Case Report

ANNALS OF MEDICINE & SURGERY

OPEN

Posterior reversible encephalopathy syndrome in a child following hypovolemic shock: a case report

Yuvraj Adhikari, MBBS[a,*], Satkirti Bista, MBBS[b], Sammridhi Karmacharya, MBBS[b], Binit Upadhaya Regmi, MBBS[e], Anupama Marasini, MBBS[a], Anisha Basukala, MBBS[a], Shakar Bhandari, MBBS[a], Krishna Ghimire, MBBS[d], Ram Chandra Subedi, MD[c]

Introduction and importance: Posterior reversible encephalopathy syndrome (PRES) is a condition that causes a wide range of clinical neurological manifestations like headache, seizures, visual changes, and altered mental sensations. It is diagnosed with the help of sequential neuroimaging findings. Manifestations may occur a few hours to months after the initial precipitating cause. In the pediatric population, the most common cause is hypertension caused by renal disease or different drugs.

Case presentation: Here, the authors present the case of a 4-year-old boy with a significant medical history of acute gastroenteritis following hypovolemic shock that later developed white matter edema of the brain on T2-weighted MRI scans along with symptoms such as headache and vomiting. Here, the patient was managed symptomatically with antiepileptic medication as prophylaxis.

Clinical discussion: PRES is a rare neurological diagnosis made in the child that presents with headache, vomiting, blurring of vision, and abnormal body movements, which have several etiology like hypertension, glomerulonephritis, organ transplant, drugs, and very rarely with hypovolemic shock. It is an acute reversible condition in which a person presents with visual disturbances, headaches, and seizures. Seizures present as a life-threatening situation, so antiepileptic drugs are used as early prophylaxis.

Conclusion: PRES is a reversible neurological condition, and prognosis is typically favorable if recognized and treated early, with symptom improvement or resolution in a few days to several weeks. Complications of PRES develop if the disease is not treated promptly. Complications include focal neurologic deficits from ischemic injury and epilepsy.

Keywords: case report, hypovolemia, pediatric, posterior reversible encephalopathy syndrome

Introduction

Posterior reversible encephalopathy syndrome (PRES) is a rare disease in children characterized by a wide range of clinical symptoms like seizure patterns, headaches, impaired consciousness, vision abnormalities, and focal neurological defects. It is diagnosed radiologically[1]. The characteristic radiological finding is the presence of white matter edema affecting the occipital and parietal lobes[2]. The actual cause of PRES in the pediatric population is unknown. Still, children with hypertension, renal disorders, collagen vascular disease, and a history of use of cytotoxic agents and corticosteroids are at high risk of developing this condition[3]. Disease pathogenesis is unknown, but it appears to be related to the destruction of cerebral vascular endothelial structure, likely due to marked blood pressure fluctuation leading to dysfunction in cerebral blood flow autoregulation, so PRES can develop in the setting of sepsis and hypotension as well[4,5]. The disease generally has a self-limiting pattern where clinical symptoms subside earlier than radiological alterations with good short-term and long-term prognoses. Recurrence is infrequent, even though the patients repeatedly experienced trigger factors for PRES; however, the resolution of MRI lesions is slower than clinical recovery[2,6].

This manuscript was prepared following the CARE guidelines (https://www.care-statement.org)

HIGHLIGHTS

- Hypovolemic shock.
- Rare cause for posterior reversible encephalopathy syndrome.
- Syndromic disease with a reversible nature.
- Pediatric population.
- MRI showing white matter edema.

Case presentation

A 4-year-old boy was admitted to the pediatric department with complaints of acute, non-radiating severe abdominal pain and multiple episodes of vomiting and severe constipation, that is, not

[a]Department of Pediatrics, Shree Birendra Hospital, [b]Nepalese Army Institute of Health Sciences, [c]Department of Neurology, Grande International Hospital, Kathmandu, [d]Suryabinayak Municipal Hospital, Bhaktapur and [e]Jibjibe Primary Health Center, Rasuwa, Nepal

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

*Corresponding author. Address: Shree Birendra Hospital, Kathmandu 44600, Nepal. Tel.: +977 9845783365. E-mail: yuvraj.adhikari06@gmail.com (Y. Adhikari).

Annals of Medicine & Surgery (2023) 85:5682–5685

Received 22 July 2023; Accepted 29 August 2023

Published online 5 September 2023

http://dx.doi.org/10.1097/MS9.0000000000001283

passing stool for 7 days. The patient was admitted to the Pediatric Incentive Care Unit (PICU) 9 days before this admission for 4 days with a diagnosis of acute gastroenteritis followed by hypovolemic shock, where his blood pressure was severely fluctuating with a lower mean arterial pressure. He also had decreased urinary output for 2 days. He had no significant family and psychosocial history. At present, clinical examination revealed an ill-looking, tachycardic boy with other vital parameters within the normal range. The abdomen was diffusely painful on palpation with guarding. Auscultation of the heart and lungs shows no pathology. On the fourth day of admission, he was transferred to PICU as his condition was deteriorating with multiple episodes of vomiting, irritability, and oxygen saturation fluctuation. He was managed promptly in the PICU for his symptoms, and after his condition stabilized, he was shifted to the ward.

His laboratory tests at the time of admission showed hemoglobin of 11 g/dl (reference: 13–17); leukocytes of 21 600/ml (reference: 4000–11 000); platelets of 761 000/ml (reference: 150–450) with peripheral blood smear reported as normocytic normochromic anemia with thrombocytosis and leucopenia.

On further evaluation with computed tomography (CT) for the abdomen and pelvis showed mesenteric lymph node enlargement with 13 × 6 mm along the ilio-colic vessel and fecal loading of the colon with the normal caliber of the appendix. On further workup, a CT scan of the head (Fig. 1) showed a subtle low signal in bilateral occipital lobes (right > left),after which an MRI of the brain (Fig. 2A, B) was done that revealed patchy high T2 fluid-attenuated inversion recovery (FLAIR) signal changes with restricted diffusion in the bilateral occipital lobe, findings suggestive of posterior reversible encephalopathy syndrome (PRES).

Following admission, he was managed conservatively for his symptoms, and antibiotics were started as per his laboratory reports. After his radiological report, antiepileptic medication, syrup Levetiracetam 10 ml/kg for 3 months, was started as a prophylactic measure for 3 months.

Discussion

PRES is a reversible neurological condition characterized by white matter edema in the parietal and occipital regions, along with manifestations such as headaches, seizures, encephalopathy, visual disturbances, and focal neurological disturbances, usually in the presence of hypertension[7]. Radiologically, PRES presents with a typical neuroimaging showing vasogenic edema in the posterior cerebral region. T2-weighted brain MRI and FLAIR sequences are considered to be highly sensitive to detect such vasogenic edema as compared with non-contrast computed tomography (CT)[8].

As proposed by Fugate and Schmutzhard[9], the diagnostic criteria of PRES include the sudden onset of neurological symptoms, abnormalities in neuroimaging suggesting focal vasogenic edema, and the reversibility of clinical and radiological findings. Our patient fulfilled two of these criteria. PRES is known to present with co-existing systemic diseases. Among children, PRES has been reported among those with kidney failure, systemic lupus erythematosus (SLE), idiopathic arterial hypertension (AHT), and patients undergoing chemotherapy and immunosuppressant treatment[10].

The pathophysiology of PRES remains unknown. Probable mechanisms put forth include endothelial injury or dysfunction of the blood–brain barrier, causing fluid and protein transudation, cerebral vasoconstriction, and subsequent brain infarction and vasogenic edema due to cerebral autoregulation[11].

The management of PRES includes symptomatic therapy where blood pressure control is essential in patients with hypertension, and mean arterial pressure should be decreased by 20–25% within the first 2 h as rapid blood pressure reduction can lead to cerebral ischemia owing to altered cerebral perfusion[12]. On a similar note, in cases of PRES occurring in association with hypovolemic shock, physicians should be careful to ensure that the BP does not fluctuate, and fluid overload should be avoided as it is a trigger for the development of PRES[13]. Our patient also had a significant past history of severe dehydration and hypovolemia, leading to hypotension due to acute gastroenteritis, which could have led to altered cerebral circulation and disease development. Similarly, a case of PRES in a child hemorrhagic dengue reported by Sawant *et al.*[14], which is generally associated with initial hypotension followed by hypertension, was treated with fluid resuscitation. Likewise, a case of PRES in a woman occurred following postpartum hemorrhage without any signs of hypertension in 2017[15]. So, with all these

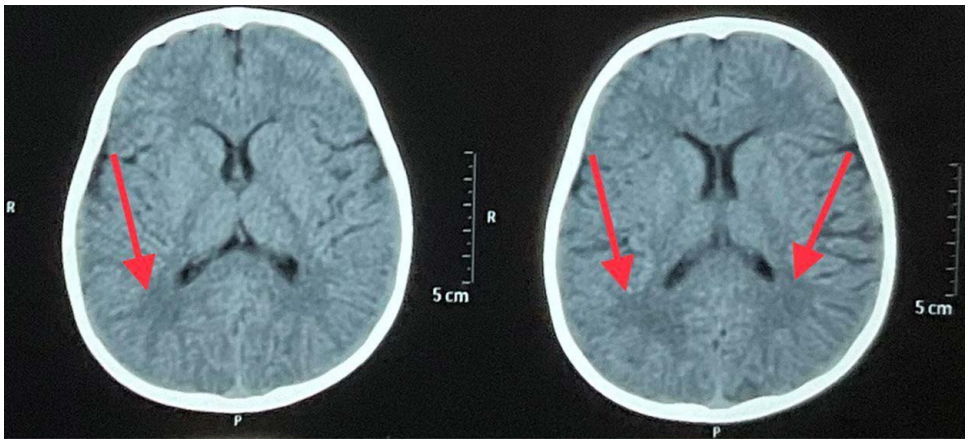

Figure 1. Computed tomography of the head (coronal view) showing a subtle low signal in bilateral occipital lobes (right > left). (Shown in red arrow).

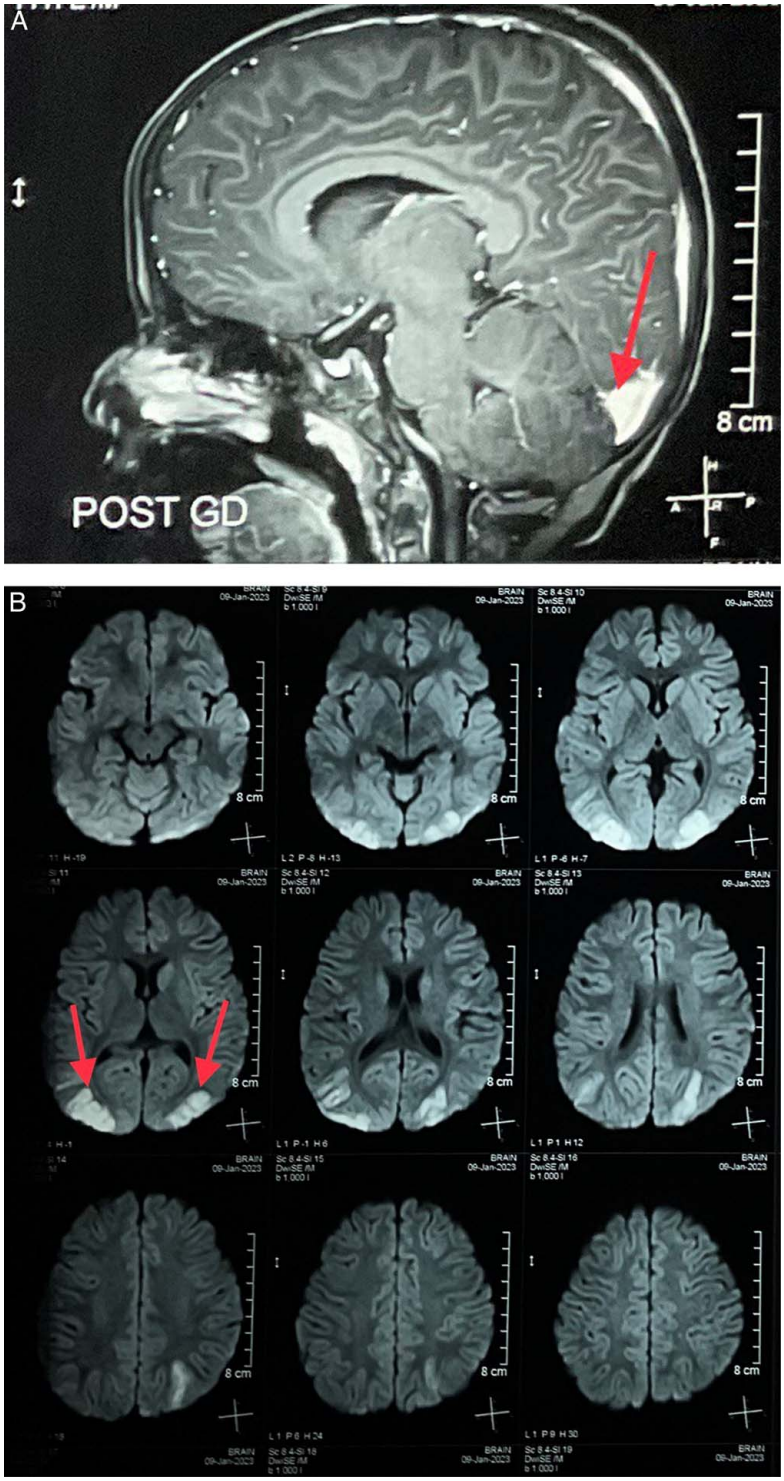

Figure 2. (A) Magnetic resonance imaging of the brain (sagittal view) showing vasogenic edema at the parieto-occipital lobe. (B) Magnetic resonance imaging of the brain (sagittal view) showing vasogenic edema at the parieto-occipital lobe. (Shown in red arrow).

instances, PRES is most commonly associated with cerebral blood flow alteration, and it can also occur in cases of hypotension treated with fluid resuscitation, so clinicians must consider PRES as one of the important complications of hypotensive crisis that has a good prognosis within 3–6 months.

Conclusion

PRES is a reversible neurological condition having various etiologies, of which hypovolemic shock in children is a rare condition. A child may not present with typical symptoms, but one presenting with headache, oliguria, hematuria, increased

blood pressure, a differential complication for PRES, should be kept in mind. Being a reversible condition, proper counseling is a must, and one should watch for complications of PRES and prophylactic measures should be started, like antiepileptic medications.

Patient perspective

The patient's guardians were thankful for having their child's condition diagnosed and managed. The patient feels his symptoms have improved, and his guardian's concern regarding the possibility of future neurological conditions has been ameliorated after comprehensive counseling.

Ethical approval

This is a case report; therefore, it did not require ethical approval from the ethics committee.

Consent

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Sources of funding

The study did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contribution

Y.A.: conceptualization, methodology, and writing – original draft, review, and editing; S.B.: data curation, investigation, revising, and editing the manuscript; S.K. and B.U.R.: data curation, methodology, revising, and editing the manuscript; A.M., A.B., S.B., and K.G.: data curation and visualization; R.C. S.: supervision, writing, and editing the manuscript. All authors were involved in manuscript drafting and revision and approved the final version.

Conflicts of interest disclosure

The authors report no conflicts of interest.

Research registration unique identifying number (UIN)

Not applicable.

Guarantor

Dr Yuvraj Adhikari, Shree Birendra Hospital, 44600 Kathmandu, Nepal. E-mail: yuvraj.adhikari06@gmail.com, Tel: +977 9845783365.

Data availability statement

Data included are publicly available.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Acknowledgements

Not applicable.

References

[1] Chen TH. Childhood posterior reversible encephalopathy syndrome: clinicoradiological characteristics, managements, and outcome. Front Pediatr 2020;8:585.
[2] Rijal JP, Giri S, Dawadi S, *et al*. Posterior reversible encephalopathy syndrome (PRES) in a patient with late postpartum eclampsia. Case Rep 2014;2014:bcr2013203162.
[3] Thavamani A, Umapathi KK, Puliyel M, *et al*. Epidemiology, comorbidities, and outcomes of posterior reversible encephalopathy syndrome in children in the United States. Pediatr Neurol 2020;103:21–6.
[4] Granata G, Greco A, Iannella G, *et al*. Posterior reversible encephalopathy syndrome – insight into pathogenesis, clinical variants and treatment approaches. Autoimmun Rev 2015;14:830–6.
[5] Liman TG, Bohner G, Endres M, *et al*. Discharge status and in-hospital mortality in posterior reversible encephalopathy syndrome. Acta Neurol Scand 2014;130:34–9.
[6] Roth C, Ferbert A. Posterior reversible encephalopathy syndrome: long-term follow-up. J Neurol Neurosurg Psychiatry 2010;81:773–7.
[7] Rijal JP, Giri S, Dawadi S, *et al*. Posterior reversible encephalopathy syndrome (PRES) in a patient with late postpartum eclampsia. BMJ Case Rep 2014;2014:bcr2013203162.
[8] Bartynski WS, Boardman JF. Distinct imaging patterns and lesion distribution in posterior reversible encephalopathy yndrome. Am J Neuroradiol 2007;28:1320–7.
[9] Fischer M, Schmutzhard E. Posterior reversible encephalopathy syndrome. J Neurol 2017;264:1608–16.
[10] Fonseca J, Oliveira K, Cordeiro M, *et al*. Posterior reversible encephalopathy syndrome: a case report. Neurol Engl Ed 2019;34:135–7.
[11] Choe S, Ganta N, Alnabwani D, *et al*. A case report of severe posterior reversible encephalopathy syndrome due to accelerated hypertension in a young patient. Cureus 2022;14:e26918.
[12] Sunita G, Krishna SS, Chandra BR, *et al*. Posterior reversible encephalopathy syndrome in a child with post streptococcal glomerulonephritis – a rare case report. Med Phoenix 2021;6:50–2.
[13] Lee SI, Choi GS, Park J, *et al*. Posterior reversible encephalopathy syndrome after hypovolemic shock which is required differential diagnosis with delirium in the intensive care unit. Acute Crit Care 2018;33:282–5.
[14] Sawant Y, Birajdar S, Doshi H, *et al*. Posterior reversible encephalopathy (PRES) in a child with severe dengue. J Trop Pediatr 2020;66:322–6.
[15] Lio CF, Lee YH, Chan HY, *et al*. Posterior reversible encephalopathy syndrome in a postpartum hemorrhagic woman without hypertension: a case report. Medicine (Baltimore) 2017;96:e6690.