CASE REPORT

Electrical Shock Survival After Prolonged Cardiopulmonary Resuscitation

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ABSTRACT

Electrical shock is typically an untoward exposure of human body to any source of electricity that causes a sufficient current to pass through the skin, muscles or hair causing undesirable effects ranging from simple burns to death. Ventricular fibrillation is believed to be the most common cause of death following electrical shock. The case under discussion is of a young man who survived following electrical shock after prolonged cardiopulmonary resuscitation (CPR), multiple defibrillations and artificial ventilation due to poor respiratory effort. Early start of chest compressions played a vital role in successful CPR.

Key words: *Electric injuries. Electrocution. Ventricular fibrillation. Cardiopulmonary resuscitation.*

INTRODUCTION

Electrical shock causes flow of electrical energy through a portion of the body causing shock. Exposure to electrical energy may result in no injury at all or may result in devastating damage or death. Burns are the most common injury from electric shock.[1] A person can feel at least 1 mA of alternating current (AC) at 60 Hz, while at least 5 mA for direct current (DC). The current may, if it is high enough, cause tissue damage or fibrillation which leads to cardiac arrest; 60 mA of AC or 300-500 mA of DC can cause fibrillation.[2]

We present a case of cardiac arrest following electric shock at home who recovered after prolonged resuscitation efforts, multiple defibrillation attempts and artificial ventilation without sequelae.

CASE REPORT

A 40 years old male was trying to connect an electric appliance to a wall-mounted socket at home. Suddenly he cried and became unconscious after sustaining electric shock. A male nurse walking on road-side accompanied him while performing chest compressions during journey. They reached the hospital after 15 minutes where the patient was found in asystole without recordable pulse and blood pressure. He was limp and cyanosed and the pupils were dilated with absent light reflex. Chest compressions were continued and airway was secured with cuffed endotracheal tube size 7.5 mm. Intravenously, adrenaline 1 mg was given thrice and atropine 1 mg was given once. The first ECG revealed no cardiac activity but ventricular fibrillation was noticed after 10 minutes of in-hospital resuscitation. Defibrillation with 200 joules was successful after third attempt. The patient started gasping after 40 minutes (15 outside hospital and 25 in hospital) of resuscitation with heart rate of 150 per minute and a palpable radial pulse. A central venous pressure line was inserted in right subclavian vein along with temporary cardiac pacing.

Artificial ventilation with synchronized controlled mechanical ventilation mode on Hamilton Galileo Gold ventilator was started for inadequate breathing efforts. Intravenous morphine (5 mg) and atracurium (40 mg) was given later, titrated to keep him sedated. Successful weaning was possible after 5 days of ventilatory support. Episodes of agitation and aggressive behaviour were found after weaning off and controlled with injection haloperidol and injection midazolam as per requirement.

Total hospital stay was 10 days. Investigations after admission to the hospital revealed enormously elevated creatinine phosphokinase levels 7904 U/L, AST 491 U/L and LDH 1698 U/L, CKMB was raised to 30 U/L (25 normal), K^+ 4.3 mmol/L, and total leukocyte count of 23.3 x 10^9. Thirteen units of fresh frozen plasma were transfused during initial 4 days for deranged coagulation. A generalized T-wave inversion was seen in all leads of ECG and diffuse radio-opaque shadows were noticed in chest X-ray, which resolved after 7 days. CT scan brain was normal and no neurological deficit was noticed. He was discharged with advice for follow-up in medical outpatient department.

DISCUSSION

The human body conducts electricity very well and direct contact with electrical current can be deadly. While some

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electrical burns look minor, there still may be serious internal damage, especially to the heart, muscles, or brain.[3]

Electric current can cause injury in three ways.[4] Cardiac arrest may occur due to the electrical effect on the heart. Muscle, nerve, and tissue destruction from a current passing through the body. Thermal burns result from contact with the electrical source.

The documented cardiovascular effects of an electrical shock include acute myocardial necrosis, myocardial ischaemia with or without necrosis, heart failure, arrhythmias, haemorrhagic pericarditis, acute hypertension with peripheral vasospasm and anomalous, non-specific ECG alterations. Cardiac arrhythmias may occur at the time of electrical shock or later, but mostly within first day after injury. It is generally believed that ventricular fibrillation is the most common cause of death in electric shock.[4]

Out-of-hospital cardiac arrest is a leading cause of premature death throughout the world. Survival from out-of-hospital cardiac arrest is variable and often less than 5%.[5] Survival depends on effective cardiopulmonary resuscitation and early defibrillation.[6] CPR is a highly effective technique when applied by a well-trained person and provide adequate short-term life support until more sophisticated treatment is available.[7] Probably this patient had cardiac arrest due to electrical shock and short-term life support by cardiac compressions was started by a trained person on road side who accompanied the patient to hospital for further management. Early chest compressions to this victim played a vital role in supporting his life till his arrival in the hospital and this is according to new 2010 guidelines of American Heart Association which has recommended early chest compressions in CPR.[8] Interruptions in chest compressions are common during treatment of cardiac arrest.[9] Animal studies demonstrate that interruptions in chest compressions decrease coronary and cerebral blood flow, resulting in worse survival outcomes.

Ventilatory support was required for this patient due to gasping and slow, shallow breathing which was inadequate for sustaining his life. This poor respiratory effort may be explained by the electrical shock trauma to respiratory centres and hypoxia during transportation.

The enormously high levels of total leukocyte count and creatinine phosphokinase were seen during his stay in the hospital which gradually decreased. No neurological deficit was noticed in this patient except agitation in initial days.

REFERENCES

1. Emedicine Health. Electric shock. Pictures, symptoms, and treatment [Internet]. [2012 Jun 11]. Available from: http://www.emedicinehealth.com/electric_shock/article_em.htm#electric_shock_overview
2. Ferris CD. Electric shock. In: Whitaker JC, editor. The electronics handbook. London: *CRC Press;* 2005.p. 2317-24.
3. Medline Plus. Electrical injury [Internet]. [updated 2011 May 01]. Available from: http://www.nlm.nih.gov/medlineplus/ency/article/000053.htm
4. Tintinalli JE, Kelen GD, Stapczynski JS, Ma OJ, Cline DM, editors. Emergency medicine: a comprehensive study guide. 6th ed. New York, NY: *McGraw-Hill;* 2004.
5. Nichol G, Thomas E, Callaway CW, Hedges J, Powell JL, Aufderheide TP, *et al*. Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA* 2008; **300**: 1423-31.
6. Wang HE, Min A, Hostler D, Chang CC, Callaway CW. Differential effects of out-of-hospital interventions on short- and long-term survival after cardiopulmonary arrest. *Resuscitation* 2005; **67**:69-74
7. Encyclopædia Britannica Online. Electrical shock [Internet]. [updated 2012 Jun 11]. Available from: http://www.britannica.com/EBchecked/topic/182882/electrical-shock
8. Field JM, Hazinski MF, Sayre M, Chemides L, Schexnayder SM, Hemphill R, *et al*. Part 1: Executive Summary. 2010 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2010; **122**: S640-56.
9. Valenzuela TD, Kern KB, Clark LL, Berg RA, Berg MD, Berg DD, *et al*. Interruptions of chest compressions during emergency medical systems resuscitation. *Circulation* 2005; **112**:1259-65.