Journal of Multidisciplinary Orthopaedic Surgery
2026;2(2):32–37
DOI 10.64575/10703p31
https://jomdos.org
Original Article

Epidemiology of occupational hand injuries presenting to a tertiary care center in Türkiye over a one-year period

Ahmet Yesevi Sarıaslan[1,*] **Muhammed Ali Demir**[1] **Tarık Özdin**[1] **and Ali Pakırdaşı**[1]

[1]Department of Orthopedics and Traumatology, University of Health Sciences Kayseri City Training and Research Hospital, 38080, Kayseri, Türkiye

***Corresponding author:** Ahmet Yesevi Sarıaslan, Department of Orthopedics and Traumatology, University of Health Sciences Kayseri City Training and Research Hospital, 38080, Kayseri, Türkiye; aysvi@hotmail.com

Received: 11 October 2025; Accepted: 17 January 2026; Published: 01 August 2026

Abstract

Background: Work-related hand injuries constitute a major public health concern and a significant cause of occupational morbidity and lost productivity, particularly in highly industrialized regions. This study aimed to evaluate the epidemiological characteristics of patients presenting with occupational hand injuries in Kayseri, Türkiye. **Methods:** A retrospective cohort study was conducted, evaluating 586 patients with work-related hand injuries between January 2024 and December 2024. Inclusion criteria comprised isolated hand injuries resulting from occupational accidents and documented patient consent. Demographic parameters, injury mechanisms, affected anatomical zones, and treatment modalities were systematically analyzed. **Results:** The patient cohort was predominantly male (91.9%), with a mean age of 31 years. The machinery sector accounted for the highest incidence of trauma (30.7%). High-energy crush injuries inflicted by press machines were the predominant mechanism of injury (62.0%). Topographically, the index finger (second digit) was the most frequently injured. While 71% of patients were treated and discharged directly from the emergency department, 29% required formal hospital admission. Anatomical analysis revealed that among the individual tendons lacerated, 57.8% involved the extensor zones and 42.2% involved the flexor zones. Furthermore, left-hand digital injuries (54%) were significantly more prevalent than right-hand injuries. **Conclusion:** Occupational hand injuries disproportionately afflict young male industrial workers and are primarily driven by high-energy mechanisms, resulting in trauma that ranges from superficial lacerations to devastating amputations.

Keywords: Hand injury, occupational accident, epidemiology, industrial trauma, hand surgery, amputation

Introduction

The International Labour Organization (ILO) characterizes occupational accidents as "an unexpected and unplanned event, including acts of violence, arising out of or in connection with work, which results in personal injury, disease, or death" [1-3]. Such accidents pose a substantial global health burden, contributing significantly to both morbidity and mortality [4-7].

Current epidemiological data indicates that work-related injuries account for approximately 1.2–1.6% of all emergency department admissions [8, 9]. Although

these incidents span all occupational spectrums, they are exceptionally prevalent among industrial laborers. Driven by rapid industrialization, the incidence of occupational trauma among factory and heavy machinery workers has surged, resulting in profound socioeconomic costs and workforce depletion [6-8].

Hand injuries are the most frequently encountered occupational traumas, occasionally accompanied by concurrent injuries to other extremities or internal organs [10]. While rarely life-threatening, the hand is unequivocally the most commonly affected anatomical region in the workplace [1-3]. The severity of occupational hand trauma is highly heterogeneous, ranging from low-energy simple lacerations to devastating high-energy crush injuries and amputations [9-11]. Consequently, treatment modalities span from primary closure to complex, multidisciplinary soft-tissue and microsurgical reconstruction. Various classification and scoring systems have been developed to assess injury severity and forecast functional outcomes [10-12]. However, compared to the extensive metrics established for lower-extremity trauma, standardized and universally adopted classification systems for the upper extremity remain relatively limited [10-12]. Furthermore, objective and independent documentation of these injuries is paramount not only for surgical planning but also to prevent misrepresentation in legal and occupational compensation proceedings [11-13].

This study aimed to evaluate the epidemiological and clinical characteristics of patients presenting with work-related hand injuries to Kayseri City Training and Research Hospital—a tertiary care center situated in a densely industrialized province with a massive workforce population—over a one-year period.

Table 1. Distribution of injury mechanisms across occupational sectors.

Type of Injury	Laceration	Crush	Total	Percent (%)
Timber / Lumber	76	11	87	14.8
Automotive	71	58	129	22.0
Agriculture	18	17	35	5.9
Machinery	115	65	180	30.7
Textile	21	16	37	6.3
Other	71	47	118	20.1
Total	**372**	**214**	**586**	**100.0**

Materials and methods

This retrospective cohort study was conducted at Kayseri City Training and Research Hospital. The study sample comprised patients who presented to the emergency department with hand injuries sustained during occupational accidents between January 2024 and December 2024. Hospital medical records were retrospectively reviewed to extract and analyze the epidemiological and clinical data of 586 eligible patients. Inclusion criteria were strictly defined as the presence of an isolated hand injury sustained during an occupational accident and documented patient consent for the proposed treatment. Patients were excluded from the analysis if they refused treatment, were transferred to another medical facility prior to definitive management, or presented with concomitant major injuries involving other organ systems or extremities.

Results

Data from 586 patients managed for occupational hand injuries were evaluated. The cohort demonstrated a stark gender disparity, consisting of 539 males (91.9%) and 47 females (8.1%), with an overall mean age of 31 years.

Stratification by occupational sector revealed that the machine industry accounted for the absolute highest number of injuries (n=180), whereas the agricultural sector accounted for the lowest (n=35). Across all occupational groups, lacerations were more frequent than crush injuries (Table 1).

Excluding isolated fractures, patients were categorized by primary injury etiology. Press machine accidents were the leading cause of trauma (n=363, 62%), followed by saw injuries (n=111, 19%) and knife lacerations (n=47, 8%). Less frequent but notable mechanisms included sheet metal cuts, cement mixer trauma, drill injuries, and nail gun penetrations (Table 2).

Table 2. Etiological classification of work-related hand injuries.

Etiology of Injury	Number of patients (n)	Percent (%)
Press machine	363	62.0
Saw injury	111	19.0
Other	55	9.3
Knife laceration	47	8.0
Glass laceration	7	1.2
Axe injury	3	0.5
Total	**586**	**100.0**

For injuries sustained via press machines, patients with multiple fractures were evaluated by assessing each affected digit independently. A total of 484 phalangeal fractures were recorded. Fracture localization analysis demonstrated that the distal phalanx was the most frequently fractured bone across all digits, followed by the middle phalanx, with the exception of the fifth digit, where the proximal phalanx was the second most common fracture site. Topographical distribution confirmed that the second digit (index finger) was the most frequently injured (n=144, 29.8%), followed by the third (n=130, 26.9%), fourth (n=97, 20.0%), first (n=71, 14.7%), and fifth digits (n=42, 8.6%) (Figure 1). Clinical interventions were stratified based on emergency department outcomes: non-invasive management (conservative), primary suturing (simple

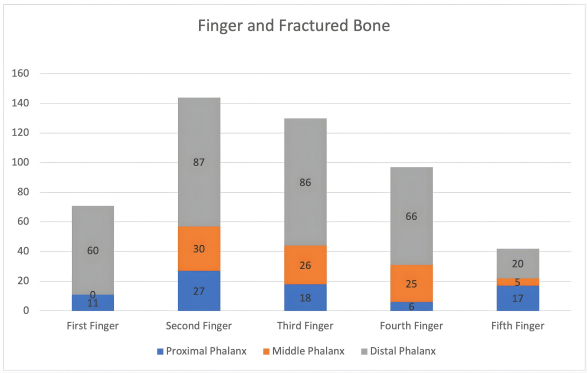

Figure 1. Anatomical localization of fractures following occupational hand injuries.

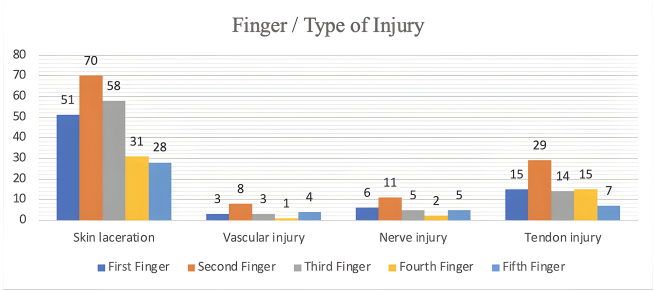

Figure 2. Distribution of structural injuries across affected digits in non-amputation cases.

intervention), emergency department procedures such as local tendon repair or foreign body removal (invasive intervention), and formal hospital admission for surgical operations or intravenous antibiotherapy (hospitalization).

Among the 363 patients with press machine injuries, 82 required hospitalization, 68 underwent invasive ED procedures, 174 received simple interventions, and 39 were managed conservatively. For saw lacerations (n=111), 45 were hospitalized, 31 had invasive procedures, 30 received simple interventions, and 5 were managed conservatively. Knife injuries (n=47) resulted in 14 hospitalizations, 17 invasive procedures, and 16 simple interventions. Glass cuts (n=7) led to 5 hospitalizations and 2 invasive procedures. The remaining injuries (n=55) resulted in 24 hospitalizations, 20 invasive procedures, and 11 simple interventions. Overall, the hospitalization rate was exactly 29% (n=170), while the remaining 71% of patients (n=416) were definitively managed and discharged directly from the emergency department.

In non-amputation cases, structural injuries were rigorously subclassified. Cases involving multiple structures were included in all relevant subgroups; however, wrist-level or more proximal injuries were excluded to maintain focus on the hand. Multiple tendon lacerations in a single patient were initially recorded as a single tendon injury event for patient-level analysis. Skin lacerations (n=238) most frequently involved the second digit (n=70) and least commonly the fifth (n=28). Vascular injuries (n=19) primarily affected the second digit (n=8). Nerve injuries (n=29) were most prevalent in the second digit (n=11). Tendon injuries at the patient level (n=80 patients) most frequently involved the second digit (n=29) and least commonly the fifth (n=7) (Figure 2). In the severe subset of patients sustaining total or subtotal amputations (n=100), surgical management encompassed stump revision/primary closure (n=47), replantation (n=24), composite tissue grafting (n=16), V-Y advancement flaps (n=7), cross-finger flaps (n=4),

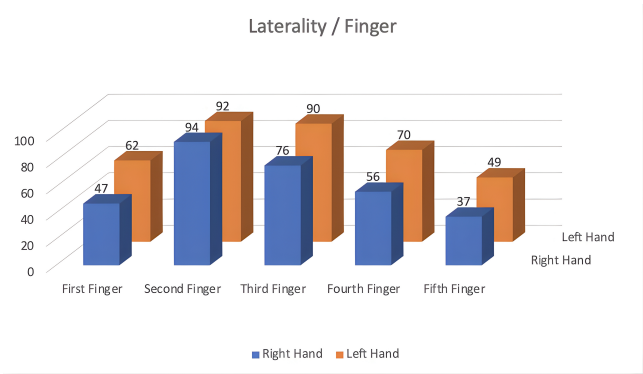

Figure 3. Frequency of digital involvement and distribution by laterality.

groin flaps (n=1), and secondary intention healing (n=1) (Table 3).

When evaluating the structural damage more granularly, a total of 239 individual tendons were lacerated across the entire cohort (including both amputations and complex non-amputation cases). Of these individual tendon injuries, 101 involved flexor zones, while 138 involved extensor zones. Tendon injuries in both zones were documented with higher frequency in the right hand (flexor: n=58, extensor: n=72).

To account for patients with multiple digital injuries, a total of 673 affected digits were recorded among the 586 patients. Regarding laterality, left-hand digital injuries (n=363, 54%) were significantly more common than right-hand injuries (n=310, 46%). Despite this, the index finger remained the most frequently injured digit on both sides (left: n=92, right: n=94), while the small finger was consistently the least affected (left: n=49, right: n=37) (Figure 3).

Table 3. Surgical treatment modalities for occupational hand injuries involving amputation.

Treatment Method	Number of patients	Percent (%)
Stump closure	47	47.0
Replantation	24	24.0
Composite grafting	16	16.0
V-Y flap	7	7.0
Cross-finger flap	4	4.0
Groin flap	1	1.0
Secondary healing (dressing only)	1	1.0
Total	**100**	**100.0**

Discussion

In this large occupational cohort of 586 patients, 91.9% were male, with a mean age of 31 years. These demographic findings strongly align with established and contemporary literature. Akça et al. reported an 88.3% male predominance with a mean age of 37 years [3], while Wu et al., in a massive cohort of 2,112 occupational hand injuries, found that 81% were male with a mean age of 31.3 years [11]. The disproportionate incidence among young adults likely reflects a critical lack of operational experience among individuals newly integrating into the workforce [1, 2, 11-14]. The overwhelming male predominance is anticipated, given that heavy industrial labor and machinery operation are traditionally male-dominated sectors [11-14]. This is consistently echoed in recent global occupational trauma analyses, including a meta-analysis by Rajak et al. among Indian laborers and a retrospective review by Niazi et al. in a South African cohort [15, 16]. Stratification by occupational sector revealed the highest injury burden among machine industry workers (30.7%), followed by the automotive (22%), timber (14.8%), textile (6.3%), and agricultural sectors (5.9%). The substantial proportion of severe industrial injuries in our study is geographically consistent with the hospital's immediate proximity to a densely populated, organized industrial zone where heavy machinery utilization is the standard.

Press machine accidents were the primary etiological factor (62%), followed by saw (19%) and knife injuries (8%). Akça et al. reported a near-equal distribution of crush (48.6%) and penetrating/cutting injuries (46.5%) in their demographics [3]. In contrast, Moellhoff et al. noted that blunt trauma and simple cuts accounted for the vast majority of general emergency hand injuries (74%) in Germany, distinguishing standard hand trauma from the specific, high-energy nature of industrial environments [14]. Şakrak et al. observed a predominance of cutting injuries (32.6%) over crush mechanisms (7%) [13]. The exceptionally high frequency of press and saw injuries in our specific cohort is a direct reflection of the heavy industrial profile of the regional patient demographic.

Due to their immense high-energy mechanisms, press machine accidents are intrinsically associated with severe phalangeal fractures [3]. Consistent with Şakrak et al., who reported the second digit as the most frequently injured (28%) [13], our data demonstrated identical anatomical vulnerability: the second digit was affected in 29.8% of cases, followed sequentially by the third, fourth, first, and fifth digits.

The hospitalization rate in our study was 29%, predominantly driven by complex press machine and saw injuries requiring advanced surgical intervention. The remaining 71% of patients were successfully managed and discharged from the emergency department. This confirms that while occupational hand injuries occur with high frequency, a significant majority still involve low-to-moderate energy trauma that is safely manageable on an outpatient or ED basis.

The structural complexity of the injuries in our study varied widely. Total or subtotal amputations occurred in 100 patients. Interestingly, our cohort demonstrated a higher incidence of extensor zone tendon injuries (57.8%) compared to flexor zones (42.2%). This anatomical distribution strongly aligns with recent findings by Niazi et al., who similarly reported extensor tendon involvement (60%) as vastly more prevalent than flexor tendon injuries (28.9%) in their occupational upper-limb injury cohort [15].

Regarding laterality, left-hand involvement (54%) superseded right-hand involvement (46%). This specific phenomenon is corroborated by Akça et al. (56.3% left vs. 43.2% right) [3]. This pattern is generally attributed to the biomechanics of handedness during heavy machine operation; the dominant right hand typically controls the machinery's primary operating levers or buttons, leaving the non-dominant left hand actively engaged with the material feeding into the high-risk 'cutting' or 'crush' zones, thereby drastically increasing its vulnerability.

Conclusions

Occupational accidents remain a critical and pervasive public health challenge, particularly in heavily industrialized regions. The hand is exceptionally susceptible to such trauma, with injuries spanning a diverse clinical spectrum from superficial lacerations to irreversible amputations.

Our findings conclusively indicate that work-related hand injuries disproportionately impact young adult males employed in the heavy machinery and industrial sectors. The index finger is the most frequently traumatized digit, and high-energy crush or cutting mechanisms—specifically press machines and saws—are the primary etiologies. Left-hand injuries occur with greater frequency than right-hand injuries due to the inherent biomechanics of machine operation.

While the majority of these injuries can be managed effectively on an outpatient basis, a highly significant subset requires advanced, multidisciplinary surgical reconstruction. To mitigate the incidence and severity

of these occupational hazards, rigorous workplace safety education must be enforced, the use of personal protective equipment must be standardized, and routine safety inspections must be prioritized. Furthermore, rapid triage, precise early diagnosis, expert surgical intervention, and robust forensic documentation are imperative to minimize permanent disability, secure workers' rights, and reduce the broader socioeconomic burden of workforce attrition.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by AYS, MAD, TO, and AP. The first draft of the manuscript was written by AYS and MAD, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Statements and declarations

Funding

The authors received no financial support for the research and/or authorship of this article.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical statement

The University of Health Sciences Kayseri City Training and Research Hospital Education Planning Board approved the study protocol (Approval No: 27.5.2025/456). The authors confirm that this retrospective study was conducted in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

ORCID iD

A.Y.S. 0009-0004-3007-2635
M.A.D. 0009-0009-5454-0735
T.Ö. 0009-0009-0308-379X
A.P. 0009-0005-3608-0887

Cite this article as

Sarıaslan A, Demir MA, Özdin T, Pakırdaşı A. Epidemiology of occupational hand injuries presenting to a tertiary care center in Türkiye over a one-year period. J Multidiscip Orthop Surg. 2026;2(2):32-37. doi: 10.64575/10703p31

References

1. International Labour Organization. Statistics of occupational injuries. Report III, sixteenth international conference of labour statisticians. Geneva; 1998 [accessed 2010 Nov 8]. Available from: http://www.ilo.org/public/english/bureau/stat/download/16thicls/report3.pdf
2. Takala J, Hämäläinen P, Sauni R, Nygård CH, Gagliardi D, Neupane S. Global-, regional- and country-level estimates of the work-related burden of diseases and accidents in 2019. Scand J Work Environ Health. 2024;50(2):73–82. doi: 10.5271/sjweh.4132.
3. Akca Ç, Akköse Ş, Durak VA, Eken G, Çeçen S, Aydoğan G, et al. Acil servise el yaralanması ile başvuran iş kazalarında konsültan hekim ve acil servis hekiminin tanısal yaklaşımlarının karşılaştırılması. Uludağ Tıp Derg. 2025;51(1):23-27. doi: 10.32708/uutfd.1518099.
4. Concha-Barrientos M, Nelson DI, Fingerhut M, Driscoll T, Leigh J. The global burden due to occupational injury. Am J Ind Med. 2005;48(6):470-81. doi: 10.1002/ajim.20226.
5. Dufort VM, Kotch JB, Marshall SW, Waller AE, Langley JD. Occupational injuries among adolescents in Dunedin, New Zealand, 1990–1993. Ann Emerg Med. 1997;30(3):266-273. doi: 10.1016/S0196-0644(97)70160-4.
6. Belville R, Pollack SH, Godbold JH, Landrigan PJ. Occupational injuries among working adolescents in New York State. JAMA. 1993;269(21):2754-9. doi: 10.1001/jama.1993.03500210054031.
7. Brooks DR, Davis LK, Gallagher SS. Work-related injuries among Massachusetts children: a study based on emergency department data. Am J Ind Med. 1993;24(3):313-24. doi: 10.1002/ajim.4700240308.
8. Dağlı B, Serinken M. Occupational injuries admitted to the emergency department. JAEM. 2012;62(2):167-70. doi: 10.5152/jaem.2012.003.
9. Nelson NA, Park RM, Silverstein MA, Mirer FE. Cumulative trauma disorders of the hand and wrist in the auto industry. Am J Public Health. 1992;82(11):1550-2. doi: 10.2105/AJPH.82.11.1550.
10. Yokoyama K, Itoman M, Nakamura K, Uchino M, Nitta H, Kojima Y. New scoring system predicting the occurrence of deep infection in open upper and lower extremity fractures: efficacy in retrospective re-scoring. Arch Orthop Trauma Surg. 2009;129(4):469-74. doi: 10.1007/s00402-008-0675-x.
11. Wu Z, Guo Y, Gao J, Zhou J, Li S, Wang Z, et al. The epidemiology of acute occupational hand injuries treated in emergency departments in Foshan City, South China. Ulus Travma Acil Cerrahi Derg. 2018;24(4):303-10. doi: 10.5505/tjtes.2016.59020.

12. Matsuzaki H, Narisawa H, Miwa H, Toishi S. Predicting functional recovery and return to work after mutilating hand injuries: usefulness of Campbell's Hand Injury Severity Score. J Hand Surg Am. 2009;34(5):880-5. doi: 10.1016/j.jhsa.2009.02.009.
13. Şakrak T, Mangır S, Körmutlu A, Cemboluk Ö, Kıvanç Ö, Tekgöz A. 1205 el yaralanması olgusunun retrospektif analizi. Turk J Plast Surg. 2009;17(3):134-8. Available from: https://izlik.org/JA88ZE65DR
14. Moellhoff N, Throner V, Frank K, Benne A, Coenen M, Giunta RE, et al. Epidemiology of hand injuries that presented to a tertiary care facility in Germany: a study including 435 patients. Arch Orthop Trauma Surg. 2023;143(3):1715-24. doi: 10.1007/s00402-022-04617-9.
15. Niazi JIK, Aden AA, Younus A. Occupational upper-limb injuries: a retrospective review of outcomes at a private hospital in Gqeberha (formerly Port Elizabeth), South Africa. Cureus. 2025;17(12):e98760. doi: 10.7759/cureus.98760.
16. Rajak R, Chattopadhyay A. Prevalence and risk factors of non-fatal occupational injury among male workers in India: a systematic review and meta-analysis. BMC Public Health. 2026;26:440. doi: 10.1186/s12889-025-25965-2.