경피적 심장 충격 장치의 사용으로 발생한 의인성 전기 화상의 증례 보고

최종윤 · 차원진 · 정이름 · 서보미 · 정성노

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Iatrogenic Spark Burn Injury to the Chest From a Transcutaneous Pacing Patch

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Iatrogenic electrical burns that occur from the use of a defibrillator, a paddle-type cardiac shock device, have been reported in various forms. Electrical burns are usually conducted directly through the skin and are more damaging than scald burns or contact burns. A transcutaneous cardiac pacing device is a patch-type cardiac shock device that automatically delivers a shock when an abnormal heart rhythm is detected. We introduce a unique case of iatrogenic electrical burns caused by the transcutaneous pacing patch of a cardiac shock device. Electrical energy was converted into a spark due to foreign bodies deposited around the patch, resulting in damage to the peripheral area of the skin. (*J Korean Burn Soc* 2021;24:50-52)

Key Words: Burns, Electric, Defibrillators, Chest, Electrocardiography

INTRODUCTION

Since the 1950s when external electrical stimulation of the heart was first reported, modern medicine has developed methods of stably and gradually maintaining cardiac pacing, such as transvenous, transesophageal, and permanent implantable pacemakers [1]. Transcutaneous pacing is a much simpler, more effective, and non-invasive method of cardiac pacing than invasive methods, such as the transvenous approach [2].

Electrical burns caused by shock paddles are relatively common iatrogenic burn injuries, and most of them are caused by insufficient preparation before use [3].

Electrical burns caused by the use of transcutaneous

pacing patches have been reported in patients at all ages, from neonates to adults [4].

We introduce a case of second-degree burn injury caused by a transcutaneous pacing patch with a novel mechanism of spark burn. In addition, we consider steps to reduce the incidence of iatrogenic burn injury.

CASE REPORT

A 57-year-old unconscious male was brought to the emergency department. The electrocardiogram (ECG) showed repeated ventricular tachycardia and ventricular fibrillation.

The patient was transferred to the cardiac intensive care unit, and a transcutaneous cardiac patch was applied for ECG monitoring and intervention (Fig. 1).

For each ventricular fibrillation, he received 150 J of electrical shock, which was performed 41 times over the course of 2 days. After the patient's recovery, multiple bullae and an eschar were observed in the location where the transcutaneous patch was removed. The burn wounds measured 8×12 cm and appeared as patch-sized, ring-like,

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Fig. 1. Transcutaneous gel pad and pacing device. (A) Anterior view. (B) Posterior view.

intense erythema outlines in the shape of the gel pads. Bullae had formed along the erythematous peripheral side, and dermal injury was observed (Fig. 2).

The burn wounds were dressed with ointment that contained recombinant epidermal growth factor (Easyef[®], Daewoong Pharmaceutical Company, Republic of Korea) and an absorbent foam material (Mepilex[®], Mölnlycke Health Care AB, Sweden) every day. Starting on the second day, his heart rhythm was stable, and no additional cardiac shock therapy was required. The patient was discharged 2 weeks later. After 3 weeks, the outpatient course showed recovery with complete epithelization (Fig. 3).

DISCUSSION

Burns caused by electrical cardioversion are a common iatrogenic complication in the hospital, and several reports describe various types of burn injuries.

Pride et al reported that pediatric and neonatal patients have a significantly higher risk of electrical burns because they have a smaller body surface area across which to dissipate the energy compared to adults [5]. In addition, Chang et al reported that deep second-to-third degree burn injuries can occur when defibrillation is performed without lubricants in children who need cardiac shock due to various medical causes [6].

Because the previously reported burns had differences in their appearance and mechanism, we analyzed several possible causes for the iatrogenic burn in the present case.

Fig. 2. Initial appearance of the burn injury after 41 electric shocks. (A) Anterior view. (B) Lateral view.

Fig. 3. Healed burn wounds after three weeks. (A) Anterior view. (B) Lateral view.

First, the tissue in the central part of the pacing patch was not injured, but injured tissue was observed in the skin that had contacted the peripheral part of the pacing patch. In addition, we observed many foreign bodies such as crust, traces of painted povidone iodine solution, and other debris at the surrounding area where the sticky patch had been attached.

The gel layer in the patch is designed to act as a bridge so that the patch can contact a broad area of skin. In the present case, the patient's burn injury was caused by a spark of thermal energy resulting from incorrect trans-

mission of electric energy such that the foreign bodies of the patch acted as a resistor between the skin and the gel layer [7]. Pagan et al also suggested histological evidence that transthoracic electric shocks caused variable degrees of skin burns, which were related to using shock energy [8].

Second, in our patient, continuous and multiple shocks were administered over several days while the gel patch was in contact with the body but produced no skin damage. The structure of the patches was broad, designed so that a large amount of electrical energy per unit area did not concentrate at one point when a current flowed from the electrode to the skin. However, if the contact area was not sufficient and if the patches were not checked for correct placement, a skin burn injury may occur. The proper use of lubricant helps with correct patch-to-skin contact.

Payne et al. reported a case of third degree burn injury due to transcutaneous pacing in a severely obese diabetic woman. They suggested that transcutaneous pacing should be performed for a short duration, if possible. So, physicians should not place the gel pads prophylactically [9].

Singleton et al. reported a case of third degree burn injury due to transcutaneous pacing in a patient with third-degree heart block. They suggested that a difference of current distribution may be caused by local high current density, resulting in burn injury [4].

In defibrillation with cardiac shock devices as well as transcutaneous pacing, the paddle position and contact force are also contributing factors that can affect skin burn injury. A previous report suggested that clinicians should ensure proper paddle position and contact force before the first shock [6].

To summarize, when transcutaneous patches are attached for the first time, the contact surface should always be clean without any foreign bodies. In addition,

physicians must correctly apply the patches on the skin with sufficient medical lubricant. Finally, as the patient's vital signs are closely monitored, physicians should carefully check for any burn injury during pacing.

CONFLICTS OF INTEREST

No potential conflicts of interest relevant to this article were reported.

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