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Case Report

Right Hemispheric Leukoencephalopathy as an Incidental Finding Following a Lightning Strike

Jera Kruja[1], Altin Kuqo[1], Serla Grabova[1], Arben Rroji[2], Gentian Vyshka[3*]

[1]Department of Neurology, Neurosurgery and Psychiatry, Faculty of Medicine, University of Medicine in Tirana, Tirana, Albania; [2]Department of Radiology, University Hospital Centre "Mother Theresa", Tirana, Albania; [3]Biomedical and Experimental Department, Faculty of Medicine, University of Medicine in Tirana, Tirana, Albania

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***Correspondence:** Gentian Vyshka. Biomedical and Experimental Department, Faculty of Medicine, University of Medicine in Tirana, Tirana, Albania. E-mail: gvyshka@gmail.com

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Abstract

BACKGROUND: Lightning injuries may produce a variety of medical conditions, and specific neurological complications have been identified, with the character of immediate aftershock effects or even long-term consequences.

AIM: The authors describe the incidental finding following a routine unenhanced brain MRI performed to a young female patient, suffering from a headache.

CASE REPORT: Diffuse white matter changes with the character of a leukoencephalopathy were seen, which strictly interested only the right cerebral hemisphere. The parents referred that she suffered from an indoor lightning strike at age of seven months, although she survived with almost no external burns or signs, and recovered uneventfully at that time. A discussion over the effects of electrocution and lightning strike on the human body in general, and over the nervous system, is made. Particular attention must be shown when making the differential diagnosis of leukoencephalopathies with a strictly one-hemisphere extension since several other conditions might resemble each other under the radiological aspect, here including brain viral infections, genetic disorders, and so on.

CONCLUSION: The particularity of the long-term aftershock effects of the lightning strike on the central nervous system raise again the necessity of collecting data and duly reporting every electrical accident, lightning events included.

Introduction

Electrical discharge, electrocution and lightning, in particular, represent accidental events whose aftermath might be really serious to humans. Contrarily to the lay opinion which comprehensively is related to the fearfulness of the phenomenon, as much as two third of the lightning sufferers will survive the occurrence and will be delivered to specialised trauma centres for further treatment [1].

Lightning will inflict serious injuries, primarily related to the high amperage of the electrical current produced, that might lead to myocardial asystole, highly lethal if not resuscitated promptly; and secondarily due to thermal effects (burns) and the blast itself, rendering the accident a highly traumatic one. Neurological complications of the lightning injuries have as well widely reported and studied; when present, these complications generally are already competence of specialised centres, and not of emergency teams. Cherington et al. have made several authoritative contributions toward classifying and explaining the nature of lightning-related neurological damage [2, 3].

Under a topographic point of view, the author has divided three groups of patients with regard to the level of the lesions: (a) lesions above the foramen magnum, (b) cranial nerve palsy / palsies and (c) spinal cord lesions [2]. In an attempt to classify the lesions under a temporal perspective as well, Cherington suggests following groups of syndromic value:

1. Immediate and transient symptoms (such as

loss of consciousness, amnesia, weakness etc.);

2. Immediate and prolonged or permanent lesions (post-hypoxic encephalopathy, brain infarction, cranial nerve palsies);
3. Possible delayed neurologic syndromes (such as motor neurone disease, movement disorders etc.);
4. Lightning-linked secondary trauma from falls or blast (epidural haemorrhage, tympanic membrane rupture) [3].

Overall, authors report a diversity of neurologic complications that cover almost the entire spectrum of the clinical neurology: there is clear evidence of damage to the central nervous system (cerebral and cerebellar lesions, spinal cord injuries), to the peripheral nervous system (neuropathy, plexopathy), to the sensorial systems (auditory and visual systems), as well as to the skeletal muscle itself (cramps, rhabdomyolysis and compartment syndromes) [4].

Little is known about the mechanisms for delayed neurological damage following lightning injuries, and the explanations are made much more hypothetical when there is no evidence of structural damage, as in cases when imaging studies reveal no abnormalities at all [5, 6]. Free radicals resulting from oxidative stress might explain the demyelination that frequently precedes the death of spinal neurones [5, 7]. The electroporation hypothesis, namely the formation of additional pores in neurones following electrical injury, is another intriguing assumption, provided that sufficient clinical data will be supportive to it [8].

Case Report

A nine-year-old female child was referred from her paediatrician for a routine brain MRI. Her general health status and growth were normal, but during the last two months she complained of daily non-specific headaches, mainly focused on the frontal region, infrequently accompanied by nausea.

The neurological status was within normality; she had brisk tendon reflexes bilaterally but no pyramidal signs or pathological reflexes. The cognition was considered as adequate, and the educational achievements of the young girl were satisfactory.

Her mother suffered from a migraine, and the family paediatrician had the suspicion of a similar medical occurrence. The MRI was performed unenhanced and detected diffuse white matter changes strictly confined to the right cerebral hemisphere (Figures 1 and 2).

The parents have interviewed a new and recalled only an episode of a lightning strike, which after all was not mentioned in the medical files when she was seven months old. At that time, the girl was lying down on the right side of the head next to the window when the lightning struck; the baby was found crying but conscious, with no signs of burn or other external trauma. Apart from some sustained material damage inside the room, parents could not remember any further injury to their daughter, in relation with the event of eight years before.

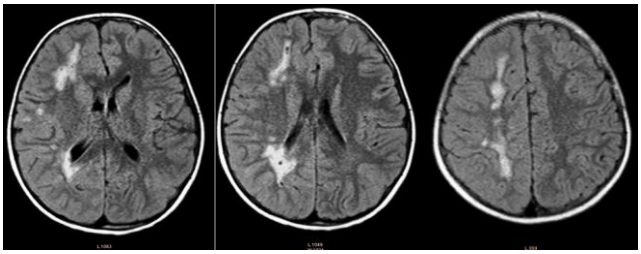

Figure 1: T2-weighted Flair (Fluid-Attenuated Inversion Recovery) images, unenhanced brain MRI

The girl was dismissed without any specific neurological therapy for a headache she complained of. A six-month follow-up medical examination showed no symptoms and signs as well, in spite of the persisting of isolated episodes of headaches. One year after performing the MRI described above, another imaging study showed no significant changes, and the radiologist concluded in favour of some 'non-progressive leukoencephalopathy changes' in the right cerebral hemisphere, with no evidence of any involvement of the contralateral hemisphere.

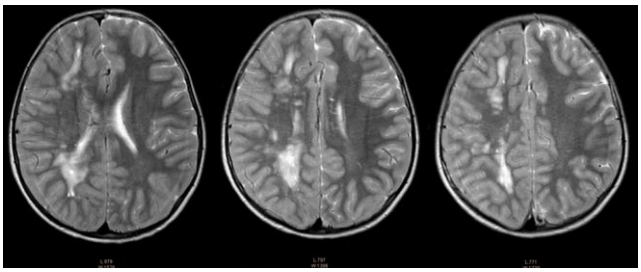

Figure 2: T2-weighted TSE (Turbo Spin Echo) images, unenhanced brain MRI

Discussion

Lightning strikes might be lethal, but under extraordinary circumstances, their thermal effects over the victim can be minimal, or confined to the contact wound, when present [9]. One hundred and twenty years after that Franklin elucidated the physical aspects of the lightning, it was the time of medical doctors to summarise and publish relevant experiences [10]. Of course, the spectrum of neurological disorders in the aftermath of a lightning

injury is immensely wide, and ad hoc terminological novelties have been coined, such as 'kerauno-paralysis' (from the Greek '*keratinous*, κεραυνός' – lightning), depicting the clinical image of a transient motor deficit mainly in the lower limbs following the occurrence [11].

The presence of an incidental finding on the brain MRI such a hemispheric leukoencephalopathy clinically silent will obviously raise important questions vis-à-vis the aetiology. In our case, the significant time delay separating the lightning strike with the brain imaging will even further endorse scepticism; nevertheless, specific MRI changes have been found in the aftermath of the lightning [12]. On the other hand, similar cases of leukoencephalopathy confined to a single hemisphere have been described, but authors have already identified respective etiologies [13-15].

The case we described above was probably related to an indoor lightning strike; this is not the first case of an indoor injury from our experience, albeit the other publication of ours dealt with a fatality [16]. However, particular attention must be shown with regard to long-term and subtle neurological consequences and sequelae of any electrical injury, lightning strikes included.

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