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Outcome of tendon transfer surgery for radial nerve palsy

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Abstract:
Objective: To evaluate the functional outcome of tendon transfer for wrist drop secondary to radial nerve injuries.
Place and duration of study: Orthopaedic and plastic surgery units of Khyber teaching hospital, Peshawar from September 2013 to August 2015
Patients and methods: In this study fifteen consecutive patients of any age group and of both gender with irreversible low radial nerve paralysis were included. Three tendons were used to restore lost functions of wrist, fingers and thumb. The pronator teres was transferred to both extensor carpi radialis brevis and longus, Palmaris longus to extensor pollicis longus and flexor carpi ulnaris to extensor digitorum and extensor indicis. The ranges of movement of the wrist, metacarpophalangeal (MCP) joints of the fingers and thumb were evaluated preoperatively and at each follow-up using goniometer. Patients were asked about their return or not to normal activities of daily living and return to work, where appropriate. The mean postoperative follow-up was 12 months.
Results: 15 patients were included in the study. The mean age was 37.13 years ± 8.17. One was female and 14 were male patients. Preoperatively, compared with the normal hands, the mean finger extension lag was 77.0º with the wrist extended and the mean thumb extension lag was 60.0º. At 12 months, the mean lag improved to about 7.0º for finger and thumb extension and 31.0º for wrist extension. (p=0.005). Tweleve patients (80%) were able to return to their normal daily work while 3 patients felt some hesitancy which improved after physiotherapy.
Conclusion: The tendon transfer is a very successful treatment for irreversible radial nerve paralysis

Key words: wrist drop, radial nerve injury, tendon transfer

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Introduction :

Radial nerve palsy results in a severe handicap to normal hand function.[1] Tendon or muscle transfers restore balance to a hand crippled by loss of muscle function. They involve the same basic concept as all reconstructive surgery. Nothing is created; rather, remaining functional parts, or those that can be made functional, are redistributed into the best possible working combination. Irreversible radial nerve paralysis should be treated by tendon transfer reconstruction to improve wrist and fingers extension and stabilization of thumb joints.[2]

Tendon transfer for radial nerve paralysis has 100 years history and any set of tendons that can be considered to be useful has been utilized for this purpose.[3] The pronator teres (PT) is used for restoration of wrist dorsiflexion, while the flexor carpi radialis (FCR), flexor carpi ulnaris (FCU) and flexor digitorum superficialis (FDS) are variably used in each for fingers and thumb movements.[3,4] The tendon transfer for irreversible radial nerve palsy is very successful and probably the success is not related to type of tendon used for transfer. The grip is severely impaired following loss of radial nerve function as a result of loss of extension of wrist, metacar-

pophalangeal (MCP) joints and thumb. If radial nerve does not show neural recovery following conservative treatment or surgical repair, tendon transfer is considered the standard treatment.[5]

Radial nerve damage results in substantial functional limitations of upper extremity. No detailed data exist regarding long term results, patient satisfaction and professional and social re-integration after tendon transfer for ir-reparable damage to the radial nerve. The aim of the study is to evaluate the functional outcome of tendon transfer for wrist drop secondary to radial nerve injuries.

Materials and Methods:

This prospective study was conducted in orthopaedic and plastic surgery units of Khyber teaching hospital, Peshawar from September 2013 to August 2015 after taking permission from hospital ethical committee and informed consent from the patient. In this study fifteen consecutive patients of any age group and of both gender with irreversible low radial nerve paralysis who had intact elbow extension were included. These patients had normal hand function prior to injury with no musculoskeletal abnormalities and all of the hand and wrist joints to be supple with no contracture deformity at the time of tendons transfer. Patients with absent Palmaris longus (PL) tendon or associated ipsi-lateral injuries of the median or ulnar nerves were not included in the study.

All the patients were selected through non-probability consecutive technique. All the surgeons were well experienced with special interest and work experience in tendon transfer of atleast five years. All the surgeons used three tendons to restore lost functions of wrist, fingers and thumb. The pronator teres was transferred to both extensor carpi radialis brevis and longus to restore lost function of wrist extension. The Palmaris longus was transferred to extensor pollicis longus to restore thumb extension and some abduction. The Flexor carpi ulnaris is transferred to extensor digitorum and extensor indicis to restore fingers extension.The transferred tendons were well detached as distally as possible to avoid the complication of tendon shortness to reach the target tendons.

After operation, a volar forearm cast was applied for a period of 4 weeks keeping wrist in 40^0 extension and metacarpophalangeal joints of fingers in full extension with thumb radially abducted and extended. At this time, sutures were removed and supervised physical therapy begun. A removable custom molded splint keeping the wrist, fingers and thumb in post operative position was worn at night and between physical therapy sessions for approximately 3 months post operatively. After surgery patients were followed up for a year i-e every month during the first 6 months and then every 3 months for the next 6 months. The ranges of movement of the wrist (wrist extension), MCP joints of the fingers (fingers extension) and extension of the thumb were evaluated pre-operatively and at each follow-up using goniometer. Patients were asked about their return or not to normal activities of daily living and return to work, where appropriate. The mean post-operative follow-up was 12 (3–18) months.

All the data was recorded on standardized proforma. Bias and confounders in the study were controlled by strictly following the exclusion criteria. The data was analyzed with the help of computer software SPSS for windows version 17. For categorical variables, frequencies were calculated while for continuous variables, mean and standard deviation were calculated.

Results:

A total number of 15 patients were included in the study. One was female and fourteen were male patients. The age range was 25 – 50 years (mean 37.13 years ± 8.17). 12 patients had radial nerve palsy on right side while 3 patients had on left side. 10 patients had road traffic accident with comminuted open humeral fracture while 5 patients had penetrating injuries with irrepairable damage to radial nerve.

Preoperatively, compared with the normal hands, the mean finger extension lag was 77.0^o with the wrist extended and the mean thumb

Table 1: Pre and post-operative range of motion of the wrist and fingers

Range of motion	Normal side	Injured side			Difference between normal and injured sides	
		Pre-op	Post-op	P-Value	Pre-op	Post-op
Wrist extension	75.0°	0.0°	44.0°	0.005	75.0°	31.0°
Finger extension	175.0°	98.0°	168.0°	0.005	77.0°	7.0°
Thumb extension	170.0°	110.0°	163.0°	0.005	65.0°	7.0°

extension lag was 60.0°. No patient was able to extend the wrist up to neutral. At 12 months, the mean lag improved to about 7.0° for finger and thumb extension and 31.0° for wrist extension, respectively (p=0.005). Table 1.

Twelve patients (80%) were able to return to their normal daily work after 8-10 weeks while 3 patients felt some hesitancy which improved after physiotherapy.

Discussion:

Majority of the authors believe in the fact that tendon transfers will result in good outcomes in cases of radial nerve palsy with irreparable damage or reconstruction failure; however, there is continuing dispute as to the best combination of tendon transfers in patients with radial nerve palsy, although the standard transfers are commonly performed with success.[6,7] Burkhalter believed that the greatest functional loss in the patient with radial nerve injury is weakness in grip and recommended an early PT to ECRL transfer to eliminate the need for an external splint.[8] In radial nerve palsy, the PT is the most common motor donor used to restore wrist extension.[9]

Our study showed that transfer of PT, PL and FCU tendon results in an acceptable restoration of wrist, thumb and fingers extension and the result was comparable to other studies.[10] Tsuge presented two series of patients with two different methods of triple tendon transfer. The mean wrist extensions were reported in his series as 36° and 32° in his two groups and 31° in our patients. Extension of the fingers was also favorable in our series, which was 7°, as compared to 4° and 3° in his two groups. All the patients in our series were able to extend the fingers and move them separately. They were also able to flex their fingers to make a full fist. We did not measure the power of the grip because of lack of equipment. Though surely this is a limitation of the study, it may be considered that power of grip differs among individuals, and even between the two hands in the same individual, both sides cannot be of equal strength, so grip is not a good parameter for comparison.

In our study 80% of the patients were able to return to normal activities without any difficulty, while 3 patients had experienced some difficulties, for which we could not find a good reason.

The limitation of our study was the fact that we did not measure the more detailed and specific scores of hand function such as "Jebsen-Taylor" test. In fact, we aimed to assess overall function of the upper extremity and not a detailed one.

Conclusion:

We conclude that tendon transfer is a viable option and is a very successful treatment for irreversible radial nerve paralysis.

Conflict of Interest: None

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Role and contribution of authors:

Dr Muhammad Salman, collected the data and references and wrote the initial writeup

Dr Muhammad Bilal, helped in collecting the references and data

Dr Tamjeed Gul, critically went through the article and improved the introduction, methodology, result and conclusion writing

Dr Muhammad Ayaz Khan, critically review the article and gave the final touchup

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