Electrocution-Related Mortality: A Review of 123 Deaths in Diyarbakir, Turkey between 1996 and 2002

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TIRASCI, Y., GOREN, S., SUBASI, M. and GURKAN, F. Electrocution-Related Mortality: A Review of 123 Deaths in Diyarbakir, Turkey between 1996 and 2002. Tohoku J. Exp. Med., 2006, 208 (2), 141-145 — Electrical burns are responsible for considerable morbidity and mortality, and are usually preventable with simple safety measures. We conducted a retrospective study of non-lightening electrocution deaths in Diyarbakir, Turkey between 1996 and 2002. All 123 deaths investigated were accidental. The age range was 2 to 63 years with a mean age of 20.7 ± 15.3 years. Eighty-six victims (69.9%) were male. The upper extremity was the most frequently involved contact site in 96 deaths (48%). No electrical burn mark was present in 14 (11.4%) cases. Home accidents were responsible for 56 cases deaths (45.5%). Deaths were caused most frequently by touching an electrical wire (52 cases, 42.3%). There was an increase in electrocution deaths in the summer (47 cases, 38.2%). One hundred one cases (82.1%) were dead on arrival at hospital. The unique findings of our study include younger age (0-10 years) of victims (39 cases, 31.7%) and a means of electrocution (electrical water heaters in bathroom) in 23 cases (18.7%). Rate of deaths due to electrocution among all medicolegal deaths was found higher in our study than in previous studies. The public should be educated to prevent children to play near electrical appliances and to avoid electrical heaters in the bathroom.

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Electricity is an integral part of the modern society (Polat et al. 1997; Soysal et al. 1999). Electrical burns are responsible for considerable morbidity and mortality, and are usually preventable with simple safety measures. Virtually all fatalities by electrocution are accidental, while suicides and homicides from electricity are uncommon. Deaths due to electrocution involve both low and high voltage currents and most of the deaths are due to low voltage currents used in home and industrial settings. We describe the epidemiology of electrical fatalities in Diyarbakir, Turkey between 1996 and 2002.

MATERIALS AND METHODS

The current study a retrospective investigation of electrocution deaths in Diyarbakir. Deaths due to lightening were not included into the study. Data were obtained from the Diyarbakir Branch of the Council of Forensic Medicine between January 1996 and December 2002. Records of medicolegal deaths were available for our study.

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The cases were evaluated in terms of age, sex, type of burn mark, body region distribution, place and season of occurrence, contact details, and the duration of hospitalisation before death.

**RESULTS**

Overall 123 deaths occurred from 1996 to 2002. All fatalities were accidental. The age range of all electrocution deaths in the study period was 2 to 63 years with a mean age of 20.7 ± 15.3 years (Fig. 1). About 30% of the victims (39 cases) were in the groups aged 0-10 years (Table 1). The majority of the victims (86 cases, 69.9%) were male and the male/female ratio was 2.3 (Fig. 2).

The upper extremity was by far the most common site, involved in 96 deaths (48%) (Table 2). Among the victims, only entry (contact) wounds were present in 93 cases (75.6%), both entry and exit (grounding) wounds in 16 (13%), and no electrical burn marks in 14 cases (11.4%) (Table 3). Home accidents were responsible for 56 deaths (45.5%) (Table 4). Nineteen (15.5%) cases occurred on a farm, 37 (30.1%) in a street, 5 (4.1%) inside a building during electrical work, 3 (2.4%) in a river, 2 (1.6%) at a school, and 1 (0.8%) in a shop (Table 4). Considering the contact details, deaths were caused most frequently by touching an electrical wire (52 cases, 42.3%), followed by touching an electrical water heater in the bathroom (23 cases, 18.7%) (Table 5). There was an increase in electrocution fatalities in the summer (47 cases, 38.2%) (Table 6). Of all cases, 101 (82.1%) were dead on arrival at hospital, 9 (7.3%) died during treatment within 24 hours, and 13 (10.6%) died during treatment after 24 hours.

![Fig. 1. Age distribution of the victims.](image-url)

**Table 1. Type of material causing electrocution at 0-10 years of age**

<table>
<thead>
<tr>
<th>Age</th>
<th>Elect. Cable</th>
<th>Elect. wire</th>
<th>Water heater</th>
<th>Electrical outlet</th>
<th>Electrical stove</th>
<th>Dynamo</th>
<th>Refrigerator</th>
<th>Washing machine</th>
<th>Total</th>
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<td>4</td>
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</table>
Electrocution is an uncommon cause of death and occurs commonly due to accident (Fernando and Liyanage 1990; Fatovich 1992). Electrocution deaths cause approximately 1,000 deaths each year in the USA (Fontanarosa 1993). In our study these deaths were found to account for 3.3% of all medicolegal deaths in our region. Previous studies reported medicolegal death rates of 2.52%, 1.98%, and 1.90% (Beyaztas et al. 2001; Rautji et al. 2003; Cekin et al. 2005). Of
the electrocution deaths 86 of 123 cases (69.9%) were male and 39 of them (31.7%) compared with 92.5% and 90.3% in previous reports (Gok and Soysal 1983; Arican et al. 1993). In our study the cases were predominately 0-10 years, but in most previous studies the majority of the cases was in the 20-30 years age group. Similar to previous studies we found the upper extremity was the most common site involved (48%) (Gok and Soysal 1983; Erkol 1995; Byard et al. 2003; Rautji et al. 2003).

In our study only entry (contact) wounds were present in 93 cases and both entry and exit (grounding) wounds in 16 cases, while there were no electric burn marks in 14 victims, who died from an electrical shock in water. Since water lowers both the skin resistance and the density of electrical current no wounds would be expected in these cases. These results are similar to the findings of other studies (Fatovich 1992; Bailey et al. 2001; Rautji et al. 2003).

Electrocution deaths occur mostly at a voltage between 110-380 volt which is the voltage range of home and industrial electricity. Our results differed from previous reports with rates of 54.5% in our population compared with 50% (Wright 1983), 12% (Fatovich 1992), 65.36% (Rautji 2003), and 32% (Karger 2002). We found deaths at home occurred in 45.5% of cases compared with 27%-69% in previous studies (Brokenshire et al. 1984; Fatovich 1992; Karger et al. 2002; Byard et al. 2003; Rautji et al. 2003).

Deaths due to electrocution had also occurred most frequently in summer months in our study (47 cases, 38.2%) compared with even higher rates of summer deaths reported by Fatovich and Rautji (Fatovich 1992; Rautji et al. 2003) (62.7%, 74%, respectively). This may be attributable to increased sweating in the summer which decreases skin resistance and increases current flow through the body (Fatovich 1991).

All our cases had occurred by accident. Only 1 of 153 cases and 1 of 16 cases was reported as a suicidal in previous studies (Byard et al. 2003; Rautji et al. 2003). However higher rate of suicides by electrocution were reported by Karger et al. (2002) in 10 cases among 37 deaths (27%).

In conclusion, rate of deaths due to electrocution among all medicolegal deaths was found to be higher in our study than in previous reports. Our finding that deaths are most likely to occur at home, highlights the frequent preventable causes of electrocution, such as carelessness and misuse or improper maintenance of equipment, including problems with wiring, flexible cords and fittings. Young children should not be allowed to play near electrical cables in streets or with electrical equipments at home. Since deaths in bathroom were frequent in our study population, education should be given to emphasize not to use electrical devices for heating purposes in bathroom.

Acknowledgments

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