

Skin Care Experience of a Case of Multiple Organ Failure Caused by High-Voltage Electrical Injury

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ABSTRACT

Background: High-voltage electrical burns are caused by the direct transmission of electric current through the body and the conversion of electric energy into heat energy, which directly heats the tissues and leads to organ function damage. Especially after high-voltage electric burns (more than 1000W), it can not only cause coagulation necrosis of the skin and even carbonization, but also cause serious deep tissue damage. The degree of tissue damage depends on the type of current, the magnitude of current, the frequency, the voltage, the resistance of the tissue, the skin humidity, the duration, the contact area, and other factors. Low voltage and low frequency electric shock mainly affect the heart and respiration, which can lead to insignificant soft tissue damage. High voltage electric shock mainly causes serious soft tissue damage, which can be accompanied by changes in the circulatory system and respiratory system.^[1]

Subject and Method: We collected the data of a case of multiple organ failure caused by high-voltage electricity that was successfully treated in July 2023. In the course of this patient's successful treatment, The main nursing measures were analyzed: The intake and output volume were actively controlled. Albumin supplementation, Debridement and dressing change were performed daily, Covered with nano-silver ion dressing, Try to ensure a sterile environment during operation, Maintain ambient temperature and humidity.

Results: Twenty days later, the skin damage caused by electric burns was reduced from 30% to 1%.

Conclusion: These are very important links: The intake and output volume were actively controlled, The balance of intake and output was maintained for 24 hours, and lactic acid was less than 2mmol/L. Albumin supplementation Controlled above 30g/L, Debridement and dressing change were performed daily, Covered with nano-silver ion dressing, Try to ensure a sterile environment during operation, Maintain ambient temperature 28~30°C and humidity 40%~50%.

KEYWORDS: Skin care, multiple organ failure, nano-silver, lactic acid, Albumin

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BACKGROUND

High-voltage electrical burns are caused by the direct transmission of electric current through the body and the conversion of electric energy into heat energy, which directly heats the tissues and leads to organ function damage. Especially after high-voltage electric burns (more than 1000W), it can not only cause coagulation necrosis of the skin and even carbonization, but also cause serious deep tissue damage. The degree of tissue damage depends on the type of current, the magnitude of current, the frequency, the voltage, the resistance of the tissue, the skin humidity, the duration, the contact area, and other factors. Low voltage and low frequency electric shock mainly affect the heart and respiration, which can lead to insignificant soft tissue

damage. High voltage electric shock mainly causes serious soft tissue damage, which can be accompanied by changes in the circulatory system and respiratory system. Death caused by high-voltage electricity usually directly affects the respiratory and circulatory systems, leading to respiratory failure and malignant arrhythmia. High-voltage electric injury accidents in industrial production are usually caused by the operator's non-standard operation.

SUBJECT AND METHOD

1. Study Design

Population and Samples: We collected the data of a case of multiple organ failure caused by high-voltage electricity that was successfully treated in July 2023. This was a 26-year-old

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male patient, An accidental electric shock occurred while working on the construction site, and the voltage exceeded 1000W. Another worker died after cardiac arrest. The patient was delirious and breathing weak after electric shock, so he was sent to the emergency department of our hospital for treatment. On admission, the patient was found to have electrical burns of more than 30% of the body surface area, and multiple skin blackened and ulcerated on the chest wall and upper limbs. In the course of this patient's successful treatment, The main nursing measures were analyzed: The intake and output volume were actively controlled. Albumin supplementation, Debridement and dressing change were performed daily, Covered with nano-silver ion dressing, Try to ensure a sterile environment during operation, Maintain ambient temperature and humidity.

2. Study Variables:

Dependent variables: the skin and soft tissue; respiratory system and circulatory system.

Independent variables: the type of current, the magnitude of current, the frequency, the voltage, the resistance of the tissue, the skin humidity, the duration, the contact area, and other factors.

Operational Definition Variables: ambient temperature and humidity

RESULTS

Twenty days later, the skin damage caused by electric burns was reduced from 30% to 1%.

DISCUSSION

1. The intake and output volume were actively controlled^[2], The balance of intake and output was maintained for 24 hours, and lactic acid was less than 2mmol/L. The skin injury of burn patients is easy to lead to a large amount of body fluid loss, so it is very important to control the intake and output volume. The circulatory status of patients is not evaluated, so that the lactic acid is in the normal range, which can effectively ensure the stability of circulatory function and no microcirculation disorders.

2. Albumin supplementation Controlled above 30g/L^[3]. In patients with extensive burns, the permeability of blood vessels and cell membranes increases after burns, the intravascular fluid is transferred to the tissue space and cells, and the effective blood volume will be drastically reduced, leading to the appearance of shock state and further aggravation of skin injury after microcirculation disturbance. Active albumin supplementation can lead to circulatory stability, maintain effective blood volume, and improve the symptoms of skin ischemia.

3. Debridement and dressing change were performed daily, Covered with nano-silver ion dressing: In clinical practice, we found that more than half of the patients with infection of small and medium-sized burn wounds were related to improper wound treatment and non-standard dressing change, which affected the clinical efficacy. The specific

dressing change time was determined according to the burn time, burn area, burn site, wound condition, and patient's constitution.^[4] Generally speaking, the dressing change time of exudation stage wounds and exposed treatment wounds was about 4 hours. The dressing change time of middle burn or semi-exposed wound was 6 hours to 8 hours. The dressing change time of the wound in the repair stage or the wound treated with bandaging was 12 hours to 24 hours. At the same time, to ensure the physiological regeneration and repair of wounds, the "three unsuitable principles" should be followed, that is, no pain, no bleeding, and no damage to normal tissues. In order to master the timing of dressing change, it is necessary to ensure that the wound is in a physiological moist environment and prevent the exudate from being impregnated. First of all, when removing the exfoliated necrotic tissue and wound exudate, the action should be gentle and accurate to prevent roughness. When forceps and scissors touch the wound, it can be very painful for the patient, and health care providers need to understand the patient's psychology. Secondly, no residual necrotic tissue or liquefaction was left on the wound during each dressing change. The wound residue should be cleaned up without damaging the normal wound tissue. The nano-silver wound plaster is composed of medical fiber cloth loaded with nano-silver particles, adhesive layer, water absorption layer, antibacterial layer, release paper and isolation layer, which can significantly reduce exudation and secretion. The antibacterial effect is good, the curative effect of controlling ulcer infection wound is significant, the effect of promoting healing is strong, it can effectively promote the healing of refractory ulcer wound, and water can further enhance the activity and strengthen the function.

4. Try to ensure a sterile environment during operation: Burn patients are very easy to cause infection, which is a high risk factor for death of burn patients^[5]. At the same time of intravenous antibiotic treatment, we need to keep the environment relatively clean, reduce the flow of people, and reduce the probability of infection.

5. Maintain ambient temperature 28~30 °C and humidity 40%~50%. Burn is a body surface injury, and the wound is in direct contact with the external environment. Therefore, the condition and stability of the external environment are very important for wound healing and recovery. For example, high ambient temperature is also conducive to the reproduction of bacteria, and high air humidity is also conducive to the reproduction of microorganisms. These external conditions are easy to cause infection of the wound, which is not conducive to the recovery of the wound. Therefore, it is necessary to control the ambient temperature and humidity.

All these factors play a vital role. For patients with multiple organ failure caused by high voltage, we need to strengthen the monitoring and treatment to improve the success rate of rescue.

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POSTSCRIPT

The following pictures do not fully show the patient's face, do not expose the patient's privacy, and the patient's consent has been obtained for the use of the pictures.



Day 1



Day 7

Skin Care Experience of a Case of Multiple Organ Failure Caused by High-Voltage Electrical Injury



Day 12



Day 20



Daily debridement