ORIGINAL ARTICLE

Epidemiology and ınjury characteristics of children with acute traumatic hand injuries undergoing surgery: a 10-year retrospective cohort study

Serpil Savaş,[1] Selman Hakkı Altuntaş,[2] Fuat Uslusoy,[2] Adnan Karaibrahimoğlu[3]

[1]Department of Physical Medicine and Rehabilitation, Süleyman Demirel University Faculty of Medicine, Isparta-*Türkiye*
[2]Department of Plastic and Reconstructive Surgery, Süleyman Demirel University University Faculty of Medicine, Isparta-*Türkiye*
[3]Department of Biostatistics and Medical Informatics, Süleyman Demirel University University Faculty of Medicine, Isparta-*Türkiye*

ABSTRACT

BACKGROUND: The epidemiology of acute hand injuries requiring surgery in children is not well understood in our country. This study aimed to describe the epidemiological and injury characteristics of surgically treated acute traumatic hand injuries in children, considering different age groups and injury severity, and to offer preventive recommendations.

METHODS: We performed a retrospective, descriptive, epidemiological study of surgically treated acute traumatic hand injuries observed between 2004 and 2024 in a tertiary university hospital. The analysis included patients under 18 years old and examined demographics, injury mechanisms, causes, injury characteristics, and severity using the Modified Hand Injury Severity Scale (MHISS).

RESULTS: A total of 295 patients were enrolled in the study. Injuries were most common among males and adolescents. The most frequent mechanism of acute hand injury was laceration (78.6%). Accidental falls with glass cups in toddlers and preschool children, street glass shards in schoolchildren, and punching glass in adolescents were the most common causes of lacerations. The Modified Hand Injury Severity Score (MHISS) indicated that most hand injuries were moderate (35.9%). Complex injuries accounted for 39.7% of all cases, and 10.8% of patients required additional surgeries.

CONCLUSION: Most injuries happen in boys and usually involve lacerations that affect flexor tendons and major nerves, typically of moderate severity. Toddlers and preschool children should not be given glass cups, and schoolchildren should not be allowed to play outside designated playground areas, as there may be shards of glass in certain areas. Schools, families, and adolescents should be informed about the dangers of punching window glass. Raising parental awareness and educating the community can help reduce the occurrence of these injuries.

Keywords: Child; epidemiology; hand injuries; surgery.

INTRODUCTION

The hand is one of the most commonly injured parts of the body in children.[1] Pain, psychological trauma caused by the injury and operation, and functional disability of the hand can be stressful for the child and family.[2] Hand injuries also incur costs, including diagnosis, treatment, hospital stay, multiple appointments, physical therapy, and secondary surgeries.[1] Despite their heavy burden, hand injuries can be effectively prevented by identifying high-risk populations, understanding their common causes, and implementing preventive measures.[3]

Previous studies on the epidemiology of acute hand injuries in children in our country and worldwide have typically focused

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Address for correspondence: Serpil Savaş
Department of Physical Medicine and Rehabilitation, Süleyman Demirel University Faculty of Medicine, Isparta, Türkiye
E-mail: serpilsavas@yahoo.com

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on injuries commonly observed in emergency departments, fractures, and only fingertip injuries.[1,4-12] Up to 30% of hand injuries in children are more severe and require surgery.[9] Although a small number of cases in those studies included children who needed surgery, there are very few studies mainly focusing on hand injuries in children requiring surgery in our country.[13,14] Therefore, epidemiological data on this topic are limited.

This study aimed to analyze the epidemiological and injury characteristics of surgically treated acute traumatic hand injuries in children, considering different age groups, injury severity, and injured structures, and to offer prevention recommendations.

MATERIALS AND METHODS

Medical records of pediatric patients who had undergone surgery for acute traumatic hand injuries at the Plastic and Reconstructive Surgery Department of a tertiary care hospital between May 2014 and August 2024 were reviewed. All patients were referred to the hand rehabilitation outpatient clinic of the same hospital three days after the operation. The Plastic and Reconstructive Surgery Department is a referral clinic that specializes in microsurgery for patients with severe hand and arm injuries from the city center, surrounding districts, and neighboring cities.

Hand injury was defined as damage to the structures of the hand located distal to the radiocarpal joint and the transverse wrist crease. The inclusion criteria for the study were patients under 18 years old who had undergone surgery for acute hand trauma. The exclusion criteria included patients with burns; those who had undergone surgical treatment at another hospital before their presentation; cases of tendon transfers; congenital or traumatic brachial plexus injuries; congenital hand deformities; previous tendon repairs; chronic boutonniere deformity; hand tumors; hand contracture releases; non-operated mallet fingers; trigger fingers; earthquake victims; patients with unclear injury details in their records who could not be reached by phone; and patients admitted more than three weeks after their injury.

Charts were reviewed to collect information on demographic features, injury specifics, and surgical data. The demographic characteristics included age, sex, and educational level. The injury details included the year, season, and month of injury; location of injury (at home or outside); whether the injury occurred during formal or informal work; the cause and mechanism of injury (crush, laceration, blunt); specific fingers injured and the number of fingers affected; the area of the injured tendon (flexor or extensor); the number and location of injured tendons; fractures and their location (phalanges, metacarpals, carpals); the presence of nerve (median, ulnar, radial, and digital nerves) and/or vascular injury (radial, ulnar, digital arteries); amputation; amputated fingers; and the number of amputated fingers. Digital nerve injuries were not considered major nerve injuries. The children were divided into four age groups: toddlers (0–2 years), preschool (3–6 years), schoolchildren (7–11 years), and adolescents (12–17 years). Hand injury is defined as a crushing injury when a compressive force is applied and the hand is squeezed between two objects; blunt trauma is caused by a traumatic injury caused by a blunt object or force; and laceration is caused by cutting the hand tissues with a sharp object.[15] Fractures were evaluated from radiographs of the system.

Hand injuries were classified as simple or complex based on the structures involved. Complex injuries included those involving two or more of the following: bone, ligament, tendon, nerve, artery, and soft tissue injuries that required tissue transfer or skin grafting.[9] Isolated tendon injuries and digital nerve injuries were not categorized as complex injuries. In adults, extensor tendon injuries were divided into eight injury sites using this system, and flexor tendon injuries were classified based on the five anatomical zones described.[16]

The severity of the injury was determined using the Modified Hand Injury Severity Score System (MHISS), based on medical records and hand photographs taken before the operation.[17] The MHISS is a scoring system that evaluates the hand, carpal, and frontal skin, as well as the skeletal, motor, and neural (SSMN) structures. Hand injury severity was categorized based on the total MHISS score as follows: minor (<20), moderate (21–50), severe (51–100), and very severe (>101). Operative details included the tissues repaired, any subsequent surgeries following the initial procedure, and any complications that occurred during the postoperative period. Patients who developed complex regional pain syndrome (CRPS) after surgery were also included. CRPS was diagnosed using clinical diagnostic criteria.[18] The study protocol was approved by the institutional medical ethics committee on 8 August 2024 (document number 78/10). The study was conducted in accordance with the Declaration of Helsinki,

Statistical Analysis

The statistical analyses were conducted using SPSS 25.0 software (IBM Inc., USA). Descriptive statistics were used to present the frequency (percentage) for categorical variables and the mean ± standard deviation for numerical variables. Pearson's χ^2 test was used to establish relationships between categorical variables, and the Monte Carlo Exact test was used when necessary. In cases where the Monte Carlo Exact solution was applied to the Pearson χ^2 analysis, some significant values were not considered statistically significant because they had only one or two frequency counts. A p-value of <0.05 was deemed statistically significant for a 5% type I error.

Table 1. Demographics and injury characteristics of the patients

Demographics and injury characteristics of patients	n=295
Age, years (mean±SD) (min-max)	11.59 ±4.92 (1-17)
Sex (n, %)	
Female	68 (23.1)
Male	227 (76.9)
Age groups, years, n (%)	
Toddler (<2)	17 (5.8)
Preschool (3-6)	44 (14.9)
Schoolchildren (7-11)	55 (18.6)
Adolescents (12-17)	179 (60.7)
Education (n, %)	
Preschool	53 (18.0)
Primary education	106 (35.9)
High school	123 (41.7)
Drop out of high school	13 (4.4)
Injury season (n, %)	
Spring	71 (24.1)
Summer	111 (37.6)
Fall	69 (23.4)
Winter	44 (14.9)
Injury location (n, %)	
Home	115 (39.0)
Outside home	180 (61.0)
Injury mechanism (n, %)	
Laceration	232 (78.6)
Crush	59 (20.0)
Blunt	5 (1.7)
Dominant hand injury (n, %)	
Yes	164 (55.6)
No	131 (44.4)
Number of the injured fingers (mean±SD) (min-max)	1.15±0.84 (0-5)
Injured fingers (n, %)	
Thumb	52 (17.6)
Index finger	83 (28.1)
Middle finger	83 (28.1)
Ring finger	71 (24.1)
Little finger	83 (28.1)
MHIIS score (mean±SD) (min-max)	48.87±55.40 (3-364)
MHISS score severity (n, %)	
Minor (<20)	102 (34.6)
Moderate (21-50)	106 (35.9)
Severe (51-100)	48 (16.3)
Very severe (>100)	39 (13.2)
Injury characteristics (n, %)	
Simple	178 (60.3)
Complex	117 (39.7)
Tendon injury (n, %)	261 (88.5)
Flexor	150 (50.8)
Extensor	111 (37.6)
Fracture (n, %)	89 (30.2)
Metacarpal	8 (2.7)
Proximal phalanx	41 (13.9)
Distal interphalangeal	46 (15.6)
Carpals	1 (0.3)
Nerve injury (n, %)	96 (32.5)
Median	16 (5.4)
Ulnar	21 (7.1)
Radial, PIN	1 (0.3)
Radial, superficialis	4 (1.4)
Digital	55 (18.6)
Artery injury (n, %)	57 (19.3)
Ulnar	17 (5.8)
Radial	10 (3.4)
Digital	29 (9.8)
Amputation (n, %)	29 (9.8)
Metacarpophalangeal	2 (0.7)
Proximal interphalangeal	7 (2.4)
Distal interphalangeal	21 (7.1)
Digital	2 (0.7)
CRPS (n, %)	
Yes	12 (4.1)
No	283 (95.9)

MHISS: Modified Hand Injury Severity Score; PIN: Posterior interosseous nerve; CRPS: Complex Regional Pain Syndrome

RESULTS

Records of 488 children who underwent hand surgery were retrospectively examined. One hundred ninety-three patients were excluded from the study due to the exclusion criteria, and 295 patients were included in the study. The parents of 16 children were contacted by phone to complete the necessary information. The distribution of the number of injuries per year is shown in Figure 1.

The average age of the patients was 11.59±4.92 (1–17) years. Injuries were more common in males (76.9%). Adolescents had the highest injury rates (60.7%). Among these adolescents, 4.4% had dropped out of high school, and 69.2% had sustained injuries while working in informal jobs.

Dominant hand injuries were present in 55.6% of the patients. Two (0.70%) patients had bilateral hand injuries. Most

Table 2. Mechanisms and etiology of the injuries

Mechanism and etio-logy of injury	Total n= 295	0-2 n=17	3-6 n=44	7-11 n=55	12-17 n=179
Laceration (n, %)	232 (78.6)	14 (6.0)	37 (15.9)	41 (17.7)	140 (60.3)
A. Glass	113 (38.3)	9 (8.0)	17 (15.0)	24 (21.2)	63 (55.8)
Punching the window pane	39 (13.2)	0 (0)	0 (0)	2 (5.1)	37 (94.9) **
Falls while holding a glass cup	22 (7.5)	7 (31.8)**	13 (59.1) *	2 (9.1)	0 (0)
Accidentally bumping into the glass door	17 (5.8)	2 (11.8)	2 (11.8)	6 (35.3)	7 (41.2)
Shards of glass on the street	17 (5.8)	0 (0)	2 (11.8)	9 (52.9) **	6 (35.3)
Pushing the door win-dow	8 (2.7)	0 (0)	0 (0)	3 (37.5)	5 (62.5)
Accidentally broke a glass cup	7 (2.4)	0 (0)	0 (0)	2 (28.6)	5 (71.4)
The window glass falls on the hand	3 (1)	0 (0)	0 (0)	0 (0)	3 (100)
C. Non-motorized far-ming equipment	21 (7.2)	0 (0)	1 (4.8)	3 (14.3)	17 (81.0)
Brush hook	15 (5.1)	0 (0)	1 (6.7)	2 (13.3)	12 (80)
Pruning shears	4 (1.4)	0 (0)	0 (0)	1 (25)	3 (75)
Ax	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Hand adze tool	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
D. Motorized farming equipment and cutting machines	36 (12.3)	1 (2.8)	8 (22.2)	2 (5.6)	25 (69.4)
Blender blade	2 (9.7)	0 (0)	1 (50)	0 (0)	1 (50)
Angle grinder	9 (3.1)	0 (0)	1 (11.1)	0 (0)	8 (88.9)
Chainsaw	12 (4.1)	0 (0)	0 (0)	1 (8.3)	11 (91.7) *
Wood cutting machine	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
PVC cutting machine	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Plow (Pulluk)	1 (0.3)	0 (0)	1 (100)	0 (0)	0 (0)
Meat grinder blade	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Screw machine	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Engine belt	4 (1.4)	0 (0)	3 (75.0)	0 (0)	1 (25.0)
Tractor propeller	4 (1.4)	1 (25.0)	2 (50.0) *	1 (25.0)	0 (0)
E. Various sharp ob-jects	62 (21.0)	4 (6.5)	11 (11.7)	12 (19.4)	35 (56.5)
Knife	33 (11.2)	3 (9.1)	1 (3.0)	9 (27.3)	20 (60.6)
Razor blade	2 (0.7)	0 (0)	0 (0)	0 (0)	2 (100)
Marble	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Plastic bottle	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Reed	1 (0.3)	0 (0)	1 (100)	0 (0)	0 (0)
Iron	4 (1.4)	0 (0)	1 (25)	0 (0)	3 (75)
Rope	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Porcelain incision	1 (0.3)	0 (0)	1 (100)	0 (0)	0 (0)
Rope	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Mirror	1 (0.3)	0 (0)	0 (0)	1 (100)	0 (0)
Brick	1 (0.3)	1 (100)*	0 (0)	0 (0)	0 (0)
Nail	1(0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Tin	1 (0.3)	1 (100)	0 (0)	0 (0)	0 (0)
Wood	1 (0.3)	0 (0)	0 (0)	1 (33.3)	2 (66.7)
Falling on unknown sharp objects	12 (4.1)	0 (0)	5 (41.7)	2 (16.7)	5 (41.7)
Crush injury	58 (19.8)	3 (5.1)	7 (11.9)	13 (22)	36 (61)
A. Working machine	6 (2)	1 (16.7)	2 (33.3)	0 (0)	3 (50)

Animal feed pellet mac-hine	1 (0.3)	0 (0)	1 (100)	0 (0)	0 (0)
Baler machine	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Tractor engine	3 (1)	1 (33.3) *	1 (33.3)	0 (0)	1 (33.3)
Work machine	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
B. Entrapment	31 (10.6)	2 (6.5)	4 (12.9)	8 (25.8)	17 (54.8)
Door	14 (4.8)	2 (14.3)	4 (28.6)	3 (21.4)	5 (35.7)
Bicycle chain	2 (0.7)	0 (0)	0 (0)	1 (50)	1 (50)
Motorcycle chain	4 (1.4)	0 (0)	0 (0)	0 (0)	4 (100)
Public exercise equipment	3 (1)	0 (0)	0 (0)	2 (66.7) *	1 (33.3)
Basketball hoop	1 (0.3)	0 (0)	0 (0)	1 (100) *	0 (0)
Iron	3 (1)	0 (0)	0 (0)	1 (33.3)	2 (66.7)
Tractor-trailer	3 (1)	0 (0)	0 (0)	0 (0)	3 (100)
Motorcycle engine	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
C. Heavy object falls on hand	11 (3.8)	0 (0)	1 (9.1)	5 (45.5)	5 (45.5)
Wood	3 (1)	0 (0)	0 (0)	0 (0)	1 (100)
Iron	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Carboy	1 (0.3)	0 (0)	0 (0)	1 (100)	1 (100)
Stone	6 (2)	0 (0)	1 (16.7)	3 (50)	2 (33.3)
D. Traffic accident	5 (1.7)	0 (0)	0 (0)	0 (0)	5 (100)
E. Various	5 (1.7)	0 (0)	0 (0)	0 (0)	5 (100)
Squib	3 (1)	0 (0)	0 (0)	0 (0)	3 (100)
Fall from stairs	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Gunshot	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Blunt injury	5 (1.7)	0 (0)	0 (0)	1 (20)	4 (80)
Ball	3 (1)	0 (0)	0 (0)	0 (0)	3 (100)
Basketball hoop	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (100)
Bumping into a friend	1 (0.3)	0 (0)	0 (0)	1 (100)	0 (0)

p<*0.01, *p<0.0001

patients (67.8%) had injuries to only one finger.

The mean MHISS score was 48.87±55.40 (3–364), and most injuries were moderately severe (35.9%). Of all the injuries, 39.7% were complex. Table 1 presents the demographic and injury characteristics of patients.

The most common mechanism of hand injury was laceration (78.6%), followed by crush trauma (20%). The mechanism of injury did not differ between the age groups (p>0.05).

Glass lacerations were most frequently caused by falling with a glass cup in toddlers and preschool children (p=0.0001 and p=0.01, respectively), by street glass shards in schoolchildren (p=0.0001), and by punching glass and chainsaw injuries in adolescence (p=0.0001 and p=0.01, respectively). The mechanisms and etiological causes of the hand injuries are listed in Table 2.

Falling with a glass cup resulted in moderate-severity hand injuries (mean MHISS=48.40±43.46), with significantly more in-

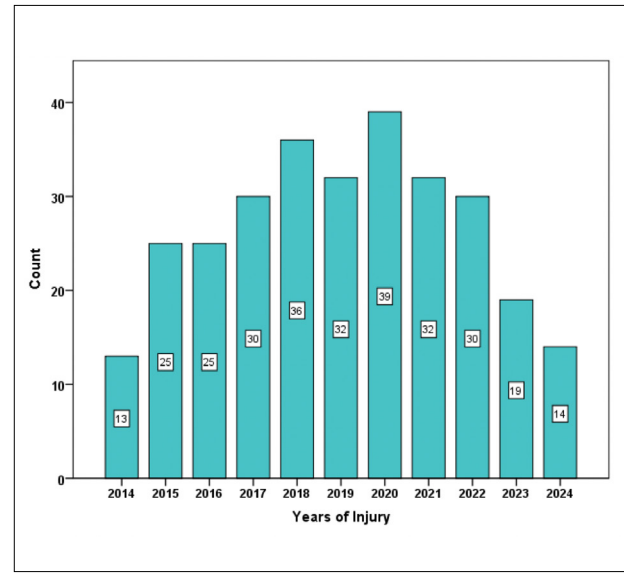

Figure 1. Distribution of injuries by years.

Table 3. Zones of the flexor and the extensor tendon injuries

Flexor tendon injury (n=150)	Injured zone (n, %)	Extensor tendon injury (n=111)	Injured zone (n, %)
Zone 1	15 (9.9)	Zone 1	17 (15.2)
Zone 2	46 (30.3)	Zone 2	22 (19.6)
Zone 3	22 (14.5)	Zone 3	25 (22.3)
Zone 4	7 (4.6)	Zone 4	7 (6.3)
Zone 5	56 (36.8)	Zone 5	18 (16.1)
T1	5 (3.3)	Zone 6	4 (3.6)
T2	3 (2.0)	Zone 7	2 (1.8)
T3	11 (7.3)	Zone 8	2 (1.8)
		T1	5 (4.5)
		T2	5 (4.5)
		T3	0 (0)
		T4	9 (8.0)

juries to the flexor tendons in zones 3 (p=0.001), 4 (p=0.02), and the ulnar artery (p=0.0001). Punching glass caused severe injuries (mean MHISS=50.38±38.92), most commonly in the dominant hand, with flexor tendons, especially in zone 5, being the most frequently affected. The ulnar nerve, ulnar artery, and radial artery were also commonly affected (p=0.004, p=0.005, p=0.0001, p=0.0001, and p=0.006, respectively). Injuries involving chainsaws resulted in extensor tendon injuries (p=0.002) and amputations (p=0.001), with a mean MHISS score of 42.25±57.79.

We identified crush injuries in 59 (20%) of the 295 patients. These injuries led to complex (p=0.002) and severe hand injuries, with a mean MHISS score of 77.76±83.59.

The most common injury among all patients was tendon injury (88.5%). Laceration injuries were significantly linked to flexor tendons (p=0.0001) and major nerve injuries (p=0.003). Table 3 shows details of the injured zones of the flexor and extensor tendons.

Hand fractures were strongly linked to crush injuries (p = 0.0001), with 81 out of 86 fractures (90.0%) needing surgical stabilization. Overall, 29 patients (9.8%) required amputation, which was also significantly associated with crush injuries (p=0.0001). A notable connection was found between door entrapment and distal phalanx fractures (p=0.03).

During the postoperative period, 32 patients (10.8%) required reoperation. The average number of reoperations was 1.28±0.72 (1-4). The reasons for the reoperations are listed in Table 4.

Patients with crush injuries, complex injuries, and amputations had a significantly higher number of reoperations (p=0.031, p=0.01, and p=0.0001, respectively). CRPS developed in 12 (4.1%) patients, with an average onset of 51.3±13.42 (37–73) days.

Table 4. Causes of reoperations

Causes of reoperations, n (%)	n=32
Tenolysis and/or tendon plication	9 (28.1)
Tendon rupture repair	6 (18.8)
Tenodesis	1 (3.1)
Stump repair and/or stump amputation and/or necrosis debridement	6 (18.8)
Contracture release	4 (12.5)
Cross fingers flap	4 (12.5)
Flap separation	3 (9.4)
Flap application	1 (3.12)
Flap revision	4 (12.5)
Nörolysis	3 (9.4)
K-wire revision	2 (6.25)
Skin grafting	2 (6.25)
Vessel anastomosis revision	1 (3.1)
Finger deviation correction	1 (3.1)
Silicon tendon (Hunter) prosthesis	1 (3.1)

DISCUSSION

Understanding the epidemiology and characteristics of injuries surgically treated for acute traumatic hand injuries in children is crucial for protecting them from emotional stress caused by surgery, additional surgeries due to complications,

and potential sequelae. This study aimed to evaluate the epidemiological and injury characteristics of children who received surgical treatment for acute traumatic hand injuries to enhance prevention by identifying high-risk groups and understanding their common causes.

The average age of the patients was 11.5 years, consistent with other studies reporting an average age of 10.1–11.5 years in children with hand injuries.[9,10,13] Our results contradict the study of Gürbüz, who reported a mean age of 4.6 years for hand injuries in children requiring surgery in our country.[14] This is because his patients were between 0 and 6 years old. The highest number of hand injuries occurred during adolescence, aligning with previous findings that hand injuries are more common in teenagers.[10,13] Boys experienced hand injuries three times more often than girls. Male dominance has been observed in surgically treated acute traumatic hand injuries.[7,9,10,13] Factors such as boys' personalities, motor skills, and cultural differences in child-rearing may contribute to their higher risk of traumatic hand injuries.[11]

Injuries occurred most frequently during the summer. This may be because the long summer days encourage children to spend more time outside.[11] Except for the toddlers, most of our patients were injured outside their homes. In line with our results, Gürbüz et al. reported that the most common injury environment was outside the house among their surgically treated patients.[14] Our finding contradicts studies that report children are most likely to be injured at home, including surgeries for hand injuries in other countries.[7,9] We believe that this contradiction is because, in our country, most families allow their children to play outside unsupervised.

In our study, 57% of hand injuries involved the dominant hand, supporting previous research that shows the dominant hand is the most commonly injured in children.[7,9,10,13,14] The dominant hand is usually the first hand extended when reaching for something or the preferred hand for holding objects. Our results show that the index, middle, and little fingers were injured at similar rates. The index and little fingers are the two frontmost fingers when reaching for objects. The middle finger, which is the most extended finger, is especially prone to jamming injuries.[19] Dizin et al. reported that the index finger is most often injured in children with acute traumatic hand injuries requiring surgery.[7]

Lacerations were the main cause of acute traumatic hand injuries requiring surgery in our patients (78.6%). These lacerations resulted from glass, motorized and non-motorized agricultural tools, knives, and various sharp objects. In contrast to our findings, laceration injuries have been reported less frequently (8.9%-53%) among surgically treated acute traumatic hand injuries in other countries.[7,9,10] The main cause of surgically treated acute hand injuries in those studies is crush injuries from door jamming and motor vehicles (such as ATVs and jet skis), lawn mower accidents, automobile crashes, and sports injuries.[7,9,10,12] In our study, crush injuries were the second most common mechanism after lacerations. We observed unusual causes of crush injuries, such as working machinery, bicycle or motorcycle chains, and dropping heavy objects on the hand, which differ significantly from those reported in other countries. In the study by Gürbüz et al., which examined operated hand injuries in preschool children in Central Anatolia, the most common type of injury was crush injury caused by belts from tractors or water engines.[14] Glass-related injuries, which were the leading cause in our study, ranked fourth in their research. In contrast, jamming caused by door slamming, which we observed less frequently, was the second most common cause in their study and the most common hand injury in Sözbilen's study.[13] The differences in injury mechanisms and causes across various countries and within our own might result from variations in socioeconomic status, culture, geography, and whether living conditions are rural or urban.

Glass is one of the most common causes of hand injuries in children.[20] In our study, toddlers and preschoolers were most often injured by falls while holding glass cups. This type of injury can cause serious harm, especially to the flexor tendon and ulnar artery. We strongly advise parents not to give young children and preschoolers glass cups, and increased parental awareness on this issue is essential. Injuries caused by broken street glass shards were the most common among schoolchildren. These shards are broken pieces found on streets and have been identified as the leading cause of glass injuries in children outside the home.[21] We recommend that children avoid recklessness on the roads and that safe playgrounds be provided as alternatives.

During adolescence, punching windows is the primary cause of lacerations from broken glass. This behavior is considered a form of self-harm.[22] This type of laceration, often called the "spaghetti wrist," can damage various structures in the wrist, including tendons, nerves, and arteries, leading to serious consequences for hand function.[23,24] Our findings showed that punching windows caused injuries to the flexor tendons, ulnar nerve, ulnar artery, and radial artery in the dominant hand, resulting in significant and complex injuries in adolescents. Adolescence is a stage of development marked by impulsive behavior as impulse control is still maturing.[25] Typically, these individuals exhibit hostile and disobedient traits and struggle to manage their anger.[26] However, self-inflicted hand injuries can often be prevented. Therefore, it is crucial to identify such cases in the emergency room and offer appropriate psychological support. Schools should teach adolescents about the dangers of punching window glass. It has been observed that preventing angry young men from punching glass is difficult, and the most practical solution may be to replace all accessible windows with safety glass, despite the associated costs.[24] The second most common cause of lacerations in adolescents is injuries involving power tools, especially chainsaws. In our region, where agriculture is common and socioeconomic status is low, adolescents often get

injured while helping their families or working without social security support. The use of motorized cutters by adolescents should be prohibited.

In our study, 88.1% of patients had tendon injuries, with flexor tendons being the most commonly affected. This rate is significantly higher than the reported 0.036–44.9% range of tendon injuries in children with acute hand injuries who have undergone surgery.[7,9,10,13] However, crush injuries, particularly fingertip injuries, were the most common injury mechanisms in these studies. We observed major nerve injuries in 12.5% of our patients, which aligns with a study by Lopes et al., who reported a 10% rate of major nerve injuries in children undergoing surgery for acute traumatic hand injuries.[10] The most frequent causes of major nerve injuries among our patients were punching window glass and falling with a glass cup, consistent with the findings of Jesus et al. regarding nerve injuries caused by broken glass in children.[27]

In the literature, the rate of fractures needing surgical treatment is generally low and has been reported as 2.5–24.7% of all hand fractures in children.[27-29] The fracture rate in hand injuries requiring urgent surgery has been reported to range from 12% to 86.3%.[7,9,10] Hand fractures were present in 30.4% of our patients, and 91% of these fractures required surgical intervention. Phalanges are the most commonly broken bones in children.[6,7,9,29] In our patients, the index and middle fingers were the most frequently fractured phalanges. The most common cause of finger fractures in our patients was door slams. The middle finger is known to be the most susceptible to breakage, especially after a door slam, because it is the longest finger.[19,27]

The mean injury severity was moderate among our patients. Our findings are similar to those of Sözbilen et al., who assessed the severity of hand injuries in pediatric patients requiring urgent surgery.[13] About 40% of the patients had complex injuries. Complex hand injuries in children are a smaller subset of serious injuries caused by hazardous equipment and have been reported in 4%-25.2% of cases.[9,10] Our results were notably higher than those of earlier studies. The increased frequency of injury mechanisms that damage multiple hand structures, such as punching glass, working with machinery, and using motorized farming equipment, may explain the higher rate of complex injuries. In our study, amputation occurred in 9.8% of patients, primarily due to door entrapment and motorized cutters. Hand amputations in children have been reported to range from 3.4% to 11%, caused mainly by door entrapment.[11,19,29] Installing a finger protection device on door hinges can prevent doors from closing unexpectedly.[24]

Pediatric hand injuries typically have a good functional outcome because of their strong regenerative ability. However, additional surgical procedures due to complications have been reported in 7.7%–24.4% of pediatric patients undergoing surgery.[9,14] In our cases, 10.5% underwent at least one second surgery. Most surgeries are performed after complex injuries occur. Patients with complex injuries are twice as likely to need further surgical procedures compared to those with simple injuries.[9,10]

CRPS appeared in 4.1% of patients nearly two months after their initial surgery. CRPS is a chronic pain condition that usually affects a limb and is characterized by neuropathic pain, sensory abnormalities, and neurovascular signs.[18] Although it was once considered rare in children and adolescents, it is now increasingly recognized in pediatric patients and can lead to significant disability.[30]

This study examined the characteristics of surgically treated acute traumatic hand injuries at a single center. This limitation exists because it does not offer information about the nationwide prevalence of these injuries. However, our study is the first comprehensive research in our region to evaluate children with surgically treated acute hand injuries. Additionally, this article provides prevention recommendations by age group and assesses the severity of injuries, which are some of the study's main strengths. This specific group of patients already forms a small subset within the broader category of pediatric hand injuries. Our data is based on a retrospective survey of an intensive reference center that receives referrals not only from the city but also from the surrounding provinces. Therefore, the n=295 sample is a valuable dataset due to the number of cases present and the nature of the subject. Furthermore, ten years of data provide a comprehensive overview of this field.

CONCLUSION

This study found that acute traumatic hand injuries in children requiring surgery most often occur in boys and are typically lacerations involving flexor tendons and major nerves, of moderate severity. Toddlers and preschool children should not be given glass cups, and they should be kept away from motorized farming equipment. Schoolchildren should not be allowed to play outside the playgrounds, as there may be shards of glass in certain areas. Schools, families, and adolescents should be informed about the dangers of punching window glass. Psychological support and anger management therapy might be necessary. If possible, replace all accessible windows with safety glass. Adolescents should not use motorized cutters.

Our research indicates that children's interactions with the outside world often reveal a lack of parental supervision. Parents should be cautious not to leave their children unsupervised. Additionally, there is a need to raise community awareness about preventing hand injuries in children. We believe our data offers field information that can support the development of preventive health policies both at the clinical level and on a national scale.

Ethics Committee Approval: This study was approved by

the Süleyman Demirel University Ethics Committee (Date: 08.08.2024, Decision No: 78/10).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Cerrahi geçiren akut travmatik el yaralanmalı çocukların epidemiyolojisi ve yaralanma özellikleri: 10 yıllık retrospektif bir kohort analiz

AMAÇ: Çocuklarda cerrahi gerektiren akut el yaralanmalarının epidemiyolojisi tam olarak bilinmemektedir. Bu çalışmanın amacı, çocuklarda cerrahi olarak tedavi edilen akut travmatik el yaralanmalarının epidemiyolojisini ve yaralanma özelliklerini belirlemek ve korunma önerileri sunmaktır.
GEREÇ VE YÖNTEM: Üçüncü basamak bir üniversite hastanesinde 2004-2024 yılları arasında cerrahi olarak tedavi edilen akut travmatik el yaralanmaların verileri retrospektif olarak incelendi. Çalışmaya 18 yaşın altındaki hastalar alındı. Hastaların demografik özellikleri, yaralanma mekanizmaları, yaralanma nedenleri, yaralanma özellikleri ve Modifiye El Yaralanması Ciddiyet Skorlaması (MEYCS) kullanılarak yaralanma şiddeti değerlendirildi.
BULGULAR: Çalışmaya 295 hasta dahil edildi. Yaralanmalar en çok erkeklerde ve ergenlerde gözlendi. Akut el yaralanmalarının en sık mekanizması laserasyon (%78.6) idi. Yeni yürümeye başlayan çocuklarda ve okul öncesi çocuklarda cam bardakla düşme, okul çocuklarında sokaktaki cam kırıkları, ergenlerde cama yumruk atma ve elektrikli testere yaralanmaları laserasyonların en sık nedeniydi. Ortalama el yaralanması şiddeti orta idi (%35.9). Kompleks yaralanmalar tüm olguların %39.7'sini oluşturuyordu ve hastaların %10.8'inde ek cerrahi gerekmişti.
SONUÇ: Çocuklarda cerrahi gerektiren akut travmatik el yaralanmalarının temel nedeni cam, motorlu ve motorsuz tarım ekipmanları, kesici makineler, bıçaklar ve çeşitli kesici aletlere bağlı laserasyonlardı. Ebeveyn bilincini artırmak ve toplumu eğitmek, toplumumuzda bu yaralanmaların görülme sıklığını azaltmaya yardımcı olabilir.

Anahtar sözcükler: Cerrahi; çocuk; el yaralanmaları; epidemiyoloji.

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