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Case Reports

Electrocution induced cardiac dysrhythmia: an Izinyoka case

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ABSTRACT

Electrical injuries, although rare, can result in significant morbidity and mortality particularly from cardiac complications. We present a 35-years-old male who developed paroxysmal atrial fibrillation after an electrical shock, had minor burns and no prior cardiac issues. The dysrhythmia resolved during hospitalization and the patient was treated with anticoagulation and wound care before discharge. In South Africa, electrical injuries are commonly seen in patients who attempt illegal connections (Izinyoka) often for socio-economic reasons. While atrial fibrillation is uncommon after electrocution, ECG remains essential for diagnosing dysrhythmias. There is a lack of consensus on the management of electrocution-induced dysrhythmias and further research is needed to develop tailored guidelines for regions with high socio-economic challenges.

Keywords: Africa, Burns, Cardiac, Dysrhythmia, Electrocution, Shock

INTRODUCTION

In 2024 the United Nations reported that the world's population has surpassed the 8 billion marks.[1] Population growth continues to rise and as the population grows, so does the demand for resources. One such resource is the supply of electricity. With the widespread provision of household electricity comes an increased exposure to electrical injuries. Electrical injuries, whether accidental or intentional, are relatively uncommon in daily life but when they occur are associated with significant morbidity and mortality.[2]

Injuries from electrical current occur under various circumstances, either domestically or in the work setting and victims are typically young adult males working in the electrical, construction and manufacturing industries.[3,4] In the United States, 17,000 patients are admitted annually as a result of electrocution, with 5% of patients dying due to complications.[5] Electrocution-related injuries are also the third most common cause of death in the American workplace.[6] In South Africa, the phenomenon of illegal electricity connections, commonly referred to as Izinyoka, has emerged as a critical public safety issue. This situation is exacerbated by high unemployment rates and rising electricity tariffs, which compel many individuals to resort to illicit connections to access electricity. Perpetrators of these acts are prone to electrocution and associated injuries.[7]

Serious complications from electrocution include cardiac abnormalities, burns and spinal cord injuries because of falling from heights.[5] Th cardiac muscle is particularly susceptible to the effects of electrical currents, especially alternating currents.[8] Manifestations of cardiac injury include dysrhythmias, conduction disturbances and damage to the myocardial tissue.[2] In this article, we discuss a 35-years-old male who presented with paroxysmal atrial fibrillation following electrocution during an unauthorized connection to the electric power grid.

CASE REPORT

A 35-year-old male presented to our Trauma Unit following an electrical shock that occurred two days prior. He was referred by the local clinic for evaluation of dysrhythmias along with minor burn wounds on his right arm and abdomen. The patient had been previously well with no history of dysrhythmias or comorbidities and had sober habits. Physical examination revealed a patient who is generally well and comfortable.

He had normal hemodynamic parameters with a pulse rate of 81 that was irregular in rate, volume and rhythm. There were no other peripheral signs and no abnormalities were detected on a urine dipstick test. Cardiovascular examination was unremarkable apart from the irregular heartbeat and peripheral pulses. Septic burn wounds were noted on the right forearm and abdomen, accounting for 5% of total body surface area (TBSA). However, the burns were non-circumferential. All other systems were unremarkable.

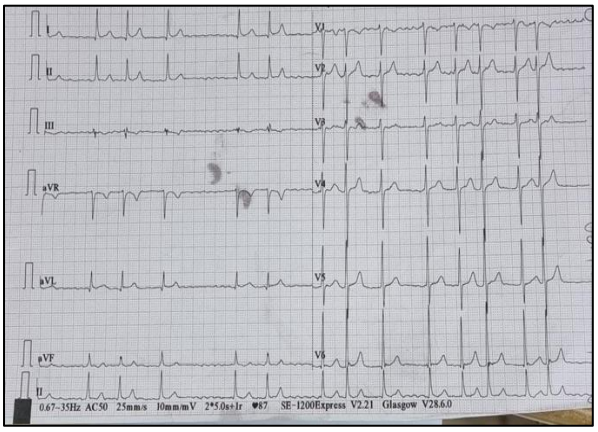

Figure 1: The electrocardiogram (ECG) strip demonstrates atrial fibrillation with normal ventricular response.

Baseline blood tests remained normal except mild elevation of urea (7.9 mmol/l), creatinine (134 mmol/l) and LDH (239 mmol/l) which corrected on the following day. Serum cardiac markers were unremarkable throughout the admission period. The patient's management included dual anticoagulation with low molecular weight heparin and warfarin, adequate intravenous hydration and burns care along with antibiotic therapy. He recovered well in hospital with complete resolution of the atrial fibrillation. Follow up ECG was scheduled in two weeks on his discharge day. Discontinuation of anticoagulation was planned if repeat ECG remained normal.

DISCUSSION

It is a reality that illegal connections are the main source of electricity in most informal settlements in South Africa.[7,9] This could be attributed to the high levels of unemployment, extreme poverty, socio-economic inequality, population growth, urban influx, government negligence and poor service delivery and the ever-increasing cost of electricity.[7] Residents of informal settlements face significant financial hardship with lack of employment opportunities, yet are expected to pay high electricity tariffs, a situation culminating in illicit electric connections.[7] Slow and inadequate service delivery from the local municipalities leave many individuals waiting to be connected for years, thus resorting to illegal connections.[7] The dawn of democracy in South Africa was followed by mass urban influx and rural depopulation, further straining already limited resources and increasing the electricity demand in the cities.[7]

Cable theft is of significant concern in South Africa with serious implications for community safety, the economy and public infrastructure. This type of criminal activity involves the stealing of copper cables which hold some value in the scrap metal market. The repercussions of cable theft are dire often with electrocutions and severe bodily injuries and fatalities, among the perpetrators as well as in the innocent bystanders.[9,10]

Electricity is distributed globally as alternating current at various voltages, typically ranging from 115 to 440 V.[3] In South Africa, electricity is supplied to households by the South African electricity supply company (ESKOM) at an alternating current of 50 Hertz and a voltage of 240 V.[9] The severity of electrical injuries depends on several factors, including the applied voltage, type and frequency of current, duration and method of contact as well as the body's resistance and the current's pathway through the body.[2-4] The electric injuries may cause significant dysfunction in any tissue and organ of the body.[5] However, given the excitable nature of the cardiac muscles, the heart is particularly vulnerable to these injuries.[5]

The extensive labyrinth of neuronal fibres throughout the heart and the conductivity of blood as it flows through its chambers render it particularly susceptible to electric injuries.[5] Recovery from a cardiac electrical shock can occur relatively quick, with or without changes in the heart rhythm.[3] This is the intended goal of procedures such as defibrillation and cardioversion.[3]

Abnormal heart rhythms caused by the pro-arrhythmic effects of an electric shock typically develop during or immediately following electrocution.[2,4] The flow of electrical current through the heart can significantly disrupt the cardiac cycle and a current of 50-80 mA (milliamps) passing through the heart is sufficient to cause death.[3,9]

This underscores the heart's vulnerability to alternating currents.[8] If the electric current impacts the heart during its vulnerable phase, it may trigger ventricular fibrillation

(VF), the leading cause of death due to electrical accidents.[2,8]

The patient in the case presented with paroxysmal atrial fibrillation (AF). While AF is the most common chronic cardiac arrhythmia, it is uncommon following electrocution. In a study by Pilecky et al, the most common arrhythmias after electrocution were sinus bradycardia and sinus tachycardia.[5] This single-centre study included 480 patients who presented to the emergency department post electrical injuries and only two patients had AF.[2] Similarly, in another study of 182 patients, AF was reported in two cases.[5]

The ECG was pivotal in diagnosing the paroxysmal atrial fibrillation and guiding our management of the patient. The literature on cardiac arrhythmias indicates that ECGs are effective diagnostic tools, particularly in stable patients.[2,4,6] However, routine ECG monitoring is generally considered unnecessary for clinically stable patients who present with a normal ECG at admission.[2,4,6] Studies have shown that late-onset malignant arrhythmias are rare in this demographic, with both in-hospital and 30-days mortality rates reported at 0% in various patient cohorts.[2,4,6]

This suggests that continuous monitoring does not significantly enhance patient outcomes in these cases.[2,4,6] The standard 12-lead ECG remains a fundamental method for diagnosing arrhythmias. It is non-invasive, inexpensive and widely available, making it a first-line diagnostic tool for cardiac issues.[2,4,6] However, its limitations include the inability to always identify the underlying mechanisms or locations of arrhythmias.[2,4,6] The use of troponin and CK-MB testing has been criticized for offering limited diagnostic value in assessing cardiac risk, particularly after events like electrical accidents.[2,4,6]

In studies, these biomarkers did not correlate strongly with the presence of arrhythmias or adverse outcomes, leading to suggestions that their liberal use may contribute to unnecessary healthcare costs without providing significant benefit.[2,4,6] The management of our patient involved a multidisciplinary team with the diagnostic evaluation and treatment plan carefully customized in accordance with standard medical practice. However, the lack of follow-up limited our ability to assess the long-term outcome of his treatment approach as the patient failed to show up for appointments.

CONCLUSION

There is limited data on electrocution injuries in sub-Saharan countries, including South Africa. Pilecky et al, noted that electrical injuries are rare, however, how uncommon are they and what is their prevalence in South Africa? While the answer to this question remains unclear, it is reasonable to hypothesize that the number of patients admitted to emergency units due to electrocution may be higher than previously reported given the socio-economic challenges in the country. This number may also rise considering the increasing demand for and supply of electricity as the population grows. The literature reviewed highlights a lack of consensus on the evaluation and management of patients with arrhythmias caused by electrocution and no definitive guidelines currently exist. Furthermore, no clear approach exists for managing patients with risk factors or pre-existing cardiac disease.

Further research is required on electrocution-induced dysrhythmias and their acute management, optimal observation and monitoring durations. There is also a need for improved case reporting for statistical analysis. Such efforts are essential to inform the development of tailored guidelines suited to the South African context.

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REFERENCES

1. United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects 2024, Online Edition. 2024. Available at: https://ourworldindata.org/population-growth. Accessed on 21 August 2024.
2. Pilecky D, Vamos M, Bogyi P. Risk of cardiac arrhythmias after electrical accident: a single-center study of 480 patients. Clin Res Cardiol. 2019;108:901–8.
3. Odell M. Electric shocks and electrocution, clinical effects and pathology. In: Payne-James J, Byard RW, editors. Encyclopedia of Forensic and Legal Medicine. 2nd ed. Oxford: Elsevier. 2016: 419–27.
4. Akkaş M, Hocagil H, Ay D, Erbil B, Kunt MM, Ozmen MM. Cardiac monitoring in patients with electrocution injury. Turkish J Trauma Emerg Surg. 2012;18(4):301–5.
5. Yıldırım BO. A sudden complication: Electrocution-induced atrial fibrillation. Mid Black Sea J Health Sci. 2024;10(1):131–6.
6. Ahmed J, Stenkula C, Omar S, Ghanima J, Bremtun FF, Bergan J, et al. Patient outcomes after electrical injury: a retrospective study. Scand J Trauma Resusc Emerg Med. 2021;29(1):114.
7. Mawuena G. Economic conditions that lead to illegal electricity connections at Quarry Road Informal Settlement in South Africa. International J Special Edu. 2002;37(3):67-9.
8. Kroll MW, Luceri RM, Efimov IR, Calkins H. The electrophysiology of electrocution. Heart Rhythm. 2023;4(7):457–62.
9. Blumenthal R. A retrospective descriptive study of electrocution deaths in Gauteng, South Africa: 2001–2004. Burns. 2009;35(6):888-94.

10. Mmakwena M. An evaluation of the impact of cable theft on free flow of traffic in South Africa. Int J Res Bus & Social Sci. 2022;11(6):542-51.

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