

## Spaghetti Wrist Injury: Epidemiology And Management in Calabar, Southern Nigeria.

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### Abstract

**Introduction:** Injuries at the forearm and wrist are a common cause of morbidity and are often associated with incomplete recovery of hand function, especially when the nerves are involved. Spaghetti wrist injury is commonly seen amongst the trauma patients visiting our hospital, yet it is not reported. These devastating injuries require urgent and prompt attention by a dedicated hand surgery team.

**Aim:** The study is to determine the local epidemiological data and stating our management protocol.

**Patients And Method:** A retrospective study of 39 patients with different degrees of extensive volar wrist injuries who were recruited over a 3- year period [Jan. 2012-Dec. 2015]. We evaluated the demographic data which included the age, sex, occupation, handedness and others such as the number of structures involved, wound contamination, reconstruction and the management protocol, physiotherapy and possible complications. Patients with less than three tendon injuries without nerve or arterial injuries were excluded as well as those with previous hand deformity. The time of repair was categorized into primary, delayed primary and secondary repair. The nerve repair outcome were evaluated serially by using advancing Tinnel's sign and sensory perception score from S0 - 4 compared with the normal contralateral upper limb. The muscle power was evaluated from P0-4 and the range of movement was also assessed.

**Result:** A total of 39 patients [24 males and 15] were seen within a three year period with average follow up period of 11 months. The age range was between 14 and 42 years with an average age of 28 +/- 4 years. The mechanisms of injury were machet cut 35.9% [n=14], glass injuries 25.7% [n=10], machine-related injuries 17.9% [n=7], gunshot injuries 7.7% [n=3], road traffic injuries 12.8% [n=5] but no suicidal attempt. The injury types were lacerations, degloving, avulsion and crushed injuries. The structures injured included the tendons ranging from 3-10 tendons, with an average of 7.2. The nerves involved were the ulnar nerve alone 48.7% [n=19], median nerve alone 38.5% [n=15] and injuries involving both nerves were 12.8% [n=5]. The ulnar artery alone 33.3% [n=13], radial artery alone 28.2% [n=11], both arteries involved 23.1% [n=9] and no arterial injury in 15.4% [n=6]. The time of repairs were primary repair, delayed primary repair and secondary repair. The tendon repair was by modified Kessler's technique with continuous peri-paratenon running stitch with nylon 4/0; the nerves had end-to-end epineurial anastomosis with nylon 8/0 or 9/0 and vascular repair with prolene 8/0 or 9/0. Early physiotherapy was instituted. There was satisfactory outcome.

**Conclusion:** Spaghetti wrist injury is increasing in incidence, thus the determination of the epidemiological data and the formulation of its management protocol had become necessary for effective care. A dedicated hand surgery team with meticulous attention to fine surgical details and care will go a long way to reduce the envisaged hand disability.

**Keywords:** spaghetti wrist injury, hand injury, spaghetti hand injury.

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### I. Introduction

Spaghetti wrist injury has become a common occurrence in our hospital due to the increasing social violence and urbanization. Spaghetti wrist injury occurs between the distal volar forearm and the wrist which contains 16 different structures [12 tendons, 2 nerves and 2 arteries] that are covered by a very thin skin. This area could be defined as starting from the distal wrist crease of proximal border of flexor retinaculum to the musculotendinous junctions of the forearm muscles. Extensive volar wrist lacerations also known as spaghetti wrist, suicidal wrist, or full house wrist syndrome has been described in the literature, but there is no standard definition as to what contributes a spaghetti wrist. [1] Despite their relatively frequent occurrence, these injuries are still surrounded with great controversies. [2]. The question, "what constitute spaghetti wrist injury?" is still under dispute. The extent of injury to be classified as spaghetti wrist is still disputed ranging from the minor form of three completely transected structures [artery, tendon and nerve] to major trauma with laceration of at least 10 structures including median and ulnar nerves [3]. This injury can be placed among the severe disabling injuries of the hand. [4]. Thus, it requires critical evaluation and prompt treatment by a dedicated hand surgery team.

## II. Materials And Method:

This is a retrospective study of 39 patients with different degrees of extensive volar wrist injuries who were recruited over a three year period [Jan. 2012 to Dec. 2015] . All the patient case notes and operation registers were reviewed within the study period. The patients with volar wrist injuries aged between 14- 42 years were recruited into the study except those with previous hand injuries before the trauma and those that had less than three structures affected without the inclusion of nerve or artery .The patients who had secondary repair of nerves were also excluded from the study. We evaluated the demographic data which included the age , sex , handedness , occupation as well as the number of structures involved , infection , reconstruction and the management protocol , physiotherapy and possible complications . The time of repair was categorized into primary repair within 24 hours; delayed primary repair between 24 hours and 14 days; and secondary repair was done after two weeks post injury. The hand function was periodically assessed in the course of treatment. The nerve repair outcome was evaluated serially by using advancing Tinnel's sign and sensory perception score from S0 - 4 compared with the normal contra-lateral upper limb. The muscle power was evaluated from P0-4 and the range of joint movement was also assessed.

## III. Surgical Procedure

All the patients recruited into the study were initially evaluated in the Accident and Emergency Department of the hospital. The primary survey and resuscitation were done and baseline investigations were performed. The wounds were examined and the patients were categorized for debridement and primary repair, delayed primary repair and secondary repair based on the type of wound, duration before surgery and the degree of contamination. At surgery, a general or regional anaesthesia was given with patient in supine position. Prophylactic antibiotics, preferably ceftriaxone and metronidazole, were administered before the application of tourniquet. Metronidazole was systematically added to the prophylactic antibiotics because most wounds were contaminated with anaerobes. The skin prep and draping were done. The wound was extended by using a lazy 'S' incision for adequate exposure of the retracted tendons which prevented the development of contracture at the wrist joint. A checklist for the lacerated structures was used, noting the types, number and segmental laceration of the structures. Wounds were thoroughly debrided and copious irrigation with 0.9% normal saline was ensured. No fracture was involved in the series. The tendons were sutured with nylon 4/0 using modified Kessler's technique and reinforced with 5/0 or 6/0 interrupted epitendinous suture .Two patients had tendon grafting while one required tendon transfer. The neurovascular structures were repaired under magnification using 8/0 or 9/0 prolene or nylon interrupted sutures. Epineurial technique was adopted for all the nerve repairs. Some patients required nerve or vascular graft if the defect was greater than 2.5 cm . The wounds were sutured with nylon 2/0 to the skin and dressed appropriately. At surgery, the patient wrists were placed at 30<sup>o</sup> – 40<sup>o</sup> of flexion, the metacarpophalangeal joints at 60- 70<sup>o</sup> and the interphalangeal joints were extended fully. The active splint [klinert splint] was applied. At 0-4weeks active extension and passive finger flexion were performed and the flexion band was removed at 4weeks. Patients were referred to physiotherapists to continue the hand excises. The patients' follow- up continued in the Surgical Outpatient Department, ranging from 3- 23 months with average duration of 11months [figure 1-3].

## IV. Result

A total of 39 patients [ 24 males and 15 females] were seen within a three year period with average follow up period of 11 months . The age range was between 14 and 42years with an average age of 28 +/- 4years. The male- female ratio was 1.7:1 .The mechanisms of injury were matchet cut 35.9 % [n=14],glass injuries 25.7% [n=10],machine- related injuries 17.9% [n=7], gunshot injuries 7.7% [n=3].road traffic injuries 12.8% [n= 5]but no suicidal attempt . The injury types were lacerations, degloving , avulsion and crushed injuries. The table below shows occupational distribution of the patients with labourers and the unemployed young men taking the lead . The structures injured included the tendons ranging from 3-11 tendons, with an average of 7.2. The nerves involved were the ulnar nerve alone 48.7% [n=19] ,median nerve alone 38.5% [n=15] and injuries involving both nerves were 12.8% [n=5] The ulnar artery alone 33.3% [n=13],radial artery alone 28.2% [n=11],both arteries involved 23.1% [n=9] and no arterial injury in 15.4% [n=6] .The time of repairs were primary repair , less than 24 hours;, delayed primary repair , between 24 hours and 14 days ; and secondary repair , period greater than 2 weeks to 18 months. The tendon repair was modified kessler's technique with continuous peri- paratenon running stitch with nylon 4/0 ; the nerves had end- to- end epineurial anastomosis with nylon or prolene 8/0 or 9/0 and vascular repair with prolene 8/0 or 9/0 . Early physiotherapy was instituted. There was satisfactory outcome comparable to the unaffected hand 92.3% of patients but 7.7 % [ n=3]of the patients had poor hand function in patients who had both nerves and arterial injuries. All the wounds that had their tendon and nerve repair done after two weeks were excluded in the study.

**A Table Showing Occupational Distribution Of The Patients**

Types of occupation	No. of patients	% of patients
Labourers	12	30.8
Passengers	6	15.4
Housewives	2	5.1
Farmers	3	7.7
Factory workers	5	12.8
Unemployed young men	11	28.2

## V. Discussion

Spaghetti wrist injury is on the increase among the young and middle age groups as shown in our study. It is more common in the urban than among the rural dwellers. The urbanization carries the risk of social violence, crime and industrialization which promotes these social vices. In urban areas, the economic pressures of the people coupled with high youth unemployment have contributed to the growing problem of crime and drug abuse leading to violence and assaults. This violence is common among the youths, thus explaining why the youths are the common victims of spaghetti wrist injury.

Both chin et al <sup>[1]</sup> and kabak et al <sup>[4]</sup> reported that the most frequent mechanisms of injury were accidental glass laceration, knife wounds and suicide attempts. In our study, we noticed that the common mechanisms of injury were knife cut and gunshot injuries which was due to assault, accidental glass cut, machine – related injuries and road traffic accident. No suicidal attempt was reported in the series. The study revealed that there were more men than women which supported the fact that more men are involved in violence and crime than the women. Concerning their handedness, about 89.7% of the patients were right- handed, 7.8% were left- handed and 2.6% were ambidextrous.

Spaghetti hand injury is a serious injury with devastating long – term effect which leads to deformed and crippling hand function .Despite the frequent occurrence of spaghetti wrist injury, they are insufficiently reported in the literature, thus their classification and management protocol are not well documented. Thus, this brings the condition to the forefront for classification and stating the protocol of management that could be adopted. About 45% of the patients arrived in the hospital within 24 hours of injury and others presented late. All the patients were managed according to the Advanced Trauma Life Support Protocol in the Accident and Emergency Department. All the wounds were examined in the resource room and the operating theatre. The wounds were grouped according to their time of arrival, degree of contamination, and type of wounds . Based on the time of arrival, we had early presentation as the patient came within 24 hours post injury and late presentation when they presented after 24 hours. Based on wound contamination, we had clean wounds and contaminated wounds . Also based on the type of wound, we had laceration, degloving, avulsion and crushed injuries . All the wounds were debrided with copious saline irrigation. Again, all the clean lacerated wounds with minimal tissue loss were repaired primarily while others were repaired either by delayed primary repair or secondary repair.

The incision was a lazy 'S' incision to allow for inspection of the retracted tendons. The structures injured included the tendons, nerves and the arteries . The tendons lacerated ranged from 3-10 with an average of 7.2. The flexor carpi ulnaris , flexor carpi radialis and the Palmaris longus were frequently lacerated than other muscles. It was also noticed that the tendons with primary repairs without much contamination healed satisfactorily with early return of hand function. The tendons that were repaired by delayed primary repair and secondary repair that had tendon graft or tendon transfer tend to have poor outcome compared to those that had direct end-to- end modified kessler's primary repair technique. The primary tendon repair had excellent result in 80% Of patients, the delayed primary repair had good result in 60% of the patients while secondary repair had poor prognosis. Tendon repair can be very successful with proper physical therapy. As a general rule, the sooner tendon repair surgery is done after the injury or insult the easier the surgery is and the easier the recovery. Both tendon graft and tendon transfer had poor prognosis with some hand disability.

The nerves involved were the median and the ulnar nerves which could be singly or in combination of the nerves with other structures in the forearm. The ulnar nerve was more lacerated than the median nerve but there was slight delay recovery with the ulnar nerve than the median nerve. Their functional recovery were assessed by the use of advancing Tinnel's sign and the sensory perception score from So-4 comparing them with the contra-lateral healthy hand .The power of opponens pollicis and adductor muscles were evaluated by comparing them with the contra-lateral muscles .Some authors <sup>[5,6]</sup> have concluded that the primary nerve repair produced improved result over delayed primary repair and grafting .This finding was in agreement with our result . The ulnar or median nerve primary repair had excellent result, the secondary repair had fair outcome, a combination of ulnar and median nerve injuries carried poor prognosis. The nerve graft had a poor prognosis. Other studies also attempted to investigate the relative merits of a fascicular versus epineurial repair but found

no significant difference.<sup>[7,8]</sup> Other works had shown that median nerve recovered faster than the ulnar nerve with more ulnar nerve post injury disability<sup>[9]</sup> while other researchers were of the view that the ulnar nerve recover faster than median nerve<sup>[10]</sup> A combination of ulnar nerve and median nerve injuries carry poor prognosis in most studies .Adjuvant therapy like the use of multivitamins containing B1, B6 and B12 were found to be useful for nerve re-growth and regeneration.

What is the best approach to the treatment of arterial injuries? If an injury involves only one artery in a young person without nerve injury and the intact artery providing adequate circulation, ligation remains a satisfactory option.<sup>[11]</sup> If both arteries are transected, repair of both arteries should be performed. A study showed that unrepaired single artery injury resulted in insignificant change in hand circulation, but combined arterial and nerve injury resulted in disabled symptoms of pain and cold intolerance.<sup>[10]</sup> In our study, after hand ischaemia was ruled out most single arterial injuries were treated by ligation whereas in combined ulnar and radial injuries , both were repaired .The ulnar or radial artery primary repair had excellent result while both arterial injuries carried poor prognosis.

Spaghetti hand injury is associated with delayed recovery, disability and return to work. Early physiotherapy which should be graduated from passive to active exercises should be taken seriously. The commitment by a dedicated hand surgery team including the physiotherapy unit has helped in quick recovery of the patients. The follow-up period varied form 6-23months with average follow-up period of 11 months. Complications noticed were pain , cold intolerance and flexion deformity of the little finger which were seen in patients with both ulnar nerve injury and tendon transfer of the flexor carpi ulnaris .The overall assessment was satisfactory.

## VI. Conclusion

Spaghetti wrist injury is increasing in incidence, thus the determination of the epidemiological data and the formulation of its management protocol has become necessary for effective care. A dedicated hand surgery team with meticulous attention to fine surgical details and care will go along way to reduce the envisaged hand disability.

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No potential conflict of interest.

### **Ethical approval:**

The research approval was obtained from the University of Calabar Teaching Hospital research ethical committee before the research began.

### **Informed consent:**

We obtained informed consent from our patients before the study started and also highlighting the risk and benefits of the study to the patients.

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**Figure 1:** Spaghetti Wrist Injury Due To A Deep Laceration



**Figure 2 :** Structures Seen At Surgery Including Ten Tendons , Radial Artery And Median Nerve



**FIG. 3. A LAZY ' S' INCISION USED TO EXPOSED STRUCTURES AT SURGERY**

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