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Dr. Bhumi Chokshi
2nd Year Resident, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat, India

Dr. Rupal J Shah
Associate Professor, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat, India

Corresponding Author:
Dr. Bhumi Chokshi
2nd Year Resident, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat, India

Comparative study of bupivacaine plus (lignocaine + adrenaline) with dexmedetomidine as an adjuvant versus bupivacaine plus (lignocaine + adrenaline) alone in ultrasound-guided supraclavicular brachial plexus block

Dr. Bhumi Chokshi and Dr. Rupal J Shah

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Abstract
Introduction: Local anesthetics when used alone for supraclavicular brachial plexus block provide good operative conditions, but have shorter duration of postoperative analgesia. Hence, various adjuvants such as opioids, clonidine, dexamethasone, midazolam, and fentanyl are added to local anesthetics in supraclavicular brachial plexus block to achieve quick, dense, and prolonged block.
Aims: To compare the effects of Bupivacaine and Lignocaine + Adrenaline and Bupivacaine and Lignocaine + Adrenaline with Dexmedetomidine combination in ultrasound guided Supraclavicular brachial plexus block.
Objectives: To compare the effect of.

- Hemodynamic parameters.
- Onset of sensory and motor blockade.
- Duration of sensory and motor blockade.
- To compare post-operative pain levels.
- Complication / Side effects if any.

Methodology: This prospective, randomized, double-blind trial consists of total 60 patients undergoing elective upper limb procedures, divided into two groups, 30 in each. Group-A Patients received 15 ml of 0.5% Bupivacaine + 15 ml of 1% Lignocaine.
+ Adrenaline and Group B Patients received 15ml of 0.5% Bupivacaine + 15 ml of 1% Lignocaine + Adrenaline + Dexmedetomidine 0.75 µg/kg. The parameters recorded were onset and duration of sensory and motor block, DOA, Hemodynamic parameters, and side effects.
Results: In both the groups, demographic data were similar. Sensory and motor block onset was significantly shorter ($p< 0.05$) in Group B than Group A, while the duration of blocks and DOA was prolonged in Group B ($p< 0.05$). Intraoperative hemodynamics were in optimal range in both Groups.
Conclusion: Dexmedetomidine as an adjuvant to local anesthetic in USG supraclavicular plexus block shortens the onset and prolongs the duration of sensory and motor block and DOA.

Keywords: Bupivacaine, lignocaine, adrenaline, supraclavicular brachial plexus block, ultrasound guided

Introduction

- Supraclavicular brachial plexus block is a popular mode of anaesthesia for various upper limb surgeries, due to its margin of safety and good post operative analgesia. It provides rapid onset, dense anaesthesia of the arm, also post op analgesia without side effects.
- Blockade of brachial plexus (C5-T1) will allow for surgical anaesthesia for elbow, forearm and hand surgeries.
- Ultrasound guided brachial plexus block gains the advantage of accurate nerve localization, real time visualization of brachial plexus, blood vessels, needle placement, local anaesthetic spread. It minimizes the number of needle attempts.
- Local anesthetics when used alone for supraclavicular brachial plexus block provide good operative conditions, but have shorter duration of postoperative analgesia. Hence, various adjuvants such as opioids, clonidine, dexamethasone, midazolam, and fentanyl are added to local anesthetics in brachial plexus block to achieve quick, dense, and prolonged block.

- Dexmedetomidine, an α2 adrenergic receptor agonist. This increased selectivity results in more effective analgesia with fewer side effects. It is increasingly being used nowadays for regional anesthesia, intravenous aesthesia, sedation and analgesia for mechanically ventilated patients in intensive care units.

Aims

To compare the effects of Bupivacaine + (Lignocaine + Adrenaline) and Bupivacaine + (Lignocaine + Adrenaline) with Dexmedetomidine combination in ultrasound guided Supraclavicular brachial plexus block.

Objectives

To compare the effect of

- Hemodynamic parameters.
- Onset of sensory and motor blockade.
- Duration of sensory and motor blockade.
- To compare post-operative pain levels.
- Complication / Side effects if any.

Materials and Methods

This prospective, randomized, double-blind, comparative study was undertaken after approval of institutional research and ethics committee. Following a detailed pre-anesthetic checkup, informed written consent was obtained from patients fulfilling the inclusion criteria.

Inclusion criteria

- Patients belonging to age group 18-60 years.
- ASA grade I and grade II.
- Patients undergoing elective operative procedure for upper limb surgeries (i.e. Elbow, forearm and hand surgeries.).

Exclusion criteria

- Patients who refuse.
- Patients with history of bleeding disorders.
- Patients with local infection at the site of block.
- Patients with documented neuromuscular disorders.
- Patients with known allergy to local anaesthetic drugs.
- 60 patients were randomly allotted into 2 groups, group A and group B. All the patients received injection Midazolam 0.05mg/kg intravenously 15 minutes before the procedure. The basal HR, SBP and DBP and SpO2 were recorded. An IV cannula of size 18 gauge (G) was inserted in non-operated arm and lactated Ringer's solution was started.
- Supraclavicular brachial plexus block was given with the patient is placed semi-sitting; raise the head of the bed about 45° and have the patient turn their head in the opposite direction The probe is parallel to the clavicle, moved laterally toward the midpoint of the clavicle; the probe should be in the supraclavicular fossa above the clavicle and brachial plexus was identified. It was approached using a 23G needle.
- Group A: Patients received 15 ml of 0.5% Bupivacaine + 15 ml of 2% Lignocaine + Adrenaline
- Group B: Patients received 15 ml of 0.5% Bupivacaine + 15 ml of 2% Lignocaine + Adrenaline and Dexmedetomidine 0.75 μg/kg.

The sensory and motor blockade onset and duration were studied.

- **Sensory block** was assessed by pin prick test using a 3point scale: 0 = normal sensation 1 = loss of sensation of pin prick 2 = loss of sensation of touch.

Motor block was determined according to the modified Bromage scale.

- **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 the fingers.

The loss of pinprick sensation was checked every 3 minutes till the onset of loss of sensation and then every15min till the regain of sensation. The motor blockade was assessed every 3 minutes till the loss of movements and then every 15min till they regained movements. HR, SBP, DBP, and SpO2 were monitored every 15 min.

Onset of action: Sensory & Motor blockade

Sensory block: The time interval between administrations of local anaesthetic solution to loss of pin prick sensation.

Motor Block: The time interval between administrations of local anaesthetic solution to loss of movements.

Duration of blockade

Sensory block: Time interval between losses of pin prick sensation to appearance of pin prick sensation.

Motor block: Time interval between losses of movements to appearance of the movements.

Duration of analgesia

Duration of analgesia was recorded with the help of Visual Analog Scale (VAS) which ranges from 0 - 10.This scale was noted per every 60 minutes post-operatively till it comes to 5. Then the rescue analgesia was provided. The drug used was Inj. Diclofenac sodium (1.5 mg/kg) iv. The time of administration was recorded.

Complications

All patients were monitored for complications (if any) during the intra-operative period and up to 24 hours post-operatively. The observations and particulars of each patient were recorded in the proforma enclosed.

Results

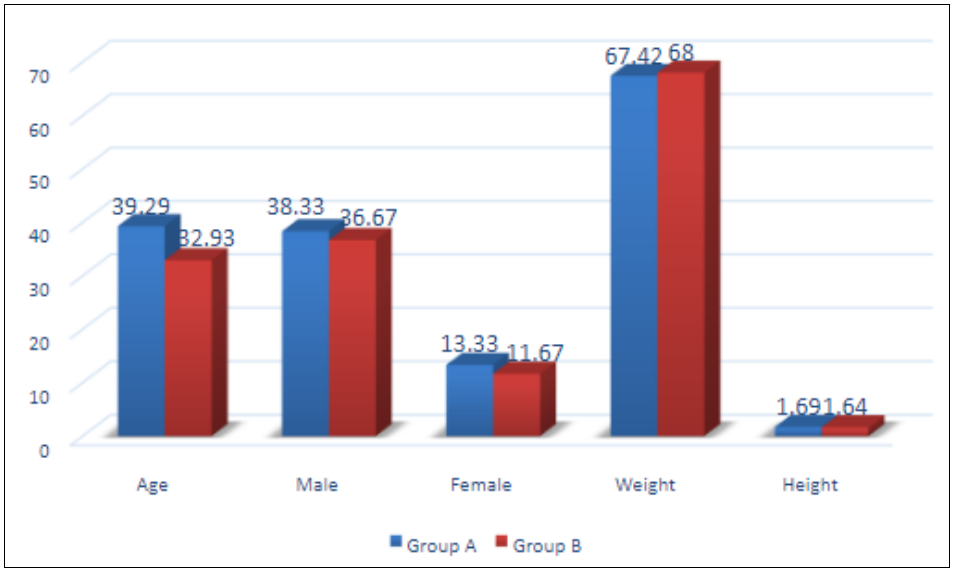

Fig 1: Descriptive analysis of socio demographic parameters

Inference

With reference to the above data, there is a minor difference, existed between mean age and proportion.

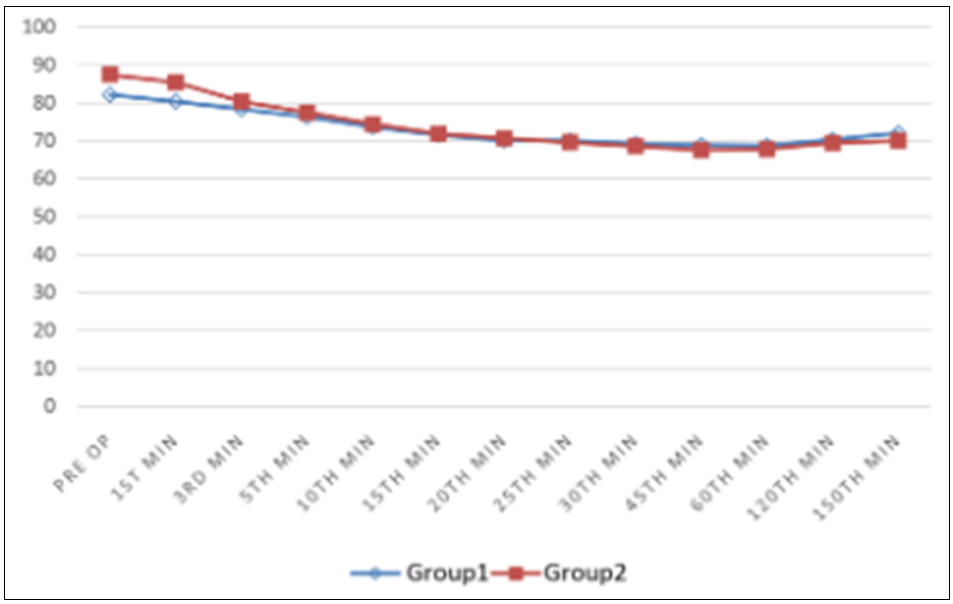

Fig 2: Heart Rate

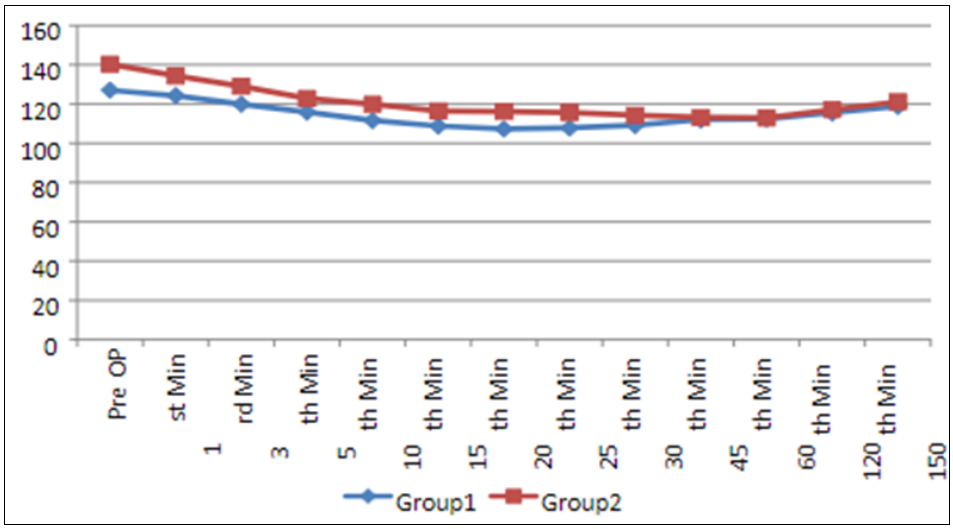

Fig 3: Systolic BP

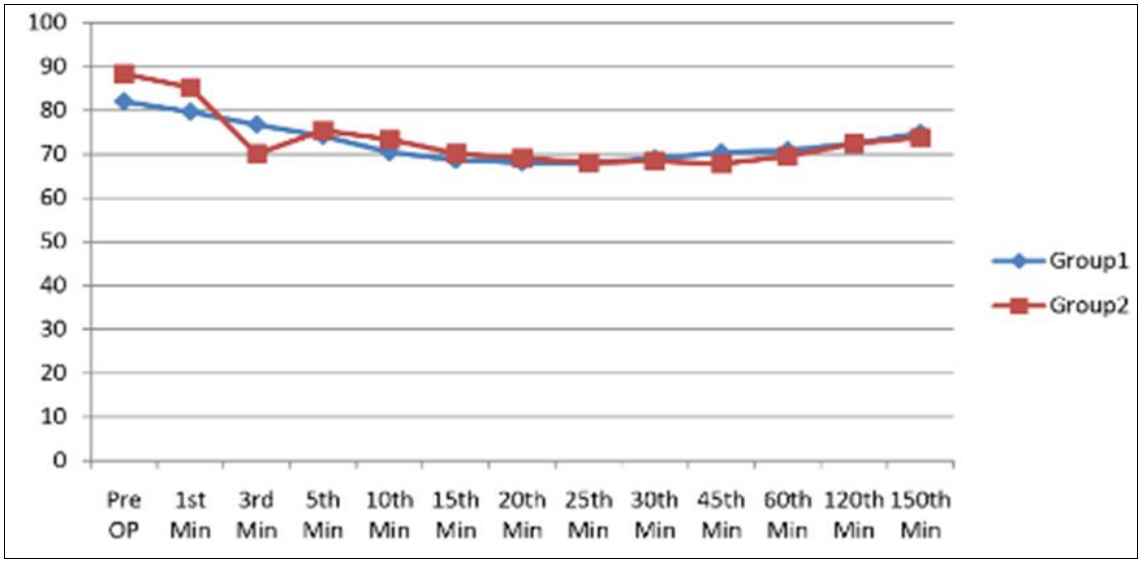

Fig 4: Diastolic BP

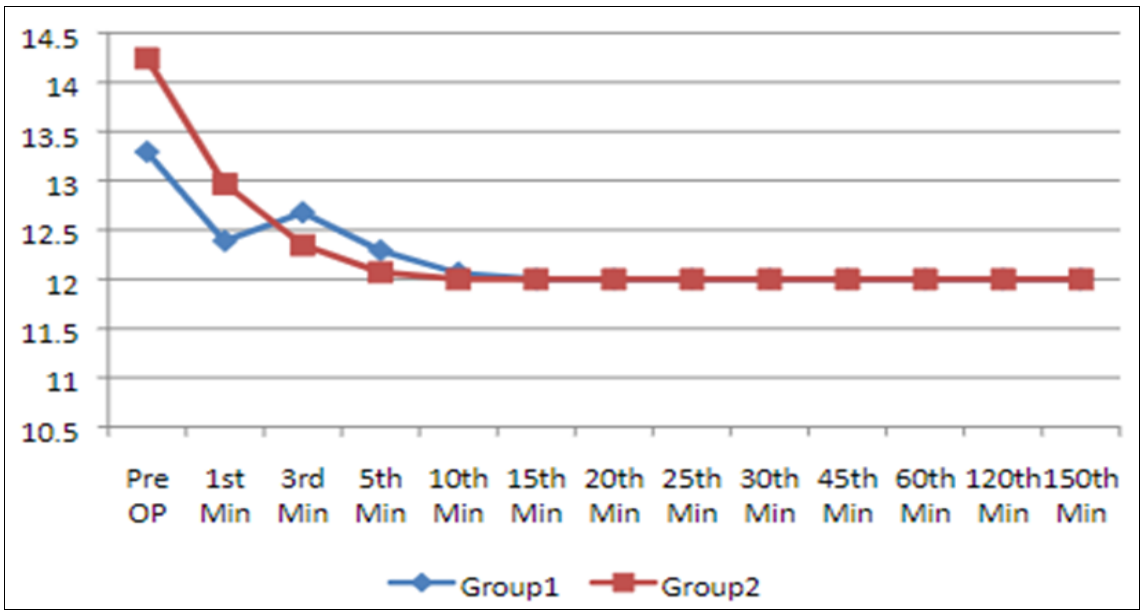

Fig 5: Respiratory Rate

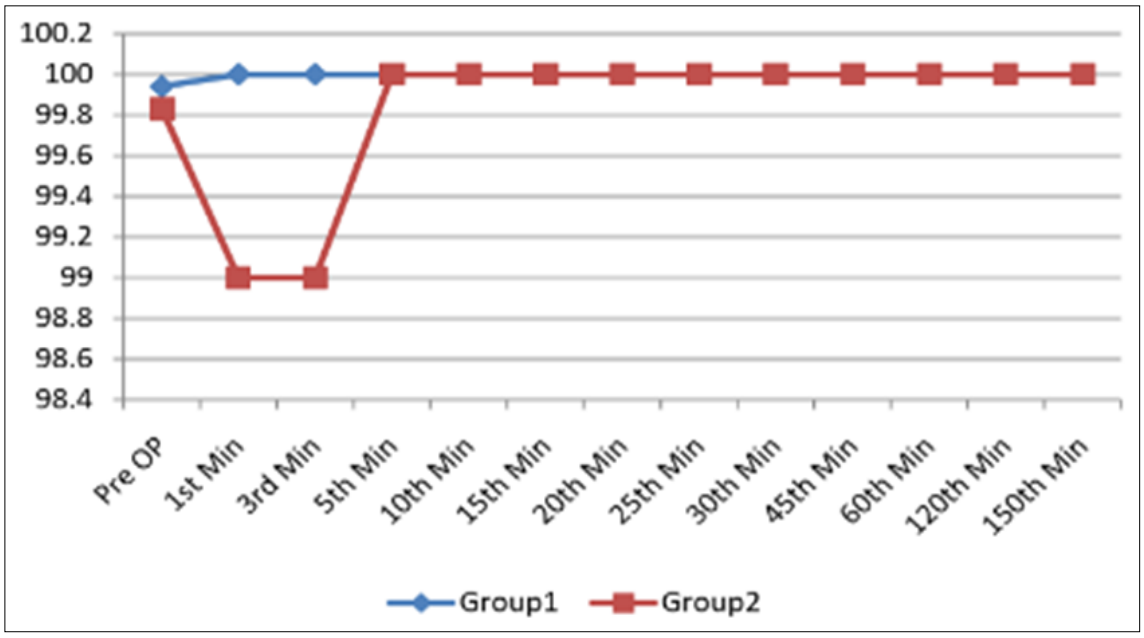

Fig 6: SPO_2

Inference

Heart rate, systolic and Diastolic BP, Respiratory rate and Spo_2 these all hemodynamic parameter were in a optimal range.

Table 1: Shows the mean and its mean difference

	Mean		Mean Difference	P
	Group A	Group B		
Onset of sensory block (min)	9.51	4.24	5.27	<0.05
Onset of motor block (min)	10.55	5.21	5.34	<0.05
Duration of sensory block (Hour)	7.84	11.23	-3.4	<0.05
Duration of motor block (Hour)	7.04	9.51	-2.47	<0.05
Duration of analgesia (Hour)	9.65	13.84	-4.19	<0.05

Table 2: Shows the group mean Time of First Pain and its Medication

Group	Mean	Time of First Pain Medication			95% CI (Upper)
		Mean Difference	P Value	95% CI (Lower)	
Group A	9.85	-4.18	< 0.00001	-4.6282	-3.7479
Group B	14.03				

Inference

Duration of complete Analgesia and time of first rescue pain medication between the study groups are statistically significant. All these parameters were longer in group B, compared to group A.

Discussion

- In our study, a mixture of (Lignocaine + Adrenaline) and Bupivacaine was used for Group A and Dexmedetomidine with (Lignocaine + Adrenaline) and
- Bupivacaine for Group B patients. Ultrasound which has become a useful tool was used in our study.
- The Heart Rate, Respiratory Rate, Non-Invasive arterial Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and Peripheral Oxygen Saturation (SpO2) were recorded.
- Sarita *et al.* [2] where clonidine and Dexmedetomidine were compared in supraclavicular block with bupivacaine, There was no statistically significant difference in onset of sensory and motor block between the two groups. Dexmedetomidine when added to bupivacaine enhanced the duration of sensory and motor block and also the duration of analgesia. The time for rescue analgesia was prolonged in patients receiving dexmedetomidine.
- Tripathi *et al.* [4] in their study of clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block. There was no statistically significant difference in the onset of sensory and motor block in both the groups. The addition of dexmedetomidine prolongs the durations of sensory and motor block and duration of analgesia and improves the quality of anesthesia as compared with clonidine.
- Amany S. *et al.* [3] compared Bupivacaine alone and Bupivacaine with Dexmedetomidine in ultrasound-guided infraclavicular brachial plexus block. Adding dexmedetomidine to bupivacaine during the placement of an ICB provides: (1) enhancement of onset of sensory and motor blockade, (2) prolonged duration of analgesia, (3) increases duration of sensory and motor block, (4) yields lower VRS pain scores, and (5) reduces supplemental opioid requirements.
- In a study by Kenan [1] *et al*., when Dexmedetomidine added to levobupivacaine in axillary brachial plexus block shortens sensory block onset time, increases the sensory and motor block duration and time to first analgesic use, and decreases total analgesic use.

In our study

- The onset of sensory blockade (mean difference -5.27, p value <0.00001), and motor blockade (mean difference -5.34 minutes, p value <0.00001) and both these findings were statistically significant. It indicates that onset of sensory blockade and motor blockade in Group B is quicker than in Group A.
- The mean duration time of sensory block in Group A (plain Bupivacaine and Lignocaine) was 7.84 hr, whereas in Bupivacaine and Lignocaine with Dexmedetomidine was 11.23 hr. The mean duration time of motor block with plain Bupivacaine and Lignocaine was 7.04 hr whereas in Bupivacaine and Lignocaine with Dexmedetomidine group was 9.51 hr.
- The duration time of effective Analgesia with plain Bupivacaine and Lignocaine was 9.65 hr, whereas in Bupivacaine and Lignocaine with Dexmedetomidine group was 13.84 hr. It indicates that duration of complete and effective Analgesia in Group B was prolonged than in Group A.

Conclusion

Based on our observations, we conclude that in ultrasound guided supraclavicular block for elbow, forearm and hand surgeries, when compared to group A, the mixture of Bupivacaine and (Lignocaine + Adrenaline) with Dexmedetomidine produces.

1. Statistically significant faster onset of sensory and motor blockade.
2. Statistically significant increase in duration of sensory and motor block.
3. The hemodynamic parameters were within optimal range in both groups.
4. Statistically, duration of post-operative analgesia is significantly prolonged in Dexmedetomidine group.
5. No side effects were reported in our study group.

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