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Original Article

Evaluation the Efficacy of 0.75% Ropivacaine with Dexamethasone Compared to 0.75% Ropivacaine with in Ultrasound Guided Ultrasound Guided Supraclavicular Brachial Plexus Block in Patients Undergoing Upper Limb Surgeries

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Abstract

Aim: The aim of the study was to evaluate the efficacy of 0.75% ropivacaine with dexamethasone compared to 0.75% ropivacaine in ultrasound guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries.

Methods: A prospective, randomized, and controlled study is conducted in 60 ASA I and II patients undergoing upper limb surgeries under supraclavicular brachial plexus block were randomized in to two groups of 30 members each group, Group I – 0.75% ropivacaine (20 mL) plus 8 mg of dexamethasone. Group II – 0.75% ropivacaine (20 mL) plus 2 mL of normal saline.

Results: Onset of sensory block was assessed by pinprick method and motor blockade by modified bromage scale for every minute till complete blockade occurs. $P < 0.05$ was considered statistically significant. Results showed that demographic data are comparable between both groups. The study results showed that 0.75% ropivacaine with dexamethasone group had prolonged duration of sensory and motor blockade and longer duration for first rescue analgesia than 0.75% ropivacaine with normal saline group.

Conclusion: Group I (addition of dexamethasone group) prolong the motor block enhances the quality of block and duration of analgesia significantly when compared with control group (normal saline) in supraclavicular brachial plexus block.

Key words: 0.75% ropivacaine, Dexamethasone, Ultrasound-guided ultrasound guided supraclavicular brachial plexus block, Upper limb surgeries

INTRODUCTION

Brachial plexus block is a popular and widely employed regional nerve block of the upper extremity. Various approaches to brachial plexus block have been described such as interscalene, supraclavicular, infraclavicular, and axillary, but supraclavicular approach is the easiest and most consistent method for anesthesia and perioperative pain management in surgery below the shoulder joint. Supraclavicular brachial plexus block is an excellent technique in experienced hands. Pneumothorax, Hemothorax, Horner's syndrome, and phrenic nerve block are the potential complications. Dexamethasone has been studied as an adjuvant to local anesthetic in peripheral nerve block steroids have nerve block prolonging effects. They produce analgesia by blocking transmission of nociceptive myelinated c-fibers and suppressing ectopic neuronal discharge. They might bring about this effect by altering the function of potassium channels in the excitable cells. With ultrasound-guided technique vital structures in supraclavicular region can be easily identified in real time along with optimum local anesthetic spread even with low volume of local anesthetic drug.

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Aims and Objectives

The aim of the study was to evaluate the efficacy of 0.75% ropivacaine with dexamethasone compared to 0.75% ropivacaine in ultrasound-guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries with respect to

1. Onset of sensory blockade and motor blockade
2. Duration of motor blockade
3. Duration of analgesia (time to first request for analgesic)
4. Quality of block
5. Complications/side effects if any

PATIENTS AND METHODS

After institutional approval, this randomized, controlled, clinical, control, and comparative study was conducted from April 2022 to December 2022 over a period of 999 months in the Department of Anesthesiology, Government General Hospital/Siddhartha Medical College, DR. YSR YSR YSR UHS, Vijayawada.

Inclusion Criteria

The following criteria were included in the study:

1. ASA Status I and II
2. Age between 18 and 65 years
3. Patients undergoing upper limb surgeries under supraclavicular brachial plexus block.

Exclusion Criteria

The following criteria were excluded from the study:

1. Patient not willing to participate in the study
2. Patients with ASA grade >III
3. Patients with known hypersensitivity to local anesthetic drugs
4. Patients with coagulation abnormalities
5. Patients with pre-existing peripheral neuropathy
6. Infection at the site of injection.

Study Design

This prospective, randomized, and controlled study conducted on 60 ASA I and II patients undergoing upper limb surgeries under supraclavicular brachial plexus block who fulfilled inclusion criteria. The study was started after receiving institutional ethical committee approval and informed written consent from all the patients and they were randomly divided into two groups.

Two Groups

- Group I-20 mL of 0.75% ropivacaine plus 2 mL of dexamethasone (30 patients)
- Group II-20 mL of 0.75% ropivacaine plus 2 mL of normal saline (30 patients).

Procedure

The basal parameters pulse rate, respiratory rate, blood pressure, and spo2 were recorded before starting the case. Peripheral venous cannulation was done with 18G IV cannula in opposite arm and all the patients were preloaded with 10 mL/kg Ringer lactate solution. Each patient would be given 0.03mg/kg of midazolam intravenously (IV) as a premedication 15 min before beginning the block technique. Under strict aseptic precautions, all the patients received brachial plexus block through the ultrasound guided supraclavicular approach.

Time of injection was recorded as 0 h. In the two groups, the following parameters are noted.

1. Onset of sensory and motor blockade
2. Duration of motor blockade
3. Duration of post-operative analgesia (time to administration of rescue analgesic)
4. Quality of block
5. Side effects.

Continuously SpO_2 and pulse rate were monitored. Hemodynamic variables such hear rate, systolic and diastolic blood pressures, and mean arterial pressure were recorded every 15 min intraoperatively after block and every 1 h postoperatively for 6 h, and 2nd hourly for 12 h.

Sensory block was assessed by pinprick method. Assessment of sensory block was done at each minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve, and musculocutaneous nerve till complete sensory nerve blockade.

Onset of sensory block

It was taken as the period from the time of injection of local anesthetic solution to the absence of pinprick sensation as experienced by the patient.

Sensory block was graded as:

- Grade 0: Sharp pin felt
- Grade 1: Analgesia, dull sensation felt (sensory onset)
- Grade 2: Anesthesia, no sensation felt (complete sensory block).

Duration of sensory block

It was taken as the period from the time of loss of pinprick sensation to the reappearance of pinprick sensation as revealed by the patient.

Duration of analgesia

It was taken as the time between the injection and the onset of pain and request for rescue analgesic. Rescue analgesia was given in form of inj. diclofenac sodium (1.5 mg/kg)

intramuscularly along with oral paracetamol 500 mg at the numeric rating scale of >4 which was assessed every 2nd hourly after shifting the patient to the post-operative ward. The time of shifting the patient to the post-operative ward was recorded as 0 h for pain assessment by numeric rating scale and time of administration of rescue analgesia was noted.

Assessment of motor blockade was carried out by the same observer at each minute till complete motor blockade occurs after drug injection.

Motor blockade was determined according to a modified bromage scale for upper extremities on a 3-point scale.

All patients were observed for any side effects such as nausea, vomiting, dryness of mouth, and complications such as pneumothorax, hematoma, local anesthetic toxicity, and post-block neuropathy in the intra and post-operative periods.

Statistical Data

At the end of the study, all the data are statistically analyzed using GRAPH PAD SOFTWARE quick calcs and VASSARSTATS.

- *P*-value was considered significant if <0.05 and highly significant if <0.001.

OBSERVATIONS AND RESULTS

Age, weight, height, and sex distribution was statistically analyzed using Fisher's exact test and $P = 0.30$ (>0.05) which is statistically insignificant.

Comparison of Onset of Sensory Block

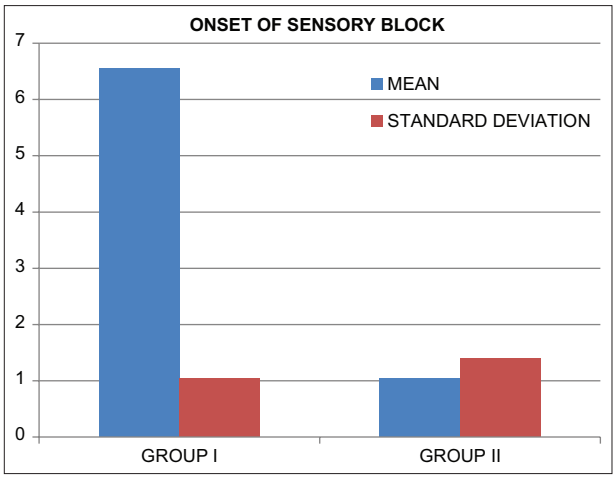
It was taken as the period from the time of injection of the anesthetic solution to the absence of pin prick sensation as experienced by the patient. (in minutes). Assessment of sensory block was done at each minute after completion of drug injection.

Time in minutes	Group I	Group II
Mean	6.57	6.87
Standard Deviation	1.05	1.40

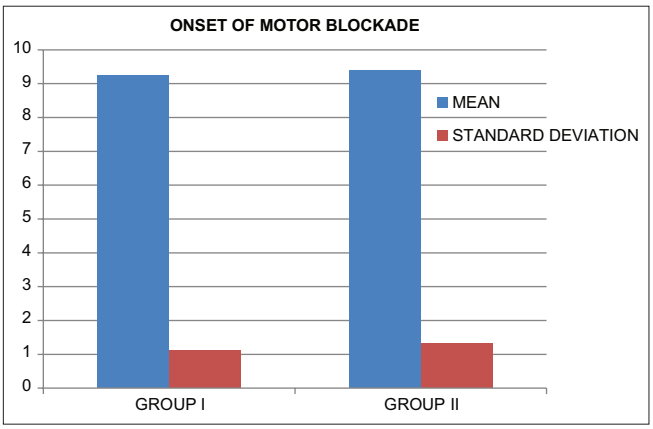
$P = 0.2288$ which is not statistically significant. In both the groups, the mean onset time of sensory blockade was between, 6.56 and 6.86 min $P = 0.22$ which is statistically insignificant.

Comparison of Onset of Motor Blockade

It was considered when there was decreased motor strength with the ability to move fingers only. Assessment of motor block was carried out at each minute after completion of drug injection by modified bromage scale for upper extremities on a 3 min scale.



Time in minutes	Group I	Group II
Mean	9.25	9.40
Standard deviation	1.10	1.31



$P = 0.56$ value which is not clinically significant. In both the groups, the onset of motor block was between 8 and 12 min.

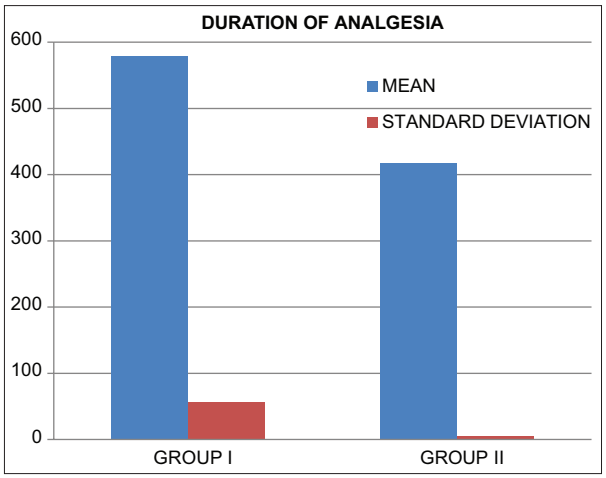
Comparison of Duration of Analgesia

It was taken as the time interval between the end of local anesthetic administration and the onset of pain and demand for rescue analgesia which was assessed using numerical rating scale of 0–10; recorded postoperatively every 2nd hourly till the score of 5.

Time in minutes	Group I	Group II
Mean	579.30	417.20
Standard Deviation	56.91	28.73

$P = 0.0001$ ($P < 0.05$).

The average duration of analgesia in Group I was 580 min which was significantly greater than the average duration of



analgesia of 420 min in Group II with $P < 0.0001$ indicating that the duration of analgesia is significantly prolonged in Group I when compared to Group II patients.

After shifting the patient to post-operative ward, the pain scores of the patient were assessed every 2nd hourly by numerical rating scale for pain assessment 0–10. The time of shifting the patient to post-operative ward was taken as 0 h and assessed.

The results were, up to 2 h postoperatively none of the patients in both the groups complained of pain. By 4th h, mild pain was complained in Group II with NRSP <5 which does not require any rescue analgesia but the pain was statistically significant when compared to Group I where no patient complained pain.

By the end of 6th h, there was significant pain complained by Group II that required administration of rescue analgesia where was as in Group I, only mild pain was complained.

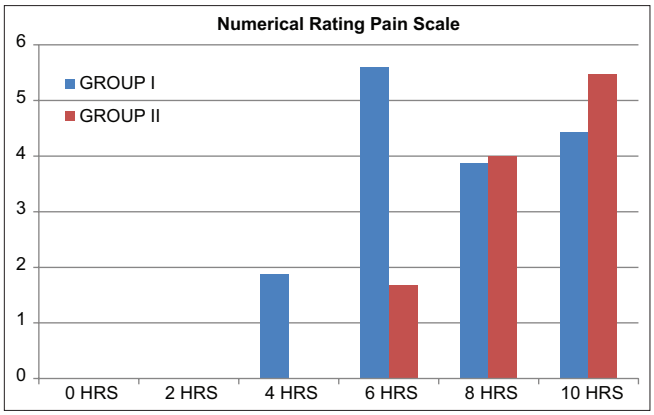
By the end of 8th h, mean pain scores were comparable between the two groups where Group I had pain score of <5 and Group II had decreased pain scores because of rescue analgesia administration.

By the end of 10th h, significant pain compliant started in Group I with mean pain scores of 5.48 which required administration of first rescue analgesia where as in Group II due to administration of rescue analgesia earlier the mean pain scores were <5.

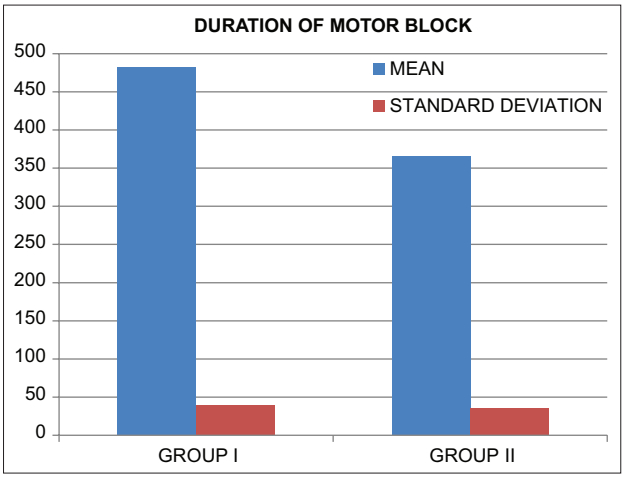
Duration of Motor Block

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

$P < 0.0001$ (<0.05)



Time in minutes	Group I	Group II
Mean	481.70	365.10
Standard Deviation	39.00	35.04

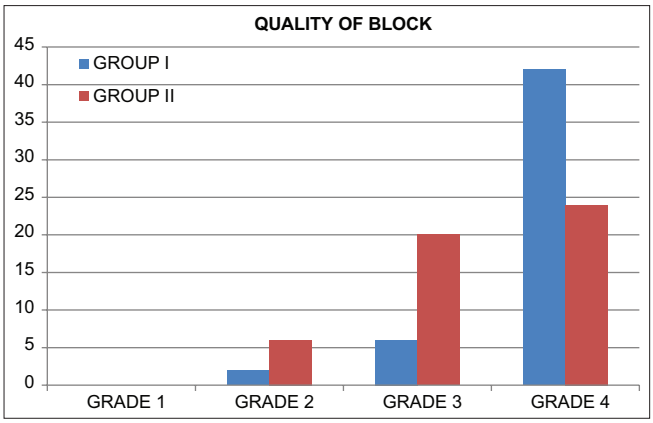


The average duration of motor block in Group I was 480 min which was significantly greater than the average duration of motor block of 365 min in Group II with $P < 0.0001$ indicating that the duration of analgesia is significantly prolonged in Group I when compared to Group II patients

Comparison of Quality of Block

	Group I	Group II
Grade 1	0	0
Grade 2	2 (4%)	6 (12%)
Grade 3	6 (12%)	20 (40%)
Grade 4	42 (84%)	24 (48%)

In Group I, 84% of patients achieved Grade 4 quality of blockade as opposed to 48% in Group II. Fischer's exact test was applied for assessment of quality of block with $P = 0.0005$ ($P < 0.05$) which was statistically significant, indicating that the quality of block was superior in Group I when compared to Group II. No patient had failed block



and 4% of patients in Group I and 12% of patients in Group II had Grade 2 block and 6(12%) of patients in Group I and 20 (40%) patients in Group II had Grade 3 block.

Comparison of Hemodynamic Parameters

The basal hemodynamic parameters were recorded initially and after drug administration every 15 min till 1 h and every 30 min until 180 min were recorded and compared. Pulse rate, systolic blood pressure, diastolic blood pressure, and mean arterial blood pressure were statically insignificant.

The side effects in our study compared are nausea, vomiting, and dry mouth, about 60% of the patients have no side effects in both groups and the side effects are also minimal and were comparable in both the groups.

Complications such as hemothorax, pneumothorax, convulsions local anesthetic toxicity were not observed in any patients of in the present study groups.

DISCUSSION

The present study was designed to evaluate the efficacy of 0.75% ropivacaine with dexamethasone compared to 0.75% ropivacaine in ultrasound-guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries.

Onset of Sensory Block

In the present study, it is observed that the onset of sensory block had mean duration of 6.56 ± 1.05 min in Group I and had mean duration 6.86 ± 1.40 min in Group II with $P = 0.22$ ($P > 0.05$).

The time for onset of sensory block is reduced in Group I than Group II, it is comparable because as $P = 0.22$ (>0.05) which was shown statistically insignificant.

The present study correlates to the study conducted by Pathak *et al.*,[1] who studied the effect of supraclavicular brachial plexus block with and without Dexamethasone – a comparative study, 50 patients were studied with two groups and conclude that the mean onset of sensory block in minutes was 5.92 ± 2.827 in dexamethasone group and 6.6 ± 2.958 in control group ($P = 0.4101$). Data were not significant statistically as $P > 0.05$. The onset of sensory blockade time with dexamethasone correlates with the present study.

Onset of Motor Blockade

In the present study, it is observed that the onset of motor block had a mean duration of 9.24 ± 1.10 min in Group I and had a mean duration of 9.38 ± 1.31 min in Group II and $P = 0.56$ ($P > 0.05$).

The time to onset of motor blockade is comparable in both the groups are comparable as *P* value is more than 0.05.

The present study was correlated with the study conducted by Shaikh *et al.*[2] Role of dexamethasone in Supraclavicular Brachial Plexus Block 60 patients studied with two groups. The onset time of motor block 19.96 ± 1.28 min in dexamethasone group versus 20.26 ± 1.28 min in control group) was also similar in the two groups ($P = 0.402$).

Duration of Analgesia

In the present study, it is observed that the duration of analgesia in Group I had a mean duration of 579.30 ± 56.91 (9.6 h) min and the mean duration of was 417.20 ± 28.73-min (6.95 h) in Group II and $P < 0.0001$ ($P < 0.05$) which is considered statistically significant.

There was a significant increase in duration of analgesia in dexamethasone group than control group and the difference was shown statistically significant.

The present study correlates with study done by, Dar and Jan.[3] The duration of pain relief (post-operative analgesia) was markedly prolonged in Group RD (14.5 ± 0.3 h), while it was only 8.3 ± 0.4 h in group R ($P < 0.001$). Which was statistically significant and showed that addition of dexamethasone to ropivacaine in supraclavicular brachial plexus block significantly prolongs the duration of analgesia and motor block in patients undergoing upper limb surgeries and is a remarkably safe and cost-effective method of providing post-operative analgesia.

This correlates well with the study conducted by Kalpana *et al.*[4] This study demonstrates that dexamethasone significantly prolongs the analgesic effect of plain ropivacaine 0.5% used as a single injection brachial plexus block. The mean time of onset of sensory block (13.85 ± 5.20 min) and motor block (22.17 ± 4.68 min) was significantly faster in Group D compared to Group R.

The present study results correlate with study conducted. In the year 2011, a study by Cummings *et al.*,[5] the mean duration of postoperative analgesia was around 22 h in a group which received ropivacaine with dexamethasone and it was around 11.8 h in group receiving ropivacaine only and stated that dexamethasone prolongs analgesia from interscalene blocks using ropivacaine or bupivacaine, with the effect being stronger with ropivacaine. However, block duration was longer with plain bupivacaine than ropivacaine. Thus, although dexamethasone prolonged the action of ropivacaine more than that of bupivacaine, the combined effect of dexamethasone and either drug produced nearly the same 22 h of analgesia.

The present study correlates well with one such randomized and prospective trial was done by Shrestha *et al.*[6] In their study, 40 patients undergoing arm, forearm, and hand surgeries were randomly selected. The 40 patients were divided in two groups of 20 each. In Group I, a brachial plexus block was done with 40–50 mL of local anesthetic with 1:200,000 adrenaline and in the other group, the block was performed with the same amount of local anesthetic with dexamethasone. Prolonged duration of analgesia occurred (12.75 ± 5.33 h verses 3.16 ± 0.48 h; $P = 0.00$) in the dexamethasone group than in the other group and concluded that addition of dexamethasone to local anesthetic significantly prolongs the post-operative analgesia.

The present study correlates well with Desmet *et al.*[7] In their study, they found that both IV and perineural administration of dexamethasone to supraclavicular brachial plexus block equivalently prolonged the duration of analgesia.

Duration of Motor Blockade

In the present study, it is observed that the duration of motor blockade in Group I had a mean duration of 481.70 ± 39.00 min and had a mean duration of 365.10 ± 35.04 min in Group II and $P < 0.0001$ ($P < 0.05$) which is considered statistically significant.

There was a significant increase in duration of motor blockade in dexamethasone group than control group and the difference was shown statistically significant.

The present study results correlate with study conducted by Movafegh *et al.*,[8] did a prospective, randomized, and double-blind study to evaluate the effect of dexamethasone added to lidocaine on the onset and duration of axillary brachial plexus block. Sixty patients scheduled for elective hand and forearm surgery under axillary brachial plexus block were randomly allocated to receive either 34 mL lidocaine 1.5% with 2 mL of isotonic saline chloride (control group, $n = 30$) or 34 mL lidocaine 1.5% with 2 mL of dexamethasone (8 mg) (dexamethasone group, $n = 30$). Neither epinephrine nor bicarbonate was added to the treatment mixture. They used a nerve stimulator in all of the patients. They found that the duration of surgery and the onset times of sensory and motor block were similar in the two groups. The duration of sensory (242 ± 76 vs. 98 ± 33 min) and motor (310 ± 81 vs. 130 ± 31 min) blockade were significantly longer in the dexamethasone than in the control group ($P < 0.01$)

The present study correlates well with One such study conducted by Shaikh *et al.*[2] The duration of motor block (846.67 ± 102.09 min in dexamethasone group versus 544.07 ± 55.40 min in control group) was also significantly longer in the dexamethasone group than in the control group ($P < 0.001$). Conclude that addition of 8 mg dexamethasone to bupivacaine 0.25% solution in supraclavicular brachial plexus block prolongs the duration of sensory and motor blockade, reduces the requirement of rescue analgesic in post-operative period but has no effect on the onset time of sensory and motor blockade.

Quality of Blockade

The quality of block was assessed by numeric rating scale from Grade I to Grade IV.

In the present study, it is observed that 84% (42/50) of the patients in Group I had Grade IV block when compared to 48% (24/50) in Group II with $P = 0.0005$ (<0.05) which is considered significant. The grades of quality of block in both the groups were already discussed in the table in our results.

The present study results correlate with study, this correlates well with the study conducted by Kalpana *et al.*[4] This study demonstrates that dexamethasone with ropivacaine and plain ropivacaine groups both were comparable in quality of blockade.

SUMMARY

In the present study, 60 patients of ASA I and ASA II of both sexes age between 18 and 50 years scheduled for elective upper limb surgeries and were randomly divided into two groups 30 each.

The two groups were designated as GROUP I and GROUP II

- Group I – 20 mL of 0.75% ropivacaine plus 2 mL of dexamethasone.
- Group II – 20 mL of 0.75% ropivacaine plus 2 mL of normal saline.

Parameters observed include onset of sensory blockade and motor blockade, duration of motor blockade, duration of analgesia (time to first request for analgesic), and quality of block.

- Onset of sensory and motor block was comparable in both the groups, which was shown statistically insignificant.
- The duration of analgesia in dexamethasone group was significantly prolonged as compared with control group and difference was statistically significant.
- The duration of motor block in dexamethasone group was significantly prolonged as compared with control group and difference was statistically significant.
- In dexamethasone group, there was enhanced quality of block with 88% achieved Grade IV block when compared to 52% in Group II which was statistically significant.
- The hemodynamic parameters, side effects, and complications were comparable in both the groups without any significant difference.

CONCLUSION

That Group I (addition of dexamethasone group) prolongs the motor block and enhances the quality of block and duration of analgesia significantly when compared with control group (normal saline) in supraclavicular brachial plexus block.

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