

The Management Outcome of Acute Hand Injury in Tikur Anbessa University Hospital, Addis Ababa, Ethiopia.

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Background: Hand is the most commonly injured part of our body. The aim of treatment is always to restore its movement, strength and dexterity. The quality of primary treatment often determines the maximal potential for recovery. The objective of this study was to evaluate the management outcome and consequences of the injured hand.

Methods: Between 1st January 2005 and 31st December 2005, a total of 253 patients were treated in Tikur Anbessa University Hospital for acute hand injury that presented within the first 24 hours of the occurrence. We evaluate the mechanism of injury, types and duration of treatments and complications.

Results: The mean age was 32 years and the male to female ratio was 7:1. The majority of patients were wood worker (32%) followed by laborers (25%) and machine operators (15%). Three quarter of the injuries occurred at work, of which 74% were caused by machines. The commonest injuries included fracture in 39% of which the majority (85%) were compound, amputation in 31% and soft tissue injury in 26%. The injury severity was moderate and above in 54%. Most were managed at emergency out-patient department and the average total treatment time was 93 days. The average impairment of hand function before and after treatment was 6% and 19% respectively. The main reason for more loss of function after treatment were more proximal corrective amputation (31%), prolonged immobilization (28%) in nonfunctional position (17%), healed in unacceptable position (19%) and infection (13%). Final results were poor in 62%, this was not significantly associated with severity of the injury.

Conclusion: Improving treatment of injured hand and establishing specialized center for hand injury may shorten duration of treatment and improve result.

Introduction

Our hand is a truly complex, active and intricate part of our body, allowing for variety of functions. It allows us to feel, grasp, perform fine movements and discriminate while displaying exquisite dexterity. Hand is the most frequently injured parts of our body¹⁻⁴ and accounts for 5-10% of all accidents seen in the emergency department and 28% of injuries to musculoskeletal systems⁵⁻¹⁰. Injury of the fingertip and/or nail bed is by far the most common hand injury¹¹. Fractures of the metacarpals and phalanges account for 10% of all fractures and are responsible annually for 16 trillion lost days of work¹². Phalangial fractures are unique in that an isolated fracture can affect the functional unit of the hand and the digit. Digital function can be impaired not only by fracture stability or deformity but equally by concomitant injury to the soft tissues that provide motion, stability, blood flow, and sensation to that digit.

Hand injury can be functionally disabling, psychologically crippling and economically disastrous for the workers thus placing great responsibility on the part of the attending clinician. The aim of treatment is always to restore function that is movement, strength and dexterity followed by pain relief and cosmetic appearance. Hand and fingers tolerate injury and immobilization poorly and it should be managed very carefully.

The hand being the most important productive organ of the worker, prevention of hand injuries, care of the injuries and restoration of function of the injured hand are of great human, social and economic importance. It is extremely important to treat even minor injuries of the hand with care, to minimize morbidity and to restore a person to his job as early as possible. In our hospital acute hand injury accounted for 12% of all patients with major limb trauma¹³ and there is no specialized hands unite.

The main objective of this study was to evaluate the management and its outcome and consequences of the injured hand. The specific objectives were to identify the types and duration of treatments, complication and extent of hand impairment.

Patients and Methods

This was a Prospective, descriptive study of all 253 patients with acute hand injury that resulted in amputation, fracture, dislocation, or extensive soft tissue injury and presented within the 24 hours of the occurrence to Tikur Anbessa University hospital (TAUH) and treated over a one year period from January 1 until December 31, 2005. The patients had been informed and had given consent to be included in the study. A structured questionnaire was used to collect the data that include patient profile, circumstance, time and nature of the injury, they were also asked about treatment and presence of pain. The hand function was evaluated based on loss of part, range of motion and presence or absence of sensation. These patients were evaluated at least at two visits. The Orthopedic Department had approved the study protocol. International standard classification was used to classify occupation¹⁴. Place of occurrence and type of injury classified based on ICD-10¹⁵.

The severity of the injury was graded according to *Campbell and Kay scale*, Hand Injury Severity Scoring system¹⁶. Results were determined for all patients after last follow-up examination by the author based on amputation as loss of digits and loss of range of motion expressed as percentage of impairment related to entire hand¹⁷, and a system formulated by Belsky et al¹⁸.

Excellent: No symptom or sign, pain free union, no angulation or rotatory deformity, PIP motion at least 100°, total active motion (TAM) greater than 250°. (Total active movement is the sum of flexion at MP, PIP, and DIP joints minus the extension deficit at the same joints.)

Good: Minimal angular or rotatory deformity, PIP motion at least 80, TAM greater than 180°.

Poor: All the remaining results.

The data analysis was performed with the aid of SPSS software. Results were expressed in terms of percentage, mean and ratio. Chi square test were used for significance test.

Results

Of the 253 patients assessed 221 (87.4%) were males and 32 (12.6%) females (M:F of 7:1). The age ranged 21-53 years (mean 32) and 231 (91.3%) were right handed. Twenty (7.9%) patients could not read or write. The leading job category includes: crafts & related trade workers 82 (32.4%), laborer 62 (24.5%) and machine operators 37 (14.6%) (Table1). One hundred and ninety one (75.5%) of the injuries occurred at work either in industries 127 (50.2%), construction areas 30 (11.9%) or trade and service areas 26 (10.3%). The commonest cause of the injury were machines in 141 (55.7%) followed by road traffic crash in 30 (11.9%), crash by heavy object 21 (8.3%) and blow by stick in interpersonal conflict 21(8.3%) (Table2). Of 141 patients who sustained machine injury, 21 (14.9%) experienced previous hand injury by machines.

Ninety Nine (39.1%) patients had at least one fracture that involved 95 digits in 83 patients, 14 metacarpal and 4 Scaphoids. The majority (85%) of fractures were compound. The commonest digits to be fractured were the index in 30 (31.6%), usually at the level of distal phalanges (43.2%) or middle phalanges (33.7%).

A total of 151 digits were amputated in 79 Patients and involved the ring finger in 34.4% followed by middle in 31.8% and index digits in 17.9%. In 109 (72.2%) of the amputations it was at the level of the distal phalanx (Table3). The other hand injuries included extensive soft tissue injury in 66 (26.1%), dislocation in 22 (8.7%) and tendon injury in 16 (6.3%) of the cases. Some patients had a combination of the above injuries. The severity of the injury were minor in 116 (45.8%), moderate 92

(36.4%), severe 29 (11.5%) and major 16 (6.3%) (Table 4). Thirty four (75.5%) of the 45 severe injuries were caused by machines

One hundred and ninety-eight (78.3%) of patients were managed non-operatively at out-patient level where there is no operative facility, by immobilization of the hand or some of the digits in 121 hands (Fracture 79, STI 28 and Dislocation 22), method of immobilization was cotton ball (43, 35.5%), splint with adjacent digits or spatula (24, 19.8%) and POP (54, 44.6%). Even though the majority (81%) presented within 8 hours of the injury (Golden period), Fifty five (21.7%) patients had corrective amputation very late in Minor Operation Theater (16 within the 1st week, and 39 after 10 days of the injury). Usually corrective amputations were done more proximal in 47 patients and 12 patients with initial diagnosis of extensive soft tissue injury were amputated later.

Problems observed in immobilization were immobilizing in non functional position 44 (36.4%), involving unnecessary joints 40 (33.1%) and prolonged immobilization 48 (39.7%). Only 42 (17%) patients had physiotherapy. Mean duration of follow up was 93 days (SD $\pm$ 34.3 days) and ranged from 45- 180. The commonest complications were joint stiffness 210 (83.0%), complain different degree of persistent pain 100 (40.0%), fracture healed in unacceptable position in 47 (18.6%), infection in 33 (13.0%), and late amputation in 12 (4.7%) of the cases (Table 5).

Overall mean loss of hand function before treatment was 5.6% and after treatment 19.2 % due to joint stiffness and ankylosis, proximal corrective amputation and late amputation.

Table 1. Socio-Demographic Characteristics of the Studied Patients

Character	Number	Percent
Gender		
Male	221	87.4
Female	32	12.6
Age (years)		
21-30	113	44.7
31-40	128	50.5
41 or more	12	4.8
Educational level		
<i>Illiterates</i>	<i>20</i>	<i>7.9</i>
<i>Grade 1-6</i>	<i>71</i>	<i>28.1</i>
<i>Grade 7-12</i>	<i>137</i>	<i>54.1</i>
Grade 12+	25	9.9
Occupational category		
Crafts & related trade workers	82	32.4
Laborer	62	24.5
Machine Operators	37	14.6
Drivers and conductors	22	8.7
Mobile plant operator	12	4.7
Others	38	15.0

Table 2. Place and Causes of the Injury

Character	Number	Percent
Place of occurrence		
Industrial Production	127	50.2
Street	54	21.2
Construction Area	30	11.9
Trade & service area	26	10.3
Home	8	3.2
Other	8	3.2
Causes of the injury		
Machine	141	55.7
RTA	30	11.9
Crush	21	8.3
Blow	21	8.3
Fall	15	5.9
Others	25	9.9

• 191 (~5.5%) of the injuries occurred at work

Table 3. Frequency of Digital Amputation and Fracture in Respect to the Level

Digits	DP	MP	PP	Total
Amputation				
Thumb	8	-	0	8
Index	19	8	0	27
Middle	38	10	0	48
Ring	36	16	0	52
Little	8	8	0	16
Total	109	42	0	151
Fracture				
Thumb	4	—	7	11
Index	14	8	8	30
Middle	9	8	7	24
Ring	8	16	0	24
Little	6	0	0	6
Total	41	32	22	95

Table 4. Types of injury and severity

Character	Number	Percent
The injuries		
Fracture	99	39.1
Amputation	79	31.2
Laceration /Digloving	66	26.1
Dislocation	22	8.7
Tendon	16	6.3
Injury Severity score		
I – Minor	116	45.8
II – Moderate	92	36.4
III – Severe	29	11.5
IV – Major	16	6.3

✦ Few patients had more than one types of injury

Table 5. Types and Final Result After Management

Character	Number	Percent
Complication		
Joint stiffness or ankylosis	210	83.0
Persistent pain	100	39.5
Deformity	47	18.6
Infection	33	13.0
Late amputation	12	4.7
Final results		
Excellent	3	1.1
Good	93	36.8
Poor	157	62.1
Patient satisfaction		
Very satisfied	20	7.9
Satisfied	62	24.5
Unsatisfied	143	56.5
Very unsatisfied	28	11.1

✦ Few patients had more than one types of complication

The management results were excellent in 3 (1.1%) patients, good in 93 (36.8%), and poor in 157 (62.1%). Severity of the injury is not significantly associated with the treatment outcome ($P>0.05$). Because of this injury 14,112 working days were lost with the mean of 55.8 days $\pm$ SD 14.5 (range 15 -90 days) and 63 (17.0%) patients could not able to resume the previous work.

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Finally the patients satisfaction on this management was considered satisfactory in 82 (32.4%) and unsatisfactory in 171 (67.6%) (Table5).

Discussion

Hand injury predominantly affects young male (M:F ratio of 7:1), most (76%) occurred at work. Different studies have shown that the rate of occupational injuries is higher for men than women¹⁹⁻²⁵. The commonest cause was machine (56%), particularly wood working machine is by far the most dangerous machine. Of all reported machine injuries 58% (82/141) were caused by wood and products of wood working machine. Which is supported by other study in Ethiopia²⁰ and study of Heycock in 1964 revealed that of all hand injuries treated in the Derbyshire Royal Infirmary, 15% was caused by wood working machine²⁶. But this is different in findings of the some other countries where it was highest in food product manufacturing in Swedish, steel manufacturing in Singapore, petroleum manufacturing in USA, and in the textile industry in India²⁷⁻³⁰.

The injury severity was moderate and above in 54%, with an amputation rate of 31%, fracture of 39%, as compared with less severe injuries with an amputation rate of 1% and fracture of 5-9% in the developed world³¹⁻³⁴ and this is comparable with the study in India³⁵. This severity was probably due to patients with minor injuries being treated in peripheral health centers, small clinics in a factory and also with little importance given to minor injuries in our patients. Moreover most of these injuries were caused by machine which contributes for the severity because the most severe hand injuries are caused by machine^{36,37}.

It is very sad that all our hand fracture, extensive soft tissue and tendon injury patients had to be treated in the emergency out patient department with no tourniquet, inadequate anesthesia, inadequate sterility, poor light and no proper type and size of suture. Those who need corrective amputation was appointed to minor orthopedic operation day which is one day a week (every Thursday), because there is no operative facility for emergency out patient and never enough beds available³⁸. All cases were initially attended by resident doctors, this shortcoming was recognized earlier by Entin and Broback

et.al. Who recommend that post graduate training in hand surgery be made obligatory for all general and orthopedic surgeons who deal with hand surgery^{39,40}.

Hand and fingers tolerate injury and immobilization poorly and thus accepted protocol for treatment for hand injuries is immediate reconstruction of all injured tissue structures because the quality of primary treatment often determines the maximal potential for recovery (as delay of treatment can have direct long term consequences)⁴¹⁻⁴⁴. Mean duration of treatment of our patients was 93 days. Most have at least one of the following complication; joint stiffness or ankylosis 83%, persistent pain 40%, deformity 19%, infection 13% and late amputation 5%. The over all results of our treatment was poor in 62% of the patients and the range of persistent post traumatic disability was between 3% and 90% and the average permanent disability was 19%. The severity of the injury was not significantly associated with the treatment out come. This high incidence of complication and poor outcome reflect our poor and delayed management and practically no proper rehabilitation. Sixty seven percents of our patients were unsatisfied in our treatment. The indirect cost of these injuries was high because the mean duration off work was 56 days and 17 % had to change the occupation.

Recommendation

1. There is a great need of improving and increasing physical facility and manpower preferably by establishing specialized hand center to improve treatment of injured hand that may shorten duration of treatment, improve result and decrease indirect cost.
2. Hand surgery attachment should be mandatory for general and orthopedic surgery residents.
3. There should be a means to decrease machine injury particularly wood working machine.

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