



Dexamethasone As An Adjuvant To Local Anaesthetic in Supra Clavicular Block A Comparative Study.

**DrSiddharth M
Khobragade**

JR III MD Anaesthesiology GMC Aurangabad

**Dr. Gayatri
Tadwalkar**

Associate Professor Department of Anaesthesia Government Medical College, Aurangabad

Dr Tushar Patil

Head of department Anaesthesia Government Medical College, Aurangabad.

ABSTRACT

Background: Aim of study was to evaluate onset of sensory and motor blockade, duration of analgesia and complications after addition of dexamethasone as adjuvant to local anaesthetics in SCB for patients with various orthopaedic upper limb surgical procedures.

Material and Methods :The study was conducted on 100 patients of ASA 1 and ASA 2 grade, with similar demographic characteristics, divided randomly into two groups .Group 1 received 8mg of inj dexamethasone + 0.5% inj bupivacaine + 2% inj lignocaine adrenaline, while Group 2 received 2 ml normal saline + 0.5% inj bupivacaine + 2% inj lignocaine adrenaline.

Results: Onset of sensory and motor blockade was shorter in Group 1 than group 2 [5.30 ± 0.99 min, 13.40± 2.30 min vs 6.80 ± 1.56 min, 15.60± 2.58 min, P=0.000] The duration of analgesia was significantly prolonged in Group 1 as compared to group 2[826.30 ± 42.07 min vs 280.20 ± 19.92 min, P=0.000]. No incidence of any complication was seen.

Conclusion :Dexamethasone used as remarkably safe cost effective potent adjuvant in supraclavicular block results in rapid onset of sensory and motor blockade and effectively prolonged the duration of analgesia without any significant unwanted side effects.

KEYWORDS

anaesthesia adjuvants; dexamethasone; supra clavicular nerve block

INTRODUCTION: The supraclavicular brachial plexus block, alone or in combination with general anaesthesia, introduced by Labat¹ in 1928, has many advantages over other approaches to brachial plexus block where anatomically compact nerve trunks are blocked reliably resulting in rapid onset of action with high success rate.² Methods to prolong analgesia beyond the actual duration of the local anaesthetic used include either placement of perineural catheters to allow continuous infusion or co-administration of adjuvant like epinephrine, clonidine, dexmedetomidine, midazolam, morphine, pethidine, fentanyl, however their use is limited because of side effects like heavy sedation, respiratory depression and psychomimetic effects.^{3,4}

The motto behind our study is to compare the effects of addition of dexamethasone to local anaesthetic drugs, the onset of sensory blockade and motor blockade, the duration of analgesia, duration of motor blockade and to evaluate any complications or side effects.

Thus, dexamethasone non-particulate steroid which is easily available, cost effective, antiemetic, anti-inflammatory, analgesic, non-neurotoxic drug was selected as an adjuvant to local anaesthetics to examine the effects of it on various characteristics of supraclavicular block.

Material and Methods :The present study was conducted in Anaesthesiology department, at tertiary care hospital, after ethical committee clearance and obtaining written informed valid consent on 100 cases who were scheduled for upper limb surgeries. After computer generated randomisation, patients were assigned into **Group I:** 50 Patients receiving Inj. Dexamethasone 8 mg + Inj. 0.5% bupivacaine + Inj. 2% lignocaine with adrenaline and **Group II:** 50 Patients receiving normal saline 2 ml + Inj. 0.5% bupivacaine + Inj. 2% lignocaine with adrenaline.

Patients with ASA Grade I & II, between 20 to 60 years, 45-70 kg and willing for procedure under brachial plexus block were included. However those with ASA Grade III & IV, consent not given, severe respiratory disease, coagulopathy, pregnancy, neurological deficit involving brachial plexus, history of allergy & sensitivity to local anesthetic, diabetes mellitus, hepatic or renal failure (contraindication to steroids) convulsions or psychiatric disease and partial effect of block were excluded.

Preoperatively patients were evaluated thoroughly and explained about the anesthetic procedure, including effect of drug to be given with the advantages of postoperative pain relief. After local anesthetic sensitivity testing, demographic and morphometric characteristics of patients were recorded. Patients were educated regarding the use of 10 cm Visual Analogue scale.

Drugs solutions use and dosage

- Inj. 2% Lignocaine with adrenaline 10ml was taken in 20 ml syringe not exceeding 7 mg. /kg.
- Inj. Bupivacaine 0.5 % 16 ml taken in 20 ml syringe. It was used in the dose not exceeding 2 mg / kg.
- Dexamethasone ampoule (4mg / ml.) 2 ml will be added to Inj. 2% Lignocaine with adrenaline in group I patients.

Total volume of solution in both groups was 35 to 40 ml range. Drug solutions were prepared by and independent anaesthesiologist not involved in the study by a complete aseptic precautions.

Procedure:

In the operating room, diagnosis, operative procedure and NBM status was confirmed, basal parameters were recorded –i.e. Heart rate, blood pressure, respiratory rate, baseline ECG and Spo₂ using standard monitoring equipments. After estab-

lishing intravenous access using 18 G IV cannula, an infusion of Ringer lactate with 50mg injection administered in it was started. All necessary equipment's and drugs needed for general anaesthesia and emergency resuscitation were kept ready.

Technique of supraclavicular brachial plexus block:⁵

Classical supraclavicular approach using single injection technique was used to give SCB with patient in supine arms by side, head turned to opposite side and shoulder down position. The part of neck was aseptically cleaned and draped. The point of needle insertion was about 1 inch lateral to the insertion of SCB which was further confirmed by subclavian artery pulsations. The drug solution was injected after eliciting paraesthesia and confirming negative aspiration for blood and the area was massaged.

Evaluation of parameters.

1. Onset of sensory block – time from injection to onset of analgesia in each of the major peripheral nerve distribution (ulna, radial, medial and musculocutaneous), by pinprick 26 G blunt end needle, corresponding to minimum of grade 2 of Hollmen scale. ⁶

2. Onset of motor block: the time from injection to the inability of the patient to move fingers or raise their hand, flexion at the elbow (musculocutaneous nerve), extension of the elbow and the wrist (radial nerve), opposition of the thumb and index finger (median nerve), and opposition of the thumb and small finger (ulnar nerve) were assessed corresponding to minimum of grade 1 of modified Bromage scale.⁷

3. Duration of analgesia: Analgesia duration was noted according to 0-10 visual analogue score (VAS) for pain at every half an hour for first 10 hours and then hourly till 24 hours in the recovery and post-operative period. Rescue analgesia (IM Diclofenac 1-1.5mg/kg) was given at moderate pain (VAS 4-5) considering termination of analgesic action.

4. Duration of motor block: The duration of motor block postoperatively was assessed every half hourly by asking the patients to move their fingers and to see whether they were able to raise the hand or not. This time was recorded and taken as cessation of motor block effect.

5. Possible side effects of brachial plexus block: Incidence of drowsiness, pruritus, nausea/vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression and sign and symptoms for local anaesthetic toxicity were looked for and noted.

6. Duration of surgery: Duration between the skin incision and complete closure was taken as duration of surgery.

Vital parameters (like pulse rate, systolic blood pressure, respiratory rate and oxygen saturation) of the patients were monitored at regular intervals intra-operatively at 5, 10, 15, 20, 30, 50, 70, 90, 120,150,180 min and post-operatively up to 24 hrs.

Statistical Analysis: For analysis of this data SPSS (Statistical Software for social Sciences) software version 20th was used. It was analyzed using chi-square test to check association between two techniques. For comparison of Quantitative variables of two groups unpaired t-test was used& it was also represented in form of mean & SD.

Results: The variables in the demographic data did not show a statistically significant difference between the two groups with respect to age, sex, weight, height, ASA physical status, and duration of surgery.

There were significant differences in the onset of sensory block and also the time for occurrence of motor block between the two groups. The onset of the sensory block was 5.30± 0.99 min in group I and 6.80 ± 1.56 min in group II

and motor block was 13.40± 2.03 min in group land15.60 ± 2.58 min in group II (p=0.000) Fig 1,2. Table 1.

The analgesic duration was 826.30± 42.07min in group I, and280.20 ± 19.92 min in group II, with p=0.000, thus the analgesic duration was significantly longer in the dexamethasone group than in the control group. In group I the mean VAS pain score was prolonged upto 720 min (0.32±0.99).At 780 min the mean VAS score was 2.85±1.44,which gradually increased to 4.26±0.5 at 900 min. In group II the mean VAS pain score 210 min was 0.6± 1.14. At 270 min the mean VAS score was 3.61±1.22 which gradually increased to 4.23±0.44 at 300 min. Regarding the motor block duration also, the mean duration of motor block was **366 ± 21.07** min, and **162 ± 20.72** in group I and group II and statistically significant difference was seen (p= 0.000) Fig 3,4. Table 1.

There was a single case who had side effect (Horner syndrome) in group I and on comparison between the two groups there was no statistically significant difference seen **P=0.968** Chi-square value **0.148** respectively Fig 5.

Table 1: Onset of sensory block, motor block, surgical anaesthesia and duration of analgesia

Parameters in mins	Group I Mean ± SD	Group II Mean ± SD	t-value	P-value
Onset of Sensory block	5.30± 0.99	6.80 ± 1.56	5.72	P=0.000
Onset of motor block	13.40± 2.03	15.60 ± 2.58	4.73	P=0.000
Analgesia duration	826.30± 42.07	280.20 ± 19.92	82.95	P=0.000
Duration of Motor block	366.10± 21.07	162.90 ± 20.72	48.46	P=0.000

SD: Standard deviation

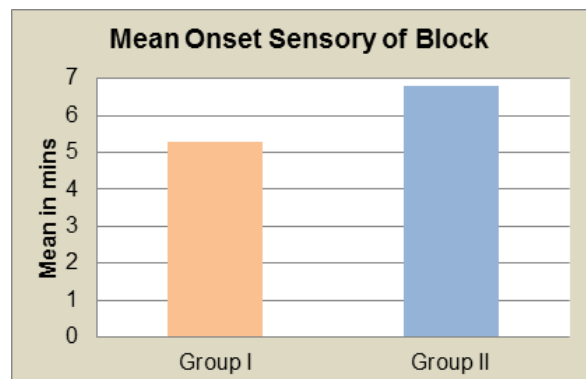


Fig. 1

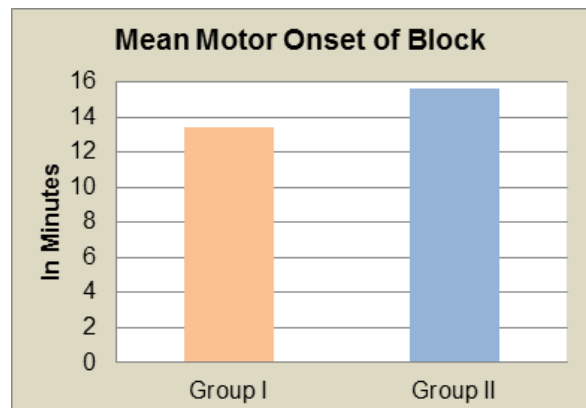


Fig. 2

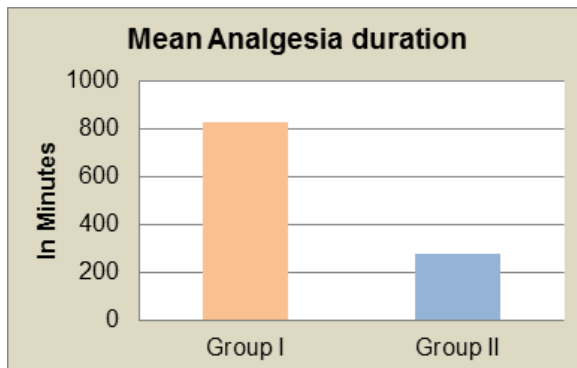


Fig. 3

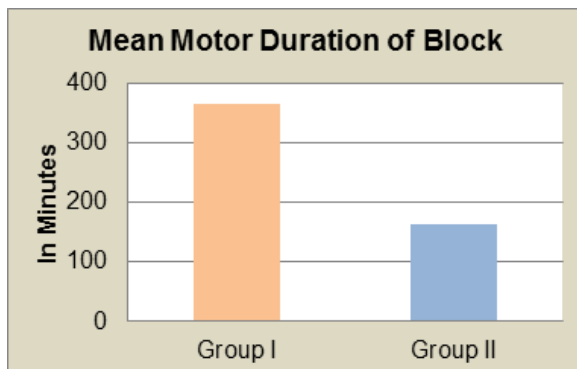


Fig. 4

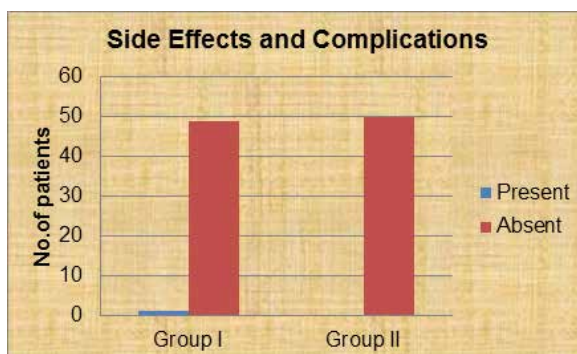


Fig. 5

Discussion: Supraclavicular brachial plexus block is widely employed regional nerve block to provide anaesthesia and analgesia for upper limb surgeries as it results in early discharge from the hospital, less nausea and vomiting, less sedation and good analgesia.

The proposed mechanism of analgesic action include attenuating the release of inflammatory mediators, reducing ectopic neuronal discharge and inhibiting potassium channel mediated discharge of nociceptive c fibres.^{8,9}It has got direct membrane action also.¹⁰Dexamethasone also has been found to protect from bupivacaine induced neurotoxicity.¹¹There are other studies which state that the analgesic property of corticosteroid is result of local action and not systemic absorption.¹²

Corticosteroid causes skin vasoconstriction on topical application. The vasoconstriction effect of topical steroid is mediated by the occupancy of classical glucocorticoid receptors.¹³

In our study, dexamethasone produced relatively rapid onset of sensory action which cannot be explained by this mecha-

nism. Therefore vasoconstriction, the presumed mechanism of action of epinephrine as an adjuvant effect on local anaesthetics is probably not responsible for block prolongation effect of anaesthetics.

Demographic data.

In our study both the groups were comparable with respect to demographic data, gender distribution and ASA class distribution surgical procedures, duration of surgery and no statistically significant difference was observed on group comparison.

Onset of sensory block

M.P. Golwala, et.al¹⁴2009 carried out a study where they used Inj. Dexamethasone 8mg + Inj. 0.5% bupivacaine +Inj. 2% lignocaine with adrenaline in one group andInj.0.5% bupivacaine + Inj. 2% lignocaine with adrenaline in other, made to same volume, the mean onset time of sensory block was 196.33 ± 26.45 sec in dexamethasone group and was 326.66 ± 27.70 in control group. Thus the mean onset time was rapid in dexamethasone group and the difference was statistically significant.

The same drugs concentration and doses were used by**Islam SM, et.al¹⁵2011**,also showed early duration of mean onset time of sensory block 9.89 ± 1.97 mins in dexamethasone group and the difference was statistically significant.

Shrestha BR, et.al¹⁶2003,carried out the same study where-onset of action was 10-30 minutes in local anaesthetic group (mean 18.15 ± 4.25) and 10-20 minutes (mean 14.5 ± 2.10) in the local anaesthetic plus steroid group. They found statistically significant difference between two groups.

In our conducted study, the mean onset time for sensory block was 5.30 ± 0.99 min in group I and was 6.80 ± 1.56 min in group II respectively and was statistically significant ($P=0.000$). Similar result was obtained in above mentioned studies.

Onset of motor block.

M.P. Golwala, et.al¹⁴2009 carried out a study where the mean motor block was 225.66 ± 26.86 sec in dexamethasone group which was rapid as compared to control group 326.66 ± 27.70 with statistically significant difference.

The study conducted by**Islam SM, et.al¹⁵2011** also showed early duration of mean onset time of motor block (11.09 ± 1.28 mins) in dexamethasone group and the difference was statistically significant.

In the study conducted by **Prashant A Biradar, et.al¹⁷2013**, where they used 1.5% lignocaine adrenaline and 8 mg of dexamethasone, the duration of onset of motor blockade was rapid and the difference was statistically significant.

Study conducted by **Dr.Mijanur Rahaman Shaikh, et. al¹⁰2013** and **M Talukdar, et.al¹²2013**, where they used 0.25% bupivacaine and dexamethasone 8 mg also showed early onset of motor blockade significantly.

In our study the mean time for onset of motor block was 13.40 ± 2.03 min in group I and was 15.60 ± 2.58 min in group II respectively and was statistically significant ($P=0.000$). The results obtained were similar to the above mentioned studies.

The early sensory and motor onset of action in dexamethasone group in this study was due to the synergistic action with local anaesthetics on blockage of nerve fibers.¹²

Duration of analgesia.

In the study conducted by**M.P. Golwala, et.al¹⁴2009**, it was observed that there was markedly prolonged duration of analgesia (12-18 hrs).

In another study by**Dr R. G. Pathak, et.al¹⁸2012**, duration of analgesia was prolonged in group dexamethasone (834mins)

and the difference was statistically significantly.

Shrestha BR, et.al¹⁶ **2003**, also conducted similar study where duration of analgesia (12.75 ± 5.33 hours) in group dexamethasone significantly prolonged.

Same results were observed by **Islam SM, et. al**¹⁵ **2011**, in their study with significant prolonged duration of analgesia (11-12 hours).

Study conducted by **Dr. Mijanur Rahaman Shaikh, et.al**¹⁰ **2013** and **M Talukdar, et.al**¹² **2013**, where they used 0.25% bupivacaine and dexamethasone 8 mg showed prolonged duration of analgesic effect significantly. Though the concentration of Bupivacaine was different in this study, as compared to our study, the dose of dexamethasone was the same i.e. 8 mg. This means that rather than concentration of bupivacaine dexamethasone is responsible for prolonged effect.

In another such study conducted by, **Prashant A Biradar, et.al**¹⁷ **2013** and **Movafegh A et al**¹⁹ **2006**, where they used 1.5% lidocaine and 8 mg of dexamethasone also showed prolonged analgesia.

In our study duration of analgesia was the time taken between the administration of local anaesthetic drug and onset of intolerable pain ($VAS \geq 4$) at rest requiring supplementary (rescue) analgesic in the form of 1.5mg/kg diclofenac sodium IM.

VAS scores tended to remain '0' at all intervals till the reception of analgesic at $VAS > 4$ in both groups. Thus, quality of analgesia was comparable between the groups. The time duration when VAS remained '0' depended on the duration of analgesia as attributed by the drug.

The patients in group II required rescue analgesia by 300min to 330 min duration as described by $VAS > 4$. On the contrary the rescue analgesia required by group I was delayed to 840 to 900 min respectively.

In accordance with our study the mean duration of analgesia was **826.30 ± 42.07 min, and 280.20 ± 19.92 in group I and group II** respectively and was statistically significant ($p = 0.000$). The results so obtained were similar and supported by above mention studies. So this confirms that the group I i.e. dexamethasone 8 mg which was added, prolonged the duration sensory analgesia.

Duration of motor blockade.

In the study conducted by **Dr R. G. Pathak, et.al**¹⁸ **2012**, duration of motor blockade was increased significantly (376 min) in dexamethasone group. Study conducted by **Dr. Mijanur Rahaman Shaikh, et.al**¹⁰ **2013** and **M Talukdar, et.al**¹² **2013**, where they used 0.25% bupivacaine and dexamethasone 8 mg also showed significantly prolonged motor blockade. Though the concentration of bupivacaine was different in this study, as compared to our study, the dose of dexamethasone was the same i.e. 8 mg. This means that rather than concentration of bupivacaine, dexamethasone is responsible for prolonged effect.

Prashant A Biradar, et.al¹⁷ **2013**, carried out a study where they used 1.5% lidocaine and 8 mg of dexamethasone, prolonged duration of motor block was seen in dexamethasone group (290 min).

Hari Kishore, et.al²⁰ **2015**, conducted a study where effects of dexamethasone and clonidine with 0.5% bupivacaine in supraclavicular block were compared. Prolonged duration of motor blockade was seen in dexamethasone group.

In another study **Movafegh A, et.al**¹⁹ **2006**, where they used 1.5% lidocaine and 8 mg of dexamethasone also showed prolonged duration of motor blockade (310 min).

After reviewing the results of above studies conducted by various authors, it is seen that 8 mg of dexamethasone is responsible for prolongation of motor blockade.

In accordance with our study the mean duration of motor block was 366 ± 21.07 min, and 162 ± 20.72 in group I and group II and statistically significant difference was seen ($p = 0.000$). The results so obtained were similar to those obtained in above mention studies.

Monitoring of vital Parameters. On comparison, all patients showed no statistically significant difference of hemodynamic parameters.

Side effects and complications. Single case of Horner syndrome, a known complication of the technique was reported in group I with respect to group II and there was no statistically significant difference seen on comparison ($P = 0.968$ Chi-square value 0.148). Beside this, no other side effects or complication occurred. Similar results were seen in the study conducted by **Islam SM, et al**¹⁵ **2011**.

Supplements

In our study, only one patient in group II required inj. diclofenac i.m. as rescue analgesia. There was no statistically significant difference seen on comparison between the two groups.

Conclusion: Perineural dexamethasone, a remarkably safe, cost effective and potent adjuvant in supraclavicular brachial plexus block, not only results in rapid onset of sensory and motor blockade but also effectively prolongs the duration of analgesia and motor blockade without any unwanted side effects and thus reduces the consumption of rescue opioids and analgesics in the post-operative period and their associated side effects. Though, further studies are required to evaluate the precise mechanism of action and optimal dose of dexamethasone still continues.

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