Late Myocardial Sequelae of Electrical Injury

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Abstract

Cardiac involvement in electrical injury is rare yet poses serious manifestations with high mortality rate. In most cases, symptoms occur immediately after the incident. We present a case of cardiac arrest six hours following uneventful electrocution. The case emphasis the potential late sequel of cardiac injury.

Key clinical Message

Cardiac injury following electrocution is rare and mostly seen immediately after the event. Our case demonstrate a late sequel of cardiac arrest after an uneventful event which emphasis the potential progressive nature of electrical injury.

Keywords: Out of Hospital Cardiac Arrest; Ventricular Fibrillation; Electrical Injury; Electrocution

ABBREVIATION

AED, Automated external defibrillator, CT, computerized tomography, ECG, electrocardiography, EEG, Electroencephalogram

BACKGROUND

Electrical injuries are relatively common and occur mostly at home or as a result of work accidents. Approximately 1000 deaths per year are due to electrical injuries in the United States, with a mortality rate of 3-5%[1]. Cardiac involvement is rare, yet poses the most serious manifestations with high mortality rate[2-4]. In the vast majority of cases, the symptoms occur immediately after the incident and only in rare cases delayed manifestations observed[5-6]. The pathogenesis isn't fully understood but vitro studies and post mortem autopsies reveled that, in selective patients, electrocution injury progress into permanent scar with late cardiac manifestation as arrhythmia[7-13].

CASE PRESENTATION

We present a 28 year-old male heavy smoker, without any known chronic illnesses, who worked as an exterminator using pesticides in a palm plantation. He was electrocuted by touching a high voltage exposed electric wire, from an electric poll. He reported pain and new pigmentation in his right hand and left foot. However, he denied losing consciousness, incontinence, chest pain or palpitation. He didn't seek medical care. Six hours later he returned to work and suddenly collapsed with cardiac arrest. Resuscitation was immediately initiated by his coworker. A few minutes later, a local nurse from a nearby settlement placed an automated external defibrillator (AED). The AED indicated ventricular fibrillation and 3 DC shocks (200J) were delivered successfully, with return of spontaneous circulation immediately after. In the ambulance, the patient was breathing heavily with six breaths per minutes and low oxygen saturation. 300mg Ketamin and 20mg Etomidate were given intravenously in order to initiate mechanical respiratory support. Three attempts of performing intubation failed.

At the local hospital he was somnolent, with pinpoint pupils. Arterial blood pressure was 113/60 mmHg, pulse was rhythmic and rapid. Burns were noticed on his right palm and left foot. Sinus tachycardia, (110-120 beat/min), Right axis deviation, long QT interval (QTc = 550 msec) and Inverted T wave (on leads III, aVF) were noticed on performed ECGs. No ST changes were seen (Figure 1). Creatinine phosphokinase was high 840 mg/dl. Troponin was not measured.

A short echocardiogram, performed by a senior cardiologist, indicated good global systolic function, with 55% estimated left ventricular ejection fracture. No significant valvular disturbance, nor pericardial effusion or regional wall motion abnormality were noticed. A full body CT scan was performed without any significant pathological findings. No enzymatic evidence of myocardial infarction was found.

Mechanical ventilation initiated in the ICU, after sedation with intravenous Propofol and Fentanyl. Mild Hypothermia established for 24 hours, with target temperature of 34[?]c. A day after he was able to breath without oxygen support and could recount the initial events. No serious neurological deficits were noticed. He was treated mainly with respiratory physiotherapy, and was discharged a few days later, fully functioning.

In the following months, the patient complained of anxiety, insomnia, urine incontinence and palpitations. He denied syncope or near syncope. He was examined by neurologist and performed an Electroencephalogram (EEG) with no pathological finding. The patient was follow up by cardiologist in ambulatory clinic. Electrocardiogram and Echocardiogram which performed two months later revealed no difference compared to previous findings. 24 hour ECG monitoring (Holter) indicated a few isolated ventricular premature beats.

DISCUSSION

Electrical injury may cause various types of damage to the heart structures, leading to necrotic scar, as seen on MRI scan and endomyocardial specimen from fatal cases[14-16].

The most common manifestation of cardiac involvement is arrhythmia. The extent of the damage varies from harmless transient sinus tachycardia to fatal ventricular arrhythmia and severe conduction abnormalities which in some cases required permanent pacemaker[7-12].

In the vast majority of cases, the onset of the injury is immediately after the incident. In rare, cases, as in ours, the onset of the injury may be after several hours, and its effect may last longer – from minutes to several weeks[5-6].

Appropriate recommendations regarding predisposition risk factors, management and monitoring of patients who sustained electrical injury has not been well defined, especially due to the prevalence of the events and lack of long-term follow-up[17].

Patients who were exposed to high voltage or have a history of loss of consciousness, prolonged tetany, ECG abnormalities, extensive soft tissue injury and an unwitnessed event, would require admission to the hospital and should be monitored with telemetry for at least 24 hours but recommendation relies mainly on expert opinion[18].

Current type and pathway seems to play a major role in predicting cardiac involvement and late sequel. Current that passes thought the head to thorax is more likely to produce fatal arrhythmia and brain injury[19-21].

CONCLUSION

Electrical injury causes various arrhythmias, mostly at the time of the incident. Physicians and patients should be aware of delayed effect of severe arrhythmia following electrocution. Patients should be followed up and monitored for 24 hours in cases of unwitnessed event, exposure to high voltage, prolonged tetany, extensive soft tissue injuries or when they have a history of loss of consciousness or ECG abnormalities. Physician should pay attention to current pathway, assume by noticeable burns. Patients should be followed up for several months by multi-discipline physicians, among them, a cardiologist, neurologist, psychiatrist and a physiotherapist.

DECLERATIONS

- **Ethics approval** – N/A
- **Consent for publication** – consent form was signed by the patient. Any patient-related data described in the case will be confidential.
- **Availability of data and materials** – The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request
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Figure & Legend

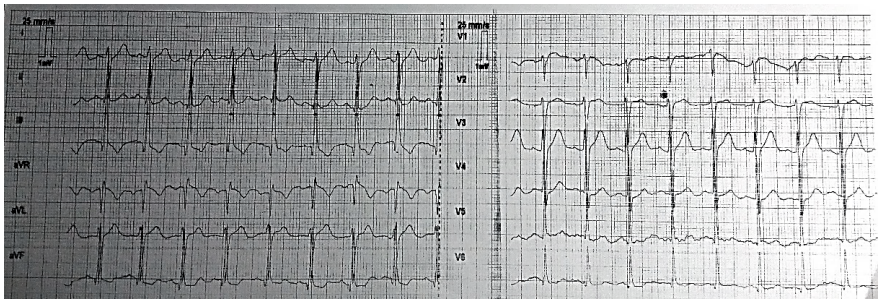

Figure 1. ECG on admission