

MANAGEMENT OF HAND INJURIES: A SIX YEAR EXPERIENCE FROM KOMFO ANOKYE TEACHING HOSPITAL, KUMASI, GHANA

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Abstract

Background: Hand injuries can ruin patients' ability to work with their hands. This could lead to depression and social isolation. It is imperative that hand injuries be reconstructed to as near normal as possible.

Patients and Method: A prospective study was undertaken from January 2005 to December 2010 at the Komfo Anokye Teaching Hospital, Kumasi, Ghana to document the pattern of hand injuries, and the outcome of management. The patients were evaluated clinically. Wound debridement was done; the defects were repaired using reconstructive techniques matched to the type of injury.

Result: Ninety-five patients (71 males) were treated. Male: female ratio was about 3:1. Their ages ranged from 2 to 60 years with mean (\pm SD) of 29.5 (\pm 12.9). Of the 102 hands injured, 52 were right. The right was the dominant hand in 65%. Both dominant and non-dominant hands were injured equally. 5% of the injuries were isolated; 95% were combined. The distribution of mechanisms of injuries was as follows: avulsion, sus-

tained through road traffic accidents (37%), crush injuries (25.3%), sharp injuries (including spaghetti wrists) (19%) machine mangling (11%), burns (8.4%), blunt injuries (15%), human bites (2.1%), snake bite (1.1%), gunshot (4.2%), and injection injuries (2.1%). Patients' occupations were: farmers 23%, mechanics (20%), traders (11%), factory workers (5%), followed by 2% each of teachers, electricians and civil servants, and 1% each of drivers and pastors; 5% were unemployed. Of the remainder, 16% were children and 11% students. Surgical procedures performed were groin flap (30%), exploration and repair (24%), skin grafting (21%), debridement alone (13%) cross finger flap (7%), decompression of carpal tunnel, (3%) and terminalisation (2%)

Conclusion: Severe hand injuries requiring reconstructive surgery were sustained through road traffic accidents. Farmers, traders, mechanics and children are at risk of severe combined hand injuries.

Key words: hand injuries, combined, avulsion, crush, debridement, spaghetti wrist.

Introduction

The hand is at risk of severe injury from a number of causes. Examples are road traffic accidents, occupational hazards, sporting and domestic accidents. The pattern of hand injuries in a community commonly reflects their commercial, industrial, social, occupational, or recreational activities. Jin et al¹ studied 560 workers with traumatic hand injuries treated in 11 hospitals in three economically active cities in the People's Republic of China over a two year period. They concluded that working in manufacturing industries, and using powered machines were the primary sources of severe hand injuries. Mirdad², in a seven-year prospective study of 136 children and adolescents with hand injuries, observed that the most common type of hand injury was crush injuries by doors at home, and recommended hydraulic automatic door closure to prevent this injury.

An injury to the hand can immediately compromise and chronically debilitate the patient's ability to perform the activities of daily living³. There could be enormous personal and family suffering from pain, loss of function of the hand, or both. The loss of one's ability to work and to provide can lead to chronic depression as well as social isolation⁴. It is therefore important that the acutely injured hand is managed adequately to prevent infection, salvage the injured parts, promote primary healing and restore its function⁵. This requires ingenious surgical skills for correction, such as provided by reconstructive hand surgery.

Patients and Methods

A prospective study was undertaken to document the pattern and outcome of treatment of patients with hand injuries presenting at the Accident and Emergency Unit of Komfo Anokye Teaching Hospital in Kumasi, Ghana, between January 2005 and December 2010. All patients with injuries involving the hand, from wrist, carpus, thumb and fingers, were entered into the study.

Management of the patient with hand injuries began with ensuring a patent airway, adequate breathing and circulation. An intravenous access was established. A general examination was done to exclude life threat-

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Conflict of interest: None declared

ening conditions such as haemothorax, haemoperitoneum or head injury. The wound was examined to determine the approximate extent; the function of the hand distal to the wound was assessed. Movement and sensation in the fingers and thumb was examined to establish a diagnosis of divided or injured structures such as tendons or nerves.

History taken included the patient's age, sex, hand dominance, occupation, the date, time, mechanism and circumstances of injury, whether work-related, contaminated and any associated thermal, chemical and electrical components. Other history was recorded such as diabetes mellitus, hypertension, and sickle cell disease, anaesthetic experience, bleeding disorders, prior operations, current medications, allergies and tetanus immunization. In assessing skeletal injury, x-rays were taken in three planes: antero-posterior, lateral and oblique. A clinical photograph of the hand was then taken. The injury was then classified according to Buchler and Hastings⁶ as follows: 1. Isolated injury (single hand structure) 2. Combined injury (more than one important hand structure).

Surgery for hand injury was performed under general or regional anaesthesia with a long acting agent such as bupivacaine. Digital or metacarpal block was used for procedures in the distal halves of digits. A tourniquet was used for most of the hand injuries especially wounds in front of the wrist. Optical loupes were worn.

All wounds were cleaned thoroughly with water, mild detergent such as "savlon" and rinsed with normal saline. Foreign bodies were removed. Dead tissue was excised. Haemostasis was secured. Decompression of the carpal tunnel was done in cases with suspected compartment syndrome, such as machine mangling and crush injuries. All divided structures such as flexor and/or extensor tendons, digital and wrist nerves, and vessels were repaired primarily. Fractured carpal, metacarpal or phalanges were reduced and fixed with Kirschner wires where possible. Soft tissue coverage included partial or full thickness skin grafting or the use of pedicled flaps. The patients were followed up at the plastic surgical clinic fortnightly after discharge.

The outcome of surgery was assessed six months after discharge at the plastic surgical clinic, using the outcome category of the modified Sheridan et al⁷ and McCauley⁸ classification for burn injuries of the hand as follows:

- A. Excellent (Normal function)
- B. Good (Abnormal function, but able to perform activities of daily living)
- C. Poor (Cannot perform activities of daily living).

The case notes of all the patients treated by the author who reported at the plastic surgical clinic at six months for assessment were compiled and analysed.

Results

A total of 95 patients were seen and treated for hand injuries within the period from January 2005 to December 2010. Of these, 71 were males giving a male:female ratio of 3:1 approximately. Their ages ranged from 2 to 60 years, with mean (\pm SD) of 29.5 (\pm 12.9). The patients' age distribution is shown in figure 1.

A total of 102 hands were injured during the study period; 52 were right hands. The right hand was dominant in 65% of the patients. Both the dominant and non-dominant hands were almost equally injured in this study.

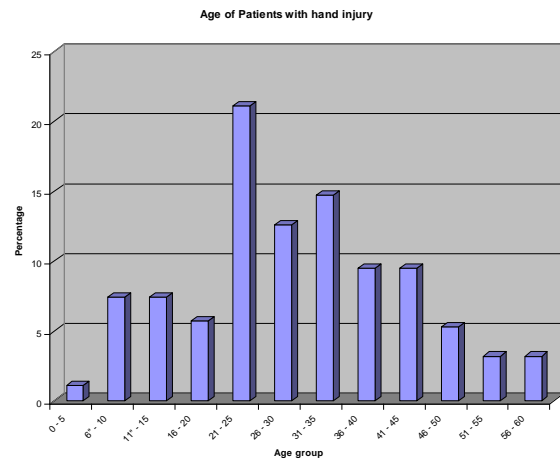


Figure 1: Age distribution of 95 patients with hand injuries seen from January 2005 to December 2010 at KATH

Avulsion injuries sustained through road traffic accidents accounted for 37% of the injuries in this study (Table 1). These were mostly repaired with flaps; the groin flap (30%) was the most frequently used.

Table 1: Mechanism of Injury and Outcome of Treatment for 102 Hand Injuries

No.	Nature of Injury	Frequency N= (%)	Outcome category
1.	Avulsion injury	35 (36.8)	A
2.	Degloving injury	2 (2.1)	A
3.	Crush injury	24 (25.1)	B
4.	Sharp injury	18 (19)	B
5.	Thermal burn	6 (6.3)	B
6.	Gunshot	4 (4.2)	B
7.	Electrical burn	2 (2.1)	B
8.	Human bite	2 (2.1)	B
9.	Injection injury	2 (2.1)	C
10	Snake bite	1 (1.0)	C

Crush injuries to the fingers were commoner in mechanics. Automobile engines or gear boxes dropping and trapping the hands was the commonest cause (25.3%).

Injuries from sharp-edged objects comprised about 19%. There were two cases each of accidental domestic injuries from louvre blades and accidents on the farm. Fourteen of these injuries however were wounds inflicted with machetes by assailants on their victims. Most of the assailants were armed robbers or gangs operating at night. The injuries were deep and required between two to three hours to explore and repair the damaged structures.

Machine mangling of the hands was also common (11%). The machines involved were three cases each of grinding machines, power saw (all victims were carpenters) and bread making machines as well as two cases of sachet water sealing machines. Wound debridement involved excision of devitalized tissue, including non-viable digits, decompression of carpal tunnel in three cases, reduction and K-wire fixation of fractured carpals, metacarpals and phalanges. Soft

tissue coverage was usually delayed until after one week.

Burn injuries to the hands occurred in 8.4 percent of the patients. The thermal burns (6.3%) were accidental and occurred as part of extensive burns to the body. Two cases of electrical burns to the hands occurred in two (2.1%) electrical technicians. These latter two injuries were full thickness burns which required several debridement sessions and groin flap repair (Figure 2).

Other forms of blunt injuries comprised about 15% and included injuries sustained at work-places, on the farms (Figure 3), in the homes (e.g. pestle-mortar finger injuries) and from assault.

Bites from humans (2.1%) and a snake (1.0%) constituted a small percentage of the hand injuries, yet caused extensive damage to the hand through tissue necrosis and gangrene. Wound debridement and flap repair was required. Function in the snake-bitten hand was lost completely (Figure 4).

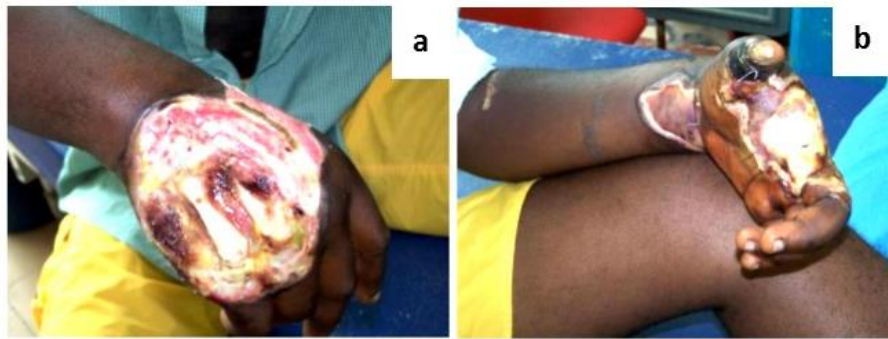


Figure 2:

Electrical burns to the hands of a 28 year old male electrical technician (a: Right hand; b: left hand)

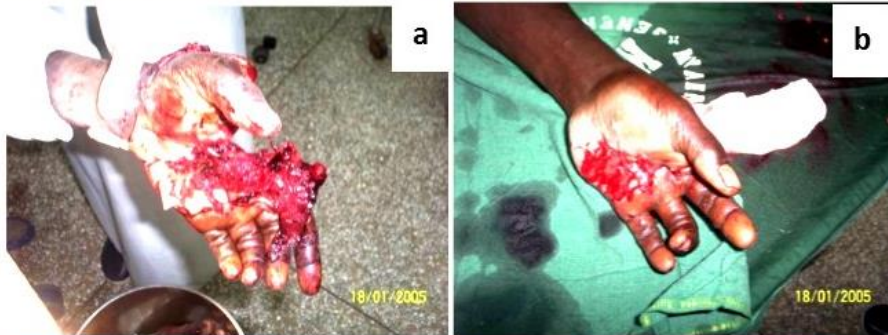


Figure 3:

Blunt injury; hand of a 45 year old male farmer trapped by a falling tree branch (a: Pre-operative; b: Post-operative)

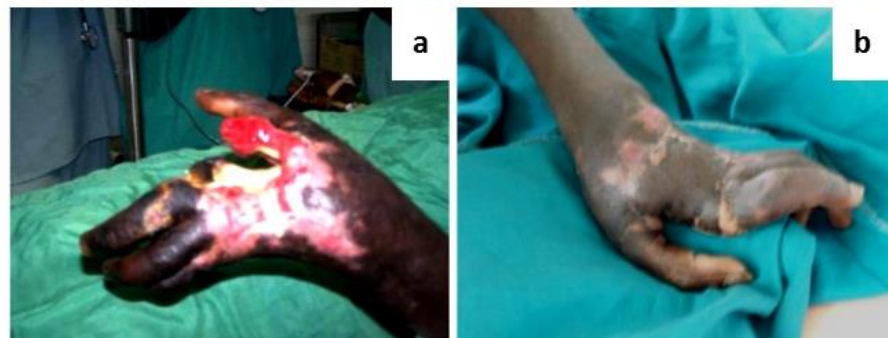


Figure 4:

Necrosis of left hand from snake bite of a 50 year old male farmer (a: Pre-operative; b: Post-operative)

Of the four gunshot wounds to the hand, three were accidental. Two farmers were shot by their own loaded guns, one during hunting for grass-cutters, and the other whilst ‘cleaning’ the gun. An eight-year-old boy was shot whilst playing with the father’s loaded gun. The fourth patient was shot with a pistol by his assailant during an argument. All the gunshot wounds were debrided and managed conservatively, except the pistol injury that required a groin flap

Two (2.1%) patients sustained high pressure injection injury to the left middle finger from grease guns. These required three sessions each of exploration and debridement before satisfactory healing was achieved. However, the fingers remained stiff and non-functional.

The occupation of the patients who sustained the hand injuries are shown in Figure 5. Farmers (23%), mechanics (20%) and children (16%) were at the greatest risk of sustaining hand injuries. Most traders (10.5%) and students (10.5%) sustained their hand injuries through road traffic accidents.

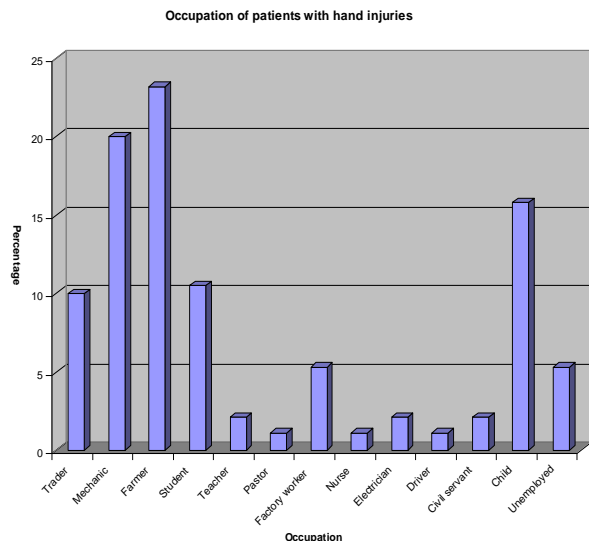


Figure 5: Occupation of patients with hand injuries showing which groups are at greater risk

Seven main surgical procedures were performed for the patients with hand injuries: groin flap 30%, exploration and repair, 24%, skin grafting, 21%, debridement alone 13%, cross finger flap 7%, decompression of carpal tunnel, 3%, and terminalisation 2%. The superficial circumflex iliac artery (SCIA) or groin flap was the commonest technique. It was used to repair defects from avulsion wounds sustained through road traffic accidents. The cross finger flap (7%) was used to repair avulsion defects on the fingers and thumb, especially of artisans involved in the woodwork industry.

Significant complications encountered in the management of hand injuries include the following. In three patients, the groin flap failed. - They became ne-

crotic and had to be debrided. The resulting defects had to be skin grafted. In three women the groin flaps became bulky as a result of adiposity. They were defatted to make them cosmetically acceptable.

Fixed-flexion deformity of the fingers, palmar contracture and mal-united metacarpal fracture were characteristic of crush injuries to the hand.

Hypertrophic scars occurred in three patients who sustained thermal burns to the hands. They were managed conservatively by massaging at the physiotherapy department.

The injuries sustained in this series were grouped into categories according to Buchler and Hastings⁶. Isolated injury which involved traumatic damage to a single relevant structure at one specific location, included two cases of sharp injury to flexor tendons and three cases of avulsion injury. The rest of the injuries were combined injuries, which were traumatic lesions involving two or more separate functionally relevant structures at specific locations. These included gunshot wounds, electrical and thermal burns, degloving, avulsion and crush injuries, human and snake bites, and required more than one surgical procedure to achieve a successful outcome (Figure 6).

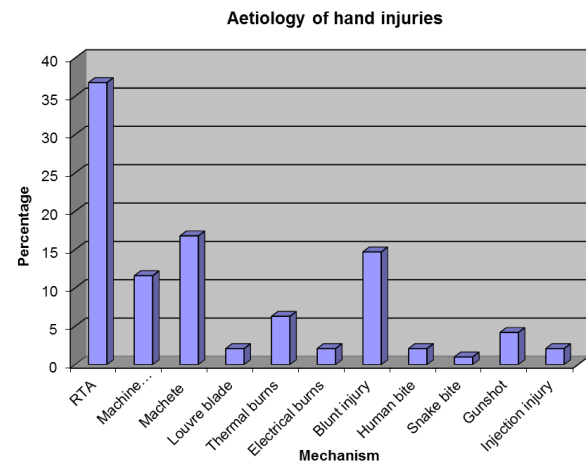


Figure 6: Aetiology of hand injuries, showing the common causes

The outcome categories for surgery for the injuries are shown in Table 1. On the whole, the surgical outcome was satisfactory. Fifty-six (55%) patients were able to perform their activities of daily living. However, in 2 cases with high pressure injection injuries, the involved digits (middle fingers) remained stiff and non-functional. One patient who had a snake bite to the left hand also lost function in the hand despite successful flap repair.

Discussion

Owing to the important role the hands play in the lives of individuals, any hand injury deserves to be managed efficiently, preferably by an experienced hand



Figure 7:
Groin flap to the hand of a 25 year old victim of road traffic accident
(a: Defect on dorsum of hand;
b: Flap inset)

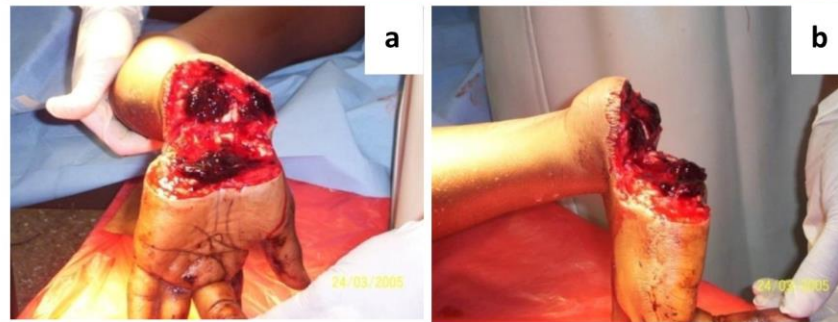


Figure 8:
‘Spaghetti wrist’ from assault in an 18 year old student, requiring urgent revascularisation

surgeon, to prevent loss of function. Such injuries require the application of principles of reconstruction present in the armamentarium of the plastic and reconstructive surgeon.

The commonest mechanism of injury to the hand in the current study is avulsion⁹ (Table 1). This injury occurs when portions of the body are torn or wrenched away. This may be a complete avulsion when no connection exist between the injured and its original site, or partial avulsion when tenuous and strained strands of tissue connect the tissue to the site⁹. In the hand, the avulsed tissue may be skin, subcutaneous tissue, tendons or nails, leaving a defect with exposed carpals, metacarpals, or phalanges. As this injury is commonly sustained during road traffic accidents, the wound is usually heavily contaminated with mud, leaves, grease and others, requiring thorough debridement before reconstruction.

To ensure optimal function of the injured hand, flap reconstruction is preferred. The pedicled flap that is versatile and often useful for such reconstruction is the groin flap, which is based on the superficial circumflex iliac artery (SCIA)^{10, 11}. In this series, 30% of the reconstructive surgery was done with this flap, with very satisfactory results (Figure 7).

Avulsion injuries to the fingers and thumb were repaired with cross finger flaps (7%). This is a rectangular flap raised on the dorsum of a finger proximal or middle phalanx. The blood supply is random in subdermal tissues. It can be innervated by the inclusion of a digital nerve¹². In the current study, this flap was used to repair volar defects of thumb, index, middle, ring and little fingers. These injuries occurred in some arti-

sans, mechanics, and farmers. No significant complications were observed with this flap.

Crush injuries were also common (25.3%). It is a compressive crushing force transmitted to all types of tissue at a given site of injury, leading to contusion, stretching, shearing and displacement. There could be massive contamination with foreign bodies. The structures commonly involved are skin, muscle, blood vessels, bone and joints. The chances for functional recovery depend on adequate debridement, prophylaxis against infection, quality of the vessels, skeletal stabilization, soft tissue reconstruction and post-operative physical therapy⁶.

Exploration and repair of deep wounds to the hand, especially to the front of the wrist was common in this series (24%). These involved division of the deep and superficial flexor tendons to the fingers, thumb and wrist; some involved division of the median and ulnar nerves; division of the ulnar and radial arteries. Some injuries fractured the carpal bones. If this type of injury involves at least ten structures inclusive of tendons, at least one major nerve and one major vessel, it is referred to as “full house” laceration or a “spaghetti wrist”¹³ (Figure 8).

Repair involved tourniquet application and use of optical loupes to allow accurate identification of divided structures for repair. Twenty-four such cases were repaired. Results were satisfactory but two cases of fixed flexion deformity occurred which was managed by physical therapy. Sensory and motor function improved in all the patients, enough to enable patients perform their activities of daily living.

Hudson and Jager¹⁴ repaired the wounds of 15 patients with simultaneous lacerations of the median and ulnar nerves with flexor tendons at the wrist. In their series flexor tendon functions yielded poor results. They were able to achieve satisfactory results with primary nerve repair, the median nerve achieving a better outcome than the ulnar nerve. They concluded similarly that a functional outcome with some degree of impairment should be anticipated following repair of this injury¹⁴.

The results in the current study could be due to the fact that most of the injuries were combined. In combined injuries the ultimate functional outcome relates to the sum of the various lesional components, and the multiple interactions among structures involved in the particular pattern of the lesion. Buchler and Hastings⁶ observed over a 10-year period that about 60% of emergencies and 20% of post-traumatic secondary reconstructions at their centres were combined injuries. The complication rate was 8% for isolated lesions and 17% for combined injuries. Isolated injuries required 1.3 surgical interventions, whilst combined injuries required 2.7 interventions⁶.

It is apparent from the above that the management of combined injuries, as in the current study, requires sophisticated level of hand surgical training, technical skills and experience in skeletal as well as soft tissue reconstruction.

Conclusion

Road traffic accidents cause the most severe hand injuries requiring skilful reconstructive techniques such as flaps for reconstruction.

Farmers, traders, mechanics and children are at risk of sustaining extensive combined injuries to the hand.

Acknowledgements

The author acknowledges the contributions of Dr. Isaac Okyere and Dr. Rita Larsen Reindolf of Komfo Anokye Teaching Hospital who, as residents in Plastic and Reconstructive Surgery, assisted at some of the surgical procedures discussed in this series.

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