Original Article

# Epidemiological study of hand injury in a tertiary care centre in Nepal

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**Abstract**

**Introduction:** The epidemiology and pattern of hand injury may vary from one region to the other. Due to the lack of systematic documentation, not much is known regarding the epidemiology of hand injury in Nepal. The purpose of this study was to determine the patterns of hand injury in a tertiary care centre in a developing country like Nepal.

**Methods:** A cross-sectional descriptive study was carried out in the Department of Plastic Surgery and Burns, Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal. The study included 174 patients presenting with hand injury in the emergency room and the outpatient department.

**Results:** There were 129 (74.1%) males and 45 (25.9%) female patients, the mean age of all patients being 30.3 years. The top four occupations concerned with hand injuries were carpenters, students, manual labourers and factory workers. Most injuries occurred in furniture and wood workshops. Electrically powered saw belt and grinding machinery were the culprits for majority of crush/avulsion injuries whereas broken glass was the commonest cause of sharp cut injury. Tendon injury was the most common diagnosis followed by fractures and fingertip injuries. Accordingly, tendon repair followed by fixation of fractures were the commonly carried out treatment procedures.

**Conclusion:** Hand injuries are very common among young male furniture and wood factory workers as well as manual labourers having occupational exposure to different machines. Formulating safety protocols in the furniture and industrial settings and other machinery related workplaces would play a significant role in reducing the incidence of hand injuries.

**Keywords:** Hand, hand injuries, occupational exposure

## Introduction

The hand is a very complex organ with unique structure and function. In addition to having an important role in prehension, for a working person it is the most valuable asset. It also helps in maintaining body image and has important role as an organ of communication, especially in humans, who are able to carry out precise movements with fingers and opposing thumb. From evolutionary point of view, primates with five digits on hand have been hand-to-mouth feeders that pluck and catch items selectively by hand before ingesting them. By virtue of its unique anatomy and functional importance, any injury to the hand might result in a serious disability to an individual.

Hand injuries are very common in both industrialized and developing world. The National Electronic Injury Surveillance System (NEISS), whose primary purpose is to collect data on consumer product-related injuries occurring in the United States, reports that the fingers and hand are the most frequently injured body parts at work and treated in hospital emergency departments.[1] Hand injuries account for nearly 10% of hospital emergency department visits.[2,3]

Hand injuries may be managed by practitioners from different specialties with the most specialized care being provided by the plastic and hand surgeons. However, they may also be managed by orthopaedic surgeons, general surgeons and general practitioners.

The epidemiology and pattern of hand injury may vary from one region to the other, relying largely on the occupation and industrial activity of that region. Owing to the lack of systematic documentation of hand injuries, little is known about the epidemiology of hand injury at national level. The purpose of this epidemiological study was to determine the patterns of hand injury in a tertiary care centre in Kathmandu, Nepal. It is important to know these patterns to come up with proper management protocols and safety measures to decrease their incidence. The implementation of preventive and safety measures have significantly reduced the incidence and severity of hand injuries in the developed countries.[4,5]

## Methods

A cross-sectional descriptive study was carried out in the Department of Plastic Surgery and Burns, Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal. The study included 178 patients who presented with hand injuries via the Emergency Department (ED) and/or the Out Patient Department (OPD) from July 1, 2017 to February 2018. Four patients with incomplete documentation were excluded. Informed consent was obtained from all the patients.

Though the hand was defined as the part of upper extremity distal to the distal wrist crease, those cases involving wrist and forearm with injury to the nerve or vessels were also included as these would fall under the domains of plastic surgery. Information was obtained on the following variables: age, sex, occupation, handedness, hand involved, duration of injury before presentation, setting/place of injury, mode of injury, tetanus vaccination status, finger involvement, mode of anesthesia and diagnosis and treatment modalities. Plain radiographs of the hand were obtained in all cases.

## Results

A total of 174 patients with hand injuries were managed in our centre during the study period. There were 129 (74.1%) males and 45 (25.9%) females, the male-to-female ratio being 2.9:1. The age of patients ranged from 2 to 63 years(mean age=30.3 years). The commonest age group affected was 21-30 years (29.3%) followed by 11-20 years (Table 1).

**Table 1: Age distribution of patients**

| Age (in years) | No. of patients | Percentage% |
|---|---|---|
| 1-10 | 6 | 3.4 |
| 11-20 | 36 | 20.7 |
| 21-30 | 51 | 29.3 |
| 31-40 | 36 | 20.7 |
| 41-50 | 21 | 12.1 |
| 51-60 | 18 | 10.3 |
| 60-70 | 6 | 3.4 |
| **Total** | **174** | **100** |

The right and left hands were equally injured with 87 patients belonging in each group. Regarding dominance, dominant hand was involved in 90 (51.7%) patients whereas non-dominant hand was involved in 78 (44.8%) patients. However in 2 cases that consisted of children below 2 years of age dominancy could not be determined.

The median duration of injury before presentation to our centre was 6 hours and the duration ranged from 30 minutes to 15 days. The number of patients presenting within 6 hours, 24 hours, 48 hours, 72 hours and >72 hours have been tallied in Table 2.

**Table 2: Duration of injury before presentation**

| Duration within (in hours) | No. of patients | Percentage % |
|---|---|---|
| 6 | 84 | 48.3 |
| 24 | 63 | 36.2 |
| 48 | 9 | 5.2 |
| 72 | 6 | 3.4 |
| >72 | 8 | 4.6 |
| **Total** | **174** | **100** |

The top occupations concerned with hand injury were carpenters, students, manual labourers and factory workers. Manual laborers and factory workers were equal in frequency and were placed together in the third place (Table 3).

**Table 3: Occupation of patients**

| Occupation | No. of patients | Percentage% |
|---|---|---|
| Carpenter | 39 | 22.4 |
| Student | 30 | 17.2 |
| Factory worker | 18 | 10.3 |
| Manual labourer | 18 | 10.3 |
| Shopkeeper | 15 | 8.6 |
| Farmer | 15 | 8.6 |
| Service | 12 | 6.8 |
| Business | 9 | 5.2 |
| Children (Preschool) | 6 | 3.4 |
| Butcher | 3 | 1.7 |
| Policeman | 3 | 1.7 |
| Housewife | 3 | 1.7 |
| Goldsmith | 2 | 1.1 |
| None | 1 | 0.6 |
| **Total** | 174 | 100 |

Describing the site/setting where the incident occurred, furniture and wood workshop ranked number one followed by home and industrial work places (factories) (Table 4).

**Table 4: Place where the injury occurred**

| Place | No. of patients | Percentage% |
|---|---|---|
| Furniture and wood workshop | 54 | 31 |
| Home | 45 | 25.9 |
| Industrial workplace (factories) | 36 | 20.7 |
| Outdoors | 12 | 6.9 |
| Bike workshop | 9 | 5.2 |
| Farm | 9 | 5.1 |
| Other workplace | 6 | 3.4 |
| Construction site | 3 | 1.7 |
| **Total** | 174 | 100 |

Considering the status of tetanus vaccination, 114 (65.5%) patients received tetanus toxoid (TT) in the Emergency Department (ED), whereas 60 (34.5%) patients had already received TT prior to presentation.

Regarding the mode of injury, 111 (63.8%) patients sustained crush/avulsion injury whereas 60 (34.5%) suffered sharp cut injury. Among those suffering crush injuries, top three comprised of injuries due to saw belt, grinding machinery and motorbike chain. Sharp cut injuries, more often were caused by glass, knife and khukuri (traditional nepali sword like) weapon (Table 5). Two of the injuries were ballistic in nature and one was caused by burn.

**Table 5: Mode of hand injury**

| Age (in years) | No. of patients | Percentage % |
|---|---|---|
| Crush/Avulsion Injury | 111 | 63.8 |
| Sawbelt | 38 | |
| Grinding machinery | 18 | |
| Farm tool | 8 | |
| Bike chain | 15 | |
| Rubber belt | 6 | |
| Punching machine | 3 | |
| Door entrapment | 8 | |
| Saw | 13 | |
| Rock | 2 | |
| Sharp Cut Injury | 60 | 34.5 |
| Glass | 24 | |
| Knife | 17 | |
| Khukuri | 15 | |
| Sickle | 3 | |
| Table fan | 1 | |
| Ballistic injury | 1 | 0.6 |
| Burn | 2 | 1.1 |
| **Total** | **174** | **100** |

The middle and the index fingers were the most commonly involved fingers followed by the thumb. Tendon injury was the most common diagnosis in 66 (37.9%) patients. Fracture and dislocations were the second common diagnoses present in 42 patients followed by finger tip injuries that were present in 27 patients (Table 6).

**Table 6: Diagnosis of hand injuries**

| Diagnosis | No of patients | Percentage % |
|---|---|---|
| Tendon injury | 66 | |
| Extensor tendon injury | 41 | 37.9 |
| Flexor tendon injury | 25 | |
| Fracture and dislocations | 42 | 24.1 |
| Finger tip injury | 27 | 15.5 |
| Nail bed injury | 12 | 6.9 |
| Laceration only | 9 | 5.1 |
| Ring avulsion injury | 3 | 1.7 |
| Near amputation of digits | 4 | 2.3 |
| Near amputation of wrist | 1 | 0.6 |
| Post traumatic raw area (PTRA) | 3 | 1.7 |
| Post burn raw area (PBRA) | 2 | 1.1 |
| Combined ischemic injury | 2 | 1.1 |
| Exposed bone/joint | 2 | 1.1 |
| Amputation | 6 | 3.4 |
| Digital nerve injury | 9 | 5.1 |
| Radial artery injury | 3 | 1.7 |
| Ulnar artery injury | 6 | 3.4 |
| Median nerve injury | 2 | 1.1 |
| Ulnar nerve injury | 3 | 1.7 |

There were a total of 61 extensor tendon injuries in 41 patients, many a times more than one tendon being injured in a single patient. The commonest extensor zone involved was zone 6 for fingers and zone 5 for the thumb. Similarly, there were 43 flexor tendon injuries in 25 patients, again many a times more than one tendon being injured in a single patient. The commonest flexor zone involved was zone 2 for both the fingers and the thumb.

Bony involvement was very common in hand injuries. There were a total of 78 fractures and 8 dislocations occurring in 42 patients, many a times more than one fracture occurring in a single hand. Distal phalanx was the most commonly fractured bone occurring in 30.8% of fracture cases followed equally by middle and proximal phalanges. Moreover, oblique fracture was the most common pattern of the fracture seen followed by intra-articular and transverse patterns. Again dislocation of the Distal Inter-Phalangeal Joint (DIPJ) was the most common followed closely by Inter-Phalangeal Joint (IPJ) of the thumb and Proximal Inter-Phalangeal Joint (PIPJ). There was one case of Metacarpo-Phalangeal Joint dislocation.

Finger tip injuries were the third most common diagnosis. Altogether there were 39 finger tip injuries occurring in 27 patients, many a times multiple fingers being involved in the same patient.

Regarding anaesthesia choice for surgery, the digital block was the most popular anesthesia (used in 78 (44.8%) patients), followed by the axillary block and the wrist block, all administered by the surgeon themselves. General anesthesia (GA) was used in only 8 cases which was administered by the anaesthesiologist.

Tendon repair was the most common treatment procedure performed followed by fixation of fractures (Table 7). Altogether 96 tendon repairs were performed and 48 fracture fixation were done. Also a total of 15 nail beds were repaired.

**Table 7: Treatment procedures for hand injuries**

| Treatment modality | No. |
|---|---|
| **Tendon repair** | 96 |
| **K-wire fixation of fracture** | 45 |
| **Needle/pin fixation of fracture** | 3 |
| **Nail bed repair** | 15 |
| **Composite grafting** | 4 |
| **Revision amputation** | 6 |
| **Ray amputation** | 3 |
| **Below elbow amputation** | 2 |
| **Homodigital flaps** | 11 |
| Atasoy | 2 |
| Kutler | 2 |
| Eponychial flap | 6 |
| Furlow's cup flap | 1 |
| **Heterodigital flaps** | 4 |
| Cross finger flap | 3 |
| Flag flap | 1 |
| **Groin flap** | 4 |
| **Radial artery repair** | 3 |
| **Ulnar artery repair** | 6 |
| **Ulnar nerve repair** | 3 |
| **Median nerve repair** | 2 |
| **Digital nerve repair** | 13 |
| **Digital vessel repair** | 4 |
| **Nerve grafting (digital)** | 2 |
| **Sural nerve cable grafting for ulnar nerve segmental loss** | 1 |
| **Full Thickness Skin Grafting (FTSG)** | 1 |
| **Split Thickness Skin Grafting (STSG)** | 3 |
| **Central slip reconstruction with Palmaris longus** | 1 |
| **Revascularization of wrist** | 1 |
| **Revascularization of digits** | 1 |
| **Primary closure** | 9 |
| **Digital replantation** | 2 |
| **Hand replantation** | 1 |

## Discussion

The majority of the study population comprised of male individuals. The predominant involvement of the male gender has been reported in other studies as well.[6,7,8] In a developing country like Nepal, women are less involved in industrial and other similar workplace, and are more likely to be involved in household chores. This could explain the high male-to-female ratio observed in our study. Also the predominant involvement of young population within the age group of 21-30 shows that this age group constitutes the significant portion of the workforce involved in industries, factories and manual labourer work. The young age groups are more likely to be injury prone and involved in high-risk jobs. They may also be undertrained and lack enough experience. The predominant involvement of the young age groups has been reported in similar other studies as well.[6,7]

There was not much difference regarding the handedness or dominancy of the hand. Both the right and left hand were equally involved, and both the dominant and non-dominant hands were almost equally involved. A similar study by Hollis and Watson observed that both the dominant and non-dominant hands were at equal risk without regard to the mechanism of injury.[9] This could be because most of the manual work required that both the hands be used at the same time, making both hands equally vulnerable to injuries. The significant involvement of the left and non-dominant hand could also suggest that the tool used by the dominant hand accidently caused injury to the non-dominant hand, or that the dominant hand was more likely to escape the hand injury than the non-dominant one.

Regarding the duration of injury before presentation to our centre, most of the patients presented to the ER department within 6 hours of injury. These were the patients living nearby or having their workplace nearby. Those having their workplace or home outside the Kathmandu valley (the valley where our centre is situated), and other referral cases from periphery of Nepal usually presented the next day or one or two day after. Patients were keen on seeking the health care early because the hand injury caused a significant disability in their daily life.

Furniture and wood workshops were the most common settings where the injury occurred followed by home and industrial workplaces (factories). Moreover, the top ranking occupations concerned with hand injuries were carpenters, students, and manual labourers and factory workers respectively. Electrically powered saw belt and grinding machinery were the main culprit of crush/avulsion injury, whereas glass and knife were the main causes of sharp cut injury. All these findings highlight the issue of the lack of occupational and vocational safety measures at the workplace.

The workplace conditions in the furniture workshop and industries play an important role in the causation of hand injuries. Not adopting safety measures, poor conditions of the equipments, faulty machinery, undertrained young workers and poor work conditions all have contributed to hand injuries, whether in the industrial setting or at home. Similarly, work related factors such as overwork, physical exhaustion, drowsiness were also responsible for causing hand injuries. Moreover, young males trying to repair or clean a motorbike chain by themselves rather than the mechanic have been another factor for the causation of crush/avulsion injury. Most of the sharp cut injurieswere caused by beer/alcoholic beverage bottle glass shards when the patients were heavily under the influence.

In a study consisting of 560 patients carried out in the People's Republic of China (PRC) severe injuries occurred most often while working with food products, furniture, non-metallic mineral products and wood products.[10] The authors in that study had concluded that working in manufacturing industries and working with powered machines were the primary sources of severe hand injuries in hospitalized workers in economically active areas. Similarly, a study carried out in Hong Kong consisting of 196 injured workers identified 7 significant transient risk factors: using malfunctioning equipment/materials, using a different work method, performing an unusual work task, working overtime, feeling ill, being distracted and rushing, for causation of acute occupational hand injuries.[11] The authors concluded that workers and their employers should increase their awareness of these risk factors, and efforts be made to avoid exposures to these factors by means of engineering and administrative controls supplemented by safety education and training.[11]

The middle and the index fingers were the most commonly involved part of the hand. This finding was similar to the study carried out in North India.[6] However the study carried out in another teaching hospital in Nepal found that the middle and ring fingers to be the most commonly injured hand part.[7] However the study from the PRC found out that the index finger was the

most commonly injured digithowever most severe injuries tended to occur in the right thumb.[10]

Most of the similar studies report traumatic amputations and fractures to be the most common diagnosis relating to hand injuries.[6,7,12,13,14] However, in this study tendon injury was the most common diagnosis followed by fractures and finger tip injury. The injuries were managed accordingly with tenorrhaphy, fixation of the fractures and, with homodigital and heterodigital flaps for finger tip injuries. Digital and axillary blocks were the commonly used mode of anaesthesia for the treatment procedures.

## Conclusion

Hand injuries are very common among young male furniture and factory workers as well as manual labourers who have occupational exposures to different machines and equipment's such as electrically powered saw belt and grinding machinery. It is thus important to consider the role of certain modifiable factors in the causation of occupational hand injury. Regular maintenance of machinery/tools, work practice controls, avoiding distractions, use of protective and safety measures, and vocational training for those lacking work experience are essential for reducing the risk of hand injury.Formulating safety protocols in the furniture and industrial settings and other machinery related workplaces and implementing them, and raising public awareness in the same regard would play a significant role in preventing disabling hand injuries. Moreover, specialized post graduate training is desirable for not only the aspiring plastic surgeons but also general and orthopaedic surgeons to effectively and skilfully manage the huge burden of hand injuries in a developing country like Nepal.

Conflict of interest: None declared.

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