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Original Research Article

Verapamil Used as an Adjuvant to Bupivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Block for Upper Limb Surgery: A Prospective Randomised Control Study

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Abstract

Calcium is crucial in the development of pain. Due to the blockage of rapid sodium channels, verapamil (a calcium channel blocker) has been found to have strong local anaesthetic activity. It has quick channel blocking effects akin to those of local anaesthetics. The purpose of the study was to determine whether rescue analgesia was necessary in the first 24 hours and how much of it was needed. This study involved 60 patients. Group 1: Participants underwent a supraclavicular brachial plexus block guided by ultrasonography using 30mL of 0.25% Bupivacaine and 2mL of sterile water. Group 2: Participants underwent a supraclavicular brachial plexus block with ultrasound guidance using 30 mL of 0.25% bupivacaine and 5 milligrammes of verapamil (dilute it as 2ml). The sensory blockade lasted for 307.83±22.77 minutes in Group 1 and 399.50±25.40 minutes in Group 2. The difference in duration between Groups 1 and 2 has a P value of 0.0001, which is very significant. The motor blockade lasted 295.80±18.43 minutes in Group 1 and 327.33±22.39 minutes in Group 2. The difference in duration between Groups 1 and 2 has a P value of 0.0001, which is very significant. Rescue analgesia lasted for 375.80±37.38 minutes in Group 1 and 434.06±68.20 minutes in Group 2. With a highly significant P value of 0.0001, Group 2's rescue analgesia lasted longer than it did in Group 1. Block was effective in every patient, and every patient who was enrolled in the research finished it. Age, sex, weight, kind of surgery, length of surgery, and patient satisfaction were all similar between the two groups. Similar values for pulse rate, systolic, diastolic, and SpO2 were found in the two groups. The addition of verapamil to bupivacaine as an adjuvant prolongs the duration of the sensory and motor blockade in the ultrasound guided supraclavicular approach to block the brachial plexus in addition to its quick onset. Thus, the least analgesic doses needed. The risk of problems is also low because the procedure is performed under ultrasound supervision.

Keywords: Supraclavicular Block, Verapamil, Bupivacaine.

Introduction

Most procedures on the upper limb are performed while receiving nerve blocks. The anaesthesiologist at the forefront of regional anaesthesia has adopted image guided peripheral nerve block as standard practice for the past ten years. Ultrasonography is one of the main imaging techniques.

The brachial plexus and its surrounding components can be precisely located and measured using ultrasound. The block needle can be guided by real-time ultrasound imaging to the target nerves with fewer attempts. Under visual supervision, needle movement is deliberate and based on ongoing image feedback, avoiding the need for manual nerve localization. While several medications have been utilized as adjutants for supraclavicular blocks, verapamil (a calcium channel blocker) was employed in this case. Calcium is crucial in the development of pain. Verapamil (a calcium channel blocker), which reflects inhibition of fast sodium channels, has been demonstrated to have strong local anaesthetic activity. It has rapid channel blocking effects comparable to those of local anaesthetics.

Aims & Objectives

To determine the amount of rescue analgesics needed in the first 24 hours and their necessity in the first 24 hours

Methods & Materials

The Institutional Ethics Committee gave its clearance for this prospective, randomised, placebo-controlled, double-blinded trial to be carried out. Before being enrolled in this trial, each patient received written informed consent after being educated about the method.

This study covered 60 patients in total. A computer-generated random number generator was used to randomly divide the sixty patients who had signed up for elective upper limb surgery into two equal groups

Group 1: Patients received ultrasound guided supraclavicular brachial plexus block using 30 mL of 0.25% bupivacaine plus 2ml of distilled water.

Group 2: Patients received ultrasound guided supraclavicular brachial plexus block 30 mL of 0.25% bupivacaine plus 5mg of Verapamil (dilute it as 2ml).

Statistical analysis

The sample size was determined to be 28 based on the primary aim time required for the first rescue analgesia, error 0.05, and power of the study (1%) = 80%.

The patient information and block characteristics, including block onset and length, were categorised and entered in the excel spreadsheet.

The chi square test and student unpaired t test were used to evaluate the data.

The statistical analysis was carried out using the SPSS 20 programme.

P values of 0.05 and 0.001 were regarded as statistically significant and highly significant respectively.

Inclusion criteria:

- Patients undergoing upper limb surgeries
- ASA risk 1 and 2
- Age- 18 to 65 years
- Both genders

Exclusion criteria:

- ASA risk 3 and 4
- Patient refusal
- Allergic to local anaesthetics
- coagulation issues
- severe renal, hepatic, and neurological disorders
- uncontrolled diabetes
- individuals with circulatory instability,
- on verapamil usage

Anaesthesia technique

All the patients were given IV fluids after securing 18 G IV cannula in the operating room.

Heart rate, blood pressure, spO2, and an electrocardiogram were continually monitored (before and after the block).

Blocking techniques were covered earlier in this chapter

Sensory blockade assessment

By measuring the response to a pinprick with a 23 G hypodermic needle, the sensory properties of the block were evaluated.

Pinpricking the patients once every minute to check for sensory blockage.

The thumb's dorsal surface was used to evaluate the radial nerve.

The index finger's palmar surfaces were used to assess the median nerve.

The little finger was utilised to examine the ulnar nerve.

Motor blockade assessment

Radial nerve function was assessed during thumb abduction.

Adduction of the thumb for the ulnar nerve.

The median nerve faces opposition from the thumb.

Elbow flexion to access the musculocutaneous nerve.

The motor block was evaluated using the modified Lovett rating scale, which ranges from 6 (normal muscle power) to 0. (complete paralysis).

Surgery began with a sensory block of 3.

Onset of sensory blockade

The period between the drug injection to achievement of the Hollmen sensory scale 2 was calculated as onset time for the sensory block

Duration of sensory blockade

The period between the start of the complete sensory block and the return of normal sensation was used to quantify the sensory block's duration.

Onset of motor blockade:

The interval from the moment the local anaesthetic injection was finished to total paralysis was used as the motor block's onset time.

Duration of motor blockade:

The time span between total paralysis and full recovery of motor function was used to determine the motor block's duration.

Throughout the first 24 hours, it was noted when the patient used their first analgesic and how many total doses they required.

Evaluation of pain:

The visual analogue scale (VAS) was used to measure pain, with zero denoting no pain, 1-3 mild pain, 4-7 moderate pain, and 8–10 severe pain. After surgery, the VAS was checked at 2, 4, 6, 8, 10, 12, 18, and 24 hours. When VAS values reached 4, it was decided that the analgesic effects of the medications had worn off and that rescue analgesic (iv paracetamol 1 gm) should be administered. It was noted when the initial dose of rescue analgesia was due.

PR, SBP, and DBP were measured every 15 minutes up to 2 hours, and then at 4 hours, 8 hours, 12 hours, and 24 hours.

The level of sedation was evaluated using the Ramsay sedation scale.

Side effects

Drowsiness, pruritus, nausea/vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression, bradycardia, hypotension, and hypoxemia were all recognised as potential adverse effects. When the block proved insufficient or inconsistent, general anaesthesia was added to it.

Results

The sensory blockade lasted for 307.83±22.77 minutes in Group 1 and 399.50±25.40 minutes in Group 2. P value of 0.0001 indicates that the duration was longer in Group 2 than in Group 1, which is very significant. The motor blockade lasted 295.80±18.43 minutes in Group 1 and 327.33±22.39 minutes in Group 2.P value of 0.0001 indicates that the duration was longer in Group 2 than in Group 1, which is very significant. Rescue analgesia took 375.80± 37.38 minutes in Group 1 and 434.06 ±68.20 minutes in Group 2, respectively. With a highly significant P value of 0.0001, Group 2 required more time for the rescue analgesia than did Group 1. Block was effective in every patient, and every patient who was enrolled in the research finished it. Age, sex, weight, kind of surgery, length of surgery, and patient satisfaction were all similar between the two groups. Both groups had equal values for pulse rate, systolic blood pressure, diastolic blood pressure, and SpO_2.

Onset of sensory blockade: The onset of sensory blockage occurred more quickly in Group 2 (9.93±1.41 mins) than in Group 1 (12.7±31.43 mins), with a statistically highly significant P value of less than 0.0001.

Table 1: Onset of Sensory Blockade

Onset (mins)	Group 1	Group 2
<10 mins	0	12
>10 mins	30	18
TOTAL	30	30
MEAN	12.73	9.93
SD	1.43	1.41
P	**<0.0001 Highly Significant**	

Onset of motor blockade: The beginning of motor blockade occurred quicker in Group 2 (12.33±0.84 mins) than in Group 1 (15.90±1.53 mins), with a statistically highly significant P value of 0.0001.

Duration of sensory blockade: The duration of sensory blocking was longer in Group 2 (399.50±25.40 mins) than in Group 1 (307.83±22.77 mins), with a statistically highly significant P value of less than 0.0001.

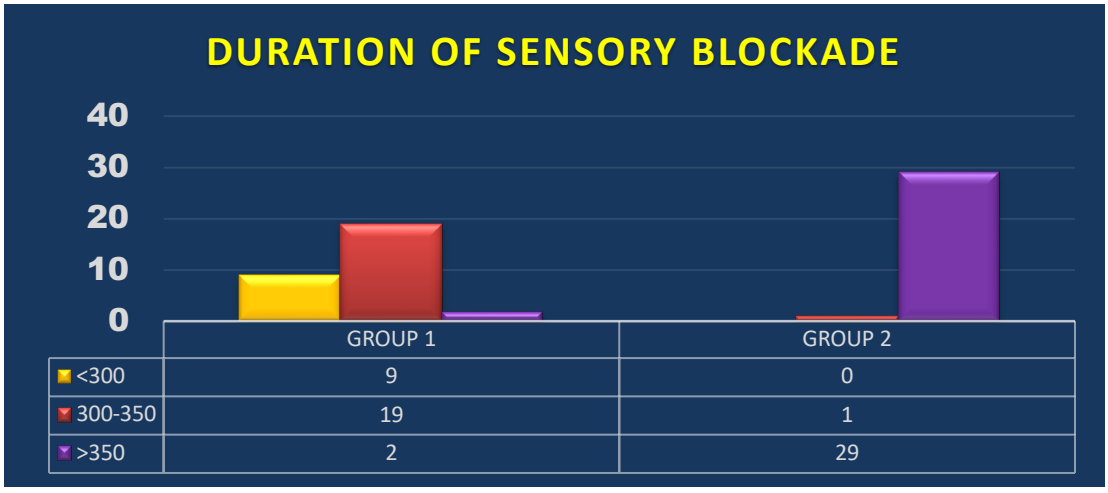

Figure 1: Duration of sensory blockade

Duration of motor blockade: The duration of the motor blockade was longer in group 2 (327.33±22.39 mins) than in group 1 (295.80±18.43 mins), with a statistically highly significant P value of less than 0.0001.

Time required for rescue analgesia: With a P value of 0.0001 (statistically highly significant), Group 2 required more time (434.06±68.20 mins) than Group 1 (375.80±37.38 mins) for the initial rescue analgesia.

Number of rescue analgesia needed in first 24 hrs

In Group 1, 3 patients needed just one dose of rescue analgesia, 7 patients needed two to three doses, and 20 patients needed more than three doses.

In Group 2, 16 patients needed just one dose of rescue analgesia, 5 patients needed two or three doses, and 9 patients needed more than three doses.

Both groups' differences were statistically very significant. No failed blocks or patchy blocks were discovered. Both groups' operational conditions had outstanding characteristics. Drowsiness, pruritus, nausea/vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression, bradycardia, hypotension, and hypoxemia were not observed during the procedure or in the days after it. Sedation levels were comparable between the two groups. There is no sedative effect of verapamil. Throughout the whole intraoperative period, every patient was awake, cooperative, and at ease.

Discussion

A synthetic derivative of papaverine called verapamil is an L-type calcium channel blocker. Fast sodium channel blocking caused by verapamil has effects akin to those of local anaesthetics. The NK-1 receptors can be activated by substance P, which also causes gradual, prolonged depolarization and aggregate calcium influx through calcium channels. phospholipase C and NMDA activity, which cause the sarcoplasmic reticulum to release calcium as a result.

The expression of the Dynorphine gene and central sensitivity, such as the wind-up phenomena, both increase when intracellular calcium levels rise, enhancing longer-lasting efficacy. Hence, the calcium channel is crucial for maintaining a pain message, and any disruptions in calcium ion transfer can impair pain perception.

Verapamil and bupivacaine were employed in this work to block the supraclavicular brachial plexus under ultrasound guidance. We found that verapamil increased the duration of the sensory and motor blockade as well as its onset time. Compared to Group 1, Group 2 required fewer rescue analgesics.

Study conducted by Sidharth SrabanRoutray, Debasis Mishra, DaityariRoutray, and Kasturi Nandausing verapamil as an adjuvant to the supraclavicular block concluded that the onset of sensory blockade was faster in the verapamil group than in the group without adding any additives. The mean time for the onset of the sensory block was 10.92±3.84 minutes which is comparable to our study where the mean time for onset of the sensory block is 9.93±1.41 minutes. Other studies conducted by Mosaffa *et al* and lalla *et al* also yielded comparable results.

Verapamil was used as an adjuvant to supraclavicular block in a study by Sidhart Sraban Routray, Debasis Mishra, Daityari Routray, and Kasturi Nanda, and it was shownthat this accelerated the start of motor blockade compared to the group receiving no additives. The average duration of the motor block was 12.40±3.20 minutes, which is comparable to the average duration of the motor block in our research, which was

12.33±0.84 minutes. Similar findings were shown by research by Choe *et al*. and Mosaffa *et al*. Our study's sensory blockade lasted for 399.50±40.0 minutes, which is comparable to experiments done by Choe *et al*., Mosaffa *et al*., and Sidharth. Our study's duration of the motor blockade—327.33± 22.39 minutes—is comparable to those of Messeha and Eldeen, Sidharth *et al*., and Tabaeizavareh *et al*. Similar to our findings, research by Hasegawa and Zacny Miranda *et al*, Carta *et al*, and Choe *et al* revealed that using calcium channel blockers alongside local anaesthetics might enhance duration of their analgesic effects.

In the study conducted by Sidharth Sraban Routray, Debasis Mishra, Daityari Routray, and Kasturi Nanda, Verapamil was shown to have no negative effects when used as an adjuvant to the supraclavicular block, which is consistent with our findings. For the supraclavicular brachial plexus block, Mosaffa *et al* assessed the analgesic impact of 2 different dosages of verapamil combined with bupivacaine. They came to the conclusion that verapamil (both 2.5 mg and 5 mg) delayed the onset of sensory and motor block and lengthened the duration of analgesia which was statistically significant.

Conclusion

In addition to its quick onset, the use of verapamil as an adjuvant to bupivacaine for ultrasound guided supraclavicular brachial plexus block prolongs the duration of the sensory and motor blockade. Thus, the least analgesic dosages needed. The risk of problems is also low because the procedure is performed under ultrasound guidance.

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