



Epidemiology of injuries treated at a hand and microsurgery hospital

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Objectives: The aim of this study was to evaluate the epidemiology of injuries treated at a hand and microsurgery hospital between 1992 and 2005.

Methods: This is a descriptive retrospective study based on medical records of a hand and microsurgery hospital in İzmir for the years 1992-2005. A total of 8,946 injuries involving 8,817 patients were included. Data on diagnosis were recorded according to ICD-10. Intent, activity when injured, mechanism of injury, object/substance producing injury, and place of injury were recorded according to International Classification of External Causes of Injury (ICECI).

Results: The most common types of injury were amputations (32.3%), fractures (23.7%), and open wounds (19.9%) of the wrist and hand. Most injuries were sustained by males; 28.4% of injuries occurred during summer. According to activity, 76.3% were injured during paid work, 10.4% during transportation, 9.1% during unpaid work, and 3.8% during leisure time sports and exercise. Injuries most commonly occurred while operating a machine. The risk of hand injury was elevated in those younger than 35 years of age, males, persons outside İzmir province, and in Social Security Institution (SSI) insured workers ($p < 0.001$). The riskiest activity for hand injuries was paid work. Compared to baseline, the risk of hand injuries was 29 times [95% confidence interval (CI) 16.36-50.40] as high in industrial or construction areas, and 50 times (95% CI 17.29-143.96) as high in commercial places.

Conclusion: Hand injuries are important because of their consequences, such as permanent disability and their high treatment costs. This study points out many important risk factors, and has contributed the development of hypotheses about injury types, under-notification of occupational injuries, and child labour. The inclusion of medical records from such specialized hospitals into national databases will aid in the prevention of these injuries, and induce developments in diagnosis and treatment.

Key words: Epidemiology; hand; injury; microsurgery.

According to World Health Organization (WHO) data for 2000, an estimated 5.2 million injury-related deaths occurred worldwide, comprising almost 9% of all deaths.^[1,2] Injuries are the fifth most common cause of death among men and the sixth most common among women, according to the National

Burden of Disease study.^[3] Hand injuries are among the most frequent injuries, constituting between 6.6% and 28.6% of all injuries and 28% of injuries to the musculoskeletal system. These injuries occur mainly during industrial activities; however, they also occur at home, in public venues, in traffic acci-

dents, and during sports activities.^[4] Hand injuries usually require a long treatment period and often result in permanent disability

The aim of this study was to epidemiologically define the characteristics of injuries recorded in EMOT Hand, Microsurgery, Orthopedics and Traumatology Hospital between 1992 and 2005.

Patients and methods

This is a descriptive retrospective study based on the medical records of a hand and microsurgery hospital in İzmir for the years 1992-2005. A total of 8,946 injuries involving 8,817 patients were included. The distribution of injuries according to age groups was given in Table 1. Although it is a private institution, EMOT Hospital functions as a referral tertiary care hospital, especially in the field of hand and microsurgery. Patients from 61 of 81 provinces in Turkey were referred to this hospital.

Data on diagnosis were recorded according to ICD-10. Intent, activity when injured, mechanism of injury, object/substance producing injury, and place

Age groups (years)	Male	Female	Total
<15	689 (9.3)	285 (19.0)	974 (10.9)
15-24	2,250 (30.4)	323 (21.5)	2,573 (28.9)
25-34	2,325 (31.4)	241 (16.1)	2,566 (28.8)
35-44	1,310 (17.7)	218 (14.5)	1,528 (17.2)
45-54	543 (7.3)	150 (10.0)	693 (7.8)
55-64	176 (2.4)	126 (8.4)	302 (3.4)
65+	111 (1.5)	156 (10.4)	267 (3.0)
Total	7,404 (100.0)	1,499 (100.0)	8,903 (100.0)

of injury were recoded according to International Classification of External Causes of Injury (ICECI).^[5] Chi-square and logistic regression (forward conditional) were used for analyses. Cases with missing data on the relevant variables were excluded from the

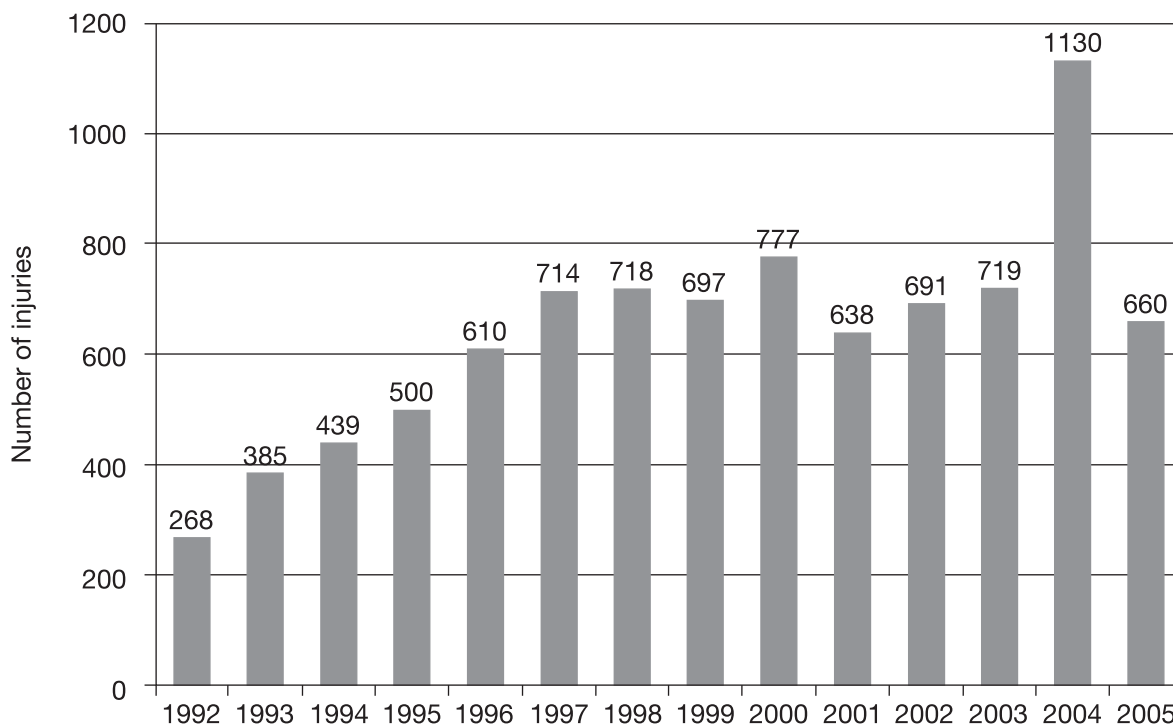


Fig. 1. The number of injuries throughout the years (1992-2005).

analyses. Risk factors for hand injuries were studied with chi-square test and dual logistic regression analysis (forward conditional) model. Reference categories in univariate logistic regression analyses were age younger than 35 years, female gender, having insurance other than Social Security Institution (SSI), injury caused by blunt force, and the activity when injured. The regression models were adjusted for age. P values <0.001 were considered statistically significant.

Results

Among injuries, 90.2% included upper extremities and 73.9% included hands. The distribution of injuries throughout the years is shown in Fig. 1. Patients from 61 provinces were referred to this hospital. Among patients, 70% lived in İzmir and 26.0% were from other Aegean provinces.

The most common injuries were traumatic amputations (32.3%; total and subtotal), fractures (23.7%), and open wounds (19.9%) of the wrist and hand. A total of 11,200 operations were performed to treat these injuries. Among patients, 81.4% had one operation and 11.4% had two operations. Among operations, 59.9% were emergency operations, 31.9% were elective, and 8.2% were elective operations of emergencies. Mean duration of operations was 2.0 hours. Operations were conducted on inpatients in 55.6% of cases and on outpatients in 44.4% of cases. Mean duration of stay in the hospital was 4.9 days.

Among all injuries, 93.1% were unintentional and

5.8% were intentional self-harm. The mean age of patients was 29.8 ± 14.7 years; 83% were male. Among women, injuries were more frequent in the age groups <15 years and >45 years. Within the group with known social security information (4,851 patients), 70% had SSI.

Time of injury

The day of the week with the highest number of admissions was Monday (16.7%), and the lowest was Sunday (9.4%). Injuries occurred more frequently in summer (28.4%), particularly in July (10.2%). Frequency was lowest in the winter (21.7%).

Activity and place of injury

Information about activity and place of injury was unknown for nearly one-fifth of records. Records with information about activity when injured showed that injuries occurred during paid work (76.3%), travelling not elsewhere classified (10.4%), unpaid work (9.1%), and sports and exercise during leisure time (3.8%). Site of occurrence of injury included industrial or construction areas (71.5%), on streets or roads (10.7%), and at home (4.5%). Most injuries to those younger than 15 years of age occurred at work (35.5%) and at home (35.5%).

Mechanism of injury

The most frequent mechanisms of injury were contact with machinery. The distribution of mechanism of injury by activity is presented in Table 2. Objects/sub-

Table 2
Mechanisms of injury according to activities

	The most frequent mechanism	%
All patients	Contact with machinery	46.6
Activity		
Paid work	Contact with machinery	73.6
Unpaid work	Cut, pierced, stabbed	46.5
Education	Falling, stumbling, jumping, pushed	100.0
Sports and exercise during leisure time	Falling, stumbling, jumping, pushed	59.5
Leisure and play	Falling, stumbling, jumping, pushed	89.5
Travelling nor elsewhere classified	Transport-other	96.2

	Object/substance producing injury	%
All patients	Machinery or fixed plant	43.1
Activity		
Paid work	Machinery or fixed plant	68.8
Unpaid work	Door, window, or related fitting/feature	22.6
Education	Unspecified building, building component, or related fitting	85.7
Sports and exercise during leisure time	Unspecified surface conformation	43.0
Leisure and play	Playground equipment	25.0
Travelling not elsewhere classified	Unspecified land vehicle or means of land transport	75.5

stances producing injury are presented in Table 3. The most frequent specific machines or machine parts producing occupational injury are presented in Table 4. Hand injuries were more frequent in males, people younger than 35 years, people with SSI security, and people living outside of İzmir (Table 5).

Men were found to have 2.5 times [95% confidence interval (CI) 2.14-2.89] the risk of women for hand injury. People younger than 35 years had 1.6 times the risk of those ≥35 years or older (95% CI 1.41-1.81). People with SSI insurance had 2.5 times (95% CI 2.14-2.73) the risk of those without SSI insurance (Table 6).

The most risky activity for hand injuries was paid work. Commercial areas had a 50-fold (95% CI 17.29-143.96) increased risk compared with others (Table 7).

Discussion

Hand injuries constitute a significant portion of unintended injuries and comprise 14-27% of unintended injuries treated in emergency departments.^[4,6,7] Likewise, the majority of visits to this hand and microsurgery hospital consisted of hand injuries. Although the use of data from only one hospital is an important limitation of this study, there is no other study from Turkey with a comparably large dataset.

Relatively more severe injuries like amputations are frequently seen at this hospital. Lacerations constituted 40% of injuries among occupational hand injuries admitted to a university hospital in Denizli, an industrial area, while 32.3% were total or subtotal amputations in our study.^[8] According to Larsen et al.^[6] 36% and 39% of hand injuries in the Netherlands and Denmark consisted of superficial or open wounds. The presence of surgeons specializing in hand microsurgery in our hospital and the lack of public hospitals specializing in this field in the Aegean Region might have increased the number of severe injuries treated in this hospital. The specialization of

	%
Wood and assimilated machines	13.9
Press (machine)	12.5
Machine belts	3.1
Planning machine	3.0
Iron part of a machine, tool or construction	2.8
Milling machine	2.3
Metal sheet	2.3
Others	10.8

Table 5
Risk factors in hand injuries

		Hand injury (%)	p value
Age (years)	<35	77.8	<0.001
	35 and above	65.4	
Gender	Male	77.4	<0.001
	Female	56.8	
Social insurance	Social Security Instution	80.1	<0.001
	Other	70.1	
Place of residence	Other than İzmir	77.2	<0.001
	İzmir	72.6	
Intent	Intentional	74.0	0.577
	Unintentional	72.9	
Activity	Paid work	90.2	<0.001
	Unpaid work	79.8	
	Sports and exercise during leisure time	36.8	
	Travelling not elsewhere classified	30.8	
	Other	27.6	
Mechanism	Contact with machinery	93.3	<0.001
	Cut, pierced, stabbed	82.8	
	Other	78.7	
	Blunt force	56.2	
Place of occurrence	Commercial area	94.4	<0.001
	Industrial and construction area	90.7	
	Farm or other place of primary production	81.9	
	Home	80.2	
	Sports and athletics area	33.6	
	Public highway, street or road	30.5	
	Other	26.2	

the hospital in hand microsurgery has led it to act as a tertiary care centre, thus severe hand injuries are more likely to be referred than more common and less severe injuries. According to a study from Canada, 2.76% of patients with hand injuries were hospitalized for one day, and 1.25% stayed for two days,^[9] while in our hospital the mean duration of stay was 4.9 days, and most cases were operated. This also supports the predominance of severe injuries in our study group.

Visits due to injuries occurred most frequently during the summer. In Canada, according to the Canadian Accident Injury Reporting and Evaluation (CAIRE) database for the years 1986-1996, injuries similarly occurred mostly during the summer. They suggested that the increased number of people par-

ticipating in outdoor activities like travelling, sports, games, and riding bicycles may underlie this finding.^[9] There are also studies from Turkey that report an increase in upper extremity injuries in summer.^[10,11] In addition to an increase in outdoor activities, the weather in Izmir is extremely hot during summer, and active work undertaken during the hottest hours of the day, combined with an increase in casual labourers in agriculture might contribute to the frequency of injuries.

The mean age of our study group (30 years) is lower than studies in the Western literature (37 years),^[4,12] but similar to a study from Kenya (28 years).^[13] The high percentage of occupational injuries and the lower starting age for working in our country

Table 6
Socio-demographic risk factors for hand injuries

Risk factor	Category	B	SE	Odds ratio	%95 CI	p value
Constant		-0.55	0.08	0.58		<0.001
Gender	Female (reference category)			1		
	Male	0.91	0.08	2.49	2.14-2.88	<0.001
Age (years)	<35 (reference category)			1		
	35 and above	0.47	0.06	1.59	1.41-1.80	<0.001
Social security	Other (reference category)			1		
	Social Security Instution	0.88	0.06	2.42	2.14-2.74	<0.001

B: The coefficient for the constant, SE: Standard error, CI: Confidence interval.

might explain this. The high proportion (35.5%) of occupational injuries under the age of 15 supports this idea.

This study has shown that hand injuries are more frequent under the age of 35. The injuries examined consisted mostly of occupational traumas. Younger age and lack of experience have been identified as important risk factors.^[4,14] The etiology of occupational hand injuries shows considerable variation among age groups. In a prospective study on railway workers in France, risk was higher during manual work with a tool or machine in the age group under 25, while risk was higher due to falls in aged workers. Hand tools were associated with a higher risk under 30 years or ≥40 years.^[15] A study by the same research team on construction workers has also revealed a higher risk of injury with hand tools in those younger than 30 years.^[16] Similar to other studies, contact with machinery caused a significant risk in our study.

In the CAIRE study, 44% of injuries occurred in the age group 10-19 years.^[9] In the Netherlands and Denmark, hand injuries peaked in the age group 10-14 years.^[6] In both studies, the most common injury type was home injuries, while in our study the proportion of occupational and home injuries are similar. Our hospital’s specialization in the field and thus the relatively higher number of admissions due to occupational injuries might have led to this result. Another factor might be the relatively high prevalence of child labour in Turkey. Turkey is the fourth country after Kenya, Bangladesh, and Haiti in its proportion of child workers. In Turkey, workplaces employing

843,944 children are not registered officially, and there is no information about workplaces employing 18,178 children.^[17] There are currently about one million children aged 6-15 years working in Turkey.^[18]

In studies on childhood hand injuries, the most common type of injuries are lacerations/superficial injuries^[19,20] or fractures.^[21] In research using the national injury surveillance database of the United States, non-occupational hand and finger amputations were most common under five years of age.^[22] In our study, the peak age groups are 15-24 years and 25-34 years. A reason might be the occupational nature and relatively high severity of injuries in our study.

The ratio of male subjects among hand injuries is reported as 76% in the United States,^[12] 69% in the United Kingdom,^[23] 62% in the Netherlands, and 59% in Denmark.^[6] This ratio is higher in our study with 83%. This may reflect the lower participation of women in work life.

It is reported that during childhood, boys have more hand injuries than girls,^[20,24-26] and our findings are consistent with this. Children were mostly injured at home; injuries were mostly crush type,^[21] and they were mostly due to doors at home.^[24] The objects/substances producing injury were doors, windows, or related fitting in injuries that occurred at home; this finding is consistent with the literature. In those older than 65 years, there were more injuries among women in our study, which is again parallel to the results from the Netherlands and Denmark.^[6]

In our study, the number of hand injuries from outside İzmir was higher. This might reflect the nature of

this hospital, which is one of the few specializing in management of severe hand injuries.

Hand injuries were more frequent in people covered with SSI insurance, when cases with information on social security were analyzed. This was an expected finding because of the large proportion of occupational injuries in our database. The SSI-insured comprise a socioeconomically disadvantaged fraction of this population. This might be another factor, since the socioeconomically disadvantaged were found to be under higher risk of hand injuries in the United Kingdom.^[27]

In this study, most of the injuries were occupational (70.5%). There was a 24-fold increased risk of hand injuries in occupational injuries and 10-fold increased risk in home injuries. In the Netherlands and Denmark, nearly 60% of hand injuries occurred during home or leisure activities.^[6] A study by Trybus et al.^[4] revealed that 45.3% of hand injuries occurred at home. Amputations were the most frequent cause of visits to this hospital, which may explain the higher fraction of occupational injuries in the hospital's

records. The hand is the body part most frequently involved in occupational injuries in Turkey,^[8] and the most severe hand injuries occur in occupational injuries.^[28]

As can be expected, hand injuries were more frequent in industrial or construction areas (29 times, 95% CI 16.36-50.40) and commercial areas (50 times, 95% CI 17.29-143.96). Although there were only 89 injuries in commercial areas, the majority were hand injuries, and this resulted in such an elevated risk. Among these, 42.7% were butchers and 19.0% were cooks.

In concordance with the literature, most hand injuries occurred due to contact with machinery.^[4,6] Ground surface followed, which is consistent with falls. Larsen et al.^[6] also found that falls were also the second most common cause of hand injuries.

In Greece, 81% of cases with hand injuries reported a problem with machinery or lack of personal protective equipment.^[29] There are studies on the risk of hand injury due to specific machines used in workplaces.^[4] In many studies designed to elucidate rea-

Table 7
Injury related risk factors for hand injuries (age standardized)

Risk factor	Category	B	SE	Odds ratio	%95 CI	p value
Activity	Other (reference category)			1		
	Travelling not elsewhere classified	0.16	0.42	1.17	0.51-2.69	0.709
	Spor	0.37	0.43	1.44	0.62-3.38	0.400
	Unpaid work	2.34	0.43	10.40	4.49-24.05	<0.001
	Paid work	3.17	0.42	23.83	10.48-54.16	<0.001
Place	Other (reference category)			1		
	Public highway, street or road	0.28	0.29	1.32	0.74-2.34	0.349
	Sports and athletics area	0.38	0.34	1.46	0.75-2.81	0.264
	Home	2.49	0.30	12.16	6.76-21.87	<0.001
	Farm or other place of primary production	2.64	0.32	14.06	7.52-26.28	<0.001
	Industrial and construction area	3.36	0.29	28.72	16.36-50.40	<0.001
	Commercial area	3.91	0.54	49.89	17.29-143.96	<0.001
Mechanism	Blunt force (reference category)			1		
	Other	1.44	0.36	4.21	2.08-8.52	<0.001
	Cut, pierced, stabbed	1.77	0.08	5.88	5.04-6.88	<0.001
	Other mechanical force	2.85	0.07	17.22	14.93-19.87	<0.001

B: The coefficient for the constant, SE: Standard error, CI: Confidence interval.

sons of occupational injuries that evaluate transient exposures, the etiology of the injury is reported as the abnormal functioning or use of machinery.^[30,31]

Hand dominance has also been investigated as a risk factor for hand injuries.^[32-34] A limitation of this retrospective chart study is that information on hand dominance was entered for only a minority of cases. It has been reported that people who have started to work recently in a job have a higher risk than longer-employed workers.^[12,15,35] Another limitation related to the data collection method of this study is that some questionnaire-requiring risk factors evaluated in the literature could not be investigated. This study presents data about hand injuries from a private hospital. The private sector poses an important barrier to access, so this study is limited to hand injuries able to be treated at this hospital. However, employing workers without insuring them is a significant crime in Turkey, thus employers might have chosen this hospital instead of the public hospitals.

The injuries treated in this hospital are severe injuries, with 83% being operated. The role of injuries was found significant in the National Burden of Disease Study, and the hand is the most injured body part involved in occupational accidents, so this database is important. Increasing preventive occupational safety and health measures in workplaces and design of machinery to minimize the risk of injury would contribute in the reduction of hand injuries. This study has pointed out many important risk factors and has contributed to hypotheses for further studies regarding types of injury, injuries not reported, and child labour.

As the hospital performs microsurgical interventions, many patients presented with amputations, and the mean duration of stay was 4.9 days. Microsurgery is a laborious team effort on a 24-hour basis, and it requires experience, infrastructure, specialty anesthesia, and specialty physical rehabilitation. In a country like Turkey where occupational injuries are high in number and where injuries are frequent at young ages, such tertiary care facilities should be established in the public sector and should be coordinated. Hence, patients can restart their productive lives earlier. Likewise, the inclusion of data from such specialty hospitals into the national databases will assist in the prevention of injuries as well as enable developments in diagnosis and treatment.

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