

Comparison of 0.5% Bupivacaine vs 0.5% Bupivacaine with Dexamethasone in USG Guided Axillary Brachial Plexus Block - A Prospective, Randomised, Double Blinded Study

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Abstract

Background: Long-acting local anaesthetic bupivacaine is widely used in brachial plexus blocks. Ultrasound guidance reduces procedure time, speeds up the onset of operation, and increases block success rates without causing neural injuries, both of which improve effectiveness. The addition of dexamethasone to regional anaesthesia with local anaesthetics has given corticosteroids a new dimension in medical practice. The aim isto compare 0.5% bupivacaine and 0.5% bupivacaine with dexamethasone in ultrasound-guided axillary brachial plexus block. **Subjects and Methods:** In this study, 60 patients were divided into 2 groups, Group B (n=27) control group received 18ml of 0.5% Bupivacaine with 2ml of isotonic sodium chloride solution and Group BD received 18ml of 0.5% Bupivacaine with 2ml (8mg) of dexamethasone. **Results:** In 60 patients, the onset time of sensory block was earlier in GROUP BD (11.45±2.18) than in GROUP B (13.85±3.76) (P=0.003). Duration of motor block was longer in GROUP BD (581.52±47.97) than in GROUP B (427.04±21.81) (P <0.0001). GROUP BD (808.48±35.98) has a significantly longer duration of analgesia than in GROUP B (627.41±36.54) (P<0.001). Total dose of rescue analgesia was lower in GROUP BD (112.12±33.14) when compared to GROUP B (192.59±47.44) (P<0.0001). **Conclusion :** To conclude, 0.5% Bupivacaine with 2ml (8mg) of dexamethasone combination effectively provides postoperative analgesia and delays the time for rescue analgesia.

Keywords: Bupivacaine, Dexamethasone, axillary brachial plexus

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Received: 16 March 2021

Revised: 09 May 2021

Accepted: 11 May 2021

Published: 05 June 2021

Introduction

The axillary block is a extensively preferred anaesthetic choice for upperlimb surgical procedures, especially for below-elbow surgeries. With ultrasound guidance, we routinely use a low dose of local anaesthetics, which can provide excellent surgical anaesthesia intraoperatively.^[1] In the postoperative period, the analgesic profile is superior when adjuvants are combined with local anaesthetic agents. There are a wide array of adjuvants available for clinical practice at present.^[2] Corticosteroids, especially dexamethasone, have been used as an adjuvant to brachial plexus block in recent studies. Dexamethasone has numerous properties such as anti-inflammatory, antiemetic, vasoconstriction and analgesic action. It substantially increased the length of postoperative analgesia and reduced analgesic requirements in the regional nerve block.^[3,4] In our study, we compared 0.5% bupivacaine

and 0.5% bupivacaine with dexamethasone in the ultrasound-guided axillary block. The primary outcome was to estimate the duration of analgesia with the addition of dexamethasone to Bupivacaine. The secondary outcomes were to assess the onset of sensory and motor blockade, total postoperative analgesic dose.

Subjects and Methods

This prospective randomised controlled study was carried out after receiving approval from the institutional ethics committee, from August 2020 to January 2021 Department of Anesthesiology, Government Villupuram medical college and hospital. 60 patients planned for elective below elbow surgeries of either sex with age group between 18 - 60 years and American Society of Anaesthesiologist (ASA) PS I and II grade were enrolled in this study. Patients under ASA grade III

and IV, with diabetes mellitus, peripheral neuropathy, renal or hepatic dysfunction, known allergy or hypersensitivity to local anaesthetics and who are not willing were excluded from the study.

The sample size required was 27 patients in each group to detect a minimum difference of 120 minutes in duration of analgesia between two groups, considering 90% power with an alpha error of 0.05 and 95% confidence interval. To minimise the margin of error, we included a dropout of 10% and the total sample size calculated as 30 patients per group.

A thorough preoperative evaluation was carried out, recording detailed history and performing complete physical examination for all patients. Total blood count, renal function test, liver function test, blood grouping and typing, electrocardiogram, and chest X-ray were among the standard blood tests performed. Written informed consent for the proposed anaesthetic technique was obtained after a detailed explanation about the block procedure. Patients were instructed for overnight fasting for 8 hours and premedicated with tablet alprazolam at 0.5mg and tablet ranitidine 150mg per orally on preoperative night.

On the day of surgery, in the operating room, under strict aseptic precautions, 18G IV cannula secured in non-operating limb and 500ml Ringer lactate was started slowly. Using multipara monitor Electrocardiogram, The baseline values for pulse oximetry and non-invasive blood pressure were reported after the devices were attached. Patients were randomly allocated into Group B and Group BD, using computer-generated tables of random numbers. Group B (n=27) control group received 18ml of 0.5% Bupivacaine with 2ml of isotonic sodium chloride solution and Group BD (n=33) received 18ml of 0.5% Bupivacaine with 2ml (8mg) of dexamethasone. The study drug was prepared by the anaesthetist not involved in the study. This study was conducted in a double-blinded fashion, the patient and the anaesthetist who performed and evaluated the block were blinded.

With the patient in the supine position, the operating limb was abducted at the arm, supinated at the forearm and flexed at the elbow. The high-frequency ultrasound probe (Mind ray Ultrasound System with 13-6 MHz frequency) was placed vertically over the axilla at the level of the anterior axillary fold. Anatomical structures in the axillary region were scanned to frame the outline of the axillary artery, vein, nerves, and relations. We located the ulnar, radial and median nerve at 2, 5 and 11 O'clock position as hyperechoic round to oval-shaped structures in relation to the axillary artery. The musculocutaneous nerve was identified lateral to the axillary artery, where it lies within the coracobrachialis muscle in the more proximal part of the arm. Using 22G hypodermic needle, local anaesthetic drug was deposited perineurally by an in-plane approach. The drug is injected as aliquots of 3ml after visualising the needle tip position and confirming negative aspiration for blood to avoid intravascular injection

with the axillary artery. While injecting the drug, accidental paraesthesia and increase in nerve diameter indicated the intraneural injection of the drug; thus needle tip repositioned to overcome the neural damage. After performing the block, hemodynamic parameters such as HR, MAP and spO₂ were monitored every 10 minutes for the first 60minutes then hourly for 24 hours.

The observer who was blinded to the technique evaluated the sensory and motor blockade in each nerve territory at a 5 minutes interval for the first 30 minutes and every 30 minutes once thereafter. Here the point of reference for comparison was evaluating sensory and motor function in the contralateral limb simultaneously. In assessing sensory blockade by pinprick method with sterile 24G hypodermic needle, the thenar eminence and hypothenar eminence were tested for median and ulnar nerves. The radial and musculocutaneous nerves were evaluated over the dorsum of the hand and base of the first metacarpal, respectively. The initiation of sensory blockade occurs when a local anaesthetic is injected and the sensation of pinprick is completely lost. The motor blockade was examined by thumb adduction, abduction and opposition for ulnar, radial and median nerves. The musculocutaneous nerve was tested by pronation of the forearm and elbow flexion in supination using a modified Bromage scale. The motor blockade onset was calculated as the composite time taken for complete paralysis of relevant muscles in the concerned nerve territory.

Modified Bromage Scale

If the desired level of the surgical blockade was not reached within 30 minutes, it was labelled as a failed block and the patient was excluded from the study. In the case of sparing detected in a single nerve territory, that particular nerve was blocked at the elbow level.

On conclusion of surgery, postoperative pain was evaluated by Visual Analogue Scale every hour for 24 hours. When VAS > 3 rescue analgesia inj. Tramadol 100mg slow iv along with inj. Ondansetron 4mg iv was administered. Here the duration of analgesia was noted as the time taken for the requirement of the first analgesic dose in the postoperative period and the total dose of analgesics administered in 24 hours was also summed up.

Results

In this study, 60 patients were divided into 2 groups, Group B (n=27) control group, received 18ml of 0.5% Bupivacaine with 2ml of isotonic sodium chloride solution and Group BD (n= received 18ml of 0.5% Bupivacaine with 2ml of dexamethasone. The mean age and weight of the patients in both group shown no statistically significance. There is no difference in the gender and ASA between the groups. The duration of surgery in Group B was 99.81±31.24 mins and

Grade 4	Full power in relevant muscle group
Grade 3	Reduced power but ability to move muscle group against resistance
Grade 2	Ability to move relevant muscle group against gravity but the inability to move against resistance
Grade 1	Flickering movement in relevant muscle group
Grade 0	No movement in relevant muscle group

Table 1: Distribution of Patient's Characteristics

Variables		GROUP			
		Group B		Group BD	
SEX	Male	15	55.6%	17	51.5%
	Female	12	44.4%	16	48.5%
ASA	I	12	44.4%	16	48.5%
	II	15	55.6%	17	51.5%

Table 2: Distribution of Patient's characteristics

Variables		N	Mean	Std. Deviation	P-value
AGE	Group B	27	36.78	7.21	0.694
	Group BD	33	35.94	8.87	
WEIGHT	Group B	27	67.89	6.88	0.231
	Group BD	33	65.45	8.38	

Table 3: Comparison of Study outcome

Parameters	GROUP				P-value
	Group B		Group BD		
	Mean	SD	Mean	SD	
Duration of Surgery (min)	99.81	31.24	104.24	28.09	0.566
Onset of sensory (min)	13.85	3.76	11.45	2.18	0.003
Onset of motor (min)	20.26	3.68	17.91	2.95	0.008
Duration of sensory (min)	505.19	22.93	677.88	37.40	<0.0001
Duration of motor (min)	427.04	21.81	581.52	47.97	<0.0001
Duration of analgesia (min)	627.41	36.54	808.48	35.98	<0.0001
Total dose of rescue analgesia (mg)	192.59	47.44	112.12	33.14	<0.0001

in Group BD was 104.24±28.09 mins, p=0.566. The onset time of sensory block was earlier in GROUP BD (11.45±2.18) than in GROUP B (13.85±3.76) (P=0.003). The onset time of motor block was earlier in GROUP BD (17.91±2.95) than in GROUP B (20.26±3.68) (P=0.008). Duration of sensory block was longer in GROUP BD (677.88±37.40) than in GROUP B (505.19±22.93) (P <0.0001). Duration of motor block was

longer in GROUP BD (581.52±47.97) than in GROUP B (427.04±21.81) (P <0.0001). GROUP BD (808.48±35.98) has a significantly longer duration of analgesia than in GROUP B (627.41±36.54) (P<0.001). Patients belonged to GROUP BD Showed significantly lower VAS score. Total dose of rescue analgesia was lower in GROUP BD (112.12±33.14) when compared to GROUP B (192.59±47.44) (P<0.0001).

Mean arterial pressure and mean pulse rate in GROUP B and GROUP BD measured at various intervals were statistically insignificant ($P < 0.0001$).

Discussion

USG guided Axillary plexus block is commonly used for below-elbow surgeries in upper limbs and it is relatively safe. Dexamethasone is a steroid with potent anti-inflammatory action (about 25-30 times more potent corticosteroid action than hydrocortisone). By adding dexamethasone to a Local anaesthetic solution (Bupivacaine), the duration of analgesia is significantly prolonged, and the onset of analgesia is also earlier compared to using Bupivacaine alone. The proposed mechanism of the Analgesic action of dexamethasone is induced by its Anti-inflammatory effect, immunosuppressive effect, vasoconstrictor effect and systemic effects of analgesia.^[5-7] The onset of Sensory and Motor Blockade in GROUP BD was significantly earlier than in GROUP B in our study. Synergistic action of Dexamethasone with Bupivacaine the blockade of nerve fibres may be the cause of the early onset of sensory and motor blockade. When comparing GROUP BD to GROUP B, the duration of analgesia was substantially longer in GROUP BD. Published reports of animal studies demonstrated that the analgesic effects of steroids when added to Bupivacaine extend analgesia duration peripheral nerve blockade. Castilo J curly et al. studied that adding steroid with Bupivacaine in sciatic nerve blockade prolonged the duration of the blockade in rats.^[8]

Droger C et al. demonstrated that combining Bupivacaine with dexamethasone resulted in a longer period of intercostal nerve blockade in sheep.^[9]

Shetha BR et al. showed that when dexamethasone was administered to a local anaesthetic solution of lignocaine and bupivacaine, the duration of analgesia in supraclavicular brachial plexus block was extended.^[10]

Conclusion

The addition of dexamethasone to 0.5% Bupivacaine in USG guided axillary block significantly prolongs the duration of the sensory blockade. This combination effectively provides postoperative analgesia and delays the time for rescue analgesia.

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How to cite this article: Venkatesan G, Rubini TP. Comparison of 0.5% Bupivacaine vs 0.5% Bupivacaine with Dexamethasone in USG Guided Axillary Brachial Plexus Block - A Prospective, Randomised, Double Blinded Study. *Acad. Anesthesiol. Int*. 2021;6(1):65-68.

DOI: dx.doi.org/10.21276/aaan.2021.6.1.12

Source of Support: Nil, **Conflict of Interest:** None declared.