

Management of Hand Burns

El Yanıklarına Yaklaşım

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Abstract

Objective: The hand is one of the most frequently affected body parts by burn injuries with a rate of 80% among all burn wounds. Early and effective treatment ensures the best chance of survival as well as a good functional prognosis. The aim of this study was to determine the epidemiology, variation, relationship between etiology and hospital stay, clinical features, and management of hand burns.

Material and Methods: This retrospective study was conducted at the University of Health Sciences; Şişli Hamidiye Etfal Application and Research Center, Department of Plastic, Reconstructive and Aesthetic Surgery and the Intensive Burn Care Unit between April 2009 and April 2014. Burns were assessed based on etiology, anatomical location, percentage of total body surface area affected, and depth of injury. Treatment was categorized as conservative, elective operative, or urgent operative.

Results: In the study period, 788 patients were admitted to our Burn Unit. Of these, 240 were females (30.5%) and 548 were males (69.5%). The most common type of burn injury in this study was thermal injury (695 cases; 88.2%), followed by electrical injury (67 cases; 8.5%), and chemical, frictional or unknown injuries (26 cases; 3.3%). Majority (more than 85%) of the patients had second-degree burns, and some had third-degree burns.

Conclusions: Burns commonly affect the hands, and many functional problems may develop if appropriate basic treatments are neglected. The best treatment for burns is prevention. Appropriate indoor arrangement and simple but effective measures that can be taken at home can significantly reduce burn trauma exposure.

Keywords: Escharotomy, hand burns, fasciotomy

Öz

Amaç: El yanık travmasında; vücudun en sık etkilenen bölümüdür. Bütün yanıkların %80'den fazlası eli etkiler. Erken tedavi el fonksiyonlarını korumak ve komplikasyonları azaltmak açısından çok büyük önem arz eder. Bu çalışmadaki amaç; yanık epidemiyolojisi, yanık etyolojisi ve hastanede yatış süresi arasındaki ilişki, klinik özellikler ve el yanıklarında tedavi yaklaşımını belirlemektir.

Gereç ve Yöntemler: Bu retrospektif çalışma yanık ünitesinde Nisan 2009 ve Nisan 2014 arası yatırılarak tedavi edilmiş olan el yanıklarını kapsamaktadır. El yanıklarındaki etiyoloji, hastanede yatış süresi, yapılan tedavilere göre değerlendirilmiş olup; tedavi seçenekleri konservatif ve acil cerrahi tedavi olarak farklı şekilde değerlendirildi.

Bulgular: Çalışma periyodunda 788 hasta yanık ünitesinde yatırılarak tedavi edildi. Bu hastaların 240'u kadın (%30,5), 548'i erkek (%69,5) idi. Bu çalışmada en sık rastlanan yanık şekli sıcak madde ile temas yaralanması (695 olgu -%88,2) ve ikinci sıklıktaki yanık yaralanma elektrik yaralanması (67 olgu-%8,5) ve diğerlerinde kimyasal, sürtünme ve bilinmeyen yanık hasarı (26 olgu-%3,3). Hastaların çoğunluğu (%85'in üzerinde) ikinci derecede yanık ve kalan hastalar üçüncü derece yanık hasarına sahipti.

Sonuç: Genel vücut yanıklarında eller yaygın olarak etkilenir ve eğer temel tedaviler göz ardı edilirse birçok fonksiyonel problem ortaya çıkabilir. El yanıklarının ve genel vücut yanıklarının en iyi tedavisi önlemdir. Uygun iç mekan düzenlemeleri, evde yapılabilecek basit ancak etkili önlemler, yanık travması maruziyetini önemli ölçüde azaltır. El yanıkları sonrası erken dönem rehabilitasyon olası fonksiyonel problemleri azaltmanın en önemli kısımlarından biridir.

Anahtar Sözcükler: El yanıkları, eskarotomi, fasyotomi

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INTRODUCTION

The hand is one of the most frequently affected body parts by burn injuries with a rate of 80% among all burn wounds.¹ Thermal injury, particularly scald burns, is the most common type of burn injury. Electrical injuries account for only 3% of admissions to burn units, but can be associated with devastating morbidities. Early and effective treatment ensures the best chance of survival and a good functional prognosis. Optimal hand burn management demands a number of major decisions regarding the necessity of an escharotomy or a fasciotomy in the early post-traumatic phase, time and type of surgical debridement, type of wound coverage, immobilization, and rehabilitation. All these procedures, if applicable, should be performed in a burn unit. The American Burn Association recommends burn unit referral for any burns that involve the face, hands, feet, genitalia, perineum, or major joints.² Despite these recommendations, many patients are evaluated and treated for hand burns in primary care settings, including the emergency department or urgent care settings, or urgent care units. Presently, there are few studies that have evaluated the management and treatment of hand burns. Therefore, we conducted a retrospective analysis of hand burns at the University of Health Sciences; Şişli Hamidiye Etfal Application and Research Center, Department of Plastic, Reconstructive and Aesthetic Surgery and the Intensive Burn Care Unit the Intensive Burn Care Unit of our hospital to examine the epidemiology, clinical features, and management of hand burns.

MATERIAL AND METHODS

This retrospective study was conducted at the University of Health Sciences; Şişli Hamidiye Etfal Application and Research Center, Department of Plastic, Reconstructive and Aesthetic Surgery and the Intensive Burn Care Unit from April 2011 to April 2016. Our institution does not require institutional review board approval, principles of the 1975 Declaration of Helsinki were followed in this study. Patient demographics included age and sex. Burns were assessed based on etiology, anatomical location, percentage of total body surface area (%TBSA) affected, and depth of injury. Treatment was categorized as conservative, elective operative, or urgent operative.

RESULTS

During the study period, 788 patients were admitted to our Burn Unit. Of these, 240 were female (30.5%) and 548 were male (69.5%). Patient ages ranged from 15 days to 89 years; median age was 19. In total, 224 patients were <16 years and 564 patients were >16 years of age. The most common type of burn injury in this study was thermal injury (695 cases; 88.2%), followed by electrical injury (67 cases; 8.5%), and chemical, frictional or unknown injuries (26 cases; 3.3%) (Figure 1). Types of thermal injuries were scald, flame, and contact. Most of these 695 thermal burn case were scald burns (480 cases; 69%), followed by flame burns followed by and flame burns (152 cases; 22%) and contact burns (63 cases; 9%). Majority of the patients (60%) suffered burns affecting less than 10% TBSA (Figure 2).

Most patients had second-degree burns (more than 85%), and some had third-degree burns. The affected area was the digits in 289 (36.7%) patients, the dorsal surface of the hand in 197 (25%) patients, the volar surface of the hand in 108 (13.7%) patients, and both volar and dorsal surfaces of the hand in 194 (24.6%) patients (Figure 3). Hospitalization time ranged from one day to 77 days. Median hospitalization time was 11.6 days. Electrical burn injuries, third-degree burns, and larger percentage burns required longer durations of hospitalization.

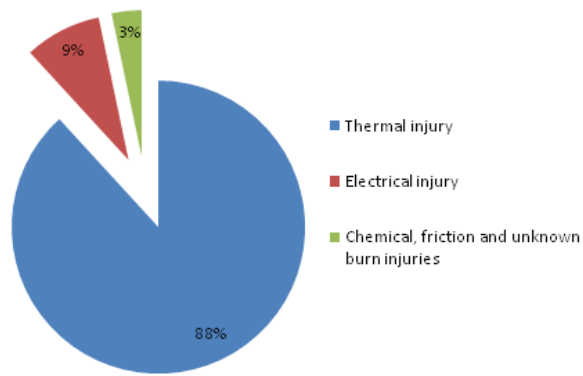


Figure 1. Distribution of patients according to the burn type

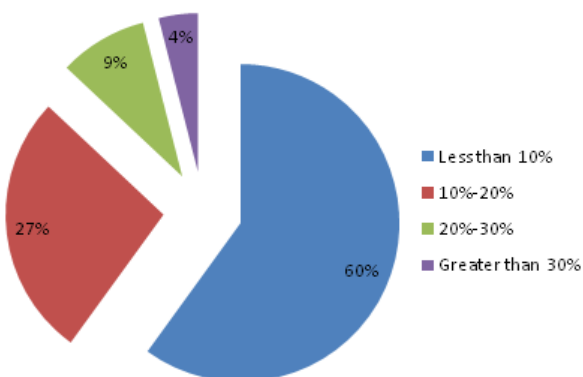


Figure 2. Distribution of patients according to the total body surface area affected

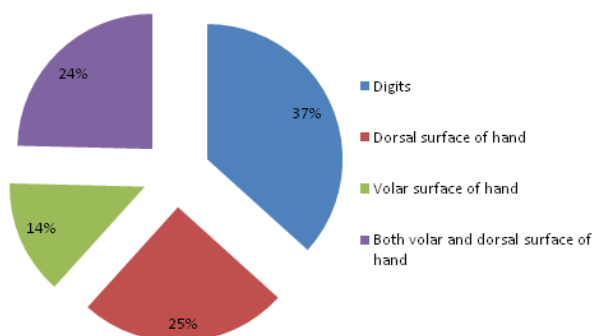


Figure 3. Distribution of patients according to the burn location

We performed escharotomy/fasciotomy in 38 patients. Most of these patients had electrical injuries (31 cases; 81.5%) and some had thermal injuries (7 cases; 8.5%). Methods of treatment for burn defects were observation and dressing change in 562 (71.4%) patients, skin graft in 161 (20.4%) patients, distant interpolation flaps in 42 (5.4%) patients, free flaps in 13 (1.7%) patients, and reverse radial forearm flaps in 10 (1.1%) patients. We allowed and encouraged hand positioning and range of motion exercises in the postinjury and postoperative periods as early as possible.

DISCUSSION

Treatments of burn were categorized as conservative, elective operative, or urgent operative. Timing of burn management may be categorized as conservative therapy, urgent debridement, or elective debridement and reconstruction. Conservative treatment includes dressing change, pain reduction, early hand therapy, and prevention of infection and edema. It is important to debride any loose or thin blisters and remove any foreign material from the wounds before applying dressings. The wide variety of dressing materials available today for burn wound management are not addressed here.³ Conservative treatment is satisfactory in most of the first- and superficial second-degree burns.

In our study, majority of the patients had second-degree partial superficial burns (more than 85%); in 562 of these patients, hand burns were managed by conservative treatment, with debridement of loose and thin blisters and application of Vestagel to painful burn wounds before applying dressings.

Unlike other parts of the body, early tangential excision of hand burns is not feasible. The current standard of care for the treatment of palm burns that have not healed within two weeks after injury is excision of the burn by the placement of a full-thickness skin graft.^{4,5} We managed second-degree deep burns and third-degree burns with skin grafts if there was no vital structure exposition (tendon, nerve, joint, bone, etc.) after debridement and escharotomy. We performed conservative treatment for the first two weeks for second-degree burns, but for third-degree burns, we did not wait for epithelization and performed early tangential excision and skin grafting. Patients with third-degree burns required extensive hand therapy both before and after grafting to avoid development of hypertrophic scarring and contractures (skin, tendon, and joint). In addition, many of these patients had altered sensation or motor function due to nerve destruction caused by the burn itself. Improvement in function is associated with aggressive early surgical and physical therapy interventions for hand burns; thus, it is important that both therapists and physicians participate in the treatment. If there was exposition of vital structures, we performed reconstruction using flaps. Most of these cases were of electrical injuries and had longer hospitalization times.

Compartment syndrome is a sequence of symptoms caused by an acute circulatory defect affecting the nerves and muscles in a particular compartment.⁶ It may develop due to many

different causes, traumatic and nontraumatic (lower limb fractures, arterial trauma, thrombophlebitis, Buerger's disease, improper splinting, overly tight bandaging, rough movement, etc.), and often result in a complex decision-making process regarding its diagnosis and management. The chief purpose of both escharotomy and fasciotomy is to relieve pressure caused by circumferential deep burns or high-voltage electrical injuries from underlying structures.

Initially, to obtain maximal penetration of the burn eschar, the hand should be dressed in mafenide cream (Sulfamylon cream) until surgical debridement is performed. If compartment syndrome is suspected, fasciotomies and escharotomies should be performed within five-eight hours of the injury.

Escharotomy by definition is a full-thickness incision through the eschar, exposing the subcutaneous fat of full-thickness circumferential burns of the extremity.^{7,8}

Fasciotomy is defined as an incision through the skin, fat, and muscle fascia, exposing the underlying muscle compartment, performed to prevent the development of or to treat compartment syndrome resulting from high-voltage electrical injuries, or deep thermal burns involving the muscles. We must release all compartments of the hand, and if required, the forearm, both dorsal and volar, as well as all digits, Guyon's canal, and carpal tunnels.

Presence of acute extremity compartment syndrome is a clear indication for fasciotomy. Pearse et al.⁹ defined acute extremity compartment syndrome as "a surgical emergency characterized by raised pressure in an unyielding osteofascial compartment" that can be caused by trauma, revascularization procedures, or exercise. Maintenance of circulation is the first and foremost aim in the acute treatment of hand burns. If compartment syndrome is suspected, fasciotomy/escharotomy is inevitable. Delayed compartment release is associated with higher rates of morbidity. In one study, the delayed fasciotomy rate was 22% (in the trauma literature, this rate is reported to be 7%-30%). Some studies have demonstrated that delayed fasciotomy is associated with higher rates of muscle excision, amputation, and mortality.¹⁰⁻¹⁴ We studied 38 cases of compartment syndrome and observed no delayed fasciotomy or complications after performing fasciotomy/escharotomy.

When comparing the etiology of burns, fire was the most common cause, followed by scalds.¹⁵ In a previous report previous reports, scalds have been stated to occur more frequently in younger patients and fire burns in older patients.¹⁶ Females suffered more contact and scald burns than men. Males were exposed to electrical injuries more often than females.¹⁷ In our study, the most common etiology of burns was scald and contact, followed by fire.¹⁷ Consistent with previous studies, in our study, scald burns were more common in younger patients (under 18 years age) and fire burns were common in older patients. We performed early tangential excision and skin grafting in deep partial-thickness and third-degree burns, thereby reducing the duration of hospitalization and making the treatment more cost effective.^{18,19}

Epileptic patients present with higher incidence and severity of burn injuries. We studied 32 patients in whom burns occurred because of and during an epileptic seizure. Such burn injuries can be deeper and may lead to more difficult management, higher costs, and increased morbidity and mortality. Burns as a result of epilepsy have previously been reported to account for 7%, 10%, 5%, and 8.6% of admissions to a burn unit.²⁰⁻²³ This study demonstrated an admission rate of 4%, and the mean admission length in epileptic burn patients was 31.8 days (range, 17-56 days). Length of stays was longer for patients with seizure disorder, with a mean of 31.8 days vs. 11.6 days. Lengths of stay at the hospital were longer in patients with seizure disorders and the mean length of stay was 31.8 days vs. 11.6 days. Josty et al.²⁴ retrospectively reviewed 111 cases admitted with burn injuries, secondary to an epileptic seizure, and concluded that scald injuries are the major cause of burns in these patients. In our study, 74% (24 patients) of epileptic patients sustained scald burns. We concluded that epilepsy, given the characteristics of seizure, can also condition the site of burn, which in typical cases, is localized in critical areas (face and hands).

Electrical injuries are observed in very young children (<6 years) and young and working-age adults.²⁵⁻²⁹ Dega et al.³⁰ reported 10,000 burn cases; of these, 665 (constituting 6.5%) were electrical burn injuries. Overall, 91% of these patients belonged to the age group of 16-50 years, with an amputation rate of 24%. In our study, 67 electrical burn injuries were investigated (constituting 8.5%).

We did not study any pediatric cases; all patients were older than 16 years of age. We observed two upper extremity and five finger amputations in this group. Our amputation rate was 10.4%. Low-voltage injuries are caused by a voltage less than 1000 V. Most of the injuries in this group were caused by household current: children who bite into cords, affecting the lip, face, neck, and tongue; occupational injuries resulting from the use of small power tools; or individuals who become grounded while touching an object that is energized.³¹ For example children who bite the electricity cords are affected mostly in the lip, face and tongue region. Occupational injuries result from the use of small power tools.³¹ Individual injuries occur while an individual becomes grounded while touching an object that is energized. Burns resulting from high-voltage (>1000 V) electric current (1000 V) are often associated with a greater degree of deep-tissue injury than is initially appreciated.³² An electrocardiogram (ECG) should be obtained for all patients who sustain electrical injuries (high and low voltage). Patients with loss of consciousness should be monitored regardless of the initial ECG because it may be a symptom of arrhythmia and the patient may be at higher risk of cardiac complications.^{33,34}

Patients with electrical injuries who have documented dysrhythmia in the field, abnormal ECG on admission, and rhythm disturbance while monitored in the emergency room are recommended for cardiac monitoring.³³ We complied with these recommendations along with cardiology consultation.

Successful treatment of the burned hand is challenging. Deformities sometimes cannot be avoided even with optimal therapy. Claw deformity, palmar contracture, web space deformity, hypertrophic scars, amputation deformity, and nail bed deformities are the deformities following hand burns outlined by Achauer.³⁵ These long-term deformities do not fall within the scope of our study.

CONCLUSION

Burns commonly involve the hands, and many functional problems may develop when appropriate basic treatments are neglected. The best treatment for burns is prevention. Appropriate indoor arrangement and simple but effective measures that can be taken at home can significantly reduce burn trauma exposure.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" (amended in October 2013).

Informed Consent: Informed consent was not received due to the retrospective nature of the study.

Peer-review: Externally peer-reviewed.

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Conflict of Interest: No conflict of interest was declared by the authors.

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Hasta Onamı: Çalışmamızın retrospektif tasarımından dolayı hasta onamı alınmamıştır.

Hakem Değerlendirmesi: Dış bağımsız.

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