CASE REPORT

Permanent Bilateral Vision Loss in Eclamptic Posterior Reversible Encephalopathy Syndrome

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ABSTRACT

Posterior reversible encephalopathy syndrome (PRES) classically consists of reversible vasogenic oedema in the posterior circulation territories, which is reversible both clinically and radiologically in the majority of patients after the control of hypertension. The authors describe a 27-year-old eclamptic patient with PRES in accelerated hypertension who revealed permanent vision loss associated with bilateral Purtscher retinopathy. One of the two competing theories that explain vasogenic brain oedema in PRES is excessive autoregulation leading to the dilation of cerebral arterial vessels, particularly in the occipito-parietal vasculatures. Dysfunction of endothelial cells that results in constriction of vessels has also been hypothesised as a cause of PRES. The concurrence of bilateral vaso-occlusive retinopathy and PRES supports the hypothesis that vasoconstriction is a more plausible mechanism of vasogenic oedema in PRES.

Keywords: Eclampsia, posterior reversible encephalopathy syndrome (PRES), Purtscher retinopathy, vision loss

INTRODUCTION

Posterior reversible encephalopathy syndrome (PRES) is a heterogeneous group of disorders most commonly seen in patients with hypertensive encephalopathy and in pregnant women with eclampsia.^{1,2} Common clinical presentations of PRES are headache, seizures, altered mental status, and retrogeniculate visual loss with scattered foci of high signal intensity without restricted diffusion reflecting vasogenic oedema.^{3,4} Although the underlying pathophysiology of PRES remains unclear,³ it is known that sudden elevations in systemic blood pressure may exceed the autoregulatory capability of the brain vasculature, leading to dilation of cerebral arterial vessels, particularly in the posterior brain regions.⁴ However, there is another competing theory that could explain vasogenic oedema that suggests that dysfunction of particular subtypes of endothelial cells may lead to constriction of cerebral arterial vessels, blood-brain barrier

breakdown, and loss of fluid from the intravascular compartment.^{5,6}

Visual disturbances such as hemianopsia, visual neglect, and cortical blindness are common and resolve rapidly both clinically and radiologically after lowering blood pressure in patients with PRES.^{3,7,8} In addition to cortical blindness due to oedema associated with PRES, the causes of visual loss in the peripartum period include retinal artery and vein thrombosis, haemorrhage, detachment of the retina, optic neuritis, psychogenic disturbances, and persistent spasm of the retinal vessels.⁹

Herein, we describe a case of eclampsia accompanied by PRES and bilateral Purtscher retinopathy, which seems to be the cause of persistent bilateral vision loss. In the setting of accelerated hypertension, the occurrence of arteriolar obstructive retinopathy in PRES offers anecdotal support for vasoconstriction as the mechanism underlying vasogenic oedema with PRES in patients with eclampsia.

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CASE REPORT

A 27-year-old woman was hospitalised with preeclampsia at 37 weeks of gestation. On admission, her blood pressure was 170/100 mm Hg and she had peripheral oedema and marked proteinuria. A laboratory workup including cell count, electrolytes, chemistry, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and coagulative status such as prothrombin and activated partial thromboplastin times and proteins C and S found that all parameters were all within normal limits. Screening for vasculitis, including antiphospholipid antibody syndrome, was negative. An electrocardiogram and echocardiography showed no abnormal findings such as atrial myxoma. After hospitalisation, the patient had two generalised tonic-clonic seizures and was treated with intravenous magnesium sulphate. She underwent a caesarean section, and her blood pressure was maintained in the range of 120–140/60–85 mm Hg during surgery. Two hours after delivery, the patient suffered another generalised tonic-clonic seizure. During the post-ictal period she complained of very poor vision in both eyes and mild headache. A brain magnetic resonance imaging (MRI) showed subcortical white matter lesions in both parieto-occipital lobes on T2-weighted and fluid-attenuated inversion recovery (FLAIR) images (Figure 1A), and there was no signal restriction on diffusion-weighted images (DWIs) and apparent diffusion coefficient (ADC) map finding indicates vasogenic oedema. MR angiography (MRA) of the brain

revealed diffuse vasospasmic narrowing at both distal internal carotid arteries and the anterior, middle, and posterior cerebral arteries (Figure 1B). Altered mental status was improved over the course of 3 days, and hypertension was controlled with MgSO₄ and nifedipine. Neuro-ophthalmologic examination revealed best-corrected visual acuity (BCVA) of hand motions in both eyes. Pupillary light responses were sluggish in both eyes but no RAPD. Intraocular pressures were 12 mm Hg bilaterally. Both maculae showed diffuse retinal whitening with a few intraretinal haemorrhages (Figure 2A). Retinal nerve fibre layer (RNFL) thickness, as measured by Stratus optical coherence tomography, was symmetric and within normal range (the mean RNFL thickness was 102.1 and 99.8 µm in each eye). Fluorescein angiography (FA) revealed evidence of capillary non-perfusion throughout the maculae and parafoveolar arteriolar vasculature in both eyes, as well as late staining of the major retinal vessels adjacent to these lesions (Figure 2B). The patient was diagnosed with Purtscher retinopathy. Two weeks after delivery, repeat brain MRI and MRA showed resolved hyperintense lesions on T2-weighted/FLAIR images and vasospasm in both cerebral arteries (Figure 1C and D). However, the patient's BCVA remained poor of hand motion even at the 3-month follow-up visit. The optic discs were pale, and the parafoveolar arteriolar vessels were attenuated (Figure 2C), and FA revealed evidence of extensive macular capillary non-perfusion with peripheral filling (Figure 2D). Her visual acuity did not change during the 2-year follow-up period.

FIGURE 1 (A) Brain MRI T2-weighted axial image through the supraventricular regions performed 2 days after symptom onset shows multiple hyperintensities in both occipital regions involving the cortex and the subcortical white matter (A, arrows). (B) Three-dimensional time-of-flight magnetic resonance angiography (MRA) shows diffuse spasm of the middle, anterior, and posterior cerebral arteries (B, arrows). (C) Repeat T2-weighted axial image after 15 days shows resolved lesions in the corresponding areas. (D) Repeat MRA shows only mild spasm of both distal middle cerebral arteries.

DISCUSSION

Preeclampsia is a disorder of pregnancy characterised by generalised endothelial cell dysfunction due to high blood pressure, leading to release of cytokines and other toxins, vasoconstriction, and platelet

activation.¹⁰ Eclampsia is the onset of seizures (convulsions) in a woman with preeclampsia. Ophthalmologic findings in preeclampsia and related syndromes consist of acute changes such as those observed in hypertensive retinopathy, including serous retinal detachment and retinal pigment

FIGURE 2 Right and left fundi (A) and fluorescein angiogram (B) on initial examination. Note multiple superficial peripapillary and macular patches of ischaemic retinal whitening, with severely narrowed retinal arterioles. There is also heavy retinal oedema. Three months after symptom onset, the right and left fundi (C) and fluorescein angiogram (D) show that perfusion and the vasculature have normalised and that retinal oedema has subsided in both eyes. However, the sequelae of retinal infarction are seen in the maculae and parafoveolar areas (arrows), and thinned retinal arterioles also resulted in optic disc pallor.

epithelial lesions secondary to choroidal ischaemia and occlusive retinal vascular disease.¹⁰ In a case of preeclampsia, reversible visual disturbances associated with retinal artery vasospasm and ischaemia were reported; in which case, retinal vasospasm during a period of visual disturbance by Doppler assessment of the orbital vasculature was demonstrated.¹¹

Severe bilateral visual loss cases attributable to multiple retinal arteriolar occlusions have been reported during peripartum, in most cases within 24 hours after childbirth.¹² Central retinal artery occlusion (CRAO) and Purtscher retinopathy share common clinical features, including retinal whitening with a possible cherry red spot, and they also have been largely described in the setting of eclampsia and childbirth.¹³ CRAO leads to severe visual disturbances and results from one or more pathological processes such as retinal emboli, vessel narrowing and thrombosis, arterial spasm, and reduction of blood flow caused by carotid or ophthalmic artery obstruction.¹⁴ However, there are features that suggest that this case may represent Purtscher retinopathy instead CRAO.¹⁵ First, retinal haemorrhages are observed in the initial fundus photos. CRAO typically does not cause retinal haemorrhage, while Purtscher retinopathy often does. Second, the angiogram shows extensive macular capillary non-perfusion with peripheral filling. This is not the typical pattern of a CRAO, which does not fill distally until very late. Third, follow-up fundus photos show macular pigment changes. CRAO usually resolves and leaves a normal macular appearance. And, finally, bilateral simultaneous CRAO is exceedingly rare, whereas bilateral simultaneous involvement is frequent with Purtscher retinopathy. Purtscher retinopathy is also a vaso-occlusive retinopathy associated with traumatic injury, acute pancreatitis, renal failure, and lupus erythematosus.^{14,15} Changes in the fundus in cases of Purtscher retinopathy are characterised by retinal whitening and cotton wool patches that are retinal micro-infarctions at the level of the nerve fibre layer.¹⁴ The pathogenesis of this disorder is uncertain but may involve arteriolar obstruction by complement-induced leukoemboli formed during parturition.

PRES related to eclampsia and visual disturbances is a common clinical presentation³ that is mostly reversible after adequate treatment of hypertension.⁷ However, in our patient, visual impairment was caused by bilateral arteriolar occlusive retinopathy rather than cortical blindness associated with PRES; thus, her vision loss persisted. Irreversible bilateral blindness due to Purtscher retinopathy associated with or concurrent development with PRES in eclampsia is rare.^{12,15} The mechanism of PRES is unclear, but emerging evidence suggests that vasoconstriction is the more likely aetiology rather than

vasodilation due to the vasogenic oedema seen in PRES related to accelerated hypertension.^{5,8,16} Brain MR studies have demonstrated significant posterior brain hypoperfusion, reduced cerebral blood volume, reduced cerebral blood flow, and a heterogeneous pattern of mean transit time on perfusion MR imaging in patients with acute hypertension.⁵ Reduced cerebral blood volume in high-signal-intensity areas of the cerebral cortex and white matter also was observed on MR perfusion studies in patients with PRES.¹⁷ In addition, as in our case, patients with PRES frequently showed diffuse vasoconstriction, focal vasculopathy, and vessel pruning of the posterior and middle cerebral arteries.⁸

Clear constriction of cerebral arteries on MRA in the current case is very similar with angiographic findings of reversible cerebral vasoconstriction syndrome (RCVS). PRES and RCVS overlap each other, and the mechanism of the vasogenic oedema cannot precisely be determined. In response to acute severe hypertension, cerebral precapillary arteriolar vasoconstriction occurs and this reaction is regulated by the endothelium through release of vasoconstrictors such as thromboxane A2 and endothelin.⁸ Overregulation, increased production of vasoconstrictors, reduced synthesis of vaso-relaxing agents such as epoprostenol and dinoprostone, and endothelial cell disorders may lead to vasospasm.¹⁶ These phenomena can also be observed in patients with eclampsia.^{16,18} Endothelial dysfunction may cause profound vasospasm and reduced organ perfusion, activation of the coagulation cascade, and loss of fluid from the intravascular compartment.¹⁹ Diffuse or multifocal segmental narrowing on conventional or MR angiography suggests vasospasm of the cerebral vasculature in PRES patients.^{16,20} Our case reversed irregular narrowing of large and medium-sized arteries on brain MRA and high signal intensity in the parietooccipital area on T2 and FLAIR MRI images, both of which are consistent with vasogenic oedema caused by vasospasm. It is not certain whether Purtscher retinopathy and PRES in our patient share the same mechanism. It might be possible that retinal vasospasm has been overlooked because it is reversible or asymptomatic while the most severe and rare form of vascular occlusion can potentially develop.

In this report, we have described a patient who developed binocular arteriolar occlusive disorder of Purtscher retinopathy in the setting of accelerated hypertension and PRES. This case suggests vasoconstriction as the underlying cause of retinal arteriolar obstruction given the additive evidence supporting vasoconstriction rather than vasodilation in the development of PRES.

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