

Management of Hand Spasticity with Ultrasound-guided Ethyl Alcohol Injection to the Deep Branch of the Ulnar Nerve

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Abstract

Patients with stroke commonly experience limb spasticity, which can prevent functional recovery and cause functional disability, due to muscle tightness and joint stiffness in the affected limb. Using the ability of ultrasound (US) to visualize nerves, we successfully performed US-guided neurolysis of the motor branch of the ulnar nerve in Guyon's canal, while avoiding injury of its sensory branch, in a 63-year-old woman with upper limb poststroke spasticity. We believe that our method has the merit of precluding the development of neuropathic pain, following injury to the sensory branch of the ulnar nerve. Moreover, our method reduces operation time and perioperative pain.

Keywords: Alcohol, deep branch of ulnar nerve, neurolysis, spasticity, stroke

INTRODUCTION

Patients with stroke commonly experience limb spasticity, which can prevent functional recovery and cause functional disability, due to muscle tightness and joint stiffness in the affected limb. Therefore, appropriate management of spasticity is essential for such patients. Spasticity of the hand typically presents with a flexor pattern and interferes with hand function by limiting the extension of the joints. The recovery of hand function after stroke is vital because it is directly associated with performing activities of daily living.^[1]

Several therapeutic methods exist for managing hand spasticity in patients with stroke, including stretching exercises, oral medication, and botulinum toxin injection. However, the effects of stretches and oral medication are often limited, and botulinum toxin injection is expensive. Moreover, treatment of hand spasticity requires injection of the botulinum toxin into several muscles of the hand. In 1987, Keenan *et al.* successfully treated intrinsic spasticity in the hands of patients with stroke with phenol neurolysis of the deep branch of ulnar nerve (DBUN), which is responsible for motor innervation of most of the intrinsic muscles of the hand, in the Guyon's canal with a blind technique.^[2] However, this method can result in

damage to the superficial branch of the ulnar nerve, which is responsible for sensory innervation of the palmar aspects of the fifth digit and the ulnar half of the fourth digit, with subsequent neuropathic pain, since the motor and sensory branches of the ulnar nerve are located in proximity at the level of the wrist.

In an effort to find an alternative to multiple hand muscles' botulinum toxin injections, we performed alcohol neurolysis of the DBUN to treat flexor spasticity in the hand of a consenting stroke patient, under ultrasound (US) guidance, to prevent damage to the superficial sensory branch of the nerve.

CASE REPORT

A 63-year-old woman received conservative treatment for a left thalamic intracerebral hemorrhage at the neurosurgery department of a university hospital. Three months after the onset of the stroke, she still had motor weakness of the right upper and lower limbs (Medical Research Council Scale for muscle power: 2–3). Moreover, she had spasticity in the muscles of the right hand, which limited metacarpophalangeal

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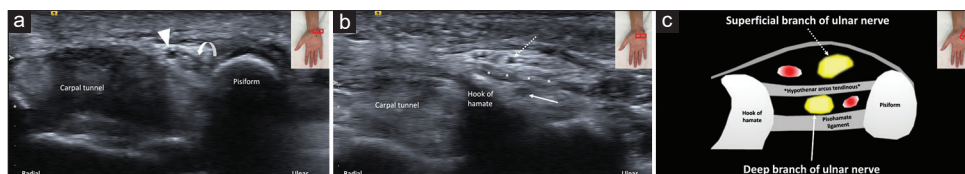


Figure 1: Gray-scale ultrasound images from a 63-year-old woman with right poststroke spasticity, in the transverse axis at the level of the entry of Guyon's canal, at the level of the pisiform bone, (a) and at the exit, at the level of the hook of hamate (b). In (a), the ulnar nerve (curved arrow) is seen medial to the ulnar artery (arrowhead). In (b), the ulnar nerve has divided in its superficial (dotted arrow) and deep (full arrow) branches, separated by the hypothenar arcus tendineus (asterisks). A schematic drawing in the axis of the pisohamate ligament with both branches of the ulnar nerve is presented (c)

joint extension of the fingers and extension and abduction of the thumb. The modified Ashworth scale (MAS) score was 3 (with considerable increase in tone, the passive movement is difficult).

Ethyl alcohol was injected around the motor branch of the right ulnar nerve at the distal end of Guyon's canal under US guidance (13–18-MHz linear probe, Acuson S2000, Siemens), with the patient in the supine position and the right hand in a supinated position [Video 1]. For the procedure, the US probe was placed at the level of the hook of hamate, where the superficial and deep branches are separated by the hypothenar arcus tendineus and the deep branch courses above the pisohamate ligament [Figure 1 and Video 1]. After identifying the deep and superficial branches of the right ulnar nerve, 1.5 mL of 20% ethyl alcohol was injected around the DBUN.

Hand spasticity was significantly reduced. only slight spasticity was observed (MAS 1: minimal resistance at the end of the range of motion) 1 day after ethyl alcohol injection, and the effect of the procedure was sustained at the 1-month follow-up (MAS 1).

DISCUSSION

Clinicians have performed neurolysis with ethyl alcohol on various nerves to control spasticity after stroke, including the musculocutaneous^[3] and obturator nerves,^[4] and the motor branch of the tibial nerve.^[5] Several studies have demonstrated the effectiveness of this procedure. Further, the use of US is paramount in proper nerve visualization^[6] and in performing accurate perineural injection.^[7] Alcohol denatures proteins, which results in splitting of myelin sheaths. During this procedure, the target nerve is usually identified with a nerve stimulator. However, in the case of neurolysis of the ulnar nerve in the Guyon's canal, ethyl alcohol injection under the guidance of the nerve stimulator could cause damage to the sensory branch of the ulnar nerve, due to the anatomical proximity of the motor and sensory branches at wrist level. Since the ulnar nerve innervates most of intrinsic muscles of the hand, including the palmar and dorsal interossei, third and fourth lumbricals, adductor pollicis, flexor pollicis brevis, and hypothenar muscles, neurolysis of the DBUN in the Guyon's canal can effectively control flexor spasticity in the hand.

CONCLUSION

Using the ability of US to visualize nerves, we successfully performed US-guided neurolysis of the motor branch of the ulnar nerve in the Guyon's canal, while avoiding injury of its sensory branch. We believe that our method has the merit of precluding the development of neuropathic pain, following injury to the sensory branch of the ulnar nerve. Moreover, our method reduces operation time and perioperative pain.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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