

Comparative Study between Local Anaesthetics alone and Dexamethasone as an Adjuvant to Local Anaesthetics in Usg Guided Supraclavicular Brachial Plexus Block in Orthopedic Surgeries at and below Elbow

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Abstract

Background: Addition of adjuvants to local anaesthetic drugs improves onset, duration and quality of brachial plexus block in terms of intraoperative anaesthesia as well as postoperative analgesia very effectively. USG guided block ensures safety ,allowing operators to perform block with greater accuracy under direct visualization. **Objective:** The study was carried to compare the block characteristics between bupivacaine and lignocaine with adrenaline alone and dexamethasone as an adjuvant to mixture of bupivacaine and lignocaine with adrenaline in ultrasound guided supraclavicular brachial plexus block for orthopedic surgeries at and below elbow. **Materials and Methods:** After obtaining the approval from the Institutional Ethics committee and written informed consent 60 ASA I and ASA II patients between age 18 to 60 years were divided into two groups. Group N(n=30),received 10ml of Lignocaine 2% with Adrenaline plus 18ml of Bupivacaine 0.5% plus Normal saline 2ml.Group D received 10ml of Lignocaine 2% with Adrenaline plus 18ml of Bupivacaine 0.5% plus Dexamethasone 2ml (8mg).Onset of sensory and motor block, duration of sensory and motor block and duration of analgesia were compared among two groups.Results:Our study revealed that onset of both sensory and motor block was earlier in Group D ,duration of sensory and motor block and duration of analgesia was longer in Group D than Group N. **Conclusion:** Dexamethasone prolongs the duration of sensory and motor block and duration of analgesia when used as an adjuvant to mixture of Bupivacaine and Lignocaine with Adrenaline as compare to mixture of Bupivacaine and Lignocaine with Adrenaline alonein USG guided supraclavicular brachial plexusblock.

Keywords: Adrenaline; Bupivacaine; Dexamethasone; Supraclavicular brachial plexus block; USG.

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Introduction

Regional nerve blocks offers safer modality of anaesthesia with distinct advantages. This takes patient care in anaesthesia to a whole new level. Anaesthesia provider can extend patient care in the form of postoperative analgesia, ensure compliance of patient with physiotherapy and early mobilization with stable haemodynamics. It provides very good intraop analgesia, extends it in the postop period without any untoward systemic side effects.¹ It also offers a better preservation of mental functions in elderly; decrease risk of aspiration due to intact pharyngeal and laryngeal reflexes, avoids difficult intubation, decreases postoperative complication associated with intubation and provides better postoperative analgesia without undue sedation facilitating early mobilization and discharge.² Thus perioperative pain management has got a crucial role in patient satisfaction both physically and psychologically which helps to early discharge from hospital and also in early return to work.

Supraclavicular brachial plexus block is the most practiced approach of brachial plexus block. Once described as the spinal of the arm, it offers dense anaesthesia of the brachial plexus for surgical procedures around elbow, forearm and hand.³ It is a very good alternative to general anaesthesia. It achieves complete muscle relaxation, intraoperative haemodynamic stability and postoperative analgesia.⁴ Use of ultrasonography ensures effective block, increases safety of procedure with avoidance of complications with direct visualisation of needle.

Bupivacaine is the most used drug as it has long duration of action from 4 to 8hrs. but it requires time for onset of action and duration of analgesia. Increasing dose or volume of local anaesthetics increases risk of systemic toxicity. So addition of lignocaine with adrenaline decreases onset time, maintains adequate drug volume, decreases systemic toxicity by decreasing absorption by vasoconstriction and hence increases duration of block along with postoperative analgesia. But mixture of bupivacaine and lignocaine with adrenaline also does not give adequate duration of analgesia. So various adjuvants have been used to prolong blockade, shorten onset of action and also prolong duration of postoperative analgesia.

Steroids have powerful anti-inflammatory as well as analgesic property. They suppress inflammation through inhibition of phospholipase A2. Local application of methylprednisolone has been found to block transmission in nociceptive C-fibers but not in myelinated A-beta fibers.⁵ The effect was reversible, suggesting a direct membrane

action of steroids. Corticosteroids also suppress ectopic neuronal discharge. Perineural injection of glucocorticoid along with local anesthetics is reported to influence the onset and duration of sensory and motor block.⁶ Dexamethasone a long acting, high potency glucocorticoid with minimum mineralocorticoid effect⁷, Anti-inflammatory effect with minimum gastrointestinal side effects, also prolongs duration of postoperative analgesia.⁸

Recent studies shown that 8 mg dexamethasone when added to local anesthetic injections prolongs the duration of peripheral nerve block analgesia.⁹ This study compares the effect with or without addition of dexamethasone 8 mg to lignocaine (2%) with adrenaline (1:2,00,000) and 0.5% bupivacaine (plain) for onset, duration of sensory and motor block, the duration of postoperative analgesia in USG guided supraclavicular brachial plexus block in patients undergoing orthopedic surgeries at and below elbow.

Materials and Methods

After obtaining the approval of the Institutional ethics committee, written and informed consent was obtained from all the patients after explaining them about the procedure in their language. A Prospective, Randomized Comparative study conducted in the Department of Anaesthesia of Late BRKM Govt. Medical college and Hospital from January 2019 to March 2020. 60 randomly selected patients aged between 18 to 60 years of ASA (American Society of Anaesthesiologist) Grade I and II of either sex undergoing elective elbow, forearm and hand surgeries using USG guidance grouped in N and D with 30 patients in each group.

Exclusion criterias

ASA grade III and IV patients with contraindications for regional anaesthesia (refusal, infection at site, bleeding disorders, on anticoagulant medications, neurodeficits or cardiac defects), allergy to local anaesthetic drugs, patients on antihypertensive and antidepressants, Patients with history of peptic ulcer disease, diabetes mellitus, hepatic or renal failure (as they are contraindications to the use of steroid etc) were excluded from this study.

Group N received 10ml of lignocaine (2%) with adrenaline (1:2,00,000) plus and 18 ml of 0.5% bupivacaine (plain) and 2ml of normal saline, a total volume of 30ml. Group D received 10ml of lignocaine (2%) with adrenaline (1:2,00,000) plus and 18 ml of 0.5% bupivacaine (plain) and 2ml of Dexamethasone (8mg), a total volume of 30ml.

The commercially available forms of the study drugs that were used: A 20 ml vial of Bupivacaine 0.5% (Bupivacaine Hcl) equivalent to 5mg/ml (NEON). A 20ml vial of lignocaine (2%) with adrenaline (1:2,00,000) equivalent to 20mg/ml (CADILLA). A 2 ml ampoule of dexamethasone 8 mg (Dexamethasonesodium phosphate) equivalent to 4 mg/ml. The USG machine used was of model ECUBE i7 ALPION BY BPL Medical Technology.

A preanaesthetic checkup was done for all patients which included a detailed history ,general physical systemic examination and also airway examination. . Basic investigations were done (Haemoglobin %, complete blood counts, bleeding time, clotting time, random blood sugar, Liver function test, Renal function tests and ECG. Patients were kept nil per oral overnight.

On the day of surgery, standard monitoring including non-invasive blood pressure, pulse oximetry and ECG were attached to the patient. Intravenous access was obtained in the limb opposite to that undergoing surgery with a 18G bore IV cannula. Baseline systolic blood pressure and diastolic blood pressure, heart rate, SpO2 were recorded at interval of every 3 minutes for the first 30 minutes and every 15 minutes thereafter. Patients were put in supine position with head turned away from the site to be blocked. Arm to be anesthetised was adducted in a comfortable position.

Under strict aseptic precautions, supraclavicular area was painted and draped. The brachial plexus was scanned using high frequency (8-14 MHz) linear ultrasound probe. After local infiltration of skin with Lignocaine 2% 2ml, a 20G cannula needle was inserted in line with the ultrasound beam till the tip of the needle was positioned near the brachial plexus within sheath which showed as a bunch of grapes appearance on ultrasound. After negative aspiration of blood, 30 ml of respective drug was injected depending on whether the patient was allotted to either Group N or Group D.

The onset of sensory blockade was defined as time taken from the completion of injection of drug till the patient did not feel the pin prick. Sensory block was assessed by pin prick with 23G hypodermic needle in skin dermatomes C5-T1 once in every 2 min for initial 30 min and then after every 30 min till patient regained normal sensations. Sensory block was graded into three: Grade 0- Normal response to pin prick. Grade 1- Analgesia, dull sensation felt. Grade 2- Anesthesia, no sensation felt.⁹ Duration of sensory blockade was defined as time taken from

the onset of sensory blockade till the patient feels pin prick.

Onset of motor blockade was defined as the time taken from the injection of the drug till the patient develops loss of movement in ipsilateral upper limb. Quality of motor block was assessed at the same interval and graded using Modified Bromage scale for upper extremities. Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers Grade 1: Decreased motor strength with ability to move the fingers only Grade 2: Complete motor block with inability to move fingers.

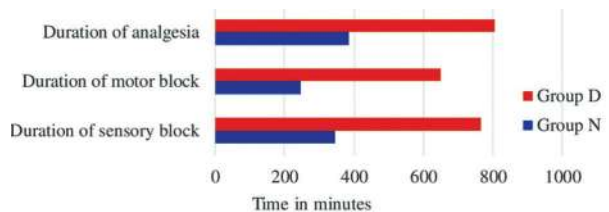


Fig. 1: Bar diagram indicating duration of sensory block and motor block and duration of analgesia between the two groups.

Duration of motor blockade was defined as time taken from the onset of the motor blockade till complete recovery of motor function of the hand and forearm. Duration of analgesia was the time between complete sensory block to the time of first rescue analgesia.

Block failure was considered when the dermatomes supply did not have analgesic effect even after 25 min of drug injection. Heart rate, blood pressure, ECG and oxygen saturation monitored every 3 min after the block intraoperatively and every 15 min post-operatively, Blood loss was assessed and fluid was administered as per the loss. Duration of surgery and any complication were noted.

Visual Analogue Scale (VAS) score, used for assessing postoperative analgesia. Score 0-10 (0=no pain, 10 = worst pain). Patients with VAS score >4 were treated with rescue analgesia(Inj.Diclofenac Sodium 75mg I.M.) and time for first analgesic supplement requirement was noted.

Statistical Analysis

The data was analysed by IBM SPSS version 28.0 (Statistical Package for Social Sciences) software and Microsoft word and Excel were used to generate graphs and tables. Demographic quantitative variables were calculated as mean,

standard deviation. For statistical analysis of onset of sensory block, onset of motor block, duration of sensory block, duration of motor block and duration of analgesia, unpaired T-Test was applied. P value <0.05 was considered as statistically significant and P <0.001 as highly significant.

Results

A total of 60 patients scheduled for elective orthopedic surgeries at elbow, forearm and hand were selected for this study. In this study, Table 1 shows distribution of patients according to their age and weight. 34.50±10.59 years was mean age in Group N and in Group D it was 35.40±9.201 years with p value being 0.596. 55.47±5.853 kg was the mean weight in Group N and in Group D it was 53.03±6.80 kg with p value of 0.059. So both the groups were comparable in terms of age and weight. (p value <0.072). The mean duration of surgery in Group N was 80.97± 20.283 minutes and in Group D was 91.67 ±33.728 minutes with p value of 0.093. There was no statistical difference between both the groups (p value <0.072).

Table 1: Demographic Data.

Characteristics	Group N	Group D
Age in years	34.50±10.59	35.40±9.201
Weight in Kg	55.47±5.853	53.03±6.80
Duration of surgery in minutes	80.97±20.283	91.67±33.728

Table 2: Distribution of subjects according to Gender.

Gender	Group N	Group D
Male	17(56.67%)	21(70%)
Female	13(43.33%)	9(30%)
Total	30(100%)	30(100%)

In this study out of 60 patients, Group N consisted of 70% males whereas there were 56.67% in Group D and Group N consisted of 30% of females and 43.33% in Group D, hence males outnumbered females in both the groups. (Table 2).

Table 3: Onset of Sensory and Motor block.

Parameters	Time in minutes		P value	Significance
	Group N	Group D		
Onset of sensory block (Mean ± SD)	13± 2.213	6.63± 1.564	<0.001	SS
Onset of motor block (Mean ± SD)	17.37 ± 1.810	8.833 ± 1.289	<0.001	SS

SD- Standard Deviation
SS-Statistically Significant

The onset of sensory block in Group D was sooner with mean onset time 6.63± 1.564 minutes in

comparison to the mean onset time of 13± 2.213 minutes in Group N. The data was found to be statistically significant (p value <0.001).

The onset of motor block was also sooner in Group D with mean onset time of 8.833 ± 1.289 minutes in comparison to 17.37 ± 1.810 minutes in Group N. This data was statistically significant (p value <0.001). The duration of sensory block was observed to be longer in Group D with mean duration of 766 ±10.157 minutes in Group D and 345.93 ±37.764 minutes in Group N. The data was statistically significant (p value <0.001).

Table 4: Duration of Sensory and Motor block and duration of Analgesia.

Parameters	Time in minutes		P value	Significance
	Group N	Group D		
Duration of sensory block (Mean ±SD)	345.93±37.764	766±10.157	<0.001	SS
Duration of motor block (Mean ±SD)	247.53± 47.93	650± 9.991	<0.001	SS
Duration of Analgesia (Mean ±SD)	384.33±33.343	806.13±12.667	<0.001	SS

SD- Standard Deviation
SS-Statistically Significant

In our study, the duration of motor block was prolonged in Group D. The mean duration was 650± 9.991 minutes in Group D and 247.53± 47.927 minutes in Group N. The data was statistically significant (p value <0.001).

The duration of postoperative analgesia was longer in Group D (806.13±12.667 minutes) when compared to Group N (384.33±33.343 minutes). The values were statistically significant with (p value <0.001).

Discussion

Regional anesthesia when compared to general anaesthesia is more advantageous as it has higher safety profile, ideal alternative technique, not only for patients with comorbidities like cardiomyopathies, Ischemic heart disease, COPD who cannot receive general anesthesia, but can also suggest regional anesthesia to normal patients because of its lesser side effects, simpler and convenient method.¹⁰

Local anaesthetics used alone for supraclavicular brachial plexus block provide good operative conditions but they have shorter duration of postoperative analgesia. A combination of bupivacaine and lignocaine provides good operating conditions but the duration of analgesia

and motor blockade may be short. So various drugs like fentanyl, clonidine, neostigmine, Midazolam, buprenorphine, dexmedetomidine and butorphanol were used as adjuvant with local anesthetics in brachial plexus block so as to achieve quick, dense and prolonged block. But the results are either inconclusive or they are associated with side effects.¹¹ Since many years a lot of research works are going on adjuvants which enhance the effects of local anesthetics. Among various adjuvants used to prolong the duration of postoperative analgesia, dexamethasone which is a long acting glucocorticoid decreases the postoperative analgesia and also has an antiinflammatory effects.^{12,13} Reported by many animal studies that on addition of microspheres of corticosteroids to local anesthetics for peripheral nerve blockade gives analgesic effects.^{14,15}

In our study we found that the addition of dexamethasone to local anaesthetic causes early onset of sensory and motor blockade. These findings concurred with study conducted by Islam SM¹⁶ Siddharth et al.¹⁷ However studies done by Shaikh MR¹⁸ and Arish BT¹⁹ didn't find significant difference in onset of sensory and motor blockade between the two groups.

Further in our study we found that the addition of dexamethasone prolonged duration of motor and sensory blockade (650±9.991minutes and 766 ±10.157 minutes respectively). Several studies conducted by Biradar²⁰ E Devander²¹ Dhumane²² Vaibhav Yadav²³ also agreed with this finding. The block prolonging effect may be due to its local action of nerve fibers and not a systemic one.²⁴ Steroids might exert this effect by altering the function of potassium channels in the excitable cells; bind to intracellular receptors and modulate nuclear transcription.

In our study we found that dexamethasone prolongs duration of analgesia significantly (806.13±12.667 minutes). Similar to our findings, Pathak RG et al²⁵ noted that the addition of dexamethasone to local anaesthetic drugs in brachial plexus block significantly prolongs the duration of analgesia and motor block in patients undergoing upper limb surgeries and found dexamethasone as safe and cost effective method of providing post operative analgesia. Shrestha et al²⁶ observed that Dexamethasone as an adjuvant to local anesthetic in brachial plexus block enhances the duration of postoperative analgesia. Ammar AS et al also documented that using dexamethasone as an adjuvant to local anesthetics increase duration of analgesia and also reduce both nausea and vomiting.

Conclusion

Dexamethasone as an adjuvant to lignocaine 2% with adrenaline and bupivacaine 0.5% offers many advantages than lignocaine with adrenaline and bupivacaine alone. It increases the duration of sensory and motor blockade in patients undergoing upper limb surgeries through USG guided supraclavicular brachial plexus block. It also prolongs postoperative analgesia and reduces the requirement of other analgesics.

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