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A Study of Fatal Electrical Injuries in Smolyan District, Republic of Bulgaria

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ABSTRACT

Introduction

Deaths due to electrical injuries occurs very rarely and has not been studied sufficiently. This study was prompted by the fact that no regional research had been done in that field.

Objective

To characterize and analyze some factors leading to fatal accidents due to electrocution in Smolyan District.

Material and methods

We studied the forensic documentation of 35 cases of electrical injuries autopsied in the Forensic Medicine Ward at the Multiprofile hospital for active treatment of Smolyan during the period 1985-2007. The results obtained were subjected to descriptive analysis using the software SPSS 11.0. Values of ?<0.05 were assumed to be statistically reliable.

Results

The cases were distributed quite unevenly over the 24-year-long period. For the period under study, an average of 1.46 per year died from electrocution, which makes 0.94 electrocution mortality per

100,000 population per year on average. In the studied sample, the relative share of males is 85.71%, and of females 14.29 %. Of all cases under study, children and adolescents from 0 to 17 years of age occupy 17.14 %. The average age of the deceased is 32.95, or 32.98 for males and 32,8 for females respectively, and depending on the voltage which caused the death, 48.57% fell victims to low voltage, and 18% to high. Domestic electrotraumatism accounts for 52.94%, and workplace for 34.29%. Suicide by electrocution was found in 1 (2.86%) case. No homicides by electrocution were found in the material under study. For the studied period, 60 % of all observed cases died during the typically summer months (June-September).

Conclusion

The relative share of males prevails over females, and most victims die in work-active age. Depending on the voltage of the electric current which caused the death, the difference in the relative share of victims of low of high voltage is insignificant. There is no considerable difference in the relative share of the cases who died as a result of domestic or work-place electrotraumatism as well. Suicides in our material are very rare, and we did not observe a homicide by electrocution. A clear seasonality is registered in electrotraumas with a peak in the summer months of the year.

Keywords: Forensic Medicine, Fatal Electric Injuries, Smolyan district, Bulgaria

Introduction

Deaths due to electrical injuries occurs very rarely[9] and has not been studied sufficiently. This study was prompted by the fact that no regional research had been done in that field.

Purpose

To characterize and analyze some factors leading to fatal electrical injuries (FEI) in Smolyan District.

Material and methods

The study was carried out in Smolyan district in the Republic of Bulgaria over a 24-year-long period (1985-2007). We examined manually 2,026 autopsy reports and their relevant forensic medical files. Of all those, we separated 35 cases of FEI.

Data are expressed as mean ± SEM. Statistical analysis was performed by analysis of variance test followed by Student *t* test for unpaired values. Calculations were conducted using a statistical program (SPSS 11.0). $P < 0.05$ was considered significant. In order to create linear trend, we used the method of the smallest squares. So as to identify the age group at highest risk, we divided the victims into eight age groups in compliance with the requirements of the World Health Organization (WHO).

Results

Smolyan district is situated in South Bulgaria, in the central part of the Rhodopes, on a territory of 3,231.8 sq km or 2.9% of the territory of the country. It has a common boundary with the districts of Plovdiv, Pazardzhik, Kardzhali and Blagoevgrad, and its south boundary coincides with the national border with Greece. Its area is 3,231.8 sq km, and its population is 135,029[11] The

distribution of the cases over the 24-year period is very uneven with a downward linear trend. Most cases were recorded in 1987,[5] 1988[4] and 1992.[4](Fig. 1)

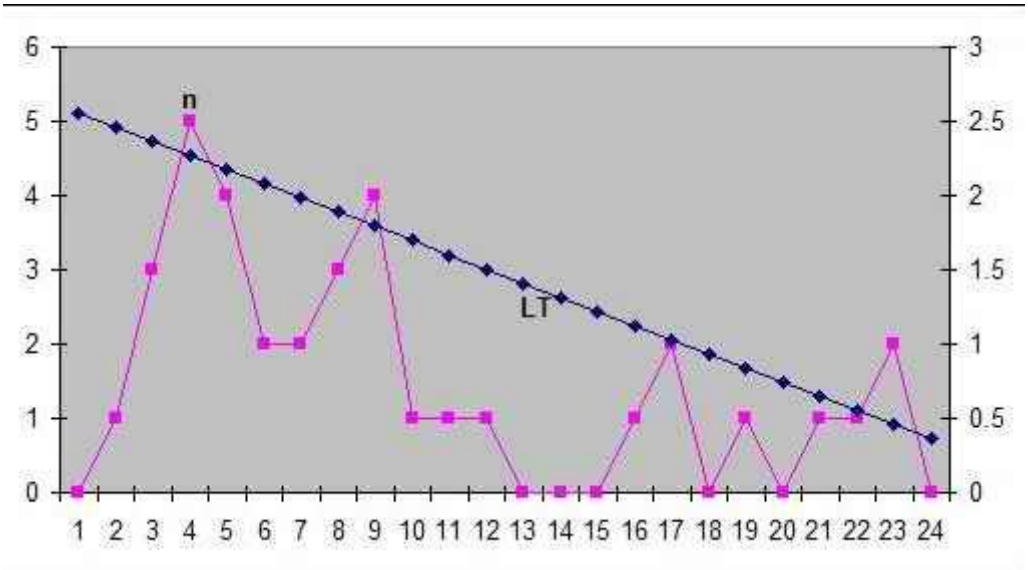

Figure 1. Distribution of the number of cases over the period under study (n) and their linear trend (LT).

For the period under study, an average of 1.46 per year died from electrocution, which makes 0.94 electrocution mortality per 100,000 population per year on average.[4,11]

The number of the fatal electrical injuries makes 1.73% of the total number of performed forensic autopsies. In the studied sample, the relative share of males is 85.71 ± 11.59% (n=30) and of females 14.29 ± 11.59% (n=5) or the ratio between the sexes is 1:6 with a statistically reliable (t=4.31; p<0.001) difference.(Fig. 2)

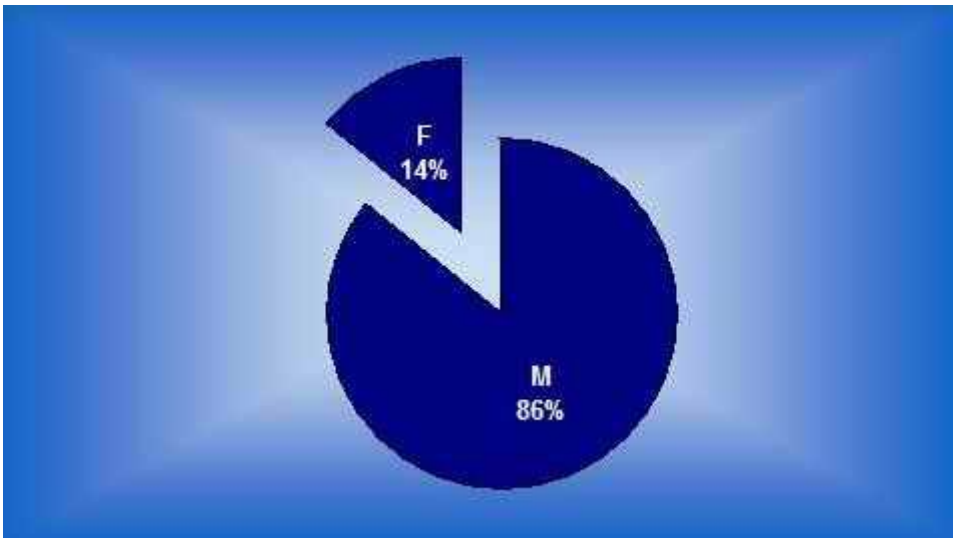

Figure 2. Distribution of the cases by sex

Of all cases under study, children and adolescents from 0 to 17 years of age occupy 17.14 % ± 12.42% (n=6).

The average age of the deceased (within the range of 1 year 3 months to 70 years) is 32.95 ± 7.58 (SD=16.02; n=35), for males it is 32.98 ± 8.25 years (SD=16,12; n=30), and for females 32.8 ± 19.38

years (SD=15,51; n=5), respectively. The most severely affected age groups are those between 25 and 44 years (n=15; 42.85 ± 16,39%), followed by the groups between 45 - 59 years (n=7; 20 ± 13,25%), between 15- 24 years (n=6; 17,14 ± 12,48%), and between 1 - 14 years (n=5; 14,28 ± 11,59%). Occasional cases can be observed in the age group between 60 - 75 years (n=2; 5,71 ± 7,68%). No cases of FEI below 1 year and above 76 years of age were registered in Smolyan district (Fig.?). The difference in incidence between the first two groups is insignificant (t = 1,15, p > 0,05).

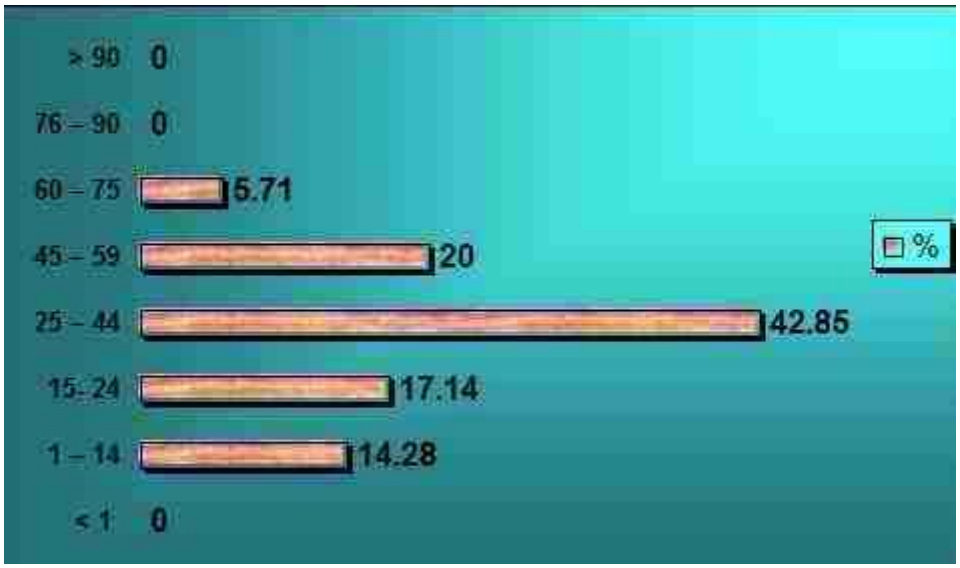

Figure 3. Relative share of the cases depending on the age groups under WHO.

Depending on the voltage of the electric current which caused the death, 17 (48.57 ± 16.59%) fell victims to low voltage (<220V), and 18 (51.43 ± 16.59%) of high (>220V) with insignificant difference (t=0.68; p>0.05). Victims of domestic electrotraumatism became 27 persons (52.94 ± 18.82%), and of workplace 12 (34.29 ± 15.73%) with insignificant (t=1,43; p>0.05) difference. Since 2000, a new phenomenon has been registered among the caused of death due to electrical traumas: theft of live electric wires. During the studied period, victims of this new for the district circumstance became 2 residents (5.1 ± 7.5%) of the district, or twice as many as the cases of suicide by electrocution (n=1; 2.86 ± 5.52%). There are no homicides by electrocution in the studied material.(Fig.4).

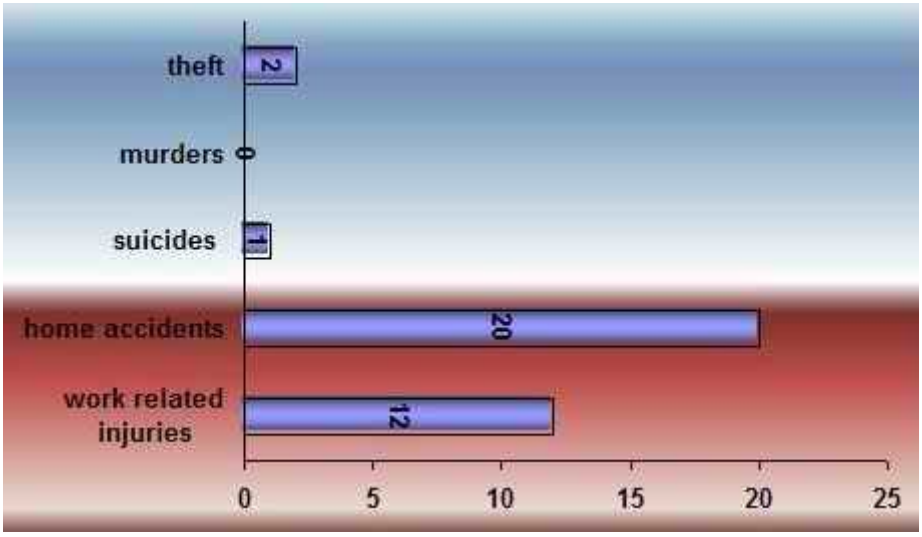

Figure 4. Number of cases distributed by the causes of the fatal accidents.

Our observations registered a distinct seasonality of fatal accidents caused by electric current. The minimum number of cases (one for each month) were recorded in the months January, February, April and October. The maximum number of victims (n=8) were recorded in August. For the studied period, 60 ± 16.23% (n=21) of all observed cases died during the typically summer months (June-September.) (Fig. 5)

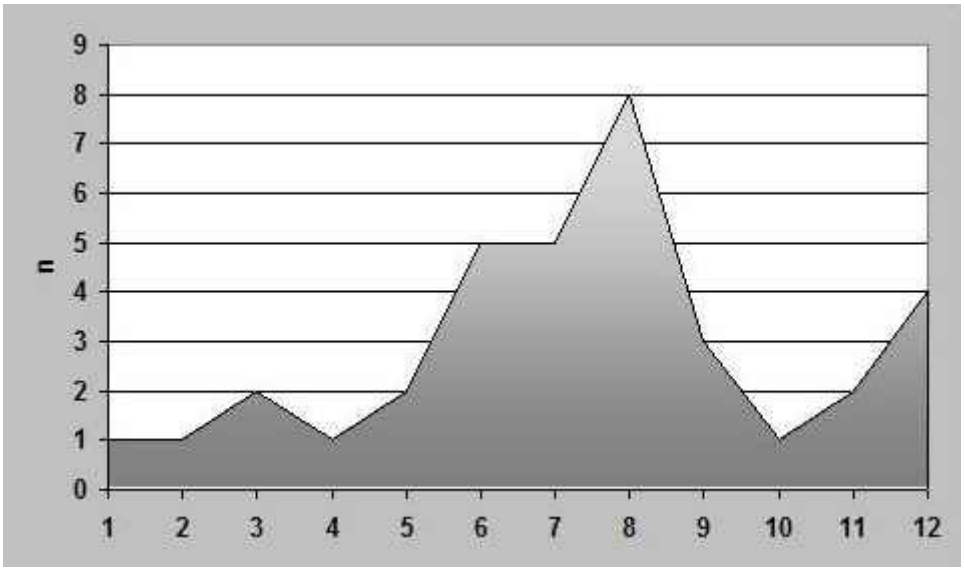

Figure 5. Monthly distribution of the number of the cases over the calendar year.

Discussion

The percentage of FEI deaths compared to all forensic autopsies performed during the studied period in Smolyan district is insignificantly lower than that (1.98%) given by other authors.[10] Calculated per 100,000 population, it is about four times higher than that given by Canadian researchers.[9]

The relative share of males prevails over females, and according to different authors, it is between 69.9%[12] and 92 - 96%,[3,13] ; therefore, our results fall well within this range of percentage and coincide with the results from other studies conducted over larger territories and population.[5,6]

With regard to the relative share of children and adolescents, victims of electrocution, our results are similar to the results obtained in other studies of ours[7] and considerably higher than the results of other authors.[1]

According to various researchers, the average age of the injured is between 20.1 years [2,12] and 49.2 years.[14] Our results correspond to those from other researchers of this problem[13] and do not go outside the outlined frames. Alongside with this, the average age is considerably lower than that found out by other studies of ours.[5,7] As per the voltage of the electricity which caused the deaths, there is no uniform opinion on that matter in literature. According to various sources, high voltage affects from 16%[14] to 60%[3] ; therefore, our results approach the upper limit of the range as outlined by various authors. The results obtained by us with regard to the relative share of the deceased due to electrocution by low voltage are considerably lower in comparison to other studies [14].[14] Work-place accidents take a relative share between 60%[3] and 74.3%.[13] The result obtained by us is closest to that for Varna district.[5]

The relative share of domestic accidents found out in our analysis is similar to the information in literature[12]and smaller than the results in other studies of ours.[7] Thefts of electric cables under high voltage are as many as in Gabrovo district.[8] Suicides are described as casuistic events only. Occasional authors[14] point to a relative share which is considerably larger than that found out in other similar studies of ours.[7,8] Similarly to some authors,[7,12,14] we also found out seasonality in the cases of death due to electrocution during the summer months of the year.

Conclusions

The relative share of males prevails over females, and most victims die in work-active age. Depending on the voltage of the electric current which caused the death, the difference in the relative share of victims of low of high voltage is insignificant. There is no considerable difference in the relative share of the cases who died as a result of domestic or work-place electrotraumatism as well. Suicides in our material are very rare, and we did not observe a homicide by electrocution. A clear seasonality is registered in electrotraumas with a peak in the summer months of the year.

References

1. Akçan R, Hilal A, Gülmen MK, Cekin N. Childhood deaths due to electrocution in Adana, Turkey. *Acta Paediatr*. 2007;**96 (3)**:443-5.
2. Al B, Aldemir M, Guloglu C, Kara IH, Girgin S. Epidemiological characteristics of electrical injuries of patients applied to the emergency department. *Ulus Travma Acil Cerrahi Derg*. 2006;**12(2)**:135-42.
3. Cheng PT, Lee CE, Yang JY. Electrical injury--clinical report of 67 cases. *Changgeng Yi Xue Za Zhi*. 1994;**17(3)**:220-5.
4. Committee on Unified System for Social Information at the Ministerial Council. Statistical Reference Book, Sofia, Bulgaria, 1983
5. Dokov W. Characteristics of lethal electrical injuries in Central and Northeastern Bulgaria for twenty seven year period (1980-2006). *ePlasty*, [serial online], 2008; **8**, 101-5.
6. Dokov W. Analysis of fatal labour-related accidents caused by electric current, in the district of Varna, Bulgaria. *Acta Medica Bulgarica*. 2007;**(34)**:1:84-88.
7. Dokov W. Does a principle of uneven territorial distribution exist for injuries caused by electricity? *Acta Medica Bulgarica* 2007;**(34)**,2:47-52
8. Dokov W., Kolev Y. On some characteristics of elecrtotraumatism victims in the district of Gabrovo, Bulgaria. *Medicina* (Minsk). 2008; **1**: 76-77
9. Laupland KB, Kortbeek JB, Findlay C, Kirkpatrick AW, Hameed SM. Population-based study of severe trauma due to electrocution in the Calgary Health Region, 1996-2002. *Can J Surg*. 2005;**48(4)**:289-92.
10. Rautji R, Rudra A, Behera C, Dogra TD Electrocution in South Delhi: a retrospective study. *Med Sci Law*. 2003;**43(4)**:350-2.
11. Smolyan District Official Site. http://www.region-smolyan.org/index.php
12. Tirasci Y, Goren S, Subasi M, Gurkan F. Electrocution-related mortality: a review of 123 deaths in Diyarbakir, Turkey between 1996 and 2002. *Tohoku J Exp Med*. 2006;**208(2)**:141-5.
13. Tredget EE, Shankowsky HA, Tilley WA. Electrical injuries in Canadian burn care. Identification of unsolved problems. *Ann N Y Acad Sci*. 1999;**888**:75-87.
14. Wick R, Gilbert JD, Simpson E, Byard RW. Fatal electrocution in adults--a 30-year study. *Med Sci Law*. 2006;**46(2)**:166-72.