

A Comparative Study on Tendon Transfer Surgery for Median and Radial Nerve Injuries

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ABSTRACT

Background: Median and radial nerve injuries are very frequent in patients admitted at our trauma department for upper limb injuries.

Aim of Work: To perform a study on tendon transfer surgery for median and radial nerve injuries.

Methods: Eight cases of median nerve injury (Group A) and eight cases of radial nerve injury (Group B) were included in our study.

Group A was further subdivided into group A1 and group A2, each including four cases.

In group A1, opponensplasty was performed using extensor indices tendon transfer, via dissecting the tendon till the level of extensor retinaculum at the dorsal wrist level, tendon transfer performed through subcutaneous tunnels, using pisiform bone as hammock and suturing the tendon at the recipient site to the abductor pollicis brevis muscle.

In group A2, opponensplasty was performed using extensor indices tendon transfer, via dissecting the tendon till the level of its musculotendinous junction at the distal region of the dorsum of the forearm, tendon transfer performed through deep tunnels, using ulnar styloid process as hammock and suturing the tendon at the recipient site to the abductor pollicis brevis muscle and the capsule of metacarpophalangeal joint of the thumb.

Group B was further subdivided into group B1 and group B2, each including four cases.

In group B1, triple transfer was performed, using subcutaneous tunnels, with creating an angle of 45 degrees between the donor and recipient tendons at suturing site. Fish mouth weaving technique was used.

In group B2, triple transfer was performed, using deep tunnels, with creating an angle of more than 45 degrees between the donor and recipient tendon at suturing site. Fish mouth weaving technique was used.

Results: According to our study, it has been found that it may be better during performing opponensplasty to; dissect the extensor indices muscle till the level of its musculoten-

dinous at the distal region of the dorsum of the forearm, dissect tunnels at deep plane for tendon transfer, use ulnar styloid process as hammock and include the capsule of the metacarpophalangeal joint of the thumb during suturing technique.

It has also been found that it may be better during performing triple tendon transfer for radial nerve injury to; dissect tunnels at superficial plane and create an angle 45 degrees between the donor and recipient tendon at suturing site.

Key Words: *Opponensplasty – Triple transfer – Median nerve – Radial nerve.*

INTRODUCTION

Injuries of radial nerve and median nerve in the upper extremity, are common [1] and can result from orthopedic injuries; radial nerve injuries associated with fractures of the humerus are the most common nerve lesions in long bone fractures, the incidence of these injuries with fractures of humeral shaft is 5-10 percent [2].

The radial nerve may be injured by the force which fractures the humeral shaft [3], directly with contusion or laceration by a bone spur or by traction when the bone ends are forcibly separated, spontaneous recovery occurs in a large percentage of cases, that is the reason for controversy about timing of surgical intervention [4].

Other causes include, surgical management of orthopedic injuries [5], direct nerve trauma [6], as a part of brachial plexus injury [7], nerve compression [8], nerve tumors [9], local inflammation and idiopathic neuritis [10].

The most appropriate management depends on the cause, the level and extent of the injury or lesion, the degree of functional impairment, and the duration of the problem. Injuries in the low

arm or forearm can usually be managed by direct repair or reconstruction with nerve grafts, offering restoration of function [11].

Proximal nerve injuries near the axilla or higher are especially problematic because of the distance and time required for reinnervation, and any delay in treatment will result in further worsening of the outcome [12], in such cases or in cases of long standing palsy, reconstruction with tendon transfers is the mainstay of treatment [13].

Radial nerve injury results in loss of wrist, finger and thumb extension, traditionally radial nerve palsies that fail to recover spontaneously have been reconstructed with tendon transfers [14].

The opposable thumb is invaluable to man for the function of grasp. Power and precision, which are both necessary for normal grasp, are dependent on this action of opposition, when lost, it can be restored by a variety of tendon transfer techniques. The best results are obtained when, following the accurate assessment of the hand and obtaining a full range of passive movement of the thumb, a technically exacting tendon transfer is done, using a suitable motor with a pulley system to make the transfer pull in the direction of the pisiform or ulnar styloid [15].

Many techniques have been described restoration of opposition in the paralysed thumb, such as using the flexor digitorum superficialis tendon or the extensor indices tendon for opponensplasty [16].

PATIENTS AND METHODS

The present work included sixteen patients, eight patients presenting with median nerve palsy and eight patients presenting with radial nerve palsy, who were managed at Kasr Al-Aini Hospital (Cairo University) Department of Plastic Surgery, between 2014-2017. All the cases included in our study are having traumatic proximal nerve injuries. The age range is 12 to 28 years including fifteen males and one female. Nerve repair has been done for all cases included in the study for the aim of restoring sensation.

Group A included eight patients with median nerve palsy, is further subdivided into group A1 (4 cases) and group A2 (4 cases). Group B included eight patients with radial nerve palsy, is further

subdivided into group B1 (4 cases) and group B2 (4 cases).

Opponensplasty using extensor indices tendon transfer, is performed in all patients in group A, however the detailed technique of tendon transfer surgery is not the same in the subgroups (A1 & A2).

Triple tendon transfer including, flexor carpi radialis to extensor digitorum sublimis, palmaris longus to extensor pollicis longus, pronator teres to extensor carpi radialis brevis, is performed in all patients in group B, the detailed technique of tendon transfer surgery is not the same in the subgroups (B1 & B2).

Opponensplasty for group A1 patients, included, dissecting the tendon till the level of extensor retinaculum at the dorsal wrist level, tendon transfer performed through subcutaneous tunnels, using the pisiform bone as hammock and suturing technique included the abductor pollicis brevis muscle at the recipient site.

Opponensplasty for group A2 patients, included, dissecting the tendon till the level of its musculotendinous junction at the distal region of the dorsum of the forearm, tendon transfer performed through deep tunnels, using ulnar styloid process as hammock and suturing technique included the abductor pollicis brevis muscle and the capsule of the metacarpophalangeal joint of the thumb.

Triple transfer for group B1 patients, included, dissecting subcutaneous tunnels for tendons transfer, with creating an angle of 45 degrees between donor and recipient tendons at the suturing site, the repair was done using fish mouth weaving technique.

Triple transfer for group B2 patients, included, dissecting deep tunnels for tendons transfer, with creating an angle of more than 45 degrees between the donor and recipient tendons at the suturing site, the repair was done using fish mouth weaving technique.

In group B, two cases were found to have absent palmaris longus muscle, in which the tendon of flexor digitorum superficialis muscle of the middle finger was used instead, one case was included in group B1 and the other case was included in group B2.

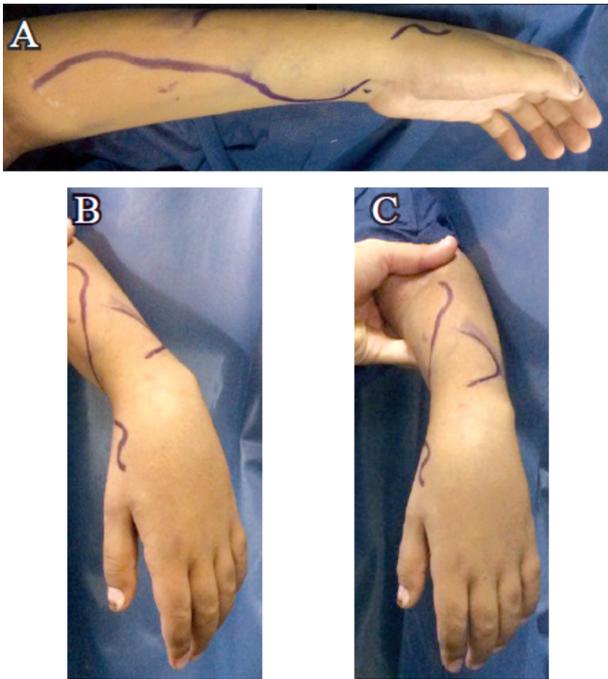


Fig. (1): Pre-operative photos of patient with radial nerve palsy revealing thumb, finger & wrist drop.



Fig. (2): Pre-operative photo of patient with median nerve palsy, revealing incision landmark.

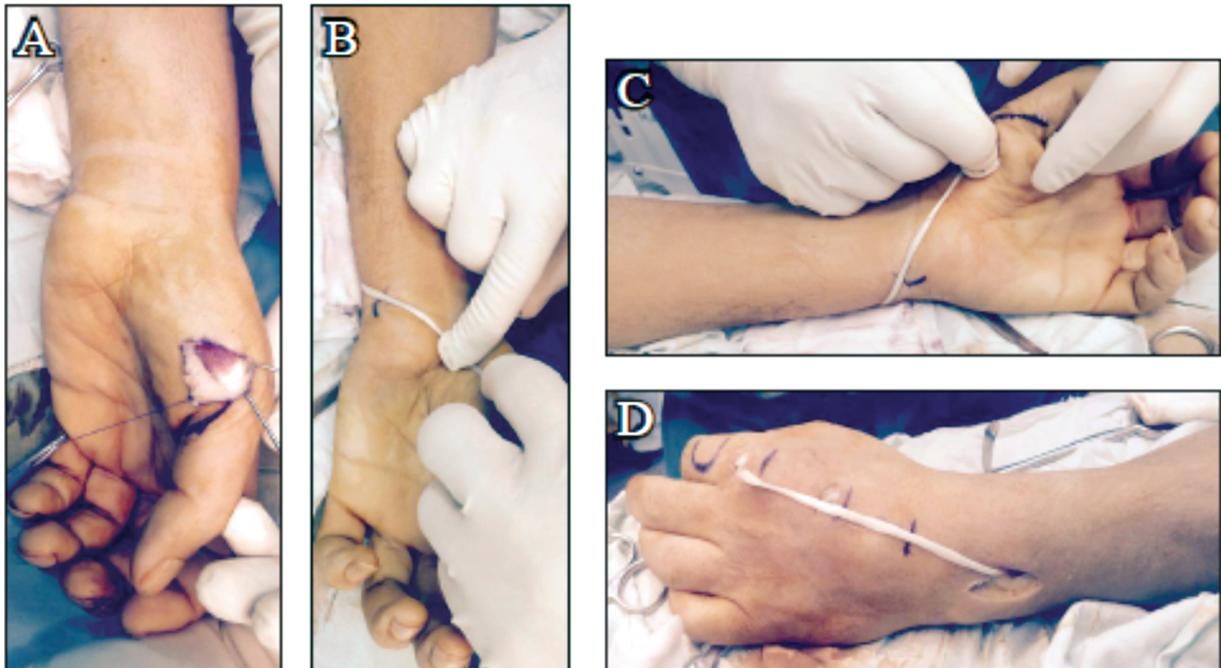


Fig. (3): Intra-operative photos of patient with median nerve palsy, during harvesting of donor tendon.

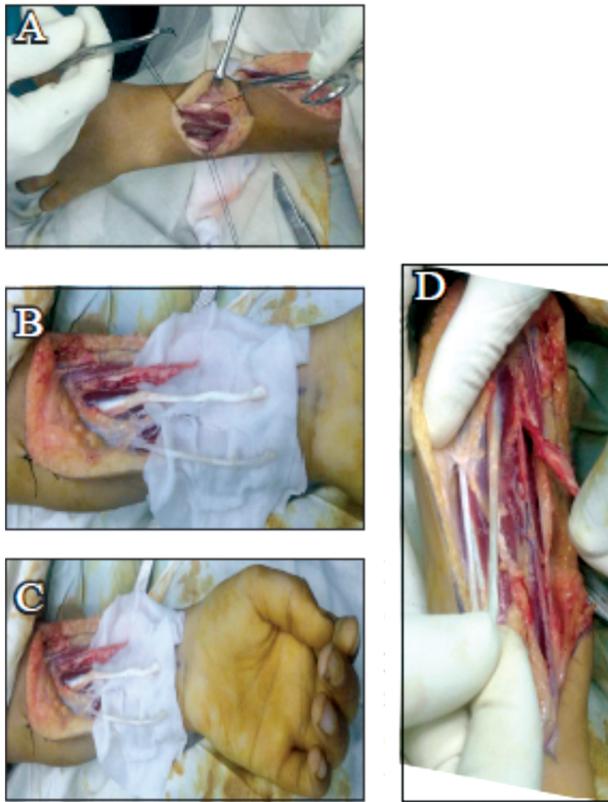


Fig. (4): Intra-operative photos of patient with radial nerve palsy, during dissection of donor tendons.

RESULTS

Sixteen patients are included in this study, fifteen males and one female. The mean age of the patients is 20 years. In all the patients included in our study, the etiology is trauma.

Assessment of the patient’s outcome is done according to the following criteria; full range of active joint movement after finishing physiotherapy, incidence of postoperative tendon suture dehiscence, period of postoperative pain, period of postoperative edema and presence of postoperative hematoma.

Full range of active joint movement, is achieved in three cases out of four in group A1 (75%), all cases in group A2 (100%), all cases in group B1 (100%), and in two cases out of four in group B2 (50%).

Postoperative tendon suture dehiscence, occurred in one case out of four in group A1 (25%), didn’t occur in groups A2, B1 and B2.

Postoperative pain, haven’t occurred in any patient in group A1, occurred in one patient out of four in group A2 (25%), occurred in one patient

out of four in group B1 (25%), and lastly occurred in two patients out of four in group B2 (50%).

Postoperative edema, haven’t occurred in any patient in group A1, occurred in one patient out of four in group A2 (25%), haven’t occurred in any patient in group B1, and lastly occurred in two patients out of four in group B2 (50%).

Postoperative hematoma, haven’t occurred in any patient in group A1, occurred in one patient out of four in group A2 (25%), haven’t occurred in any patient in group B1, and lastly occurred in one patient out of four in group B2.

In our study, 10 patients were followed for 8 months, 2 patients were followed for 6 months and 4 cases were followed for 45 days.



Fig. (5): Post-operative photos of patient after performing opponensplasty revealing absence of extension lag at donor finger.

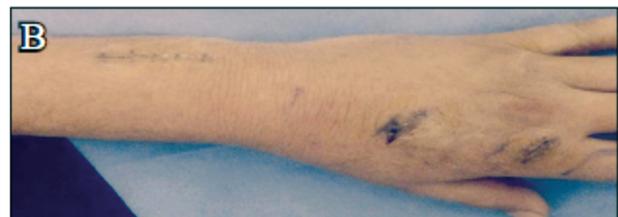


Fig. (6): Post-operative photos of patient after performing opponensplasty revealing a linear scar at the dorsum of forearm to facilitate tendon dissection till level of musculotendinous junction.

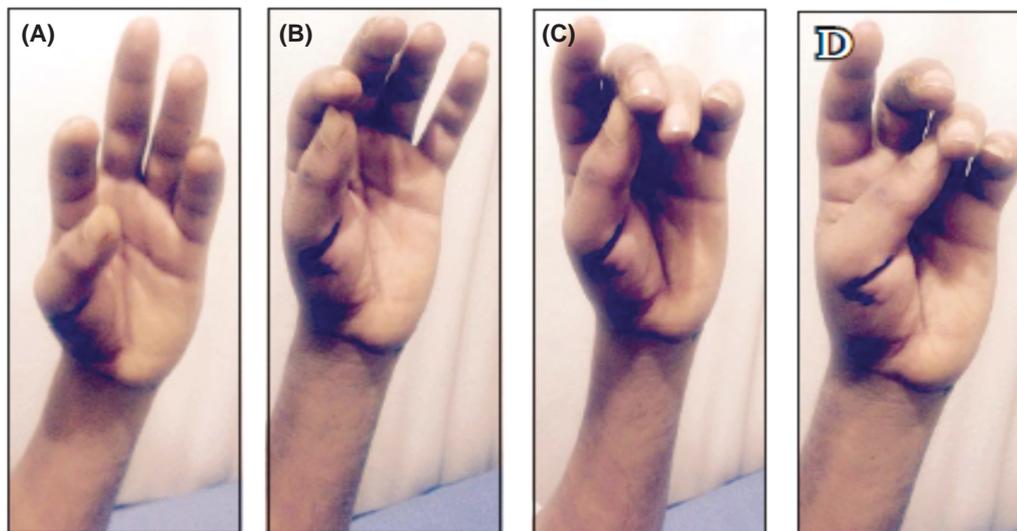


Fig. (7): Photos after 2 weeks of opponensplasty.

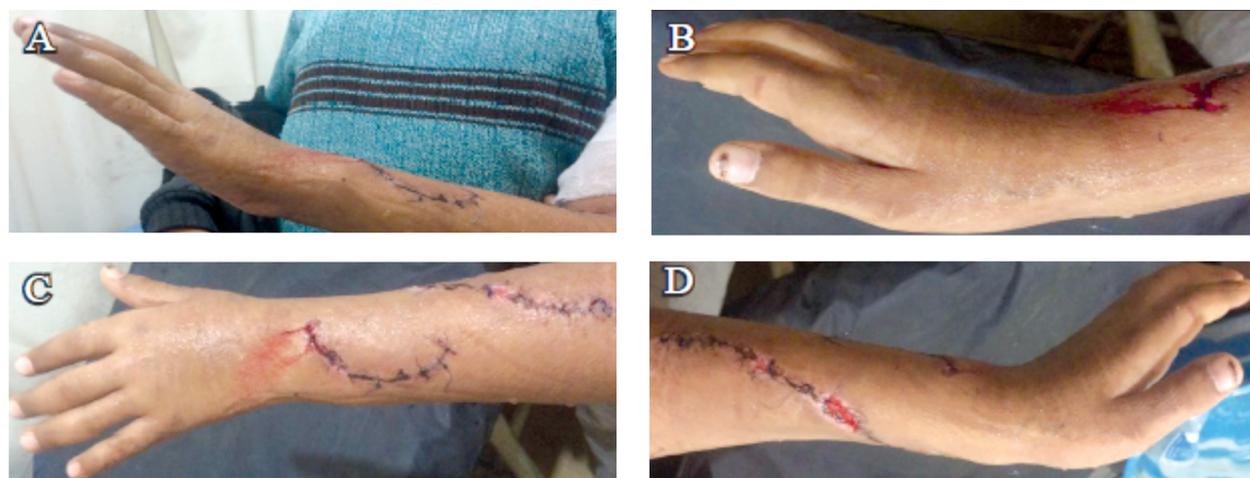


Fig. (8): Post-operative photos, after triple transfer for radial nerve palsy.

Table (1): Criteria of assessment of patient's outcome.

	Group A 1	Group A 2	Group B 1	Group B 2
Full range of active joint movement	75%	100%	100%	50%
Post-operative tendon suture dehiscence	25%	–	–	–
Post-operative pain	–	25%	25%	50%
Post-operative edema	–	25%	–	50%
Post-operative hematoma	–	25%	–	25%

DISCUSSION

Our study proved that some fine modifications in the surgical techniques of tendon transfers for median and radial nerve palsies, may affect surgical outcome and patient satisfaction.

According to our study, during opponensplasty, dissecting the extensor indices tendon till the level

of its musculotendinous junction may be beneficial in achieving, postoperative full range of active movement of 1st metacarpo-phalangeal joint and decreasing the risk of post-operative tendon suturing dehiscence.

It may be better to fix the tendon by sutures to both the abductor pollicis brevis muscle and the capsule of the 1st metacarpophalangeal joint, in order to minimize the risk of postoperative tendon suturing dehiscence.

During opponensplasty, using ulnar styloid process as a hammock may be better than using the sesamoid bone (pisiform), in terms of achieving better opposition of the thumb, for the function of grasp.

During triple tendon transfer for radial nerve palsy, it may be better to keep an angle of 45 degrees between the donor and recipient tendons

at suturing site in order to achieve full range of active joints movement. According to our study, the fish mouth weaving suturing technique is an excellent technique with no incidence of postoperative tendon suturing dehiscence.

Dissection through deep tunnels, may be associated with increased risk of post-operative pain, edema and hematoma.

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