

# Missed Injured Structures In Acutely Injured Hand

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## Abstract

**Purpose:** The aim of this prospective case series study is to find the frequency of missed injured structures, define their pattern, and identify the main contributing factors. **Method:** The criterion for admission to this study is patients who are treated for their hand injuries in emergency room and discharged without referral to hand clinic, some of them continue to have symptoms and present to the hand clinic where missed injured structure is diagnosed. The data collected included: wound type (open or closed), age, sex, handedness, type of injury, time of detection, what and where the injured structures are missed. **Results:** Over a 3 year period, a total of 860 patients attended the emergency room due to acute hand injury, 58% of them with open wounds. 43 (9.8%) patients proved to have undiagnosed injured structures. Missed injured structures are extensor tendons (10), flexor tendons (13), nerves (15), fractures (4), and ulnar collateral ligament of the thumb. Mean age was 19 years. The mean duration between time of the original injury and its detection was 6 weeks. Glass laceration, knife, domestic fights, and sports are the main mechanisms of injury. **Conclusion:** Knowledge of hand anatomy, proper clinical examination, exploring innocent looking wounds, adequate investigations, and domestic education are ways to reduce the incidence of missed injured structures in traumatized hand.

## INTRODUCTION

Hand injuries are among the commonest injuries seen in the emergency room, they represent 10% -20% of all attendees. Most of these injuries are not fatal, however, the anatomical complexity of the hand can pose many diagnostic and treatment difficulties (1-5).

The importance of failure to detect all injured structures in acutely traumatized hand lies in the fact that it is common happening (6-9) and represents one of the leading causes of malpractice claims in emergency medicine.(1, 10-12). Missed injured hand structures are associated with a long term disability, need further surgical intervention, end up with sub-optimal outcome and significant socio- economic implications (8, 13).

Recently, Philip Yoong and his colleagues, pointed out that the common missed injured structures in the emergency department include: Bennett's fracture, ulnar collateral ligament injury, volar plate avulsion and avulsion of the flexor digitorum profundus tendon (14)., Most authorities agree that proper clinical examination and continuous education are the best guarantees to avoid and minimize missing injured hand structures in the emergency room. (15-19)

We know that most of the available studies looked at patients who received primary treatment in the emergency room and referred to hand clinic where the correct diagnosis is made (1, 4, 8, 14). Therefore the injured structures of these patients are either correctly diagnosed , partially diagnosed or not diagnosed in the emergency room To the best of our knowledge, we don't know about any study looked at the frequency and profile of missed injured hand structures among those patients who are treated in the emergency room and discharged without further referral or follow up appointment, which is the purpose of this study

## METHODS

This observational case series study was conducted between the hand clinic and the emergency room at King Abdulla University Hospital (KAUH) Jordan. Its aim is to find out the percentage and profile of missed injured hand structure among patients presented to emergency room due to acutely traumatized hand; this will answer the question "is the emergency room doctor always right in discharging patients with hand injuries without further follow up or referral?"

The criteria for admission to the study are patients who have acute hand trauma, have treatment in the emergency room by reassurance or simple dressing, then discharged home without referral to hand clinic or follow up

appointment. Some of these patients continue to have symptoms, and present directly to hand clinic where the proper diagnosis is made. The exclusion criteria are patients, who are seen in emergency room and admitted for special treatment or referred to hand clinic.

The emergency room doctors fill the study sheet for all patients who present to emergency room, complaining of acute hand trauma. The sheet shows the following data: patient name, age, sex, file number, handedness, date, side of injury, site of injury, mechanism of injury, investigations, diagnosis, treatment and patient disposal ( admission, referred to hand clinic or discharged). Discharged patients are the subject of our study. In emergency room injuries are classified into two groups the first one is associated with laceration or skin cut is called open hand injuries, the second group is called closed hand injury when it is not associated with laceration or skin cut.

In the clinic the emergency medical records are reviewed and checked out to make sure that these patients are seen during the specified period, are not referred to the hand clinic, no records for any injured structure and record the duration till proper diagnosis is made.. These patients were examined carefully with special emphasis on deformities, neurological deficits, tendon functions, range of movement, and scar anatomy. Further investigations, such as neurophysiology and X-ray, were carried out when needed. The injured structure is considered missed when there is an abnormal finding which is not mentioned in the emergency medical records. Patients with missed injury are treated accordingly and their data are collected and analyzed

## RESULTS

Between January 2008 and December 2010, a total 860 patients attended the emergency department with hand injury (500 open hand injury and 360 closed hand injury). About half of patients (48.0% among patients with open hand injury and 55.6% among patients with closed hand injury) were discharged without referral to the hand clinic. Later, 43 (9.8%) patients of those who were discharged attended the hand clinic and diagnosed as having missed injured structure (Table 1). The proportion was 11.6% for patients with open hand injury and 7.5% among patients with closed hand injury, with no significant difference between the two proportions (p-value = 0.192).

The missed injured structures, mechanism of injury, presenting symptoms, and other relevant characteristics of those who were diagnosed with missed injury are shown in

Table 2. Patients with closed hand injury were significantly older than those with open hand injury. Nerve and flexor tendon were the only missed structures among those with open hand injury. In those with closed hand injury, extensor tendon was the commonest missed structure followed by metacarpal fracture. About half of patients with open hand injury (46.4%) presented with loss of movements, 25% with deformity, and 28.6% with numbness. On the other hand, 66.7% and 33.3% of patients with closed hand injury presented with deformity and pain, respectively.

The site of the missed injured structures is shown in Table 3. The index finger and the Guyon's canal were the commonest sites where injured structures had been missed.

## Figure 1

Table 1. The distribution of patients attended the emergency department because of the hand injury

	Type of injury					
	Open hand injury			Closed hand		Total
	N	%	injury			
				N	%	N
Number of patients	500	58%	360	42%	860	100%
Admitted patients	30	6.0%	20	5.6%	50	5.8%
Referred patient to hand clinic	230	46.0%	140	38.9%	370	43.0%
Discharged patients (no follow up)	240	48.0%	200	55.6%	440	51.2%
Patients with missed injured structures (proportion of missed injury among discharged patients)	28	11.6%*	15	7.5%	43	9.8%
p-value = 0.192						

**Figure 2**

Table 2. Missed injured structures, mechanism of injury, presenting symptoms, and other relevant characteristics of discharged according to type of injury

Variable	Open hand injury (N = 28)	Closed hand injury (N = 15)	All patients (N = 43)	P-value
Age (year)				0.025 *
Mean (SD)	16 (16)	27 (12)	19 (15)	
Median	12	24	16	
Range	2-80	14-55	2-80	
Time until final diagnoses (week)				0.475
Mean (SD)	7 (10)	5 (5)	6 (8)	
Range	1-52	1-24	1-52	
Missed injured structures; n (%)				<0.005 *
Nerve	15 (53.6)	0 (0.0)	15 (34.9)	
Flexor tendon	13 (46.4)	0 (0.0)	13 (30.2)	
Extensor tendon	0 (0.0)	10 (66.7)	10 (23.3)	
UCL	0 (0.0)	1 (6.7)	1 (2.3)	
Metacarpal #	0 (0.0)	4 (26.7)	4 (9.3)	
Mechanism of injury; n (%)				<0.005 *
Glass injury	18 (64.3)	0 (0.0)	18 (41.9)	
Knife / sharp metal	10 (35.7)	0 (0.0)	10 (23.3)	
Sports injury	0 (0.0)	7 (46.7)	7 (16.3)	
Dropped Object	0 (0.0)	3 (20.0)	3 (7.0)	
Domestic fights	0 (0.0)	5 (33.3)	5 (11.6)	
Presenting symptoms; n (%)				<0.005 *
Deformity	7 (25.0)	10 (66.7)	17 (39.5)	
Loss of movements	13 (46.4)	0 (0.0)	13 (30.2)	
Pain	0 (0.0)	5 (33.3)	5 (11.6)	
Numbness	8 (28.6)	0 (0.0)	8 (18.6)	

**Figure 3**

Table 3. Site of missed injured structures

Site of injury	Nerves	Flexor tendon	Extensor tendon	Fractures	Total
Thumb	0	0	2	0	2
Index	3	7	1	0	11
Mid. Finger	3	0	3	0	6
Ring Finger	2	0	4	0	6
Little finger	0	6	1	0	7
Guyon's canal	7	0	0	0	7
Metacarpals	0	0	0	4	4
Total	15	13	11	4	43

## DISCUSSION

Hand injuries are common, most of them are obvious and not fatal but without systematic clinical examination subtle injuries can be missed (1-2, 4-5). Bruser stated that even in the hands of qualified surgeons with special training in hand surgery, failure to diagnose injured hand structures is expected to continue with it's all implications for patients, employers, the economy, the health services and the insurance, additional training will only reduce the incidence of these errors and not eliminating them (15)..

This study confirms that missed hand injuries do occur, but it is worrying to note that they represent significant percentage (9.8%) of those patients discharged without

referral to hand clinic. Our findings suggest that missed injured hand structures among patients associated with open hand injury (11.6%) are more common than in patients associated with close hand injury (7,5%). Again, our study shows the percentage of open hand injuries to be 58% which is much higher than what Murphy and others (20-21) found (33%-42%). We believe the reason for this is that significant number of the patients with open injuries is children, who are not cooperative and proper medical examination is not possible; at the same time care provider is reluctant to explore innocent looking wounds.

James et al (2) relate age and the type of injury and said that the type of injury seen in each decade of life varies; children most commonly are injured at home, with fingertip injuries and burns prevailing. Falls are frequently the etiology in the elderly; sports in younger patients, and work-related injuries in middle-aged individuals. In our study the age distribution of those patients with undiagnosed injured structure shows a significant variation. The mean age of patients with closed hand injury (24 years), is double that patients with open hand injury (12 years). This means that most patients with open hand injury and having missed injured structure are children. Children have special importance to the family, so this could explain the higher number of patients with open hand injury who have attended the emergency department.

Some authors believe that the most common cause of hand injuries is blunt trauma followed by sharp object injury (21), others (4) think that 16.3% were caused by a fall; 15% by sport; and 7% were work/machinery related. Our study finds that the commonest mechanism of injury, in open hand injury group, is glass laceration followed by knife or sharp instrument. For those patients with closed hand injury and missed injured structure, sports and domestic fights are the main mechanism of injury. Small cuts (innocent looking wounds) are the real trap for the primary care provider, because he will underestimate the extent of the underlying damaged structures.

The literature is clear regarding the importance of early diagnosis and treatment of hand injury, delayed treatment end up with suboptimal results. Our study find that six weeks passed till final diagnosis is reached, this could be due to the defects in the system, or due to the ignorance of the family and the patient.

What make patient seeks further opinion is either deformity, inability to move the interphalangeal joints, pain, or numbness. Deformity is the leading presenting symptom

(40%), the commonest form of deformity is mallet deformity followed by claw finger deformity and lastly Boutonniere's deformity. The second common presenting symptom is inability to move interphalangeal joints (30%) due to flexor tendon injury. In 7 patients numbness due to digital nerve injury (20%) is the presenting symptom. Failure to pick up these clinical findings indicates that the primary care provider failed to perform proper history and clinical examination, furthermore there is lack of knowledge of hand anatomy.

It is obvious from our study that missing an injured nerve or flexor tendon occur mainly in an open hand injury, while missing a metacarpal fracture or an injured extensor tendon occur mainly in a closed hand injury. Digital nerve injury was missed in 8 patients, followed by ulnar nerve injury in Guyon's canal in 7 patients. Flexor tendons injury was missed 13 times in patients with open hand injury. Extensor tendon injury, metacarpal bone fractures, central slip injury, and UCL injury are forms of missed injured structures in patients with closed hand injury, this is not consistent with what Young P and his colleagues have found (14).

Aronowitz et al (22) said the importance of closed tendon injuries lies in the fact that they are common, and most of them if they are diagnosed acutely will need conservative treatment, but if the diagnosis is delayed, then operative treatment will be needed and this will lead to some disability. This was reiterated by Matzon (23) and Sivaloganathan (24). What the mind does not know the eyes will not see, we strongly believe that, if the primary care provider knew the anatomy of the hand, took proper history and performs adequate clinical examination, explore wounds when necessary, and evaluate x-rays properly, such an important injured structures should not be missed.

According to Ljungberg et al fingers are fractured more frequently than metacarpals, with the little finger ray (phalanx and metacarpal) being fractured more often than the other 4 rays (3). While our study shows that index finger is the commonest site of missed injured structures followed by the little finger and Guyon's canal area.

In treating hand injuries, failure to diagnose an injured structure is multifactorial. Those which are related to the patient himself (age, cooperation, and ignorance), primary care provider factors (lack of hand anatomy knowledge, improper clinical examination, inability to read x-rays, reluctance to explore innocent looking wounds), family related factors (educate children about safety measures,

keep house hold and dangerous things away from children reach, and not ignoring their children symptoms), and finally the system related factors (we think that phone call after a few days of patient discharge from the emergency room will pick up those missed injured structures early}. In order to decrease the incidence of such missed injured structures, we need to reverse all previously mentioned factors.

We conclude that missed injured hand structures will continue to be a problem, and every effort must be made to diagnose all injured hand structures, because timely medical evaluation and treatment is the key to decrease the long term effect of hand injuries. Many factors contribute to this problem reversing them will minimize the incidence of missed hand injuries.

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