Case 14949

Eurorad

Permanent brain MRI injury after electrical shock

Published on 19.08.2017

DOI: 10.1594/EURORAD/CASE.14949
ISSN: 1563-4086
Section: Neuroradiology
Area of Interest: Neuroradiology brain
Procedure: Diagnostic procedure
Imaging Technique: MR
Imaging Technique: MR-Diffusion/Perfusion
Special Focus: Pathology Case Type: Clinical Cases
Authors: Anastasia Zikou1, Christina Naka1, Sigliti-Henrietta Pelidou2, Maria I Argyropoulou1
Patient: 38 years, male

Clinical History:

A 38-year old man experienced an electrical shock as an occupational accident. The patient was hospitalised in Intensive Care Unit in coma, with reactive pupils, weak tendon reflexes, and intact brainstem reflexes. A brain MRI was performed the 3rd day after the event.

Imaging Findings:

Brain MRI revealed increased signal intensity in the globus pallidus, the posterior limb of internal capsule and the semioval centre on T2-weighted (Fig. 1) and on FLAIR images (Fig. 2) bilaterally. On ADC maps, the same regions revealed restricted diffusion (Fig. 3). Two months after the incident the patient was still in coma. The follow-up MRI showed the previous affected regions with persistent hyperintensity on T2-weighted (Fig. 4) and on FLAIR images (Fig. 5), quite “normal” or slight hyperintense signal on ADC maps (Fig. 6) and mild ex vacuo dilatation of the lateral ventricles (Fig. 4, 5).

Discussion:

Electrical injuries are progressively common and occur primarily in young men as an occupational accident. They usually lead to central nervous damage. However, the injury mechanism is not completely defined, including several hypotheses. The most obvious is thermal, which result in external and internal burns. Another one is electroporation. The membrane proteins alter modulation and can no longer maintain transmembrane ion gradients, resulting in cell death. Another mechanism includes the actual physical direct and indirect forces involved in the injury leading to event-associated injuries [1, 2].

Brain imaging is crucial for detecting the central nervous damage after an electric shock injury. CT is indicated to rule out event-associated injuries [2]. Brain MR imaging is important for initial evaluation of central nervous system and ongoing follow-up. There are four types of electrical injuries, which are useful in guiding appropriate imaging. I) The most common are immediate and transient injuries, such as loss of consciousness, amnesia, confusion, paraesthesias, and weakness or paralysis. They often resolve within minutes to hours. Acute brain MR imaging examinations demonstrate T2 signal abnormalities consistent with neurologic symptoms. In follow-up imaging the findings are partially resolved. II) Less common are immediate and prolonged or permanent injuries, including haemorrhage, chromolysis of pyramidal and other neurons, glial proliferation, and infarction. These injuries are debilitating and neurologic imaging does not accord with clinical findings. Brain MRI usually reveals persistent T2 signal abnormalities, due to Wallerian degeneration. III) Delayed and progressive injuries may be difficult to

differentiate from the second type of injuries. They are also debilitating and receive a disproportionate amount of imaging. They include basal ganglia with motor system disorders and they carry a poor prognosis. IV) The last and most obvious type of electrical injuries are event-associated injuries. They usually include trauma or hypoxic damage due to ventricular fibrillation [1].
The diagnosis of brain electrical injury is not always clear and has to be considered when encountering confluent white matter signal intensity abnormality in patients with appropriate clinical history [1].
Differential Diagnosis List: Cerebral electrocution injury, Leukoenchephalophathy, Intoxication from CO, Ischaemic lesions

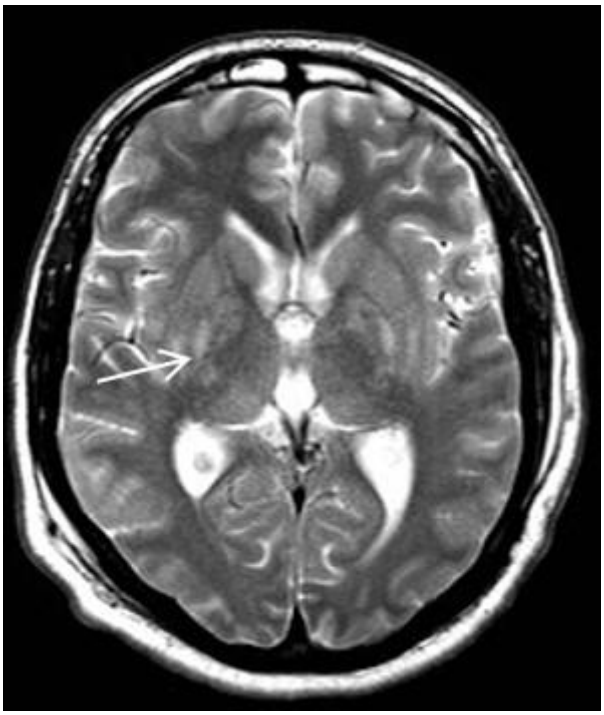
Final Diagnosis: Cerebral electrocution injury

References:

Johansen CK1, Welker KM, Lindell EP, Petty GW (2008) Cerebral corticospinal tract injury resulting from high-voltage electrical shock. AJNR Am J Neuroradiol 29(6):1142-3 (PMID: 18372420)
Grassner L, Bierschneider M, Strowitzki M, Grillhösl A (2007) Different sequelae of electrical brain injury - MRI patterns. Burns 43(4):e7-e10 (PMID: 28400149)

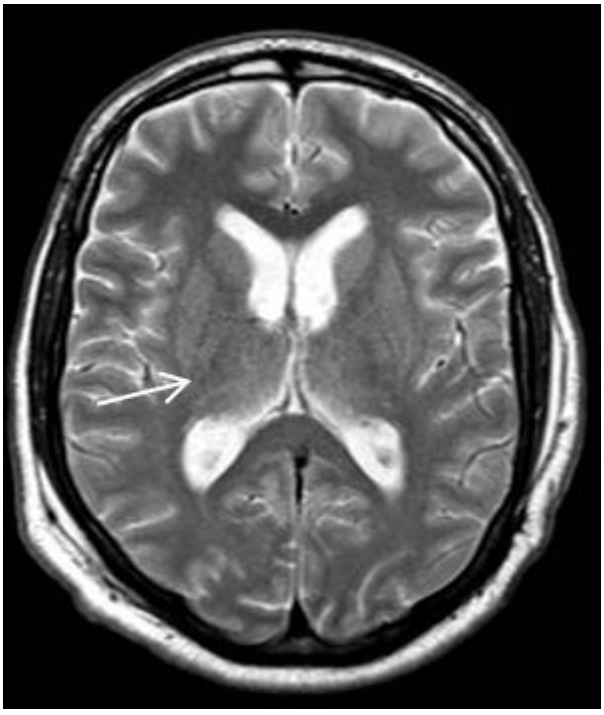
Figure 1

a



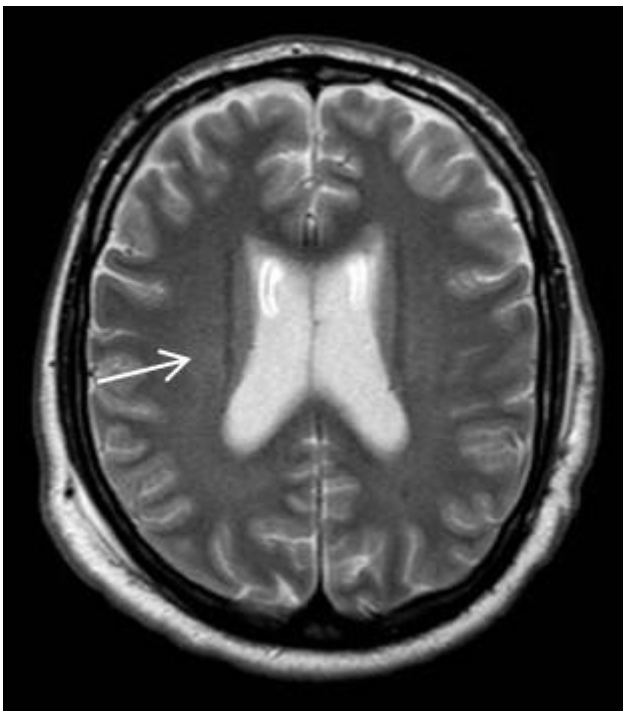
Description: T2 weighted axial images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

b



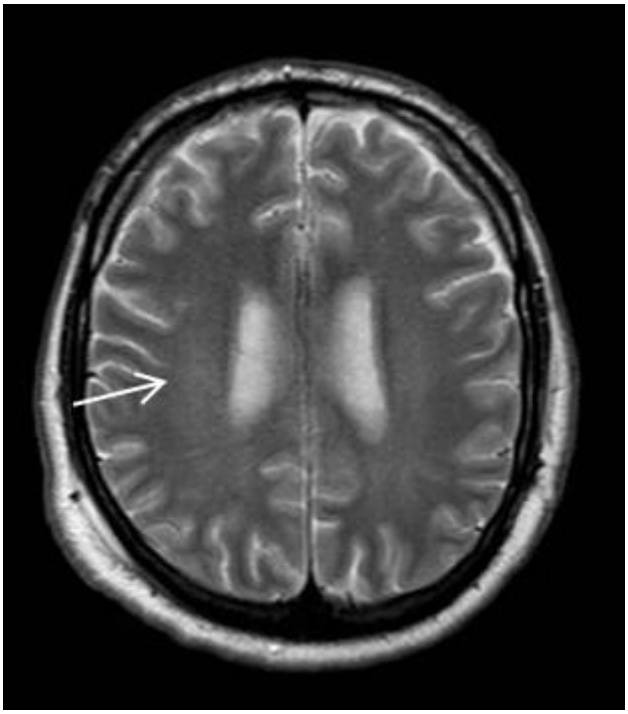
Description: T2 weighted axial images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

c



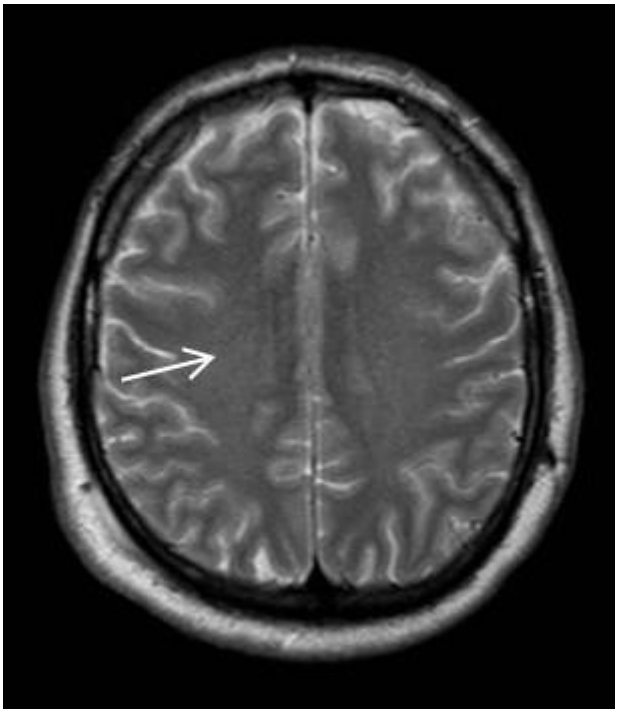
Description: T2 weighted axial images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

d



Description: T2 weighted axial images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

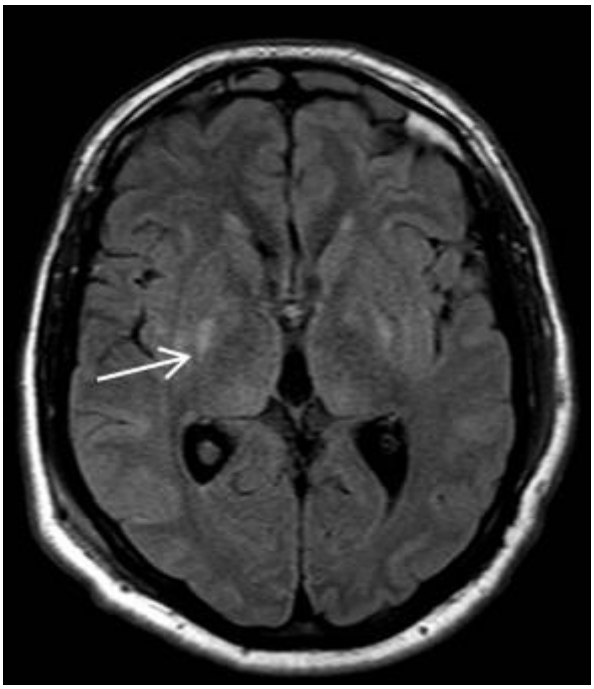
e



Description: T2 weighted axial images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

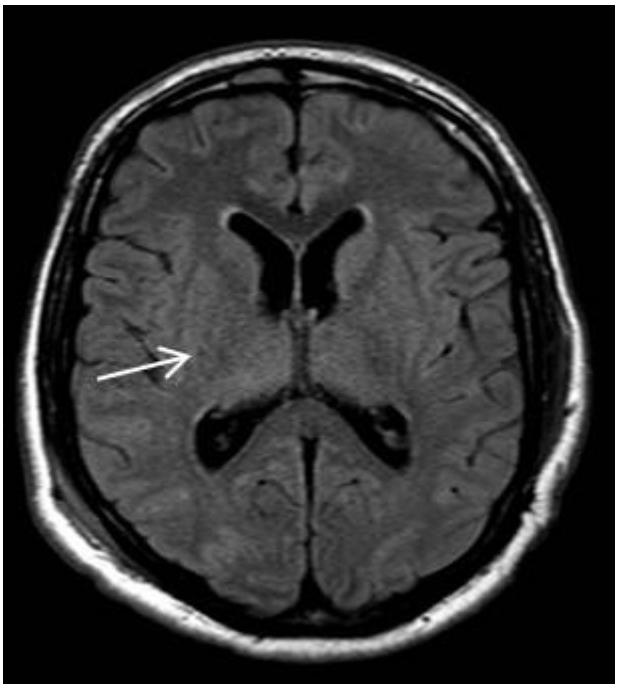
Figure 2

a



Description: Axial FLAIR images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

b

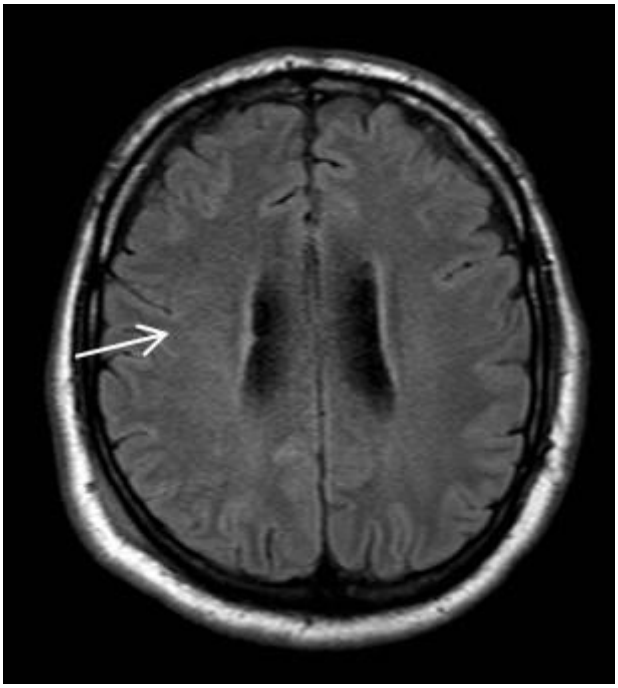


Description: Axial FLAIR images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

c

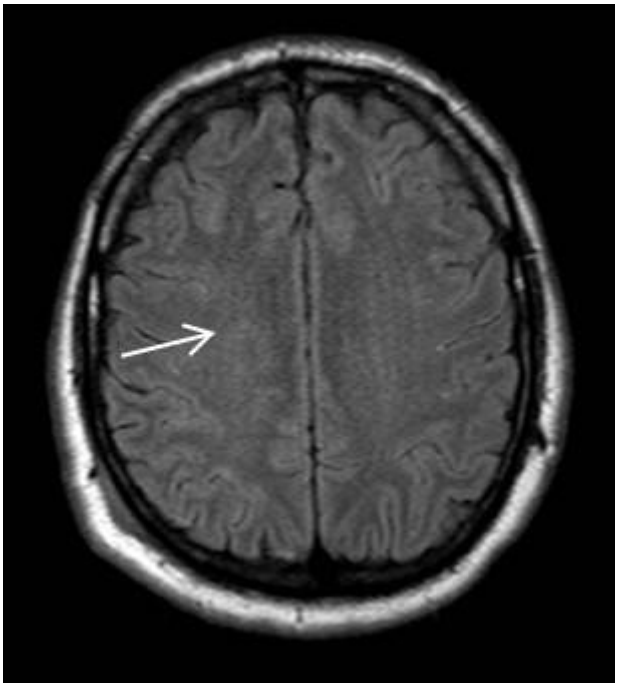
Description: Axial FLAIR images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

d



Description: Axial FLAIR images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

e



Description: Axial FLAIR images show bilateral, symmetrical hyperintensities in the globus pallidus, posterior limb of internal capsule, corona radiata and semi-oval centre (arrows) **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

Figure 3

a

Description: ADC maps show restricted diffusion in the same regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

b

Description: ADC maps show restricted diffusion in the same regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

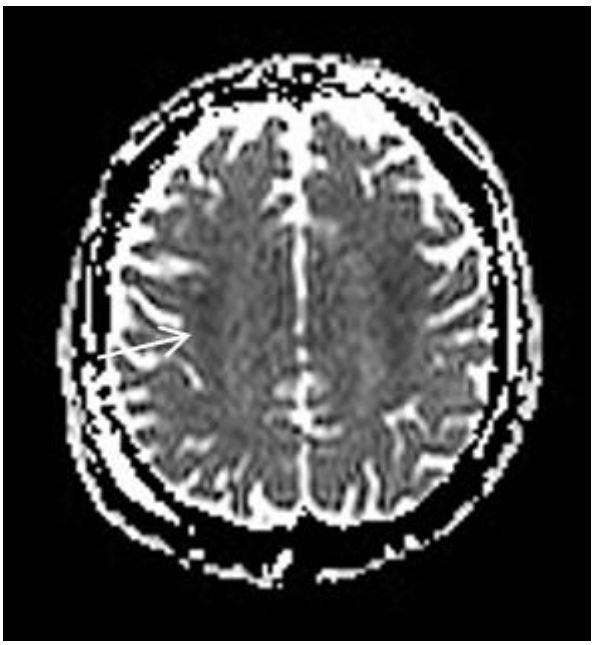
c

Description: ADC maps show restricted diffusion in the same regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

d

Description: ADC maps show restricted diffusion in the same regions (arrows) **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

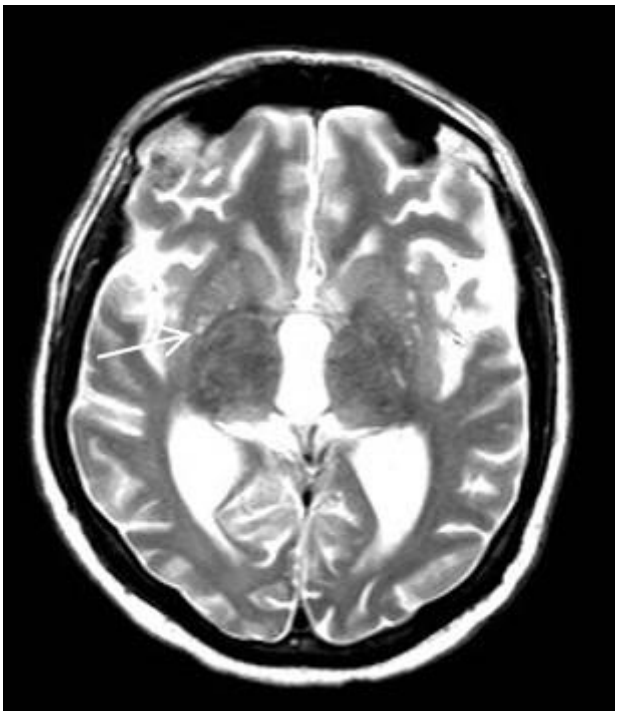
e



Description: ADC maps show restricted diffusion in the same regions (arrows) **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

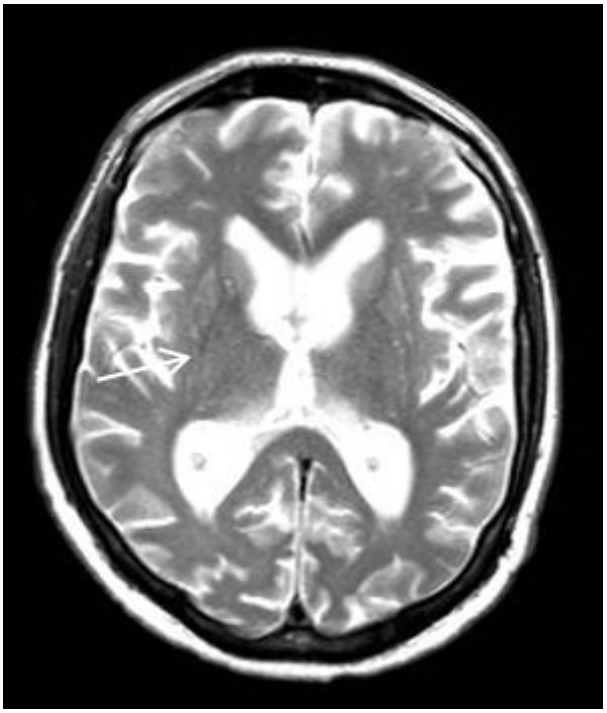
Figure 4

a



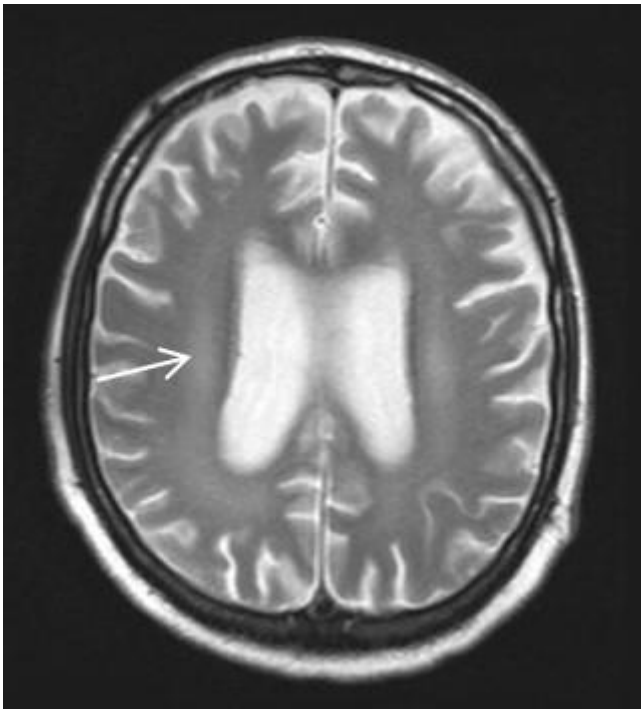
Description: T2 weighted axial images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

b



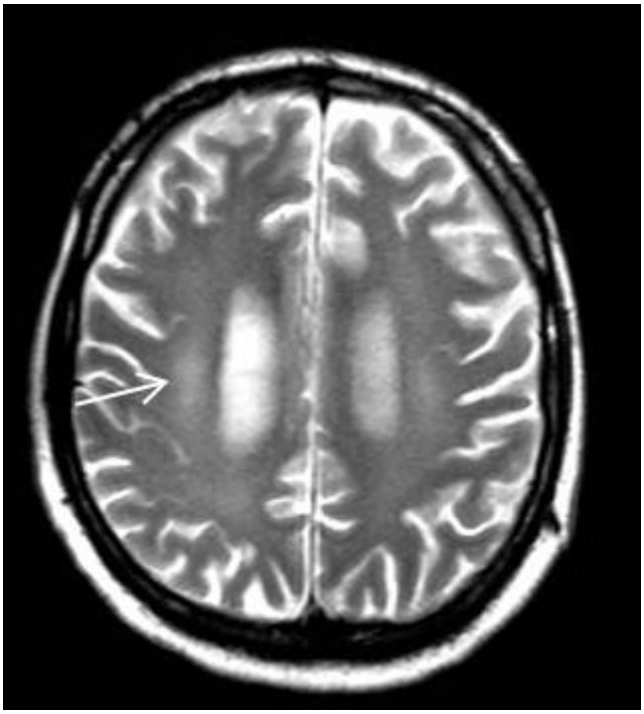
Description: T2 weighted axial images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

c



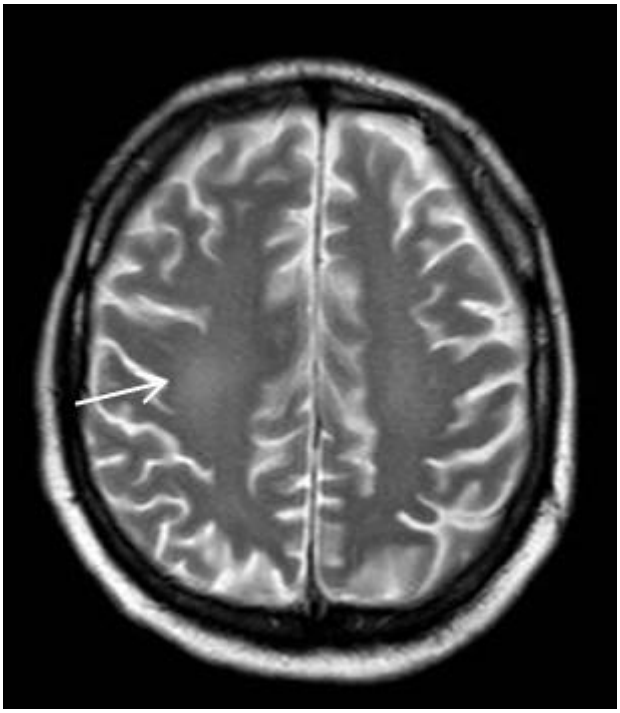
Description: T2 weighted axial images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

d



Description: T2 weighted axial images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

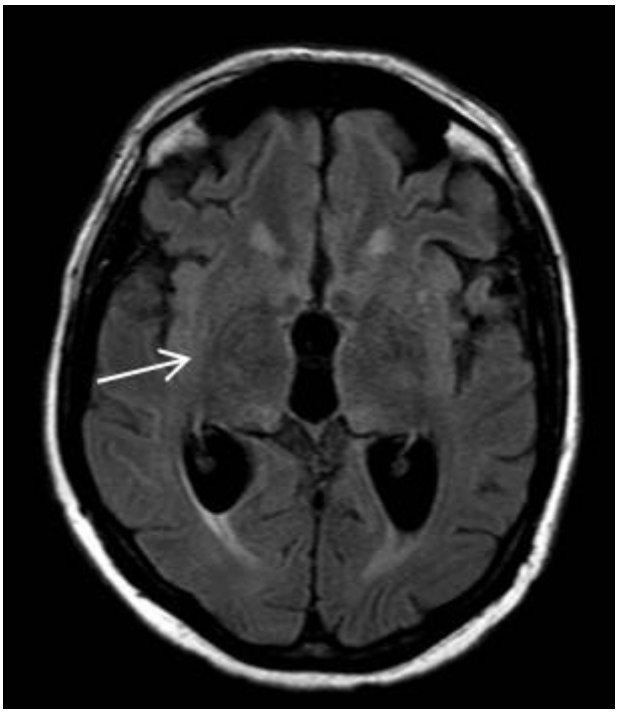
e



Description: T2 weighted axial images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

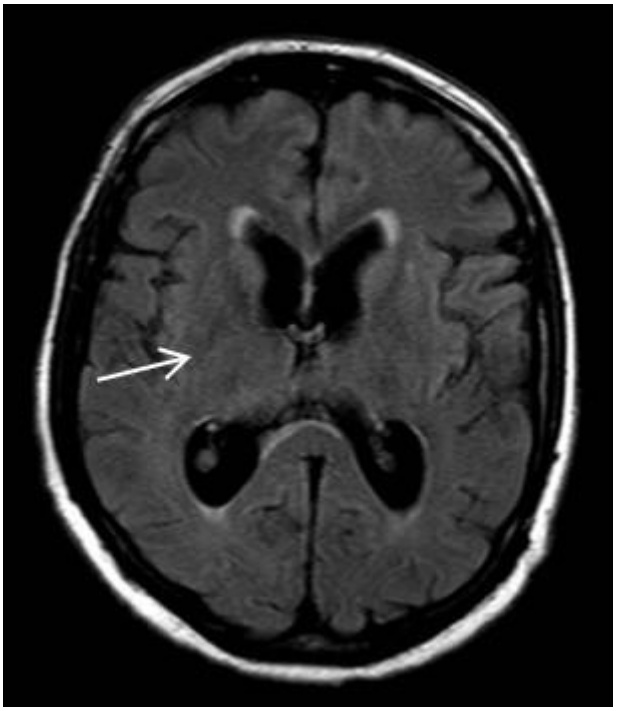
Figure 5

a



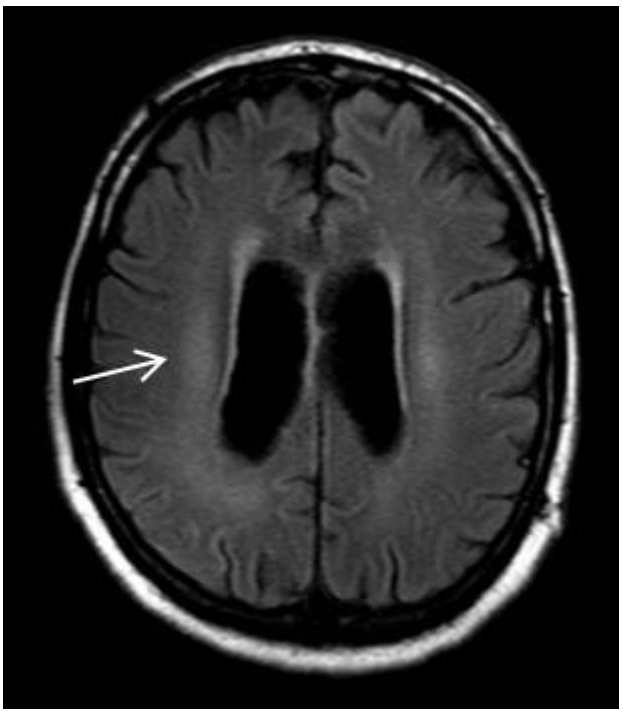
Description: Axial FLAIR images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

b



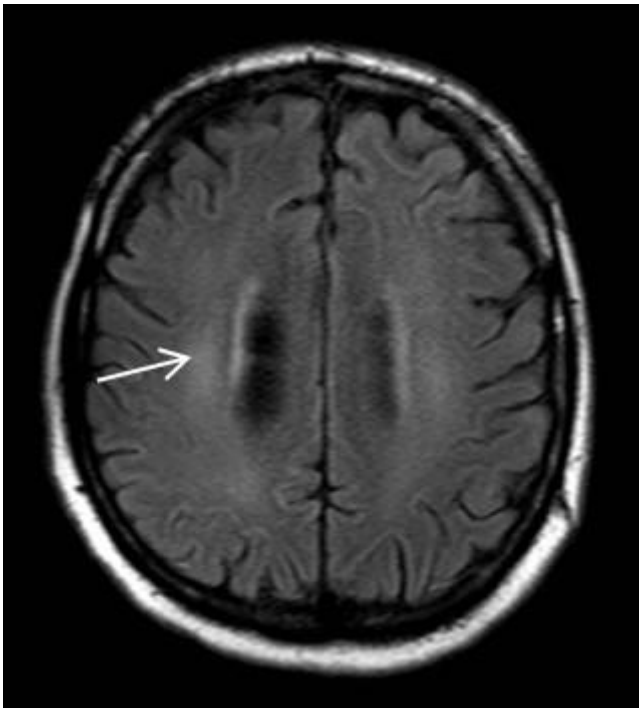
Description: Axial FLAIR images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

c



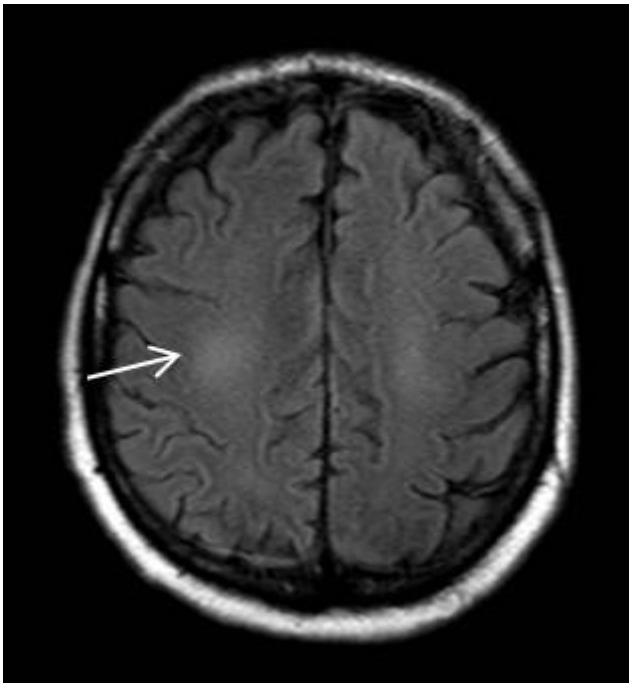
Description: Axial FLAIR images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

d



Description: Axial FLAIR images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

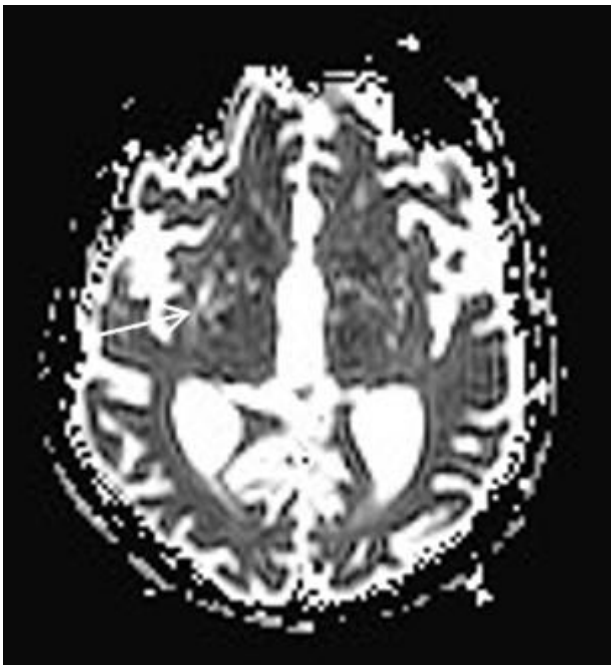
e



Description: Axial FLAIR images demonstrate the previous affected regions with persistent hyperintensity and mild ex vacuo dilatation of the lateral ventricles (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

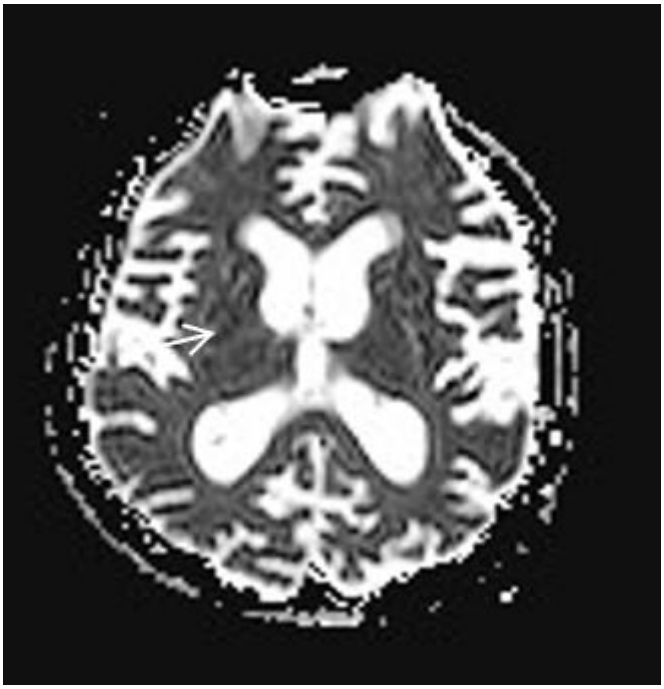
Figure 6

a



Description: ADC maps show quite “normal” or slight hyperintense signal in the previous affected regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

b



Description: ADC maps show quite “normal” or slight hyperintense signal in the previous affected regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

c

Description: ADC maps show quite “normal” or slight hyperintense signal in the previous affected regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

d

Description: ADC maps show quite “normal” or slight hyperintense signal in the previous affected regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.

e

Description: ADC maps show quite “normal” or slight hyperintense signal in the previous affected regions (arrows). **Origin:** Department of Clinical Radiology, University Hospital of Ioannina, Greece.