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Put Your Lights On: Electrocution As a Cause of an Unexplained Fall and Loss of Consciousness

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ABSTRACT

Electrical accidents are not reported very frequently, and may occur undetected as the signs are often manifold and not very specific. We report the case of a 43-year-old woman admitted to hospital due to a fall of unclear cause, with loss of consciousness, partial amnesia, paresis of both legs and crush syndrome. Only by thorough and repeated history-taking, and a careful physical examination that revealed burns typical of electrical current injuries, was the case resolved. With this case presentation, we would like to make the reader aware of electrocution as a possible cause of bruises and unconsciousness of unclear origin.

LEARNING POINTS

- Bruises and loss of consciousness of unclear origin should make one think of electric shock as a possible cause.
- Rhabdomyolysis and crush syndrome are rarely seen conditions in low-voltage current accidents.
- Thorough physical examination and careful history-taking are very important and can provide precious hints for our clinical work.

KEYWORDS

Electric shock, crush syndrome, bruises and unconsciousness of unclear origin

INTRODUCTION

In Germany, low-voltage electrical current (<1000 volts) accidents in adults are not frequently reported. In an analysis of the Charité Berlin, only 0.17% of all acute medical admissions of adults were for electric shock. Accidents mainly occur in an occupational context[1]. In 2016, 3463 accidents were reported, 88% of which were caused by a low voltage[2]. Five deaths caused by electric shocks in households were reported in 2015[3]. The range in the severity of the resulting injuries is quite large and depends on the type of electricity, the duration of contact, the amplitude of the current, the size of the contact area and the electrical current's path through the body[4].
The most obvious symptoms – ECG abnormalities and skin marks – are not that frequent. Only 32.5% of the patients had electricity marks (9.8% had burns) at the entry site, and an even smaller number had signs at the exit site. 24.2% of the adults had ECG evidence of mild cardiac arrhythmias on admission, while creatine kinase was elevated in only 26.1% of the cases (always occurring in combination with concomitant injuries such as falls)[1].

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In current accidents, there are three main mechanisms of importance: 1) direct tissue damage caused by electroporation, 2) the conversion of electricity into thermal energy leading to coagulation necrosis, and 3) injuries caused by falls or by continuous muscle contractions [5-7]. Nerves, muscles and blood vessels are good electrical conductors because of their high water and electrolyte content and are therefore very prone to damage[6]. Myonecrosis, myoglobinaemia and myoglobinuria caused by electricity lead to tissue oedema and rhabdomyolysis[5].

CASE DESCRIPTION

Our case describes a 43-year-old female patient admitted to hospital after a fall of unclear cause and loss of consciousness of unknown duration. She had suddenly fallen in her kitchen with a feeling of 'lightning' or 'having been pushed' but had no recall of the incident nor its duration. The patient reported involuntary urinary incontinence as well as hypoaesthesia and paresis of the legs after the incident. She had crawled into bed and only two or three days later called for help, urinating and defaecating into nearby sheets during this period.

There was no history of drug abuse, nor a significant past medical history. Several days after admission, with recurrent anamnestical workup, she recalled touching the light switch when entering her kitchen, before falling.

On physical examination the patient was afebrile, haemodynamically stable and oriented. She had a large haematoma of the right thigh and knee, and bruises of unclear origin in the popliteal space and on both insteps (*Figs. 1–3*). Both lower legs were swollen and painful and showed hypoaesthesia. In addition, a paresis of the toe extensors and flexors was noticed.

Figure 1. Electrical mark in right popliteal space

Figure 2. Electrical mark on right instep.

Figure 3. Electrical mark on left instep.

Blood work-up revealed an increased serum creatinine of 1.99 mg/dl (normal value 0.5–0.9 mg/dl), urea of 137 mg/dl (16.6–48.5) and creatine kinase of 44,163 U/l (<170), but only a slightly increased CRP of 3.9 mg/dl (<0.5) was observed. Urinalysis revealed haemoglobinuria and proteinuria. An MRI scan revealed oedema of the posterior compartment and circumferential oedema of both lower legs, possibly consistent with rhabdomyolysis. An electromyogram showed lesions of both common peroneal nerves.

An ECG, EEG, cranial CT as well as lumbar puncture and a lumbar MRI (to exclude spinal ischaemia) gave normal findings. An additional psychiatric examination revealed no pathological findings. The bruises on the insteps and popliteal space were diagnosed as third-degree burns consistent with current injuries (the patient had been wearing sandals with metal buckles on the insteps).

A diagnosis was made of crush syndrome accompanied by acute kidney injury AKIN 2, lesions of both nervi peronei, amnesia and unconsciousness due to electrical shock. The patient was treated with forced diuresis and alkalisation of urine as commonly recommended[8]. She received physiotherapy, bilateral ankle foot orthesis and was sent for neurological rehabilitation.

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DISCUSSION

The triad of our patient's history, the findings of the MRI and blood work-up and the typical bruises in our case made a current accident highly likely.

The most frequently reported symptoms in electrical current accidents are fatal arrhythmia and respiratory arrest[1]. Rhabdomyolysis and crush syndrome are rarely seen conditions in low-voltage current accidents.

Pathophysiologically, our patient's paresis was caused not only by the muscle destruction, but also by direct damage to the peroneal nerves. On the one hand, the circumferential oedema of the calf led to damage of the nerve blood supply and the myelin sheath. On the other hand, coagulation necrosis in the nerves – similar to the muscle necrosis – leads to a reduction in conductivity[7]. The affected nerves are located between the burns on the entry site (popliteal space) and the exit site (insteps).

Particularly in short-term exposure to current, the non-thermal mechanisms of cell destruction seem to be more important[5], which clearly explains the mismatch between the minor external and distinct internal pattern of injuries.

Furthermore, we suspect an additive muscle crush injury since our patient hardly moved for three days due to peroneal paresis.

Such an electric accident in our patient's household occurred because her apartment did not have a residual current circuit breaker, unlike newly built houses since 2009 in Germany[9]. We informed the facility manager of the housing estate and had an electrician sent out in order to avoid further harm.

Our case once more underlines the importance of a thorough physical examination and repeated history-taking in diseases with hidden underlying causes.

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