

## ORIGINAL ARTICLE

## Burn Injuries in Patients with Epilepsy in Our Region: A10-Year Review

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### Abstract

**Objectives:** The aim of our study is to evaluate the frequency and the complications of burn injuries in epileptic patients and to specify the required measures to decrease the occurrence of these injuries.

**Methods:** Socio-demographic data of patients with epilepsy who were admitted to our hospital's burn center were retrospectively analyzed. The data used in our study are obtained from patient files and electronic registries.

**Results:** Eighteen patients with burn injuries resulting from epileptic seizures were admitted to our center. Four (22%) patients were male and 14 (78%) were female. In 17 patients, the accident occurred in the home environment (94.4%) and outdoors in one patient (5.6%). The most frequently affected sites of burns were right arm and forearm. Burn percentage ranged between 3% and 17% and the mean percentage was 9.5%. Burn degrees ranged between 2 and 3. Four patients had 2<sup>nd</sup> degree burns while 14 patients had 3<sup>rd</sup> degree burns. All patients underwent escharotomy in the early stage and the wound site was covered with a silver burn dressing. Split-thickness skin graft was performed in only one patient since there were burnt areas that did not heal.

**Conclusion:** Since the unpredictable epileptic seizures lead to loss of consciousness and accidental burn injuries, it was revealed in our study that patients with epilepsy should be classified as a high-risk population considering the sudden state of their seizures. Early surgical intervention, targeting all epilepsy patients for training and taking specific preventive measures result in positive outcomes.

**Keywords:** Burn injury; epilepsy; preventive measures; treatment.

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### Introduction

Epilepsy is a brain condition characterized by the recurrence of unprovoked seizures. In general, prognosis refers to the probability of attaining seizure freedom on treatment and little is known about the natural history of the untreated condition.<sup>[1]</sup>

Epilepsy is a condition which causes loss of consciousness and contractions. Although patients with epilepsy should be encouraged to live a normal life as much as possible,

sometimes they may pose a risk for themselves as well as for others, especially in the peri-ictal period.<sup>[2]</sup> Due to the nature of epilepsy, injuries in epileptic patients differ from those occur in non-epileptic individuals. According to the studies on this subject, it has been reported that individuals with epilepsy are more prone to trauma which results in serious injuries compared to the normal population.<sup>[3,4]</sup> Studies demonstrate a significant association between epileptic seizures and injuries. Type and frequency of seizures and the side effects of anti-epileptic medications play an important role in this association.<sup>[5,6]</sup> Burn injury is one of the major injuries associated with epileptic seizures. Therefore, the association between epilepsy and burn injuries is frequent, particularly when epileptic seizures are developed around agents that cause burns. Thus, it is important to identify the high-risk group in terms of taking preventive measures and providing specific treatment.

### Materials and Methods

Gazi Yasargil Training and Research Hospital is the only center that admits burn patients from all the provinces of the



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## Bölgemizde Epilepsi Hastalarında Yanık Yaralanması: 10 Yıllık İnceleme

### Öz

**Amaç:** Çalışmamızın amacı, epileptik hastalarda yanık yaralanmalarının sıklığını ve gelişen komplikasyonları değerlendirip, azaltmak için alınacak tedbirleri belirlemektir.

**Gereç ve Yöntem:** Ocak 2010 ile Ocak 2020 tarihleri arasında hastanemiz yanık merkezine başvuran 18 epilepsi hastasının sosyodemografik verileri retrospektif olarak incelendi. Çalışmamızda veriler hasta dosyalarından ve bilgisayar kayıtlarından edinilmiştir.

**Bulgular:** Epilepsi nöbetleri nedeniyle yanık yaralanması oluşan 18 hasta merkezimize başvurdu. Tüm hastaların vital bulguları takip edildi. Sıvı-elektrolit replasmanı, yara yeri kültür sonuçları gelinceye kadar tüm hastalara ampirik tedavi verildi ve spesifik koruyucu önlemler konusunda eğitildi. Hastalardan 4'ü (%22) erkek ve 14'ü (%78) kadındı. On yedi hasta da kaza ev ortamında (%94.4), bir hastada da (%5.6) dış mekanda gerçekleşti. Yanık yeri olarak en çok etkilenen alan sağ kol ve önkoldu. Yanık yüzdesi %3–%17 arasında olup, ortalama %9.5' idi. Yanık derecesi 2–3 arasında değişmekteydi. Dört hastada 2. derece, 14 hastada ise 3. derece yanık vardı. Bütün hastalar erken dönemde eskeretomi yapıp, yara yeri gümüşlü yara örtüsü ile kapatıldı. Sadece bir hastada iyileşmeyen yanık alanları olduğu için kısmi kalınlıkta deri grefti (STSG) yapıldı. Hiçbir hastada kontraktör ve hipertrofik skar gelişmedi.

**Sonuç:** Çalışmamızda öngörülemez epileptik nöbet atağı bilinç kaybına ve kaza sonucu yanık yaralanmalarına yol açtığı için epilepsili hastaların ani durumlarını dikkate alınarak yüksek riskli bir grup olarak sınıflandırılması gerektiğini ortaya koymuştur. Erken cerrahi müdahale ve tüm epileptik hastaların eğitim için hedeflenmesi ve özel önleyici tedbirlerin alınması iyi sonuçlar verir.

**Anahtar sözcükler:** Epilepsi; önleyici tedbirler; tedavi; yanık yaralanması.

Southeastern Anatolia region of Turkey. Eighteen patients with burns that occurred during an epileptic seizure who were admitted to our burn center between January 2010 and January 2020 were included in our study. Both female and male patients and patients from all age groups were included in our study. Patients with active medical or psychiatric disorders were excluded from the study. The socio-demographic characteristics of the patients such as age, gender, marital status, and level of education were recorded. The type of burn injury that occurred in epileptic patients, degree of the burn, area of the burn, total body surface area, the surgical procedure performed on the patients, the site where the injury occurred, adherence to anti-epileptic treatment, the frequency of injuries, general outcomes, and precautions was evaluated.

### Results

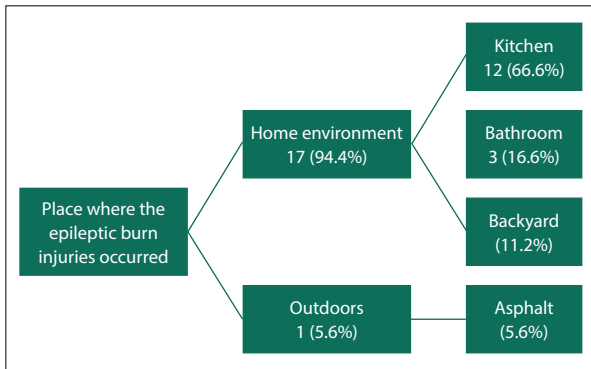
Four (22%) of our patients were male and 14 (78%) were female. The age range was 5–64 years while the mean age was 26.5. Five of these patients were children (5–13 y) and 13 were adults (Table 1). Two (11.1%) patients were from rural areas whereas 16 were from urban areas. While the burn injuries occurred at home in 17 of our patients (94.4%), one of our patients had the burn injury outside the house. Twelve (66.6%) of the burns that occurred at home took place while cooking in the kitchen, four of them were children. The children had burns due to the contact of hot liquid. Three (16.6%) patients were taking a shower and two (11.2%) patients were burning a furnace to bake bread in the backyard of their house. The burns that took place outside the house occurred as a result of the patient falling on the hot asphalt (Fig. 1).

The causes of burn injuries were boiling water burn in seven patients (38.9%) (Fig. 2), boiling pot liquor in three patients (16.9%), flame in two patients (11%), hot milk in two patients (11%), hot object in two patients (11%), hot oil in one patient (5.6%), and falling on hot asphalt in one patient (5.6%) (Table 2).

In our study, population of epileptic patients, burn areas affected during a seizure were as follows: Right upper extremity (56.25%), right lower extremity (43.75%) left lower extremity (5.6%) (Table 2).

**Table 1.** Demographic characteristics of the patients

	n	%
Gender		
Male	4	22
Female	14	78
Age		
Adult	13	72.2
Child	5	27.8
Profession		
Employed	3	16.6
Unemployed	15	83.4
Family status		
Single	8	44.4
Married	10	55.6
Educational stage		
Primary education	15	16.6
Higher education	3	83.4
Type of epilepsy		
Focal	1	5.6
Generalized	17	94.4



**Fig. 1.** Location of burns

ity (37.50%), anterior chest + abdomen (37.50%), left upper extremity (25%), head + neck (25%), and posterior chest + back (6.25%), respectively. Burn percentage ranged between 3% to 17% and the mean percentage was 9.5%. Degrees of the burns varied between 2<sup>nd</sup> and 3<sup>rd</sup> degree; four patients had 2<sup>nd</sup> degree and 14 patients had 3<sup>rd</sup> degree burns.

Regardless of the severity of the burn, all patients presented with a burn that occurred during an epileptic seizure were admitted to our center. Fluid resuscitation, empirical antibiotic therapy, and tetanus prophylaxis were performed to all patients until their culture results were obtained. *Staphylococcus aureus* grew on the culture media obtained from the wound site of three (16.7%) patients.

All patients requested neurology consultation regarding epilepsy treatment. Generalized tonic-clonic seizure (GTCS) was diagnosed in 17 patients and partial epileptic seizure in one patient. Mean duration of epilepsy was 14 years in our study population. In terms of epilepsy etiology, two patients had brain tumors, one patient had meningomyelocele, one patient had cerebral palsy, and 14 patients had abnormal EEG findings (Table 3). Early surgical intervention was considered in all cases. All patients underwent escharotomy in the early stage and the wound site was covered with a sil-

**Table 2.** Etiology of burn

Cause of burn	Boiling water	Boiling pot liquor	Flame	Hot object	Hot milk	Hot oil	Asphalt
Percentage	38.9%	16.9%	11%	11%	11%	5.6%	5.6%

**Table 3.** Causes of epilepsy

Etiology of epilepsy	Abnormal EEG	Brain Tumor	Cerebral palsy	Meningomyelocele	CVE
Percentage	72.2%	11.3%	5.5%	5.5%	5.5%

EEG: Electroencephalography; CVE: Cerebro vasscular events.



**Fig. 2.** Boiling water burn after epileptic seizure.

ver burn dressing. Split-thickness skin graft (STSG) was performed in only one patient since there were burnt areas that did not heal. None of the patients developed contractures or hypertrophic scar. None of our patients had gangrene requiring amputation. The duration of hospitalization was 2–42 days and the mean duration was 10.5 days.

### Discussion

Burn injury is a potentially fatal danger often faced by patients with poorly managed epilepsy. In the study of Spitz, 12% of the patients had severe burns that required serious medical treatment.<sup>[7]</sup> The rational treatment of epilepsy requires the appropriate combination of anti-epileptic medications and optimization of the dose. The expert opinion is essential for the treatment of refractory cases.

It has been reported that burns resulting from epileptic seizures are mostly encountered in third world countries lacking effective epilepsy management.<sup>[8]</sup> In community-based study abroad, the rate of burn occurrence due to seizures was determined to be 6.9% in individuals with epilepsy, while it was 3.9% among normal population.<sup>[3]</sup> According to the study conducted in our country, the cause of burn was epilepsy in 1.6% of the patients.<sup>[9]</sup> Burn cases resulting from epileptic seizures constituted 0.85% of the total burn admissions in our study.

It was stated in the literature that most epileptic burns occurred during daily activities such as cooking, ironing, hair drying, and bathing.<sup>[10-12]</sup> According to the study conducted in our country, it was revealed that burns occurred during cooking or serving hot beverages among epileptic patients.<sup>[12,13]</sup> The burns most frequently occurred during cooking followed by bathing in our study.

In most studies conducted developing countries, epilepsy prevalence remains stable during the third and the fourth decade and typically declines after the fifth decade of life.<sup>[14]</sup> This statement is in line with our observation that 68.75% of the epileptic burn cases occurred before the fourth decade of life. These cases were frequently observed during the second and fourth decades in our study as well.

About 78% of the patients in our study were female. The reason behind the higher rates of burns among women may be attributed to the fact that domestic chores such as cooking are mostly performed by women and the abundance of cooking appliances at home are frequently used by female patients. On the other hand, male patients generally work outside the house and have a lower possibility of exposure to agents that cause burns.<sup>[13]</sup>

Epileptic patients are most frequently admitted with burn injuries caused by scalding.<sup>[15,16]</sup> In Jang et al.<sup>[17]</sup> and Josty et al.<sup>[11]</sup> studies, it was observed that most of the burns were caused by scalding injuries and occurred in the home environment. Mzezewa et al.<sup>[18]</sup> also reported that 98% of burns resulted from flame or scalding. Cheng et al.<sup>[19]</sup> reported flame as the most common (67.9%) cause of burn cases. In our study, 13 patients (72.2%) had scalding burn, two (11.1%) patients had flame burns, two (11.1%) patients had burn due to contact with a hot object, and one (5.6%) patient had hot asphalt burn. Since most of the epileptic patients have epileptic seizures during bathing or cooking, scalding burns tend to be more common. Among the burn injuries occurred during an epileptic seizure, 17 (94.4%) took place at home and one (5.6%) outside the house. Among the burns that occurred at

home following an epileptic seizure, 12 (66.6%) took place while cooking in the kitchen, three (16.6%) patients were taking a shower, and two (11.2%) patients were lighting a furnace in the backyard of their house.

Since the epileptic burn victims become unconscious at the time of the accident; the severity of the burn, burn surface area and the depth of the burn are higher due to the long contact time of these patients with heat and almost no attempt to avoid the burn.<sup>[20]</sup> In our study, we found out that the 77.8% of epileptic burns were 3<sup>rd</sup> degree burns. This rate is 63.6% in usual burn injuries. In a study performed by Li et al.,<sup>[21]</sup> 40.1% of the patients had a full-thickness burn and the main cause of these burns was flame. It was found out in another study that most of the patients were (48.7%) presented with second-degree burns.<sup>[22]</sup> In our study, the rate of 2nd degree burns was 22.23%.

Upper extremities and hands are common areas of burns in epileptic patients. The reason behind is that patients fall close to the burning agents during the seizures and the contact time with these agents is prolonged due to the patient's immobility. Occasionally, permanent burns are only in the facial area due to the sudden fall on the burning agent.<sup>[20]</sup> In our study population of epileptic patients, burn areas affected during a seizure were as follows: Right upper extremity (56.25%), right lower extremity (43.75%) left lower extremity (37.50%), anterior chest + abdomen (37.50%), left upper extremity (25%), and head + neck (25%), posterior chest + back (6.25%), respectively. It was stated in the literature that the most common burn areas in 72% of all epileptic burns were the extremities.<sup>[21]</sup> Almost all of the patients in our study were affected on their extremities. Yao et al.<sup>[23]</sup> reported that 31.98% of burn victims had multiple body areas affected from the burns. In parallel with our study, the upper and lower extremity burns were also more frequent in the studies performed by Jang et al.<sup>[17]</sup>

Some risk factors are associated with a higher risk of burn injury in epileptic patients. Studies showed that the risk of injury is mostly associated with the type of epileptic seizure.<sup>[24,25]</sup>

Since GTCS and atonic and myoclonic seizures lead to loss of consciousness and cause the patients to fall, they carry a higher risk of burn injury. It was revealed in the literature that the risk of injury among GTCS patients was high. In addition, patients with a high frequency of seizures also have a higher rate of exposure to accidents.<sup>[13,18]</sup> According to the study conducted by Jang et al.,<sup>[17]</sup> GTCS was the type of seizure most commonly associated with the epileptic burns, followed by the absence and complex partial seizures. In

our study, the neurology department was consulted for all patients and tonic-clonic seizure was determined to be the most common type of epilepsy. While GTCSs were detected in 17 of our patients (94.4%), one patient (5.6%) had a burn following a complex partial epileptic attack. Our study supports previously published literature.

All of the patients who had burn injuries during epileptic seizures were already diagnosed with epilepsy and almost all of them were unable to receive the necessary treatment. Contributing causes such as the use of anti-epileptic medications in all of our cases, most of them having a generalized type of seizure, more than half of them having poor compliance to their treatment and most of them having one or more seizures per month are considered to be important risk factors in our study population. If these patients had received proper treatment, they would not have suffered from epileptic seizures and consequently burns would not have happened. A few patients had epilepsy in spite of treatment and they needed a dose optimization or modification of medical treatment. In their study, Josty et al.<sup>[11]</sup> reported that the rate of inadequate treatment was higher than 75% in low-income countries and that this rate might be even higher in rural areas. It was stated that low accessibility to medications, lack of trained medical personnel and related beliefs might be the factors behind this situation. In our study, 68.75% of the patients with epileptic burn injuries were residing in urban areas while 31.25% of them were living in rural areas. The reason for the high number of patient applications from the urban area is that the patients residing in rural areas cannot access our research hospital which is located in the city center due to financial reasons or due to the self-administered alternative medical treatments.

Deep burns include various layers of the skin and impede early scar-free healing. Surgical intervention is required to accelerate healing and reduces scar formation in deep dermal and full thickness burns. This can only be achieved through escharotomy and split-thickness skin grafts. In our study, early surgical intervention was considered in all cases. All patients underwent escharotomy in the early stage, and their wounds sites were covered with silver burn dressing. STSG was performed on only one patient since there were burnt areas that did not heal as anticipated. None of the patients developed contractures or hypertrophic scar. In a 5-year study regarding amputation rates following burn injuries caused by epileptic seizures conducted by Adigun et al.<sup>[26]</sup> with 250 patients in their own burn unit, amputation was performed in two patients (0.8%). In our study, none of our patients had gangrene requiring amputation. However, regardless of the method, the success of the epilepsy man-

agement is important for identification of accident rate. Since it was reported that the rate of accidents in individuals who effectively manage their own disease did not differ from that of the normal population.<sup>[27]</sup>

**Conclusion**– It was revealed in our study that patients with epilepsy should be categorized as a “high-risk group” due to sudden and unpredictable nature of epileptic seizures that leads to loss of consciousness and accidental burn injuries. If these patients were included in a high-risk group, most of them could have been saved from burn injuries. Apart from receiving burn care, these patients will also have early and delayed morbidities. While superficial burns may be treated with conservative methods, deeper burn injuries require surgical intervention. The best results are achieved by early surgical intervention in select patient groups through targeting all epileptic patients for training and taking specific preventive measures. Measures such as g heating up the dishes in microwave ovens or taking a shower instead of a bath to prevent burns in epileptic individuals may reduce the frequency of burns among these patients. Targeted anti-epileptic therapies and collaboration with a neurologist for preventive strategies should be considered for the treatment of such burn patients.

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**Informed Consent**– Due to the retrospective design of the study, informed consent was not taken.

**Ethics Committee Approval**– This study approved by the Gazi Yaşargil Training and Research Hospital Ethics Committee (Date: 12.02.2021, Decision No: 667).

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**Authorship Contributions**– Concept: Z.Ş.B.; Design: Z.Ş.B., E.Y.; Supervision: Z.Ş.B., E.Y.; Data collection &/or processing: E.Y.; Analysis and/or interpretation: Z.Ş.B.; Literature search: Z.Ş.B.; Writing: Z.Ş.B., E.Y.; Critical review: Z.Ş.B., E.Y.

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

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