

IMAGING OF EPILEPSY FOLLOWING ELECTRICAL INJURY

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Electrical injury may result in brain injury with delayed symptoms and sequelae. We report a case of high-voltage cerebral electrical injury in a 42-year-old man through his right hand with delayed symptoms and with imaging abnormalities suggesting that haemorrhage had occurred on the cortical somatosensory areas of his left cerebral hemisphere. An appropriate patient's clinical history should be obtained to correlate the lesions to the event as delay between the event and the symptoms can be very long.

Key-word: Epilepsy.

Electrical injuries to the extremities are a relatively uncommon form of trauma and may be responsible for a range of delayed neurologic manifestations (1). As an increasing number of such injuries are explored by MR imaging, potential abnormalities related to this condition are being discovered. We report a case of high-voltage cerebral electrical injury with delayed symptoms and with imaging abnormalities. Only a very precise anamnesis could help in making the link between the imaging abnormalities and the injury.

Clinical case

A 42-year-old man came to the emergencies in June 2010 showing a first crisis of seizure with right hemiparesia and language disability lasting for few minutes followed by a post-critic paresis. CT scanner of the brain was normal (Fig. 1).

He had no clinical and no surgical history except for an occupational incident in July 2006 when he experienced an electrical shock while working in an elevator. The electrical current got through his right hand, the patient collapsed and lost consciousness for few minutes. His right hand was slightly burned for a few days. No further worked up was performed.

Four years after this electrical incident, the first seizure occurred. Brain MR imaging was performed one month after the seizure and demonstrated an increased T2 and FLAIR signal intensity in the left fronto-parietal white matter inside the rolandic sulcus. There was a slight enhancement seen around and no mass effect (Fig. 2). On the T2*-weighted gradient echo (GE)

sequence, sensitive to the inhomogeneity in static magnetic fields, multiples punctuate foci of hypointensities were seen along the cortex of the precentral and the post central gyri of the left rolandic sulcus (Fig. 3). These foci were not surrounded by oedema and were not visible on other sequences.

A second brain MR imaging, performed one week later in the absence of contrast showed the same foci of hypointensities along the left rolandic cortex on the T2*-weighted GE sequence. On this MRI, the T2 and FLAIR signal intensity in the left fronto-parietal white matter inside the rolandic sulcus completely disappeared without subsequent volume loss within the left corticospinal tract (Fig. 4).

The evolution leads us to conclude that the transient T2 signal abnormality in the white matter was related to a post-critic oedema due to the epileptic event that had occurred one month previously.

The multiples punctuate foci of hypointensities were considered as sequelae related to the electrical shock underwent 4 years before. Thanks to detailed interrogation, it has been evidenced that the patient was presenting from time to time as the incident itched in his right fingers.

The localisation of the abnormalities in the left somatosensory cortex, the signal loss on T2* sequence and the clinical history lead us to suspect that the patient's imaging findings represented a cortical sequela of a cerebral electrocution injury and that the epileptic crisis was caused by the sequelae essentially because the clinical appearance of the epileptic crisis oriented through a left cortical pathology.



Fig. 1. — Axial CT without contrast at the rolandic level shows no abnormality (no hemorrhage nor calcification).

Discussion

Electric shock is a relatively uncommon form of trauma and the severity of the injury depends on the type of current used and the applied voltage. High voltage shock is responsible for persistent and severe complication of electrocution (2). Low voltage electrical shocks are the most reported types of electrocutions and most of the related complications are relatively minor and transient (3). However, patients surviving high-voltage electrical injury may show delayed sequelae (4) like clonus, limb dystonia (5), parkinsonism (7), or tremor. The mechanisms of these symptoms are unknown and the hypothesis of a direct damage to the nervous system or a delayed indirect effect such as denervation has been proffered (8). The abnormalities seen on the T2* weighted axial images in our patient suggest that haemorrhage occurred on the cortical somatosensory areas of his left hemisphere. Functional organization of the primary motor

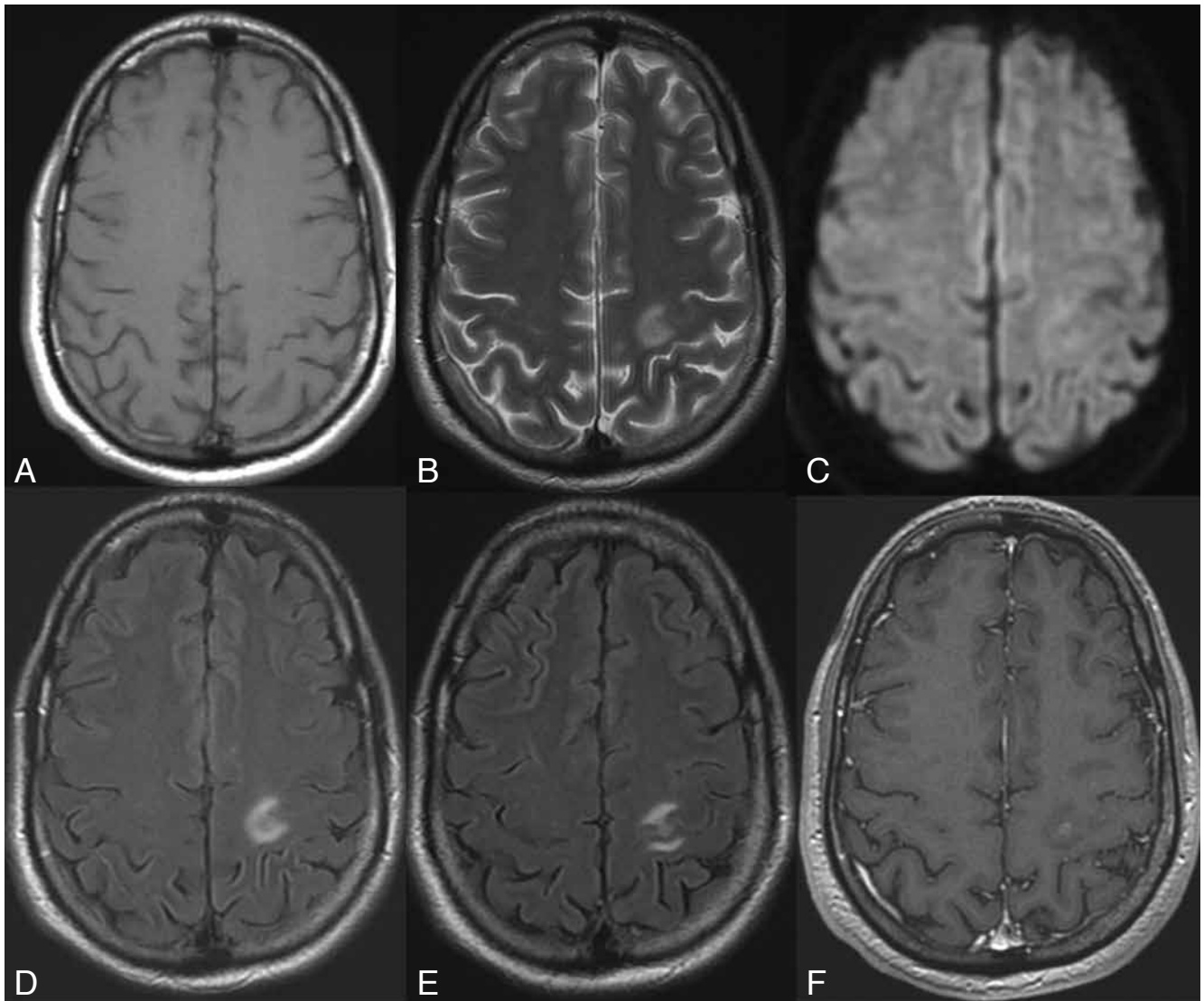


Fig. 2. — Axial T1-weighted (A), T2-weighted (B), diffusion weighted (C), FLAIR- (D, E) and T1 weighted with contrast (F) images show an increased increased T2 and FLAIR signal intensity in the left fronto-parietal white matter inside the rolandic sulcus (B, D, E) and a slight enhancement (F, arrow).

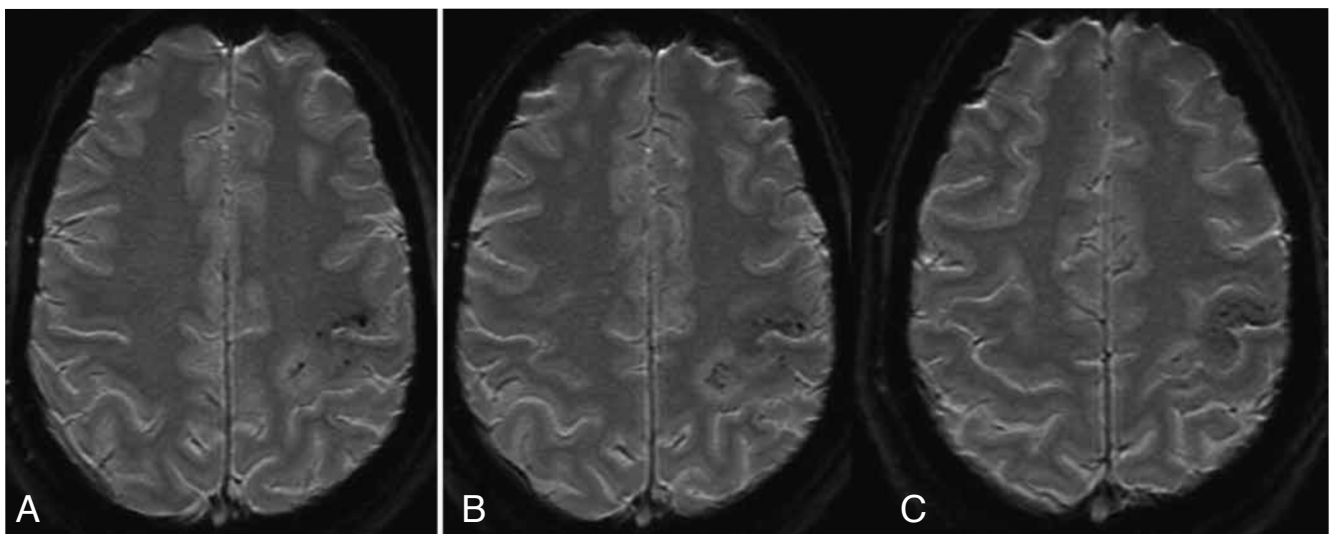


Fig. 3. — Axial T2 gradient echo image shows hypointensities along the cortex of the precentral and the post central gyri of the left rolandic sulcus.

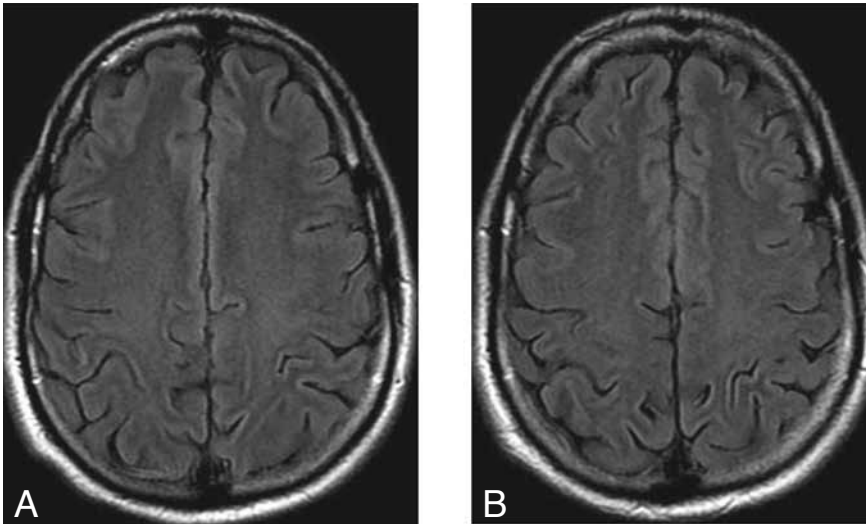


Fig. 4. — Axial FLAIR images show total disappearance of the parenchymal anomalies.

and somatosensory cortex (SI) is well established, with digit representation along the postcentral gyrus. This somatotopic organization has been detected with several techniques, including fMRI. Tactile stimulation of the hand is known to activate the SI located in the cortex of the contralateral central sulcus (9). In our case, the abnormalities are exactly located on the contralateral somatosensory cortex of the right hand which was injured. This suggests a sensory input through the nervous circuit to the contralateral primary motor and somatosensory cortex.

Only few cases have been reported with MR abnormalities (10) and to our knowledge, none had cortical

hemorrhagic sequelae described on MRI. In our case, the correct diagnosis was important as it corresponded to an occupational incident, therefore, even 4 years after the event, the sequelae could be considered for insurance.

Conclusion

Electrical injury may result in brain injury with delayed symptoms and sequelae. With MRI, some lesions may be detected. However an appropriate clinical history should always be performed in order to correlate the lesions to the event. This can be very important especially in the context of an occupational accident.

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