

# Spaghetti Wrists: Assessment and Management of extensive volar wrist lacerations: A Case Presentation

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## Introduction

Lacerations to the volar wrist surface have the potential to be severely debilitating, mainly due to the superficial location and high density of tendons, nerves and arteries in that area. Extensive injuries to flexor tendons and surrounding structures are sometimes referred to as "spaghetti wrist". The definition of spaghetti wrist, however, is not firmly set, and varies anywhere between a minimum of 3-10 structures completely transected. The original minimum of 3 was established in 1985 by Puckett and Meyer.<sup>1</sup> Some definitions also stipulate the involvement of at least one major nerve or one major vessel.<sup>2</sup> Various mechanisms of injury can lead to spaghetti wrists, the most common are; glass lacerations, knife wounds, and suicide attempts.

## Case

RC is an 18 year old man who presented to Emergency the morning after a night of drinking. He had suffered a small laceration to the volar surface of his R wrist after falling on a broken bottle. (Fig. 1 & 2) He denied any pulsatile bleeding but did report some numbness and weakness. The patient's brother reported that he had seen "white cords" in his brother's wrist.

## Wrist Anatomy

The anatomy of the volar surface of the wrist and hand is divided into 5 zones

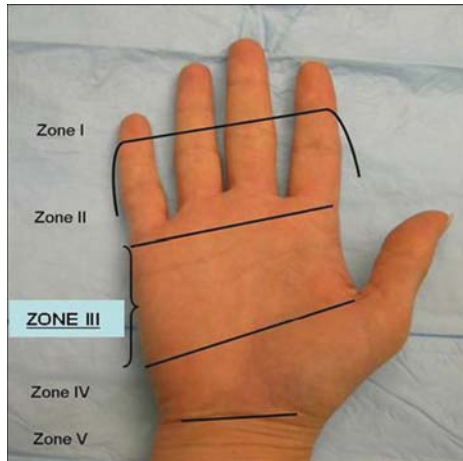
(Fig. 3). Spaghetti wrists involve lacerations in zone 5, proximal to the distal wrist crease. Within the distal forearm and proximal wrist there are 12 flexor tendons, 2 major nerves, and 2 major arteries. (Fig. 4) The flexor digitorum superficialis (FDS) tendons lie volar to the flexor digitorum profundus (FDP) tendons: each is made up of 4 tendons. Other tendons include: 2 flexor carpi tendons (ulnar and radial), the flexor pollicis longus, and the sometimes absent palmaris longus tendon.



**Figure 1:** Patient's forearm following exploration of the wound.



**Figure 2:** Close-up of patient's injury.



**Figure 3:** Zones of the volar wrist. Adapted from Canuto HC, *et al.*<sup>3</sup>

The nerves include the median and ulnar nerve which lie in relative proximity to the radial and ulnar artery respectively. The median nerve sensory distribution in the hand includes almost the entire palmar surface (Fig 5), except for the ulnar side of the ring finger and the entire little finger which are ulnar nerve territory.

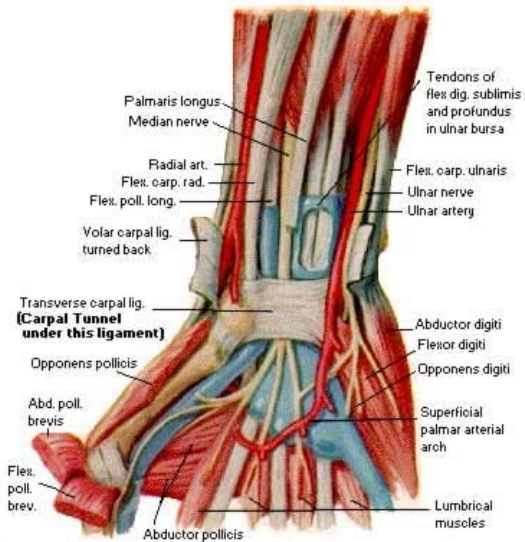
### Clinical Exam

FDP function can be tested by blocking flexion at the PIP joint of the finger in question and getting the patient to flex the DIP joint. All 4 tendons that make up the FDP originate from a single muscle (the FDP muscle) and hence are unable to contract independently. It is good to take advantage of this fact when testing the FDS tendons which have independent muscle fibers. To test FDS function one should passively keep the adjacent fingers extended to block the deep flexor tendons, while looking for flexion at the PIP joint.<sup>5</sup>

Nerve injury is tested using both sensory and motor components. For sensation, simply test pin prick, 2 point discrimination, light touch, and vibration in the appropriate sensory distributions

as previously mentioned. Unambiguous tests for motor function of these nerves include the following:

- A) Median: abduct thumb perpendicular to palm (tests abductor pollicis longus)
- B) Ulnar: Cross long finger over index.



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**Figure 4:** Anatomy of the deep wrist. Adapted from Netter.<sup>4</sup>



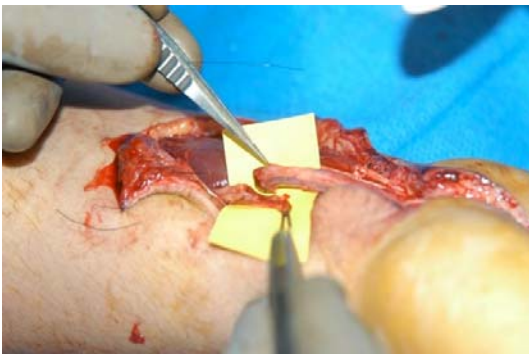
**Figure 5:** Median nerve sensory distribution.<sup>4</sup>

### Case continued

In emergency, RC was immediately noted to have an abnormal cascade. There was a 6cm transverse laceration ~2cm proximal to the proximal wrist crease. His radial and ulnar nerves were clinically intact. There was absent sensation in the median nerve distribution (Fig 6). He had strong radial and ulnar pulses, with a normal Allen's test and normal cap refill. RC's FDS to his index, long, and ring fingers were absent. FDP to the index was weak but the remaining tendons were thought to be intact.



**Figure 6:** Area of no sensation: corresponds to median nerve distribution.



**Figure 7:** Close up of transected median nerve.

RC was taken to the OR to undergo more thorough exploration and to receive tendon and nerve repair. In total, he had completely transected the FDPs to his little, ring and long fingers, the FDS to his index, long, ring, and little

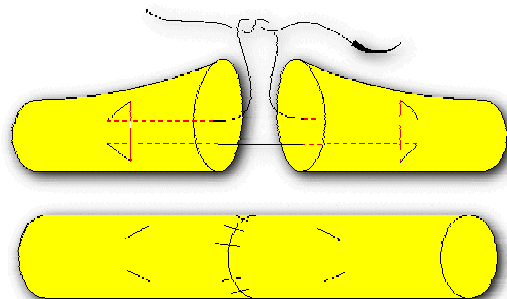
fingers, as well as the palmaris longus tendon and his median nerve (Fig 7).

### Operative Repair Technique

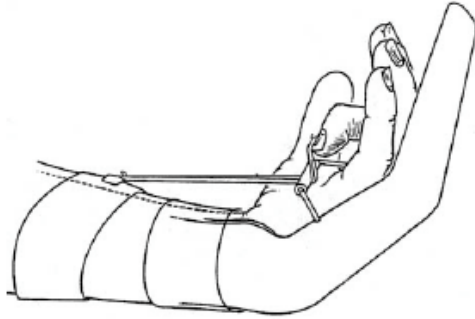
Using tourniquet control, the laceration is extended obliquely proximally and distally to ensure full exposure of the structures. The carpal tunnel is opened. All structures are identified.

Flexor tendons are first repaired using the Kessler or figure-of-eight technique with 4-0 nylon or braided polyester (Fig 8). These are reinforced with 6-0 nylon continuous epitendinous suture. The type of suturing technique is important because it dictates whether active mobilization is possible or not. Also, one must remember that although increasing the number of sutures per tendon increases the strength of the repair, a greater number of knots increases the risk of developing adhesions.<sup>6</sup>

The nerve was repaired using 9-0 nylon simple interrupted epineural sutures. Following closure, patients with spaghetti wrist should receive dorsal splints and have follow-up arranged with Occupational Therapy to receive dynamic splints for rehabilitation (Fig. 9).



**Figure 8:** Kessler suture technique.



**Figure 9:** Kleinert splint: this passively flexes the fingers, and allows the patient to actively extend within the limits of the splint.

### Outcomes

Although potentially very debilitating, most victims of spaghetti wrist have good outcomes if the proper surgical treatment is received. Almost 70% of patients will have good to excellent outcomes with little or no decrease in power, ROM, or sensation. The rest may experience loss of stereognosis and 2 point discrimination, muscle atrophy and trophic changes, etc.<sup>7</sup>



**Figure 10:** Tendons have been approximated and repaired.

### Case conclusion

RC's eight tendons and median nerve were approximated and repaired using appropriate technique (Fig 10). The wrist was immobilized in 20-30 degrees of flexion using a dorsal wrist splint and the patient was told to follow up in clinic

in 2 weeks time. An occupational therapy consult was arranged.

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