

CASE REPORT

Posterior reversible encephalopathy syndrome revealing renal artery stenosis in a child

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SUMMARY

A 14-year-old girl was admitted to the emergency department for repeated seizures with no fever. High blood pressure at admission was ascribed to the status epilepticus. Seizure recurrence promoted transfer to the paediatric intensive care unit. The MRI visualised bilateral, subcortical, white-matter lesions in the parietal and occipital lobes suggesting posterior reversible encephalopathy syndrome (PRES). Continuous nicardipine infusion corrected the hypertension and neurological manifestations within a few hours. The diagnostic workup showed right renal artery stenosis. Blood pressure returned to normal values for age after right nephrectomy. She was discharged home without treatment. She had no residual neurological impairments. This case highlights the risk of misinterpreting sustained hypertension in children with repeated seizures. We briefly review paediatric PRES, which is rare as compared to adults. Increased awareness among critical care physicians, together with greater availability of cerebral MRI, is decreasing the time to diagnosis.

BACKGROUND

- ▶ Underdiagnosis of hypertension is frequent in childhood and typically occurs in emergencies. Underdiagnosis is due to the low prevalence of paediatric hypertension, frequent lack of knowledge of normal values and difficulty of blood-pressure measurement.
- ▶ Hypertension is very common in status epilepticus and must be monitored closely to verify resolution after seizure control.
- ▶ In contrast, PRES is very rare in children compared to adults.
- ▶ Paediatricians must be alert to PRES when evaluating patients who have neurological symptoms such as headaches, seizures and visual abnormalities with high blood pressure.
- ▶ Paediatricians must rule out kidney disease in children with PRES, in addition to all other causes (eg, chemotherapy and bone marrow transplantation).

CASE PRESENTATION

A 14-year-old girl with an unremarkable medical history was admitted to the paediatric emergency department after two seizures at home in the last 20 min. She had a one-week history of nausea and headache, and a more recent onset of blurred vision, unsteadiness and abdominal pain, without fever. Both seizures were focal, starting in the right lower limb and then becoming generalised; they

were accompanied by transient loss of consciousness and stopped spontaneously within 5 min.

On admission, she had a third seizure with the same clinical presentation and duration, which stopped after intrarectal diazepam. Her weight was 65 kg, body temperature was 37.4°C, heart rate was 145/min, blood pressure was 150/100/115 mm Hg and glycaemia was 8.8 mmol/L. She quickly regained subnormal consciousness. A detailed neurological evaluation showed normal vision and oculomotor tests and a mild pyramidal syndrome; balance could not be assessed. End of physical examination was normal except for hypertension, which was ascribed to repeated seizures. One hour later, a fourth generalised tonic-clonic seizure that lasted for 10 min was followed by unconsciousness prompting her transfer to the paediatric intensive care unit. She received intravenous diazepam and phenytoin, treatments for potential intracranial hypertension (invasive ventilation, mannitol injection and moderate fluid restriction), probabilistic antibiotic therapy and acyclovir.

INVESTIGATIONS

- ▶ Standard blood tests, including glycaemia and calcaemia, were normal.
- ▶ Lumbar puncture was deferred due to clinical severity.
- ▶ Cranial (CT) was the emergent brain-imaging investigation because an MRI was unavailable. Two intra-axial hypodensities involving the subcortical white matter of the left posterior parietal lobe were seen, with no mass effect or contrast enhancement.
- ▶ MRI showed bilateral, subcortical and white-matter lesions in the parietal and occipital lobes generating low signal on T1-weighted images and high signal on T2-weighted images, with a high apparent diffusion coefficient and no contrast enhancement
- ▶ (figure 1A).

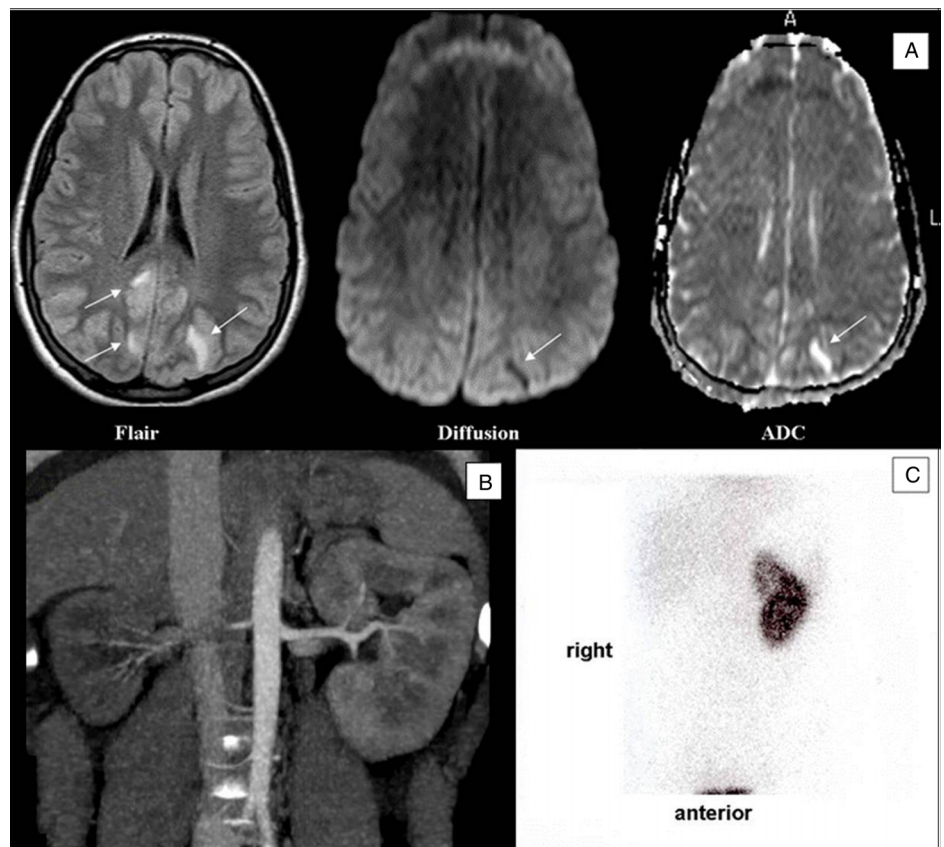
These findings, together with neurological manifestations and severe hypertension, suggested PRES.

Results of diagnostic investigations were as follows:

- ▶ Funduscopy was normal;
- ▶ Echocardiography showed isolated left ventricular hypertrophy;
- ▶ Doppler ultrasonography evidenced right renal atrophy without arterial flow and compensatory hypertrophy of the left kidney;
- ▶ Abdominal CT angiography visualised an isolated tight stenosis of the right renal artery (figure 1B); and

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Figure 1 (A) Cerebral MRI fluid-attenuated inversion recovery sequence, axial image through the parietal lobes at the level of the lateral ventricles: high-intensity lesions in the subcortical white matter. Diffusion-weighted image: low signal intensity of the lesion on the left. Apparent diffusion coefficient (ADC) map: increased ADC indicating vasogenic oedema. (B) Abdominal CT-angiography: tight stenosis of the right renal artery with atrophy of the right kidney and enlargement of the left kidney. (C) Pre- and post-captopril isotopic renography: minimally functioning right kidney, homogeneous uptake by the left kidney.



- ▶ Post-captopril isotopic renography showed a minimally functioning right kidney and homogeneous uptake by the left kidney (figure 1C).

DIFFERENTIAL DIAGNOSIS

Our patient was deficient of the bradycardia usually associated with increased intracranial pressure or the fever that typically accompanies encephalitis. Her history was not suggestive of exposure to toxic agents.

Cerebral infarction and Guillain-Barré syndrome were among the possible diagnoses.

TREATMENT

After identification of the renal artery stenosis, a continuous nicardipine infusion was given. All neurological manifestations were resolved within 24 h. She was then switched to long-acting oral medications: nifedipine followed by amlodipine and finally, by combined amlodipine and acebutolol because of refractoriness to monotherapy. These drugs were stopped after the nephrectomy.

The aetiological treatment consisted in retroperitoneal laparoscopic nephrectomy, now considered the reference standard for nephrectomy in children, given the minimal right kidney function and likely failure of angioplasty.

OUTCOME AND FOLLOW-UP

Blood pressure returned to normal for the patient's age immediately after nephrectomy. The patient was discharged home without medications and had no residual neurological impairments. Her blood pressure and kidney function were normal 1 year later. A Doppler study showed normal arterial flow in the left kidney.

DISCUSSION

PRES, also known as reversible posterior leukoencephalopathy syndrome, is a rare disorder most frequently reported in adults. It is a clinical presentation usually combining headaches, nausea, visual disturbances, seizures, drowsiness and confusion. Paraplegia and peripheral facial paralysis have also been reported. Neuro-imaging studies show abnormalities predominating in the parieto-occipital lobes.¹ Hypertension is the most frequent cause and the main conditions associated with PRES are haematological and auto-immune diseases, haemolytic-uremic syndrome, chronic renal failure, hepatitis C, HIV infection, blood transfusion and immunosuppressive drug therapy.²⁻³

The pathophysiology of PRES is incompletely understood. When acute systemic blood-pressure elevation exceeds the auto-regulatory capacity of the cerebral vasculature, focal vasodilatation and vasoconstriction develop, particularly in arterial watershed zones, followed by blood-brain barrier disruption with fluid transudation.⁴ Imaging abnormalities predominating in the parieto-occipital lobes but involvement of the brain stem, cerebellum, frontal and temporal lobes and basal ganglia has been reported. An MRI showed hypointense lesions on T1-weighted images and hyperintense lesions on T2-weighted images. Vasogenic oedema with subsequent increases in the apparent diffusion coefficient have been observed.⁵

PRES is rare in childhood,⁶ a fact that may partly explain failures to diagnose this condition early.⁷ Our case illustrates the difficulty in interpreting hypertension in paediatric patients, particularly in emergencies. Underdiagnosis of paediatric hypertension is common due to lack of knowledge of normal values for age and a tendency to ascribe high values to factors such as pain or measurement error.⁸ Hypertensive crisis is defined as a sudden blood-pressure elevation from baseline values normal for age, gender and height.⁹ A hypertensive crisis is an

emergency when there is a risk of acute end-organ damage (central nervous, cardiovascular, or renal systems and eyes). In our patient, the diagnosis of underlying sustained hypertension was delayed because transient hypertension is common after prolonged generalised tonic-clonic seizures. Physicians must routinely check that blood pressure returns to normal values for age within a few minutes after seizure resolution.

All hypertensive emergencies must be treated by a continuous anti-hypertensive-drug infusion (which is safer than bolus injections) to obtain a controlled blood-pressure decrease. Intravenous nicardipine has been found effective and well tolerated in doses of 1–3 µg/kg/min. The aim is to obtain an initial blood pressure decrease of not more than 25% over the first 8 h followed by gradual normalisation over 26–48 h.¹⁰ The clinical and imaging abnormalities resolve rapidly as the blood pressure decreases. Although residual impairments have been reported after PRES,¹¹ most patients recover completely. Routine follow-up neuro-imaging studies are unnecessary when clinical recovery is complete; they were not performed on our patient.

In a child with PRES, investigations for an underlying disease are mandatory. Kidney and urinary tract abnormalities are the most frequently reported causes of PRES in childhood. Many children with secondary hypertension have reno-vascular abnormalities such as renal artery stenosis, whose main cause is fibromuscular dysplasia.¹² The treatment relies initially on antihypertensive drugs including a calcium channel blocker, a β-blocker, or both. An ACP inhibitor can be used if bilateral stenosis or a solitary kidney has been excluded. Percutaneous transluminal renal angioplasty may be considered when medications fail to achieve adequate blood pressure control. Additional stent implantation may be performed in the event of failed dilation or early restenosis.^{13 14} Surgical revascularisation and auto-transplantation may be required by the characteristics of the stenosis (ostial lesion, tight stenosis or extensive segmental renal artery involvement), renal failure, failed non-operative management or failed angioplasty. Nephrectomy is the best treatment for a unilateral atrophic kidney with poor function and a normal contralateral kidney, as documented in our patient.¹⁵

Learning points

- ▶ Do not neglect hypertension in emergencies, even in case of prolonged or repeated seizures. Hypertension due to seizures resolves rapidly after seizure resolution.
- ▶ Suspect posterior reversible encephalopathy syndrome (PRES) in a child with hypertension and headache, vomiting, visual disturbances, seizures, drowsiness and confusion. Absence of fever increases the index of suspicion.
- ▶ MRI is the neuro-imaging technique of choice in patients with suspected PRES.
- ▶ Start a continuous antihypertensive-drug infusion as soon as possible to gradually decrease blood pressure to normal values for age.
- ▶ Perform a comprehensive diagnostic work-up including investigations for kidney disease.

Contributors GB wrote the first version of the manuscript. CD was in the charge of this child all along her stay in hospital after discharge. She actively participated to reading and correction of the manuscript. ME performed all clinical images of this child during diagnosis procedure and wrote the radiological description and the legend of figure 1. SD designed the presentation of the manuscript and wrote according to all authors suggestions.

Competing interests None.

Patient consent Obtained.

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