Case Report

Posterior reversible encephalopathy syndrome (PRES): Should more attention be paid to the atypical forms?✩

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Abstract

Posterior reversible encephalopathy syndrome (PRES) is an uncommon, but important, pathology affecting primarily the posterior cerebral circulation. Typical imaging features include vasogenic edema involving the bilateral occipital and parietal lobes. We report 4 cases of atypical PRES: The first one is a 59-year-old woman with a medical history of diabetes and hypertension who presented a consciousness disorder. MRI of this patient revealed signal abnormalities in the thalamus, the cerebellum, the brainstem and the corpus callosum with microbleeds and vascularization disorders. The second patient is a 41-year-old woman admitted for right hemiparesis and facial paralysis. Physical examination found a hypertension and the atypical imaging features on MRI were low ADC values with a pearl necklace appearance on ARM sequences. The third patient is a 32-year-old woman who underwent a surgery for an ectopic pregnancy and went in a coma for 8 days. Physical and biological parameters were normal. Diagnosis was delayed because of atypical signal abnormalities in caudal and lentiform nuclei that worsened on follow-up MRI, resulting in a dramatic evolution to bilateral cecity and psychosis. The last case is a 34-year-old woman with terminal renal failure hospitalized for spontaneously resolving tonic-clonic seizures. Biology showed high uremia and brain MRI revealed a gyriform enhancement at gadolinium injection with unilateral putamen lesion. The patient improved after blood purification. Knowledge of these atypical findings can help the radiologist make an accurate, timely diagnosis, and improve patient care.

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Introduction

Posterior reversible encephalopathy (PRES) is a radio-clinical entity reflecting a neurotoxic state mainly linked to hypertension. However, many etiologies are reported: toxic, metabolic and infectious. The pathophysiology is still controversial. If the radio-clinical association, the typical posterior location and the reversibility allow the diagnosis, atypical forms are not rare and constitute a challenge for the neuroradiologist.

The objective of our study is to report, through diagnosed cases in the neuroradiology department of the Specialties Hospital of Rabat, the atypical manifestations of PRES imaging, to recall its clinical and radiological presentation and to illustrate in imaging these cases to improve their management.

Case report

Case 1

A 59-year-old woman with a medical history of diabetes and hypertension who presented to emergency department with a consciousness disorder. Her blood pressure was 170/100 mmHg and her physical examination was normal including blood glycemia. Brain Computed Tomography (CT) was normal. Brain Magnetic Resonance Imaging (MRI) showed white matter abnormalities in temporal and occipital regions, in corpus callosum, in brainstem and cerebellum, these lesions were hyperintense in DWI with a low ADC value (Figs. 1A-C). On susceptibility-weighted images (SWI), microbleeds were identified and ARM showed an interruption of vascularization at the junction of the second and third portions of the posterior cerebral artery (Fig. 1D). The patient was made under observation and antihypertensive drugs. Her illness course was marked by progressive recovery.

Case 2

A 41-year-old woman with no medical history, presented with a right hemiparesis and central facial paralysis. Physical examination revealed high blood pressure of 180/110 mmHg and biological tests were normal. Brain MRI showed an abnormal signal on DWI with low ADC values associated with a pearl necklace aspect at ARM sequences (Figs. 2A,B). Two weeks later, a follow-up MRI was performed in front of the partial recuperation, it demonstrated the resolution of signal abnormalities (Fig. 2C). Symptoms improved months later and the patient was made under antihypertensives.

Case 3

A 32-year-old woman with a medical history of surgery for an ectopic pregnancy a month ago was admitted for a coma which lasted 8 days. Physical examination and blood parameters were normal. Brain MRI was performed with additional 3D CISS sequences, it demonstrated signal abnormalities in the gray nuclei on FLAIR and T2WI with no other abnormalities on the other sequences (Fig. 3A). PRES syndrome was not raised at first, the patient was treated symptomatically in the intensive care unit and in front of persistent coma, another follow-up MRI was performed showing the extension of lesions to the white matter at the level of the splenium of corpus callosum (Fig. 3B). The patient outcome was of poor prognosis marked by a bilateral cecity, a cophosis and a psychosis. She was followed in a psychiatric unit.

Case 4

A 34-year-old woman with terminal renal failure under dialysis was admitted for generalized tonic clonic seizures which spontaneously stopped few minutes later. Physical examination with blood pressure was normal. Biological analyses identified high uremia of 0.60 g/l and creatininemia of 20 mg/dl. Brain MRI demonstrated atypical signal abnormalities in the left putamen on FLAIR and T2WI associated with a cortical enhancement at FLAIR and T2WI with a possible focal deficit.

Discussion

Posterior reversible encephalopathy syndrome, initially described by Hinchey in 1996, commonly called hypertensive encephalopathy or reversible posterior cerebral edema, is a neurotoxic condition characterized by headaches, confusion, nausea, vomiting, generalized tonic-clonic seizures with sometimes a status epilepticus, disturbances of consciousness ranging to coma, visual disturbances with possible focal deficits.

The predisposing factors and those associated with the occurrence of PRES can be summed up mainly in arterial hypertension (HTA), pre-eclampsia and eclampsia with the possibility of occurrence several weeks postpartum (trophoblastic retention?), chemotoxic and immunosuppressive drugs, especially in the course of allogeneic bone marrow transplants, sepsis and states of infectious shock, in particular by gram-positive bacilli, autoimmune disorders such as during SLE, Wegener, scleroderma and metabolic disorders.

The pathophysiological mechanisms seem imperfectly elucidated with, until today, 2 controversial theories: one of a cerebral vasospasm contributing to the ischemia and the cytotoxic edema in the peripheral arterial zones due to an increase in blood pressure (which could explain the diffusion anomalies with low ADC in atypical cases). The second theory is that of a loss of self-regulation mechanism when the blood pressure increases beyond a threshold value, which under normal conditions leads to vasoconstriction preventing cerebral hyperperfusion. This would therefore better explain the posterior predilection where the action of the sympathetic system is weaker.

The typical aspects of PRES on imaging include abnormalities of white and gray matter in hypo or iso-signal T1, hypersignal T2 and FLAIR WI whose enhancement is inconstant with high ADC reflecting the vasogenic edema of toxic endothelial damage. The locations are diffuse; cortical, subcortical and deeper in the brain, listed in a decreasing order as parieto-occipital (98%), frontal (68%), temporal (40%), and cere-
Fig. 1 – Case 1: Brain MRI according to sagittal FLAIR image (A) makes evidence of atypical localizations in the thalamus, the cerebellum, the brainstem, and the splenium of corpus callosum (White arrow). Axial SWI (B) showing microbleeds (White arrow). Low ADC values are identified (C) with interruption of vascular flow in the Posterior cerebral artery on angiographic sequence (ARM) (D) (white arrows).

bellar (30%) with 3 aspects described: holohemispheric, at the level of the sulcus superior frontal and predominant parieto-occipital. Angio-MRI translates vascular involvement in the form of alternating areas of vasoconstriction and vasodilatation generating a pearl necklace appearance. Perfusion sequences reveal a slight decrease in cerebral blood volume (reflecting hypoperfusion with vasogenic edema which seems less significant in chronic hypertensives due to adaptive phenomena).

Atypical imaging damage, however, no longer seems to be a really rare and can sometimes be the cause of a diagnostic delay leading to sequelae and irreversibility. It includes seat atypia with lesions of the basal nuclei (14%), of the brainstem (13%), of the deep white matter (10%) especially in the splenium of the corpus callosum or unilateral involvement. The other unusual aspects are an enhancement on injection of the contrast product which can be explained by an alteration of the blood barrier with a progressive loss of cerebral regulation or even a restriction of the diffusion such is the case of some of our patients with a low ADC reflecting a cytotoxic edema. Hemorrhage is a rare aspect observed in less than 30% of PRES cases, seen in one of our patients, with 3 incidences similarly reported as focal hemorrhage <5 mm, intraparenchymal or subarachnoid sulcal. This risk seems greater in subjects who have undergone an allogeneic transplant or on anticoagulants [4,5].

If the typical clinico-radiological presentation restricts the range of differential diagnoses, the atypical aspects raise more. These remain dominated by an acute cerebral stroke which, however, is systematized in a vascular territory, cerebral venous thrombosis whose involvement is diffuse, asymmetrical with possible hemorrhagic complication. The others are more diffuse, such asymmetrical post-infectious or vaccinal ADEM-type, autoimmune disorders with variable ADC and often nodular or circular enhancement, as well as pontine encephalopathies secondary to metabolic disorders [6].
Fig. 2 – Case 2: Axial DWI (A) showing a restriction of diffusion in the central sulcus with a low value of ADC (B) (White arrows) and a pearl necklace appearance on ARM sequence (C) (arrowheads). Follow-up MRI (D) making evidence of the total reversibility of the same lesions.

Fig. 3 – Case 3: Brain MRI according to axial FLAIR images showing bilateral asymmetric caudal and lentiform nuclei lesions (A) in hypersignal with a diffuse extension to the splenium of corpus callosum on follow-up MRI (B) (arrows).

Fig. 4 – Case 4: Axial T1 brain MRI with gadolinium injection identifying a gyriform enhancement (arrows) (A) with atypical locations in the left putamen nucleus in hypersignal FLAIR (head arrow).
When the diagnosis is made on time, clinico-radiological reversibility is the rule. Treatments are based on antihypertensives and anti-epileptics associated with the suppression of the causative agent. However, some patients may present with recurrent cases of PRES when blood pressure is incorrectly controlled or when the continuation of some immunosuppressive drugs is necessary.

**Conclusion**

PRES is a neurotoxic entity with easy clinical and radiological diagnosis when the presentation is typical. Atypical forms are numerous and should not be ignored by the radiologist who must be made aware of them, particularly during unilateral involvement, atypical site, diffusion restriction, contrast enhancement or even hemorrhage.

**Patient consent**

Consent of the 4 patients was obtained to publish the article.

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