

## Mass casualty from electrical injury at Makurdi, Nigeria

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### Abstract

**Background:** Mass casualty electrical injury is not a common occurrence.

This is a report of a mass casualty electrical injury event that occurred at the building site of a Pentecostal church at Makurdi involving 12 patients in a single electrical contact.

**Method:** This is a case presentation of twelve young men aged 22 - 28 years who were mounting the metal gate of a Pentecostal church under sagging high tension electrical lines. Contact of the gate with the power lines caused production of sparks and electrocution of the patients.

**Results:** There were 2 instant mortalities, varying levels of

electrical shock in 7 and burns in 3 patients. The hall mark of treatment was resuscitation, and management of the burn wounds. No obvious gross internal organ complications were present.

**Conclusion:** Prompt resuscitation and care of burn wounds gave a favourable outcome for the 10 surviving victims.

**Key words:** Electric Shock, Electrocution, Resuscitation.

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### Introduction

Electrical injuries are not a common event.<sup>1,2,3,4</sup> Mass casualty electrical injuries are rare.<sup>5</sup> Mass casualty electrical injuries giving rise to case fatalities have been reported across the world.<sup>6,7,8</sup>

Electrical shocks are life threatening to the victims as well as the rescuers.<sup>3,4,9</sup>

Management of patients involve rescue, resuscitation, recovery, rehabilitation, restoration and research.<sup>4</sup> Electricity causes burns and internal organ injury by mechanisms of the direct effect of the current high (>1000 volts) or low (<1000 volts) voltage as it is conducted through the body, ignition of clothing by sparks produced by the contact, the "Joule effect" due to generation of heat as a result of resistance encountered, the voltage and duration of contact with the source and electric arc effect.<sup>10,11</sup> Deeper tissue injury is usually more than the surface expression of the burn or damage.<sup>2</sup> Damage may occur to the heart, brain, skin in form of burns, kidneys, bones, lens of the eyes and so on.<sup>2</sup> The type of current may be Alternating current (AC) from power lines, Direct current (DC) from car batteries or a combination of both as in lightning strike.<sup>2,10</sup> Secondary injuries like fractures of the spine and other long bones may occur when the victim is thrown away from the

source as typically seen with alternating current.<sup>2</sup>

In electrical injury, the patient may experience an electrical shock or electrocution.

In electric shock, contact with an electric source results in transfer of energy from the source to the patient. When that energy transfer produces a cardiac arrest, it is considered an electrocution.<sup>3</sup>

Electrical injuries can occur at work site especially for electricians installing power lines or maintaining them. Injuries can occur when poor weather downs power lines and people accidentally run into them, or at vehicle collision accident sites where power lines are downed. Electric shocks can occur in the office from faulty electric switches or at home from leaking electrical outlets or faulty appliances like electric iron, electric kettle or dip-in heater. Tasers used by law enforcement officers which deliver electric shock to immobilize suspected criminals can cause death in victims who have taken alcohol or psychotropic drugs.<sup>2</sup> Lightning strike which can occur outdoor or indoor may cause death from cardiopulmonary arrest, and varying degrees of injury.

Lightning can also strike on telephones, headsets (ear speakers), plugged computers and television sets while in use.<sup>12</sup> Feathering burns (also called Lichtenberg figures) are due to electron showers in lightning injuries.<sup>13</sup>

Theft of electrical cables from installed power lines for sale is a common cause of electrocution and electric shock. Cardiac dysrhythmias like sinus tachycardia, heart block, atrial fibrillation, ventricular fibrillation, asystole can occur.<sup>2</sup> Transuterine current passage in a pregnant woman can cause fetal death, spontaneous abortion and intrauterine growth retardation.<sup>2,14,15</sup>

In low income countries, many uninformed citizens

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transact business like commerce under high voltage power lines that many times have sagged or fallen under the devastating influence of rain storm and have not yet been repaired.

The case scenario is the electrocution, sustenance of varying degrees of electric shock and burns by 12 youths erecting the gate of a Pentecostal Church at Makurdi, Benue State, causing 2 mortalities.

### Case Report

A group of young men, 12 in number aged 22 – 28 years were installing the metal gate of a Church. As they lifted it to mount, it made contact with sagged, naked high tension electrical cables giving rise to sparks and electrocution of the workers. All of them lost consciousness instantly and were rushed to the accident and Emergency unit of Federal Medical Center Makurdi.

Table 1 Showing the vital signs of the patients

Patient Initials	State of patient brought	Profession	Pulse Rate Beats/ Minutes	Respiratory Rate Breaths/min	Blood Pressure mmHg
1.	alive	Labourer	64	20	110/70
2.	alive	Wheelbarrow pusher	100	24	110/80
3.	alive	Labourer	120	30	100/65
4.	alive	Labourer	108	26	110/80
5.	alive	Labourer	94	22	106/75
6.	alive	Labourer	80	18	120/80
7.	alive	Labourer	60	26	110/60
8.	alive	Labourer	76	28	115/75
9.	alive	Labourer	100	26	105/70
10.	alive	Labourer	80	20	110/75
11.	Brought in dead				
12.	Brought in dead				

On arrival, there was triaging of the injured. The dead, two in number were confirmed by the Accident and Emergency Doctor. The other ten, alive all went through a brief history of the incident, resuscitation involving setting up of intravenous Normal Saline and urethral catheterization. Some of these were bought by the relatives of the patients in a nearby pharmacy. Only two nurses were on duty, and there was a surge by members of the public to the hospital to identify their relatives making crowd control difficult. Three of them sustained bilateral hand burns 2% each. One of the three had in addition 3% burns on the medial aspect of his right thigh as well. There were mild to moderate derangements of pulse rate and respiratory rate in the patients, Table 3. There were no electronic monitors so none of the patients was connected to them to detect dysrhythmias, creating a challenge of diagnosis. There were no hemoglobin/myoglobin dip sticks, mannitol

and sodium bicarbonate.

Wound debridement and dressing with sufratulle gauze was done for those with surface burns. They were all admitted for observation. ECG was not done because of cost. They were all discharged from hospital 24 hours later.

### Discussion

Challenges were involved in the management of these patients. Resuscitation at the site of the injury was virtually nonexistent because there was no ambulance service. The sparks and throwing asunder of the victims from the metal gate helped to retrieve them from the electrical source.

They were all transported with speed by passersby who decided to help and put them in commercial buses. At the Accident and Emergency department, the hospital manpower and resuscitation resources were overwhelmed. There was no ringers lactate, so normal saline purchased by relatives from a nearby pharmacy was used for the patients' intravenous fluid resuscitation. This prevented them from going into hypovolaemic shock. In resource poor environment, resuscitation is sometimes achieved by the oral route.<sup>16</sup> There were no electronic monitors for assessment of cardiac rhythm and detection of dysrhythmias. This was done manually and fortunately for the patients, the bradyarrhythmias in 2 and tachyarrhythmias in 4 reverted to normal rhythm following resuscitation with the crystalloid. The majority of the patients who were initially unconscious recovered on the way while some did so during resuscitation in the hospital.

There was no indication for assisted respiration in any of the patients. There were no myoglobin or haemoglobin detection kits to detect these in urine. Non availability of sodium bicarbonate ( $\text{NaHCO}_3$ ) to alkalinize the urine and also no mannitol led to their not being used. None of the patients went into renal failure, further confirming that the use of these 2 in management of electrical burns is controversial and may not be of any beneficial effect.<sup>2</sup> The burn wounds were debrided and dressed with sufratulle gauze. Analgesics were administered for pain relief. All the patients urine output in 24 hours was adequate. The anxiety associated with electric shock was exhibited in all the patients who were successfully counseled and managed by the psychiatrist. Multidisciplinary care involving the Plastic Surgeons, Orthopedists, Clinical Psychologists, Psychiatrists, Social Workers, Nutritionists and Physiotherapists is usually employed in patients who sustain other injuries. The 2 mortalities were deposited in the mortuary. The ten surviving patients were all discharged after 24 hours of admission.

This study showed that patients with electric shock who do not have severe dysrhythmias always do well and could be discharged within 24 hours.<sup>2</sup>

Patients who develop significant dysrhythmias warranting intervention could benefit from medical treatment with drugs. Amiodarone intravenous infusion or intravenous bolus can be used to treat atrial fibrillation as it causes cardioversion of recent onset.<sup>17</sup> Intravenous flecainide can also be used. Advances in research have given rise to development of implantable defibrillators that cause cardioversion of electrocution-induced ventricular fibrillation.<sup>18</sup>

The devastating effects of electrical injury in terms of causing instant death and long term complications makes it mandatory for humans to prevent it. Prevention strategies are geared towards the education of citizens to handle electrical appliances safely. Faulty appliances should be repaired or replaced; sagging/fallen power lines should be repaired.

Rescue of victims involved in electrocution at home or retrieval at accident sites where power lines are downed should be done by well trained, informed rescuers who have the protective equipment to prevent them being caught up in the injury.<sup>3,4</sup> Children should be well looked after to prevent them from biting electrical cords or poking their fingers into electrical outlets and getting electrocuted.<sup>13</sup> Use of telephones, television, headsets and computers should be avoided during thunderstorms and rain.<sup>12</sup> Where electrical injury has occurred, resuscitation of the patients should begin at the site and patient rapidly transported preferably to a burn care centre, well equipped to care for the patients.<sup>3,4,19</sup> In this study the surviving patients were admitted, treated and successfully discharged. They were all to be followed up in the clinic but only two came who did well clinically, their burn wounds healed and so were discharged from the clinic.

### Conclusion

Challenges associated with mass casualty events are coordination of rescue at the site of injury, transportation of victims to appropriate health care facility, management of the high number of victims which cause a strain on the medical materials, trained personnel and finance of the victims and their family members. Emotional/psychological issues are in the form of prolonged hospital stay, long term disabilities requiring rehabilitation and where there are mortalities attendant depressions of the affected relatives. Mass casualty electrical injury has all these challenges.

Rescuers should be well trained, and have the right protective equipment to work with. Sagging or fallen power lines should be repaired and maintained regularly. Citizens should avoid doing business under high voltage power lines to avoid coming in contact with them and getting electrocuted.

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