Mystery Burns and Nocturnal Seizure Safety

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PRACTICE **POINTS**

- Burns and scars from burns can lead to both life-threatening consequences and lifelong psychological effects.
- Many epileptic patients who present with thermal burn injuries do not remember getting burned.
- Clinicians should be aware of all the potential dangers that patients with epilepsy may encounter both during the day and night.

Thermal burn injuries are common and are associated with physical and psychologic repercussions. For epileptic patients, the risk for environmental injuries is remarkably higher. We present 2 cases of thermal burn injuries following nocturnal seizures. Many epileptic patients are educated on ways to prevent injury; however, these safety precautions tend to focus primarily on daytime activities. We highlight the potential presentation and impacts of the thermal lesions. In addition, we offer suggestions for improvements in patient education and injury prevention.

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Patients with seizures are placed at an increased risk for sustaining burn injuries, which may occur during common daily activities such as cooking, showering, and using heaters.[1] Although patients are warned of the risks of injury at the time of their epilepsy diagnosis, patients still experience injuries that commonly occur during the seizure or the postictal phase. In a study of 134 patients with epilepsy, only 38% recalled being burned during a seizure, with approximately 9% being burned multiple times.[2] Another study investigated the circumstances resulting in burns in this patient population and found that cooking on a stove was the most common cause, followed by hot water while showering and exposed room heaters.[1] Another study found that the majority of burns in seizure patients were from spilled hot drinks.[3]

We report 2 patients who presented to the dermatology clinic with second-degree burns following nocturnal seizures. In both cases, the patients were sleeping next to exposed heaters, which led to burn injuries from seizures that occurred in the night.

Case Reports

Patient 1—A 30-year-old woman with a history of a seizure disorder presented with painful second-degree blistering burns along the left arm and flank (Figure 1). One day prior to presentation, she had woken up to find these lesions and visited the emergency department where she was prescribed silver sulfadiazine cream to prevent infection of the wound site and was referred to our dermatology clinic. Initially, the patient had difficulty pinpointing the source of the burn lesions and thought that it may have been due to sleeping with her cell phone, but she later realized that they were due to the space heater placed next to her bed. Because of the unclear etiology at the initial presentation, a skin biopsy of a lesion was taken while she was at the clinic.

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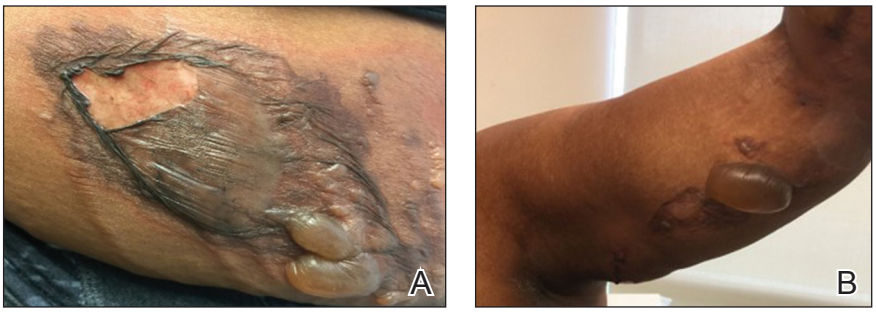

FIGURE 1. A and B, Blisters from a thermal burn injury (patient 1).

Biopsy of the lesions exhibited separation of the epidermal and dermal layers (Figure 2). Thermal damage was seen extending into the dermal layers with notable edema present. A few inflammatory cells, neutrophils, and monocytes were noted in the biopsy. The initial pathology results showed the epidermis was necrotic with edema, spongiform vesicles, and few neutrophils. The histologic findings aligned with the timeline of the injury occurring 2 days prior to the biopsy. She was treated supportively using mupirocin ointment to prevent secondary infection.

Case 2—A 27-year-old woman with a history of epilepsy presented to the dermatology clinic with painful blistering lesions along the right upper arm (Figure 3). She was found to have notable second-degree burns along the right arm. She reported placing her bed near a baseboard heater to stay warm overnight. She noticed the painful lesions after waking up next to the heater following a suspected seizure. She was treated supportively using mupirocin ointment to prevent secondary infection.

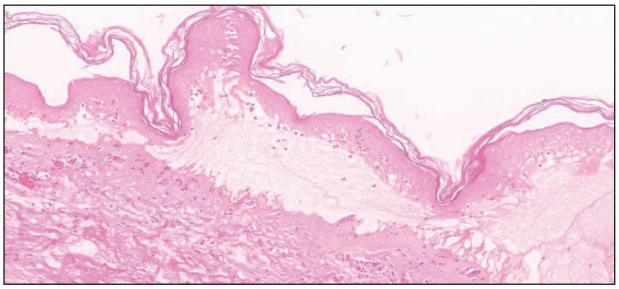

FIGURE 2. Histology revealed necrosis with minimal inflammation consistent with a thermal burn injury (H&E, original magnification ×100).

FIGURE 3. A and B, Blisters from a thermal burn injury (patient 2).

Comment

Classification of Burns and Damage—According to the World Health Organization, nonfatal burn injuries are a leading cause of morbidity and occur mainly in the home and workplace.[4] There are many types of burns: radiation, electrical, chemical, friction, and thermal. The most common type of burns are thermal burns,[4] which can be further subdivided into wet and dry. Both of our patients experienced dry thermal burns.

Based on the skin tissue layers involved in the thermal damage, burn wounds are further divided into first-degree burns, superficial second-degree burns, deep second-degree burns, and third-degree burns.[5] These classifications each have characteristic gross features. Based on these criteria, our patients both presented with blistering and ruptured bullae and no eschar formation, which is classified as second-degree superficial burns.

Following thermal insult to the skin, 3 zones are formed. The central zone consists of irreparable damage referred to as the zone of coagulation. The zone of stasis lies between the completely damaged central region and the outermost regions of the burn lesion, and it receives slightly less blood flow. This area can fully recover after complete perfusion is returned early in the healing process. The outermost zone of hyperemia can fully

recover and is an area marked by intense vasodilation from inflammatory reactions.[5]

Wound Healing—During the healing process, metabolic activity is remarkably increased, which leads to formation of reactive oxygen species.[6] The production of reactive oxygen species is both beneficial and harmful. It is protective against invasion of microorganisms, but it delays the re-epithelialization process. The burn injury itself generates multiple cytokines and lipid mediators.[7] After the initial keratinocyte migration and proliferation, angiogenesis and fibrogenesis lead to the formation of the basement membrane at the dermoepidermal junction,[5] which is followed by structural strengthening of the skin with collagen and elastin deposition. The final results of healing are dependent on the depth of the wound. With deeper burns there will be contractures and hypertrophic scarring and a possibility for hypopigmentation from melanocyte death.[5] With more superficial injuries, the burned area appears hyperpigmented from overactivity of melanocytes during the healing process. In less severe cases of superficial burns, it can take 5 to 7 days for granulation tissue to cover the wound and to heal with little to no scarring.[5]

Burns in Patients With Seizure Disorders—Burns pose a serious risk to patients with seizure disorders that often is underappreciated by patients and health care providers. Although many burns are first-degree burns, up to 10% of burns require medical attention.[1] In the initial phase following a thermal insult, the skin's microflora is killed off, but within a week the sterile skin can become infected.[5] The most common microbial invasions seen in blistering wounds are due to *Pseudomonas aeruginosa* and *Staphylococcus aureus*.[8] With larger burns associated with immunocompromising factors such as diabetes mellitus or older age, patients are at an increased risk for becoming septic. Prior to the period of infection, the damage caused by the heat leads to vasodilation of the microvasculature surrounding the injured area. In addition, release of cytokines leads to migration of inflammatory cells. With the vasodilation of vasculature, proteinaceous fluids from the intravascular space can collect between the dead epidermal and dermal layers to form blisters.[5] In larger burns, the fluid shifts will lead to severe oncotic pressure decreases intravascularly and can lead to hypotensive shock.[6] When burns have a more severe global effect, aggressive resuscitation and vasopressors are required to maintain perfusion of vital organs.

Both of our patients experienced painful lesions, but they were fortunate to have factors of youth, superficial damage, and low total body surface area burns for a smaller risk for infection, fluid loss, and severely disfiguring scars.[8] Because the duration of the postictal phase can vary, there is potential for more severe burns that can leave a lifelong reminder of the event. Depending on the skin type and the depth of the thermal insult, evidence of injury may last many years in the form of hypertrophic scars, contractures, and changes in skin pigmentation.[5] At distances 30 cm or less from the standard blow-dryer, it takes 2 minutes to cause cell death.[9] In comparison to a heat source that is meant to provide warmth to a room, there is a notable difference in potential for severe burns with the standard heater vs the standard blow-dryer.

Along with the physical pain, the visual reminders of the injurious event can have notable psychological effects. Scars can decrease self-esteem and lead to depression, anxiety, body image problems, and sexuality issues.[10]

Given the immense risks associated with burn injuries and the many unfortunate outcomes, emphasis should be placed on patient education regarding safety precautions with seizure disorders. In one study, it was found that only 5% of patients recall receiving a warning about the risk for burn injuries with seizures.[2] It is important for patients and physicians to develop a written comprehensive safety plan that addresses the risks for daily activities during the day and night. Although patients may not remember being told about the risks, a written safety plan likely will increase patient awareness and reduce avoidable injuries. In addition to written safety plans, prior recommendations for reducing burn injuries in seizure patients include the use of fire and heater guards as well as flame-retardant clothing and blankets.[11]

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