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CASE REPORT

An unusual electrical burn caused by alkaline batteries

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Electrical burns caused by low-voltage batteries are rarely reported. We recently encountered a male patient who suffered from a superficial second-degree burn over his left elbow and back. The total body surface area of the burn was estimated to be 6%. After interviewing the patient, the cause was suspected to be related to the explosion of a music player on the left-side of his waist, carried on his belt while he was painting a bathroom wall. Elevated creatine kinase levels and hematuria indicated rhabdomyolysis and suggested an electrical burn. Initial treatment was done in the burn intensive care unit with fluid challenge and wound care. The creatine kinase level decreased gradually and the hematuria was gone after 4 days in the intensive care unit. He was then transferred to the general ward for further wound management and discharged from our burn center after a total of 11 days without surgical intervention.

Introduction

Electrical burns can cause different degrees and extents of damage, depending on factors such as voltage, current flow (amperage), type of current (alternating or direct), path of current flow, duration of contact, skin resistance, and individual susceptibility.[1–4] Clinically, electrical injuries could be divided into high-voltage (over 1000 V) and low-voltage (less than 1000 V). High-voltage electrical injuries are characterized by varying degrees of thermal cutaneous damage combined with extensive destruction of the deep layers, which manifest as fat necrosis, rhabdomyolysis, vascular thrombosis, or nerve injury. Low-voltage electrical injuries, on the other hand, usually result in cutaneous burn with or without soft tissue injury.[5] Skin resistance is affected by certain factors such as humidity.[6] It happens more apparently when the skin is soaked with water that contains free ions, such as sweat. In such special

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circumstances, one can suffer from electrical injury at low voltages, resulting in thermoelectrical burn.

In this report, an unusual electrical burn, caused by alkaline batteries, is presented. Possible pathophysiology and mechanisms are also discussed. We believe that this is one of a few cases of electrical injury caused by extremely-low voltage electricity.

Case report

This case report is of a 63-year-old male patient who had no history of major systemic disease. He was painting a bathroom wall on the afternoon of March 18, 2010, while listening to music via earphones from a battery-powered music player. The player was carried on his belt at the left hip. A short circuit induced a small explosion and a great noise was heard over the earphone. The patient lost consciousness immediately and regained it gradually within a few minutes. He complained of tinnitus with ear ache and therefore visited an Ear Nose Throat (ENT) doctor's clinic in the evening. There were no specific findings for the ear; only a mildly injected tympanic membrane was noted. However, a large area of epidermal loss with surrounding burned gangrenous skin was noted over the back and left elbow. He was transferred to our emergency department right away with suspected acute burn injury.

Upon arrival, the patient's consciousness was clear with no neurological deficit. Physical examination showed no other wounds or tenderness except for the superficial second-degree burns over the patient's back and left elbow; the estimated total body surface area (TBSA) was about 6% (Fig. 1). Due to the initial loss of consciousness, cranial computed tomography was done, and no acute hemorrhaging was noted. However, his serial examinations showed mildly hemoconcentrated hemoglobin (Hb) to be 160 g/L. He also had decreased renal functions [blood urine nitrogen: 19.6 mmol/L and creatinine (CRE): 99.1 μmol/L with previous CRE level 53.4 μmol/L in October, 2009, observed during a regular health examination] and markedly elevated creatine kinase (CK) [11485 U/L] and creatine kinase-muscle and brain (CK-MB) [71.5 U/L]. Urine analysis showed gross hematuria with occult blood 3+. Electrocardiography showed normal sinus rhythm with no evidence of cardiac injury or arrhythmia. In summary, the patient was strongly suspected to have electrical burn with rhabdomyolysis and acute renal injury, probably due to dehydration or myoglobinuria. Therefore, he was admitted to our burn intensive care unit for intravenous hydration with lactated Ringer's solution and received sodium bicarbonate for urine alkalization. Urine output reached 85—105 mL/hour with these treatments and gradual improvement was noted in the follow-up blood and urine examination (Table 1), which suggested a reduced risk of acute renal failure. He was transferred to the general ward after 4 days of intensive treatment. His wound was initially managed with silver sulfadiazine (Flamazine®) coverage, which was shifted to op-site occlusive dressing over the back and intra-site® gel [containing 2.3% modified carboxymethylcellulose polymer together with propylene glycol (20%)] over the left elbow for removal of the eschar after transferring to the general ward. His wounds healed gradually and the eschar was successfully removed (Fig. 2). When stable, he was discharged from our burn center after 11 days of hospitalization, without any surgical intervention.

Discussion

Reviewing the patient's whole clinical history and laboratory data, the known fact is that there was a burn injury caused by the explosion as a result of a short circuit in a music player, an elevation of the CK and CRE levels, and

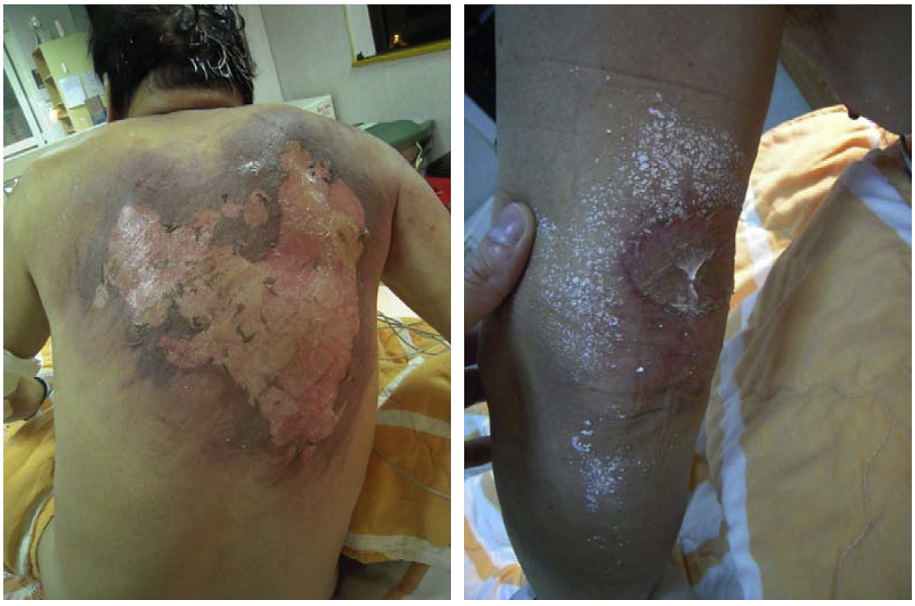

Figure 1 The patient suffered from superficial second-degree electrical burns over the back and left elbow region. Total body surface area was about 6%. These pictures were taken upon the patient's arrival at the emergency department.