

Clinical Forensics in Electric Shock Trauma: A Case Study

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ABSTRACT--*Electricity needed in all our daily activities. Ranging from household life to low scale low voltage, medium to high scale industrial activities with high voltage. Electric shock trauma is a rare case. Electric shock victims are generally caused by workplace accidents. Electric shock that causes injury to death is related to alternating current and rarely due to direct current. humans are more sensitive 4 to 5 times more sensitive to alternating current. A man claimed to be a 36-year-old construction worker fell and hit the State Electricity Company (PLN) cable to get an electric shock alternating current. the patient was referred to Dr Soetomo hospital Surabaya and received emergency assistance and subsequently received joint inpatient services by plastic surgeons, internal medicine doctors and psychiatric doctors. Patients suffering from severe burns on the left hand and right hand 10% with a muscle base and emergency surgery performed at an emergency care installation. This paper comes from a clinical forensic case report at the Forensic and Medicolegal Installation of Dr Soetomo Hospital Surabaya. Alternating current can cause injury to death. The clinical forensic service is intended to explain that an electric shock incident is an occupational accident*

Keywords: *voltage, electric shock, workplace accidents, clinical forensic, hospital*

I. INTRODUCTION

Electric shock can cause skin lesions, organ damage and death. The severity is determined by the type of electric current, voltage, resistance and time. In electric shock get an electric path that crosses organs, in a fatal state through vital organs. Electric shock passes through a single point and exits through its usual electrical exit points that are close to the ground.[1] At AC currents 4 to 6 times more causes fatality than DC currents. At AC currents 50-80 mA can result in death while 250 MA on DC victims can still be saved[2]. AC can cause cardiac arrhythmias. The higher level of electrical voltage will cause fatal risks to increase.

Electric shock barriers are skin that has high resistance compared to other tissues. Therefore burns occur in the skin tissue. After passing through the skin an electric shock can easily penetrate other organs. Skin resistance is affected by the thickness of keratin in the

skin(1). Resistance varies from 500 Ohms and 10,000 Ohms on the palms and soles of the feet.

Ampere is the most important factor in being electrocuted. Because the voltage is usually constant, the main factor that determines the amount of amperage that enters the body is resistance, which is expressed in ohms. The minimum amount of amperage received by humans is 1 mA (0.001 A). A current of 5 mA will cause tremors in the muscles where 15-17 mA will cause contractures of the muscles, which prevents the release of electricity. This last current is the "loose - not loose" threshold. At 50 mA, contractures occur in all muscles, respiratory paralysis and death if the current is maintained.[1]

Ventricular fibrillation occurs at currents of 75-100 mA. Extremely high currents, ~ 1 A and higher, do not result in ventricular fibrillation, but rather lead to ventricular stopping. If the current is then turned off, it will not Electrothermal injury from the heart occurs, the heart will beat normally again.[2]

When an electric current flows in the body, the current runs from the initial point of contact to the point that comes in contact with the ground, following the nearest path. Often, traces originate from hand to foot or hand to hand. The time needed for a current to cause death depends on the amount of amperage.[1] Finally, in a very low amperage electric shock, death is caused by paralysis of the muscle with secondary asphyxia, long-term contact with electric current is needed. With household currents, where the mechanism of death is ventricular fibrillation, contact time is needed to produce fibrillation which is measured in 1 or 10 seconds, depending on the amount of amperage. This is of course influenced by skin resistance as large as 1000 ohms, where as much as 120 V reaches the body. In such cases, contact for 5 seconds is needed to produce ventricular fibrillation[1]. If the contact points come from thin, moist skin, the resistance will be low, which is 100 ohms. In this case, the flow into the body is approximately 1200 mA (1.2 A) and ventricular fibrillation occurs within 0.1 second. [1][2] Through a high-voltage electric shock, cardiac stops can occur quickly.[3]

Low-voltage electric shock with ventricular fibrillation, awareness may not disappear quickly. Often people get fatal electric voltage but do not lose consciousness, but to cheer or state that he just "burned" himself before collapsing. This happens because the brain has oxygen reserves of about 10-15 seconds, unlike the heart.[2]

Finally, a person can maintain his consciousness about 10-15 seconds after cardiac arrest as an organ pumping. In the case of low voltage electric shock, resuscitation and defibrillation can prevent death.[4] It must be kept in mind that ventricular fibrillation can sometimes be reversible where the heart will return to spontaneous rhythm after fibrillation in a short time.[4]

In high voltage electric shock, irreversible electrothermal injury can occur.[5] When the heart beats spontaneously after cardiac arrest, respiration may not return due to paralysis of the respiratory centre. This matter It may be caused by damage from the respiratory centre of the brain stem by the hyperthermic effect of an electric current.[4][6]

The hyperthermic effect of a high voltage electric current can be seen in the execution of an electric chair, where third-degree burns occur in the contact area between the electrodes and the skin after execution, the brain temperature becomes 63 °C.[2]

When someone comes into contact with a power source that has a current of 50 mA or greater, muscle contractions occur in general. Whether the current has a high or low voltage, this contraction can break bones.[2] Report bilateral scapular fractures from 440 V, 60 Hz currents; [7] from 220 V, 50 Hz current exposure.[8] Presenting cases of bilateral humeral fracture after contact with 110 V. Contact with currents, especially high voltage currents, can produce intense muscle contraction.[9]

II. RESEARCH METHOD

This manuscript is a forensic clinic case at Dr Soetomo Hospital Surabaya Indonesia in the Department of forensic and medico-legal medicine. A 36-year-old man construction worker fell and hit an electric cable then was electrocuted. the patient was referred to the Surabaya Soetomo Hospital. Patient treated by plastic surgeon, internist and psychiatrist.

III. FINDINGS AND DISCUSSION



Figure 1

Figure 1 on the clinical forensic examination found burns on the chest, abdomen, left and right arms. Burns on the top of the shoulder are irregularly shaped, blackish-brown colour measuring 5 cm by 4 cm.



Figure 2

Found in the forearm burns reddish-white irregular shape with peeling epidermis covering an area of 27 cm by 15 cm. on the forearm on the front side was found oval-shaped red-brown burns measuring 11 cm by 9 cm. found on the palms irregularly shaped burns in the form of reddish-white skin tissue with peeling epidermis blackish brown.



Figure 3

Figure 2 in the left limb found on the upper arm of the front side was found oval-shaped burns in the form of skin that is coloured brown, swollen, filled with fluid, measuring 6 cm by 2 cm. On the inner side of the upper arm, burns were oval-shaped, in the form of reddish-white skin, with peeling epidermis blackish brown, measuring 4 cm by 3 cm.

On the forearm on the front side, right at the crease of the elbow, burns were found, oval-shaped, in the form of brown skin, bubbling filled with fluid, measuring 12cm by 2cm.

Figure 4



Figure 4 on the forearm, starting from the back around the arm, through the inside, front, to the outside, starting from four cm below the folds of the elbows to the wrists, are found irregularly shaped burns, in the form of reddish-white skin with a red epidermis peel blackish brown, measuring 25cm by 23cm. On the entire left palm of the

palm of the thumb, starting 7cm from the base of the finger to the tip of the finger, irregularly shaped burns are found, in the form of reddish-white skin tissue with peeling blackish-brown epidermis, measuring 14cm by 9cm.

IV.CONCLUSION

Injuries caused by electric shock are trauma that can be life-threatening for patients. quick and appropriate help to resolve emergencies(4). the incidence of electric shock is commonly found in unsafe behaviour at work. socialization and education needs to be done in the community to prevent incidents of electric shock. clinical forensic services in an electric shock to explain that electric shock, in this case, is a work accident.

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