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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. 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. 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, 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. 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.

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.

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 are:

<table>
<thead>
<tr>
<th>Voltage (kv)</th>
<th>Minimum distance of separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>330</td>
<td>4.0 metres (12 feet)</td>
</tr>
<tr>
<td>132</td>
<td>2.1 metres (7 feet)</td>
</tr>
<tr>
<td>33</td>
<td>1.2 metres (4 feet)</td>
</tr>
<tr>
<td>1</td>
<td>1.0 metres (3 feet)</td>
</tr>
</tbody>
</table>

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.

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.

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.
BIBLIOGRAPHY


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