

Posterior Reversible Encephalopathy Syndrome (PRES)

Check out our other handouts and podcasts at www.emboardbombs.com

Twitter/Instagram: @emboardbombs



Board Bombs

Authors: Sean Cassidy, MS4; Blake Briggs, MD

Posterior Reversible Encephalopathy Syndrome (PRES) is a neurologic condition classically identified as vasogenic edema in the subcortical white matter of the parieto-occipital lobes on MRI. Remember “hypertensive encephalopathy”? PRES is basically a close cousin to that but we cannot treat BP without other considerations like kidney disease, seizure control, and immunosuppression. Don’t let the name fool you, as PRES is not always posterior, not always reversible, and affects both gray and white matter. (1, 2)

Pathophysiology

The pathophysiology of PRES remains incompletely understood. However, the most agreed upon evidence suggests it stems from a combination of dysregulated cerebral autoregulation and endothelial dysfunction which breaks down the blood-brain barrier resulting in vasogenic edema. (1-4)

Etiology

The pathophysiology of PRES is thought to be related to cerebral perfusion and endothelial dysfunction. The most common causes of PRES are:

- **Hypertension** - About 75-80% of patients present with severe hypertension. (3,5)
- **Immunosuppression** - Transplant and cancer patients, those with rheumatologic conditions such as SLE, TTP, IBD, hypothyroidism (among others), or other conditions requiring immune modulation are at higher risk for PRES. A retrospective cohort study of PRES patients reported about half of patients being treated with one or more immunosuppressive drugs. Cyclosporine, tacrolimus, sirolimus, gemcitabine are the most commonly cited drugs related to PRES. (3,4,6)
- **Kidney Disease** - A good mixture of kidney dysfunction is reported such as renal failure, ESRD, lupus nephritis, and other glomerulonephropathies. However, this should be taken in context with the concurrent presence of hypertension or autoimmune disorders. Renal dysfunction as an independent risk factor has yet to be supported. (1, 3, 5)

Clinical Presentation

PRES typically presents acutely with symptoms progressing over hours to days. Hypertension is frequent, but PRES can still be present with normal or even low blood pressures. (1-6) Hypertensive crisis can precede PRES, but PRES develops acutely usually in less than a day. PRES is characterized by the following:

- **Seizures** - In 60-75% of cases seizures can occur. Beginning as focal seizures and progressing to generalized tonic-clonic seizures with some cases ending in status epilepticus. (3 - 5)
- **Encephalopathy or Altered Mental Status** - The most common presenting symptom. Reported in up to 94% of cases ranging from confusion, somnolence, and agitation to more extreme presentations of stupor or coma. (3-5)
- **Headaches** - About 50% of PRES cases reported headaches. Which is characterized as constant, diffuse, moderate to severe, and refractory to medications. (2-6)
- **Visual Disturbances** - In up to 40% of cases reported decreased visual acuity, visual field deficits, hallucinations, or cortical blindness.

Diagnosis

PRES is a clinical and radiographic diagnosis without agreed upon criteria which underscores the importance of thinking of this condition in patients with severely elevated blood pressure in the setting of encephalopathy. In the ED, patients will first undergo noncontrast CT imaging of the head which may appear normal in early or mild cases. Findings consistent with PRES has about 50-70% sensitivity with the following:

- Bilateral symmetric hypodensity in parieto-occipital white matter (7)

However, CT sensitivity is very limited, and MRI needs to be performed if there is concern for PRES.

The gold standard for diagnosing PRES is MRI (T2-Weighted and FLAIR Sequences) with findings of:

- Bilateral, symmetric hyperintensity in the posterior cerebral hemispheres. (7)
- Atypical imaging pattern: frontal lobe, basal ganglia, brainstem, cerebellum (8)

Broad lab panels will be sent, but will have low diagnostic capability from the Emergency Medicine perspective.

Management

The cornerstone of management is identifying and treating the underlying cause:

- **Hypertension** - In other patients with hypertension, use clinical symptoms and baseline blood pressure to reduce MAP by 25% over the first few hours. The goal is smooth, controlled reduction. There is no evidence to support the preferential use of any hypertensive agents. (9) Clevidipine IV drip (3); Nicardipine IV drip (3); Labetolol IV pushes (3).
- **Seizures** - treat with standard antiseizure medication such as levetiracetam or phenytoin.
- **Pregnancy** - Eclampsia and PRES can coexist. Therefore, delivery of the baby and placenta are indicated along with IV magnesium. (1,9)

Posterior Reversible Encephalopathy Syndrome (PRES)

Twitter/Instagram: @emboardbombs

- **Other** - patients on immunosuppressants or chemotherapy should stop their course of treatment temporarily until their prescribing physician can be consulted. (9) Patients with TTP, sepsis, hypothyroidism etc. should be treated at the standard of care. (9)

Disposition and prognosis

Typically PRES has a favorable outcome and most cases resolve in days to weeks with the treatment of underlying disease and blood pressure control. (3,9) However, there have been reported cases of death, irreversible neurologic damage, and intraparenchymal or subarachnoid hemorrhage (3). Guidelines do not exist from an emergency medicine standpoint on proper patient disposition. If PRES is suspected, the patient requires ICU admission for antihypertensive drips and frequent neurologic checks.

References:

1. Zelaya JE, Al-Khoury L. Posterior Reversible Encephalopathy Syndrome. [Updated 2024 Oct 11]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK554492/>
2. Lee VH, Wijidicks EFM, Manno EM, Rabinstein AA. Clinical Spectrum of Reversible Posterior Leukoencephalopathy Syndrome. *Arch Neurol*. 2008;65(2):205-210. doi:10.1001/archneurol.2007.46
3. Neill TA. Posterior reversible encephalopathy syndrome. In: UpToDate, Wilterdink JL (Ed), Wolters Kluwer. (Accessed on Jan 7, 2025.)
4. Fugate JE, Rabinstein AA. Posterior reversible encephalopathy syndrome: clinical and radiological manifestations, pathophysiology, and outstanding questions. *Lancet Neurol*. 2015 Sep;14(9):914-25. doi: 10.1016/S1474-4422(15)00111-8. PMID: 26184985.
5. Gao B, Lyu C, Lerner A, McKinney AM. Controversy of posterior reversible encephalopathy syndrome: what have we learnt in the last 20 years? *J Neurol Neurosurg Psychiatry*. 2018 Jan;89(1):14-20. doi: 10.1136/jnnp-2017-316225. Epub 2017 Aug 9. PMID: 28794149
6. Koyfman A, Long B. Headache. In: Stapczynski J, Cline DM, Thomas SH, editors. Tintinalli's Emergency Medicine: A Comprehensive Study Guide [Internet]. 9th ed. McGraw-Hill Education; 2025. Available from: <https://accessmedicine.mhmedical.com/content.aspx?bookid=2353§ionid=218080366>.
7. Hinchey J, Chaves C, Appignani B, Breen J, Pao L, Wang A, Pessin MS, Lamy C, Mas JL, Caplan LR. A reversible posterior leukoencephalopathy syndrome. *N Engl J Med*. 1996 Feb 22;334(8):494-500. doi: 10.1056/NEJM199602223340803. PMID: 8559202.
8. McKinney AM, Short J, Truwit CL, McKinney ZJ, Kozak OS, SantaCruz KS, Lucato LT. Posterior reversible encephalopathy syndrome: incidence of atypical regions of involvement and imaging findings. *AJR Am J Roentgenol*. 2007 Oct;189(4):904-12. doi: 10.2214/AJR.07.2024. PMID: 17885064.
9. Fugate JE, Hawkes MA, Rabinstein AA. Posterior reversible encephalopathy syndrome: evolving insights in diagnosis, management, and outcomes. *Lancet Neurol*. 2025 Sep;24(9):789-800. doi: 10.1016/S1474-4422(25)00232-7. PMID: 40818477.