of analgesia in extremity nerve blocks[21]. A study in axillary block, suggested that dexamethasone when added to lignocaine significantly prolonged duration of analgesia without any change in onset time[21]. Another study in supraclavicular block reported that dexamethasone when added as adjuvant to mixture of local anaesthetics resulted in significantly early onset and longer duration of analgesia[22]. Both the groups had high success rate (>90%). The incidence of complication was low and comparable between the groups except higher incidence of Horner's syndrome. No case of clinical pneumothorax was observed in the present study. Horner's syndrome was observed in 40% patients in group A and 33.33% patients in group B which is comparable to the study of Niazi et al[23]. Dyspnoea or chest discomfort was encountered in 6.66% in group A and in 3.33% patient in group B respectively. Recurrent laryngeal nerve block was encountered in 3.33% patient in group A and 6.66% patient in group B, respectively; inadequate block was observed in one patient in either groups. Brand and Papper injected local anaesthetic agent by Murphy's supraclavicular route but had 6.1% incidence of pneumothorax[24]. In another study by this route Pham Dang et al observed asymptomatic Phrenic nerve paralysis (60%), Horner's Syndrome (10%) and transient recurrent nerve paralysis[25]. Dupre et al and Hampel et al also reported Horner's syndrome in their studies[26,27]. Kumar et al and Ross reported epidural and subdural blockade due to widespread distribution of anaesthetic agent with interscalenous route[28,29]. Dupre et al and Moore et al had 11% and 8% failure rates[26,30]. Brand and Papper had 84.4% success rate[24].

Although corticosteroids have been used successfully for postoperative pain relief in oral, general and orthopedic surgery[31,32]; other studies have not corroborated these reports[33,34]. The mechanism of the analgesia induced by corticosteroids is not fully understood. This effect is suspected to be mediated by their anti-inflammatory or immune-suppressive effects[35,36]. The use of corticosteroids as an adjuvant to local anesthetic for peripheral nerve blocks rarely has been described and its mechanism of action is not clearly understood. According to the traditional theory of steroid action, steroids bind to intracellular receptors and modulate nuclear transcription. In this study, dexamethasone produced a relatively rapid effect which cannot be explained by the above mechanism[37]. Corticosteroids may have a local effect on the nerve; the dexamethasone effect may be related to this action[38]. Adverse effects with a single dose of dexamethasone are probably extremely rare and minor in nature and previous studies have demonstrated that short-term (24 hours) use of dexamethasone as safe[39]. Adding a steroid to local anesthetic solution may not be indicated in all patients. For example, diabetic patients may experience

hyperglycemia and patients with a continuing infectious process may be detrimentally affected by the anti-inflammatory effects of steroids.

Conclusion

The use of dexamethasone to increase the duration of action of local anesthetics is not an indication of this drug. It may be useful in situations in which epinephrine must be used with caution (e.g., hypertension, ischemic heart disease).

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