UNUSUAL ELECTRIC BURNS CAUSED BY COMMUNICATION DISC CONTACT WITH A HIGH-VOLTAGE ELECTRIC TRANSMISSION CABLE: A POTENTIAL OCCUPATIONAL HAZARD

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SUMMARY. The case reported is that of a communications technician admitted to hospital with 38% burns sustained while climbing a communications mast. The mast was erected less than 3 metres from a 33 kv electric transmission cable. His condition is described, as also the treatment he received until his discharge three months later. In the absence of guidelines regarding the erection of such masts, a number of recommendations are made.

Introduction

Emerging trends in communication technology have led to a shift in emphasis from dependence on cable-network and multi-channel radio communications alone to the use of satellites. Satellite communication systems have opened up all areas of the world. This has increased the demand for telecommunication infrastructures. These include earth, base, relay, and booster stations.

Central to most of these stations is the construction of steel masts and the installation on them of discs and/or antennae. In a typical city, masts are found dotting the skyline everywhere you go.

Equally present in cities today are both underground and overhead electric cables. Underground cables are insulated, though occasional damage does occur, but overhead cables are mostly uninsulated.

Insulated electric cables constantly discharge electric arcs, which can jump various gaps depending on the voltage being transmitted.[1]

In Nigeria, the voltages carried by these lines vary from 230 V to 330 kilovolts. Discharges from the latter can jump a gap of 300 cm or more.[2] When they are approached closely or made contact with, severe injuries can result.

A case report of a mastman who sustained burns in the course of his work job high up on a mast is presented.

Case report

O.K., a 28-yr-old male communications technician, was admitted to Lagos State University Teaching Hospital with 38% burns (28% full thickness) to the face, neck, anterior aspect of the trunk, both forearms, and the right lower limb sustained while climbing a communications mast with a communications disc and the attached antennae tied to his waist.

The mast was erected less than 3 metres from a nearby 33 kv electric transmission cable. His apparel caught fire at the time of incident. His safety belt held him in place and prevented him from falling off the mast.

On admission, no cardiac, nerve, or intravisceral injuries were observed. Sequestrectomy was required for sequestrum of the distal end of the right tibia. Multiple escharotomies were done on the trunk and limbs. Partial-thickness skin grafts were performed on the forearms and trunk.

The use of silicone sheets with pressure garments was commenced on the developing hypertrophic scars on the face and neck.

O.K. was discharged after three months of hospitalization, with follow-up in our plastic unit's surgical outpatient clinic.

Discussion

The communications boom has led to the erection of steel masts everywhere, especially in cities with a large population. The demand for telecommunications facilities is population-driven.

With increased demand, there is the tendency to overlook some of the necessary safety measures that should be put in place.

In Nigeria, there are three different categories of masts. These are: a) masts erected by the government-owned telecommunications company; b) masts belonging to multinational or big-time telecommunications service providers; and c) masts owned by various business centres or cyber cafés.

In cases a) and b), it is likely that the safety precau-

tions will be considered before the masts are erected. However, in case c), masts will be erected wherever there is space.

In the crowded city of Lagos, with its estimated population of 15 million,[3] most spaces have been commercialized; hence it is not unusual to find masts located very close to uninsulated electric cables.

Electricity is the flow of electrons from atom to atom. The electrons constitute the current. Amperage is the term used for the rate of flow of the electrons. The driving force moving these electrons in one direction is the voltage. The higher the voltage, the greater the force exerted on the electrons, and the more the quantity of electrons moved through the wire at a given time.[4] A voltage of less than 250 volts is considered to be low-tension voltage in Nigeria. Voltages higher than 250 volts are considered to be high voltages.[2,5]

High-tension voltage is generated at various generating stations and transmitted to the various cities and villages. Various transmission lines carry the following voltages:

a) 330 kv transmission lines arising directly from the generating stations - the National Grid;
b) 132 kv transmission lines are from a), after being stepped down. These lines usually run from a power control centre to a substation;
c) 33 kv sub-transmission lines run either within large cities or from smaller cities to villages. They are from b);
d) 11 kv distribution lines are found along the streets of villages and towns, supplying the various power transformers that will eventually supply the distribution lines. These distribute the 415 volts to the various streets.

As the current flows in the conducting cables, static electricity is generated in the air surrounding them. The static electricity may be high enough to break the air insulation and this will be associated with an arc or light flash.

The arc has an intense pale violet light and consists of ionized particles. The temperature of the ionized particles and immediate surrounding gases of the arc can be as high as 4,000 °C.[6]

Generally speaking, an arcing of several centimetres can arise for each 10,000 volts. Because of this, the electricity power authority in Nigeria has a general rule that restricts the distance of structures to these transmission lines. The rules[2] are:

Voltage (kv)	Minimum distance of separation
330	4.0 metres (12 feet)
132	2.1 metres (7 feet)
33	1.2 metres (4 feet)
1	1.0 metres (3 feet)

Burns due to contact with high-voltage electric circuits are of two types: a) burns caused by an electric arc; and b) burns caused by the passage of an electric current between the power source and the anatomical point of contact.[5]

In the case reported, the mast was erected very close to a 33 kv line. The antennae attached to and jutting out from the mastman's waist further reduced the distance between the electricity cables and the mast. The static electricity surrounding the cables caused arcing with the communications antennae and the subsequent burns. The distribution of the burns in the patient was consistent with other observations.[7-9]

The telecommunications companies erecting the various masts, the engineers, technologists, and technicians working on the masts, and the public should be educated about the possible dangers associated with erecting masts very close to electric transmission cables.

Conclusions

We are not aware of any guidelines for the erection of such masts, and we would therefore make the following points and suggestions:

- Remember that electricity can jump gaps. Masts need not touch an electric line to cause lethal current to flow.
- Electric transmission lines can carry up to 330 kv voltage, which can kill instantly or cause major burn injury.
- Remember that these electric cables can sag in the course of time. The supporting poles may also be damaged, bringing the cables closer to installations.
- In general, masts should be located at a minimum distance of 4 metres (measured along the ground) from electric cables.

RÉSUMÉ. Les Auteurs, après avoir présenté le cas d'un technicien des télécommunications atteint de brûlures dans 38% de la surface corporelle subies quand il montait sur un pylône des télécommunications qui se trouvait à moins de 3 mètres d'un câble de transmission électrique de 33 kv, décrivent les conditions du patient et le traitement qu'il a reçu jusqu'à son renvoi après trois mois. Faute de lignes directrices pour ce qui concerne l'érection de ce type de pylône, les Auteurs proposent une série de recommandations.

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AWARD OF THE G. WHITAKER INTERNATIONAL BURNS PRIZE, PALERMO, ITALY, FOR 2007

At a meeting held on March 26, 2007, at the seat of the G. Whitaker Foundation, Palermo, after examining the scientific activity in the fields of research, teaching, clinical organization, prevention and cooperation presented by various candidates and in consideration of the high level of the candidates, the Adjudicating Committee unanimously decided to award the prize for 2007 to Professor NAOKI AIKAWA, General Director Emergency, Critical Care & Trauma/Burn Services, Keio University Hospital, Tokyo, Japan.

The prize is awarded with the following motivation:

"Professor Naoki Aikawa was born in Kanagawa, in Japan. Within a very few years of taking his medical degree in 1968, he began to develop an interest in the burn disease and from 1973 to 1976 he attended the Clinical and Metabolic Research Laboratories and the Harvard Medical School Clinical Surgical Service of Burn Trauma at Massachusetts Hospital, directed by Professor J.E. Burke, who defined him one of the best Research Fellows. He later completed his training at Keio University Hospital, Tokyo, holding the position of Resident and Chief Resident in General Surgery. From 1988 to 2003 he held the posts of Associate Director and Director, Emergency, Critical Care & Trauma/Burn Services, Keio University Hospital.

"Professor Aikawa's university teaching career began in 1988, first as Associate Professor and subsequently, in 1992, as Professor, Department of Emergency & Critical Medicine, School of Medicine, Keio University, the position he holds today.

"His training stimulated his interest in study and research in various aspects of the burn disease: initially in the treatment of burn wounds, diagnosis, and the treatment of infection in extensively burned patients and later in the humoral immune response, which he called 'a cytokine storm', the shock and reanimation phase in extensively burned patients, and the prevention of renal damage, damage due to inhalation, and multi-organ failure, as a complication of sepsis.

"His findings, published in more than 400 papers in the leading scientific journals and presented at top-level international congresses, have become points of reference for our knowledge of the basic physiopathological variations that occur in the course of the burn disease. In view of his scientific activity he was elected to the Board of Direction of the International Burn Foundation and to the Editorial Board of the most prestigious national and international scientific journals.

"As Director of Emergency, Critical Care & Trauma/Burn Services, his outstanding clinical skills were expressed on the occasion, among others, of the dramatic Kobe earthquake, when together with his team he treated large numbers of burned and polytraumatized patients in difficult and dramatic circumstances.

"As Professor of the Department of Emergency & Critical Care Medicine, School of Medicine, Keio University, he has carried out teaching and training activities at the highest level for numerous young students and doctors; he has also been appointed to the position of member of the Ministry of Education Doctor's Thesis Approval Committee and member of the Medical Profession Advisory Committee.

"Professor Aikawa's career has been full of official recognitions: Member and Honorary Member of the world's most authoritative scientific societies. President: Japanese Society for Burns Injuries (1996), Japanese Society for Critical Care Medicine (2001), Japan Shock Society (2002), American College of Surgeons, Japan Chapter (2001-2002), International Society for Burn Injuries (2002-2004). Academic honours and awards: Everett Idris Evans Memorial Lectureship (American Burn Association), Testimonial for Emergency Medicine and the Firefighter General's Medal for Merit (Ministry of Internal Affairs and Communications, Japanese Government).

"The official prize-giving will take place in Palermo at the G. Whitaker Foundation on 4th October 2007 in the presence of authorities and representatives of the academic, scientific and cultural world."