EDITOR'S CHOICE

Comparison of Ultrasound-Guided Axillary Brachial Plexus Block Properties in Diabetic and Nondiabetic Patients: A Prospective Observational Study

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Purpose Patients with diabetes mellitus (DM) type 2 may have subclinical peripheral nerve neuropathy. We performed this study to compare the differences in duration of axillary brachial plexus blocks in patients with type 2 DM and without DM (NODM). Our hypothesis was that the sensory block duration would be prolonged in patients with DM.

Methods A total of 71 patients who were scheduled for elective forearm and/or hand surgery were enrolled in this study. Before surgery, they received ultrasound-guided axillary brachial plexus blocks with a mixture of 10 mL lidocaine 2% and 20 mL bupivacaine 0.5%. After surgery, all patients received 1 g paracetamol every 6 hours as needed. The primary end point was sensory block duration. Secondary end points were motor block duration, time until first pain (numeric rating scale [NRS] 4 or greater), highest NRS pain scores, and rescue analgesic consumption (NRS 4 or greater) through the first 2 postoperative days.

Results In all, 67 patients completed the study: 22 in the DM group and 45 in the NODM group. Sensory and motor block durations were longer in the DM group than in the NODM group (mean [range], 773.5 [479−1155] vs 375 [113−900] minutes, and 523 [205−955] vs 300 [110−680] minutes). Time until first pain was 855 (590−1,285) minutes in the DM group and 500 (200−990) minutes in the NODM group. The highest NRS scores were also significantly lower in the DM group at 6 and 12 hours. Paracetamol consumption was lower in the DM group through the first 2 postoperative days.

Conclusions The presence of DM was associated with longer duration of the sensory block after axillary brachial plexus block. *(J Hand Surg Am. 2017;42(3):190−197. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic II.

Key words Diabetes mellitus, axillary brachial plexus blocks, block duration, time until first pain, postoperative analgesia.

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DIABETES MELLITUS (DM) IS A LARGE and increasing global health problem with an estimated prevalence of 9% among adults.[1] The incidence rises with increasing average age, excess body weight, and lack of physical activity characteristic of modern civilizations, and this confronts anesthesiologists with more type 2 diabetic patients requiring elective surgery in every field of the specialty.[2,3] Anesthetic management of these patients is challenging because they are likely to have airway difficulties, dysglycemia, and multiple-organ system disorders including myocardial and renal dysfunction.[4–6] For these reasons, peripheral nerve block (PNB) techniques may be preferred for extremity surgeries. However, PNB outcomes in diabetic patients with neuropathy remain controversial.

Microvascular damage of the nerve fibers, calcium homoeostasis abnormalities, reduced activity of potassium and sodium channels in nerve fibers, loss of myelinated and unmyelinated fibers, axonal degeneration, and collateral sprouting and axonal regeneration failure in rats have been proposed to be factors in the pathophysiology of diabetic peripheral neuropathy.[7–9] These may also be reasons for alterations in evoked motor response thresholds, conduction velocity, and nerve sensitivity to local anesthetic (LA) agents during and after PNB performances in diabetic patients with peripheral neuropathy.[10–17]

Delayed recovery after sciatic nerve block has been demonstrated in diabetic rats,[18] and prolonged duration or absence of recovery after continuous interscalene brachial plexus and femoral nerve blocks have also been reported in diabetic patients.[13,19] Recently, prolonged sensory and motor block durations after sciatic nerve blocks in patients with type 2 DM were reported in a prospective study.[15] Nevertheless, a lack of evidence remains regarding the impact of type 2 DM on PNB outcomes, especially in the upper extremity. We designed a prospective observational study to explore whether the presence of type 2 DM would affect the clinical results of axillary brachial plexus blocks (ABPBs). We studied sensory and motor block durations of ultrasound (US)-guided ABPBs in patients with or without DM. The null hypothesis was that sensory block duration was similar in diabetic and nondiabetic patients.

Moreover, we followed the sensory and motor block onset times, time until first pain, highest numeric rating scale (NRS) scores, and rescue analgesic (paracetamol) consumption through the first 2 postoperative days.

This study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[20]

MATERIALS AND METHODS

This study was approved by our institutional ethics committee and registered on ClinicalTrials.gov (NCT02685475). After written informed consent was obtained, 71 patients with American Society of Anesthesiologists (ASA) physical status I to III, aged 40 to 75 years, and who were scheduled for elective forearm and/or hand surgery to be performed under US-guided ABPBs, were enrolled between February 2015 and January 2016. Considering a similar study by Cuvillon et al[15] that compared sensory block duration in type 2 diabetic and nondiabetic patients, we performed this pilot study to obtain a 20% difference in sensory block duration after ABPBs. A total of 24 patients per group were planned to be recruited for the study, and then all patients fullfilling inclusion criteria were enrolled consecutively until the appropriate number of diabetic patients was obtained. Exclusion criteria were a diagnosis of DM type 1, only diet-controlled therapy for DM type 2 patients, difficulty in understanding instructions and/or pain scales, known allergy to LA agents, local infection, coagulopathy, neurologic disorders of the upper extremity (traumatic, peripheral nerve palsies, cerebral palsy, or brachial plexus derangements), mental disorders, acute and/or chronic opioid use (other analgesics could be used until the night before surgery) or history of substance abuse or emergency surgeries (replantations, amputations, compartment syndrome, fulminating infections, or open fractures).

Standard monitoring including electrocardiography, noninvasive blood pressure, pulse oximetry, and end-tidal monitoring of CO_2 was applied before performing ABPBs. Oxygen 2 L h^{-1} was administered via a facemask, and 2 mg midazolam and 50 μg intravenous fentanyl were used routinely for sedation before the ABPB performance in all patients.

Patients were allocated according to the diagnosis of their illness: (1) group DM was patients with type 2 DM; (2) group NODM was patients without DM. Demographic data of all patients and the characteristics of diabetic patients were noted.

Ultrasound-guided ABPBs

Axillary brachial plexus blocks were performed with US guidance using an LA mixture of 10 mL lidocaine 2% and 20 mL bupivacaine 0.5%. During PNB performance, US guidance was combined with a peripheral nerve stimulator to avoid inadvertent neural