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Case Report

EFFECTIVENESS OF ULTRASOUND-GUIDED WRIST BLOCK FOR SURGERY OF A FRACTURED PROXIMAL INTERPHALANGEAL JOINT: A CASE REPORT

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ABSTRACT

For upper extremity surgery involving wrist and hand, ultrasound (US) guide distal nerve block produces sufficient anesthesia with patient satisfaction. Here, we report a case study of adult with a proximal interphalangeal joint fracture and planned for US-guided wrist block involving media and ulnar using 0.5% bupivacaine + 2% lidocaine. Patient had maintenance of motor function with no complication of nerve injury. Wrist distal block produces safe anesthesia and effective patient satisfaction.

Keywords: Interphalangeal joint fracture, Ultrasound-guided, Distal peripheral nerve block, Motor functions.

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INTRODUCTION

The primary function of the proximal interphalangeal joint (PIPJ) is to facilitate joint movement for grasping objects in 85% of individuals. Hence, the fractures or dislocations of PIPJ have a significant impact on hand utility and affect the quality of life [1]. PIJP occurs more frequently in males than in females. Sports-related injuries are the primary cause in individuals under 30 years old, work-related reasons in patients aged 30–70 years, and falls in elderly patients over 70 years old [2]. The current treatment approaches include open reduction, extension block pinning, dynamic external fixation, hemi-hamate arthroplasty, percutaneous fixation, etc. The dynamic external fixator approaches often used a Suzuki frame, Ligamentotaxis device, or pins and rubber bands with Kirschner wires [3]. While upper extremity treatments often need general anesthesia, utilizing an ultrasound (US)-guided wrist block can be an advantageous alternative. It can expedite subject's post-operative mobility and provide analgesia during and after the surgery [4]. The present case report describes the effectiveness of US-guided wrist block for the surgical treatment of PIPJ fractures.

CASE REPORT

Male patient aged patient 34-year-old male (height-170 cm, weight-74 kg, American Society of Anesthesiologists-II) with the diagnosis of left-sided PIPJ fracture 5th metacarpophalangeal joint was posted for Suzuki frame fixation and fracture reduction of left 5th PIPJ.

The anesthesia was planned by USG-guided wrist block and it was pertained to the ulnar and median nerve. The patient's vitals during presentation, namely blood pressure (122/70 mmHg), heart rate (82 bpm), SpO_2 (98% on room air), and respiratory rate (18 bpm), were recorded. Following the acquisition of informed consent, the subject was transferred to the operating theater and positioned in a supine posture, and monitors were attached. Standard monitoring was performed (Electrocardiogram, Pulse oximetry, Non-invasive blood pressure), and 4 L/min O_2 was delivered through face mask. An IV line was placed opposite the surgical site, and the patient was pre-medicated with 1 mg of midazolam IV. The blocking arm was prepared by marking the area on the skin so that the ulnar and median nerves are clearly visible.

The median nerve passes through the elbow on the inner side of the brachial artery and continues toward the wrist below the flexor digitorum superficialis muscle in the middle of the forearm, near the crease on the palm. As the wrist is approached, the median nerve gradually approaches the surface and ultimately settles behind the flexor retinaculum within the carpal tunnel. The median nerve provides both sensory and motor innervation to the bones, muscles, and skin on the palm surface and the fingertips of the three outermost fingers.

The ulnar nerve is located on the medial aspect of the ulnar artery in the middle of the forearm, adjacent to the tendon of the flexor carpi ulnaris muscle. The ulnar nerve supplies sensory and motor innervation to the inner side of the hand, as well as the 4th and 5th fingers.

After locating the ulnar and median nerves, the puncture site was sanitized. A sterile USG probe with a cover was then placed at the marked location on the forearm. The patient was placed in a lying position facing upward to examine the palm side of the wrist. Next, a block was executed with a 20G needle placed at the wrist crease to ensure the blockage of the palmar branches of the median and ulnar nerves, which are located a few centimeters from the wrist crease. The anesthetic solution used for the US-guided wrist block consisted of 0.5% bupivacaine and 2% lidocaine, with a volume of 5 mL administered for each nerve.

A 5 mL mixture of anesthetic was injected into the tendon of the flexor carpi medialis, located 3 cm above the wrist crease, during the median nerve block procedure. Similarly, a 5 mL mixture of anesthetic was injected into the flexor carpi ulnaris tendon, located 3 cm above the wrist crease, for the purpose of ulnar nerve block.

Assessment of the block

The block performance time was determined as the duration between the insertion and removal of the needle. The motor and sensory blocks were evaluated at 5-min intervals for a duration of 30 min. Afterward, the needle used for the block was removed from the patient.

The evaluation of the sensory block involved comparing the perception of cold sensation with that on the opposite side. The sensory block was evaluated and classified according to the following criteria: 0 represents the complete lack of a cold sensation, one indicates a decreased cold sensation, and two signifies no change in cold sensitivity. Anesthesia was considered adequate when the cold sensation score was 0, indicating a total lack of cold sensation.

The satisfaction of both the patient and surgeon was assessed using a numerical scale. The scale comprised five grades: Grade 5 designated exceptional contentment, Grade 4 showed high satisfaction, Grade 3 represented satisfactory satisfaction, Grade 2 marked low satisfaction, and Grade 1 suggested minimal enjoyment. The surgeon's satisfaction rating for this patient was a perfect score of 5 out of 5.

Patients were directed to evaluate the severity of paresthesia felt while receiving blocks using a three-tier scale. The scale included the following categories: 0 – Absence of paresthesia, 1 – Mild paresthesia (perception of modest stimuli without any withdrawal response), and 2 – Moderate paresthesia (moderate electrical discharges accompanied by withdrawal response).

Moreover, a four-tiered scale was utilized to evaluate the level of discomfort encountered following the conclusion of the block. The scale is as stated: The pain scale is as follows: 0 represents the absence of pain, one indicates modest pain, two signifies moderate pain, and three represents acute pain.

The participants were given explicit instructions to evaluate the pain induced by tourniquet inflation using a 10-point scale, ranging from 0 (representing no discomfort) to 10 (representing the highest level of agony). In addition, participants were instructed to evaluate the intensity of pain they experienced during surgery as a result of the tourniquet, using a four-point scale. Afterward, a tourniquet was placed on the forearm and pressurized to 300 mmHg. The tourniquet was inflated for 15 min. The patient endured the inflation of the tourniquet without experiencing any complications.

The strength of the sensory block was evaluated by applying ice at 5, 10, and 20-min intervals. A three-level scale was used to assess the response: 0 for feeling cold, one for reduced cold sensation, and two for no cold sensation, with or without touch perception.

The degree of ulnar nerve sensory blockade was assessed by examining the sensation in the medial region of the hand and little finger, as well as the lateral area of the palm adjacent to the index finger. The integrity of the median nerve block was assessed by examining the feeling at the lateral aspect of the wrist. The patient met the criteria for the procedure when their score reached two in each region.

DISCUSSION

US-guided regional anesthesia is a standard protocol used in subject experiencing hand surgery [5]. The failure to use the damaged limb as a result of a motor block decreases patient satisfaction [6]. Hence to deal with this problem, a wide range of regional anesthesia has been employed. For surgeries on the wrist and hand, a combination of short-acting brachial plexus blocks and long-acting distal peripheral nerve blocks has been used [7]. However, this method also lacks the capability to prevent the required period of immobility as a result of a proximal brachial plexus block, thereby impeding subject's contentment [8]. Hence, Minor hand surgeries distal peripheral nerve blocks itself may be applied for the preservation of motor function and elicit effective anesthesia resulting in greater patient satisfaction [9].

In this case, the US-guided wrist block was performed using a local anesthetic mixture of 0.5% bupivacaine + 2% lidocaine in both the median and ulnar nerve. Precise US-guided injections and monitoring ensure optimal local anesthetic dissemination, perhaps leading to enhanced nerve exposure to the anesthetic. The lower density of connective tissue around the median and ulnar nerves facilitates a more efficient spread of local anesthetic compared to the larger nerves, which have a higher concentration of connective tissue surrounding them.

By utilizing distal peripheral nerve blocks as the main anesthetic technique for trigger finger or carpal tunnel release, patients can maintain motor function, enabling them to follow instructions and manipulate the affected finger(s) or hand during the surgical process. Distal peripheral nerve block reduces surgical time and eliminates upper limb movement and the absence of protective reflexes associated with brachial plexus blockade. In addition, by preventing motor block during distal peripheral nerve blocks, the use of additional interventions and its associated costs can be minimized, while also enabling the patient to safeguard the operating limb against unintentional injuries [10].

In the present case, the toxicity associated with the local anesthesia was avoided due to the low volume of anesthetic agents injected, about 10 mL. Likewise, Soberón *et al*. described a low volume of 15.5 mL of local anesthetic in the forearm block category when compared to supraclavicular block (29.9 mL) [11]. Hence, the proximal block has higher chances of local anesthetic toxicity due to high volume of injection. In addition, we have not observed major complications like pneumothorax and Horner's syndrome in the case of distal peripheral nerve block, which is one the major advantage of this technique.

The incidence of transient or permanent nerve injury after wrist block is lower when compared to brachial plexus block, which ranges from 2.1% to 9%. Typically, there are two types of tourniquet pain. The first type happens immediately after the cuff is inflated and is depending on the amount of pressure applied. The second type occurs 30 min after the tourniquet is applied and is not affected by the amount of pressure. The tourniquet is well received in brief medical operations. These are important features that support the use of distal blocks at the wrist during surgery for PIPJ fractures. The choice to administer the medial and ulnar blocks 3 cm proximal to the wrist was made based on anatomical factors. The purpose of this was to assure the inclusion of all sensory branches of the median and ulnar nerves, which originate above the wrist and provide palmar branches [12].

CONCLUSION

The present case demonstrates that performing distal blocks at the wrist is a safe procedure with good tolerability. The current methodology for this particular instance is uncomplicated and secure, resulting in high patient satisfaction.

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AUTHORSHIP CONTRIBUTIONS

Dr. Shivika Nath and Dr. Priya Sikka have participated in gathering the case particulars and creating the initial draft of the case report. Dr. Shivika Nath has been engaged in conducting literature searches, editing manuscripts, checking for plagiarism, and submitting them to journals in accordance with the rules.

CONFLICTS OF INTEREST

Nil.

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