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Authors: Donghyun Kim, Lae-Young Jung

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Electrical injury induced polymorphic ventricular tachycardia with cardiac arrest

Donghyun Kim[1], Lae-Young Jung[1, 2, 3]

[1]Division of Cardiology, Jeonbuk National University Hospital and Jeonbuk National University Medical School, Jeonju, South Korea
[2]Research Institute of Clinical Medicine, Jeonbuk National University, Jeonju, South Korea
[3]Biomedical Research Institute, Jeonbuk National University Hospital, Jeonju, South Korea

Correspondence to:
Lae-Young Jung MD, PhD,
Division of Cardiology,
Jeonbuk National University Hospital
and Jeonbuk National University Medical School,
20 Geonji-ro, Deokjin-gu, Jeonju, Jeonbuk, 54907, South Korea,
phone: +82 63 250 18 40,
e-mail: lyjung@jbnu.ac.kr

Arrhythmias are the most common cardiac complication of electric injury [1]. While exposure to high-voltage (like lightning) or direct current will most likely cause ventricular asystole, even low-voltage alternating current can cause sudden cardiac death by ventricular fibrillation.

A 52-year-old male suddenly collapsed while connecting air conditioner electrical wiring (380 V) without wearing gloves. A colleague nearby noticed that he was unconscious and had no pulse, and began cardiopulmonary resuscitation. Five minutes later, an ambulance arrived, and the automated external defibrillator indicated a shockable rhythm, so defibrillation was performed. Subsequently, spontaneous breathing and pulse returned, and he was transported to the emergency room. Upon arrival at the emergency room, his blood pressure was 125/85 mm Hg, pulse was 80 beats per minute, and body temperature was 36.5°C. Blood chemistry and echocardiography showed normal findings, except for an elevated troponin I level of 0.310 ng/ml (normal range, <0.1 ng/ml). The electrocardiogram (ECG) strip from the automated external defibrillator brought by the paramedics showed polymorphic ventricular tachycardia (VT) converting to sinus rhythm after defibrillation (Figure 1A–B). The patient's

consciousness was clear, and an electrical burn mark (entry point, yellow arrows) was observed on his right hand (Figure 1C). The patient had no significant comorbidities or family history, nor any recent history of medication use. Since coronary artery disease is one of the most common causes of sudden cardiac arrest [2], a cardiac computed tomography angiography was performed, but no abnormal findings were observed. Additionally, there were no abnormalities in serum ion levels. Considering the patient's clinical situation, the fact that he was performing electrical wiring work at the time, and neither paramedics at the scene nor in-hospital examination did not reveal any other causes of cardiac arrest, it was presumed that the cardiac arrest was related to polymorphic VT caused by the electrical injury. The patient was observed with ECG monitoring without any additional treatment and recovered without any significant arrhythmic events over the course of two days before being discharged.

The frequency of 50–60 Hz, commonly utilized in domestic and commercial electrical systems, increases the risk of cardiac exposure to current during the vulnerable phase. This may induce an ‘R-on-T phenomenon’, which can subsequently trigger ventricular fibrillation [3]. The occurrence of polymorphic VT due to electrical injury has been reported in animal experimental models [4] and controlled surgical settings [5]. However, to our knowledge, this is the first case where it was induced by everyday electrical exposure, confirmed through ECG, and successfully treated.

Article information

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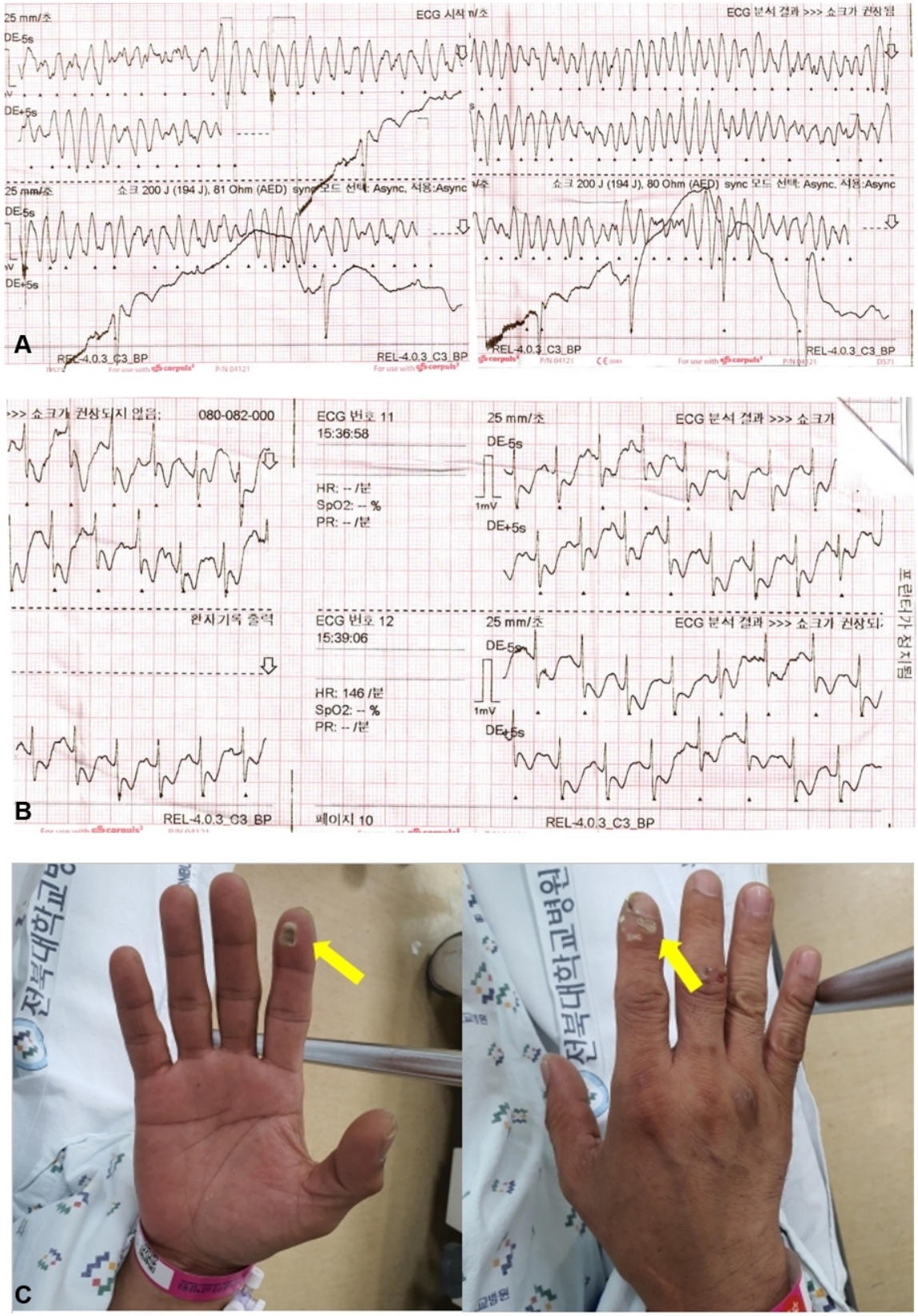

Figure 1. A. Initial automated external defibrillator rhythm strip showing polymorphic ventricular tachycardia. **B.** Conversion to sinus rhythm after defibrillation. **C.** Entry point skin burns (yellow arrows) of right hand