ORIGINAL ARTICLE

Prospective randomized comparative clinical study of buprenorphine with 0.5% ropivacaine versus dexmedetomidine with 0.5% ropivacaine in peripheral nerve stimulator-guided supraclavicular brachial plexus block

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Introduction: As a secure substitute for general anesthesia for upper limb surgery and for the alleviation of post-operative pain, brachial plexus block has developed into a crucial instrument in the anesthesiologist's arsenal. It results in a shorter hospital stay, a lighter financial load, and also prevents the unfavorable consequences of general anesthesia. In the present study, we will contrast the analgesic effects of 0.5% ropivacaine with dexmedetomidine and 0.5% ropivacaine with buprenorphine on the onset and duration of complete motor and sensory blockade in patients undergoing supraclavicular brachial plexus block with a peripheral nerve stimulator. **Materials and Methods:** A prospective randomized comparative clinical study was done in 60 patients between 19 and 65 years of ASA grade I and II divided into two groups each comprising of 30 patients. (1) Group C: (Buprenorphine group) received 25 mL, 0.5% ropivacaine with 300 µg of buprenorphine. (2) Group L: (Dexmedetomidine group) received 25 mL, 0.5% ropivacaine with 1 µg/kg of dexmedetomidine. **Results:** Onset of sensory blockade between Group C and Group L is 9.72 ± 1.51 and 10.53 ± 2.30 min, respectively. Mean onset of motor blockade between Group C and Group L is 12.46 ± 1.98 and 14.12 ± 4.18 min, respectively. Mean duration of sensory blockade between Group C and Group L is 7.83 ± 2.51 and 9.17 ± 3.49 h, respectively. Mean duration of motor block in minutes between Group C and Group L is 9.56 ±2.48 and 11.53 ± 3.99 h, respectively. Mean duration of rescue analgesia in Group C and Group L is 8.14 ± 2.31 and 10.17 ± 2.88 h, respectively. **Conclusion:** Dexmedetomidine group has longer duration of sensory and motor block with prolonged post-operative analgesia. However, onset of sensory and motor block is earlier in buprenorphine group.

KEYWORDS: Ropivacaine, Dexmedetomidine, Buprenorphine, Upper limb surgeries, Supraclavicular brachial plexus block

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INTRODUCTION

The most typical procedure utilized for procedures on the upper extremities is a brachial plexus block. There are several methods for treating the brachial plexus block. They are:

1. Interscalene approach
2. Supraclavicular approach

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3. Axillary approach
4. Infraclavicular approach.

The easiest and most efficient route is the supraclavicular one.

In Germany, Diedrich Kulenkampff conducted the first percutaneous supraclavicular block in 1911.[1] Regional anesthesia provides site specific, effective, and long-lasting anesthesia. Regional anesthesia technique is used to conduct pain free surgery. It also helps in post-operative and chronic pain management.[2]

Peripheral nerve block has good success rate and is also safe. Peripheral nerve blocks provide intraoperative anesthesia; extend analgesia in post-operative period.

As a secure substitute for general anesthesia for the upper limb surgery and for the alleviation of postoperative pain, brachial plexus block has developed into a crucial instrument in the anesthesiologist's arsenal. The use of nerve stimulators, ultrasound, newer adjuvant medications, local esthetic agents, and newer adjuvant procedures for regional anesthesia have all contributed to its rising popularity. It results in a shorter hospital stay, a lighter financial load, and also prevents the unfavorable consequences of general anesthesia.

Local anesthetics alone will usually have a shorter duration of analgesia. Hence, various drugs such as opioids, dexmedetomidine were used as an adjuvant with local anesthetics in peripheral nerve block.[3]

MATERIALS AND METHODS

After obtaining approval from the Institutional Ethical Committee, a prospective randomized clinical study was conducted in Rohilkhand Medical College and Hospital, Bareilly. A thorough, well informed and written consent was taken from all patients before the procedure and patients of ASA grade I and II posted for the lower limb surgery between the age group of 19–65 years who were randomly divided into two groups using computer generated randomization technique each comprising 30 patients. Group C, patients were given 25 mL 0.5% of ropivacaine with 300 micrograms of buprenorphine, while in Group L, patients were given 25ml 0.5% ropivacaine with 1 μm/kg of dexmedetomidine.

Intervention

Pre-operative evaluation and preparation

All patients were evaluated through proper history taking, clinical examination, and routine laboratory investigations. All patients were informed regarding the procedure's merit and demerits of PNS-guided brachial plexus block.

Pre-anesthetic preparation and premedication

- Pre-anesthetic check-up was done on evening before surgery. All patients were kept nil per oral 6 h before surgery. Patients were explained about the procedure and a written informed consent was taken. Wide bore (18 G) intravenous line was secured. Standard monitors such as electrocardiogram (ECG), heart rate (HR), oxygen saturation (SpO_2), and non-invasive blood pressure (NIBP) cuff were be applied and patient's baseline parameter such as pulse, blood pressure, respiratory rate, and SPO_2 was recorded.

Anesthetic technique

- Then PNS-guided brachial plexus block was performed.

Technique of PNS-guided brachial plexus block

Patients were placed in supine position and the upper limb was placed on the corresponding side of the body. The positive electrode of PNS (Stimuplex HNS 12 B Braun) was attached to an ECG lead and was placed on the ipsilateral shoulder and negative electrode was attached to the needle (Stimuplex ultra 360° B Braun). After all aseptic precautions, skin was prepared, and then, subclavian artery was palpated in supraclavicular region and skin was colonized with 2% lignocaine just lateral to artery. Needle will be directed, cauded, so as to cross the clavicle almost perpendicularly and was placed one inch lateral to insertion of sternocleidomastoid on the clavicle. Needle was connected to the peripheral nerve stimulator (PNS) and set to 1.5–2.5 mA. Goal of the block was to bring the needle in proximity of lower trunk which is manifested by twitch of fingers as once finger twitch is obtained the current was gradually reduced to 0.2–0.5 mA and the drug was administered.[4]

Sensory block grading[5]

Grade 0	Normal sensation to pin prick
Grade 1	Dull response to pin prick
Grade 2	No response to pin prick

Motor block grading

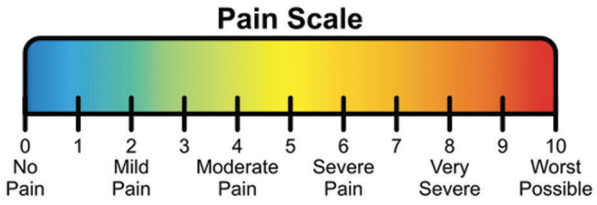
Grade 0	Normal motor function (no effect)
Grade 1	Decrease motor strength compared to contra lateral limb
Grade 2	Complete motor block

Post-operative

The presence and severity of pain, nausea, vomiting, and any other side effects was assessed for all patients in both groups. These assessments were performed in PACU for 30 min, then at 2, 4, 6, 12, and 24 h postoperatively. All patients were requested to give scores for the pain. Pain severity will be measured using numerical rating scale.

Numerical Rating Scale[7]

The scale used to assess the severity of pain. NRS is in the of a shape horizontal line with an eleven point numerical range, ranging from 0 to 10. 0 being no pain at all and 10 being the worst pain possible.



0	No pain
1-2	Mild pain
3-4	Moderate pain
5-6	Severe pain
7-8	Very severe pain
9-10	Worst pain possible

RESULTS

Every patient who was enrolled in the trial successfully had supraclavicular brachial plexus block, and every patient who started the study finished it. Age, gender, and weight were equivalent across both groups' demographic variables [Table 1].

Mean onset of sensory blockade between Group C and Group L is 9.72 ± 1.51 and 10.63 ± 2.30 min, respectively, which is statistically insignificant [Graph 1]. Mean onset of motor blockade between Group C and Group L is 12.46 ± 1.98 and 14.12 ± 4.18 min, respectively, and is statistically insignificant [Graph 2].

Mean duration of sensory blockade between Group C and Group L is 7.83 ± 2.51 and.17 ± 3.49 h, respectively [Graph 3]. Mean duration of motor block in hours between Group C and Group L is 9.56 ± 2.48 and 11.53 ± 3.99, respectively [Graph 4].

Mean duration of rescue analgesia between Group C and Group L is 8.14 ± 2.31 and 10.17 ± 2.88 h, respectively [Graph 5].

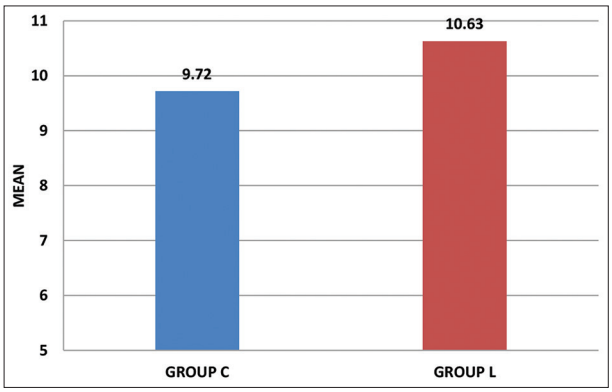
DISCUSSION

Peripheral nerve blocks are now frequently used for procedures on the upper limbs instead of general anesthesia because they offer the best possible operating conditions, muscle relaxation, stable intraoperative hemodynamics, excellent pain control, post-operative analgesia, less financial burden, early recovery, and reduced side effects.

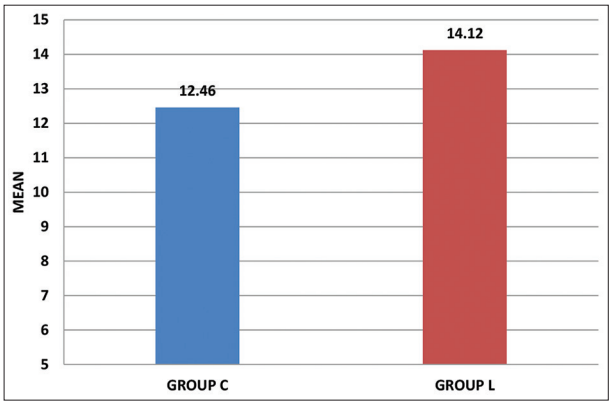
The relatively short duration of the local anesthetics that are now on the market, which may lead to block resolution before the worst post-operative pain period, can limit and shorten the benefits. Adjuvants have been tested with LAs to extend the intraoperative anesthetic and post-operative analgesia to overcome this. It is established that opioids and two adrenergic agonists extend the effects. We chose to contrast these two groups to see how well SCB performed as an adjuvant in the upper limb procedures.

Table 1: Demographic parameters

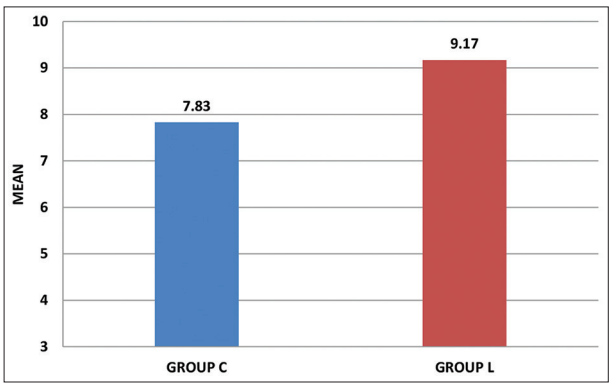
Parameters	Group C	Group L	*P* value
Age in years	35.63±9.29	39±12.3	0.237#
Gender (male/female)	18/12	17/13	0.792#
Weight (in kg)	52.43±8.84	53.33±8.78	0.694#



Graph 1: Onset of sensory blockade



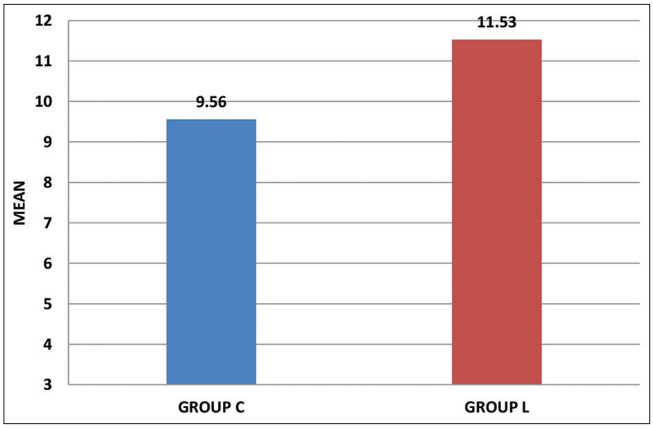
Graph 2: Onset of motor blockade



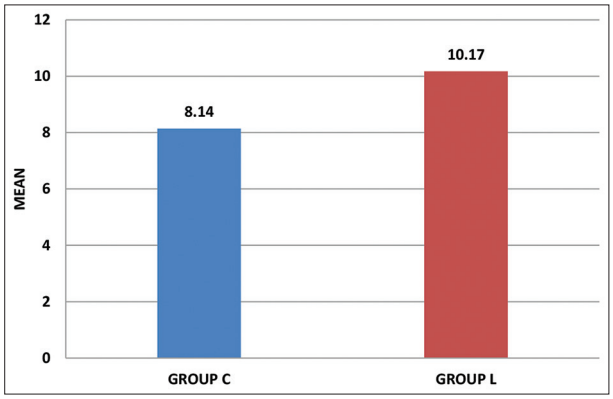
Graph 3: Duration of sensory blockade

Onset of Sensory and Motor Blockade

In our study, the median onset time for sensory block is 9.72 ± 1.51 (min) in group ropivacaine plus buprenorphine (C) and 10.63 ± 2.30 (min) in group ropivacaine plus dexmedetomidine (L) with *P* value of 0.0752.



Graph 4: Duration of motor blockade



Graph 5: Duration of rescue analgesia

The median onset time of motor block is 12.46 ± 1.98 (min) in Group C and 14.12 ± 4.18 (min) in Group L with *P* value of 0.0540. There was insignificant difference among two groups in the time.

The mean motor block onset in the buprenorphine group was about 11.13 ± 1.89 min, and the mean sensory block onset in the buprenorphine group was approximately 8.60 ± 2.82 min. They came to the conclusion that buprenorphine group's onset was noticeably quicker than control group's.[6]

The mean motor block onset time was 15.6 ± 6.3 and the mean sensory block onset time was 9.5 ± 5.8° in the study by Chinnappa *et al.* with dexmedetomidine as an adjuvant. They came to the conclusion that the dexmedetomidine group's sensory and motor block onset were noticeably quicker.[6]

Duration of Sensory and Motor Blockade

Our study's average sensory block duration is 7.83 ± 2.51 (min) in group ropivacaine plus buprenorphine and 9.17 ± 3.49 (min) in group ropivacaine plus dexmedetomidine with *P* value of 0.093 and it was concluded that there was insignificant difference among two groups ($P > 0.05$).

Furthermore, the average duration of motor block is 9.56 ± 2.48 (min) in group ropivacaine plus buprenorphine and 11.53 ± 3.99 (min) in group ropivacaine plus dexmedetomidine with *P* value of 0.0253, thus having a significant difference among two groups ($P < 0.05$). Thus, dexmedetomidine significantly prolongs duration of motor block.

In the study done by Saikat *et al.,* the average duration was much longer in the dexmedetomidine group when used as adjuvant., with $P < 0.05$.[1]

Furthermore, in the study done by Kathuria *et al.* with dexmedetomidine as adjuvant, the duration of sensory and motor block in dexmedetomidine group was around 9.17 ± 3.49 and 11.53 ± 3.99 min, with $P < 0.05$.[3]

Duration of Analgesia

In our study, the average duration of first analgesia is 8.14 ± 2.31 (h) in group ropivacaine plus buprenorphine and 10.17 ± 2.88 (h) in group ropivacaine plus dexmedetomidine with *P* value of 0.003 thus having a significant difference among two groups ($P < 0.05$).

In the study done by Chinnappa *et al.* with dexmedetomidine as adjuvant, the mean duration of first analgesia was 805.7 ± 205.9 min, with $P < 0.05$.[6]

In the study done by Vandana *et al.* with dexmedetomidine as adjuvant, the duration of first analgesia was prolonged with 780.5 ± 203.7 min, with $P < 0.05$.[7]

CONCLUSION

Upper extremity surgical procedures for forearm and arm surgeries can be easily performed under supra clavicular block. We came to the conclusion that, compared to adding buprenorphine (300 µg) as an additive to ropivacaine, the addition of dexmedetomidine (1 µg/kg) to ropivacaine as an adjuvant in PNS-guided supraclavicular brachial plexus block showed prolonged duration of motor blockade and analgesic duration without any post-operative side effects.

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