Journal of Clinical Research in Pain and Anaesthesia
ISSN: 2689-6141

Academic Strive
Researcher's perception is our reality

Research Article *Volume 5 Issue 1*

Dexamethasone as an Adjuvant to Bupivacaine in Ultrasound Guided Axillary Brachial Plexus Block for Upperlimb Surgeries

Kapdi M[1] and Patel S[2]*

[1]Professor H.G in Anaesthesia, Narendra Modi Medical Collage, India

[2]Assistant professor in Anaesthesia, Gujarat Medical & Education Research Society, India

***Corresponding author:** Shivangi Patel, Assistant professor in Anaesthesia, GMERS, Junagadh, India, Email: shivangipatel133@gmail.com

Received Date: November 18, 2024; **Published Date:** December 05, 2024

Abstract

Background: Upper limb surgeries are very common surgeries.Axillary route of Brachial plexus block is mostly used regional anaesthesia technique worldwide.Usage of Ultrasound makes technique more precise& scientific so that less amount of drug can be given at target nerve in real time to get proper nerve block.

Aim & objective: Aim is to compare Bupivacaine & Bupivacaine with Dexamethasone for axillary block.

Primary objective is to compare Bupivacaine& Bupivacaine with dexamethsone in terms of onset of sensory & motor block, Duration of sensory & motor block, Duration of analgesia& secondary objectives are complications & haemodynamic stability.

Methods: After institutional approval and informed consent, a comparative study of 60 patients (ASA Grade I/II) scheduled for various surgeries on hand, forearm and arm, under USG axillary brachial plexus block was carried out.

All 60 patients were divided in 2 Groups.

Group A received Inj. Bupivacaine 0.5% - 2.5mg/kg (20ml) and2 ml Normal saline.

Group B received Inj. Bupivacaine 0.5% - 2.5mg/kg (20ml) and 2 ml of Dexamethasone 8 mg in axillary brachial plexus block. The onset and duration of sensory and motor blockade was compared Intraoperative and postoperative hemodynamic monitoring was done and notified in tabular form. Patients were watched for adverse effects of drugs and complications of procedure itself. The duration of postoperative analgesia was compared between the 2 groups using visual analogue scale and in terms of first rescue analgesic requirement with inj. diclofenac sodium 75 mg.

Statistical analysis: The data were studied using mean values and mean ± SD and then compared using unpaired't' test.p value of <0.05 was considered significance.

Results: Duration of sensory & motor onset, Duration of sensory & motor block, Duration of analgesia was more in group B in comparision to group A.

Both groups, patients are haemodynamicaly stable.

Conclusion: Bupivacaine 0.5%with dexamethasone is associated with faster recovery of sensoy and motor function with better safety profile compared to Bupivacaine 0.5% alone.

Keywords: Axillary Brachial Block, Bupivacaine, Dexamethasone, Ultrasound Guided Block, Upperlimb Surgeries

Abbreviations

VAS: Visual Analogue Scale; MN: Median Nerve; UN: Ulnar Nerve; RN: Radial Nerve; AA: Axillary Artery; MCN: Musculocutaneous Nerve; CBM: Coracobrachialis Muscle; NS: Non-Significant; HS: Highly Significant.

Introduction

The axillary brachial plexus block is a extensively preferred anaesthetic choice for upperlimb surgical procedures, especially for below-elbow surgeries. With ultrasound guidance, we routinely use alow dose of local anaesthetics, which can provide excellentsurgical anaesthesia intraoperatively [1]. In the postoperative period, the analgesic profile is superior when adjuvants are combined with local anaesthetic agents. There is a wide array of adjuvants available for clinical practice atpresent [2]. Corticosteroids, especially dexamethasone, have been used with local anaesthetic agent in various nerve blocks in recently. Dexamethasone has numerous properties such asanti-inflammatory, antiemetic, vasoconstriction and analgesicaction. It substantially increased the length of postoperative analgesia and reduced analgesic requirements in the regionalnerve block [3,4]. In our study, we compared 0.5% Bupivacaine and 0.5% Bupivacaine with dexamethasone in the ultrasound guided axillary block.

Primary outcome: It was to estimate analgesic duration with or without the addition of Dexamethasone to Bupivacaine.
Secondary outcomes: They were to assess the onset of sensory and motor blockade, total postoperative analgesic dose.

Aims and Objectives

Present obsrevational study was conducted to compare between Bupivacaine 0.5% with or without Dexamethasone in ultrasound guided axillary brachial plexus block for upper limb surgeries. The objectives of our study were to compare

- Time to onset, duration of sensory & motor blockade
- Perioperative hemodynamic stability
- Perioperative complications
- Analgesia Duration (Time to 1st analgesic in postoperative period was given)

Materials and Methods

After taking inform consent, Adult patients scheduled for elective upper arm surgeries were included in this study.

Prerequisites
After all basic & systemic laboratory tests, patients were preoperatively examined, VAS was explained

Inclusion Criteria
All adult patients having age <60 yrs& ASA gradelessthan Iii
Patient's weight should be of 50 kgs or more.

Exclusion Criteria
Unwillingness of patients
Hypersensitivity to study drugs
Local infection, Patients with bleeding disorder and altered coagulation
Nerve injuries associated.

Consent
The written informed consent was taken.

Methodology:

Thorough pre-anaesthetic evaluation including history taking, local examination and systemic examination were carried out on day before surgery. Weight was recorded. All patients were explained about Visual Analogue scale (VAS) and were made well conversant with it.

All patients were nil by mouth as per standard starvation protocol.

Group Allocation
All patients were allocated to either of 2 Groups of 30 each.
Group A(n=30): Inj. Bupivacaine 0.5%isobaric - 20ml+ 2 ml of NS
Group B(n=30): Inj. Bupivacaine 0.5%isobaric-20 ml +Injection Dexamethasone 8mg
Randomisation: It was done at the time of giving block by odd& even numbers in seal opaque envelope.

Equipments for giving Axillary Block:

- Ultrasound machine (Fujifilm Sonosite, Bothell WA,98021,USA)and linear probe
- Disposable syringes of 10 ml.
- Disposable 23G 3.75cm block needle.
- Emergency drug tray and fully equipped anaesthesia machine & inj.Intralipids to treat local anaesthetic toxicity.

Preparation
After taking IV line, intravenous fluids started. After taking patient in the operation theatre, various monitoring like Pulse oximeter, Non-invasive, blood pressure cuff and ECG electrodes were applied and baseline pulse, blood pressure, oxygen saturation and respiratory rate were recorded.

Premedication
Tab Alprazolam 0.5 mg one night before surgery.
In operation theatre,

Inj. glycopyrrolate 4 mcg/kg iv, Inj.
ondansetron 0.08 mg/kg iv,
Inj. midazolam 0.02 mg/kg iv.
Vitals were noted before and after pre-medication.

Details of Procedure

The patient was placed in the supine position, with the head turned away from the side to be blocked and the ipsilateral arm adducted. The operative arm was abducted and externally rotated, and the elbow flexed to 90 degrees. The skin of the axilla and the medial upper arm was prepared in an aseptic fashion. A sterile transparent cover was placed on the ultrasound transducer, and sterile water-based ultrasound gel was used as an acoustic couplant. Ultrasound examination of the axilla was performed using a Fijifilm Sonosite ultrasound machine ,Bothell,WA,98021,USA)with a 38-mm high frequency (7–10 MHz) linear array transducer. The ultrasound transducer was placed in a vertical orientation at the level of the anterior axillary fold. The axillary artery was identified and placed in the center of the image. Minor adjustment of scanning planes facilitated the identification of the median, ulnar, and radial nerve complexes surrounding the axillary artery. The musculocutaneous nerve was then identified in a connective tissue plane between the biceps and the coracobrachialis muscles. The identity of each nerve was confirmed by tracing the nerve from the axilla to a fixed reference point and then back to the axilla. The ulnar nerve was traced to and from the medial epicondyle. The median nerve was traced to and from the antecubital fossa, where it lies medial to the brachial artery. The radial nerve may be seen to emerge in a fascial plane within the triceps muscle at the mid humeral level and may be traced back to the axilla. The musculocutaneous nerve can be identified in a fascial plane between biceps and coracobrachialis muscles and traced backwards to the axilla. A 23G 3.75 cm sterile block needle was introduced percutaneously at the center of the transducer, directly parallel to the scanning beam.

A needle in plane approach was used, and the needle was advanced to positions adjacent to the median, ulnar, and radial nerves in this order. The study volume of drug was injected adjacent to each nerve after negative aspiration of blood. The needle was repositioned during injection and circumferential perineural injectate spread was ensured. After blockade of the ulnar, median, and radial nerves, the block needle was withdrawn to the subcutaneous tissues and redirected toward the musculocutaneous nerve.

In Plane Approach for Needle Insertion:

In plane approach: Insert the needle through the skin on the lateral side of the probe at an angle of approximately 30°. Pass the needle in a lateral to medial direction (Figure 1 & 2).

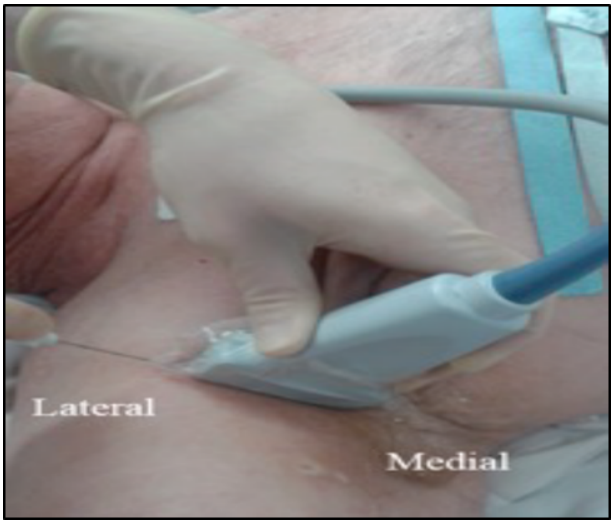

Figure 1: In-plane technique for right sided brachial plexus block.

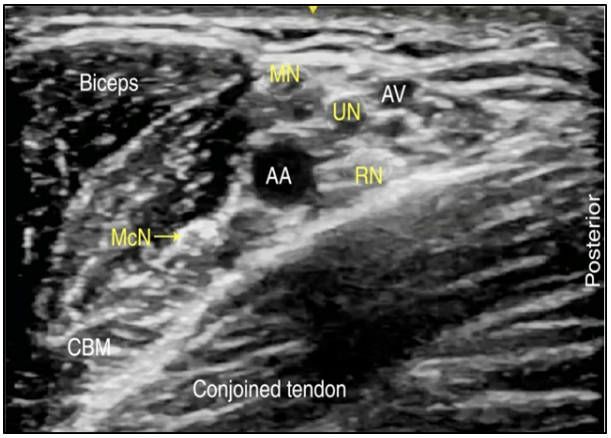

Figure 2: The median (MN), ulnar (UN), and radial (RN) nerves are seen scattered around the axillary artery (AA). The musculocutaneous nerve (MCN) is seen between the biceps and coracobrachialis muscle (CBM), away from the rest of the brachial plexus AV, axillary vein.

The needle is inserted in-plane from the anterior aspect and directed toward the posterior aspect of the axillary artery (Figure 3). Because nerves and vessels are positioned closely together in the neurovascular bundle by adjacent musculature, advancement of the needle may require careful hydrodissection with a small amount of local anesthetic or other injectables. This technique involves the injection of 0.5–2 mL, indicating the plane in which the needle tip is located. The needle is then carefully advanced stepwise few millimeters at a time. Local anesthetic should be deposited posterior to the artery first, to avoid displacing the structures of interest deeper and obscuring the nerves, which may occur if injections for the median or ulnar nerves are carried out first.

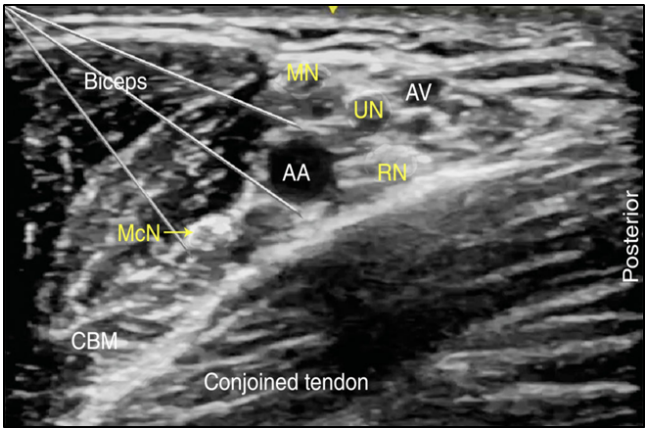

Figure 3: Needle insertions for axillary brachial plexus block. Axillary block can be accomplished by two to four separate injections, depending on the disposition of the nerves around the axillary artery (AA) and the quality of the image. MCN, musculocutaneous nerve; MN, median nerve; RN, radial nerve; UN, ulnar nerve. AA, axilary vein, AV, axillary vein.

The posteriorly located radial nerve is often visualized more clearly once surrounded by local anesthetic. Once 5–7 mL has been administered, the needle is withdrawn almost to the level of the skin, redirected toward the median and ulnar nerves, and a further 7–10 mL is injected in these areas to complete the spread around the nerves.

Patients were observed for following parameters -

- Onset and duration of sensory blockage
- Onset and duration of motor blockage
- Haemodynamic parameters
- Time to 1st rescue analgesic was given
- Perioperative complications

Sensory and motor blockage

For Median nerve, sensory bkockade check on thenar eminence & motor block by thenar opposition.

For Radial nerve: sensory block checked on Dorsum of hand& motor bythumb abduction.

For ulnar nerve: sensory block check onhypothenar eminence & motor by thumb adduction

For musculocutaneous nerve sensory block checked on Lateral border of forearm at site of radial artery, whereas motor block by elbow flexion.

Sensory Blockade was assessed by Pin Prick Test using a 3 Point Scale:

0 = normal sensation

1= loss of sensation of pin prick (analgesia)

2=loss of sensation of touch (anesthesia).

Motor Blockade Assessed by Using 3-Point Scale:

0=normal motor function

1=reduced motor strength but able to move fingers

2=complete motor block.

Onset time of sensory blockade was defined as the time interval between the end of total local anesthetic administration and complete sensory block. Complete sensory block was defined by anesthetic block (score 2) on all nerve territories.

Duration of sensory blockade was defined as the time interval between the end of local anesthetic administration and the complete resolution of anesthesia on all nerves.

Onset of motor block was defined as the time interval between the end of total local anesthetic administration and absence of voluntary movements on hand and forearm (score 0).

Duration of motor block was defined as the time interval between the end of local anesthetic administration and the recovery of complete motor function of hand and forearm.

If the effect was inadequate, general anesthesia was given and those patients were excluded from study.

Perioperative Hemodynamics:

Peri-operative vitals were taken at the time of induction, at the time of incision then, then 2,4,6,8,10,15,20,25,30,45,60 ,75,90,105,120, minutes, 2.5hrs,3 hrs, 3.5 hrs, 4 hrs, 6 hrs, 8 hrs, 10 hrs , 12 hrs, 16 hrs, 20hrs and 24hrs. Duration of surgery were noted. Signs and symptoms of local anaesthetic toxicity were observed.Duration of sensory block was defined as the time interval between the end of local anesthetic administration and the complete resolution of anesthesia on all nerves.

Duration of motor block was defined as the time interval between the end of local anesthetic administration and the recovery of complete motor function of hand and forearm.

Post-operatively patients were assessed according to visual analogue score (VAS).Patients were asked to describe their pain from 0 to 10, where 0 means no pain and 10 means worst pain. When VAS > 4 rescue analgesia was given intravenously

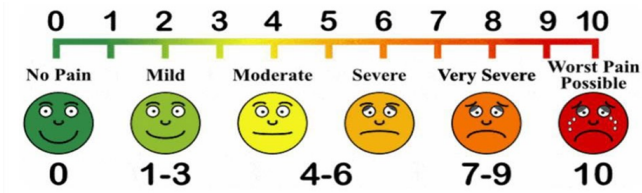

Figure 4: Visual Analog Scale for pain assessment.

Duration of analgesia: total duration of analgesia was defined as the time duration from onset of Grade 1 sensory block to requirement of first rescue analgesia. The duration of analgesia was counted till VAS > 4.

Statistical Analysis

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by suitable SPSS software. Data had been summarized as mean +/- SD for numerical variables and count and percentages for categorical variables. For numerical values unpair t-test & for categorial values chi- square test was done.

P<0.05 is significant (S)

P<0.001 is Highly Significant (HS)

P>0.05 is Non-significant (NS)

Perioperative complications

Time to 1st rescue analgesic was given

Sensory Blockade was assessed by Pin Prick Test Using a 3 Point Scale:

0 = normal sensation

1= loss of sensation of pin prick (analgesia)

2=loss of sensation of touch (anesthesia)

Motor Blockade Assessed by Using 3-Point Scale:

0=normal motor function

1=reduced motor strength but able to move fingers

2=complete motor block.

- Surgical anaesthesia is defined as a motor score of 2 or higher with absent appreciation of pinprick sensation.

Peri Operative Complications

- Tachycardia / Bradycardia / Arrythmia
- Systemic adverse effects of local anaesthetics
- Convulsions/ circumoral numbness/ dizziness (CNS complications

Observation and Results

The present Randomised observational study was done on 60 adult patients with physical ASA I-II,posted for various forearm surgeries after taking written informed consent. The following data was analysed.

	GroupA	Group B	p value
Gender M:F	16 (53.33%)	16 (53.33%)	-
	14 (46.66%)	14 (46.66%)	
ASA Grade (1/2)	18-Dec	19-Nov	-
Age (Years)	36.96±12.50	36.83±7.68	0.967
Weight (Kgs)	61.03±7.68	62.93± 8.98	0.3821
Duration of Surgery (min)	97.66±14.12	103.66±8.98	0.3302

Table 1: Comparison of Demographic Data.

From Table 2 it shows faster mean onset of sensory and motor block in Group B in comparison to Group A. (p < 0.0001)

Onset (in min.)	Group A	Group B	p value	Inference
Sensory (Mean ± SD)	13.8±3.71	11.13±0.84	<0.0001	HS
Motor (Mean ± SD)	12.3±1.48	10.91±1.39	<0.0001	HS

Table 2: Mean Onset of Sensory- Motor Blockade.

From Table 3 it shows that duration of sensory & motor block was longer in Group B compared to Group A. (p<0.0001).

Duration (in minutes)	Group A	Group B	p value	Inference
Sensory blockade (Mean ± SD)	445±25.12	550.16±39.62	<0.0001	HS
Motor blockade (Mean ± SD)	681.16±15.23	880.83±31.67	<0.0001	HS

Table 3: Duration of Sensory and Motor Block.

From Table 4 it is evident that duration of analgesia was prolonged in group B as compared to group A. (p<0.0001).

	Group A	Group B	p value	Inference
Duration of Analgesia (in Min) (Mean ± SD)	888.83±162.85	1356.16±139.51	<0.0001	HS

Table 4: Duration of Analgesia.

From Table 5, Total number of analgesic requests in Group B were less than Group A (p value <0.0001). All patients in each group were haemodynamicaly stable.

	Group A (n=30)	Group B (n=30)	p value	Inference
Total Analgesic Requests in 24 hrs (Mean ± SD)	2.2±0.40	1.23±0.43	<0.0001	HS

Table 5: Total Analgesic Requets in 24 Hours.

Discussion

USG guided Axillary route of brachial 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 by using Dexamethasone as adjuvant to Bupivacaine. 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 Gr. B was significantly earlier than in Gr A 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 Gr B to Gr A, the duration of analgesia was substantially longer in Gr B. Published reports of animal studies demonstrated that the analgesic effects of steroids when added toBupivacaine 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 theblockade in rats [8]. Droger C et al. demonstrated that combining Bupivacaine with dexamethasone resulted in a longer period of intercostal blockade in sheep [9]. Shestha 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 blockade was extended [10].

Conclusion

The Dexamethasone as adjuvant to isobaric Bupivacaine in USG guided axillary brachial plexus blockade significantly prolonged the duration of the sensory blockade & effectively provided prolonged postoperative analgesia and delayed the time for rescue analgesia.

References

1. Satapathy AR, Coventry DM (2011) Axillary Brachial Plexus Block. Anesthesiol Res Pract, pp: 1-5.

2. Swain A, Nag DS, Sahu S, Samaddar DP (2017) Adjuvants to localanesthetics: Current understanding and future trends. World JClin Cases 5(8): 307-323.

3. Noss C, MacKenzie L, Kostash M (2017) Dexamethasone a Promising Adjuvant in Brachial Plexus Anesthesia. A Systematic Review. J Anesth Clin Res 5(7): 421.

4. Marks R, Barlow JW, Funder JW (1982) Steroid-Induced Vasoconstriction: Glucocorticoid Antagonist Studies. J ClinEndocrinol Metab 54(5): 1075-1077.

5. Pehora C, Pearson AM, Kaushal A, Crawford MW, Johnston B (2017) Dexamethasone as an adjuvant to peripheral nerve block.Cochrane Database Syst Rev 11(11): 11770.

6. Jabbari A, Hassan-nasab B, Maleh P, Bani-hashem N, Pour E, et al. (2011) Addition of intrathecal Dexamethasone to Bupivacaine for spinal anesthesia in orthopedic surgery. SaudiJ Anaesth 5(4): 382-386.

7. Mahmoud K, Ammar A (2012) Effect of adding dexamethasoneto bupivacaine on transversus abdominis plane block forabdominal hysterectomy: A prospective randomized controlledtrial. Saudi J Anaesth 6(3): 229-233.

8. Castillo J, Curley J, Hotz J, Uezono M, Tigner J, et al. (1996) Glucocorticoids Prolong Rat Sciatic Nerve BlockadeIn Vivo from Bupivacaine Microspheres. Anesthesiology 85(5): 1157-1166.

9. Drager C, Benziger D, Gao F, Berde CB (1998) Prolonged Intercostal Nerve Blockade in Sheep Using Controlled-release ofBupivacaine and Dexamethasone from Polymer Microspheres. Anesthesiology 89(4): 969-979.

10. Shrestha BR, Maharajan SK, Tabedar S (2003) Supra clavicular brachial plexus block with and without dexamethasone -a comparative study -kathmandu univ med. J (KUMU) 3: 158-160.