ISSN NO. 2320–7418 DOI: 10.22270/jmpas.V10I4.1196

International open access journal

Journal of Medical Pharmaceutical and Allied Sciences

Journal homepage: www.jmpas.com

Research article

Study of effect of dexamethasone added to lignocaine plus adrenaline in supraclavicular brachial plexus block: a prospective study

Ashok R Chaudhari[1], Pratibha Deshmukh[1]*, Harleen Sandhu, Kirti Gujarkar[2]

1. Datta Meghe Medical College, Shalinitai Meghe Hospital and Research Centre, Nagpur, Maharashtra, India
2. Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Science, Wardha, Maharashtra, India

ABSTRACT

Various additives have been employed to extend the brachial plexus block. Dexamethasone, when added to local anesthetic block prolongation with analgesic and anti-inflammatory effects has been seen. Group I (Control group) received Inj. Lignocaine 1.5% plus adrenaline (1:200000) max safe dose of 7mg/kg+ NS- 2ml while group II (Dexa group) received Inj. Lignocaine 1.5% plus adrenaline (1:200000) max safe dose of 7mg/kg + Inj. Dexamethasone - 2ml (8mg). Total volume in each group ranged between 25-32ml considering the patients individual body weight. Block characteristics, duration and quality of analgesia in the post-operative period were noted. Dexamethasone hastens the onset and prolonged the duration of motor and sensory blockade. The mean duration of postoperative analgesia was prolonged till 8th hour in the dexamethasone group while in the control group it was continued till 3hrs, the role of rescue analgesia commenced after 3rd hour. Dexamethasone provides better hemodynamic stability and profound analgesia without any untoward side effects in the perioperative period. In the supraclavicular method of brachial plexus block, the addition of dexamethasone to lignocaine adrenaline offers excellent anesthetic and analgesia.

Keywords: Dexamethasone; Supraclavicular; Lignocaine; Adrenaline; Brachial plexus block; Orthopedic surgery; Analgesia

Received - 05-06-2021, Reviewed - 30/06/2021, Revised/ Accepted- 27/07/2021

Correspondence: Pratibha Deshmukh* ✉ pratibhauday@gmail.com

Datta Meghe Medical College, Shalinitai Meghe Hospital and Research Centre, Nagpur, India

INTRODUCTION

Orthopedic upper limb surgeries are quite common and a routine encounter for the anesthesiologist and supraclavicular brachial plexus block is an established regional anesthetic method for this surgical procedure [1]. Various medications are being utilized as adjuvants with local anesthetics in brachial plexus block to promote rapid, dense, and extended block [2]. For this reason, drugs such as epinephrine, tramadol, buprenorphine, fentanyl, and clonidine are routinely used in conjunction with local anesthetics. Nevertheless, their usage is restricted due to either associated side effects like excessive sedation, respiratory depression, and psychomimetic effects or inconclusive outcomes, therefore medicines with minimal of these are always sought after. [3].

Dexamethasone has recently been investigated as an adjuvant to local anesthetic in peripheral nerve block. Even though the precise mode of action of dexamethasone is uncertain, preliminary research indicates that its addition can significantly increase the duration of analgesia with few side effects [4]. In patients receiving brachial plexus block for upper limb orthopedic surgical procedure, it is particularly applicable to administer dexamethasone into the brachial plexus sheath along with local anesthetic, so that surgery is completed under the effect of local anesthetic administered and the steroid provides residual analgesia in the postoperative period because of its longer duration of action [5].

With this context in mind, the present research was designed to look at the effectiveness of adding dexamethasone to lignocaine plus adrenaline for supraclavicular brachial plexus blocks. The onset time of motor and sensory block, duration of sensory and motor block, and quality of intraoperative and post-operative analgesia were our key goals.

MATERIALS AND METHODS

After obtaining the approval from Institutional Ethical Committee, the present prospective research was carried out in the "Anaesthesiology Department, JNMC Sawangi (Meghe), Wardha" during the study period of two years. The study included 80 adult patients of either gender from ASA physical status classes I&II, aged

18 to 70 years, who were scheduled for different upper limb orthopaedic procedures excluding shoulder procedures. Patients with ASA grade III, IV & V, less than18 years and more than 70 years, pregnant women, patients with coagulation disorder / bleeding problems, known neurological deficit, local sepsis, local bony deformity, patients who were very obese, patients having history of seizures, liver, hepatic or pulmonary disease, alcohol or drug abuse dependence, allergy to study drug, compromised cardio respiratory profile, patients having pneumothorax and Patients who refused to take part in the study were ruled out.

A detailed systemic and general investigation was performed to exclude any cardiovascular, pulmonary, or neurological abnormalities, as well as any accompanying issues. Routine investigations like complete Hemogram, KFT, LFT, routine urine analysis was done. Preoperative blood pressure, pulse rate, respiratory rate, and weight of the patients were noted. An I. V. line was set up in the opposite upper limb. Informed consent was obtained and local anesthetic sensitivity testing was done. Preoperative sedation was purposefully circumventedin order to diminish interference throughout the evaluation of block quality and postoperative pain management. Patients were randomly categorized into2 groups of 40 each.Group I (Control group): Patients receivedInj. Lignocaine 1.5%plus adrenaline (1:200000) max safe dose of 7mg/kg+ NS- 2ml. Group II (Dexa Group): Patients receivedInj. Lignocaine 1.5% plus adrenaline (1:200000) max safe dose of 7 mg/kg + Inj.Dexamethasone - 2 ml (8 mg).Total volume in each group ranged between 25-32 mlconsidering the patient's individual body weight.

The patient was placed supine with the head turned away from the side to be blocked. A pillow was kept below the shoulders. The anaesthetized arm was abducted, and the hand was stretched as far as possible along the side towards the ipsilateral knee. Stimuplex DIG nerve stimulator" with 22 gauage, 2 inch, short bevel insulated needle.

The following landmarks were identified Midpoint of the clavicle, Posterior border of sternocleidomastoid muscle, Subclavian artery, 1.5- 2.0 cm posterior to the midpoint of the clavicle in the interscalene groove where the anterior scalene can be palpated. The performer used to stand beside the patient's head. The anesthetic approach employed was subclavian perivascular employing a nerve finder after proper patient placement and stringent aseptic and antiseptic measures. The stimuplex DIG nerve locator was used (B. Braun, Allentown, PA). Under full aseptic precautions, a 2-inch, 22-gauge, short-bevel insulated needle (Stimuplex; B. Braun) was utilized for all blocks. The block needle was placed via a skin wheal raised 1 finger breadth above the lowermost perceptible section of the interscalene groove. The needle was then pushed immediately caudal with the nerve stimulator output adjusted to 0.9 mA at 1 Hz until a flexor or extensor response of all fingers was observed, at which time the output was lowered to 0.5 to 0.7 mA. If the response was still apparent at this degree of stimulation, the local anesthetic solution was administered in 5-mL increments, with repeated aspirations between each increment, until the whole amount of local anesthetic solution was administered. The time of medication administration was recorded. During and after the injection, We kept verbal andvisual contact with the patient.

Patients were sedated with Inj. Midazolam 0.02 mg per kg slow i.v. after the blocks were evaluated. Patients were supplied oxygen through nasal masks and were adequately screened out of the operative field. Vital parameters (pulse, respiration, and blood pressure) were checked every 5 minutes for the first 30 minutes, then every 15 minutes until the procedure was completed. Any changes in blood pressure, pulse rate, respiratory rate, or oxygen saturation were documented.

Postoperatively motor & sensory blockade and vitals of patients were noted every half hourly. The duration of analgesia was taken from the time of the onset of block to the first complaint of pain. Rescue analgesic was administered in the form of Diclofenac sodium intragluteally in the dose of 1.5mg/kg, Inj. Ranitidine 50 mg giveni.v along with Inj. ondansetron 4 mg i.v. injection. Overall pain was assessed using the verbal response score [VRS], in which patients were asked to verbally rate their perceived pain intensity on a numerical scale ranging from 0 to 100, with zero representing one extreme (e.g., no pain) and 100 representing the other extreme (e.g., the worst pain possible).Rescue analgesic was administered when VRS was 60 or more. Patients were observed carefully for any complications of supraclavicular technique and local anesthetic toxicity were noted and treated accordingly. Patients who required supplemental anesthesia were excluded, only patients who achieved full motor and sensory blockade were included in the study. In each patient, a chest x-ray 6 hrspostoperatively to rule out pneumothorax was done.

Statistical analysis

The inferential and descriptive statistics were used in the statistical analysis, which included the "the student's unpaired t test and Chi square Test". Graph Pad Prism 5.0 and SPSS 17.0 were used in the study, and $p<0.05$ was regarded the level of significance.

OBSERVATIONS AND RESULTS

A total of 80 adult patients were enrolled, and they were categorized into two groups of 40 individuals each. Both the groups were comparable and found no significant difference in regards to demographic profile and mean duration of surgery as shown in table 1. Maximum number of patients underwent closed reduction and K wire fixation (32.5%) in control group and open reduction and plate osteosynthesis (37.5%) in dexamethasone group, (Figure 1). Overall there was no statistical difference in any respect, $p >0.05$.

Table 1: Demographic data of patients and mean duration of surgery

Demographic data	Control group	Dexa group	P value
Age	41.17±13.34	39.95±15.02	0.63
Male /female	27(67.5%)/13(32.5%)	33(82.5%)/7(17.5%)	0.12
Weight(kg)	60.38±7.58	54.92±9.25	0.15
Mean duration of surgery (min)	77.37±27.66	89.50±28.90	0.059

Figure 1: Distribution of patients according to type of Operative Procedure

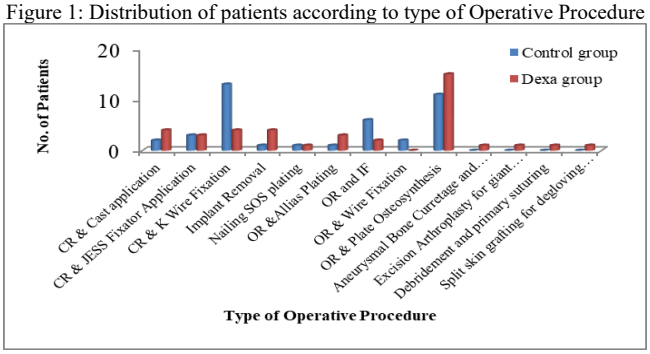


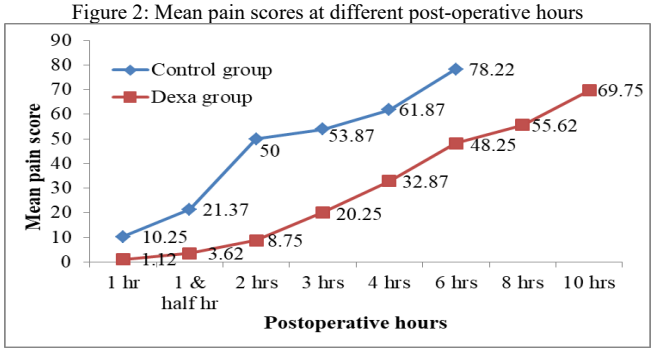
Table 2 shows that the time of onset of motor and sensory block was shorter and prolonged duration of sensory and motor blockade in dexamethasone group as compared to control group. It is evident from the table that the mean value of total duration of analgesia was markedly increased in dexamethasone group (462.75±56.88min) as compared to control group (194.50±35.73min).

Table 2: Comparison of brachial plexus block characteristics between two groups

Characteristics	Control Group	Dexa Group	P value
Onset of sensory block (min)	10.55±1.17	8.97±1.40	0.0002
Onset of motor block (min)	15.87±0.64	13.90±0.77	0.0001
Duration of sensory block (min)	145±23.20	325±29.08	0.000
Duration of motor block (min)	105±29.08	265±29.08	0.000
Duration of analgesia (min)	194±35.73	462.30±56.88	0.000

Figure 2 shows that in control group the pain score, suggestive of 'good' analgesia was maintained upto 1 1/2 hrs in most of the patients while in dexamethasone group all the 40 patients maintained good analgesia upto 3hours. 'Fair analgesia' was recorded in control group upto 4hrs& in dexamethasone group upto 8 hrs in most of the patients. Rescue analgesia was administered in control group from 4th hr onwards and in the dexamethasone group after 10 hrs given in the form of intramuscular injection of diclofenac sodium 1.5mg/kg in the postoperative period.

Figure 2: Mean pain scores at different post-operative hours



Mean values show no significant change in respiratory rate, pulse rate, and systolic blood pressure (SBP) intra-operatively as wellas post-operatively in both the groups as shown in table 3, ($p<0.05$).

Table 3: Comparison of haemodynamic parameters between two groups

Parameters		Preoperative	Intra-operative	Post-operative (upto 6 hrs)
Pulse rate	Control group	81.10±8.77	80.58±9.35	85.41±10.56
	Dexa group	86.80±12.25	87.79±9.89	88.44±15.83
Respiratory Rate per minute	Control group	13.37±1.61	15.89±15.74	14.23±1.68
	Dexa group	15.30±2.49	14.87±2.16	14.13±2.83
SBP per minute	Control group	123.95±10.35	120.98±6.94	128.08±7.42
	Dexa group	124.20±10.37	123.50±8.65	122.82±5.09

There was no major side effects like nausea, vomiting, bradycardia , and hypotension occurred and complications of supraclavicular block technique like pneumothorax, Horner's syndrome, surgical emphysema were not noted in both groups intraoperative and post-operatively.

DISCUSSION

Supraclavicular brachial plexus block is the most frequently used regional nerve block to induce anesthesia and analgesia for upper limb surgery because it delivers the most consistent anesthesia of any brachial plexus block. In regional anesthesia, several perineural adjuvants have been used in conjunction with local anesthetics in an attempt to optimize block properties and enhance clinical results. The usefulness of steroids in the treatment of post-operative pain is being investigated. Preliminary research has shown that adding corticosteroid microspheres to local anaesthetics lengthens the duration of peripheral nerve blockage [6].In healthy human volunteers, an intercostal injection of dexamethasone with bupivacaine microcapsules induces an extended duration of anaesthesia and analgesia [7].

In the present study, there were no significant difference between the two groups in terms of demographic profile and surgical duration. The difference in mean duration of onset of motor and sensory block was statistically significant ($P<0.05$) suggesting quite earlier onset of motor and sensory block with the addition of dexamethasone for achieving brachial plexus block. These findings concurred with the research carried out by Shende et al [8], Khobragade et al [9] and Islam et al [10]. The early onset of effects might be attributed to the synergistic impact of dexamethasone and local anaesthetics on nerve fibre blockage [6, 11]. Furthermore, we detected that the addition of dexamethasone increased the duration of motor and sensory blockage in the current investigation. Several studies [5, 8, 12-14] also agreed with this finding. The block prolonging effect might be attributable to local nerve fiber activity rather than systemic impact [15]. Steroids might exert this impact through binding to intracellular receptors and modulate nuclear transcription and by affecting the function of potassium channels in excitable cells [14, 16].The mode of action of dexamethasone-induced extension of

peripheral nerve blockade is likely to be mediated by traditional glucocorticoid receptors and is local rather than systemic effects, as dexamethasone incorporation has not been proven to change the kinetics of bupivacaine release from microcapsules. It is suggested that action on the glucocorticoid receptor alters the functioning of ion channels or causes local acidosis in nerve cells, lowering the amount of local anaesthetic necessary to cause conduction failure or trapping the highly ionized bupivacaine molecule in the neuronal cell [14].

In present study the duration of postoperative analgesia was prolonged and significant (P<0.05) in dexamethasone group which is comparable with the study done by Shende et al [8] Jyotipurkar et al [12], and Pathak et al 2012 [17]. The quality of analgesia was assessed every hour for 24 hours post operatively with the help of a subjective pain scoring graded from 0-100 pain scores. 0- 30 suggested 'good' analgesic from 31-60 suggested 'fair' analgesia and >60 suggested 'poor' analgesia. Systemic analgesics were given when the pain scores read >60.Pain is a subjective sensation and individual variation may occur. The patients on whom we studied came from lower socio-economic strata and were mostly illiterate. Hence we chose and preferred this type of pain scoring wherein the patients were asked to quantity their pain in the form of fractions of a rupee or in percentage in case of literate patients. It was evident that the pain scores were significantly lower with the addition of dexamethasone i.e. in dexamethasone group and as compared to lignocaine plus adrenaline alone i.e Control group.

The mean pain scores started increasing quickly in Control group from (10.25±10.06) just after the end '1' hour to (78.35±9.42) at 6 hours in the postoperative period .Most of the patients needed systemic analgesics after 3rd hour onwards and rest all the patients required rescue analgesia after 4th hour onwards in Control group i.e. with plain lignocaine adrenaline. In dexamethasone, the mean pain scores suggestive of 'good' analgesia (pain scores 0-30) were observed upto 3 hours with a mean of (20.25±7.75). The pain scores gradually increased with a mean reading of (48.25±17.95) at 6 hours to (69.7±7.05) at 10th hour. Rescue analgesia was required after 8th hour in a few patients and from 10th hour all the patients required rescue analgesia. These findings are correlated with the previous studies [18, 19].

The mean values for pulse rate, B.P. and R.R did not change significantly intraoperatively as well as postoperatively. No respiratory depression was observed. Infect no technique is free from any complication and same is true for supraclavicular approach of brachial plexus block. They could be in the form of local haematoma, pneumothorax, "Horner's syndrome", phrenic nerve palsy. No patients in our study groups i.e. lignocaine adrenaline group and dexamethasone group had any complications and no respiratory embarrassment was observed. There were no complications of drug toxicity like sedation, hypotension, bradycardia were seen. Thus, the use of dexamethasone in supraclavicular brachial plexus block helps to reduce costs while also providing maximum patient comfort throughout the intra- and post-operative period. Also the aim of providing postoperative analgesia can be fulfilled with the addition of dexamethasone (steroids) to lignocaine adrenaline in supraclavicular brachial plexus block.

LIMITATIONS

In our study we have used nerve locator to identify the "trunk" level of supraclavicular brachial plexus where the drug is administered. The blind parasthesia technique was not used. Ultrasound guided supraclavicular block reduces the volume and dose of the local anesthetics with high success rate and without any major risk of complication. Since ultrasound facility is not available, which is more precise and specific for performing blocks, the utilization of this technique could not be made.

CONCLUSION

The addition of dexamethasone to lignocaine adrenaline in supraclavicular approach of brachial plexus block produces excellent analgesia & anesthesia with the advantages of hastens and prolongs the onset of motor and sensory blockade, prolongs the duration of postoperative analgesic requirement and offers better recovery conditions. Also dexamethasone provides better hemodynamic stability and profound analgesia without any untoward side effects in the perioperative period. So, we recommend the use of dexamethasone as an adjuvant to local anesthetics in order to achieve a pain free post-operative period without any untoward effects. Further studies should be conducted to assess the effectiveness in a comparatively large sample size.

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How to cite this article

Ashok R Chaudhari, Pratibha Deshmukh, Harleen Sandhu, Kirti Gujarkar, 2021. “Study of effect of dexamethasone added to lignocaine plus adrenaline in supraclavicular brachial plexus block: a prospective study”. Jour. of Med. P’ceutical & Allied. Sci. V 10 - I 4, 1196, P- 3354-3388. doi: 10.22270/ jmpas.V10I4.1196