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Original article

## Surgical treatment and functional outcomes of multicomponent soft tissue injuries of the wrist

### *Traitement chirurgical et résultats fonctionnels des lésions pluritissulaires des parties molles du poignet*

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#### ARTICLE INFO

##### Article history:

Received 6 June 2017

Received in revised form 7 December 2017

Accepted 9 February 2018

Available online xxx

##### Keywords:

Spaghetti wrist

Flexor zone V

Tendon

Artery

Nerve

Repair

##### Mots clés :

Poignet spaghetti

Tendons fléchisseurs

Zone 5

Tendon

Artère

Nerf

Réparation

#### ABSTRACT

The aim of this study was to emphasize the importance of early surgical treatment of multicomponent soft tissue injuries of the wrist. A retrospective review was performed on 156 patients with multicomponent soft tissue injuries of the wrist who were treated between July 2007 and July 2015. All the patients included in the study were operated within the first 36 hours of the injury and were hospitalized after the surgery based on the extent of their injury. The patients were evaluated in terms of age, gender, etiology, injured structures, total number of damaged structures, mean follow-up time, complications and reoperation. The results were evaluated based on tendon function, opposition, intrinsic muscles, deformities and sensation. According to these criteria, excellent results were obtained in 81.6% to 88.8% of the patients. Poor results were found in less than 4 percent of the patients. In conclusion, we believe that early surgical management of multicomponent soft tissue injuries of the wrist, a meticulous approach and regular physical therapy are required to achieve good functional outcomes.

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#### R É S U M É

Le but de cette étude était de souligner l'importance du traitement chirurgical précoce des lésions des parties molles du poignet. Une étude rétrospective a été réalisée pour 156 patients avec lésions pluritissulaires des parties molles du poignet qui ont été traités entre juillet 2007 et juillet 2015. Tous les patients inclus dans l'étude ont été opérés dans les 36 premières heures de la blessure et ont été hospitalisés après la chirurgie en fonction de l'étendue de leur blessure. Les patients ont été évalués en fonction de leur âge, de leur sexe, de l'étiologie, des structures blessées, du nombre total de structures endommagées, de la durée moyenne de suivi et les données concernant les complications et la réintervention. Les résultats ont été évalués en fonction de la fonction tendineuse, de l'opposition, des muscles intrinsèques, des déformations et de la sensibilité. Selon ces critères, d'excellents résultats ont été obtenus chez 81,6 à 88,8 % des patients. Dans seulement moins de 4 pour cent des patients, de mauvais résultats ont été observés. En conclusion, nous croyons que la prise en charge chirurgicale précoce des blessures pluritissulaires des parties molles du poignet, une approche méticuleuse et une rééducation régulière sont les moyens nécessaires pour obtenir de bons résultats fonctionnels.

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## 1. Introduction

Multicomponent soft tissue injuries of the wrist, also known as the “Full House Syndrome,” “Spaghetti Wrist Injuries,” or the “Suicide Wrist,” are consistent with injuries that occur between the distal wrist crease and the flexor musculotendinous junction in which at least three structures—including at least one nerve and often an artery—are completely transected [1]. Although the exact definition varies, this condition was first described by Puckett and Meyer in 1985. There are 16 functional structures in the volar aspect of the wrist: 12 flexor tendons, 2 arteries and 2 nerves. The complexity of the surgical procedure and the overall rehabilitation process tend to escalate with the number of total structures injured [2]. In contrast, a patient in whom both the ulnar and median nerves are completely severed along with any one of the flexor tendons may have devastating functional deficiency, even though only 3 of the 16 structures are affected.

Although multicomponent soft tissue injuries of the wrist are seen relatively frequently and can be of considerable importance due to devastating functional outcomes, there is relatively little data in literature about this specific type of injury. The available studies included only a limited number of patients.

There are many different causes of these injuries. In our group of 156 patients, there is a clear predominance of young and middle-age male patients over all other subgroups. There is little mention and emphasis in the published literature of this undeniable male predominance in distal volar wrist injury. As a matter of fact, in the limited available literature and data about these lacerations, there is not much emphasis on the etiologic factors for this type of injury.

The aim of this study was to identify the key points that may affect functional outcomes in multicomponent soft tissue injuries of the wrist. In this study, we describe an unprecedented number of 156 patients of all ages with multicomponent soft tissue injuries of the wrist. This cohort is very diverse as we have patients of both genders and all ages with different injury mechanisms and a very wide spectrum of injured structures. Our goals in this study were:

- to point out the etiological causes and demographic characteristics of this type of injury;
- to analyze the surgical strategies and functional outcomes in a large number of patients;
- to compare our results and the assessment and management strategies with those of the previous studies;
- and to emphasize the importance of early surgical intervention as well as the importance of early passive and active physical therapy on the final functional outcome.

## 2. Material and methods

A retrospective review was performed of 156 patients with multicomponent soft tissue injuries of the wrist treated between July 2007 and July 2015 at our department of plastic, reconstructive, aesthetic, and hand surgery. All were admitted to the emergency room of our university hospital. Patients included in our study were operated on within the first 36 hours of the injury and then hospitalized after the surgery, depending on the extent of their injury. Information on the patients' age, gender, etiology, injured structures, total number of damaged structures, as well as mean follow-up time, complications and reoperations is shown in Table 1.

All injured structures were repaired using microsurgical techniques. The severed nerves were repaired using microsurgical epineurial suturing technique with 9/0 or 10/0 polypropylene sutures. In some cases, nerve release was required to relieve

**Table 1**

Summary of patient data including demographics, etiology, affected structures, complications, and reoperation.

Total number of patients	156
Mean age (years)	24.8 (6–61)
Male/Female ratio	7.7/1
Most common mechanism of injury	Glass-related laceration
Total number of reconstructed structures	1256
Total number of repaired tendons	903
Total number of repaired nerves	209
Total number of repaired arteries	146
Most commonly severed tendon	Flexor carpi ulnaris (FCU)
Most commonly severed nerve	Ulnar nerve
Most commonly severed artery	Ulnar artery
Mean follow-up time in months (range)	20.1 (6–40)
Number of patients with complication	8
Number of reoperations	8

tension on the proximal and distal nerve endings. During the nerve release, the vasa nervorum was preserved as best possible. No nerve graft was required during the primary nerve repair. Likewise, transected arteries were anastomosed under microscope using 8/0 or 9/0 polypropylene sutures. The core sutures for the damaged tendons were applied using 3/0 or 4/0 polypropylene sutures with round-tip needle followed by addition of 5/0 polypropylene sutures for epitendinous repair.

The outcomes were evaluated based on the criteria presented by Noaman [2], namely: tendon function, opposition, intrinsic function, deformities, and sensation (Table 2). Each of these criteria was evaluated and the results were rated as excellent, good, fair, and poor, except for deformities, which were rated as major or minor:

Tendon function was rated excellent if individual tendon function was evident with 85% to 100% range of motion or finger flexion to 1.0 cm or less from the distal palmar crease; good with 70–84% total normal range of motion or 2.0 cm from the distal palmar crease; fair with 50–69% total normal range of motion; or poor if fixed contractures or adhesions were present.

Opposition was rated excellent if the tip of the thumb moved freely over the three phalanges of the other four fingers; good if the tip of the thumb touched only the tip of the other four fingers; and poor if the tip of the thumb could not reach the tips of the other four fingers.

Intrinsic function was rated as excellent if the patient could do both finger abduction and adduction with no Froment's sign; good if the patient could do both finger abduction and adduction and had Froment's sign; fair if the patient could do either finger abduction or adduction and had Froment's sign; poor if the patient could not do finger abduction or adduction and had Froment's sign.

Deformities were rated as major if both claw hand and ape hand were present; minor if either claw hand or ape hand was present.

Sensation was rated excellent if two-point discrimination was less than 10 mm; good if two-point discrimination was 10–20 mm; fair if two-point discrimination was more than 20 mm with light touch and pain prick sensation; and poor if there were trophic changes or skin ulceration [2].

Even though not all patients showed the same level of compliance in the recommended therapy (which we believe hindered the rehabilitation process, ultimately leading to a negative effect on the functional outcome in some patients), all the patients included in the study were referred to the department of physical therapy and rehabilitation at our hospital. They were given exercises and assigned motor function restrictions according to their specific injury and functional recovery expectations.

## 3. Results

Of the 156 patients included in our study, there was a clear male predominance vs. females, with a sex ratio of 7.7:1. While our

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