Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 1 January 2023

Case Report

Multiple Tendon Transfer in Radial and Ulnar Nerve Palsy Using WALANT: Case Report

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Received: October 27, 2022

Published: December 05, 2022

Abstract

In the current scenario in hand surgery and microsurgery, there has been an exponential development in Wide Awake Local Anesthesia with No Torniquete techniques (WALANT). We present the case of a male with chronic injury of the radial and ulnar nerves. With extension deficit of the wrist and fingers in addition to ulnar claw. Tendon transfers were performed with WALANT technique, which allowed us to evaluate the exact tension required for the patient. We transferred pronator teres to extensor carpi radialis brevis, flexor carpi radialis to extensor digitorum communis and palmaris longus to extensor pollicis longus. We also performed a fourth transfer for the ulnar claw with Zancolli technique. Patient completed painless surgery with 6-hour analgesia.

Six months later after triple tendon transfer surgery for radial nerve palsy and correction of the ulnar claw, the patient achieved extension of the wrist, fingers and thumb, opening and closing of the hand, with excellent function and mobility, which allows him to perform most daily activities without major difficulty.

We conclude that the WALANT technique represents a reliable and safe alternative to perform multiple tendon transfers, being an easy and reproducible technique, with intraoperative utility to be able to dynamically evaluate the result of the repair and with postoperative benefits, by allowing the patient to initiate early movement.

Keywords: WALANT; Surgery; Tendon

Introduction

Radial nerve injury is the most common among the major nerves of the upper extremity due to its intimate relation with the humeral shaft and its long and tortuous path. It may be affected acutely, mainly associated with fractures of the humeral shaft, or chronically by entrapment or compression. When faced with an irreparable injury either at the level of the brachial plexus or in chronic palsy, tendon transfers are presented as an excellent alternative [1].

Among the existing options, the Brand technique consisting of transfers from pronator teres (PT) to extensor carpi radialis brevis (ECRB), palmaris longus (PL) to extensor pollicis longus (EPL) and flexor carpi radialis (FCR) to extensor digitorum communis (EDC), has been shown to have good results, with recovery of both the extension of the wrist, as well as the extension of the thumb and fingers [2].

In the current scenario in hand surgery and microsurgery, there has been an exponential development in Wide Awake Local Anes-

thesia with No Torniquete techniques (WALANT), with the combined use of local anesthetic (Lidocaine) and vasoconstrictor (Epinephrine). This tendency was driven more than 10 years ago by D. Lalonde and has been gaining followers in various countries over the last few years: either for the good results obtained, without observing the most feared complication and mythologized digital necrosis associated with epinephrine use; or the need to adapt to the crisis produced by the COVID-19 pandemic, in which access to the operating theater and the availability of anesthetists was severely limited, especially in elective procedures [3,7].

Particularly in tendon surgery, since the beginning of WALANT technique in Canada in 2002 by the Dalhousie University Group, good results were observed in primary tenorrhaphy and single tendon transfers such as extensor indicis proprius (EIP) to EPL [8,9]. WALANT transfers of flexor digitorum superficialis (FDS) to flexor pollicis longus (FPL) [10], FDS to flexor digitorum profundus (FDP) [11] and thumb opponensplasty for leprosy patients have also been described [3].

For more proximal tendon transfers, such as those required for radial nerve palsy, literature is still scarce, however in 2020 Shalimar Abdullah., *et al*. published the use of WALANT technique to perform this procedure, which was reproduced in 2022 by Fahandezh-Saddi., *et al.* in both cases with excellent results.

From this last publication arises the motivation to apply the WALANT technique for the tendon transfers with Brand's technique for radial nerve palsy and associate a fourth tendon transfer by performing the correction of the ulnar claw with the Zancolli Loop technique [14]. The following is the medical history, preoperative physical examination, anesthetic technique, step by step surgery and postoperative functional result.

Case Report

A 23-year-old male patient. High-speed motorcycle accident. Admitted with the diagnosis of mangled upper extremity, with stripping of the anterolateral arm, bone exposure of a fractured humerus and closed fracture of both forearm bones. The brachial artery and median and ulnar nerves were unscathed (Figure 1 and 2).

Figure 1: Forearm stripping.

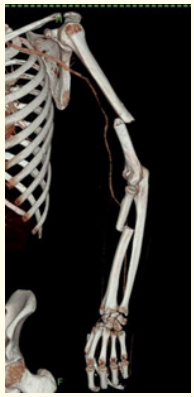

Figure 2: Preoperative computed tomography.

In emergencies, surgical cleaning, reduction and external fixation were performed. After 10 days second time; reduction and osteosynthesis with plaques in humerus and forearm. In the immediate postoperative period, radial and ulnar nerve palsy stood out, traction injury was impressive, so conservative management and observation were indicated.

In postoperative controls; bone consolidation of fractures is observed at 8 months (Figure 3), however, despite kinesic treatment it persists with radial nerve palsy (Figure 4) and ulnar nerve which progresses to ulnar claw (Figure 5), so tendon transfer is indicated, which is deferred up to 2 years after the injury in the context of the COVID19 pandemic.

Radial tendon transfer and ulnar claw correction are performed with the technique described below.

Figure 3: X-ray of 8 months postoperative.

Figure 4: Inability to extend the wrist due to radial paralysis.

Figure 5: Ulnar claw secondary to long-standing paralysis.

Description of anesthetic and surgical technique

First 200 ml of WALANT anesthetic solution is prepared; of 1:400,000 epinephrine, 0.25% lidocaine buffered with bicarbonate.

The infiltration technique was performed according to what was published by Shalimar Abdullah., *et al.* [12] adding a sixth site of injection in palmar region for the correction of the ulnar claw.

STEP 1) Surface injection for 30ml PT; First we perform a superficial plane of subcutaneous and muscular.

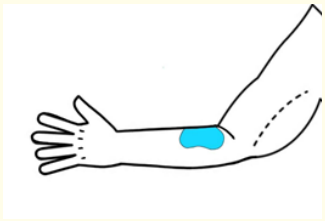

Figure a

STEP 2) Deep injection for PT of 10 ml ; reaching periosteum and infiltrating in different directions.

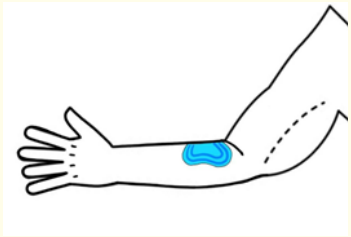

Figure b

STEP 3) Injection for EPL, EDC, and >20 ml ECRB; Infiltration is performed from proximal to distal, waiting for the infiltration halo to cause an anesthetic effect in the region proximal to the puncture zone.

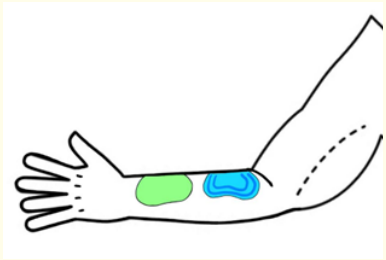

Figure c

STEP 4) Injection for PL and FCR of >20 ml; It is performed in the distal area of the forearm where the section of both tendons is made.

STEP 5) Injection for PT-ECRB >20 ml; It infiltrates between 1 and 3 extensor zone.

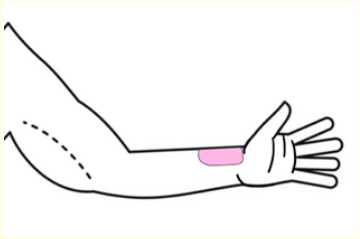

Figure d

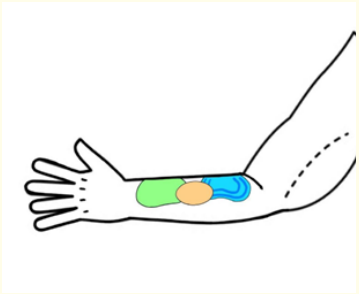

Figure e

STEP 6) Palmar injection in relation to flexor zone 3 and A1 pulleys of >20 ml starting with central area that advances towards both ulnar and radial ends.

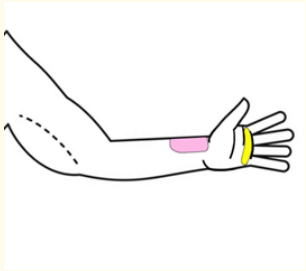

Figure f

Surgical technique

30 minutes after the infiltration of the anesthetic solution, the intervention begins, which is performed on a hand table and without the use of a tourniquet.

Initially, the flying boarder is marked to rescue PL and FCR and for dorsal approach for the identification of PT, ECRB, ECD and ELP.

By dorsal approach of the forearm (Figure 6), PT is proximally identified and released with periosteal flap, then step to dorsal to perform tenorrhaphy with Pulvertaft to ECRB technique, achieving adequate tension for wrist extension.

The ELP is identified and rescued by the floor of 4 compartments, Distal section of PL, It is performed step to dorsal through a subcutaneous tunnel and is fixed by 4 steps with Pulvertaft technique, achieving adequate tension, which is verified with active movement of the patient.

FCR is sectioned to distal, passed through the subcutaneous tunnel to the RCD, passed through each of the extensor tendons, interlacing all sutures with PDS 3.0. Passive and active extension of all fingers is checked with adequate excursion.

Figure 6: Image of the dorsal approach after transfers.

Figure 7: Image of the flying boarding after transfers.

In the second surgical period, a transverse palmar approach is performed at the level of pulleys a1 from finger 2-5 (Figure 8). Dissection by planes respecting neurovascular structures. Zancolli technique for ulnar claw is performed. Surface flexor section is performed with A1 pulley plicatura with the same surface flexor to achieve phalangeal metacarpal flexion.

Correction of the clawed hand is checked with the patient awake.

Plaster valve for protection.

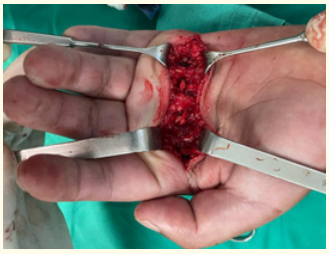

Figure 8: Palmar approach at pulley level A 1 from 2nd to fifth finger.

Performs active mobilization rehabilitation process after immobilization of two weeks with gypsum leaflet. In the follow-up to 6 months, patient achieves wrist extension to neutral position, complete extension of the thumb, partial extension of the fingers and correction of the ulnar claw deformity, recovering MTF flexion and possibility of making a fist.

Figure 9: Wrist extension to neutral position and finger extension.

Figure 10: Thumb extension.

Figure 11: Metacarpophalangeal flexion and fist.

Currently performing tasks of daily living independently.

Discussion

This article describes a multi-tendon transfer surgery using WALANT technique for the treatment of concomitant radial and ulnar nerve palsy, secondary to high-energy trauma with associated bone lesions and previous multiple interventions.

The preoperative state, surgical technique step by step, dose of local anesthetic and corresponding location, and immediate functional result and late postoperative period are described.

Previously, two cases of tendon transfers have been described using WALANT for the treatment of radial palsy [12,13], as in our case, the repair is performed with a triple transfer; using transfer from PT to ECRB, PL to EPL and FCR or FCU to EDC, in our case we decided not to use the FCU with the objective of not intervene in the path of the ulnar nerve and avoid the injury.

However, our case adds a fourth tendon transfer for the correction of the ulnar claw, using "Lazo technique" described by Zancolli in 1974 [14,15], the association of these two surgical techniques of tendon transfers there are not reported using WALANT.

To perform this surgery, we used the infiltration points of the forearm indicated by Lalonde, used by S. Abdullah [12] for the triple radial transfer, however, we added a sixth palmar infiltration point for the fourth tendon transfer in relation to flexor zone 3 with 20 ml of solution , maintaining a total of 200 ml of the solution distributed in the forearm, achieving 3 hours of painless surgery.

In our case, the sequence of radial transfers were performed using the same order previously described; it starts with PT to ECRB, followed by FCR to EDC, ending with PL to EPL. In a second stage, the transfer of the superficial flexor of the fingers is carried out, sectioning the tendon at the level of pulley A1 and suturing on itself at the same level, achieving correct flexion of the MCF articulations. At the end of both surgical times, adequate passive and active excursion of the transferred tendons is verified with the cooperation of the awake patient.

We believe that the use of the WALANT technique in upper limb procedures such as tendon transfers, which requires the dynamic evaluation of the tension and excursion of the transferred tendon, represents a greater benefit compared to the use of conventional anesthesia with neuromuscular blockade, allowing to observe the tendon tension against active movements, evaluate the resistance of the suture technique used for tenorrhaphy and perform the adjustment of the repair tension when evaluating this against the normal physiological stress of flexo extension in the intraoperative.

In addition, as in previous reports [12,13], we agree that the fact that the patient is awake and cooperates by performing the movements indicated, represents a positive factor for subsequent rehabilitation, being able to experience immediately how the brain adjusts to the new function of the transferred tendon, the range of mobility and its resistance.

Although the cases reported so far describe satisfactory functional results [12,13], there is a lack of standardized tools for measuring upper extremity functionality such as DASH score, which allows objectifying the clinical improvement after transference, this, associated with the fact that most of the scarce evidence available are isolated case reports. makes imperative the need to generate evidence that compares the functional outcomes, complications and cost effectiveness of technique compared to the use of conventional anesthesia, in order to support and promote the WALANT technique in upper limb tendon transfer surgery [16].

Conclusions

The WALANT technique represents a reliable and safe alternative for multiple tendon transfers. Although there is no evidence comparing the benefits of WALANT technique vs conventional anesthesia technique in this type of intervention, we recommend this technique by granting a dynamic intraoperative evaluation of the excursion, tension and quality of the tendon transfer which facilitates the surgeon work and also allows the patient to instantly experience the functional effect of the transfer which facilitates early mobilization and rehabilitation, improving functional outcome.

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