ORIGINAL ARTICLE

An endemic threat of agricultural mechanization: Hand injuries caused by electric pruning shears

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ABSTRACT

BACKGROUND: Electric pruning shears have become increasingly popular in Türkiye, particularly in regions where viticulture and olive cultivation are common. Although these tools offer ergonomic advantages, they also pose a significant risk of hand injuries. While injuries from other agricultural machinery have been documented in the literature, electric pruning shear injuries have not been systematically studied. Clinical observations of increased emergency admissions during the pruning season prompted this study.

METHODS: We retrospectively reviewed 28 patients admitted to our emergency department between November 2024 and March 2025 due to electric pruning shear injuries. Demographic data, injury mechanisms, affected anatomical zones, and associated tissue damage were recorded. Injuries were classified according to the volar hand injury zones and Ishikawa's classification. The time of injury, use of protective equipment, and patient training status were also evaluated.

RESULTS: All patients sustained single-digit injuries distal to the metacarpophalangeal joint. The average age was 53.6 years, and 92.9% were male. Injuries predominantly affected the non-dominant hand (82.1%), with the index finger being the most commonly injured (39.1%). Twenty-seven patients were not wearing protective gloves, and none had received formal training in device use. Neurovascular injury was present in 20 cases, and distal circulation was absent at admission in 13 patients. Smoking was reported by 78.5% of patients. All injuries occurred during daylight hours, with a peak incidence around 2 p.m. Three patients were under 18, and five were over 70 years old, highlighting both the accessibility and physical risks associated with the device.

CONCLUSION: Electric pruning shear injuries have emerged as a significant occupational hazard in agricultural regions. Ease of access, lack of training, and low awareness of protective measures contribute to their increasing frequency. Public health strategies such as safety regulations, mandatory training programs, and awareness campaigns are urgently needed. Further prospective studies are needed to evaluate functional outcomes and broader seasonal injury patterns.

Keywords: Electric pruning shear; hand trauma; agricultural accidents; occupational injuries; amputations.

INTRODUCTION

Acute traumatic hand injuries can result in substantial physical and socioeconomic consequences, often requiring complex treatment and prolonged rehabilitation.[1-2] Several studies have examined the treatment outcomes and functional limitations following traumatic finger and thumb amputations. While industrial injuries have been widely studied, agricultural settings, particularly those involving newer mechanized tools, remain underrepresented in the literature.[3-5]

Electric pruning shears, increasingly used in vineyard and orchard farming, operate with high-speed, high-pressure mechanisms. These devices can cause deep, clean lacerations and distal amputations that often involve bone, tendon, and neurovascular structures.[6-8] Despite their growing popularity, injuries related to electric pruning shears have rarely been reported in scientific publications.

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Most traumatic finger amputations occur in occupational settings and disproportionately affect working-age males.[3-5] Risk factors such as lack of safety training, improper tool handling, and absence of protective equipment contribute significantly to both the incidence and severity of these injuries.[6-7] In this context, electric pruning shears represent a novel injury mechanism with unique clinical challenges.

This study was initiated following a noticeable increase in emergency department admissions for electric pruning shear injuries observed during the regional pruning season. We aimed to characterize the anatomical, temporal, and demographic features of these injuries and to evaluate their surgical management. By doing so, we sought to highlight the clinical and public health implications of this underrecognized hazard and to contribute to the development of effective preventive strategies.

MATERIALS AND METHODS

Ethical approval for this study was obtained from the local ethics committee (Date: 09.04.2025, Approval number: 20.478.486/3031). The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants were informed about the study, and written informed consent was obtained.

A total of 216 patients were referred to our clinic via the emergency department between November 2024 and March 2025. Among 101 acute finger injuries evaluated during this period, 28 cases involving pruning shear injuries were included. The study period was limited to the active pruning season; cases outside this time frame were excluded.

For each patient, data were collected on age, sex, time of injury, injury mechanism, educational background, occupational status, whether the incident was work-related, hand dominance, alcohol and tobacco use, use of protective equipment, and experience with pruning shear operation. Additionally, the time interval between injury and hospital admission was recorded. For amputated cases, the condition of the transported digit (e.g., appropriate preservation with saline-moistened gauze and ice) was assessed.

Injury zones were classified anatomically. Zone I injuries, located distal to the distal interphalangeal joint, were further subdivided according to the Ishikawa classification into Subzone 1 (n=1), Subzone 2 (n=5), Subzone 3 (n=5), and Subzone 4 (n=7). Zone II included injuries extending from the proximal phalanx to the metacarpal region (n=10).[9-10]

Following initial evaluation and emergency management in the emergency department, patients were operated on under infraclavicular block anesthesia in the operating room (Fig. 1). Replantation was performed in eight patients. In six

Figure 1. Representative case of an electric pruning shear injury to the index finger. **(a-c)** Initial clinical presentation showing a clean, deep laceration on the volar and lateral aspects of the right index finger. **(d-e)** Radiographic images demonstrating a transverse distal phalanx fracture without bone loss. **(f)** Intraoperative view showing an intact tendon with vascular and nerve damage requiring repair. **(g-h)** Postoperative follow-up images at 3 weeks, showing wound healing and satisfactory finger alignment with preserved distal joint mobility.

patients with preserved distal circulation, Kirschner wire (K-wire) fixation and nail bed repair were performed. In two patients who presented late, soft tissue closure was achieved using local flaps. For the remaining 12 patients, at least two of the following procedures were performed: K-wire fixation, tendon repair, and digital neurovascular bundle repair. Among these 12 patients, five had no distal circulation at the time of admission; however, during surgery under regional anesthesia, at least one digital artery was found to be intact, and circulation was restored after reduction and bony fixation.

Statistical Analysis

Descriptive statistics were presented as frequencies, percentages, means, minimums, and maximums. Calculations were performed using Microsoft Excel.

RESULTS

A total of 28 patients who sustained injuries from electric pruning shears were evaluated. All injuries involved a single finger. The mean age was 53.6 years (range: 16-75). Of these, 26 patients (92.9%) were male and two (7.1%) were female. Eight injuries occurred on the right hand, while 20 occurred on the left, indicating that the non-dominant hand was more frequently affected (dominant side: 5; non-dominant side: 23).

Although all patients reported prior experience using pruning shears, 27 lacked any specific protective equipment and had not received formal training related to their work. Only one patient was wearing protective gloves at the time of injury. None of the injuries were considered occupational accidents; all patients stated that the incidents occurred while working in their own fields. No patients reported a previous history of similar injuries.

The injuries were distributed fairly evenly throughout the day, although 25% occurred around 2:00 p.m. One patient presented to the hospital one day after the injury, and another four days later, both with prior wound suturing. These two cases were excluded from the timing analysis. Among the remaining 26 patients, all arrived within six hours after injury. The average time from injury to surgery was 6.7 hours (Fig. 2).

Of the 28 patients, 18 were referred by emergency personnel or another healthcare facility. In these cases, the injured part or amputated digit had been appropriately wrapped in saline-soaked gauze and/or stored under cooled conditions. The remaining eight patients, who arrived on their own, lacked proper dressing and transport of the injured part. The two patients who presented late had wounds that were already sutured and dressed, making accurate reconstruction more challenging.

All injuries were located distal to the metacarpophalangeal joint, and each case involved a single digit. There were 27 bone injuries, 20 neurovascular injuries, 11 extensor tendon injuries, and nine flexor tendon injuries. The injuries involved the thumb in five patients, the index finger in 11, the middle finger in four, the ring finger in three, and the little finger in five (Fig. 3).

Of the 27 bony injuries, 18 involved the distal phalanx and nine involved the proximal phalanx. All fractures were treated with K-wire fixation. In 14 distal phalanx cases, the K-wire did not cross the distal interphalangeal (DIP) joint. In four cases with accompanying extensor tendon injuries, the K-wire crossed the DIP joint for added stability. All nine proximal phalanx fractures were fixed using K-wires. No plates or screws were used in any case.

Digital artery and nerve repairs were performed using microsurgical techniques under loupe and microscope magnification with 10-0 sutures (Ethilon® 10-0, Ethicon). All neurovascular repairs were completed with end-to-end anastomosis without the need for grafting.

Replantation was attempted in eight patients. In two of these cases, venous insufficiency developed postoperatively and required revision surgery; despite intervention, both resulted in secondary amputation. One patient developed nonunion at the middle phalanx level by week 8. Two patients who presented late were treated with local flaps, with no complications observed. In one case involving an open fracture at Zone 2 with initially intact perfusion, pulp necrosis developed by day 7, necessitating debridement and flap coverage.

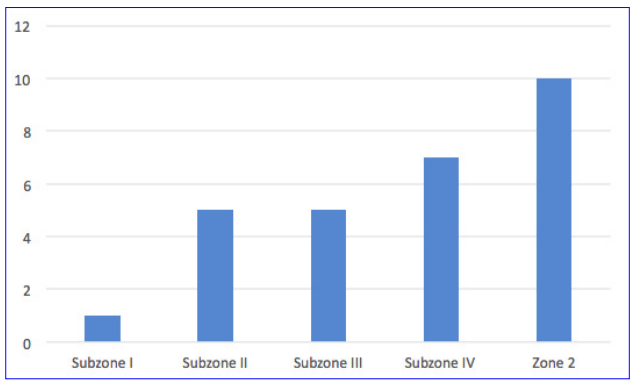

Figure 2. Distribution according to Ishikawa classification.

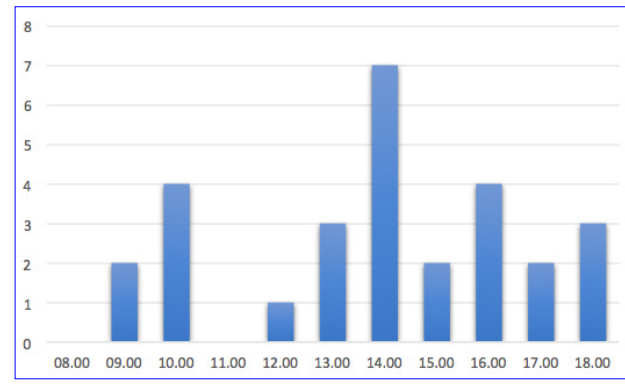

Figure 3. Temporal distribution of injuries.

Figure 4. Clinical presentation of various electric pruning shear injuries showing characteristic sharp, clean lacerations. Injuries present as circumferential or semi-circumferential cuts localized to the phalanges, demonstrating a consistent pattern of clean, guillotine-like wounds typically caused by electric pruners.

DISCUSSION

According to the emergency department records of our clinic, there was a noticeable increase in electric pruning shear injuries during the current pruning season. In response, we initiated a data collection process. This type of injury represents an endemic occupational threat, particularly in agricultural regions where grapevine and olive farming are common. In these areas, providing proper training and education on the safe use of agricultural tools is a critical need.

Clinically, we observed that, unlike other machinery-related injuries, electric pruning shears tend to cause clean, sharp cuts. This characteristic allows for easier repair of neurovascular structures without the need for grafting or bone shortening. Additionally, the absence of bone loss facilitates simpler reduction and fixation. Because all anatomical structures at the injury site are typically affected simultaneously, careful assessment of distal circulation is essential during the initial evaluation. Among the 28 patients in our study, two presented late (on day 1 and day 4). Of the remaining 26, 13 had no distal circulation at admission. In five of these cases, circulation was restored after bone fixation, but digital artery and nerve repair were still required. Therefore, even in isolated soft tissue injuries, vascular assessment should be performed meticulously (Fig. 4).

The average patient age was 53.6 years (range: 16-75), consistent with the demographic of retired individuals working in their own fields. Three patients (10.7%) were under 18 years old, suggesting that these devices are easily accessible and used without restriction. Additionally, five patients (17.8%) were over 70, a group with potentially reduced motor function and an increased risk of injury.[11]

Injuries occurred predominantly on the non-dominant hand (82.1%), likely because the device is typically operated with the dominant hand. The index finger was the most frequently injured digit (39.1%), possibly due to its role in supporting branches during pruning.

All patients were working independently on their own land, and none had received formal training in using the device. This finding highlights the urgent need for regulation and safety education. According to the survey, all patients had been using the tool for less than three years. They obtained the devices through recommendations from friends or neighbors rather than through advertising or online channels. If access and advertising continue to expand, these devices may become a growing public health concern in agricultural areas.

Because the work is performed outdoors and requires daylight, all injuries occurred between 09:00 and 18:00 and were evenly distributed throughout the day. In a study by Lombardi et al.,[12] most occupational injuries occurred between 10:00-

11:00 a.m., with a secondary peak between 1:00-2:00 p.m.

Individuals from lower socioeconomic backgrounds are at greater risk for hand injuries due to involvement in more physically demanding work, poorer overall health status, and higher rates of smoking.[13] Smoking not only affects physical function but also impairs cognitive performance and attention, thereby increasing the risk of accidents.[14] In our study, 78.5% of patients were smokers, consistent with findings in the literature.

This study was conducted during the pruning season in response to an observed increase in the frequency of these specific injuries. Although various occupational hand injuries caused by industrial machinery have been reported previously, to our knowledge, this is the first study to specifically address injuries associated with electric pruning shears. Previous research has shown that successful replantation can yield favorable functional outcomes and improved quality of life, although complications such as nonunion and joint stiffness may still occur.[15-18]

A primary limitation of this study is the absence of long-term functional outcome data and the relatively small sample size. Another limitation is that data collection was restricted to the pruning season, based on the observed seasonal increase in pruning shear-related injuries. As a result, the annual distribution and potential off-season cases could not be evaluated, limiting our ability to fully understand the year-round incidence and trends of such injuries. Because this injury mechanism has only recently been recognized, further studies are warranted. A long-term prospective study involving a larger patient population and evaluating functional outcomes throughout the year is planned to better define the seasonal distribution and overall impact of these injuries.

CONCLUSION

Injuries related to electric pruning shears have increased significantly in parallel with the growing popularity of these tools. These injuries represent an endemic threat in agricultural regions. While pruning shears provide efficiency and ease of work, they also pose a substantial risk to hand safety, creating significant burdens on public health and the national economy. To prevent such injuries, it is imperative to implement appropriate regulations and training programs on the safe use and distribution of these devices.

Ethics Committee Approval: This study was approved by the Manisa Celal Bayar University Ethics Committee (Date: 09.04.2025, Decision No: 20.478.486/3031).

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Authorship Contributions: Concept: V.Ö.; Design: V.Ö.; Supervision: V.Ö.; Resource: V.Ö., M.B.; Materials: V.Ö., M.B.; Data collection and/or processing: V.Ö., M.B.; Analysis and/or interpretation: V.Ö., M.B.; Literature review: V.Ö., M.B.; Writing: V.Ö., M.B.; Critical review: V.Ö., M.B.

Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Tarımsal makineleşmeye bağlı endemik bir tehdit: Elektrikli budama makası ile el yaralanmaları

AMAÇ: Elektrikli bağ makasları, özellikle bağcılık ve zeytinciliğin yaygın olduğu bölgelerde ülkemizde son yıllarda yaygın olarak kullanılmaya başlanmıştır. Ergonomik avantajlarına rağmen bu aletler, el yaralanmaları açısından ciddi bir risk oluşturmaktadır. Diğer tarım makinelerine bağlı el yaralanmaları literatürde yer bulmuşken, elektrikli budama makaslarına bağlı yaralanmalar sistematik olarak incelenmemiştir. Budama sezonunda acil başvurulardaki artış üzerine bu çalışmayı planladık.

GEREÇ VE YÖNTEM: Kasım 2024-Mart 2025 ayları arasında elektrikli bağ makası yaralanması nedeniyle acil servise başvuran 28 hasta retrospektif olarak değerlendirildi. Hastaların demografik verileri, yaralanma mekanizmaları, anatomik tutulum bölgeleri ve eşlik eden doku hasarları kaydedildi. Yaralanmalar volar el yüzü ve Ishikawa sınıflamasına göre değerlendirildi. Ayrıca yaralanma zamanı, koruyucu ekipman kullanımı ve eğitim durumu da incelendi.

BULGULAR: Tüm hastalarda metakarpofalangeal eklem distalinde tek parmak yaralanması mevcuttu. Ortalama yaş 53.6 olup hastaların %92.9'u erkekti. Yaralanmalar %82.1 oranında non-dominant elde görüldü. En sık etkilenen parmak işaret parmağıydı (%39.1). Hastaların 27'sinde koruyucu eldiven kullanılmadığı, hiçbir hastanın cihazla ilgili eğitim almadığı saptandı. 20 hastada nörovasküler yaralanma vardı; 13 hastada başvuru anında distal dolaşım yoktu. Hastaların %78.5'i sigara kullanıcısıydı. Yaralanmalar yalnızca gün ışığı saatlerinde meydana geldi ve saat 14.00 civarında pik yaptığı gözlendi. 3 hasta 18 yaş altı, 5 hasta ise 70 yaş üzerindeydi; bu durum cihazın hem erişilebilirliğini hem de yaşlı bireylerdeki fiziksel riski ortaya koymaktadır.

SONUÇ: Elektrikli bağ makası yaralanmaları, tarım bölgelerinde önemli bir mesleki sağlık sorunu haline gelmiştir. Aletin kolay ulaşılabilir olması, eğitim eksikliği ve koruyucu ekipman kullanımındaki yetersizlik bu yaralanmaların artmasına neden olmaktadır. Bu sorunun azaltılması için güvenlik düzenlemeleri, zorunlu eğitim programları ve farkındalık kampanyaları hayata geçirilmelidir. Fonksiyonel sonuçları ve yıllık dağılımı içeren ileriye dönük çalışmalara ihtiyaç vardır.

Anahtar sözcükler: Amputasyon; elektrikli budama makası; el travması; tarımsal kazalar; mesleki yaralanmalar.

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