

Single tendon transfer of the flexor carpi ulnaris for high radial nerve palsy

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Abstract

Complete radial nerve palsy results in a lack of extrinsic extensors of the wrist, fingers and thumb. The optimal treatment of persistent high radial nerve palsy is tendon transfer, which leads generally to acceptable results with better extension of the fingers and ability to grasp large objects. There are a multiple techniques of tendon transfers from a single to multiple one generally three tendons, however a single flexor carpi ulnaris tendon (FCU) transfer has some advantages, including simplicity, shorter operation time, less morbidity and less surgical scars, which can be important in some patients, particularly women.

We present a case report of single tendon transfer of the FCU to the digital extensors for high radial nerve palsy secondary to closed diaphyseal humeral fracture.

Keywords: Hand palsy; Radial; Nerve; Transfer

1. Introduction

Transfer of a single healthy tendon for treatment of hand paralysis secondary to high radial nerve injury can restore wrist, finger, and thumb extension. Transfer of multiple tendons including either the flexor carpi radialis (FCR) or flexor carpi ulnaris (FCU) tendon, with the palmaris longus (PL) and pronator teres tendons named as a triple tendon transfer has been suggested for high radial nerve paralysis. However, a simpler procedure of single tendon transfer of the FCU to the digital extensors including extensor pollicis longus (EPL) can restore digital and thumb extension and wrist dorsiflexion [1].

2. Case report

A 29-year old right handed woman was referred to our Hospital for further management of his left upper limb problem. He had been involved in a domestic accident four years ago in which he had sustained closed fracture of the mid-shaft of the left humerus associated with radial nerve palsy. We reviewed him one year later and noted there was no sign of radial nerve recovery (no wrist, thumb and fingers extension and no advancement of Tinel sign) but fortunately complete union of the humeral fracture that was plating.

A single tendon transfer was decided transferring the FCU to the digital extensors; surgical procedure was performed under general anesthesia and tourniquet, two small anteromedial longitudinal incisions was made in the distal and middle third of the forearm over the FCU muscle and tendon. The FCU tendon was transected just proximal to the pisiform and freed up proximally under direct vision. [Fig 1]

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Figure 1 Two volar incisions were made over the ulnar aspect of the distal third forearm to harvest the flexor carpi ulnaris (FCU)



Figure 2 Wrist posterior curvilinear incision was made and FCU tendon was transferred to the EDC and EPL through Pulvertaft technique



Figure 3 Postoperative view showing immediate finger movements started as soon as the patient was comfortable

We encountered ulnar neurovascular pedicle entering the proximal part of the distal third of the FCU. It can be sacrificed to allow easier transfer of the tendon. The muscle belly of FCU is long and usually extends close to the insertion of

tendon. To facilitate precise suturing at the transfer site and a less bulky appearance, we usually excised 1 to 2 cm of the distal end of the muscle belly.

Through a dorsal curvilinear incision of the distal forearm, the tendons of extensor digiti communis (EDC), extensor indicis proprius (EIP), extensor digiti minimi (EDM) and extensor pollicis longus (EPL) were exposed and any adhesions to them within their osseo-fibrous tunnels released. To increase the pulling force of the transferred FCU tendon, we often incised the proximal third of the extensor retinaculum. The FCU tendon was then passed under the superficial fascia and around the ulnar bone to the dorsal incision. It is vital that the line of pull of the FCU is as straight as possible from the medial epicondyle to the EDC. The FCU tendon was passed through the EDC, EIP and EDM tendons as far distally as possible and sutured to each, separately, with non-absorbable 2-0 Nylon sutures while the wrist is maintained at 30°, the metacarpophalangeal joints at 20° and interphalangeal joints in full extension. Then distal end of the FCU was passed through the extensor pollicis longus (EPL) tendon through Pulvertaft weave method and sutured to it with the thumb in full extension (Fig 2).

After completing the transfers, tension was checked by passive movements of the wrist, using the tenodesis effect. The hand was immobilized postoperatively with the wrist in extension of 45 degrees, fingers and thumb in full extension and the metacarpo-phalangeal joints in 90 degrees in flexed position during four weeks, Postoperatively, passive finger movements were started as soon as the patient was comfortable (Fig 3). Then active rehabilitation programmes were started after one month of plaster slab.

Patient had good functional outcomes of wrist and fingers extension with appropriate return to normal activities of daily living and return to work.

3. Discussion

The treatment goal for high radial nerve palsy is to restore grip strength and wrist extension, so many studies related that tendon transfers will result in good outcomes in cases of radial nerve palsy with irreparable damage or reconstruction failure [1,2].

Conventionally, triple tendon transfer has been used to reconstruct wrist, fingers, and thumb extension separately. But transfer of a single FCU has some advantages, including simplicity, shorter operation time, less morbidity due to transfer of only one tendon, and, not least, less surgical scars, which can be important in some patients, particularly women, besides, patients with multiple injuries or scarred limbs having less choice of available tendons for transfer [3]. Nonetheless, this technique remains controversial, because the FCU is a stronger muscle than the extensors of the wrist and fingers; the excursion of the muscle is smaller than these extensors; and the FCU is a major stabiliser of the wrist in ulnar deviation and so too important to be sacrificed [4,5]. The loss in wrist flexion and ulnar deviation is significant. Thus, transfer of the flexor carpi radialis (FCR) is suggested as an alternative as part of the Tsuge procedure based on transfer of pronator teres (PT) to extensor carpi radialis brevis (ECRB) tendon, FCR to extensor digiti communis (EDC) tendon, palmaris longus (PL) to extensor pollicis longus (EPL) tendon, and tenodesis of abductor pollicis longus (APL) to brachioradialis (BR) tendon.[6] In our case there was no major functional disability after single transfer of the FCU, and a functional range of motion and grip strength for all activities of daily living were maintained. The FDS can act as an ulnar wrist stabiliser in the absence of the FCU [7]. The average activities of daily living require 5° flexion, 30° extension, 10° radial deviation, and 15° ulnar deviation of the wrist [10]. 20° wrist extension and 20° wrist flexion has been considered functional [8,9].

As the FCU was also sutured to the EPL, the loss of independent thumb extension is theoretically possible. However, our patients were able to make a thumb-up position with simultaneous MCP joint extension and patient doesn't complained of any functional disability due to this altered pattern of thumb extension, although the power of independent thumb extension was weaker than that in the normal side.

There is only one important contraindication to use of this technique. In general, a muscle should not be used for transfer unless it can be graded as M5. Therefore, if the FCU tendon was not sufficiently strong, we added the PT transfer to ECRB for restoration of wrist extension. This situation had been encountered in some patients with brachial plexus injury, simultaneous injury to the radial and ulnar nerves in the arm, cubital tunnel syndrome and partial damage to the FCU muscle itself [10].

4. Conclusion

Hand paralysis secondary to high radial nerve injury is frequent and tendon transfers are commonly used for its treatment varying from single to multiple tendon transfers. However, the single healthy flexor carpi ulnaris tendon transfer is a simple procedure that can restore wrist, finger, and thumb extension with less morbidity and more efficiency.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Statement of informed consent

Patient gives informed consent for publication.

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