

A unique case of bilateral high ulnar nerve laceration

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J Robb, R Jassal, B Mehling, MJ Morhart. A unique case of bilateral high ulnar nerve laceration. *Plast Surg Case Studies* 2015;1(3):71-72.



High ulnar nerve injuries are now commonly treated with a distal nerve transfer, in which the anterior interosseus nerve to pronator quadratus is coapted to the deep ulnar nerve motor branch. Herein, the authors describe a case of bilateral ulnar nerve laceration that provides an opportunity to directly compare two operative techniques on different extremities of the same patient.

The patient sustained bilateral ulnar nerve injuries 6 cm superior to the medial epicondyle. The right ulnar nerve was proximally repaired with primary neurorraphy and a distal motor nerve transfer. The left ulnar nerve underwent primary neurorraphy without a nerve transfer because the median nerve was mistakenly tied off to control bleeding.

Physical examination and nerve conduction studies two years postsurgical intervention demonstrated an undeniable difference in cosmesis and function. The clinical findings suggest a superior result with a combined primary neurorraphy and a distal nerve transfer compared with a primary neurorraphy alone.

Key Words: AIN transfer; Claw deformity; Nerve repair; Nerve transfer; Ulnar nerve lesion

Proximal ulnar nerve injuries are challenging to treat and can result in weakness and associated sensory loss in the hand and forearm. These injuries are time sensitive because there is a loss of motor end plates if re-innervation does not occur before one year. The distance of re-innervation is important to consider because irreversible changes may occur in the distal denervated muscle before the repaired axons have had a chance to bridge the distance from the neurorraphy to the motor end plates (1-4).

Recently, a distal nerve transfer was proposed for the treatment of ulnar nerve lesions in which the anterior interosseus nerve (AIN) to pronator quadratus is coapted to the deep ulnar nerve motor branch (5,6). Traumatic high ulnar nerve injuries usually result in a transection of the all or part of the nerve. In this circumstance, the AIN to ulnar motor nerve transfer (UMNT) is typically completed end to end. In contrast, nontraumatic ulnar neuropathies are treated with an end to side transfer.

The present article describes a patient with a bilateral high ulnar nerve laceration treated in two ways. It compares the recovery of distal ulnar innervated intrinsic muscles with either a distal nerve transfer combined with a primary neurorraphy or a primary neurorraphy alone on the same patient.

CASE PRESENTATION

A healthy, 22-year-old, right-handed woman presented to the emergency department with deep lacerations on the medial aspect of both arms. The patient had sustained the injury when she fell through a broken window.

The patient was stabilized in the emergency department at the Royal Alexandra Hospital (Edmonton, Alberta). An unknown vessel was ligated on the left arm to control bleeding.

On physical examination, the patient presented with a deep 5 cm laceration on each upper extremity 6 cm proximal to the medial epicondyle. Both hands remained well perfused. Clinically, the patient had decreased sensation to the fourth and fifth digits bilaterally. Due to difficult patient compliance, secondary to intoxication, the motor examination was unreliable. Initial assessment was suspicious for bilateral high ulnar nerve injuries. Diagnostic imaging, including plain films and bilateral computed tomography (CT) angiograms, were completed and found to be normal.

In hospital, the patient demonstrated a progressive decrease in sensation extending over the volar aspect of her left first and second digits. She was taken to the operating room 48 h after admission for exploration of both lacerations, debridement and repair of nerve injuries with a possible distal nerve transfer.

In the right upper arm, a high laceration of the ulnar nerve was identified 6 cm proximal to the elbow crease. The surgical team decided to perform an end-to-end AIN to UMNT in addition to the direct neurorraphy. The proximal neurorraphy was performed without tension using two 8-0 sutures and fibrin sealant. The ulnar nerve was then identified in Guyon's canal. The motor branch was dissected sufficiently proximal to allow a tension-free transfer and transected. The anterior interosseus nerve to the pronator quadratus was subsequently identified and transected as distally as possible. A tension-free coaptation using fibrin sealant was then completed.

In the left upper arm, a high laceration of the ulnar nerve was also identified 6 cm proximal to the elbow crease. The median nerve was identified with a circumferential 3-0 polypropylene suture encircling it. The nerve had been presumably mistaken for the brachial artery and ligated in the emergency department. The ligature was removed and the nerve subsequently explored under magnification. A zone of discoloration and contour deformity was clearly identified where the suture had been placed. For this reason, it was deemed unwise to proceed with distal median to ulnar nerve transfer. The ulnar nerve was primarily repaired similar to that on the opposite side.

The patient was splinted for seven weeks. She was immobilized above the elbow for three weeks, then placed in a thermoplastic anti-claw hand splint. Physiotherapy was undertaken for range of motion and strengthening. The splint was gradually weaned over the subsequent four weeks.

One year postrepair, the patient presented with several characteristic signs of ulnar nerve injury including a positive Wartenberg and Froment sign, as well as clinical signs of bilateral claw deformities (Figure 1). The ulnar nerve signs were more pronounced on the left side. The patient was able to adduct and abduct her fingers; however, it was weak with resistance. She had decreased sensation in the ulnar nerve distribution on the right and decreased sensation in the ulnar and median nerve distribution on the left.

Two years postrepair, the patient had marked improvements in the claw deformity of her right hand (Figure 2), and used her right hand without concern for aesthetics or function. The strength was graded from 0 to 5 based on the Medical Research Council grading system and is presented in Table 1. The left hand had a persistent claw deformity, decreased sensation in the ulnar nerve distribution and wasting of the adductor pollicis muscle.

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Figure 1) One-year follow-up



Figure 2) Claw deformity at two-year follow-up



Figure 3) Bilateral lateral hand

Electrodiagnostic studies were completed one and two years after repair. The motor response of the abductor digiti minimi (ADM) and flexor dorsal interosseous (FDI) muscles were recorded. At the one year follow-up, the ADM on the right was measured at 0.4 mV compared with 0.2 mV on the left. The FDI was not recordable on the right and was recorded at 0.4 mV on the left. At the two years follow-up, the patient refused to undergo electrodiagnostic studies on her right hand because of lack of systems. Two years post-primary neurorrhaphy, the left ulnar nerve to ADM improved from 0.2 mV to 7.1mV and left ulnar nerve over FDI increased to 0.4 mV from 2.7 mV (Table 2).

Clinically, the patient continues to complain about both the appearance and function of her left hand. She continues to be dependent on her anticlaw splint and is currently entertaining the possibility of a tendon transfer.

DISCUSSION

To compare treatment options of nerve function following repair, it is important to group similar nerve injury patients together. There are few articles describing high ulnar nerve injuries; those that are published often report mixed data, comparing both high and low injuries in a variety of patients (3,7). The case presented herein involves bilateral high ulnar nerve injuries. Two different methods of nerve repair were completed on each side: left isolated proximal repair and right combined proximal repair as well as distal nerve transfer.

TABLE 1

Manual strength examination based on Medical Research Council grading system*

	Right	Left
Flexor dorsal interosseous	3	2
Abductor digiti minimi	4	1
Abductor pollicis brevis	4	4
Flexor pollicis longus	4	4
Flexor digitorum profundus 1 and 2	4	5
Flexor digitorum profundus 3 and 4	3	0
Flexor carpi radialis	4	4
Flexor carpi ulnaris	4	2

*0: Complete paralysis; 1: Minimal contraction; 2: Active movement that cannot overcome gravity; 3: Active movement that can overcome gravity; 4: Active movement against gravity and resistance; 5: Normal muscle strength

TABLE 2

Postoperative electromyography results

	One-year follow-up		Two-year follow-up	
	Right	Left	Right	Left
Abductor digiti minimi	0.4 mV	0.2 mV	Not completed	7.1 mV
FDI	Not recordable	0.4 mV	Not completed	2.7 mV
FDP sensory needle	1 units	2 units	Not completed	4 units

Flexor dorsal interosseous; FDP Flexor digitorum profundus

In the current literature, favourable results have been observed with distal nerve transfer in terms of intrinsic hand muscle (5,8,9). Our case suggests intrinsic hand motor response was improved on the side where a distal nerve transfer was completed. Despite supporting literature, there continues to be a paucity of high-level evidence. As such, many individuals are hesitant to consider this technique as the standard of care.

The present case is a unique situation in which two methods of repair could be performed within the same patient. Unfortunately, the median nerve was injured, which could have altered the clinical outcome. Additionally, the patient has refused any further testing and, therefore, we are unable to exclude the possibility of an anatomical variant such as a Martin-Gruber anastomosis.

In the present rare case of simultaneous traumatic, bilateral high ulnar nerve injuries, distal nerve transfer in addition to proximal neurorrhaphy suggests a favourable long-term result compared with proximal neurorrhaphy in isolation.

DISCLOSURES: None to declare.

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