Case Report

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Lung Parenchymal Damage Due to High Voltage Electric Shock

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Abstract

In electric shocks, lung tissue is a poor conductor and has low resistance. Therefore, they are not very sensitive to the development of tissue damage due to electric current. In this study, we wanted to present a rare case of lung parenchymal burn as a result of electric shock. A 21-year-old male patient was brought to the emergency department by ambulance after being electrocuted with a current of 15,000 volts after contact with a high voltage line while working with a construction machine. The general condition of the patient was good and vital signs were stable. However, his pulse oxygen value was 74 and his breathing was slightly tachypneic. There were no lesions in the chest and abdomen due to electrical burns. Radiologic imaging showed bilateral diffuse tissue damage in the lung tissue. The patient was referred to a tertiary care institution with an intensive care burn unit. In traumas caused by high-voltage electric shock, burns on the body surface may be insufficient to determine the severity of the trauma. A multidisciplinary approach must be provided to these patients

Keywords: Emergency medicine, high voltage, electrical injury, lung damage

Introduction

The most common type of injury in the body as a result of electric shock is burns (1). In high-voltage electrical injuries, myoglobinuria, renal failure and compartment syndromes may be observed due to muscle destruction in the body. The mortality rate of high-voltage injuries is quite high and surgical treatment is required in some cases in addition to medical treatment (2). In electric shocks, electric current causes damage to internal organs by creating a closed circuit current effect especially on wet surfaces. Although there are no entry and exit burn scars in the chest area, pneumonia, pleural effusion, hemothorax and liver capsule burn may occur (3). In electric shocks, lung tissue is a poor conductor and has low resistance. Therefore, they are not very sensitive in the development of tissue damage due to electric current (4).

In this study, we aimed to present the case of burns in the lung parenchyma tissue of a heavy equipment operator who was injured in an electric shock caused by the contact of the vehicle with a high voltage line with a current of 15,000 volts during the use of heavy equipment.

Case Report

A 21-year-old male patient was brought to the emergency department by ambulance after being electrocuted with a current of 15,000 volts after contact with a high-voltage line while working with a construction machine. The patient was conscious with a Glasgow Coma Scale (GCS) of 15. Vital signs; blood pressure: 118/72 mmHg, pulse rate: 98/minute, temperature: 36.7oC, pulse oxygen saturation: 74. The patient's respiration was mildly tachypneic and he stated that he had difficulty breathing. Physical examination revealed burns around the left shoulder and ear and electrical output burns on the right thigh, right foot and left foot (Figure 1). Laboratory and imaging tests were performed. According to the results, white blood cell count was 22.85 10^3 u/L, hemoglobin: 16.1 g/dL, platelet: 475 10^3 u/L, urea: 34 mg/dL, creatinine: 0.99 mg/dL, sodium: 137 mmol/L, potassium: 4 mmol/L, AST: 26 U/L, ALT: 26 U/L, CRP: 8.1 mg/dL, Troponin T: 5.1 ng/dL, CK: 3.3 µ/L, CK-MB: 2.7 µ/L, pH: 7.344, PCO2: 40 mm/Hg, PO2: 68 mml/Hg, HCO3: 21.3 mmol/L, lactate: 4.09 mmol/L. Electrocardiography (ECG) evaluation revealed normal sinus rhythm. Radiologic imaging revealed diffuse ground glass images in bilateral lung tissue on thoracic tomography (Figure 2). The patient had no recent known signs of lung infection (cough, sputum, fever, etc.). It was concluded that the images in the lung parenchymal tissue occurred after electric shock. The patient received tetanus prophylaxis, antibiotics, analgesics and fluid replacement therapy.

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Vital signs were stable and urine output was normal. After consultation with the relevant departments, the patient was referred to a center with a burn unit. The patient was referred to a tertiary health care institution with a burn unit and intensive care unit. After remote follow-up, the patient received treatment in the intensive care unit for eight days without intubation and was discharged with healing with the improvement of the lung tissue. It was learned that the patient did not develop any complications.

Discussion

As a result of electric shock; burns in the body at various degrees, musculoskeletal injuries, orthopedic injuries and cardiac arrhythmias may occur. The most important cause of death in electric shocks is cardiac arrhythmias (5). In electrical injuries, the voltage of the electric current and the duration of exposure to current may cause injuries in internal organs disproportionately to skin burns. Therefore, the voltage and duration of exposure to electric current must be questioned in persons exposed to electric current even in the absence of skin burns, and the patient must be evaluated extensively (6). In our case, the burn findings observed in the patient suggested that the patient had been exposed to high-voltage electric current for a long time. We attribute the fact that the patient responded to treatment in a short time without complications and did not end with death to the fact that the working environment was dry and the contact with the current was relatively short. Indeed, in a similar case reported by Yaşar et al. in 2006, an 18-year-old male patient was electrocuted during a car wash and was exposed to current for about 30 minutes on a wet floor. The burns observed in the lung and liver parenchyma tissue were severe and the patient died (6). In a case reported by Aydın et al. in 2019, a 52-year-old male patient was exposed to 36,000 volts of current with a transformer explosion and compartment syndrome and rhabdomyolysis occurred in the patient's arm. In this case, cardiac pathology, lung and liver tissue damage did not develop and electric current caused major tissue damage on musculoskeletal tissue (7). Araç et al. retrospectively analyzed electrical injuries admitted to the emergency department and observed pneumomediastinum in one patient (0.6%), pneumothorax in one patient (0.6%) and lung contusion in one patient (0.6%) in 178 patients (8).

Patients exposed to high-voltage electric current are generally younger and the morbidity and mortality rates are high in these cases. Follow-up of these patients would be more appropriate in centers with more comprehensive burn surgery and burn intensive care compared to low-voltage injury patients (8).Our patient was referred to a more comprehensive health center to reduce mortality because of his young age and exposure to high-voltage electric current.

Conclusion

In traumas caused by high-voltage electric shock, burns on the body surface may be insufficient to determine the severity of the trauma. A multidisciplinary approach should be provided to these patients and it should be kept in mind that diffuse parenchymal damage may develop in the lung tissue.

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