

**SOME CHARACTERISTICS OF FORENSIC DEATH CASES CAUSED BY ELECTRICITY IN PLOVDIV REGION FOR THE PERIOD 2006 – 2015**

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Abstract:

Death cases caused by electricity don't have any specific morphological signs.

Aim of the research is to determine the forensic characteristics of death cases, caused by electricity.

Materials and Methods: We studied data from obductions, performed at University Hospital "St. George "EAD in Plovdiv for 2006 - 2015. We analyzed identified signs in 42 cases of victims of electricity. The data was processed statistically with the methods of the graphic assay and the alternative assay.

Results: The majority of victims ( $52,38 \pm 7,70\%$ ) are suffered from household electricity at a voltage 220V. Specific skin electrosigns are found at  $78,57 \pm 6,33\%$ ; liquid dark blood- at  $73,81 \pm 6,78\%$ ; intensive blood inside the organs - in  $66,67 \pm 7,27\%$ . Intensive livor mortis appears  $54,76 \pm 7,68\%$ , and subserous haemorrhagias in internal organs and mucous membranes- at  $42,86 \pm 7,63\%$ . Metallization of the skin is detected in two cases. Maximum deaths cases caused by electricity emerged in the summer and among those with blood group 'A'.

Conclusion: This full forensic assessment of death cases caused by electricity in Plovdiv region showed that specific electrosigns and liquid dark blood are the most characteristic morphological indicators for this kind of death.

*Key words: Electricity, morphological parameters, blood groups.*

Electricity is widely-spread in all parts of our life. Considering its immense use and the daily contact people have with electrical appliances, serious incidents caused by electricity are fairly low in number. According to studies, accidents caused by electricity are mainly domestic or industrial cases (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14). Committed suicides are rare, and murders even more so (7, 14). Due to their small number, these fatal accidents are not subject of thorough study. The lack of specific morphological signs makes diagnosing the cause of death in cases involving electricity more difficult.

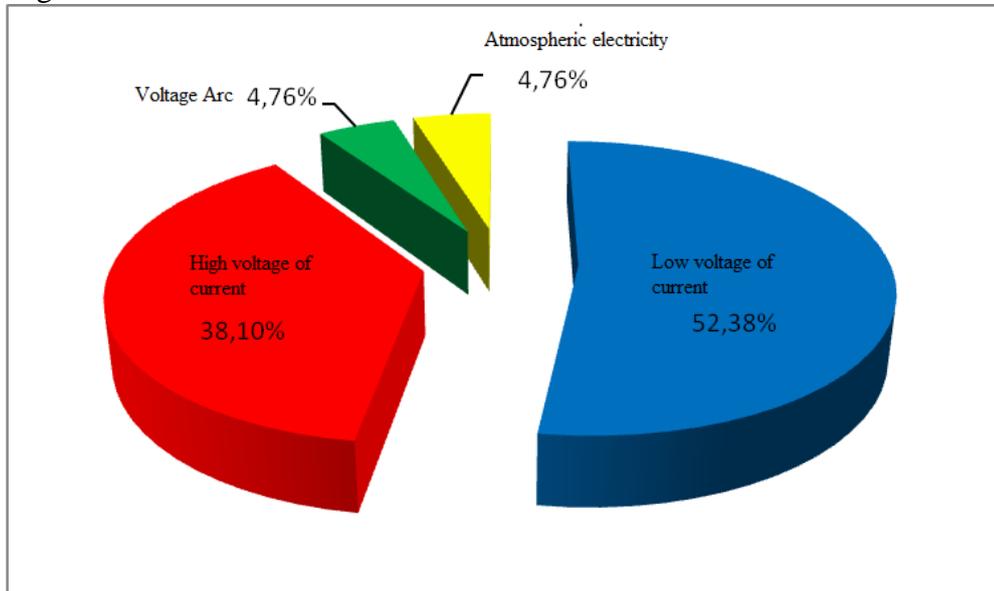
The aim of the study is to determine the forensic characteristics of death cases caused by electricity.

Material and Method: Data were analyzed from autopsies performed at the Department of Forensic Medicine at the University Hospital "St. George "EAD in Plovdiv in the period 2006 – 2015. The cases are classified according to several criteria, such as specific "skin marks", findings during the external and internal examination of the body, seasonality of the accident, blood group of victims. When processing the data we were using the methods of historical and alternative analysis (1, 2).

Results: The nature of the injuries caused by electricity depends on its voltage. The majority of cases - 22 people from all 42 cases ( $52,38 \pm 7,70\%$ ) suffered from the low voltage current, and 16 people ( $38,10 \pm 7,49\%$ ) of electric current with high voltage. The atmosphere electricity and voltage arc killed two people each (Fig. 1).

CONTRIBUTION OF DEATH CASES ACCORDING TO VOLTAGE OF THE ELECTRIC CURRENT

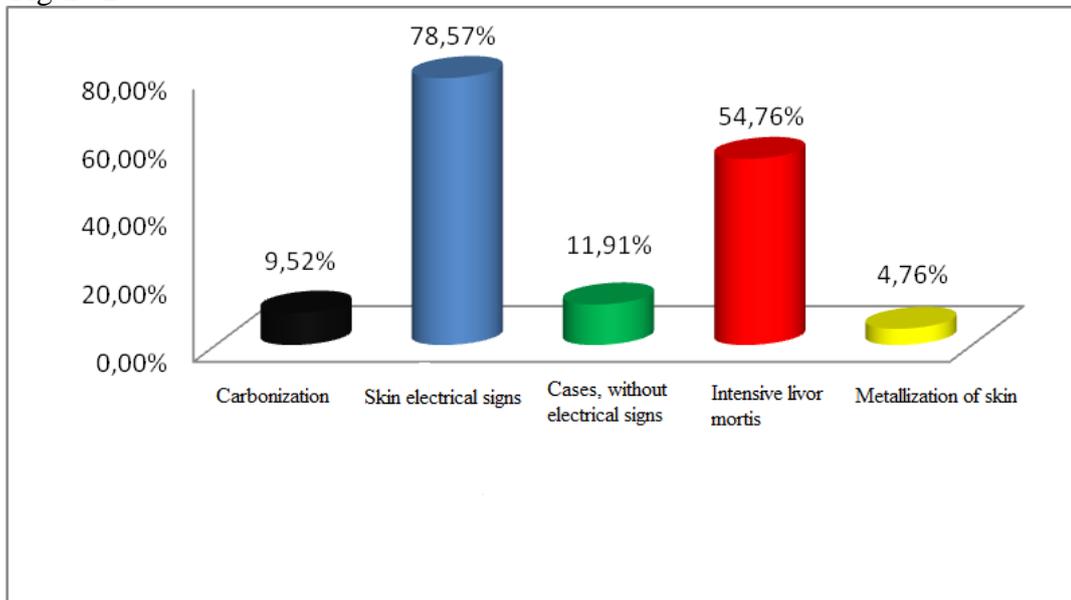
Figure 1.



Totally carbonized are four of all cases (9,52%). During external examination of the remaining 38 cases were found various skin changes. The specific signs of electrical activity, called “skin electric marks” were found in 33 cases ( $78,57 \pm 6,33\%$ ), and in five cases ( $11,9 \pm 4,99\%$ ) they were absent. Besides them, in 23 victims ( $54,76 \pm 7,68\%$ ) we observed heavy and intensive livor mortis. Metallization on the skin was found in only two cases (4,76%) (Fig. 2).

DETECTED SKIN CHANGES IN ANALYZED DEATH CASES

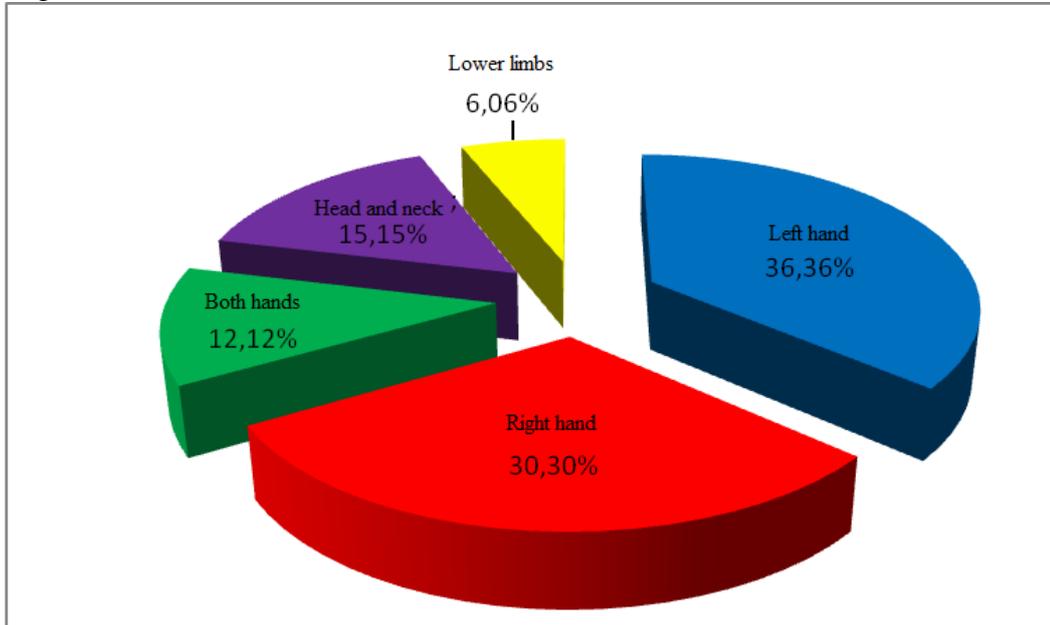
Figure 2.



Electrical skin marks may be formed in the place of the entry of the electrical current into the body (input electrical marks) and in the place of its exit (output electrical marks). Only input electrical marks were detected in 8 cases ( $19,05 \pm 6,06\%$ ) and in 25 ( $59,52 \pm 7,57\%$ ) both – input and output – were present. Input electrical skin marks are most often in the upper limbs and – rarely on the head, neck and legs (Fig. 3).

DISTRIBUTION OF INPUT ELECTRICAL SKIN SIGNS

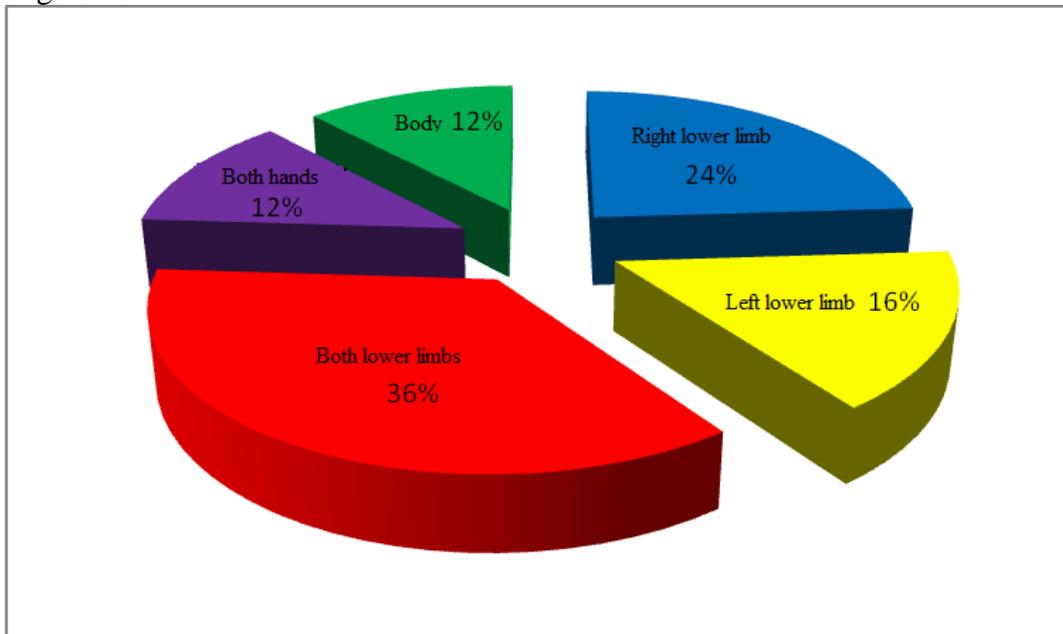
Figure 3.



4). Output electrical skin marks were found in 25 cases, usually in the areas of lower limbs (Fig.

DISTRIBUTION OF OUTPUT ELECTRICAL SKIN SIGNS

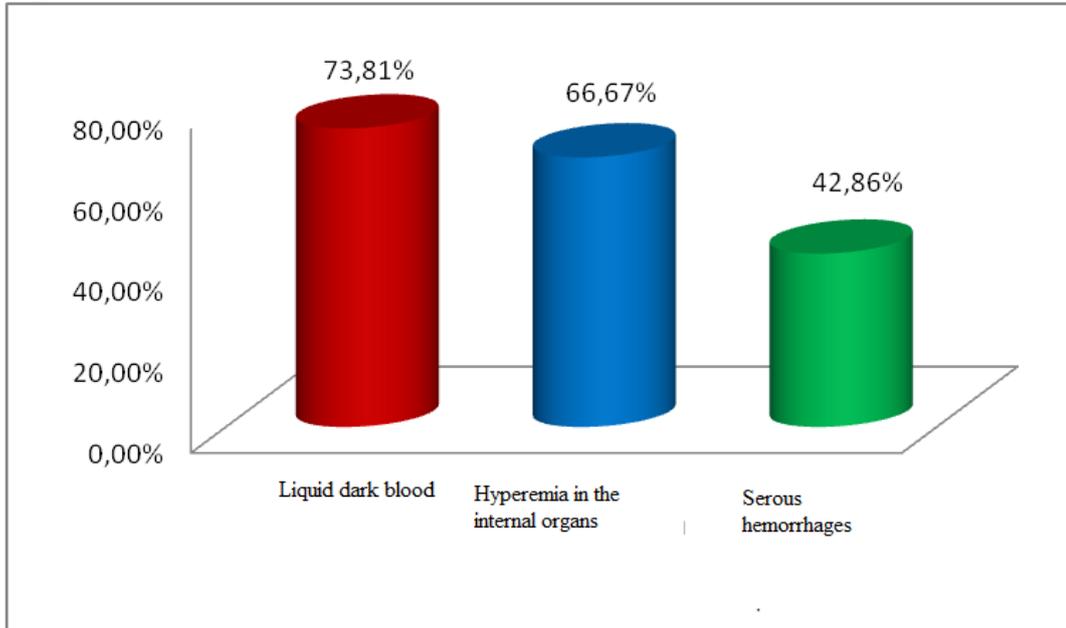
Figure 4.



The internal examination of the victims' bodies showed some morphological signs, the most common of which were: Liquid dark blood in 31 cases ( $73,81 \pm 6,78\%$ ); diffuse hyperemia in the internal organs in 28 cases ( $66,67 \pm 7,27\%$ ); serous hemorrhages of internal organs and mucous membranes in 18 cases ( $42,86 \pm 7,63\%$ ) (Fig. 5).

INTERNAL MORFOLOGICAL SIGNS

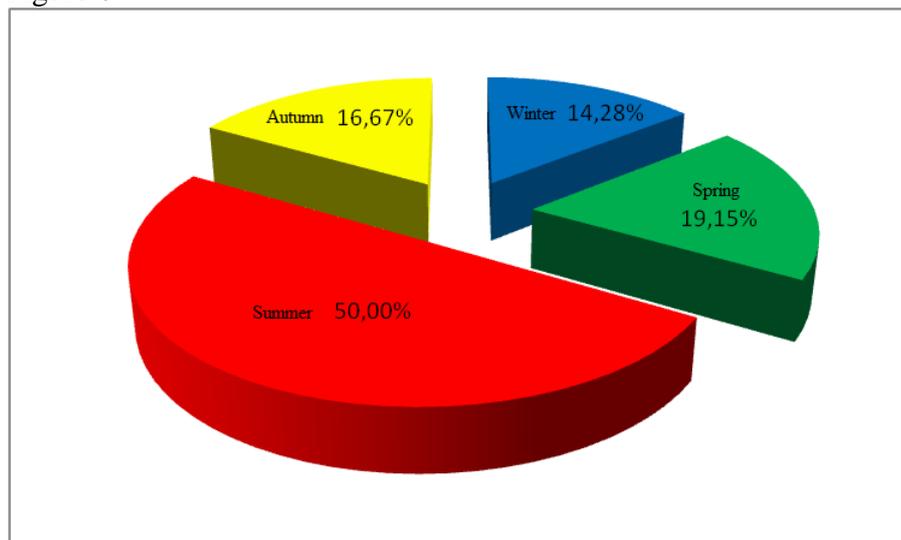
Figure 5.



The influence of the external environment was determined by dividing the cases based on the season in which they occurred. The study showed that half of the victims are in the summer (Fig. 6).

DISTRIBUTION OF VICTIMS IN SEASONS

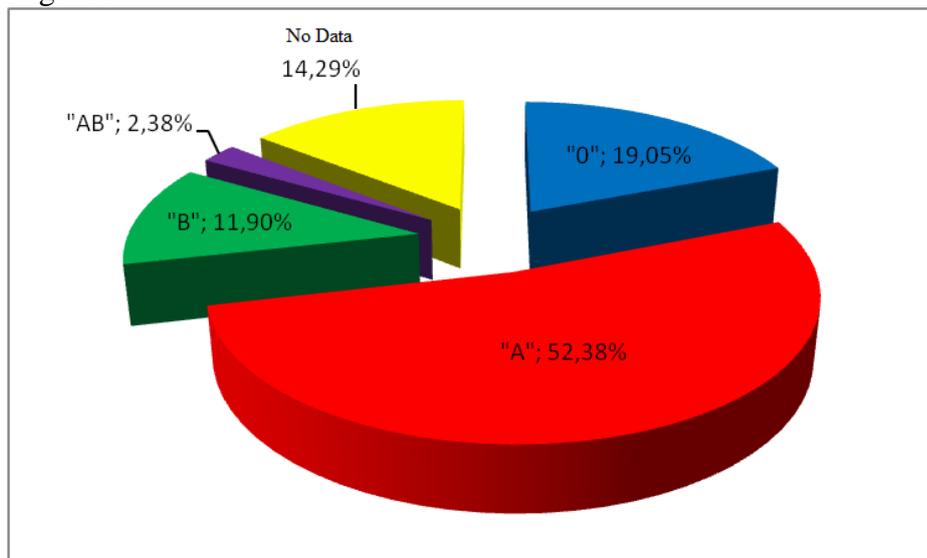
Figure 6.



The study looked for a link between the blood group of the victims and the potential risk of electrotrauma. It was found that more than half of the victims have blood type "A" - 22 people (52,38 ± 7,71%), followed by those with blood type "0" - 8 people (19,05 ± 6,06%) (Fig. 7).

DISTRIBUTION OF VICTIMS BY THEIR BLOOD GROUPS

Figure 7.



Study conclusions: The increased number of victims of electric current with low voltage correlates with the established fact, that in Plovdiv region domestic incidents caused by electricity dominate. This coincides with data reported from other regions in Bulgaria and other countries (3, 4, 9, 10, 12, 14). A possible explanation may be the use of outdated and faulty electrical appliances and devices.

Specific skin marks, considered as a certain sign of electrotrauma, did not occur in all cases. Most often they were located on the upper limbs and less frequently – on the lower limbs, as cited in literature (5, 6, 8, 9, 11, 13). We refined the locations of input and output electrical skin marks and found that the current most often enters through upper limbs, goes through the body and leaves from the lower extremities.

Intensive livor mortis was not a subject of analysis before. The presence of intensive livor mortis in more than half of the victims shows that it can be used as an additional criterion in cases of death caused by electricity.

Internal morphological signs are rarely subject of studies. Dark liquid blood, which is present in 74% of the cases can be considered as an additional internal morphological sign. Hemorrhages under the pleural sheets or epicardium, shown in 43% of cases, also put them in the group of internal morphological signs, specific for electrotrauma, as other authors said (7).

The season, in which electrotrauma occurs most, is summer, as it's cited in the publications of other researchers.(3, 4, 5, 6, 7, 8, 9, 10, 11, 12).

For the first time we examined the relationship between blood group and the risk of electric trauma. The study shows that death cases with blood type "A" are 1.5 times more than others.

In other blood groups the proportion of victims is lower than the spread of blood groups among residents of the region.

CONCLUSIONS:

1. Most common cause of electrotrauma is electric current with low voltage.
2. Most common external signs of electrotrauma are specific electrical skin marks and intensive livor mortis.
3. Liquid dark blood, serous hemorrhages in the internal organs are specific morphological signs that characterize the death caused by electricity.

4. People with blood group "A", are more often victims of electric current.

### CONCLUSION:

Deep forensic study of death cases, caused by electricity in Plovdiv Region for the last ten years, established additional morphological signs - such as a dark liquid blood, serous hemorrhages in internal organs and intense livor mortis. These signs can be useful in the diagnosis of the cause of death. For the first time we studied blood groups of victims and found the relationship between blood groups and increased risk of electrotrauma.

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