

# Median Nerve Mistaken for Palmaris Longus Tendon: Restoration of Function with Sensory Nerve Transfers

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**Abstract** Intraoperative iatrogenic nerve injuries occur despite vigilance in the operating room. Most of these injuries occur as a result of patient positioning, traction or pressure injury, hematoma, or technical error. The median nerve is especially susceptible to injury during carpal tunnel release. A rare but devastating injury of the median nerve is complete transection. The number of devastating injuries is not well known, as few of the injuries are documented or publicized. We report a case where the median nerve was harvested instead of the palmaris longus tendon. We present a review of the literature and suggest an alternative treatment to median nerve grafting using sensory nerve transfers in the hand.

**Keywords** Intraoperative iatrogenic nerve injury · Median nerve · Complete transection

## Introduction

Iatrogenic peripheral nerve injuries may occur in the course of diagnostic or therapeutic medical procedures for various reasons. Despite thorough preoperative assessment and vigilance during operative procedures, nerve injuries do

occur. In some cases, motor deficits may be overlooked for several months because of the more obvious sensory complaint of pain. [11] In a retrospective review of over 700 traumatic peripheral nerve surgeries, almost one fifth were a result of an iatrogenic injury. [23]

Specifically, the median nerve is most susceptible to injury during carpal tunnel release. These injuries are usually partial. A rare but devastating injury occurs when the median nerve is completely transected. [15] The standard treatment is primary repair, or grafting when primary repair is not possible. We report a case where the median nerve was harvested instead of the palmaris longus tendon, present a review of the literature, and suggest an alternative treatment to median nerve reconstruction with sural nerve grafts.

## Case Report

Patient EM is an 18-year-old, right-hand-dominant, high school female. In December 2002, she dislocated her left elbow doing a back handspring while cheering. The patient felt the joint “pop” out and then back into place. She was diagnosed with a torn medial ulnar collateral ligament of the left elbow. Two months after the injury, she underwent surgical repair with an ipsilateral palmaris longus tendon graft. In the immediate postoperative period, the patient reported acute numbness to the median and ulnar nerve distributions, as well as an inability to flex any of the digits in her dominant left hand. Nerve conduction studies were unable to elicit any response to the median nerve and found severe conduction delay to the ulnar nerve. During surgical exploration 5 days later, the median nerve was identified in the carpal tunnel, and proximally at the level of the pronator teres with no intervening median nerve present. The

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anterior interosseous nerve appeared to be intact to the exploring surgeon, and the remaining median nerve was presumably harvested for the tendon repair. She was referred to us for evaluation and treatment of her condition. In addition to the left arm pain, the patient complained of numbness and marked weakness in the hand.

Her past medical and surgical history was remarkable for multiple injuries related to her cheerleading activities. She has had chronic back pain and a lumbar stress fracture necessitating a back brace. She has been treated conservatively for wrist fractures to both arms at different times and for bilateral ankle instability. She suffers from bilateral knee pain; however, only the right side required reconstruction of the right anterior cruciate ligament and lateral meniscus repair 4 years earlier. On physical examination, she had no touch sensation to the median or ulnar distribution of the left hand. She had weak ulnar intrinsic function and some weak ulnar wrist flexion but no median nerve motor function and no extrinsic finger flexion.

At surgery, the patient had evidence of a median nerve harvest from the level of the carpal tunnel to just distal to the cubital fossa (Fig. 1). The median nerve was found at the level of the elbow sewn together in place of the tendon reconstruction. The few proximal median motor fascicles that appeared to be intact did not stimulate with intraoperative nerve stimulation and an obvious anterior interosseous nerve was not identified. The ulnar nerve was found to be intact but severely compressed at the cubital tunnel. The deep motor branch of the ulnar nerve was released in Guyon's canal and the ulnar nerve anteriorly transposed at the elbow. A suture neuroma of the medial antebrachial cutaneous nerve was excised and this cutaneous nerve was transposed proximally into the region of the triceps muscle.

As an alternative to long cable sural nerve grafts from the elbow to the wrist, nerve and tendon transfers were

performed to reconstruct finger function and sensibility. The sensory nerves to the radial side of the thumb and first web space were repaired with a nerve transfer from the portion of the ulnar nerve that would innervate the fourth web space. [10, 22] The common digital nerve to the second webspace and the third webspace were then transferred in an end-to-side repair to the ulnar digital nerve to the small finger. The motor median nerve was not reconstructed. Instead, the brachioradialis tendon was transferred to the flexor pollicis longus tendon and the extensor indicis proprius was transferred to the left thumb for opposition. The flexor digitorum profundus to the fourth and fifth digits were tenodesed to the flexor digitorum profundus to the second and third digits, anticipating the recovery of ulnar nerve function.

At 3 months postoperative, the patient's pain had improved although it was still present, and she began to have extrinsic flexion of the fingers. By 14 months postoperative, the patient had significant improvement of hand function from the tendon transfers. Her pinch and grip strength were half that of the unaffected hand; however, preoperatively she had no strength whatsoever in the left hand. She has light touch perception in the thumb and index fingers related to the fourth web space sensory nerve transfer. The ten test [17] qualitative sensory perception is 6/10 in the thumb and 4/10 in the index finger at this time. Pinch and grip on the left is 12 and 40 lb, compared to 20 and 82 lb on the right. She still has significant pain and is being treated with pain management for her ongoing pain symptoms.

## Discussion

Iatrogenic nerve injuries occur for various reasons. We have previously reviewed our experience with nerve injuries

**Figure 1** Left arm of patient EM with iatrogenic injury to the median nerve. The visibility background is seen at the proximal and distal sites of the median nerve transection. Two proximal branches (black arrows) were thought to be pronator teres branches but did not stimulate at the time of surgery.



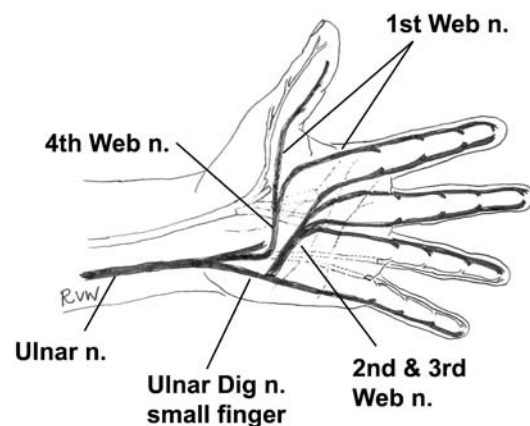
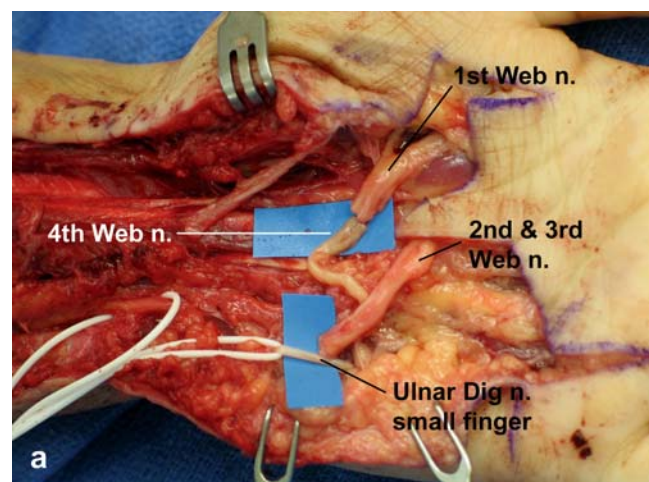
associated with cheerleading activities and described this patient as a part of that series (Weber and Mackinnon, submitted for publication). In a recent retrospective study of over 700 peripheral nerve injuries that required surgical treatment, 17% of those cases were iatrogenic in origin. [13] The most commonly injured nerves were the spinal accessory nerve as a result of lymph node biopsy, the common peroneal nerve, the ilioinguinal and genitofemoral nerve branches, the superficial radial nerve, and the median nerve. The median nerve is most vulnerable during carpal tunnel release. When endoscopic carpal tunnel release first became popular, the incidence of median nerve injuries was greater than in traditional open techniques [14]; however, as the surgeon's familiarity with the endoscopic equipment increases and the knowledge of the technique and its applications have become better defined, these injuries have occurred less frequently. [5] Median nerve injuries can also occur as a result of puncture techniques. One case reported a permanent median nerve injury after brachial artery puncture for a blood-gas sample [21], whereas another case of permanent injury occurred from direct injection of anesthetic to the median nerve for a median nerve block. [6]

While most median nerve injuries are partial injuries, complete transection of the median nerve has been reported with endoscopic elbow surgery [8] and with endoscopic carpal tunnel release. [2] A devastating median nerve injury is the erroneous harvest of the median nerve in place of the palmaris longus tendon; however, virtually no documentation of this injury exists and the incidence of its occurrence can only be estimated. Thus far, we have found only six cases documenting the use of the median nerve as a free tendon graft in patients who had no palmaris longus tendon. [7, 12, 20] Of the reported injuries, only two were successfully treated with sural nerve grafts and tendon transfers.

Our patient had the median nerve harvested through a small incision at the wrist instead of the palmaris longus tendon. From both cadaver and live human studies of Caucasians, up to 16% of individuals may not have a palmaris longus tendon and 9% of patients have bilateral absence of a palmaris longus tendon. [18, 19] In most cases, the palmaris longus tendon is very superficial and easily palpated in the wrist, just ulnar to the flexor carpi radialis tendon. Nonetheless, with any peripheral nerve transection, the standard treatment is repair with sural nerve graft if a primary neurorrhaphy cannot be achieved. In cases of a primary repair of the median nerve, 31% of patients achieved S3 or better sensory recovery. [3] The result of nerve grafts for upper extremity nerve injuries come from the trauma and amputation literature. It is known that short grafts (usually less than 5 cm in length) have better recovery than long grafts (20 cm or greater). Even in short grafts with optimal conditions, the sensory

recovery in the median nerve varies from 36% [16] to as high as 63% [9] in low median nerve injuries. Because both motor and sensory recovery is generally poor with long grafts, vascularized nerve grafts have been proposed for defects greater than 20 cm [4]; yet, despite the use of vascularized nerve grafts, the static two-point discrimination ranged from 10 to 20 mm.

Because any nerve grafts used in this particular patient would need to be at least 20 cm in length, the median nerve motor branch was not reconstructed. Instead, tendon transfers were used, with excellent clinical results. As an alternative to cabled sural nerve grafts that would have been at least 20 cm in length, we elected to use sensory nerve transfers in the hand to restore sensation. We prefer to use the nerve to the fourth web space (ulnar) to reinnervate



**Figure 2** The common digital nerve to the fourth web space (ulnar nerve) is transferred to the first web space nerve (median nerve) in a direct end-to-end manner to provide the best pinch sensation to the ulnar border of the thumb and the radial border of the index. To restore protective sensation to the remaining median sensory distribution, the terminal digital nerve of the second and third web spaces are transferred end-to-side to the ulnar digital nerve of the small finger. **a** shows the intra-operative sensory nerve transfer and **b** is a drawing of the same.

the radial side of the thumb and ulnar side of the index finger, performed with an end-to-end repair to provide the best reinnervation possible. [10, 22] The common digital nerve to the second webspace and the third webspace can be transferred in an end-to-side repair to the ulnar digital nerve to the small finger (Fig. 2a,b). The sensory recovery is less sensitive by two-point discrimination; however, protective sensation is achieved in this manner. Our success with sensory nerve transfers stems from the senior author's experience with brachial plexus injury patients, and sensation recovery in the first web space is between four and eight out of ten by ten test. [17] According to our unpublished data, nerve recovery after sensory nerve transfers in the hand provides protective sensation, but poor measurable sensation by two-point moving and static discrimination sensation and is comparable to data published by Brunelli. [1] We believe that sensory nerve transfers are as effective if not better than standard nerve grafts for the treatment of nerve gap greater than 20 cm in peripheral nerve injuries and have the advantage of eliminating morbidity from the donor defect.

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