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Fingertip injury epidemiology: an Indian perspective

Srikant Aruna Samantaray , John Oommen , Chandrabose Vellani Thamunni , Kader Kalathingal ,
Hafiz Muhammed Koyappathody , Srivatsa M. Shet , Subin Joseph and Rajesh Vardhan Pydi

Department of Plastic Surgery, Baby Memorial Hospital, Kozhikode, India

ABSTRACT

Fingertip injuries result in significant morbidity. It is associated with pain, loss of work and recreational hours, financial burden, and distortion of body image. Although it is a common injury, the epidemiology of fingertip injury is a subject with scanty literature. This study is aimed at providing epidemiology of fingertip injury in India. Epidemiological data were collected and analysed through a retrospective review of all fingertip injuries over a period of four years treated in our department. In the paediatric population, among the 241 injuries in 221 children, most occurred at home (98%). Most incidents were in children under five years of age (74%). The most commonly involved digit is the middle finger (29%) and door crush was the commonest reason (80%). Incomplete fingertip amputation with nail bed injury was seen in 80% of cases. In adults, there were 351 injuries in 290 patients, most of which occurred by jamming of the finger at a two-wheeler chain (22.5%). The second most common cause is cut by machine and associated with heavy machinery (17.6%). Complete amputation at the nailbed level was seen in 50% of the cases. Both children and adults need to be educated regarding the causation and effects of fingertip injuries. Damage to fingers can be prevented and reduced by observing safety measures both inside the home and at the workplace.

ARTICLE HISTORY

Received 8 January 2021
Revised 4 June 2021
Accepted 26 July 2021

KEYWORDS

Fingertip injury; paediatric
fingertip injury; adult
fingertip injury; fingertip
injury epidemiology

Introduction

Fingertip is the most distal part of our finger. It includes the peri-onychia, shaft and tuft of the distal phalanx and volar soft tissue. As the first part of the upper extremity that often interacts with the environment during exploratory and manipulative activities, it is vulnerable to injuries [1]. A fingertip injury can be defined as any soft tissue, nail or bony injury distal to the dorsal and volar skin creases at the distal interphalangeal joint and insertion of flexor and extensor tendons of digits. Suboptimal management of these injuries can result in persistent pain, abnormal sensation, finger shortening, nail deformity, joint stiffness, and reduced grip strength. Hence even seemingly trivial fingertip injuries should be always treated by a specialised practitioner. The upper extremity is affected in one-third of all traumatic injuries and hand injuries account for 5% to 10% of emergency department visits [2,3]. Although extremely common, there is limited literature regarding the epidemiology of fingertip injuries in the Indian population. Therefore, we conducted this study to know more about the epidemiology and the clinical aspects of fingertip injuries in a tertiary care hospital in north Kerala, India.

Patients and methods

After getting clearance from the institutional ethics committee, case records of patients with hand injury treated at our hospital between 2015 and 2019 were collected. All patients with fingertip injury were included in the study irrespective of age and sex. Patients with incomplete case records were excluded. Data including the age at the time of injury, gender, type of injury, fingers injured, presence of fractures, and concurrent injury to other

fingers were collected and analysed. The anatomic location of the injury, final diagnosis, and surgical procedures performed were also included. In patients where multiple fingers were injured, who had bony or tendon injury of the different finger at least one of which was a fingertip injury, were also included. For the study purpose fingertip was defined as the part of digits distal to the flexor and extensor tendon insertion, hence patients with a similar mode of injury who had a distal phalanx injury proximal to flexor tendon insertion were excluded. All statistical analyses were performed using SPSS software (SPSS 25.0, IBM) using the student *t*-test and chi-square tests.

Results and analysis

Between January 2015 and December 2019, there were 1498 patients with hand injury treated in our department including 551 patients with fingertip injury. Amongst them 395 (72%) were male and 156 (28%) were female patients with fingertip injury, including 234 (42.5%) paediatric patients (0–14 years). Due to the lack of a complete case record, 45 patients were excluded from the study leaving 506 patients and 592 injured fingers.

Number of digits involved

Among the study population, 444 (88%) were isolated digit injuries and 62 (12%) patients had multiple finger injuries. Amongst multiple finger injuries, the two-digit injury was more common and 47 patients in our study had two fingers of the same hand involved. The combined injury of the middle and ring finger was most common, in 25 patients (53%). There were twelve patients with combined index and middle fingertip injuries and five

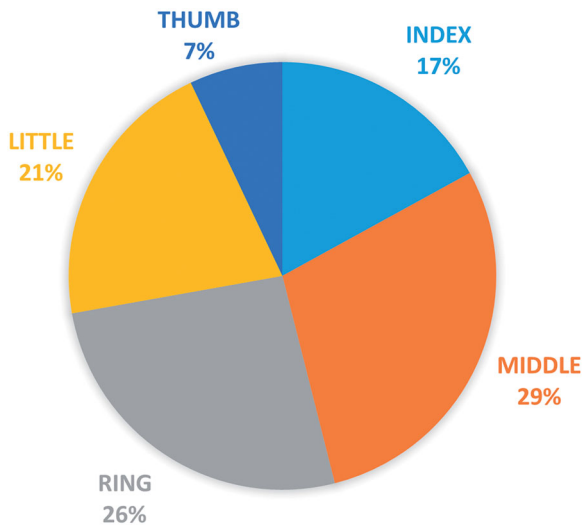


Figure 1. Finger involvement in the paediatric population.

patients with ring and little finger injuries. Only one patient had all four fingers of his hand with fingertip injury and thirteen patients had three fingers of the same hand injured. One patient had the index fingertip of both hands injured.

Paediatric study population

There were 221 patients with age less than fourteen years and 241 digits were injured. Among the paediatric group, the mean age of injury was 4.12 years, the youngest being a five-month old. Children of 2 years of age were the most common victims. In the preschool group, all injuries occurred inside the home. In the school-going group only 7 (8.3%) injuries occurred outside the home.

Gender

There was no significant difference between injuries in preschool children, which included 59 girls and 85 boys. In school-going children, there is a higher incidence of fingertip injuries in boys. Among our study, there were 24 girls and 53 boys ($p = 0.152$).

Finger involvement

The most commonly involved finger was the middle finger, which was involved in 70 (29%) cases (Figure 1).

Dominance

Hand dominance usually develops between 2 and 4 years. For the study purpose hand dominance of all patients elder than 4 years was calculated. There was no significant difference in hand involvement in the age group below 4 years, 64 (49%) had left, and 67 (51%) had right-hand injuries. In the paediatric study population of children above four years of age, 34 (44%) patients had injuries in the non-dominant hand and the rest 44 (56%) had injuries on the dominant hand. There was no significant difference between digits involved, complete or incomplete amputation to hand dominance.

Complete amputation

In the paediatric population, most injuries led to the incomplete amputation of the fingertip. There were 202 fingers (84%) with incomplete amputation and only 19 fingers (16%) with complete amputation. With age, the incidence of complete amputation also increased ($p=0.069$). Among the total amputated digits, two were

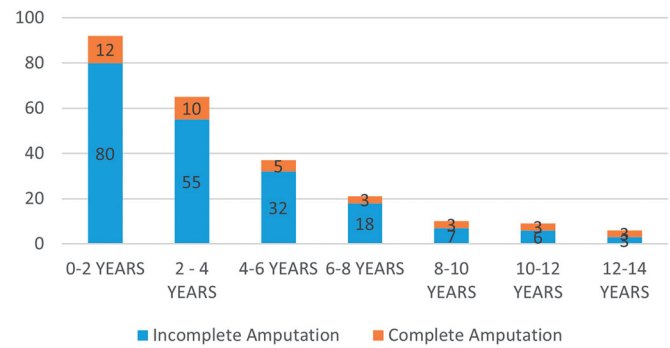


Figure 2. Age-wise distribution of complete and incomplete fingertip amputations in the paediatric population.

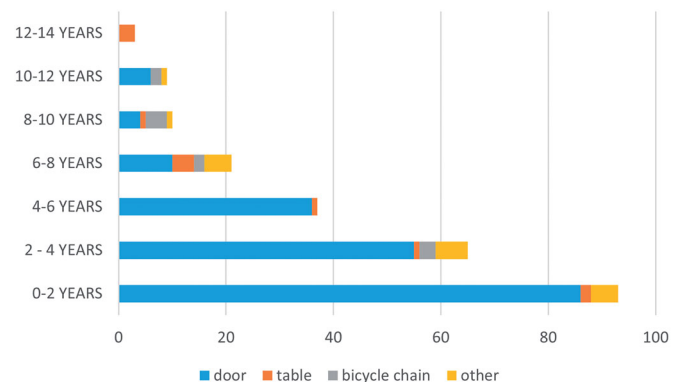


Figure 3. Age-wise distribution of mode of injury in paediatric population.

volar amputation, six were dorsal amputation rest 29 were transverse amputation. Most common were Allen type III (74%) [4] (Figure 2).

Bony involvement

In our paediatric study population, 118 digits (49%) injured were having associated bony injury of the distal phalanx.

Mechanism of injury

The most common mode of injury was by crush in the door hinge, found in 193 of 241 injured digits (80%). In school-going children other modes as crush between school stationery as table and stools were also observed. Only ten fingers had sustained a cut injury and five of them were caused by a knife. There is a significant relationship between door crush injury in the paediatric population compared to adults ($p = 0.001$) (Figure 3).

Treatment

As incomplete fingertip amputations were the most common mode of injury most paediatric patients were treated with nailbed repair. In complex hand injuries with tendon, nerve, or bony injuries the patient also underwent surgeries for associated injuries (Figure 4).

Adult study population

There were 290 patients with 351 injured fingertips in the adult study population. Among them, the mean age of injury was 34 years. The oldest patient treated was 85 years old. The age group of 15–25 years was the most common victims (35.5%). Compared to the paediatric population, only 10% of the injuries occurred inside their home ($p = 0.001$) (Figure 5).

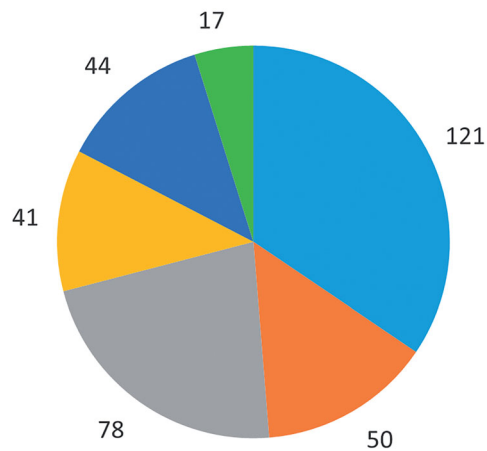


Figure 4. Treatment of fingertip injury in the paediatric population.

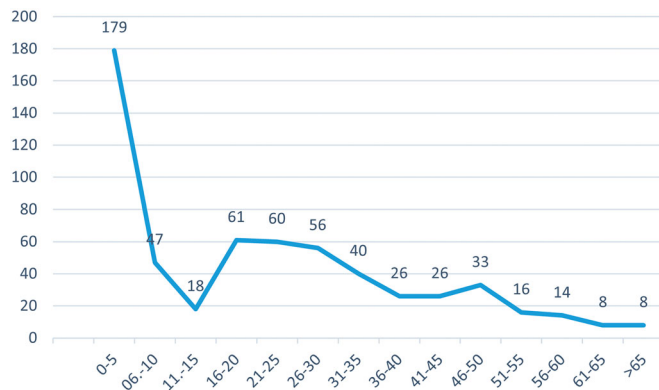


Figure 5. Age-wise distribution of fingertip injuries.

Gender

In the adult group of patients, males had a significantly higher number of digit injuries compared to females ($p=0.002$), when compared to the paediatric population. In our study group there were only 73 female patients while 217 were male patients.

Dominance

The incidence of injury to the dominant hand was not much different from that of the non-dominant hand. The dominant hand was involved in 51% of cases. Irrespective of dominance, the left hand was slightly more commonly injured (51%) compared to the right hand. No significant association was found between dominant hand involved and finger injured.

Finger involvement

Injuries most often involved a single digit and the involvement of fingers are in the following order: middle finger in 95 cases (27%), the index finger in 81 cases (23%), thumb in 71 cases (20%), ring finger in 68 cases (19%), and little finger in 36 cases (10%). Compared to the paediatric population there was a higher incidence of thumb injury in the adult population ($p=0.001$). No significant association between hand involved and finger injured was found (Figure 6).

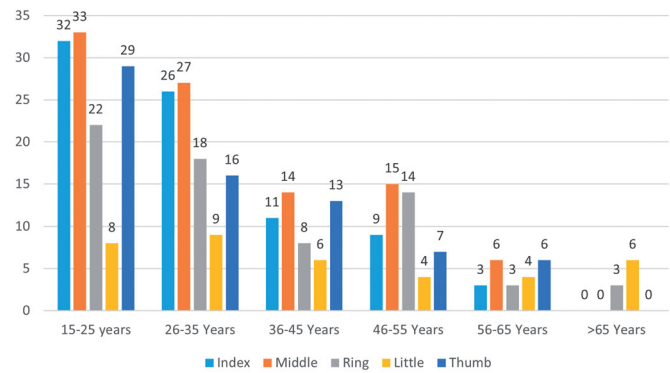


Figure 6. Age-wise distribution and finger involvement in the adult population.

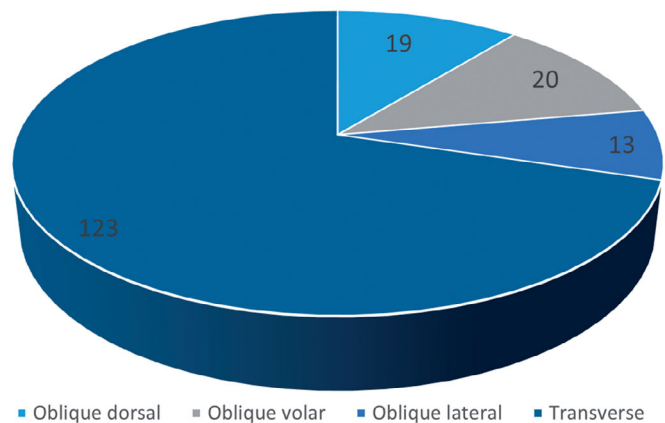


Figure 7. Type of amputation in adult fingertip injury.

Complete amputation

In 174 cases (50%) there was complete amputation of the injured fingertips and the rest 177 injured fingers had incomplete amputations. There were two cases of nailbed hematoma and four pulp tissue losses. This is significantly different compared to the paediatric population where most injuries were incomplete amputations ($p=0.001$). Among the total amputated digits, 20 were volar amputations, 19 were dorsal amputations, and 123 were transverse amputations. Most common were Allen type III (66.6%) [4] (Figure 7).

Bony involvement

Only in 38 (10%) cases in the adult population, there was no associated bony injury with fingertip injury. This is significantly different compared to the paediatric population ($p=0.001$).

Mechanism of injury

The most common mode of injury was crush injury. Crush between moving parts in a machine and crush between heavy objects were the common causes. There were 234 finger injuries with crush injuries and 104 cases of cut injuries. There were five fingertip injuries associated with blast injury and eight were injured by getting jammed in between conveyor belts. There was a significant correlation between chain crush injury with male patients ($p=0.001$) and mixer grinder cut injury in female patients ($p=0.001$). There was a significant number of patients age between 15 and 35 years, (young adults) who had an injury from a cycle/bike chain. Out of 91 chain crush injuries, 76 were in the age group of 15–35 years ($p=0.001$) (Figure 8).

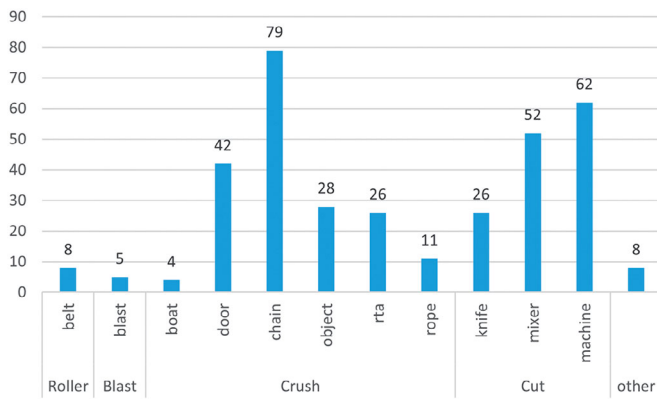


Figure 8. Mode of injury in the adult population.

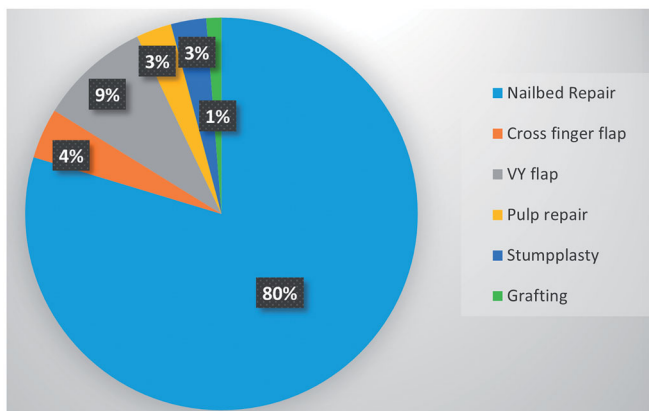


Figure 9. Treatment of adult Fingertip injury.

Treatment

One-third of the incomplete amputations needed bony fixation along with nailbed repair and the rest were treated with only nail bed repair. Fingers with complete amputation were treated with various flap covers, the most common being V-Y advancement flap and cross finger flaps (Figure 9).

Discussion

Approximately 4.8 million emergency visits in the USA are attributed to fingertip injuries [2]. The numbers in a developing country like India are still not known. Comparing to population and lower safety measures at the worksite the numbers can be approximately three to five times higher. This is a significant burden on the healthcare system. It is estimated that in the paediatric population fingertip injuries account for two-thirds of all hand injuries. The most common mechanism is a crush between a door and its frame [5–7]. In our study also the data was similar. Similar to other studies boys are the most common victim of fingertip injury and the incidence increases with age [8,9]. Most of the fingertip injuries in children occurred at home, reinforcing the belief that children are more vulnerable to fingertip injuries at home than at school.

The middle finger is the longest and also the most vulnerable one, which is the most frequently injured finger [10]. Although adjacent fingers were often injured together, it was not exclusive. There was one case each of thumb and ring, thumb and little finger, index with little finger, and middle with little finger

involvement. The last two cases also had other associated hand injuries. These were in a blast injury and a road traffic accident.

Unlike the adult population in the preschool age group, there is no significant difference between the involvement of either of the hands. This can be because, in these children, as the hand dominance is not settled, they use either of the hands for the purpose. Compared to previous studies which stated that the injuries most commonly involve age groups between 4 and 30 years, most patients in our study were under 5 years of age [8].

Fractures of the distal phalanx were present in most adult fingertip injuries and most injuries occur to the middle or distal third of the nail bed i.e. involving haft and tuft of the distal phalanx. Unlike other studies, in our study, the adult population had 90% involvement of bony injury with fingertip injuries [11]. There were a large group of patients with amputation at the distal interphalangeal joint level also in our hospital which was excluded from the study. Contrary to other studies, in our study group, the dominant hand was the most commonly involved [3,8].

In our study thumb injuries were rare in the paediatric group compared to adults, this may be due to the lower tendency of children to use the thumb or due to the tendency of adults to use the thumb to exert more pressure while doing day to day activities. Similarly, there was a significant difference in the total amputation of the injured fingertip and bony involvement among the paediatric and adult population. Compared to other studies, we found a large number of young adults with chain crush injuries in our hospital [12]. This can be attributed to the social habit of cleaning two-wheelers at home in the local society, and the victim not being a trained mechanic gets injured more often.

The treatment of fingertip injuries depends on the presence of complete or incomplete amputation and associated bony injury, exposed bone, availability of microsurgery and surgeon's microsurgical skill [2]. In the majority of the paediatric population as an incomplete amputation was more common, most patients underwent nailbed repair. In complete amputation of fingertip, the ideal treatment would be replantation of the amputated part. The treatment Some selective patients can be treated expectantly with regular dressings [4]. To provide a supple cover over the fingertip various homo-digital and hetero-digital flaps are also used.

Given the significant health burden of fingertip injuries, we consider preventive strategies and educational measures to decrease the incidence of fingertip injuries. Education should be provided to parents regarding the prevention of such injuries. Design modifications of the door are highly recommended. Inclusion of door stoppers placed near the hinge or at the base of the door, which prevent unopposed closure of the door, should be a common household practice. The families should be advised regarding corrective steps to make their children's surroundings safe such as difficult locks that the children can't open. Better workplace safety measures are needed to prevent worksite injuries. Replacement of cutting tools with smarter machines, which are costly but may be a safer alternative.

The epidemiological data for fingertip injury may be used for plans to avoid such injuries.

Disclosure statement

This manuscript has neither been published nor is being considered for publication elsewhere. All authors have made substantial contributions to the work reported in this manuscript.

ORCID

Srikant Aruna Samantaray  <http://orcid.org/0000-0002-5253-5096>
 John Oommen  <http://orcid.org/0000-0001-7394-2638>
 Chandrabose Vellani Thamunni  <http://orcid.org/0000-0001-6752-0412>
 Kader Kalathingal  <http://orcid.org/0000-0002-3773-1312>
 Hafiz Muhammed Koyappathody  <http://orcid.org/0000-0001-8172-2459>
 Srivatsa M. Shet  <http://orcid.org/0000-0001-8494-8779>
 Subin Joseph  <http://orcid.org/0000-0002-4079-5499>
 Rajesh Vardhan Pydi  <http://orcid.org/0000-0002-6014-3375>

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