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VIOLENT DEATH BY ELECTROCUTION CAUSED BY ATMOSPHERIC ELECTRICAL DISCHARGE. CASE PRESENTATION

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Abstract

Electrocution caused by atmospheric electrical discharge, sometimes has lethal effects on the human body; the medico-legal autopsy is mandatory in this situations in order to establish the cause of death. The effects of the atmospheric electrical discharge on the human body can be: mechanical, caloric, biochemical and electrolytic. The purpose of this work is to underline the importance of medico-legal autopsy and also the importance of knowing the circumstance in which the cadaver was found, in the cases of death by electrocution. Material and method: this paper will present the case of a young person, female, deceased by electrocution caused by the atmospheric electrical discharge, while she was hiking through the woods in the Apuseni mountains. The investigation team present on the scene has requested the medico-legal autopsy. During the autopsy, the external examination of the victim's body revealed violent electrical mark type lesions, burns with multiple localizations(posterior cervical, anterior thorax, limbs), epidermolysis, skin hyperpigmentations, electrogenic edema. On the internal examination of the cadaver have been found signs of asphyxia, right lung rupture, heart structural modifications. The examinations of the clothes and footwear have shown numerous burns and tears. Conclusions: Investigation data, the examination on the scene, knowing accurately the weather conditions at the time of death, are elements extremely useful to establish with certainty the diagnostic of violent death by electrocution caused by atmospheric electrical discharge.

Key words: electrocution, atmospheric electrical discharge, death, autopsy, electrical mark.

INTRODUCTION

The electrocution induced by a natural electrical discharge in the atmosphere represents an electric aggression on the human body, and the modifications this produces on the human body represent the atmospheric electrotrauma(Iftenie V., Dermengiu D., 2009). Natural atmospheric electricity is mainly caused by the electrical phenomena of the storm clouds, the electrical state of the atmosphere, the electrical charge of the precipitations, resulting in a form of electrical discharge, highly dangerous to humans, called lightning strike that could be lethal to the human body (Iftenie V., Dermengiu D., 2009)(Florian, Ş., 2004). It is estimated that 10% of cases casualties are related to trees(Holle R.L., 2013) (Holle R.L., Cooper M.A., 2016).

The atmospheric instability leads to the formation of storm clouds which cause the electrical discharge in the atmosphere(Dogaru I., 2011) (Florian Ş., 2004). The power of lightning is between 10 000 and 200 000A of current, voltage ranging from 20 million to 1 billion V, length of a few km, width up to 20 cm(Seidl S., 2006)(Beliş V., 1995). The effects of these atmospheric electrical discharges over the human body can be mechanical, caloric, and biochemical/electrolytic: from wounds with entrance and exit orifices, rupture of the viscera, erythema of the teguments with fern leaf aspect to first/second degree burns, partial or total carbonization of the body, from electrogen edema to metachromasia(Buhas C., et al, 2011) (Dogăroiu C.et. al, 2010).

Establishing the diagnosis of death by electrocution caused by an atmospheric electrical discharge is done by correlating the data of the internal and external examination of the body, with the data from the investigation of the scene, and the result of the complementary investigations performed at the autopsy(histopathological examination, tanato-chemical)(Belis V., et al, 1992)(Dermengiu D., 2002).

Usually death occurs instantly, and could be caused by cardio-respiratory arrest (the inhibition of cardio-respiratory nerve center of the cerebral trunk), acute peripheral cardiac insufficiency (frequently ventricular fibrillations), or through acute peripheral respiratory insufficiency (respiratory muscles tetany)(Dogaroiu C., et al, 2010)(Iftenie V., et al, 2009)(Bucholtz A., 2015). In case of survival, victims could frequently have ocular lesions, hearing and speech disturbances, paralysis, etc. (Iftenie V., Dermengiu D., 2009) (Belis V., 1995)(Dickshit P.C., 2010).

MATERIAL AND METHOD

We will present the case of a female, age 33, deceased by electrocution caused by an atmospheric electrical discharge. The information provided by the investigation team tells us that the victim was caught in a thunder and lightning storm with heavy rain in The Apuseni Mountains while hiking.The young female separates from the group looking for shelter. After the storm passed, the female's body was found inert in the vicinity of a tree which was struck by lightning. SMURD service is called, and upon their arrival they pronounced the victim's death. The cadaver of the victim is transported to Bihor County Legal Medicine and Forensics Service, and the investigation team requests the medico-legal autopsy to establish the cause of death.

RESULTS AND DISCUSSION

The medico-legal autopsy revealed on the external examination signs of the actual cause of death, and identified signs of violent death. When examining the victim's clothes: T-shirt(cotton), bra(mix of cotton and polyester), underwear(polyester) and trousers(cotton), these showed numerous areas with burn/melted aspect, mainly on the T-shit and bra; the sport shoes of the victim were wet, dirty, torn and had holes on both medial sides (with a ruffled aspect) (img.1,2,3).

Img.1. The external examination of the body and bra examination: traces of ashes on the teguments and on the bra, burns of the tegument and bra, electrical mark, epidermolysis

Img.2. External examination of the body: aspect of the left calf and left foot (electric mark, calf erythema and edema). Aspect of the shoes

Img.3. External examination of the body: aspect of the right calf and right foot (burns, hyperpigmentations, erythema, edema). Aspect of the shoes

On the surface of the skin and clothes, dark-gray ash like deposits were found (on the anterior thorax and both arms) and the pubic pilosity showed in some spots a lack of post burns substance, the remaining pubes having a spiral aspect. The nail bed was purple with cyanotic aspect, on the anterior thorax showed the paddle marks from the post resuscitation electrodes. The victim had on her metal keys, bank cards, and currency bills (img.1,4,5).

Img.4. External examination of the body: traces of ashes on the teguments, burns of the teguments and pubic hair, erythema of the skin, epidermolysis

Img.5. External examination of the body: burns of the teguments and pubic hair, right hand cyanosis of the nail bed, areas of erythema of the skin, calfs edema

The violent marks detected on the external examination of the body showed entrance and exit "electric marking" lesions due to the atmospheric electricity passing through, and burn lesions on the skin. The aspect of the violent lesions was brown-red, non-homogenous, hardened, paper like tegument areas, some in polycyclic shape, and others with irregular aspect, merging in some areas, localized on the cervical area, the thorax, and limbs as follows: posterior-cervical 1/3 midline, lateral thorax 1/3 superior and midline, anterior thorax 1/3 inferior, abdomen (mainly right), right arm 1/3 midline on antero-interior, right tigh 1/3 midline antero-interior, left thigh 1/3 midline poster-interior, posterior right calf 1/3 inferior, right foot medially corresponding to the internal malleolus extending to the arch of the foot. On the left foot medially corresponding to the metatarsal phalange 1 articulation, an electric mark is noticed. In the vicinity of these areas the teguments are either erythematous of a red color or hyperpigmented, brown; in some spots with epidermolysis. The calfs have an edematous aspect (img. 1,2,3,4,5).

The internal examination of the cadaver revealed: pluriviceral stasis, asphyxia spots with small, reddish-brown aspect localized on the pericranial soft tissues and on the serosa(pleura, pericardium), leptomeningeal and cerebral edema, middle lobe rupture of the right lung, acute pulmonary edema, liquid blood into heart cavities, micro and macroscopic structural modification of the heart (muscular granular degenerations, myocardial fiber dystrophy with loss of striations, occasional broken muscular fibers, areas of parcelar necrosis, interstitial edema), of the brain and spinal cord(petechial haemorrhages in the brain and spinal cord, fragmentation of the axons).

The histopathological examination on the tissue fragments collected from the cadaver confirms also the presence of electric marks and burns, and the fact that those lesions were made when the person was alive.

CONCLUSIONS

Correlating the findings of the internal and external examination of the cadaver with the results of the histopathological examination and with the information provided by the investigation team, it was concluded that the victim had a violent death due to the electrocution from an atmospheric electrical discharge.

The external electrocution markings of the atmospheric electrotrauma on a cadaver are not as obvious on all cases. In these situations, the investigation information, the examination of the scene, knowing accurately the weather conditions at the time of death, the exam of the victim's clothes,

are extremely useful factors to establish the precise cause of violent death through electrocution caused by an atmospheric electrical discharge.

REFERENCES

1. Beliş V., Dragomirescu V., Naneş C., Gacea E., Panaitescu V., Drugescu N., 1992, Medicină Legală, Editura Teora, pp. 117-118
2. Beliş V., 1995, Tratat de Medicină legală,vol.II, Editura Medicală Bucureşti, pp.60-61
3. Bucholtz A., 2015, Death Investigation, Anderson Publishing, Elsevier Inc. , p.238
4. Buhaş C., Mihalache G., Pusta C., 2011, Forensic Medicine, Editura Universităţii din Oradea, pp. 99-101
5. Curcă C., 2003, Medicina legală Curs, pp.77-78
6. Dermengiu D., 2002, Patologie medico legală, Editura Viaţa Românească, Bucureşti, pp.287-289, 292
7. Dogaru I., 2011, Paratrăznetele moderne-mijloace de protecţie a mediului. Formarea competenţelor pentru formare şi întreţinere, Analele Universităţii "Constantin Brâncuşi" din Târgu Jiu, Seria Inginerie , Nr. 3/2011, p.254 http://www.utgjiu.ro/revista/ing/pdf/2011-3/26_DOGARU_ILEANA.pdf
8. Dogăroiu C., Dermengiu D., Curcă C., 2010, Essentials of Forensic Medicine, Editura Tehnoplast Company S.R.L, Bucureşti, pp.83-85
9. Florian Ş., 2004, Patologie medico- legală, Editura Napoca Star, Cluj-Napoca, p.259
10. Holle RL., 2013, Lightning-caused deaths and injuries In the vicinity of trees. In: Preprints of the 6th Conference on the Meteorological Applications of Lightning Data, 6–10 January 2013; Austin, Texas, American Meteorological Society; 8 pp
11. Holle RL., Cooper MA, 2016, Lightning Occurence and Social Vulnerability, p.14. In: Atmospheric Hazards - Case Studies in Modeling, Communication, and Societal Impacts http://dx.doi.org/10.5772/63001 https://www.researchgate.net/publication/307436427_Lightning_Occurrence_and_Social_Vulnerability
12. Iftenie V., Dermengiu D., 2009, Medicină legală, Editura CHBeck, Bucureşti, pp.271-275
13. Dikshit P.C., 2010, Textbook of Forensic Medicine and Toxicology, PEEPEE Publishers and distributors (P) Ltd., New Delhi, pp. 292-293
14. Seidl S, 2006, Pathological Features of Death From Lighting Strike. In: Forensic Pathology Reviews, vol.4. Humana Press., Totowa, NJ, pp.3-4 http://link.springer.com/chapter/10.1007/978-1-59259-921-9_1#page-1
15. http://www.cursurimedicina.ro/files/Carte%20ML.pdf
16. http://www.usem.md/uploads//files/Note_de_curs_drept_ciclul_1/034_-_Medicina_legala.pdf
17. http://www.forensicpathologyonline.com/E-Book/injuries/electrical-injuries
18. http://emedicine.medscape.com/article/770642-overview#a5