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Comparision of the Efficacy of 0.5% Levobupivacaine with a Combination of 0.5% Levobupivacaine and Hyaluronidase, in Ultrasound Guided Peripheral Nerve Block for Forearm and Hand Surgeries

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ABSTRACT
The advantages of the regional anesthesia are improved by the addition of adjuncts and the complications associated with the peripheral blocks using blind approaches were also decreased with the introduction of ultrasound in the medical field. Our study is to evaluate the efficacy of 0.5% Levobupivacaine with combination of 0.5% Levobupivacaine and hyaluronidase in USG guided axillary brachial plexus block for forearm and hand surgeries. Hyaluronidase drug acts as a spreading factor. The parameters evaluated were onset of sensory block, onset of motor block, duration of sensory block and time to rescue analgesia. A total of 70 patients belonging to ASA PS class 1 and 2 in the age group of 20-60 years who underwent elective hand and forearm surgeries in the orthopedic department of medical college from to were included in the study. They were divided into 2 groups. Group A were treated with 20ml of 0.5% levobupivacaine and Group B with 20 mL of 0.5% levobupivacaine and hyaluronidase 300 units and they were given Ultrasound guided axillary brachial plexus block. The mean onset of sensory block in the Group A patients who only received 0.5% Levobupivacaine was 13.4±0.8 min and the mean onset of sensory block in Group B patients who received 300 units of hyaluronidase to 20 mL of 0.5% levobupivacaine was 10.6±0.9 min. The mean onset of motor block in the Group A patients was 14±1.45 min and the mean onset in motor block in the Group B patients was 11.8±1.6 min. The mean duration of sensory block in Group A patients who did not receive the adjunct hyaluronidase was 10.10±2.0 hrs and the mean duration of sensory block in Group B patients who received the adjunct was 7.6±1.0 hrs. The mean duration to rescue analgesia in Group A was 12.0±2 hrs and in the Group B was 9.5±1.3 hrs. The addition of 30 units of hyaluronidase to 20 mL of 0.5% levobupivacaine in the Ultrasound guided axillary block reduces the onset of sensory block, reduces the onset of motor block, therefore shortens the total analgesic time before the surgery. This study also concludes that it reduces the duration of the sensory block and also reduces the mean time to rescue analgesia.

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Key Words
Levobupivacaine, hyaluronidase, ultrasound-guided peripheral nerve block

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INTRODUCTION

Regional anesthesia is ideal for many operations, in particular those on the limbs and lower abdomen. Regional anesthesia is attained through nerve blocks. Injection of cocaine into peripheral sites for minor surgical procedures is described by The American surgeons Halsted and Hall[1]. Nerve blocks may be classified as Central neuraxial blocks (Spinal and Epidural) and Peripheral nerve blocks. These nerve blocks are used not only for regional anesthesia but also for acute and chronic pain relief. The most important nerve block for shoulder and upper limb surgeries is brachial plexus block[2]. Brachial plexus block is the second most commonly performed block after neuraxial block. Brachial plexus can be blocked by four approaches. They are: (1) Interscalene block, (2) Supraclavicular, (3) Infraclavicular block (4) Axillary block and (5) Peripheral blocks at midhumeral level, elbow and wrist[3].

Axillary block is a popular block for shoulder and upper limb surgeries. It is easy, reliable and safe. Indications of axillary block are analgesia or anesthesia for forearm, wrist and hand surgeries. The drug is injected around axillary artery in axilla and the blockade occurs at the level of the terminal nerves. Complications like pneumothorax, phrenic nerve block and horner syndrome can be avoided[4]. But, there is high chance of intravascular injections and hematoma formation with axillary approach. Direct visualization of peripheral nerves, the needle tip and local anesthetic distribution is possible because of USG imaging. This imaging techniques are helpful to: (1) Accelerate block onset, (2) Increase block success rate, (3) Decrease the dose of Local anesthesia, (4) Decrease complications like vascular puncture and other complications associated with this procedure[5-8].

Hyaluronidase is one of the adjuncts used more commonly in peribulbar and retrobulbar blocks of the eye to enhance local anesthetic spread. It is an endoglycosidase that breaks down hyaluronic acid into monosaccharides by cleaving its glycosidic bonds and it also break down other acid monopolysaccharides in the connective tissue. Therefore, it renders the tissues readily permeable to injected fluids by increasing membrane permeability and reducing the viscosity. Finally, the overall outcome is greatly improved for techniques in regional anesthesia when ultrasound imaging is used[8-12].

Objectives: This study is to evaluate the efficacy of 0.5% Levobupivacaine with combination of 0.5% Levobupivacaine and hyaluronidase in USG guided axillary brachial plexus block for forearm and hand surgeries. The evaluation is done with respect to the onset of the sensory block, onset of the motor block, duration of the sensory block and the rescue analgesia.

MATERIALS AND METHODS

Study type: An Observational prospective study.

Study area: A group of 70 adult patients in the age group of 20-60 years to undergo elective upper limb orthopedic surgeries were divided into two groups: Group A and Group B, each consisting of 35 patients. All the patients either belong to ASA 1 or 2. All the patients were assessed preoperatively and the patients with normal parameters were included in the study. Informed consent is taken from all the patients.

Group A: This group includes 35 patients undergoing Ultrasound guided axillary brachial plexus block with 20ml of 0.5% Levobupivacaine.

Group B: This group includes 35 patients undergoing Ultrasound guided axillary brachial plexus block with 20 ml of 0.5% levobupivacaine and hyaluronidase of 300 units.

Inclusion criteria: All the patients belonging to ASA PS 1 (normal healthy patient) and ASA 2 (with mild systemic illness).

Exclusion criteria: Patients with history of coagulation disorders, neuromuscular disorders, psychiatry disorders, patients allergic to local anesthetics.

Patients included in the study were assessed preoperatively. The procedure was explained and consent was taken from patients. The assessment of pain is done preoperatively using pin prick method. The score that is assessed postoperatively is Visual analogue score and it is explained to patients preoperatively. 1 mg midazolam i.v is given to all the patients in the study preoperatively. Blinding is followed in the study. The anesthetist that prepared the drug combination did not participate either in the monitoring or in the assessment of the patient. The person who is assessing the axillary block as well as monitoring was blinded to the groups that patient belong.

Once the preoperative medication is given, the patient is taken to the operating room. In the operating room, the patient is connected with monitors like pulse oximetry, electrocardiogram and non invasive blood pressure. The patients were given USG guided axillary brachial plexus block. The technique used is IN PLANE ultrasound technique. The brachial plexus around the axillary artery is visualized and 2% lignocaine solution was injected to the skin area where the needle was to be placed. A 50 mm needle was inserted 1-2 cm away from the centre of the probe and maintained at 0-45 degrees to skin. After the needle was visualized on the scan, the radial

nerve, the median nerve, the ulnar nerve, the musculocutaneous nerves were identified and 5 mL of the drug was injected around each nerve.

The parameters that were observed during our study were hemodynamic parameters which includes Pulse rate, non invasive blood pressure and oxygen saturation. These parameters were recorded both before and also after the application of the block and also 3 min intervals until the end of the procedure. Any drop in the vitals were managed immediately. If there is drop in BP of more than 20% from the baseline, inj ephedrine 6 mg is given. If there is a drop in PR of less than 60 beats min^{-1} it is managed with INJ atropine 0.6 mg. sensory and motor block were assessed accordingly.

Test for sensory block: Sensory block was tested by PIN PRICK method. A 22 gauge needle was used to evaluate the sensory block by PIN PRICK method. The result is compared with same stimulation on the other hand. It is evaluated in the nerve distribution of the radial nerve, ulnar nerve, median nerve, musculocutaneous nerve.

Scoring system: A three point scoring system was used:

O = Loss of sensation
1 = Impaired sensation
2 = Normal sensation

Motor block was also assessed in the nerve distributionof radial nerve, ulnar nerve, median nerve, musculocutaneous nerves.

Scoring system:

2 = Normal motor function
1 = Impaired motor function
0 = No motor function

Definitions: Onset of sensory block: It is the time between the end of the last injection and total pin prick response score of 0.3 over hand and forearm.

Onset of the motor block: It is the time taken from the injection of drug to total block score of 0.35 over head and forearm.

Duration of the sensory block: It is the time between withdrawl of the needle and reappearance of paraesthesia in all the nerve distribution areas

Rescue analgesia: It is the time interval between block and patients first analgesia request. It is given only if the VAS score is 4 or above.

OBSERVATION AND RESULTS

This study includes two group A and B, each consisting of 35 patients. The mean age of the patients in Group A was 43.8±16 and the mean age in the Group B was 44.4±13.4. All the patients in the two groups were comparable with respect to age, height and also ASA 1 and 2 grading. There is significant difference with respect to age in the two groups and it is also comparable with other studies. The mean height of the patients in the group A was 164.4±8.4 cm and in the group B was 164.9±8.5 cm. There is no significant difference with respect to height in the two groups and it is also comparable with other studies.

The mean onset of sensory block in the Group A patients who only received 0.5% Levobupivacaine was 13.4±0.8 min and the mean onset of sensory block in Group B patients who received 300 units of hyaluronidase to 20 mL of 0.5% levobupivacaine was 10.6±0.9 min. The difference between the two groups is statistically highly significant with $p<0.001$. The mean onset of motor block in the Group A patients was 14±1.45 min and the mean onset in motor block in the Group B patients was 11.8±1.6 min. The difference between the two groups in the mean onset of motor block is statistically highly significant with $p<0.001$ (Table 1).

The mean duration of sensory block in Group A patients who did not receive the adjunct hyaluronidase was 10.10±2.0 hrs and the mean duration of sensory block in Group B patients who received the adjunct was 7.6±1.0 hrs. The difference between the two groups is statistically highly significant with $p<0.001$.The mean duration to rescue analgesia in Group A was 12.0±2 hrs and in the Group B was 9.5±1.3 hrs. The difference between the two groups is statistically highly significant with $p<0.001$. These results were also comparable with other studies (Fig. 1).

DISCUSSIONS

The present study was to compare the efficacy of 0.5% levobupivacaine with efficacy of 20 mL of 0.5% levobupivacaine with 300 units of hyaluronidase, an adjunct[13]. The effect of hyaluronidase in our study is done by axillary brachial plexus block under USG guidance. In this study, 300 units of hyaluronidase to 20 mL of 0.5% levobupivacaine is used. This study confirmed that addition of hyaluronidase to levobupivacaine, there is faster onset of sensory block and also faster onset of motor block[14]. This helps to minimize the exposure of anesthesia to a patient. This study also concludes that the duration of sensory block also reduced. There is also reduction in the early usage of rescue analgesia in the hyaluronidase group which

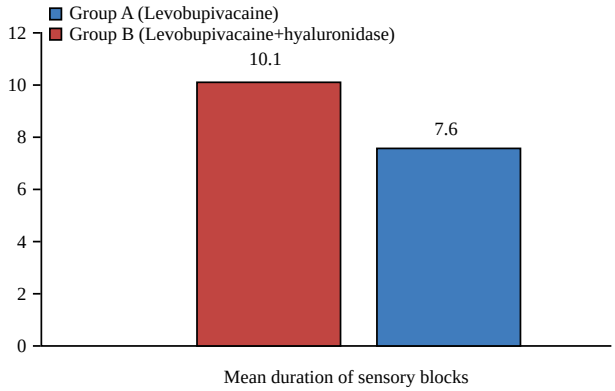

Fig. 1: Mean duration of sensory blocks

Table 1: Sensory block in group A and B

Parameters	Group A	Group B
Mean onset of sensory block	13.40±0.8 min	10.6±0.9 min
Mean onset of motor block	14.00±1.45 min	11.8±1.6 min
Mean duration of sensory block	10.10±2.0 hrs	7.6±1.0 hrs
Mean time to rescue analgesia	12.00±1.0 hrs	9.5±1.3 hrs

is statistically significant in our study[15]. The faster onset of block in this study is very helpful in places where there are numerous surgeries to be done in a day and even this reduction in time between surgeries is very helpful.

The faster onset of the block is mainly due to spreading factor of hyaluronidase. Hyaluronidase spreads the drug easily, so it is widely used in ophthalmology surgeries to minimize the drug volume. This study uses Ultrasound imaging which increases precision of better needle placement and also helpful to reduce the duration of anesthesia. Other studies like Sarvela[16] and Koh *et al.*[17] also evaluated the efficacy of hyaluronidase and concluded that there is faster onset of sensory block, faster onset of motor block and decreases the duration of anesthesia. So, we can conclude that the results in our study are similar to their results.

Onset of sensory and motor block: In this study, 0.5% levobupivacaine was given to 35 patients belonging to Group A and 300 units of hyaluronidase to 20 mL of 0.5% levobupivacaine to 35 patients belonging to Group B. The onset of sensory block in Group A was 13.4±0.8 min which was higher than the onset of sensory block in Group B which was 10.6±0.9 min. Our study concludes that onset of sensory block was faster in those patients who was given hyaluronidase as an adjunct. The results in our study were statistically significant p<0.001 and were comparable to results in other studies like Sarvela[16] and Koh *et al.*[17] The onset of motor block in Group A was 14±1.45 min which was higher than the onset of motor block in Group B which was 11.8±1.6 mins. Our study concludes that onset of motor block was faster in those patients who was given hyaluronidase as an adjunct. The results in our study are statistically significant p<0.001 and were comparable to results in other studies like Sarvela[16] and Koh *et al.*[17]

Sensory block duration and time to rescue analgesia: The duration of sensory block in Group A was 10.10±2.0 hrs which was higher than the duration of sensory block in Group B which was 7.6±1.0 hrs. This study also concludes that the duration of anesthesia is reduced in those patients who was given hyaluronidase as an adjunct. The results in our study were statistically significant p<0.001 and were comparable to results in other studies like Sarvela[16] and Koh *et al.*[17]. The mean time to rescue analgesia in Group A was which was higher than the mean time to rescue analgesia in Group B which was .This study also concludes that the mean time to rescue analgesia is reduced in those patients who was given hyaluronidase as an adjunct. The results in our study were statistically significant p<0.001 and were comparable to results in other studies like Sarvela[16] and Koh *et al.*[17]

CONCLUSION

The addition of 30 units of hyaluronidase to 20 mL of 0.5% levobupivacaine in the Ultrasound guided axillary block reduces the onset of sensory block, reduces the onset of motor block, therefore shortens the total analgesic time before the surgery. This study also concludes that it reduces the duration of the sensory block and also reduces the mean time to rescue analgesia.

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