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Ultrasound-guided hydrodissection to entrapped median nerve after electric shock: A case report

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ABSTRACT

A complication of electrical burns that increase the dysfunction is the peripheral nerve compression syndrome. Here, we presented a seventeen-year-old male patient who had an above-elbow amputation on the left and developed burns and severe median nerve entrapment in the right upper extremity after an electrical shock and underwent ultrasound-guided hydrodissection treatment. After the treatment, the edema detected ultrasonographically in the median nerve regressed, pain decreased and hand functions improved in the right upper extremity.

Introduction

Peripheral nerve compression and neuropathies are among the neurological consequences of electrical burns. The heat generated by the electrical current can cause direct peripheral nerve injury and neuropathy caused by edema and scar formation in tissues surrounding nerves. Although peripheral nerve compression due to scar formation following electrical burn exists in the literature, it has also been reported to occur through perineural fibrosis and nerve necrosis (1-3). The most common region of peripheral nerve involvement is the upper extremities, and the median and ulnar nerves are most commonly injured (2). Various conservative or surgical treatment methods are used to eliminate the pressure on the peripheral nerve. However, as these methods may be insufficient, additional interventions are necessary to alleviate peripheral nerve compression (2,4).

The ultrasound-guided hydrodissection technique of peripheral nerves has recently attracted the attention of physicians, especially in the fields of pain and musculoskeletal

medicine, but there is no information about its use in nerve entrapment complications due to electrical burns. The hydrodissection method eliminates the pressure on the nerve by injecting a non-irritating solution between the nerve and the surrounding tissues (5).

In this case report, we presented the treatment results of a 17-year-old patient who developed severe right median nerve entrapment due to electrical shock burn and underwent ultrasound-guided hydrodissection of the median nerve.

Case Presentation

A 17-year-old male patient was admitted to our hospital with complaints of pain in his right arm, weakness in his right hand, and limitation in range of motion (ROM) in his right wrist and fingers. The patient had undergone amputation above the left elbow eight months ago following electrical shock. The wound was repaired with a flap on the right axilla and with a graft placed on the anterior aspect of the right wrist and palm. Despite a 2-month physical therapy program including joint ROM, stretching, and strengthening exercises, no significant improvement was noted in his complaints.

In the physical examination of the patient after the first physical therapy program, the pain in the right arm was 8 according to the visual analog scale (VAS, 1-10), the wrist passive extension was 50°, and the proximal interphalangeal (PIP) joint passive extension of 3rd and 4th fingers was -30. There was no limitation in other passive ROM measurements of the extremity. Extensor and flexor muscle strengths of the wrist were 3/5, and flexor, extensor, abductor, and adductor muscle strengths of the fingers were 2/5. Complete loss of sensation was noted in the palm and fingers. The handgrip strength was 12 kg with a dynamometer, and the key pinch strength was 0.6 kg with a pinchmeter. Electromyographic (EMG) examination performed on admission showed that the right median nerve was denervated after giving a branch to the pronator teres muscle and right ulnar nerve after giving a branch to the flexor carpi ulnaris muscle. There were signs of moderate partial axonal degeneration in the right radial nerve. On ultrasonographic imaging, the median nerve was edematous in the proximal third of the forearm (cross-sectional area 0.13 cm²).

Hydrodissection procedure was performed using 5-12 MHz linear array transducer ultrasound (Logiq-e portable; GE Healthcare, China) in the proximal third of the forearm. After appropriate skin sterilization with chlorhexidine, the injection was performed with 1 mL of 2% lidocaine and 2 mL saline using a suitable needle tip (Figure 1). The procedure was applied 2 times with 1-month intervals. During this interval, the patient was allowed to continue daily therapeutic exercises.

After the treatment, the patient's pain regressed to VAS 2. The wrist extension improved up to 60°, and the 3rd and 4th PIP joint extension up to -10°. The extensor and flexor muscle strength increased to 4/5 in the wrist, and 4/5 in the fingers. The abductor and adductor muscle strengths of the fingers increased to 2/5. The handgrip strength rose to 17.3 kg and key pinch strength to 1.3 kg. Although EMG showed some improvements, some pathological findings consistent with the total axonal degeneration of median nerve distal to the lesion, and moderate to severe partial axonal degeneration of ulnar and radial nerves persisted. Post-treatment ultrasonographic imaging showed regression of edema in the median nerve (cross-sectional area 0.10 cm²).

Figure 2 displays the view of the right hand after treatment.

Discussion

Although there is no adequate treatment for median nerve entrapment, different treatments have been applied depending on the severity of the compression. It has been reported that conservative treatment is often beneficial in mild and moderate

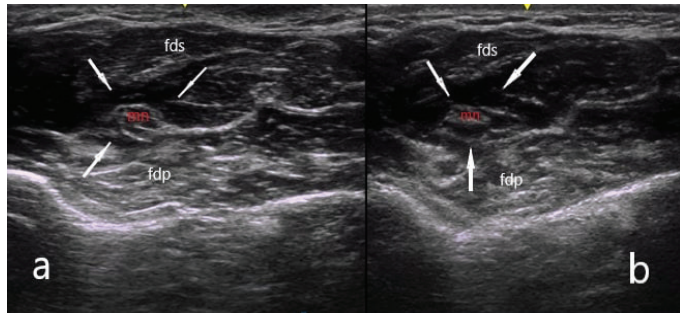

Figure 1. Axial ultrasound image of the median nerve during hydrodissection in proximal third of the forearm at first application (a) and second application (b). The space created by hydrodissection around the nerve (anechoic area, arrows) is seen. The change in the median nerve cross-sectional area in the month between the two applications is remarkable

mn: Median nerve, fds: Flexor digitorum superficialis, fdp: Flexor digitorum profundus

Figure 2. View of the right hand in active extension (a) and flexion (b) after treatment

cases, but the effect may be short and limited. Surgical treatment is used in cases with severe and insufficient response to conservative treatment. However, a significant number of patients experienced postoperative complications or recurrence (4,6).

Hydrodissection is a minimally invasive method used to separate normal tissues and fibrotic adhesions with a solution such as saline, steroid, local anesthetic, dextrose, or platelet-rich plasma (7-11). Several studies have reported that hydrodissection was effective in the treatment of peripheral nerve compressions such as piriformis syndrome (12) and carpal tunnel syndrome (8). Although it has been reported in the literature that dextrose may be preferred due to its analgesic effect, the ability used for multiple nerves, and higher doses, we used a more conventional fluid (i.e., normal saline) as an injection into a single nerve (7).

In the current case, although the ulnar and radial nerves were involved in clinical and electrophysiological evaluations, hydrodissection was applied only to the median nerve. Hydrodissection of the ulnar nerve has previously been performed only in a cadaver study and a few case reports (13,14). It was applied to the radial nerve only in one study where two cases were presented (15). We chose the median nerve as there was more scientific evidence for hydrodissection of this nerve (5,7,8). However, data on the risks and benefits of this new treatment method are limited (5). In this case report, we observed that ultrasound-guided hydrodissection to severely entrapped median nerve improved pain and functions without any complications in a patient who had multiple operations due to electrical burns.

Conclusion

Ultrasound-guided hydrodissection was found effective and safe in reducing pain and improving hand dysfunctions due to median nerve compression. Hydrodissection can be considered as an alternative treatment method before surgery.

Ethics

Informed Consent: Written informed consent was obtained from the patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Medical Practices: E.Y., E.G., Concept: E.Y., E.G., N.K., Design: E.G., N.K., Data Collection, or Processing: N.K., S.G.A., Analysis, or Interpretation: N.K., Literature Search: N.K., S.G.A., Writing: N.K.

Conflict of Interest: The authors declared they have nothing to disclose regarding conflict of interest.

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