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Original Article

Evaluation of patterns, cause and risk factors of burns in patients with seizure

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Abstract: Background: Burns following convulsion could be an important problem for patients with epilepsy. In the present study we aimed to identify the pattern and the cause of burns in these patients. Methods: This is a cross-sectional study that was performed in 2017-2019 in Guilan on 40 patients with burns following seizure. The information in the records of patients were reviewed. We collected data including age, sex, marital status, occupation, place of residence, length of hospital stay, anatomy of the burn site, percentage of burn, degree of burns, cause of burns and disease outcome. Results: The mean age of the patients was 42.2±2.99 years. Seven cases (17.5%) had burns due to fire, 5 cases (12.5%) due to gas explosion, 3 cases (7.5%) due to electrocution, 15 cases (37.5%) with hot water, 1 case (2.5%) with hot liquids, 5 cases (12.5%) with hot surface, 1 case (2.5%) with hot bath, 2 cases (5%) with hot food and 1 case (2.5%) with hot glue. The mean burning percentage of patients was 19.3±3.18%. The most common patterns of burns were observed as 7 (17.5%) upper limbs and 7 (17.5%) lower limbs. The mean duration of hospitalization was 5.05±0.69 days ranging from 1 to 18 days. 37 patients (92.5%) recovered partially and 3 patients (7.5%) died. Conclusion: Hot water, fire and hot surface are most common causes of burns and there were significant direct correlations between age with percentage of burns and duration of hospitalization. We believe further studies should evaluate the preventive strategies in this regard.

Keywords: Burn, seizure, epilepsy

Introduction

Burns are one of the most devastating injuries and major public health concerns in the world [1]. Burns are the fourth most common trauma after car accidents, falls and interpersonal violence [2]. More than 300,000 people die from burns each year worldwide [3]. Millions of people suffer from disabilities and social, psychological and economic disabilities caused by burns [4]. About 95% of burn deaths are in low- and middle-income countries [5]. Every year, a large number of people in the world die or become disabled due to thermal, chemical and electrical burns.

Burns involve the destruction of part or all of the skin's cellular layers by contact with hot liquids or solids. Important causes of burns include hot liquid, flame, electricity, chemicals and caustics, respectively [6]. Superficial partial thickness lesions (first-degree burns) affect the epidermis and upper surfaces of the dermis and, simply by their wet, pink appearance, produce specific blisters and are extremely sensitive to stimuli. In second-degree burns, the skin retains some of its elasticity, but the underlying tissues become severely swollen and the pressure of the tissue around the burn site increases moderately. Deep partial thickness wounds are wounds that take more than three weeks to heal [7].

Full-thickness or third-degree burns are usually easily recognizable. These burns are mostly caused by contact with concentrated chemi-

cals, or high-voltage electricity, or prolonged contact with fire and flammable materials. Skin with a third-degree burn is inelastic. If these burns occur in sensitive areas, the accumulation of edema and increased tissue pressure will pose a risk and a scarotomy may be needed [8].

Epilepsy is defined as a brain disorder characterized by a persistent tendency to have seizures and neurological, cognitive, psychological and social consequences [9]. Epilepsy is the second leading cause of diseases of the central nervous system (CNS) after stroke and about 0.5% to 1% of people in the world suffer from this disease [10, 11]. Epilepsy is a debilitating condition that adversely affects the quality of life of the sufferer and his family and with attacks of sufficient intensity and frequency can affect all aspects of daily life and its uncontrolled seizures can lead to irreversible destruction in the brain [12]. Epileptic seizures occur without any warning signs and can lead to loss of consciousness and seizures. Therefore, patients with epilepsy are at increased risk of injury during routine activities [13].

One of the most common injuries in these patients that can have long-term and debilitating complications is burns. Several studies have examined burns in a patient with epilepsy [14]. It has been stated that 38% of patients with epilepsy experienced degrees of burns during the attack, of which 10% required hospitalization and 4% required surgery [15].

It is necessary to identify the characteristics of epilepsy and the factors affecting the incidence of epilepsy as well as its epidemiological pattern in people who have suffered from epileptic seizures. On the other hand, the pattern and the cause of burns can also help identify the risk and determine the best way to care to minimize injury in these patients.

Methods and material

Study design

This is a cross-sectional study that was performed in 2017-2019 in Velayat hospital affiliated to Guilan University of Medical Science. The current study was conducted on patients with burns following seizure admitted to our medical center. The study protocol was approved by the Research Committee of Guilan University of Medical Sciences and the Ethics committee has confirmed it (Ethics code: IR.GUMS.REC.1399.480).

Inclusion and exclusion criteria

The inclusion criteria were admission to our center due to burns, epileptic seizure as the main cause of burn, admission to our center in 2017-2019 and signing the written informed consent to participate in this study. The exclusion criteria were burns during traumatic traffic events and patient's will to exit the study.

All patients with the mentioned criteria were entered to our study using census method.

Data collection

After referring to the medical records unit of Velayat Hospital, the information in the records of patients admitted in 2017-2019 who had the inclusion criteria were reviewed. We collected data including age, sex, marital status, occupation, place of residence, length of hospital stay, anatomy of the burn site, percentage of burn, degree of burns, cause of burns and disease outcome.

Statistical analysis

The obtained data were entered into the Statistical Package for Social Sciences (SPSS) version 24. Statistical tables and graphs were used to describe the variables of age, sex, marital status, occupation, place of residence, length of hospital stay, anatomy of the burn site, percentage of burns, degree of burn, cause of burn and outcome. Chi-square and Fisher tests were used to compare the patterns of burns following seizures in terms of age, sex and disease outcome. The significance level was 5% in all tests.

Results

Study population

In this study, 44 patients were evaluated for eligibility. During the data collection, 4 patients were excluded due to incomplete data (N=3) and lack of consent (N=1). At the end, we evaluated data of 40 burn patients due to seizures. The flow chart of the study population is shown in **Figure 1**.

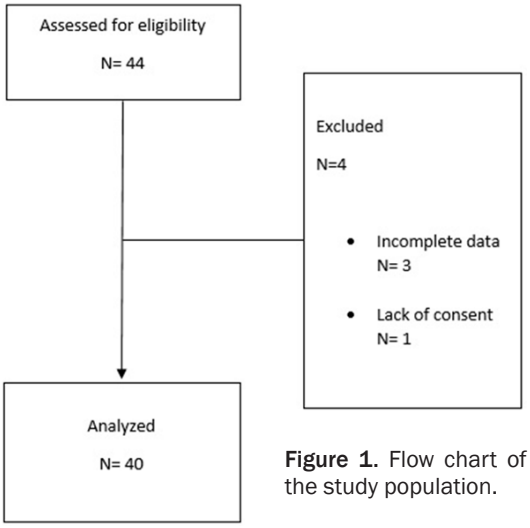

Figure 1. Flow chart of the study population.

Patient's demographic data

The mean age of the patients was 42.2± 2.99 years ranging from 2 to 83 years. We also found that 18 patients (54%) were under 42.2 years and 22 patients (55%) were older than 42.2 years. Further evaluation of demographic data showed that 27 patients (67.5%) were male and 13 patients (32.5%) were female, 25 patients (62.5%) were married and 15 patients (37.5%) were single, and the place of burns was at home in all cases (100%). These data are summarized in **Table 1**.

Causes of burns

It was also shown that 7 cases (17.5%) had burns due to fire, 5 cases (12.5%) due to gas explosion, 3 cases (7.5%) due to electrocution, 15 cases (37.5%) with hot water, 1 case (2.5%) with hot liquids, 5 cases (12.5%) with hot surface, 1 case (2.5%) with hot bath, 2 cases (5%) with hot food and 1 case (2.5%) with hot glue (**Figure 2**).

Burn percentage and degree

The mean burning percentage of patients was 19.3±3.18% ranging from 2% to 90%. Evaluation of burn degrees showed that 1 case (2.5%) had degree 1 of burn, 16 patients (40%) had degree 2, 9 cases (22.5%) had degree 3, 12 cases (30%) had degree 2 and 3 and 2 cases (5%) had degree 3 and 4 of burn.

Burn patterns

Of the 40 patients with burns due to seizures due to epilepsy, the patterns of burns were observed as following: 7 (17.5%) upper limbs, 7 (17.5%) lower limbs, 2 (5%) face and upper limbs, 2 (5%) whole body, 2 (5%) upper and lower limbs, 1 (2.5%) right leg, 2 (5%) trunk and thighs, 2 (5%) face and trunk, 1 (2.5%) upper limbs and trunk, 1 (2.5%) face and neck, 1 (2.5%) anterior trunk, 1 (2.5%) abdomen and genitals, 2 (5%) left foot, 1 (2.5%) left hand and left truck, 1 (2.5%) face and arms, 1 (2.5%) back and truck, 1 (2.5%) ankles, 1 (2.5%) head and face and trunk, 1 (2.5%) head and face, 1 (2.5%) trunk and limbs and 2 (5%) right arm and leg.

Table 1. Demographic data of patients

Variable		Mean ± SD/N (%)
Age (years)		42.2±2.99
Gender	Male	27 (67.5%)
	Female	13 (32.5%)
Marital status	Single	15 (37.5%)
	Married	25 (62.5%)

Further assessments

The mean duration of hospitalization was 5.05±0.69 days ranging from 1 to 18 days. 37 patients (92.5%) recovered partially and 3 patients (7.5%) died. We found significant direct correlations between age with percentage of burns (P=0.022) and duration of hospitalization (P=0.027). We observed no significant correlations between gender and the assessed variables (P>0.05). On the other hand we observed higher hospitalization duration in patients with mortality (P=0.007).

Discussion

Burns are one of the most devastating injuries and major public health concerns in the world. Epilepsy is defined as a brain disorder characterized by a persistent tendency to have seizures and neurological, cognitive, psychological and social consequences. The findings of our study depend on previous observations. In our study, it was shown that out of 40 patients with burns due to seizures due to epilepsy, 27 (67.5%) were male and 13 (32.5%) were women. It was consistent with a 2019 study by Tavousi and colleagues [16].

In our study, the mean age of patients was 42.2±2.99 years. In a 2019 prospective study by Tavousi and colleagues, out of 2119 patients

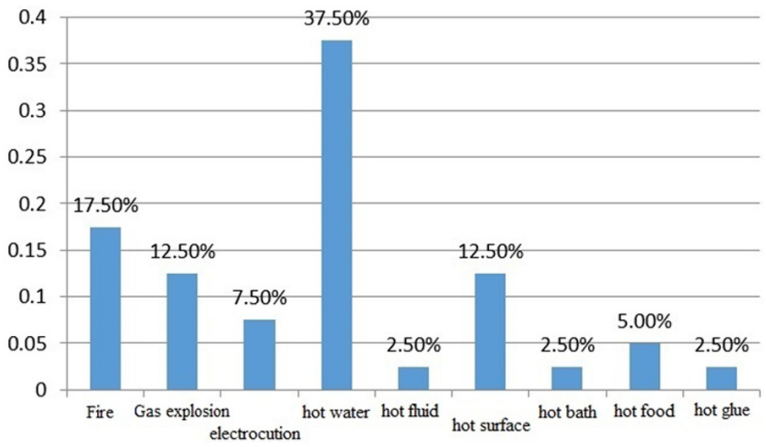

Figure 2. Frequency distribution of burn causes in the study.

admitted between 2015 and 2017, 44 had a history of epilepsy due to burns (2%). Patients with epilepsy were 38.3±12.9 years old and 27 patients (61.4%) were male [16].

In our study, it was shown that all 40 people (100%) had burns at home. We also assessed the causes of burns. In a study by Akhtar and others, from 2008 to 2012, out of 54 patients with burns due to seizures, 56% of patients were admitted due to burns with hot liquids, 22% of patients due to burns with hot surfaces, 11% of patients due to electrical burns and 11% of patients presented with direct flame burns [17].

In our study, the mean percentage of burn patients was 19.3±3.18%. Also, the lowest percentage of burns of the study person was 2% and the highest percentage of burns of the study person was 90%. In a 2018 study by Pius Agbenorku and others in Ghana, 95% of patients suffered from moderate to severe burns and had an average body burn rate of 19.1%, which was consistent with our study [18].

In our study, the patterns of burns were observed as following: 7 (17.5%) upper limbs, 7 (17.5%) lower limbs, 2 (5%) face and upper limbs, 2 (5%) whole body, 2 (5%) upper and lower limbs. In a 2014 study by Akhtar and colleagues, the trunk and limbs were the most common site of burns [17]. In another study by Tavousi and others in 2019, the most common sites of burns were upper limb (61.4%) [16] and these data were consistent with our study.

Based on our results the mean duration of hospitalization was 5.05±0.69 days, 37 patients (92.5%) had a relative improvement and 3 patients (7.5%) died. The study of Tavousi and colleagues reported a death rate of 4% (n=3) [16]. The study of Agbenorku and others in 2018 reported a death rate of 9.5%. These data were also in line with the findings of our study [18].

The important point of this study was that we found significant direct correlations between age with percentage of burns and duration of hospitalization. It was also demonstrated that patients with higher hospitalization duration had higher mortality rates. Previously, Szűcs and colleagues assessed the mechanisms of seizure-related burns and reported that 82% of the study population had partial epilepsy and 9 (18%) had idiopathic generalized epilepsy and 51% reported decreased pain perception during or after seizures in general. This could increase the risks of burns in these patients [19].

Taken together, we evaluated and compared the data of patients with burns following seizure and we believe that this issue could be an important challenge in daily life of patients with epilepsy. As a result, preventive strategies have high importance in this regard. As Cengiz and colleagues in 2019 reported, seizure-related injuries especially burns could significantly decrease the quality of life in patients [20, 21].

Here we had a retrospective evaluation of patient's documents. The limitations of this study were that this study could have unknown potential confounders, we used the data that were originally collected for these purposes, not all the relevant information, and we had also inferior level of evidence compared with prospective studies. We also had restricted study population compared to some former studies and therefore, suggest that more studies on larger populations should be performed. Another limitation was that this study was con-

ducted in one center and we believe that multicentric studies could better clarify this issue.

Conclusion

Burns following seizure is an important issue in patients with epilepsy. Here we evaluated the pattern and characteristics of burns and showed the hot water, fire and hot surface are most common causes of burns and there were significant direct correlations between age with percentage of burns and duration of hospitalization.

Disclosure of conflict of interest

None.

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References

[1] Greenhalgh DG. Management of burns. N Engl J Med 2019; 380: 2349-2359.
[2] Rafiee Zadeh A, Ghadimi K, Ataei A, Askari M, Sheikhinia N, Tavoosi N and Falahatian M. Mechanism and adverse effects of multiple sclerosis drugs: a review article. Part 2. Int J Physiol Pathophysiol Pharmacol 2019; 11: 105-114.
[3] Rafiee Zadeh A, Askari M, Azadani NN, Ataei A, Ghadimi K, Tavoosi N and Falahatian M. Mechanism and adverse effects of multiple sclerosis drugs: a review article. Part 1. Int J Physiol Pathophysiol Pharmacol 2019; 11: 95-104.
[4] Saeman MR, Hodgman EI, Burris A, Wolf SE, Arnoldo BD, Kowalske KJ and Phelan HA. Epidemiology and outcomes of pediatric burns over 35 years at Parkland hospital. Burns 2016; 42: 202-208.
[5] He S, Alonge O, Agrawal P, Sharmin S, Islam I, Mashreky SR and Arifeen SE. Epidemiology of burns in rural Bangladesh: an update. Int J Environ Res 2017; 14: 381.
[6] Rafiee Zadeh A, Ghadimi K, Mohammadi B, Hatamian H, Naghibi SN and Danaeiniya A. Effects of estrogen and progesterone on different immune cells related to multiple sclerosis. Casp J Neurol Sci 2018; 4: 83-90.
[7] Singla N, Srivastava V and Mehta DS. In vivo classification of human skin burns using machine learning and quantitative features captured by optical coherence tomography. Laser Phys Lett 2018; 15: 025601.
[8] Amirian S, Rasheed K, Taha TR and Arabnia HR. Automatic image and video caption generation with deep learning: a concise review and algorithmic overlap. IEEE Access 2020; 8: 218386-400.
[9] Rafiee Zadeh A, Falahatian M and Alsahebfosoul F. Serum levels of histamine and diamine oxidase in multiple sclerosis. Am J Clin Exp Immunol 2018; 7: 100-105.
[10] Thijs RD, Surges R, O'Brien TJ and Sander JW. Epilepsy in adults. Lancet 2019; 393: 689-701.
[11] Fahim M, Rafiee Zadeh A, Shoureshi P, Ghadimi K, Cheshmavar M, Sheikhinia N and Afzali M. Alcohol and multiple sclerosis: an immune system-based review. Int J Physiol Pathophysiol Pharmacol 2020; 12: 58-69.
[12] Fisher RS. Redefining epilepsy. Curr Opin Neurol 2015; 28: 130-5.
[13] Lucke-Wold BP, Nguyen L, Turner RC, Logsdon AF, Chen YW, Smith KE, Huber JD, Matsumoto R, Rosen CL and Tucker ES. Traumatic brain injury and epilepsy: underlying mechanisms leading to seizure. Seizure 2015; 33: 13-23.
[14] Babak A, Rouzbahani R, Khalili Nejad R and Rafiee Zadeh A. Comparison of nutritional behaviors and physical activities between overweight/obese and normal-weight adults. Adv Biomed Res 2019; 8: 62.
[15] Lam NN, Duc NM and Nam L. Epilepsy related burn injuries in developing country: an experience in national burn hospital. Burns Open 2019; 3: 99-102.
[16] Tavousi SH, Khadem-Rezaiyan M, Sahabi R, PourZahed A and Ahmadabadi A. Burn: a repeatable injury with severe sequelae in epileptic patients. Research in Medicine 2019; 43: 247-252.
[17] Akhtar M, Ahmad I, Khan A, Khurram MF and Haq A. Burn injury in epileptic patients: an experience in a tertiary institute. Ann Burns Fire Disasters 2014; 27: 126.
[18] Agbenorku P, Bukari ARA, Effah AT, Agbenorku M, Asare NYO and Bayuo J. Burn injury in epileptics: the trend and risk factors in the middle belt of Ghana. Burns Open 2018; 2: 122-125.
[19] Szűcs A, Horváth A, Rásonyi G, Fabó D, Szabó G, Sákovics A and Kamondi A. Ictal analgesia in temporal lobe epilepsy-the mechanism of seizure-related burns. Med Hypotheses 2015; 85: 173-177.
[20] Cengiz O, Atalar AÇ, Tekin B, Bebek N, Baykan B and Gürses C. Impact of seizure-related injuries on quality of life. Neurol Sci 2019; 40: 577-583.
[21] Andalib A, Etemadifar MR, Zadeh AR and Moshkdar P. Treatment of pilon fractures with low profile plates. Int J Burn Trauma 2021; 11: 486.