Effect of Ultrasound-guided Nerve Block With 0.75% Ropivacaine at the Mid-forearm on the Prevalence of Moderate to Severe Pain After Hand Surgery

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ABSTRACT

Purpose: This study tested the hypothesis that ultrasound-guided mid-forearm nerve block with 0.75% ropivacaine reduces the prevalence of moderate to severe pain after wrist and hand surgery, and provides prolonged postoperative analgesia with minimal motor blockade.

Methods: Thirty patients undergoing elective wrist and hand surgery were randomly assigned to 1 of 2 groups: group R (n = 15) and group NS (n = 15). We combined an ultrasound-guided supraclavicular brachial plexus block with mid-forearm median, radial, and ulnar nerve block in all patients. The supraclavicular brachial plexus was blocked with 20 mL of 1.5% lidocaine, and the mid-forearm nerves were blocked with 15 mL of either 0.75% ropivacaine (group R) or normal saline (5 mL each nerve) (group NS). A blinded observer provided a numeric rating pain score at 1, 2, 6, 12, 24, and 48 hours after surgery. The durations of sensory and motor blockade, patient satisfaction, morphine requirement for postoperative pain rescue, and adverse events were recorded.

Findings: The prevalence of moderate to severe pain in group R was significantly lower than that in group NS (33% vs 86%; $P = 0.008$). The highest mean (SD) numeric rating pain score (worst pain) in group R was lower than that in group NS (2.7 [1.9] vs 5.6 [2.9]; $P = 0.004$), and the median (Q1, Q3) amount of morphine required for postoperative pain rescue in group R was lower than that in group NS (0 [0, 6] vs 8 [6, 10]; $P = 0.001$]. Additionally, there were no differences in the durations of motor blockade between the 2 groups.

Implications: Based on the findings from this study, ultrasound-guided mid-forearm nerve block with 0.75% ropivacaine significantly reduces the prevalence of moderate to severe pain after wrist and hand surgery, provides long-term postoperative analgesia, and facilitates the return of motor function in the upper limb. Chinese Clinical Trial Registry identifier: ChiCTR-IOR-15007278 (October 2015). (*Clin Ther.* 2018;▮:▮▮▮–▮▮▮)

Key words: analgesia, mid-forearm, ultrasound-guided, wrist and hand surgery.

INTRODUCTION

Most hand and wrist surgeries can be performed with the patient under ultrasound-guided regional anesthesia. Interscalene, supraclavicular, axillary, and infraclavicular approaches to the brachial plexus block provide effective anesthesia for surgical procedures.[1] Long-acting local anesthetics used in a proximal brachial plexus block may lead to a prolonged period of motor paralysis, that is, "dead arm"

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(although the duration of postoperative analgesia may be prolonged). Practitioners should be aware that the early return of motor function influences patient satisfaction.

Liebmann et al[2] reported that forearm ultrasound-guided nerve block of the radial, ulnar, and median nerves was feasible for emergency surgery of the hand. Lam et al[3] reported that mid-forearm median and ulnar nerve block with 1.5% mepivacaine, combined with local anesthesia on the volar side of the wrist at the level of the palmar crease, provided effective anesthesia in ambulatory hand surgery while preserving motor function. Dufeu et al[4] concluded that distal median, ulnar, and radial nerves blocked with 0.75% ropivacaine provides effective postoperative analgesia for hand surgeries. However, there is little literature on the control of moderate to severe pain and subsequent motor function after nerve block performed at the mid-forearm postoperatively.

We hypothesized that the mid-forearm median, ulnar, radial nerves blocked with 0.75% ropivacaine would reduce the prevalence of moderate to severe pain for 48 hours after hand and wrist surgery. We designed this randomized, double-blinded trial to examine the analgesic effect of ultrasound-guided nerve block at the mid-forearm with 0.75% ropivacaine as compared to normal saline in patients with hand or wrist surgery under supraclavicular brachial plexus block with 1.5% lidocaine. The primary end point was the prevalence of moderate to severe postoperative pain. The secondary end points included the amount of morphine required for pain control postoperatively (rescue), the durations of sensory and motor blockades, patient satisfaction, and adverse events.

PATIENTS AND METHODS

Study Participants

The Ethics Committee at the First Affiliated Hospital of Wenzhou Medical University (Zhejiang, China) approved the protocol of this prospective trial, and the trial was registered with the Chinese Clinical Trial Registry (ChiCTR-IOR-15007278, October 2015). The study adhered to the World Medical Association's Declaration of Helsinki. Data are presented in accordance with the Consolidated Standards of Reporting Trials' statement. Figure 1 summarizes the design of the study. After providing written informed consent, 30 patients who were aged 18 years or older, American Society of Anesthesiologists grades I to III, and scheduled for elective hand and wrist surgery between October 2015 and April 2016 were enrolled in the study. Exclusion criteria were as follows: allergy to local anesthetics, chronic pain, coagulopathy, presence of infection at the planned injection site, peripheral neurologic disease, and an inability to comprehend study-related procedures.

Study Design

On arrival in the preoperative preparation room, all patients received standard monitoring, including non-invasive blood pressure, ECG, and pulse oximetry. A 20-G IV catheter was secured in the opposite forearm and IV midazolam 1 mg, droperidol 1 mg, and fentanyl 20 μg were administered before nerve blockade unless contraindicated. An anesthesiologist experienced in ultrasound-guided regional anesthesia performed all blocks in the preoperative preparation room using an ultrasound machine (SonoSite X-Porte; SonoSite, Bothell, Washington) with a 6- to 15-MHz high-frequency linear array transducer. The drugs used in this study were prepared by an anesthesiologist who did not participate in the anesthetic procedures or in the postoperative evaluations of the patients.

Patients were randomly assigned to 1 of 2 groups, group R (n = 15) and group NS (n = 15), by a random number–generating table, with randomization numbers delivered in sealed envelopes. The supraclavicular brachial plexus block in both groups was performed with 1.5% lidocaine 20 mL. The distal median, radial, and ulnar nerves were blocked at the mid-forearm with 0.75% ropivacaine (group R) or normal saline (group NS), 15 mL (5 mL each nerve). The ultrasound-guided supraclavicular brachial plexus block, combined with distal median, radial, and ulnar nerve block at the mid-forearm, was performed in all patients. The sequence of the block was the same in all patients: an ultrasound-guided supraclavicular brachial plexus block was performed first, followed by distal median, radial, and ulnar nerve block at the mid-forearm.

A double-injection (see subsequent text), ultrasound-guided, supraclavicular brachial plexus block was performed in all patients.[5] Patients were supine with the head slightly turned to the contralateral side. After skin and transducer preparation, a 6- to 15-MHz high-