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SYSTEMATIC META-ANALYSIS

Occupational Hand Injuries and Third-Line University Hospital Emergency Department Admissions in Istanbul

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Abstract

Introduction: The severity of occupational hand injuries ranges from mild to serious (such as loss of a limb). Here, we retrospectively studied patients presenting to an emergency department with hand injuries and the causes of such injuries. We recommend measures that will reduce occupational injuries and the associated effects on the workforce.

Methods: Injuries diagnosed as occupational accidents from January 2017 to June 2019 were retrospectively analyzed. A total of 221 cases met this inclusion criterion. The following variables were analyzed: Age, sex, occupational injury type, time from trauma to emergency department admission, insurance status, whether or not consultation was requested, injury details, and operations performed. All data were statistically analyzed.

Results: Patient age ranged from 18 to 65 years (average 31.4 years). Of all patients, 85% were male and 15% female. Most hand injuries were caused by sharp objects (81 cases), followed by angle grinders or saws (33), compression (66), and falls (24). Fifty-one cases were treated in the emergency department and subsequently discharged without any further consultation. However, 172 cases were referred onward, 151 to the plastic surgery department and 21 to the orthopedic department. The vast majority (143) of referred patients required further surgical interventions.

Discussion and Conclusion: The incidence of limb loss can be reduced by increasing the number of finger re-attachment centers and improving existing centers. We believe that better education would decrease the incidence of workplace injuries in Türkiye. An increase in the number of qualified workers and more rigorous certification would ensure that workers are adequately informed of the difficulties and dangers of any particular job. If more precautions were taken, time lost from work would decrease.

Keywords: Amputation; hand; hand injury; job; occupational accident; occupational health.

Work is the most important determinant of physical, mental, and social well-being. Workplace health and safety are a priority in both developing and developed countries. In Türkiye, tens of thousands are injured in occupational accidents annually, and thousands die from such injuries. According to the International Labour Organisation (ILO), 2.3 million workers die annually from occupational illnesses and accidents[1]. The Turkish Social Security Institution recorded 241,547 occupational accidents in 2015; 1,252 workers died, causing major economic losses[2].

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The ILO found that, in developing economies, occupational illnesses and accidents consume 4% of the gross domestic product. The severity of hand injuries caused by occupational accidents ranges from mild to serious, including the loss of a limb. Of all occupational accidents, hand injuries constitute 4–11%, depending on the work sector[3].

No national or global study has investigated hand injuries caused by occupational accidents. We performed our study in Istanbul, which is the most populous, industrially developed and economically active city of Türkiye[4]. Istanbul engages in more economic activity than does any other Turkish city. Therefore, the SBU Haydarpaşa Numune SUAM emergency medicine department located in the center of Istanbul was an ideal location in which to research hand trauma caused by occupational accidents between January 2017 and June 2019.

Materials and Methods

Istanbul is a global metropolis and the 23rd-largest city in the world[5]. The study was approved by the SBU Haydarpaşa Numune SUAM Ethics Committee. We retrospectively evaluated patients presenting to our emergency department with hand injuries caused by occupational accidents from January 2017 to June 2019. We recorded information on age, sex, insurance status, citizenship, the extent of occupational safety education, occupational experience, the duration of hospital stay, monthly income, educational status, any prior occupational accident, any disease, tobacco and alcohol consumption, the injury and treatment details, the dominant hand and time off work.

Inclusion and Exclusion Criteria

Of 1253 patients aged 18–65 years presenting to our emergency department with hand traumas secondary to occupational accidents between January 2017 and June 2019, 221 were included in the study. Patients <18 and >65 years of age, and those whose injuries were not sustained in occupational settings, were excluded from the study.

Data Collection

We investigated cases suffering occupational accidents, as confirmed by forensic reports. Our hospital data management system contained information on their demographic characteristics, citizenship, insurance status, trauma characteristics, duration of hospital stay treatments, and time off work. Patients were contacted by telephone and asked about their occupational safety education, educational status, any prior occupational accident, monthly income, occupational experience, dominant hand, disease history, and tobacco and alcohol consumption.

Ethics Committee Approval

The SBU Haydarpaşa Numune SUAM Clinics Ethics Committee approved the study, which conformed with the tenets of the declaration of Helsinki.

Statistical Analysis

Data were entered into Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Statistical analysis was performed using SPSS ver. 22.0 software (SPSS Inc., Chicago, IL, USA). We calculated averages and standard deviations for continuous variables and numbers and percentages for categorical variables.

Results

Demographics

We evaluated 221 patients 18–64 years of age treated between January 2017 and June 2019, of whom 188 (85.1%) were male and 33 (14.9%) were female. Male patient ages ranged from 18 to 64 (average 37.28±10.42) years. Female patient ages ranged from 18 to 61 (average 32.76±11.21) years. The average age of all patients was 36.61±10.64 years. Thirty patients were aged 18–25 years, 135 were aged 25–45 years, and 56 were aged 45–65 years (Table 1). Sixty-six patients (29.8%) had ≥5 years of experience in their present jobs, 92 (41.6%) had 1–5 years of experience, and 63 (28.6%) had <1 year of experience. A total of 167 patients (75.5%) had health insurance and the remaining 54 (24.5%) had no insurance. Of all patients, 181 were Turkish (81.9%).

Of all patients, 172 (77.8%) stated that they did not receive any specific occupational safety education, whereas 49 (22.2%) did.Of those who had suffered prior accidents, 6 (9.5%) patients had <1 year of work experience, 14 (15.2%) had 1–5 years of work experience, and 18 (27.2%) had >5 years of work experience. Of all patients, 54 (24.4%) earned <24,000 Turkish Lira (TL) annually, 131 (59.2%) had an annual income of 24,000–60,000 TL, and 36 (16.2%) had an annual income of >60,000 TL. In terms of tobacco use at the time of admission, 13 (43.3%) of those aged 18–25 years, 77 (57.0%) of those aged 25–45 years, and 37 (66.0%) of those aged 45–65 years smoked (total 127 [57.4%]). Of all patients, 43 (19.4%) stated that they were social alcohol consumers.

Table 1. Evaluation of Age by Gender

	Age	
	Min-Max	**Mean±SD**
Sex		
Female	18–64	37.28±10.42
Male	18–61	32.76±11.21
Total	18–64	36.61±10.64

Fourteen (6.3%) patients had hypertension (HT), eight (3.6%) diabetes mellitus (DM), three (1.35%) coronary artery disease (CAD), and four (1.8%) bronchiectasis. Two of the CAD patients also had HT and DM. In total, 27 (12.2%) patients suffered from diseases. Of all patients, 123 (55.7%) suffered right-hand trauma and 98 (44.3%) suffered left-hand trauma (Table 2). Of the 221 patients, 182 (82%) were right-hand dominant and 39 (17.6%) were left-hand dominant. In terms of educational status, 14 (6.3%) patients lacked formal education but could read and write, 26 (11.7%) were primary school graduates, 93 (42.0%) were middle school graduates, 56 (25.3%) were high school graduates, and the remaining 32 (14.4%) were university graduates.

Trauma Characteristics

Occupational accidents were most commonly caused by sharp objects (36.7%) and least commonly by contact with hot objects (1.4%). The fingers were affected in 85% of all injuries, the area between the wrist and the fingers was affected in 10%, and the wrist was affected in 5%. Of all patients, 92 were admitted within 30 min after injury, 105 between 30 min and 2 h, and 24 later than 2 h. In patients who underwent finger re-attachment after accidental amputation, the average time from injury to admission was 45 min. Of the injured fingers, fingers 1 and 4 on the right hand and fingers 2 and 4 on the left hand were most often affected (Table 3).

Table 2. Evaluation of Trauma Type

	n	%
Type of Trauma		
Drilling Cutting Tool	81	36.7
Jamming	66	29.9
Spiral Saw	33	14.9
Falling - Traffic Accident	24	10.9
Animal Bite / Scratch	5	1.3
Infected Medical Metals	9	4.1
Hot Matter	3	1.4

Table 3. The Side of Injured Finger

	Side	
	Right hand n (%)	Left hand n (%)
Finger 1	33 (26.8)	24 (24.5)
Finger 2	28 (22.8)	36 (36.7)
Finger 3	28 (22.8)	23 (23.5)
Finger 4	32 (26)	27 (27.6)
Finger 5	29 (23.6)	13 (13.3)

Treatment

Of all patients, 49 (22.1%) were discharged after wound suturing or dressing, but 172 were admitted for operations. In descending order, the most common surgeries were tenorrhaphy, neurorrhaphy, finger re-attachment and fracture, and nailbed and vessel repair (Table 4). Of patients undergoing tenorrhaphy, 29 extensor and 35 flexor tendons were repaired. No patient had both extensor and flexor lacerations. Zone 2 tendon lacerations were the most common in both the extensor and flexor groups (Table 5). Of patients who underwent neurorrhaphy, 23 (71.8%) required digital nerve repair, and 4 (12.5%), 3 (9.3%) and 2 patients required median, ulnar and both median and ulnar nerve repairs, respectively. Of patients who required vessel repair, 8 (71.4%), 2 (14.2%), 2 (14.2%), and 2 (14.2%) required digital, palmar arch, ulnar artery (14.2%), and radial artery repairs, respectively. The average hospital stay length of patients who underwent surgery was 4.2 (range 1–8) days; those undergoing finger re-attachment required the longest hospital stays and those undergoing nailbed repair the shortest. After surgery, the patients returned to work after an average of 47.2 (range 7–143) days.

Table 4. Determination of Treatment Groups

	n	%
Type of Treatment		
Tenorrhaphy	62	28.1
Neuroraphy	32	14.5
Vascular Repair	14	6.3
Nail Bed Repair	19	8.6
Open Fracture Repair	34	15.4
Amputation Repair	35	15.8
Primary Repair	37	16.7
Reduction	6	2.7
Wound Dressing	22	10

Table 5. Distribution of Tendon Injury

	Tendon Injury		Total
	Extensor n (%)	Flexor n (%)	n (%)
Zone 1	2 (6.9)	4 (11.8)	6 (9.5)
Zone 2	12 (41.4)	26 (76.5)	38 (60.3)
Zone 3	3 (10.3)	2 (5.9)	5 (7.9)
Zone 4	1 (3.4)	1 (2.9)	2 (3.2)
Zone 5	4 (13.8)	1 (2.9)	5 (7.9)
Zone 6	6 (20.7)	0 (0)	6 (9.5)
Zone 7	1 (3.4)	0 (0)	1 (1.6)
Total	29 (100)	34 (100)	64 (100)

Discussion

After the industrial revolution, machinery and equipment became integral components of work. Thus, workplace health and safety have become of prime importance[6]. Many factors threaten occupational health and safety. Protective measures greatly benefit employees, employers, and governments[7,8]. Worldwide, occupational accidents cause serious workforce losses and greatly damage national economies.

Occupational hand injuries range from mild injuries to severe ones that include a loss of a limb. Globally, hand injuries constitute 4–11% of all occupational injuries (depending on the work sector). The US Centres for Disease Control and Prevention found that 30% of occupational accidents were hand injuries[9]. Upper extremity accidents (including hand injuries) cost over US$ 18 billion annually. Istanbul, the largest and most economically active city of Türkiye, is home to many industrial centers/corporations with large workforces. Accordingly, SBU HaydarpaşaNumune SUAM Emergency Department, which is centrally located in Istanbul, treats many occupational hand injuries.

The literature on occupational hand injuries is very limited, consisting of only a few regional studies[9]. Of these, one of the largest and most comprehensive was conducted by Wu et al.,[10] who included 2,112 patients, of whom 81% were male. In a Turkish study by Serinken et al.,[11] 87.5% of 244 patients were male. In a study by Garg et al.,[12] 94% of the patients were male. Similarly, Sorock et al.[13] reported that 76% (894) of 1,166 patients were male, and De Jong et al.[14] reported that 85% of their patients were male. Our figure was 85%. Thus, males seem to be at higher risk of occupational accidents. Notably, the average age of affected patients is 30–40 years[10-15] because young adults and the middle-aged constitute large proportions of the workforce and often work in occupations where accidents are common.

Sharp object injuries (29%) and compression (42%) injuries have been commonly reported[10]. Serinken et al.[11] found that the former injuries were the most common (40%). In addition, injuries from avulsions, falls, traffic accidents, human and animal bites, electrical shocks, and contact with hot materials were reported. Injuries have been categorized by etiology and type. The occupational hand injury-related etiological classification system (IKEYES) of Özçelik et al.[16] is one of many examples. Other commonly used systems are that of Tamai[17] and the disabilities of the arm, shoulder, and hand systems[18]. These reveal that sharp object and compression injuries are the most common, as we also found. Note that no classification system or any analysis by injury type yields any clear prognostic information.

Of the hand, the fingers are the most injured[10,11]. The specifically affected fingers varied among studies. Wu et al. found that, in descending order, fingers 1, 2, and 3 were most affected. The order reported by Jong et al. was 2, 1, and 3, whereas the order observed in our study was 2, 1, and 4. Thus, fingers 1 and 2 are the most affected.

Hand injuries can have varying consequences ranging from skin laceration to loss of a limb with a serious risk of morbidity. Panagopoulou et al.[19] found that occupational accidents caused 65% of all amputations. Amputation rates vary greatly in the literature and are largely affected by proximity to an industrial zone, the lack of qualified employees, antiquated workspaces, and attention deficits caused by alcohol consumption.

De Jong et al.[14] found that the most commonly injured tendon was the extensor tendon (68%),with most injuries in zone 2. Although the extensor and flexor tendon injury rates vary in the literature, we also found that zone 2 injuries were the most common, possibly because workers attempt to minimize damage by immediately retracting the affected digits, thus preventing damage at higher levels. Therefore, it is likely that the implementation of certain precautions and better individual awareness would reduce such injuries.

Of our patients, 22.2% had received job-specific health and safety training before the injury occurred. Furthermore, 14.4% of the patients were university graduates and 75.5% had health insurance. Of all workers, 29.8% had held the same job for >5 years. Most patients (81.9%) were Turkish. In terms of repeat accidents, most (27.2%) occurred in patients with >5 years of work experience. Unreported employment, a lack of job-specific education, a lack of insurance, and inappropriately high self-confidence despite a lack of experience may result in serious consequences if not addressed.

Many patients can be treated through wound dressing and simple skin suturing, but high-energy trauma cases require operations. We most frequently performed tenorrhaphy, neurorrhaphy, finger re-attachment and fracture, nail bed, and vessel repair. The hospital stay ranged from 1 to 8 days depending on injury severity, but the average time off work varied greatly; those undergoing finger re-attachment were unable to work for months. High-energy trauma is more commonly associated with serious morbidity and limb loss.

Our work had certain limitations. We did not include all of Istanbul or compare the groups in detail. We lack the long-

term results afforded by prospective studies, and longer-scale multi-center studies are required. However, we have laid the foundation for future comprehensive prospective research.

Conclusion

Hand injuries caused by occupational accidents pose economic, social, and health-care burdens in Türkiye. Such injuries are common, and most require surgical intervention, leading to workforce losses. The incidence of limb loss can be reduced by increasing the number of re-attachment centers and updating the existing centers. Health and safety education should serve as the first-line preventative strategy. Increasing the number of qualified workers and ensuring their certification will increase worker awareness of occupational difficulties and dangers. The prevention of occupational accidents will reduce workforce losses.

Ethics Committee Approval: The University of Health Sciences Türkiye, Hamidiye Faculty of Medicine, Haydarpaşa Numune Health Application and Research Center, Istanbul, Türkiye Clinics Ethics Committee approved the study, which conformed with the tenets of the Declaration of Helsinki.

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