

## EFFICACY AND SAFETY OF DEXAMETHASONE AS AN ADJUVANT WITH BUPIVACAINE AND LIGNOCAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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### Abstract

**Background:** Perineural injection of corticosteroid has been successfully used to prolong the local anesthetic action. The aim of this study was to evaluate the efficacy and safety of dexamethasone as an adjuvant with bupivacaine-lignocaine in supraclavicular block. **Material and methods:** This analytical study was carried out in the Department of Anesthesiology in Chittagong Medical College Hospital in collaboration with the Department of Orthopedic Surgery over a period of 22 months starting from January 2012 to December 2014. A total 130 adult patients of either sex with American Society of Anesthesiology (ASA) health status I-II were selected for upper limb surgery under supraclavicular brachial plexus block was randomly allocated into two groups of 65 patients in each. Group-D was received dexamethasone 2ml (10mg) and Group-C (Control) was received distilled water 2ml in 38ml of bupivacaine and lignocaine with adrenaline (total volume of 40ml). **Results:** The mean onset of sensory & motor block was  $7.72 \pm 1.949$ min &  $8.75 \pm 2.008$ min in group-D and  $10.49 \pm 0.75$ min &  $9.41 \pm 0.76$ min in group-C. The duration of analgesia in group-D was  $11.40 \pm 0.844$ hrs and in group-C

was  $3.81 \pm 0.88$ hrs. **Conclusion:** There was significantly prolonged duration of analgesia and better onset of sensory and motor block in dexamethasone group without any unwanted effects.

### Key words

Supraclavicular brachial plexus block; Dexamethasone; Bupivacaine; Lignocaine; Adjuvant.

### Introduction

Supraclavicular brachial plexus block is commonly used approach in providing surgical anesthesia. In recent years, the technique has gained importance for surgical, diagnostic and therapeutic purposes in interventional pain management<sup>1</sup>.

Mixture of local anesthetics provides few clinically significant advantages. But the onset of action and duration of anesthesia are the limiting factors. Lignocaine is an effective local anesthetic of amide group, with a rapid onset of action and lasts for 60-90 minutes. It has a tendency to cause vasodilatation and this is normally counteracted by the addition of a vasoconstrictor. Adrenaline is used with Lignocaine to delay absorption and prolong the action. Bupivacaine is a local anesthetic of amide group, four times more potent than lignocaine, slower in onset but has a significantly longer duration of action<sup>2, 3</sup>. However local anesthetics provide analgesia for not more than 4-8 hrs. Increasing the duration of local anesthetic action is often desirable because it prolongs surgical anesthesia and analgesia.

Steroids when used intrathecally are reported to cause arachnoiditis but there is no evidence suggesting any neuritis when steroids are used in low concentration in peripheral nerve blocks. Steroids have powerful anti-inflammatory as well as analgesic property. Perineural injection of steroids is reported to influence postoperative analgesia. They relieve pain by reducing inflammation and by blocking transmission in nociceptive myelinated C fibers and suppressing ectopic neuronal discharge<sup>4</sup>. The block prolonging

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effect may be due to its long action on nerve not a systemic one<sup>5</sup>. A study in supraclavicular brachial plexus block suggest that dexamethasone when added to lignocaine results in a faster onset and prolonged duration of sensory and motor blockade<sup>6</sup>. Several study in Shrestha BR et al, Gowala et al., Islam et al, Pathak et al, reported significantly early onset and markedly prolonged supraclavicular brachial plexus block without any unwanted effects by using dexamethasone to local anesthetics<sup>7, 8,9,10</sup>.

Considering the fact, the current study was planned to observe the anesthetic and analgesic effects of adding dexamethasone to bupivacaine-lignocaine in supraclavicular brachial plexus block for upper limb surgery.

#### **Materials and methods**

All patients of both sexes, age 18-60 years, ASA class-I & class-II undergone routine operation schedule for upper limb surgery under supraclavicular brachial plexus block were enrolled in this study. Patients were excluded if they had sepsis at the site of injection, body wt<50kg, pregnant women, known hypersensitivity, circulatory instability, diabetes, coagulopathy, history of neurological, renal & liver diseases, peptic ulcer disease.

Patients were randomly selected by card sampling method into two groups. Sample size was 65 in each group. A box was prepared containing 130 cards (C-card & D-card in equal numbers). Randomization of the sample was done by asking the patient to draw one card blindly from the box. The patients who drew card marked C were allocated into group-C (Control group) and patients with card marked D were assigned to group-D (Dexamethasone group). After selecting the patient entry of the name of the patients in the case record form and initial pulse, NIBP (Noninvasive Blood Pressure) RR (Respiratory Rate) Saturated Pluse Oximetry (SPO<sub>2</sub>) were monitored and were recorded as base line value.

Group-D received Dexamethasone 2ml (10 mg) and Group-C received Distilled 2ml in 38ml of Bupivacaine and Lignocaine with adrenalin.

After block given, Patients pulse, blood pressure, RR, SPO<sub>2</sub> were recorded and then first 30 mins at 10 mins interval then 15 mins interval up to the end of surgery.

The onset of sensory block was assessed in every minute using pin prick method in different areas innervated by radial, ulna, median and musculocutaneous nerve. The onset of motor block was assessed in every minute by modified bromage scale compared to the opposite limb by asking the patient to raise their hand or move their fingers. The time of onset of sensory block (The time elapsed between the injection of local anesthetic drugs and just impaired sensation to pinprick perception i.e. grade1 compared to the opposite upper limb). The time of onset of motor block (The time elapsed between the injection of local anesthetic drug and just impaired ability to raise the hand ie. grade1 of modified bromage scale, compared to the opposite limb) was noted. Duration of block (Time between onset of sensory anesthesia and patient complaining of pain visual analog scale>3) and quality of block by Numeric scale was noted.

Any incidence of nausea, vomiting, pruritus, respiratory distress, dryness of mouth, local anesthetic toxicity, pneumothorax, hematoma formation or any others was noted by yes/no. If respiratory distress develops, phrenic nerve block and Pneumothorax were excluded by X-ray chest posterior anterior view. If any side effects detected clinically in per and post operative period then it was managed according to the need. The patient who needed sedative drug assessed by Ramsay Score was recorded.

Postoperative analgesia was noted by interviewing the patient according to Visual Analog Scale (VAS) and Verbal Rating Scale (VRS) in post operative ward.

The sociodemographic variables studied were age, sex and weight. The preoperative variables were pulse, blood pressure, SpO<sub>2</sub>, respiratory rate. The outcome variables were the assessment of sensory and motor block, onset time of sensory and motor block, duration of surgery, duration of anesthesia, adjuvant required, sedation score, G /A required, quality of block, side effects monitored as well as per-operative hemodynamic stability by recording pulse, NIBP, SPO<sub>2</sub> and RR. Postoperative variables on analgesic demand by VAS and VRS to determine analgesic demand. A structured case record form was developed containing all the variables of interest. Proper permission was taken for this study from the ethical committee of Chittagong Medical College.

Collected data was compiled, checked and edited. Data processing and analysis was done with the help of computer using statistical software SPSS (Statistical Package for Social Sciences) version - 18(Chicago, IL, USA). The test statistics used for analysis of data was Student's t-test (For comparison of data presented in quantitative scale-age, sex, wt) Chi-square test (For comparison of data presented in categorical scale- outcome in both groups). The results were presented in tables and figures. The statistical terms was included in this study are mean, standard deviation, percentage. Statistical significance was set at  $p < 0.05$  and confidence interval set at 95% level.

**Results**

**Table I :** Onset of sensory and motor block in study patients (n=130)

	Group D (n=65)		Group C (n=65)		p value*	
	Mean	±SD	Mean	±SD		
Onset of sensory block (Min)	7.72	1.949	10.49	0.75	0.000	
Onset of motor block (Min)	8.75	2.008	9.41	0.76	0.015	

\*(Calculated by t- test)

**Table II :** Duration of analgesia between the study groups (n=130)

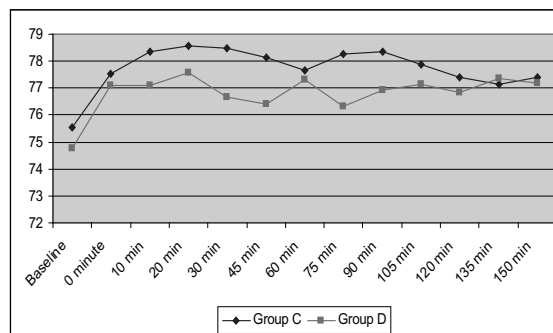
	Group D (n=65)		Group C (n=65)		p value*	
	Mean	±SD	Mean	±SD		
Duration of analgesia (Hrs)	11.40	0.844	3.81	1.747	0.001	

\*(Calculated by t- test)

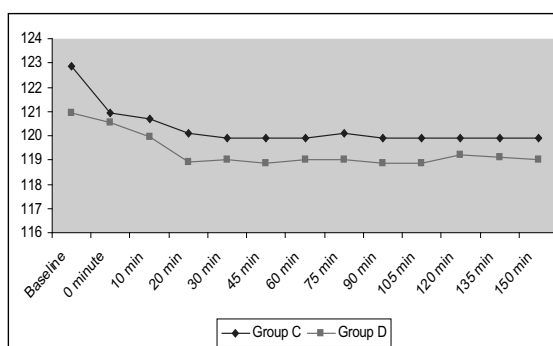
**Table III :** Side effects observed in the study patients (n=130)

Side effects	Group D (n=65)		Group C (n=65)		Total	
	No.	%	No.	%	No.	%
Hematoma formation	0	0	1	1.5	1	4.6
Ptosis	2	3.1	3	4.6	5	
None	63	96.9	61	93.8	124	95.4

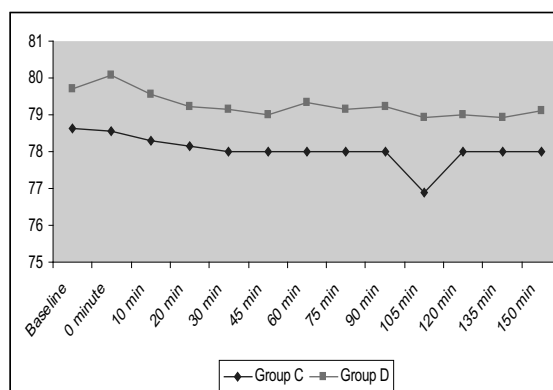
$p = 0.680$  (Calculated by Chi square test)



**Fig 1 :** Per operative monitoring of pulse of the study patients (n=130)



**Fig 2 :** Per operative monitoring of systolic blood pressure of the study patients (n=130)



**Fig 3 :** Per operative monitoring of diastolic blood pressure of the study patients (n=130)

The mean onset of sensory & motor block was  $7.72 \pm 1.949$  &  $8.75 \pm 2.008$  min in group-D and  $10.49 \pm 0.75$  &  $9.41 \pm 0.76$  min in group-C. Both the results was statistically significant in group-D ( $p > 0.05$ ) [Table I].

The duration of analgesia in group-D was  $11.40 \pm 0.844$  hrs and in group-C was  $3.81 \pm 0.88$  hrs. The results was significantly higher in group-D than group-C ( $p < 0.05$ ) [Table II].

The side effects of procedure and the drug of study patients where 2 case of ptosis in group-D and 3 case of ptosis, 1 case of hematoma in group-C. Total 4.6 % (p=0.680) [Table III].

Preoperative variables pulse, SBP, DBP have no effect on drug group [Figure 1, 2, 3].

### Discussion

The present analytical study was carried out with the objectives evaluation of the efficacy and safety of dexamethasone as an adjuvant with bupivacaine-lignocaine in supraclavicular block during upper limb surgery.

Regarding the mean onset of the sensory block in group-C and group-D was  $10.45 \pm 0.75$  min and  $7.72 \pm 1.949$  min (p=0.000). The mean onset of the motor block in group-C and group-D was  $9.41 \pm 0.76$  min and  $8.75 \pm 2.008$  min (p=0.015 respectively). Both these data were statistically significant as p<0.05. The mean duration of analgesia was significantly longer in group-D ( $11.40 \pm 0.844$ ) than that produced by group-C ( $3.81 \pm 0.88$ ). p=0.000, which was highly significant between two groups.

In a study by Shrestha BR et al, brachial plexus block was done by paraesthesia technique with 40-50 ml of local anaesthetic with 1:200,000 adrenaline in one group and same amount of local anesthetic plus 4-8mg dexamethasone in other group<sup>7</sup>. Onset of action was significant faster (Mean  $14.5 \pm 2.10$  min versus  $18.15 \pm 4.25$  min, p<0.05) and prolonged duration of analgesia ( $12.75 \pm 5.33$  hrs versus  $3.16 \pm 0.48$  hrs, p=0.000) in dexamethasone group. As compared to the study done by Islam et al, who used 35ml of mixture of 2% lignocaine and 0.5% bupivacaine in one group and same amount of local anesthetic plus dexamethasone 8mg in another group<sup>9</sup>. Achieved faster onset of the sensory and the motor block ( $11.64 \pm 2.19$  and  $13.32 \pm 0.98$  min versus  $9.89 \pm 1.97$  and  $11.09 \pm 1.28$  min) and prolonged duration of analgesia ( $3.43 \pm 0.49$  hrs versus  $11.87 \pm 0.53$  hrs) in dexamethasone group. Both of the study results nearly matched with the present study. But this does not correlate with the study done by Pathak et al; in brachial plexus block, performed by nerve stimulator technique<sup>10</sup>. They found that the onset of sensory and motor blockade at 5.92 min and 15.8 min in local anesthetic (1.5% adrenalized xylocaine 20ml and 0.5% bupivacaine 16ml) plus dexamethasone group and duration of analgesia was  $834 \pm 78.1$  min. Similarly many previous studies,

Birader et al, Parrington et al reported early onset and marked prolonged supraclavicular brachial plexus block without any unwanted effects by using dexamethasone to local anesthesia<sup>6,11</sup>. The onset of sensory block was faster than motor block in both groups in this study which was similar in most of the study done in brachial plexus block. But the study done by Jarbo et al and Shrestha et al, have shown in their study, the onset time of motor block was significantly faster than the onset of the sensory block, which does not correlate with those found in present study<sup>12,13</sup>. This can be explained by the "core and mantle concept" of Winnie<sup>14</sup>. As described by Winnie, the outer motor fibers are blocked earlier than the sensory fibers which are situated deeper in the brachial plexus at the level of trunk and division. But the earlier time to achieve the sensory block than motor in present study, as compared to theirs, can be attributed to the mixture of local anesthetics which were used.

Regarding the side effects the present study was showing side effects of ptosis was found 2case in group-D and 3case in group-C. Hematoma in 1 case in group-C. All above side effects were related to procedure rather than drug. Others side effects like nausea, vomiting, pruritus, respiratory distress, dryness of mouth, LA toxicity (CNS, CVS, Hypersensitivity) Pneumothorax was not found in both groups. Though the Pneumothorax is possible complication when attempting supraclavicular block. But the incidence of Pneumothorax is likely reduced by operator experience and using shorter needles with caution<sup>15,16</sup>. Regarding the safety of dexamethasone use in nerve sheath may raise some concerns. In Sugita K et al study, after approximately 2000 intrathecal injection of dexamethasone (8mg) in 200 patents for treatment of posttraumatic visual disturbance, no neurological disorder found at 1-month follow up. Nerve injury is a rare complication of dexamethasone injection, and it usually occurs in the context of needle trauma. The neurological risk, if any, of dexamethasone thus appears to be small<sup>17</sup>.

In the present study the baseline characteristics were within normal value, which support the Jarbo et al. Study<sup>12</sup>. In this study it was observed that per-operative mean pulse rate, systolic blood pressure, diastolic blood pressure,  $SPO_2$  and respiratory rate changes at different times were almost similar

between two groups, no significant ( $p > 0.05$ ) mean difference was found. In another study Dogru et al. showed stable hemodynamic parameters in their study groups, which support the present study findings<sup>18</sup>.

#### Limitation and recommendations of the study

It was a single center study. Relative perception of pain by the patients may have caused biasness regarding postoperative pain assessment by VAS and VRS and that could have affected the findings of the present study. Availability of an ultrasound and/or peripheral nerve stimulator would have helped to achieve more accurate nerve blocks. Large scale multicenter double blind study with nationally representative sample and nerve stimulator or ultrasound guided techniques, find more accurate result to have a conclusion.

#### Contribution of authors

SH - Conception, drafting and final approval.

AANC - Design, drafting and final approval.

KMBH - Analysis, drafting and final approval.

SNK - Acquisition of data, critical revision and final approval.

MHOR - Interpretation of data, critical revision and final approval.

MRH - Analysis, drafting and final approval.

KB - Acquisition of data, critical revision and final approval.

AKMSA - Data analysis, critical revision and final approval.

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#### Conclusion

In this study, main analysis was done on duration of analgesia by use of Dexamethasone as an adjuvant with Bupivacaine and Lignocaine in Supraclavicular brachial plexus block. In our study Dexamethasone was more prolonged duration of analgesia and early onset than Local anesthetics along. The side effects and hemodynamic stability was almost similar.

So, on the basis of student's t-test and Chi-square test, we can conclude that there was significantly prolonged duration of analgesia and better onset of sensory and motor block in Dexamethasone without any unwanted effects.

#### Discloser

All the authors declared no competing interest.

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