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Original Research Article

A Study between 0.5% Levobupivacaine and 0.5% Levobupivacaine with Dexamethasone 8 mg Combination in Brachial Plexus Block by the Supraclavicular Approach

Satyendra Kumar[1], Garima Gaurav[2], Bijoy Kumar[3], Ashok Kumar[4]

[1]Senior Resident, Department of Anaesthesiology, Nalanda Medical College and Hospital, Patna, Bihar.

[2]Senior Resident, Department of Anaesthesiology, Darbhanga Medical College and Hospital, Laheriasarai, Bihar.

[3]Associate Professor, Department of Anaesthesiology, Nalanda Medical College and Hospital, Patna, Bihar.

[4]Professor and Head, Department of Anaesthesiology, Nalanda Medical College and Hospital, Patna, Bihar.

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Corresponding author: Dr Garima Gaurav

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Abstract

Background: Motor and sensory blockade is prolonged when dexamethasone is added to bupivacaine for supraclavicular brachial plexus (SCBP) block. Levobupivacaine and dexamethasone (8 mg) have not been thoroughly researched to see how they interact. This study looked at the analgesic effectiveness of dexamethasone when used as an adjuvant to levobupivacaine in the SCBP block.

Methods: The ultrasound-guided SCBP block was administered to 60 patients who were divided into two groups at random. Both Group S (thirty patients) and Group D (thirty patients) received 2 mL of normal saline with 25 mL of levobupivacaine (0.5%), while Group D received 2 mL of dexamethasone (8 mg) with 30 patients in Group S. The first rescue analgesia response time, the total number of rescue analgesics needed in a 24-hour period, and various block properties were evaluated. For statistical analysis, the chi-square test and Student's t-test were utilised.

Results: In Group S, it took 396.13±109.42 min to request the first rescue analgesia, whereas in Group D, it took 705.80± 121.46 min to request the same ($P< 0.001$). In comparison to Group D, Group S had a greater need for rescue analgesics. Comparing Group D to Group S, the onset of sensory and motor block occurred more quickly in Group D. Group D had sensory and motor blocks on average for substantially longer than Group S.

Conclusion: With a quicker onset and longer duration of sensory and motor block, the addition of dexamethasone to levobupivacaine in SCBP blocking lengthened time for initial rescue analgesia and decreased the need for rescue analgesics.

Keywords: Dexamethasone, levobupivacaine, supraclavicular brachial plexus

Introduction

Today, peripheral neural blocking is a widely used technique for treating post-operative pain. In addition to providing intraoperative anaesthesia and postoperative analgesia, ultrasound-guided supraclavicular brachial plexus (SCBP) block significantly lessens problems such intravascular injection. Levobupivacaine is less harmful to the body than bupivacaine [1,2]. Even when taken with adjuvants like opioids that cause opioid-related adverse effects, its limiting characteristics are late onset and short-lived analgesia [3]. Dexamethasone can extend the effects of regional anaesthesia, according to studies [4]. Adjuvant dexamethasone may help prevent opioid-related adverse effects. Regarding the use of dexamethasone as an adjuvant to levobupivacaine, there is a dearth of literature. The purpose of the study was to evaluate the analgesic effectiveness of dexamethasone when used in conjunction with levobupivacaine during an ultrasound-guided SCBP block.

The main goal of the current study was to ascertain if using dexamethasone (8 mg) as an adjuvant to levobupivacaine in an ultrasound-guided SCBP block would reduce the number of times rescue analgesia was needed in the first 24 hours following surgery. The study's secondary objectives were to determine the effects on sensory or motor block characteristics.

Material and Methods

From March 2022 to August 2022, a randomised prospective study was carried out at a tertiary care facility (Nalanda Medical College and Hospital, Patna, Bihar).

In the current study, patients between the ages of 16 and 65, of either gender, with American Society of Anesthesiologists Grade I or II status, who had been posted for upper limb surgery, were included. Patients who refused to provide informed consent, were obese, had short necks, had neuropathy or a local infection at the location of the block, had a history of drug allergies or abuse, and were anticipating an operation lasting longer than two hours were all excluded from the trial.

The day before the operation, a pre-anaesthetic examination was conducted. The patients were informed of the block operation and any potential problems, and written informed agreement was acquired.

On the eve before surgery, all patients received 150 mg of ranitidine and 0.5 mg of alprazolam by mouth while fasting.

Using a computer-generated algorithm, 60 patients were randomly split into two groups (Group S, n = 30, and Group D, n = 30). To guarantee that the allocation sequence remained a secret, the assigned random group was placed inside a sealed envelope. In the operating room, the anesthesiologist who was not involved in the study opened the envelope and prepared the medication accordingly. The anesthesiologist, who was drug-blind, conducted the observations. The following measurements were made: heart rate (HR), systolic and diastolic blood pressures (SBP and DBP), mean arterial pressure (MAP), peripheral oxygen saturation (SpO2), and a three-lead electrocardiogram.

A portable ultrasound equipment with a linear ultrasound transducer was used to execute the SCBP block (8–13 MHz). The brachial plexus was visualised by inserting the transducer in the supraclavicular fossa, which is behind the middle third of the clavicle, while the patient was supine, the affected arm abducted, and the head rotated to the opposite side. The plexus, which is situated lateral and superior to the subclavian artery between the anterior and middle scalene muscles, either resembled a cluster of grapes (5–6 hypoechoic circles) or three hypoechoic circles with a hyperechoic outer ring. Based on group allocation, the drug

solution was administered after negative aspiration to prevent unintentional intravascular needle penetration, and the drug's dissemination in tissue planes was noted. The brachial plexus sheath's distension was regarded as a sign that the needle had been inserted properly. Both Group S (30) and Group D (30) received 25 mL 0.5% levobupivacaine plus 2 mL normal saline around the brachial plexus, as well as 25 mL 0.5% levobupivacaine plus 2 mL Dexamethasone (8 mg). After the block was delivered, midazolam 0.05 mg/kg intravenous was given.

Pinprick testing was used to measure sensory blockage one minute after the block had been completed. The palmar surfaces of the index and little fingers were used to test for blockage of the median and ulnar nerves, respectively, while the dorsal surface of the thumb was utilised to test for blockage of the radial nerve. The sensory block was graded as follows:[5] Grade 0: A pinprick is a typical sensation. Grade 1: A dull, pinprick feeling. No feeling was felt in grade 2. The period of time between the injection of the medication and the onset of Grade 1 sensory block in the hand was used to determine the onset of sensory block (3 nerve distribution). The total loss of sensation to a pinprick was referred to as the full sensory block. The period of time between the onset of the entire sensory block and the resumption of normal sensation was called the duration of the sensory block.

A Lovett rating scale was used to track the degree of motor block in the thumb adduction (ulnar nerve), thumb abduction (radial nerve), thumb opposition (median nerve), elbow flexion, and pronation of the forearm (musculocutaneous nerve) [6]. The time between the end of the local anaesthetic injection and total paralysis was used to determine the beginning of the motor block, and the time between total paralysis and full recovery of motor function was used to determine the duration of the motor block. When at least two of the four nerves (radial, median, ulnar, and musculocutaneous) were unaffected 30 minutes after the block was performed, the block was deemed to have failed. The following scale was used to assess the operational condition's quality in response to the patient's and surgeon's complaints: No complaints (Grade 4), minor complaints (Grade 3), moderate complaints (Grade 2), complaints needing analgesics (Grade 2), and general anaesthesia (Grade 1) are all considered better than zero (unsuccessful) [5,6]. An anesthesiologist who wasn't involved in the formulation of the drugs or in the group allocation was in charge of monitoring the block's performance, intraoperative variables, and postoperative analgesia.

Every hour for the first 24 hours, post-operative analgesia was assessed using a numeric rating scale from 0 to 10 [6]. Tramadol 100 mg intravenously was administered as rescue analgesia if the numerical rating scale score was 5 or above, which indicated that the block's analgesic efficacy had worn off. In the intra-operative phase, pneumothorax and side symptoms like nausea, vomiting, convulsions, mouth dryness, respiratory issues, and neuropathy were identified. Prior to surgery, measurements of HR, SBP, DBP, and SpO2 were taken. These measurements were also taken at 0 min (immediately following medication administration), 15 min, 30 min, 45 min, 60 min, 75 min, 90 min, 105 min, 120 min, 4 h, 8 h, 12 h, and 24 h.

The average start and end times of the sensory and motor block were recorded. All haemodynamic measures (SBP, DBP, MAP, and HR), the timing of the first rescue analgesic, the total amount of rescue analgesic required within the first 24 hours, and any additional complications were also recorded.

The sample size calculation was based on a preliminary pilot study with ten patients, with the study's primary endpoint being "time

needed for first rescue analgesia." Levobupivacaine saline group: 405.14±110.35 min; levobupivacaine-dexamethasone group: 590.28±115.64 min; time to first analgesic request. The sample size was calculated to be about 28 in each group, with an error of 0.05 and a power of the research (1− β) at 80%, to detect a minimum difference of 120 min in the time needed for rescue analgesia between the two groups. To account for potential dropouts, we put thirty patients in each group. The study did not include the patients who took part in the pilot study. Student's unpaired t-test and Chi-square test were used to classify and analyse the patient data and features, as well as the commencement and length of the block. A $P < 0.05$ was considered as statistically significant and a $P < 0.001$ as statistically highly significant.

Results

Age, sex, weight, and operation time differences between the two groups were equivalent (Table 1). In comparison to Group D, Group S had a considerably earlier request for the first rescue analgesic. [Table 2]. Group S, 20% of patients received just one rescue analgesic dose in the first 24 hours after surgery, while 80% of patients needed three. Only 10% of patients in Group D received three rescue analgesic doses during the first 24 hours after surgery, compared to 60% who received just one dosage and 30% who received two.

The statistical difference between the two groups was quite substantial (P< 0.001).

In this study, Group S experienced a delayed onset of motor and sensory block compared to Group D. This difference was extremely significant (P< 0.001) in both Group S and Group D [Table 2]. Group D's motor and sensory block lasted longer than Group S's did (P <0.001) [Table 2]. No instance of a failing block or a patchy block was present. Neither group's patients needed further analgesia or general anaesthesia. Both groups' operative conditions had outstanding characteristics, and there was no statistically significant difference between them. The two groups' intraoperative and postoperative hemodynamic values were equivalent. Throughout and after surgery, there were no negative effects.

Table 1: Demographic parameters

Parameters	Group S	Group D	p-value
Age (years)	38.17±11.72	39.77±11.72	
Gender (male/female)	21/9	20/10	
Weight (kg)	64.23±7.92	63.77±6.74	
American Society of Anaesthesiologists status (I/II)	27/3	26/4	
Duration of surgery (min)	122.4±8.4	124.8±9.2	0.296

Table 2: Brachial plexus block characteristics

Variables	Group S (n=30)	Group D (n=30)	p-value
Sensory block-onset (min.)	7.20±1.73	4.30±1.32	<0.001
Motor block-onset (min.)	9.03±1.73	6.03±0.96	<0.001
Sensory block-duration (min.)	178.60±30.26	420.73±80.87	<0.001
Motor block-duration (min.)	150.70±32.52	306.93±70.24	<0.001
Time to request for first rescue analgesia (min.)	396.13±109.42	705.80±121.46	<0.001

Discussion

To increase success rates and prolong the sensory and motor block during SCBP block using the paraesthesia approach, many anesthesiologists utilise large volumes (30–40 mL) of local anaesthetics.

However, because of the unique spread, this increases the risk of systemic local anaesthetic toxicity and causes complications like Horner's syndrome and phrenic nerve palsy. A less amount of local anaesthetics may result in an incomplete or block that lasts less time. In comparison to blind approaches, ultrasound guided SCBP block offers adequate block with less local anaesthetic. Adjuvants like dexamethasone may be used to prolong the block's duration while minimising negative effects and the volume of injection [7].

The brachial plexus block has been explored with a variety of adjuvants to local anaesthetics, including clonidine, tramadol, dexmedetomidine, and neostigmine, but each medication comes with a unique set of side effects. Dexamethasone, a long-acting glucocorticoid, recently demonstrated its effectiveness when used as an adjuvant to local anaesthetics during brachial plexus block [8]. It causes vasoconstriction, decreases local anaesthetic absorption, and so extends the duration of local anaesthetic effect [9]. When dexamethasone was administered as an adjuvant with bupivacaine and lignocaine in brachial plexus block, many other studies reported the prolonged duration of sensory and motor block, although they varied regarding the onset of sensory and motor block [10-13]. When dexamethasone and bupivacaine were used for an interscalene block, it was shown that the sensory block was prolonged and that post-operative opioid consumption was decreased [14]. In our investigation, we found that supplementing levobupivacaine with dexamethasone (8 mg) delayed the onset of the first rescue analgesic and reduced the need for additional rescue analgesics. Additionally, the synergistic effects of dexamethasone and levobupivacaine resulted in early onset of the sensory and motor effects as well as an enhanced duration of the block, which may have contributed to these effects.

Similar to our findings, a research that combined low-dose dexamethasone (4 mg) with levobupivacaine (0.5%) in a 25 mL SCBP block found that the combination prolonged post-operative analgesia and postponed the first request for a rescue analgesic. Contrary to our study, it had no impact on the start of block, nevertheless [15]. It was shown that 1 mg and 2 mg of dexamethasone increased the sensory and motor block duration to the same extent as 4 mg in a research comparing dexamethasone at various doses as an adjuvant to bupivacaine for SCBP block [16].

When ropivacaine (0.5%) and dexamethasone (8 mg) were used to treat brachial plexus block, the duration of the motor and sensory blockade was prolonged compared to when ropivacaine was used alone, but the start of the block was unaffected.[17] According to a meta-analysis, dexamethasone delayed the onset of sensory and motor block and prolonged the duration of motor block, and lower dosages (4–5 mg) were just as beneficial as higher doses (8–10 mg).[18] However, no trial combining dexamethasone (8 mg) and levobupivacaine for supraclavicular brachial plexus block was examined in the meta-analysis. Our study completely agrees with the previous studies in terms of the time to initial rescue analgesia. However, there was no consensus over when the block started [15–18].

In a different study, the administration of 8 mg of dexamethasone to 30 mL of levobupivacaine prolonged analgesia in supraclavicular brachial plexus block by paraesthesia technique while delaying the

onset of sensory and motor block [19]. In contrast to this study, 25 mL of levobupivacaine was deemed suitable for our investigation since the SCBP block was guided by ultrasound. Use of dexamethasone (8 mg) with bupivacaine (30 mL) in a comparative trial of adjuvants such midazolam and epinephrine not only produced early onset of sensory and motor block but also delayed the need for rescue analgesia [20]. Both of the aforementioned studies [19, 20] were entirely consistent with ours.

The ideal dosage of dexamethasone as an adjuvant to local anaesthetics and its effect on the onset of block have been the subject of conflicting studies. Furthermore, there were hardly any trials that included levobupivacaine and 8 mg of dexamethasone in a SCBP block in the literature. Using 8 mg of dexamethasone as an adjuvant in brachial plexus block, no notable adverse effects were documented in the literature. As a result, we utilised 8 mg of dexamethasone to examine its impact on the onset and duration of sensory and motor block.

The high volume of local anaesthetics may be the cause of the prolonged sensory and motor block that occurs after perineural administration of dexamethasone with (30–40 mL) of anaesthetics [21]. The fact that we utilised a relatively small amount (25 mL) of local anaesthetic in this trial to block the supraclavicular brachial plexus suggests that dexamethasone may have been the cause of the prolonged block.

The safety of dexamethasone injection perineurally is a subject of some concern. Blood flow to normal nerves was decreased for 4 hours after topical application or intrafascicular injection of dexamethasone in animal experiments on the drug. There are no data on long-term effects on peripheral nerves, however this may have negative consequences on nerve fibres [22]. When dexamethasone is added to levobupivacaine, the adverse effects of adjuvants like clonidine, dexmedetomidine, and opioids can be avoided [23]. A single dose of dexamethasone is unlikely to cause systemic harm. Anaesthesiologists frequently utilise it and deliver it intravenously to prevent post-operative nausea and vomiting.

As a result, when compared to alternative adjuvants for levobupivacaine, dexamethasone may be favoured. The present investigation was limited in that we did not investigate the prevalence of steroid-induced hyperglycemia or carry out long-term follow-up. As a result, late-onset neuropathy was not identified. Therefore, it is advised to set up ongoing follow-up for a longer period of time.

Conclusion

In upper extremity procedures using an ultrasound-guided supraclavicular brachial plexus block, the use of dexamethasone (8 mg) as an adjuvant to 0.5% levobupivacaine delayed the need for rescue analgesia and reduced the dosage needed for it. It accelerated the onset of sensory and motor block and lengthened the duration of blockade.

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