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Case Report

POSTERIOR REVERSIBLE ENCEPHALOPATHY SYNDROME (PRES) WITH HYPERTENSIVE RETINOPATHY AND HYPERALDOSTERONISM

Chand Dhiraj Nagpal[1], Taufik Mesiano[2], Al Rasyid[2], Rakhmad Hidayat[2], Mohammad Kurniawan[2], David Pangeran[2], Salim Harris[2]

[1]Neurology Residency Program, Faculty of Medicine, Universitas Indonesia; email: chandnagpal@hotmail.com
[2]Department of Neurology, Dr. Cipto Mangunkusumo Hospital

ABSTRACT

Introduction Posterior Reversible Encephalopathy Syndrome (PRES) is a neurological syndrome with an acute or subacute onset characterized by reversible cerebrovascular dysregulation. Hypertension is the primary risk factor for PRES, however other conditions such as hyperaldosteronism accompany and precipitate PRES.

Case Summary This case illustrates a 32-year-old man without prior medical history with loss of consciousness and seizures 1 day prior to admission with blurry vision and vomiting 2 weeks prior that progressed gradually. Brain MRI revealed vasogenic edema of bilateral occipital lobes. The patient was assessed for hypertensive retinopathy and suspected primary hyperaldosteronism. Management with anti-hypertensives, anti-epileptic medications, electrolyte correction and supportive therapy was given, and the patient improved gradually and was discharged 10 days later without any complications.

Discussion No diagnostic criteria are available for PRES, however brain MRI is the crucial to establish a diagnosis of PRES. The resolution of symptoms with blood pressure regulation is another validation of the diagnosis of PRES. Ruling out differentials is prudent to ensure appropriate therapy. Management of PRES encompasses blood pressure regulation, anti-epileptic medications, treating other causes such as drug exposure and metabolic disorders. Previous reports PRES due to secondary hypertension attributed to primary hyperaldosteronism have been reported, although evidence about this causality is limited, nonetheless must be explored and treated as a cause of the hypertension triggering PRES.

Conclusion PRES is a neurological syndrome that is reversible, with hypertension as the primary risk factor that could be secondary due to disorders like primary hyperaldosteronism, that could ultimately trigger PRES.

Keywords: Posterior reversible encephalopathy syndrome (PRES); magnetic resonance imaging (MRI); hyperaldosteronism; occipital

INTRODUCTION

Posterior Reversible Encephalopathy Syndrome (PRES) is a neurological syndrome with an acute or subacute onset characterized by reversible cerebrovascular dysregulation. [1] It is most commonly attributed due to hypertension, which leads to hyperperfusion, blood brain barrier dysfunction and vasogenic edema.[1,2,3] Other etiologies such as drug exposure, preeclampsia, eclampsia and metabolic conditions such as hyperaldosteronism precipitate PRES. Clinical

manifestations most commonly appear as headaches, altered mental status, seizures, visual disturbances, nausea, vomiting and other focal neurological deficits.[4,5,6] No diagnostic criteria is available for PRES, however brain MRI, especially T2-weighted, DWI and FLAIR sequences that depict vasogenic oedema of bilateral occipital lobes is the backbone to establishing a diagnosis of PRES.[1,4,5,7,9] Ruling out differentials is prudent to ensure appropriate therapy. Management of PRES encompasses blood pressure control, rectifying other causes such as drug exposure and metabolic disorders, anti-epileptic medications, electrolyte correction, managing cerebral edema and symptomatic therapy.[4,5,8,9] The resolution of symptoms with blood pressure control is another validation of the diagnosis of PRES.[9] Most patients experience complete resolution, while others persist to have some neurologic complications such as epilepsy. Mortality rate is reported at 16%.[10]

CASE REPORT

A 32-year-old patient was brought to the emergency department with loss of consciousness 8 hours prior to admission. Two weeks prior to admission, the patient started experiencing nausea and vomiting up to 10 times a day and fever. He visited a local clinic and was treated symptomatically and his symptoms subsided temporarily. One week later, the patient complained of vomiting and blurry vision that gradually worsened, with elevated systolic blood pressure 180mmHg and was started on Amlodipine 10mg once a day. One day prior to admission, he started feeling drowsy, and experienced two episodes of seizures. He was rushed to a nearby hospital, and a brain CT scan was performed and showed a lesion suspected as a mass, and was referred to our centre.

Upon arrival, the patient appeared delirious and had fever. No other symptoms such as one-sided weakness, headache, lopsided lips or slurred speech were reported, neither did he have a history of seizures and past medical history was unremarkable. On physical examination, blood pressure was 190/110mmHg, pulse 98x/min, respiratory rate 20x/min, temperature 38.6°C and oxygen saturation 100% on O2 3lpm nasal cannula. On neurologic examination GCS was E3M5V3, reactive pupils, hemiparesis of the left side, positive

bilateral Babinski reflexes without signs of meningeal irritation or cranial nerve involvement. Laboratory studies revealed blood leukocytes 13,710 cells/uL, random blood glucose 209mg/dL, serum ureum 64.2 mg/dL, creatinine 2.0mg/dL, eGFR 44.6 ml/min/1.73m^2, procalcitonin 0.75 ng/mL, D-Dimer 2370 ug/L, and albumin 3.3g/dL. His previous brain CT scan revealed vasogenic edema of bilateral occipital lobes without signs of herniation or hemorrhage. A non-contrast brain MRI-MRA was depicted symmetrical vasogenic edema of the white matter of bilateral occipital lobes that was suggestive of posterior reversible encephalopathy syndrome (PRES). MR angiography revealed no vascular malformations, stenosis or occlusion. Carotid Duplex revealed high peripheral resistance of both common carotid arteries, left internal carotid artery and left vertebral artery. Cardiovascular assessment was unremarkable. The patient was diagnosed with posterior reversible encephalopathy syndrome (PRES). Electroencephalography indicated asymmetry and rhythmic slow activity of bilateral fronto-temporal lobes.

The patient was treated with anti-seizure medications valproic acid 2000mg loading dose followed by 2x1000mg (40mg/kgBW) PO, mannitol 4x125ml IV, anti-hypertensive medications ramipril 1x10mg, amlodipine 1x10mg and nifedipine 1x30mg. Electrolyte correction was initiated. Prior to electrolyte correction, his urinary potassium to creatinine ratio of 13 mEq/g suggested renal loss with high blood pressure that reflects excess mineralocorticoids that is consisted with primary or secondary hyperaldosteronism. Ophthalmologic evaluation reported obliteration of optic disc margins, reduced macular reflex, soft, erythematous exudate, ‘copper-wiring’ appearance and dot blot hemorrhages indicative of bilateral grade 4 hypertensive retinopathy.

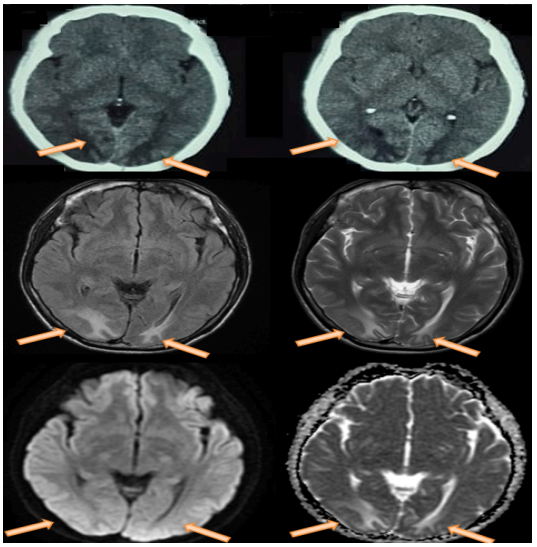

Figure 1. Neuroimaging reveals hypodense lesions with "finger-like appearance" in bilateral temporooccipital lobes suggestive of vasogenic edema on CT brain without contrast (top left and top right). MRI brain without contrast reveals, showing hyperintense lesions of bilateral occipital lobes without any mass effect or herniation on T2 FLAIR (mid left), T2 (mid right), DWI (bottom left) and ADC (bottom right) sequences, consistent with vasogenic edema and indicative of PRES.

Three days after his admission, he regained consciousness, did not experience seizures and by his sixth day, his blurry vision was restored to normal. Renal function tests improved with serum ureum 23.5 mg/dL, creatinine 1.0mg/dL, eGFR 102.6 ml/min/1.73m^2 without hemodialysis and only with blood pressure control. The patient was eventually discharged ten days after his admission without any symptoms, and his anti-seizure and anti-hypertensive medications were continued.

Upon follow-up to the neurology clinic, the patient had no symptoms or seizures, normal neurological examination and cognitive function test was unremarkable. A follow-up EEG still had a degree of focal delay of bilateral temporal lobes, his anti-epileptic medications were tapered off and the patient continued his daily routine without any symptoms.

DISCUSSION

Posterior Reversible Encephalopathy Syndrome (PRES) is a neurological syndrome with an acute or subacute onset is characterized by reversible cerebrovascular dysregulation that can occur in all age groups.[1]

There are two reported pathophysiological mechanisms; hyperperfusion theory where elevated blood pressure disrupts

autoregulation of blood vessels causing sustained arteriolar dilation, increased capillary hydrostatic pressure, consequently disrupting the blood brain barrier and cerebral blood flow, leading to vasogenic edema.[1,2,3,4] Hypoperfusion occurs in cases of altered vascular tone and vasoconstriction due to endothelial dysfunction in sepsis and inflammation, increasing permeability and causes vasogenic edema.[2,3,4] Hypoxia releases VEGF, increasing permeability, leading to vasogenic edema.[5] The occurrence of PRES in occipital lobes is due to lesser sympathetic innervation in posterior areas that makes it more susceptible to blood pressure changes and hypertension-related damage, resulting in vasogenic edema.[1,4]

A recent update on PRES revealed that arginine vasopressin (VAP) could be a crucial component in the pathophysiology of PRES, where excessive activation of cerebral V1a receptors may lead to endothelial dysfunction, cerebral vasoconstriction that may lead to ischemia. Hyperstimulation of AVP also occurs with other conditions such as drug or toxin exposure, metabolic conditions such as preeclampsia, eclampsia, transplantations and other etiologies.[6] In cases of PRES, there are four patterns of vasogenic edema based on location, namely; the classic parieto-occipital pattern involving near the border zone between middle cerebral artery (MCA) and posterior cerebral artery (PCA) affecting parietal and occipital lobes as seen in this patient. Other patterns include watershed areas of the superior frontal gyrus predominantly affecting watershed zone between anterior cerebral artery (ACA) and MCA, holohemispheric watershed pattern affecting large areas of both hemispheres affecting ACA-MCA, and central pattern involving deep white matter structures, basal ganglia, thalamus and brainstem.[5] The pattern nor extent of edema are strongly correlated to the severity of clinical presentation.[6]

Although the most common risk factors are hypertension (76.4%) and drug consumption, there are other conditions that can be regarded as risk factors such as dysautonomia, subarachnoid hemorrhage, preeclampsia, eclampsia, renal disease and endocrine disorders.[7,8] About 50 – 55% of PRES patients are observed to have impaired renal function and in some cases are suspected to be precipitated due to end-stage renal

disease (ESRD), however it is still unclear whether this dysfunction is due to the elevated hypertension or as the primary causal factor for PRES.[1,7,8] Seizure occurrence in PRES is suspected to occur due to cortical irritation consequent to vasogenic edema that disrupts blood-brain barrier, thereby suggesting that PRES is not just a subcortical pathologic disease.[9]

Some endocrine disorders such as pheochromocytoma and primary aldosteronism can lead to secondary hypertensive encephalopathy that can lead to PRES.[7,8,10]

Previous reports of PRES with chronic and poorly controlled hypertension were further evaluated for secondary hypertension attributed to primary hyperaldosteronism (Conn Syndrome). Although the clinical development of PRES was characteristic, MRI scans showed restricted diffusion indicating cytotoxic edema of temporo-parietal regions, and serial MRI scans with diffusion-weighted imaging (DWI) showed progression of these lesions indicating possible a metabolic etiology. Further work-up with decreased plasma renin levels, elevated aldosterone and decreased potassium levels and adrenal lesion on abdominal CT scan were indicative of primary hyperaldosteronism. The presence of an extracranial pathology that contributes to chronic hypertension may delay the recovery of PRES and contribute to morbidity and neurologic complications.[10]

Clinical manifestation of PRES are headaches (50.6%), altered mental status (43.7%), seizures (41.9%), visual disturbances (34.9%), nausea/vomiting (23.4%) and focal neurological deficits (18.2%).[7] Headaches are the most frequent and initial symptom, described most commonly as pulsating or throbbing. Seizures mostly described as generalized tonic-clonic or focal onset to generalized tonic-clonic seizures. One-sided weakness and slurred speech are the most common focal neurologic manifestations reported.[7] Symptoms typically last from a few hours to several days or weeks, and resolution of symptoms happens as blood pressure is controlled or the causative drug is retracted.[7] Blurred vision, visual field defects, cortical blindness and visual hallucinations are some of the ocular manifestations in PRES that is consequent of vasogenic edema of the parieto-occipital regions of the brain.[1,7,10] Ocular manifestations are mostly bilateral, and fundoscopy is an important examination for

assessing hypertensive retinopathy with signs such as cotton-wool spots, hemorrhages, obliteration of optic cup borders and edema of optic disc, because ocular manifestations persist in about 10-20% of all patients.[10,11]

No diagnostic criteria is available for the diagnosis of PRES, and although the alleviation of clinical manifestations after the control of blood pressure enforces the diagnosis of PRES, neuroimaging is the primary key to establishing a diagnosis of PRES.[1,3,7] Diffusion weighted imaging (DWI) combined with apparent diffusion coefficient (ADC) help differentiate cytotoxic from vasogenic edema that is important for differentiating PRES from ischemic lesions.[12] Common radiologic findings of PRES on brain MRI are hyperintense lesions relatively symmetric at subcortical and cortical levels in bilateral occipital lobes, hyperintense T2-weighted and FLAIR sequences and increased ADC values reflective of vasogenic cerebral edema is characteristic of PRES.[1,7,8,12] MRI can also be used to determine cerebral edema grading. Mild PRES is defined as cortical or subcortical white matter edema without signs of hemorrhage, mass effect, herniation and minimum involvement of one of the structures cerebellum, brainstem or basal ganglia.[12] About 95% of all patients present with vasogenic edema of the cortical and subcortical areas of parieto-occipital region. Differentiating PRES from other differentials such as watershed infarction, basilar artery syndrome, cerebral vein thrombosis, leukoencephalopathy, CNS vasculitis, meningoencephalitis, malignancies and hypoxic ischemic encephalopathies is important to ensure appropriate and timely treatment.[7,12] Lumbar puncture is not commonly performed or reported in literature as a work-up for PRES, however it is performed to rule out other differentials.[4]

Seizures usually present as generalized seizures and require antiseizure medications.[3] EEG findings in PRES usually depict generalized slowing, additional abnormalities such as epileptiform discharges, focal slowing with or without epileptiform discharges, or other lateralized discharges. Patients with resolution of seizures and discontinuation of epileptic drugs may still depict generalized or focal slowing.[12] Clinical evidence showing EEG patterns associated to clinical severity and prognosis in PRES are scarce, therefore epileptogenesis due to vasogenic

edema in PRES is not well established.[9] Long-term outcomes in a case series showed that recurrent seizures occurred in 3% of patients, and 1% of patients developed epilepsy.[1]

The primary aim of treatment is to treat the and control underlying cause, as well as supportive therapy. Treatment is targeted towards blood pressure regulation, withdrawal of cytotoxic drug exposure, managing seizures with antiepileptics, brain edema, delivery or C-section to overcome pre-eclampsia with or without HELLP syndrome, correction of metabolic conditions such as electrolyte correction and hemodialysis if required and other symptomatic treatment. Hypertension is the most common risk factor for developing PRES, and managing blood pressure is a pivotal aspect of its treatment. There are no randomized controlled trials or guidelines that devise blood pressure treatment in PRES; however some studies have reported that blood pressure should be reduced up to 20% within the first 24 hours of onset. Anti-hypertensives should be initiated immediately if systolic blood pressure exceeds 160 mmHg and/or diastolic blood pressure exceeds 105-110 mmHg. In cases of blood pressure above 200 mmHg with end-organ damage, or 220 mmHg without end-organ damage, anti-hypertensive treatment should be more aggressively reduced.[13] Blood pressure should not be reduced too aggressively due to risk of hypoperfusion and cerebral ischemia. First-line anti-hypertensive medications are calcium channel blockers such as nicardipine or nimodipine, because apart from reducing blood pressure, it also has capabilities for preventing cerebral vasospasm. Additionally, beta-blockers such as labetalol maybe used. Second-line treatment such as sodium nitroprusside or hydralazine maybe used. Nitroglycerin however must be avoided due to vasodilation effect, that could exacerbate vasogenic edema. [14] First-line anti-seizure medications that have been recommended are benzodiazepines such as lorazepam or diazepam. Second-line anti-seizure medications recommended are phenytoin or valproic acid, especially in cases of status epilepticus. Recent reports have also shown levetiracetam to be extremely effective in managing seizures in PRES. In pregnant women with conditions such as preeclampsia and eclampsia, magnesium sulphate

must be used. [14]

Up to 70% of patients may require ICU initially.[1,7,15] Corticosteroids are commonly used for treating vasogenic edema, however the use of corticosteroids in treating vasogenic edema in PRES still remains unclear and no guidelines are available for recommending of corticosteroids in PRES. Multiple models and previous studies have shown that the use of corticosteroids was not associated or has a weak association with reduced severity of vasogenic edema in PRES, nor has it shown to improve the extent of edema.[16] Prognosis is favourable if the underlying cause is treated promptly with good outcome in 56% of patients, 37% with some level functional impairments and mortality rate has been reported in upto 16% of patients.[15]

CONCLUSION

PRES is a neurological syndrome that is characterized by reversible cerebrovascular dysregulation, with hypertension as the primary risk factor. PRES due to secondary hypertension attributed to primary hyperaldosteronism have been reported, although evidence about this causality is limited, nonetheless must be explored and treated as a cause of the hypertension that can trigger PRES. Hypertensive retinopathy is one of the possible manifestations that could occur and is attributed to hypertension, however interestingly ocular manifestations may return back to normal once the etiology has been treated. Establishing a diagnosis is crucial to rule out other differentials and initiate appropriate therapy. Blood pressure management is crucial, however no definitive treatment guideline is available for PRES. Corticosteroid use for reducing vasogenic edema is not recommended in cases of PRES. Anti-epileptic medication is required in cases of seizures, and ICU treatment may be required initially.

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REFERENCE

1. Geocadin RG. Posterior Reversible Encephalopathy Syndrome. N Engl J Med. 2023; 388:2171-8. Doi:10.1056/NEJMra2114482
2. Lim JH, Kim SH, Mo C, et al. Clinical features and outcomes of posterior reversible encephalopathy syndrome after heart transplantation: a case series. Clin Transplant Res. 2024; 38:154-162. https://doi.org/10.4285/ctr.24.0009
3. Ali K, Karan A, Biswah S, et al. Posterior Reversible Encephalopathy Syndrome: Tips for Diagnosis and Treatment. Cureus. 2021; 13(3): e14087. DOI 10.7759/cureus.14087
4. Granata G, Greco A, Iannella G, et al. Posterior reversible encephalopathy syndrome-Insight into pathogenesis, clinical variants and treatment approaches. Autoimmunity Reviews. 2015;14:830-36.
5. Alzahrani Y. Pediatric Posterior Reversible Encephalopathy Syndrome: A Review with Emphasis on Neuroimaging Characteristics. Cureus. 2023; 15(12): e51216. DOI 10.7759/cureus.51216
6. Largeau B, Bergeron S, Auger F, et al. Experimental Models of Posterior Reversible Encephalopathy Syndrome: A Review from Pathophysiology to Therapeutic Targets. Stroke. 2024; 55:484–493. DOI: 10.1161/STROKEAHA.123.044533
7. Ando Y, Ono Y, Sano A, et al. Posterior Reversible Encephalopathy Syndrome: A Review of the Literature. Intern Med. 2022; 61:135-141.doi: 10.2169/internalmedicine.7520-21
8. Fischer M, Schmutzhard E. Posterior reversible encephalopathy syndrome. J Neurol. 2017; 264:1608–1616. DOI 10.1007/s00415-016-8377-8
9. Danhofera P, Tomečkováa M, Černáb D, et al. Prognostic factors and seizure outcome in posterior reversible encephalopathy syndrome (PRES) in children with hematological malignancies and bone marrow failure: A retrospective monocentric study. Seizure: European Journal of Epilepsy. 2019; 72:1–10. https://doi.org/10.1016/j.seizure.2019.08.007
10. Ali A, Raviskanthan S, Mortensen PW, et al. Posterior Reversible Encephalopathy Syndrome in a Patient with Primary Hyperaldosteronism (Conn Syndrome). J Neuro-Ophthalmol. 2023; 43: e9-e11
11. Ramnani V, Ramnani S, Trivdei D, et al. Posterior Reversible Encephalopathy Syndrome: The Eyes Reflecting Systemic Health. Cureus. 2025; 17(4): e82754. DOI: 10.7759/cureus.82754
12. Hinduja A. Posterior Reversible Encephalopathy Syndrome: Clinical Features and Outcome. Front. Neurol. 2020; 11:71. doi: 10.3389/fneur.2020.00071
13. Liu L, Zhang L. Posterior reversible encephalopathy syndrome coexists with acute cerebral infarction: challenges of blood pressure management. Quant Imaging Med Surg. 2020;10(12):2356-2365. http://dx.doi.org/10.21037/qims-20-392
14. Herrera MF, Estrada MV, Salazar DG, et al. Diagnosis and management of posterior reversible encephalopathy syndrome in systemic lupus erythematosus. Case report. Rev Colomb Reumatol. 2019;26(1):74–79
15. Parasher A, Jhamb R. Posterior reversible encephalopathy syndrome (PRES): presentation, diagnosis and treatment. Postgrad Med J. 2020; 96:623-628.
16. Parikh NS, Schweitzer AD, Young RJ, et al. Corticosteroid Therapy and Severity of Vasogenic Edema in Posterior Reversible Encephalopathy Syndrome. J Neurol Sci. 2017; 380: 11–15. doi:10.1016/j.jns.2017.06.044.