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Original Article

# EVALUATION OF TRAUMATIC AMPUTATIONS FROM A FORENSIC MEDICINE PERSPECTIVE

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**ABSTRACT**

**Introduction:** Objective: High-energy injuries such as traffic accidents and occupational accidents, which are commonly encountered in forensic medicine practice, may result in traumatic amputations (2,5). All such cases are considered medicolegal incidents and require official notification. This study aimed to evaluate the medical findings and medicolegal reports of amputation cases and to share regional data on traumatic amputations with the existing literature.

**Methods:** This retrospective study evaluated traumatic amputation cases that presented to the Department of Forensic Medicine, Eskişehir Osmangazi University Faculty of Medicine, over a 10-year period between 2015 and 2024. Demographic characteristics such as age and sex, event characteristics such as mechanism and type of injury, and medicolegal report contents were analyzed.

**Results:** A total of 157 traumatic amputation cases were evaluated. The majority of patients were male (82.2%), with a mean age of 29 ± 7.5 years. Occupational accidents were the leading cause of injury (74.5%). Finger amputations were the most common (83.4%), most frequently involving the right index finger. Replantation was possible in 16 cases (10.2%). Functional loss was identified in 25 cases (15.9%), and functional impairment in 29 cases (18.5%).

**Conclusions:** Traumatic amputations in this study predominantly affected young male patients and were most commonly caused by occupational accidents, with finger amputations being the most frequent injury type.

**Keywords:** Traumatic amputation, medicolegal report, occupational accident.

## INTRODUCTION

Traumatic amputation is defined as the separation or detachment of limb segments from the body as a result of trauma (1–3). Amputation injuries are complex lesions that may involve damage to muscles, ligaments, bones, blood vessels, and nerves (4). Common high-energy injuries encountered in forensic medicine practice—such as traffic accidents and occupational injuries—may result in amputation (2,5). All of these cases are considered medicolegal incidents and require official notification to legal authorities. The characteristics of traumatic amputation cases reported in the literature vary depending on the specialty and geographic region of the researchers (1,7,8). Among studies on traumatic limb amputations, those focusing on finger amputations of the hand are more prevalent (1,6,9–11).

Amputation causes both anatomical and functional loss. Treatment aims to restore anatomical integrity and function, typically through replantation. However, replantation is not always possible due to factors such as extensive tissue damage that prevents reattachment, inability to maintain sterile and appropriate conditions, or the amputated part not being recovered (12–14). Medicolegal reporting is crucial for legal evaluations, including determining the penalty for responsible parties and the compensation to be awarded to the injured person. In amputation cases, it is important to assess whether the injury was life-threatening, whether it could be managed by simple medical intervention, and whether it led to functional impairment or disability, as well as to determine the degree of permanent disability (6,15). According to relevant legal regulations, the treatment process must be completed, and all medical documentation must be complete for a proper legal evaluation (6).

The aim of this study was to present and share regional data on the medical findings and medicolegal reports of amputation cases with the existing literature.

## METHODS

In this study, traumatic amputation cases that presented to the Department of Forensic Medicine at Eskişehir Osmangazi University Faculty of Medicine over a 10-year period between January 1, 2015, and December 31, 2024, were retrospectively evaluated. Demographic characteristics such as age and sex, event characteristics such as the mechanism of injury and type of

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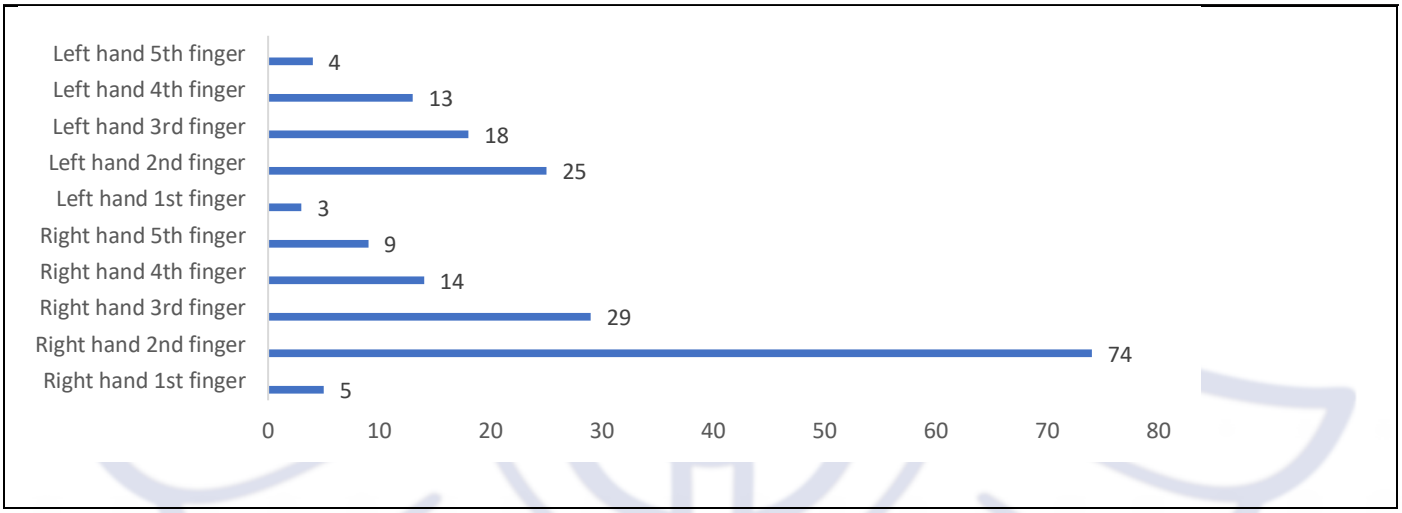



**Figure 1.** Distribution of the number of fingers amputated on the hand

trauma, and the contents of medicolegal reports were analyzed. Hospital records and medicolegal reports of the cases were used as data sources.

Amputation levels were determined according to the anatomical reference points described by the orthopedic specialist. For the evaluation of functional loss, if the amputated tissue could not be anatomically replanted and the treatment consisted only of stump repair or flap/graft application, an 18-month follow-up period was not required. However, in cases where replantation was performed after amputation, an 18-month follow-up period was allowed to determine whether anatomical and functional recovery had been achieved.

Because the legal investigation files of the incidents could not be accessed, information regarding the circumstances of the incidents was limited. Consequently, detailed data about the scene, the individual's position during the injury, or the use of protective equipment were not available. As the study was retrospective, some data could not be obtained due to incomplete information in the hospital files; these were considered study limitations.

Bone fractures were evaluated according to the classification system defined in the Forensic Medicine Guide for the Evaluation of Injury Offenses Described in the Turkish Penal Code, in which bone fractures are categorized into six grades; therefore, fracture severity was assessed based on this classification system (6).

The data were analyzed using the SPSS statistical software package. Descriptive statistics were presented as percentages, and chi-square tests were used for the analysis of categorical variables. The study was approved by the Non-Interventional Clinical Research Ethics Committee of Eskişehir Osmangazi University (Approval No. 15, dated 31.07.2025).

## RESULTS

During the 10-year study period, 157 patients with traumatic amputations presented to our department. The demographic characteristics and injury features of the cases are summarized in Table 1. Of the cases, 129 (82.2%) were male and 28 (17.8%) were female. The youngest patient was 14 years old and the oldest was 48 years old, with a mean age of 29 ± 7.5 years. Eleven patients (7%) were under 18 years of age.

The grading of bone fractures refers only to fractures of the bones involved in the amputated extremity and does not include other associated fractures. Regarding the mechanisms of injury, 117 cases (74.5%) were occupational accidents, 27 (17.2%) were traffic accidents, 10 (6.4%) were assaults or intentional injuries, and 3 (1.9%) were domestic accidents. Among the 10 assault cases, 6 involved sharp or sharp-crush injuries and 4 involved firearm injuries. Of the 11 patients under 18 years of age, 4 (36.4%) sustained occupational injuries; all were male. In two of these pediatric cases, the child was uninsured and working informally.

With respect to amputation levels, injuries most commonly involved the fingers of the hand (n = 131, 83.4%). The distribution of injury mechanisms according to sex and amputation level is shown in Table 2. A statistically significant relationship was found between injury mechanism, sex, and amputation level ($P < 0.001$). Occupational accidents accounted for 83.7% of injuries among males and 32.1% among females. Moreover, 85.5% of finger amputations resulted from occupational accidents.

All injuries resulting in amputations at sites other than the fingers were unilateral. Among the 131 finger amputation cases, 2 (1.5%) involved bilateral finger amputations; both were related to occupational accidents. Of the 135 cases involving the wrist and fingers, 106 (78.5%) affected the right hand, 27 (20%) the left hand, and 2 involved both hands. The maximum number of fingers injured in a single incident was four. In 86 cases (65.6% of all finger amputations), a single finger was amputated, whereas in 3 cases (2.3%) four fingers were amputated. A total of 194 fingers were injured (Figure 1).

Of the 194 finger amputations, 105 (54.1%) were at the distal interphalangeal joint and 89 (45.9%) at the proximal interphalangeal joint. Among the 131 finger amputation cases, 84 (64.1%) involved the right hand, 45 (34.4%) the left hand, and 2 (1.5%) involved both hands. The most frequently injured finger was the right index finger (n = 74, 56.5%) (Figure 2).

In 48 cases, the amputation was classified as subtotal. Regarding treatment methods, replantation was performed in 16 cases (10.2%), while stump closure, flap, or graft repair was performed in 141 cases (89.8%).

Evaluation of medicolegal reports revealed that the injury was considered life-threatening in 17 cases (10.8%), resulted in functional loss in 25 cases (15.9%), and led to functional impairment in 29 cases (18.5%). Regarding the classification of bone fractures, 34 cases (21.7%) were categorized as grade 2, 57 cases (36.3%) as grade 3, 43 cases (27.4%) as grade 4, 20 cases (12.7%) as grade 5, and 3 cases (1.9%) as grade 6.

**Table 1.** Demographic data of the cases and information regarding injury characteristics

| Gender | n | % |
|---|---|---|
| Male | 129 | 82,2 |
| Female | 28 | 17,8 |
| Age group | | |
| 0-18 age group | 11 | 7,0 |
| 19-29 age group | 76 | 48,4 |
| 30-39 age group | 54 | 34,4 |
| 40-49 age group | 16 | 10,2 |
| Type of incident | | |
| Workplace Accident | 117 | 74,5 |
| Traffic Accident | 27 | 17,2 |
| Assault/Effective Action | 10 | 6,4 |
| Home Accident | 3 | 1,9 |
| Amputation Level | | |
| Shoulder | 5 | 3,2 |
| Elbow | 2 | 1,3 |
| Wrist | 4 | 2,5 |
| Finger | 131 | 83,4 |
| Pelvis | 1 | 0,7 |
| Knee | 3 | 1,9 |
| Ankle | 2 | 1,3 |
| Toe | 9 | 5,7 |
| Side of Amputation | | |
| Right Side of Body | 101 | 64,3 |
| Left Side of Body | 54 | 34,4 |
| Both Sides | 2 | 1,3 |
| Treatment Method | | |
| Replantation | 16 | 10,2 |
| Stump Repair / Flap-Graft Repair | 141 | 89,8 |
| Forensic Report Content | | |
| Causing Life-Threatening Injury | 17 | 10,8 |
| Causing Functional Impairment | 29 | 18,5 |
| Causing Functional Loss | 25 | 15,9 |
| Second-Degree Bone Fracture | 34 | 21,7 |
| Third-Degree Bone Fracture | 57 | 26,3 |
| 4th Degree Bone Fracture | 43 | 27,4 |
| 5th Degree Bone Fracture | 20 | 12,7 |
| 6th Degree Bone Fracture | 23 | 1,9 |

## DISCUSSION

Traumatic amputations are frequently encountered in both emergency medicine and forensic practice. A 10-year study conducted in France reported that approximately 50,000 patients presented to the emergency department, and traumatic amputation was identified in 3% of these patients (16). In Turkey, a study conducted in Afyon found a traumatic amputation rate of 2.8% among emergency department admissions (6). Previous studies on traumatic amputations have reported that injuries occur predominantly in young adult males (1,6,17–20). Similarly, in the present study, the majority of cases were male (82.2%) and within the 19–29 age group (48.4%).

The most common cause of traumatic amputation reported in the literature is occupational accidents (1,6,21–23). Consistent with previous studies, occupational accidents accounted for 74.5% of the cases in the present series. This finding is also related to the predominance of young adult males among the injured population. A statistically significant relationship was observed between injury mechanism, sex, and amputation level ($P < 0.001$). Occupational accidents accounted for 83.7% of injuries among males and 32.1% among females. This is likely due to males working more frequently in occupations with a higher risk of work-related injuries.

Kayhan et al. reported that 85.2% of traumatic amputation injuries involved the fingers (6). Similarly, a study conducted in Van, Turkey, which evaluated both traumatic and non-traumatic amputations, found that the fingers were the most commonly affected sites (178/440, 40.5%) (24). Epidemiological studies have consistently highlighted that finger amputations represent a major portion of traumatic amputation cases (1). In the United States, approximately 45,000 traumatic finger amputations occur annually, with an incidence of 7.5 per 100,000 population (9). This is thought to be related to the predominance of occupational injuries as the leading cause of amputation (21,25–27). In a study from Iran, 85.8% of finger amputations were attributed to occupational accidents (25).

A study conducted in Boston, USA, on upper extremity amputations reported that the index finger was the most commonly amputated digit (28). Similarly, a meta-analysis of 29 studies on traumatic finger amputations confirmed that the index finger was the most frequently affected (29). Kayhan et al. also reported that the right index finger was the most commonly amputated (6). Consistent with the literature, in the present study, the right index finger (n = 74, 56.5%) was the most frequently injured. This may be explained by the dominant role of the index finger in hand function and the predominance of right-hand dominance in the general population.

The primary goal in the treatment of amputation injuries is to restore anatomical integrity and function as much as possible. This requires rapid replantation of the amputated part, provided that it is recovered intact and in sterile conditions. Treatment varies depending on the location of the injury, the structures involved, and patient- and event-specific factors, and may include

**Table 2.** Distribution of incident origins by gender and amputation level

| | | Origin of the Incident | | | | | |
|---|---|---|---|---|---|---|---|
| | | Workplace Accident | | Other Cases | | | |
| | | n | % | n | % | $\chi^2$ | p |
| Gender | Male | 108 | 83,7 | 21 | 16,3 | 32,23 | >0,001 |
| | Female | 9 | 32,1 | 19 | 67,9 | | |
| Amputation Level | Finger | 112 | 85,5 | 19 | 14,5 | 10,85 | <0,001 |
| | Other | 15 | 57,7 | 13 | 42,3 | | |

$X^2$: Chi-square test

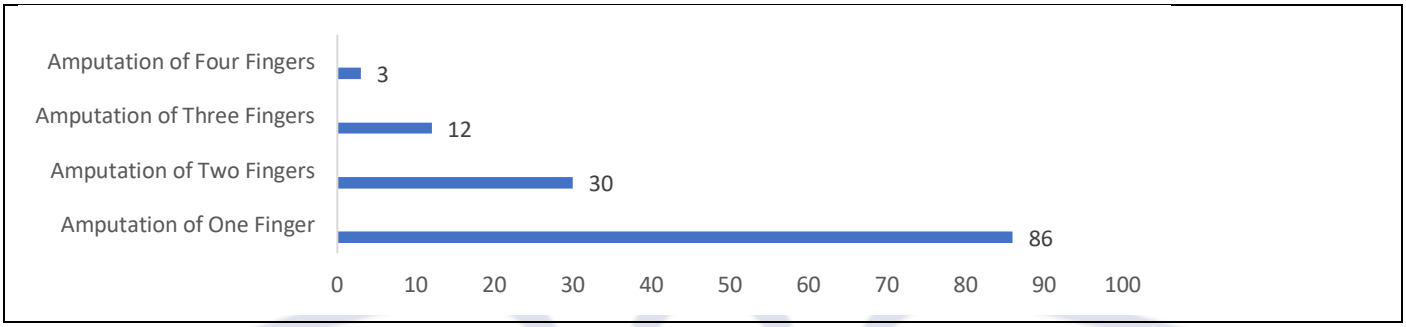



**Figure 2.** Distribution of amputated fingers

repeated surgeries and rehabilitation (22,30,31). In the present study, replantation was performed in 16 cases (10.2%), while stump closure or flap/graft repair was performed in 141 cases (89.8%). Medicolegal reporting plays a crucial role in protecting the legal rights of injured individuals. In Turkey, medicolegal reports are prepared using the "Forensic Medicine Guide for the Evaluation of Injury Offenses Defined in the Turkish Penal Code", which is based on internationally accepted scales such as the *Abbreviated Injury Scale* and the *Injury Severity Score*. Depending on the mechanism of injury, reports are prepared in accordance with Articles 86–89 of the Turkish Penal Code, which address intentional or negligent injury. Kayhan et al. reported that 5.2% of amputation injuries involved life-threatening conditions and 6.9% involved functional loss or impairment (6). In the present study, injuries were classified as life-threatening in 17 cases (10.8%). Life-threatening injuries are generally related to damage to major blood vessels.

In terms of fracture severity, 34 cases (21.7%) were classified as grade 2, 57 cases (36.3%) as grade 3, 43 cases (27.4%) as grade 4, 20 cases (12.7%) as grade 5, and 3 cases (1.9%) as grade 6. Functional loss was reported in 25 cases (15.9%) and functional impairment in 29 cases (18.5%). When evaluating functional impairment or loss, if replantation of the amputated tissue could not be achieved, the treatment process was not prolonged. Replantation was performed in 16 cases (10.2%) in the present study. In a study conducted by Doğan et al. in Van, the replantation rate was 5.5% (24/440) (24). The functional impact of the amputation depends on the anatomical location and extent of the injury. For example, distal interphalangeal amputations of a single finger generally do not result in functional loss or impairment. If the injury is appropriately treated and anatomical integrity is restored, an 18-month postoperative follow-up is typically required to assess functional recovery. Thus, the anatomical level of amputation and the treatment process are critical determinants of outcome.

The demographic findings of the present study are consistent with the existing literature on traumatic amputations. Proper medicolegal documentation throughout the entire treatment process is essential for the accurate preparation of legal reports. Occupational accidents were identified as the most common cause of amputation injuries. Implementing effective occupational safety measures could significantly reduce the incidence of traumatic amputation injuries.

## CONCLUSION

This study presents regional data on traumatic amputation cases evaluated from a medicolegal perspective. The findings are consistent with the existing literature, particularly regarding demographic characteristics and injury mechanisms. Accurate and complete medical documentation during the treatment process is essential for the preparation of appropriate medicolegal reports in traumatic amputation cases.

**Ethics Committee Approval:** The study was approved by the Non-Interventional Clinical Research Ethics Committee of Eskişehir Osmangazi University (Approval No. 15, dated 31.07.2025).

**Informed Consent:** Informed consent was not obtained due to the retrospective design; all data were anonymized prior to analysis, in accordance with institutional and ethics committee policies.

**Authorship Contributions:** Concept – AHC, MD, US, KK, NP ; Design – AHC, MD, US, KK, NP ; Supervision – AHC, MD, US, KK, NP ; Resource – AHC, MD, US, KK, NP ; Materials – AHC, MD, US, KK, NP ; Data collection &/or processing – AHC, MD, US, KK, NP ; Analysis &/or interpretation – AHC, MD, US, KK, NP ; Literature search – AHC, MD, US, KK, NP ; Writing – AHC, MD, US, KK, NP ; Critical review – AHC, MD, US, KK, NP.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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