



# Emergency Room High Index of Suspicion in Apparently Innocent Wounds Can Encounter Missed Tendon Injuries

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## Authors' contributions

*This work was carried out in collaboration between all authors. Author ZMK designed the study and wrote the first draft of the manuscript. Author GYN performed the protocol and overall supervised the work. Authors AS, ZA and BN collected the data of the patients and tabulated in the prescribed proforma. Author TY managed the literature search and analysed the results. Author OAS reviewed the manuscript and tabulated and figured the results. All authors read and approved the final manuscript.*

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## ABSTRACT

**Introduction:** Limb injuries by sharp objects commonly result in tendon or neurovascular damage. The aim of this study is (1) to determine the incidence of significant neurological, musculotendinous or vascular injury; (2) to explore the cause of such wounds; (3) to determine the incidence of missed injuries; and (4) to assess the prognosis of neurological, vascular and musculotendinous injuries.

**Methods:** Fifty eight adult patients were evaluated in the Emergency Department of our institution for incised wounds sustained to upper and lower extremities. Major trauma with obvious

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musculotendinous, vascular and neurological injuries was excluded. An injury was characterized as being missed if a patient had received inappropriate treatment or had returned due to persistent symptoms despite being examined, treated and discharged. Only wounds of less than 24 hours duration were included. Non-accidental injuries were excluded.

**Results:** Fifty one (89%) patients sustained upper extremity wounds while only seven (11%) sustained injuries to the lower limb. Neurovascular and tendon injuries occurred exclusively in the upper limb. Twenty one (36%) patients sustained tendon, nerve and/or vascular injuries (41.2%). Glass injury was found to be the most common cause (41.3%) followed by Knife injuries (15.5%). Fifteen patients were offered an admission to hospital by the Trauma service for definitive treatment. Four of these patients signed DAMA (Discharge against Medical Advice). Six patients did not warrant admission and were discharged from the Emergency Department following appropriate treatment. Thirty seven patients were treated by Emergency Physicians and subsequently discharged. A missed tendon injury was reported in one patient (1.7%).

**Conclusion:** A thorough clinical examination and accurate injury documentation in the Emergency Department is fundamental in recognizing tendon injuries.

*Keywords: Sharp objects; emergency room; limb injuries; tendon injuries; neurovascular injuries.*

## 1. INTRODUCTION

Lacerations of the hand and wrist may affect underlying tendons, nerves and vessels [1]. Although lacerations over the ankle and foot are uncommon, injuries to the underlying tissues can be anticipated [2]. Hand injuries are the commonest injuries seen in the emergency room and they comprise between 10-20% of total emergency attendees. Most of them are non fatal. The importance of failure to diagnose them lies in the fact that they represent one of the leading causes of malpractice claims in emergency medicine.

Acute hand injuries account for 6.6% of all new attendances in the Emergency Department [3]. Despite the abundance of epidemiologic studies concerning hand injuries there is no study that emphasizes the significance of initial laceration size [4].

The aim of this study is to ascertain the common cause of tendon, nerve and vessel injuries and to determine the incidence of missed injuries. Also, we aim to suggest methods for reducing the incidence of such missed injuries through training and education.

We evaluated 58 adult patients with limb injuries caused by sharp objects such as broken glass, knife, grinder, electrical cutter, steel sheets, aluminum sheets, scissors, blade, fiber glass etc.

## 2. METHODS

This is an observational prospective cohort study of the patients who presented to our Emergency

Department with extremity injuries caused by sharp objects spanning a period of six months (Jan 2011 – July 2011). A total of 58 adult patients (ages 17 – 70) were evaluated. Four experienced Emergency Physicians working 8 hour shifts in a period of 24 hours were involved in identifying these patients. Our institute serves a large inner city area and has an annual census of over 150,000 patients.

Inclusion criteria allowed for the enrollment of any patient with clean laceration(s) of either an upper or lower limb by a sharp object such as glass, knife, grinder, electric cutter, steel and aluminum sheet, scissors, blade and fiber glass. Injuries sustained earlier than 24 hours were entirely excluded from the study. Para-suicidal and other non-accidental wounds, infected wounds and wounds on other parts of the body were not included.

Patients were assessed for hemodynamic stability by a triage nurse and sent to the treatment area for wound evaluation and management. The data recorded included; Occupation, Mode of injury, Site of injury, wound size, Neurological status, vascular status and musculoskeletal examination. A thorough examination of the wound was carried out and all abnormal findings were noted. Wounds without tendon, nerve and vascular involvement were treated conservatively followed by reassessment and discharge. Patients with significant tendon, nerve and vascular injuries were referred to the Trauma service. Minor tendon injuries were treated in the Emergency Department and subsequently discharged by the ED Physicians. Admitted patients were followed up after

discharge to record the operative findings and to determine any discrepancies. All data was manually recorded by the emergency physician on a specially designed pro forma and results were analyzed.

### 3. RESULTS

A total of 58 patients were evaluated. The majority of patients, 51 (89%), had upper limb injuries. Only 7 (11%) patients presented with lower limb injuries (Fig. 1). Twenty one (41.2%) patients had tendon, nerve and/or vessel injury (Table 2). Out of these 21 patients, 13 (62%) had a combination of injuries like tendon(s)/nerve(s)/vessel(s), tendon(s)/nerve(s), tendon(s)/vessel(s) and nerve(s)/vessel(s), seven (33.3%) patients had isolated tendon injury and 1 (4.7%) patient had an isolated nerve injury (Fig. 2). Most of the nerve and vessel injuries were of digital branches. Broken glass was the commonest cause of these injuries followed by the knife. Twenty four (41.5%) patients had been accidentally injured with broken glass, 9 (15.5%) had sustained knife injuries and the cause of injury in the remaining 25 (43.2%) patients was of one of the aforementioned objects (Table 1).

Ten (48%) patients with tendon, nerve and/or vessel injuries were due to broken glass, whereas knife contributed in 5 (23.5%) patients and the remainder of objects listed above caused injuries in 6 (28.5%) patients (Table 3) (Fig. 3).

Fifteen patients were admitted by the Trauma service for definitive surgical intervention. Four patients refused admission and signed against medical advice but received appropriate treatment by the trauma service prior to discharge. Six patients with nerve/tendon/vessel injuries did not require admission and were treated by the Emergency Physicians and discharged. Thirty seven patients had no tendon/nerve/vessel injury as per the initial Emergency Department evaluation and were discharged after appropriate wound care. However, 1 (1.7%) patient returned to the Emergency Department within one week of initial presentation with a missed flexor tendon injury to the distal phalanx of the thumb (Fig. 4). The patient had sustained a glass injury with a small wound over the volar surface of the thumb. Upon second visit, the patient was admitted for repair of the severed tendon.

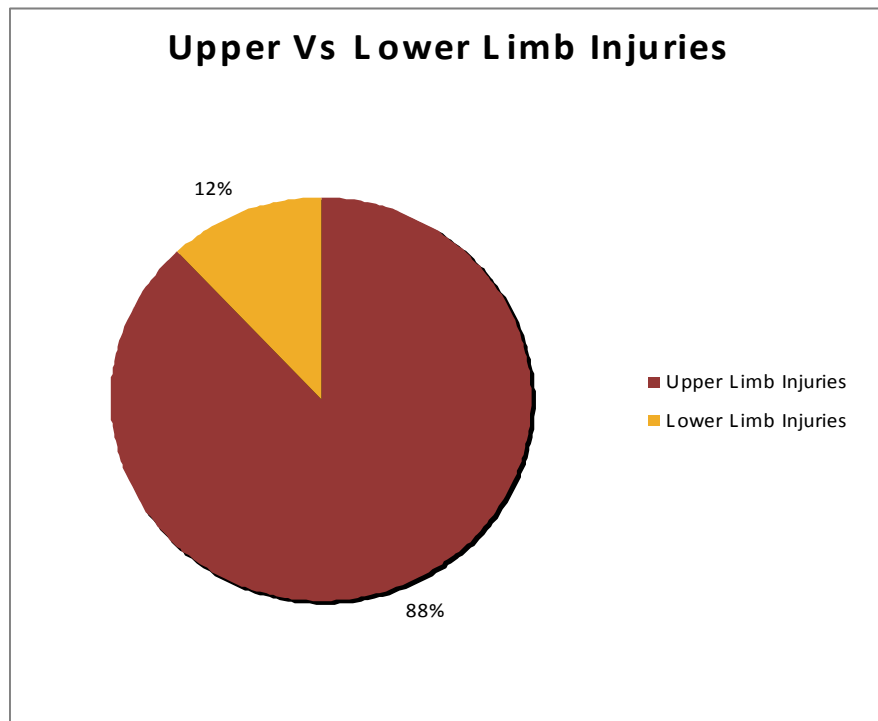
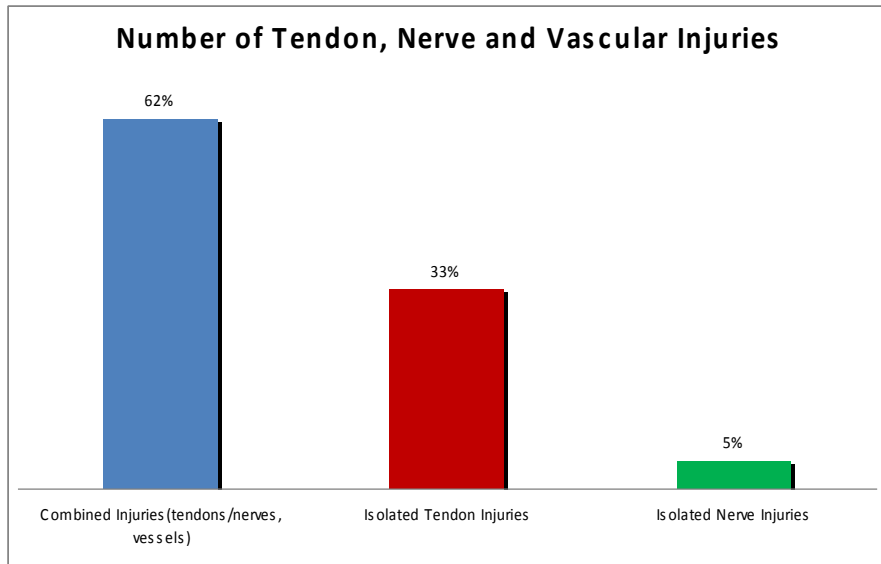
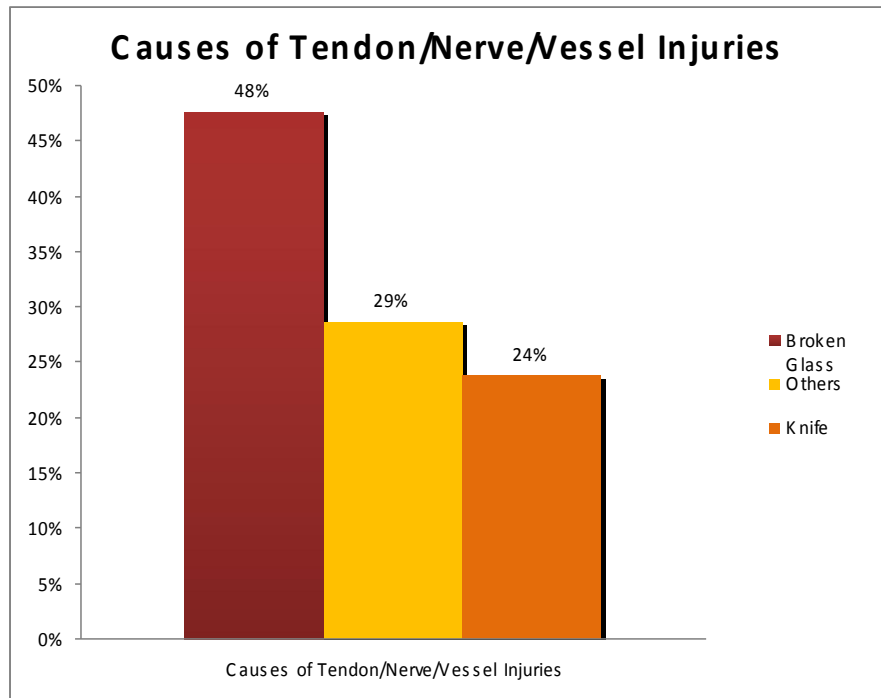


Fig. 1. Upper and lower limb injuries



**Fig. 2. Number of tendon, nerve and vascular injuries**



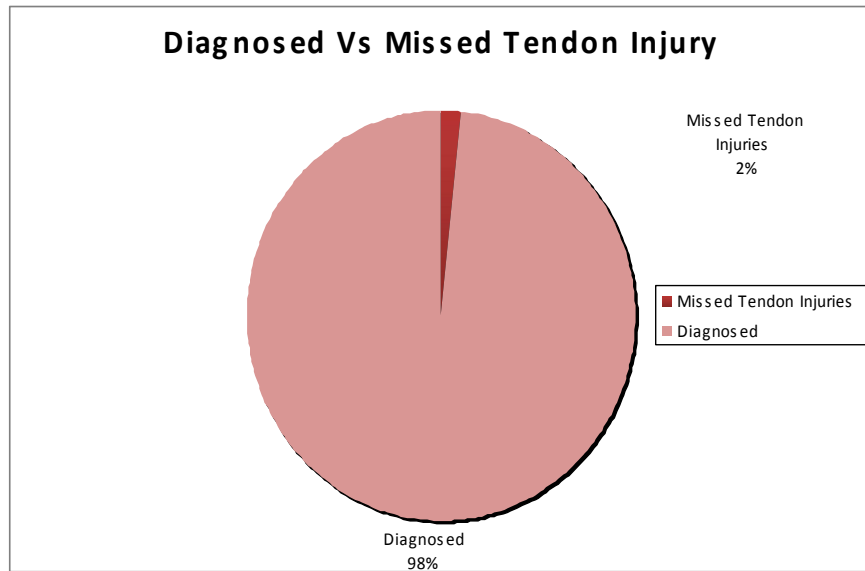
**Fig. 3. Causes of tendon/Nerve/Vessel injuries**

#### 4. DISCUSSION

The best outcome of hand injuries often depends on an accurate initial evaluation and treatment [5]. In the emergency and primary care setting, wound care and laceration repair and

management is not without significant risk potential [6].

Upper limbs are the most common site of injury with sharp objects compared to lower limbs as evidenced by our study (89% v 11%). Moreover, there were no injuries to any vital structures in



**Fig. 4. Diagnosed vs Missed tendon injury**  
Missed Tendon Injuries 01 (1.7%)

**Table 1. Mechanism of injury %**

Broken glass	24 (41.3%)
Knife	09 (15.5%)
Others (Grinder/Electric cutters, Steel sheets, Aluminum sheets, Blade, Scissors, Fiber glass etc.	25 (43.2%)

**Table 2. Number of Tendon, Nerve and Vascular injuries [Total= 21 (41.2%)]**

Combined Injuries (tendons/nerves, vessels)	13 (62%)
Isolated Tendon Injuries	07 (33.3%)
Isolated Nerve Injuries	01 (4.7%)

**Table 3. Causes of Tendon/Nerve/Vessel Injuries**

Broken glass	10 (48%)
Knife	05 (23.5%)
Others	06 (28.5%)

the lower limb in our series. This may be due to the anatomical variation in terms of the depth of vital structures in upper and lower extremities. Although sharp object injuries are uncommon in lower limbs, injury to the deeper structures is still possible [7].

Broken Glass injury was the most common mechanism of the sharp object injury in our study (48%). This is comparable to a Northern Ireland study that showed 47% glass injuries [8]. In another similar study by Noaman HH in 2007 a slight increase in the incidence of Glass injuries was demonstrated (55%) [9]. Knife injuries have a relatively lower incidence in our study (15%) when compared to Noaman (24%). This may be attributed to harsher penalties for carrying weapons like knives and daggers in the UAE. In our study all knife injuries were caused by domestic kitchen knives and may, therefore, be considered the reason for a low incidence as compared to the other study quoted herein. Glass injuries remain the most common cause of the tendon and nerve injuries in our study comparable to Guly HR 1991 [10]. We encountered one patient (1.7%) with a missed tendon injury, a number significantly lower than Guly HR [9] and Green DP [11], who showed a 3.2% incidence of a missed tendon injury. This difference in the incidence of missed injuries is due to application of functional anatomy to these special injuries and regular training in the evaluation and management.

Missed tendon/nerve/vascular injuries may lead to a prolonged period of disability, further surgical intervention and suboptimal outcome [12].

## 5. CONCLUSION

Tendons in the hands and feet are strings of fibrous tissue that allow finger and toe movements. They are often cut, mostly by accidents with glass and knives. Tendon injuries are more common in the hands and wrists due to their superficial anatomy. A glass injury to the limb can be deceiving injury and may result in significant debilitation. It is recognized that despite best efforts, hand injuries may be missed.

Lower limb injuries by sharp objects are uncommon due to protective shoes, thick trousers and deeper vital structures.

A thorough clinical examination and a high index of suspicion in apparently innocent wounds can minimize the incidence of missed injuries.

## 6. RECOMMENDATIONS

1. The Emergency Physician must have knowledge of the functional anatomy of the hand and wrist, understand the treatment options including repair and splinting and be aware of possible long term sequelae of certain tendon injuries.
2. Resistance testing is crucial to rule out tendon injury.
3. Examination of wound should ideally occur under good lighting, adequate anesthesia and a bloodless field.
4. All wounds should be thoroughly explored.
5. Emergency Physician must maintain a high index of suspicion for open wounds on the dorsum of the hand and assume a tendon injury.
6. Junior doctors in the Emergency Department should have regular training sessions for the evaluation of these injuries.
7. Universal precautions like protective gloves for construction industry workers must be used to avoid such injuries.

## CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

## ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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