Original Article

Posterior Reversible Encephalopathy Syndrome: A Comparative Study of Pediatric Versus Adult Patients

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ABSTRACT

BACKGROUND: Posterior reversible encephalopathy syndrome (PRES) is an acute neurotoxic syndrome that, although characteristically reversible, can result in long-term disability. Our aim was to identify the clinical and radiological factors that are unique to children with PRES compared with adults with the syndrome in a single center. **METHODS:** We retrospectively reviewed the clinical and radiological records of all patients with PRES admitted at a tertiary care medical center from 2007 to 2014. All patients who met the clinical and radiological criteria for PRES were dichotomized into children (less than 18 years) and adults (18 years or older) based on their age groups, and comparison of their baseline variables, clinical, laboratory, and imaging features was performed. **RESULTS:** During this study period, 19 pediatric patients and 100 adult patients with PRES were identified. On univariate analysis, factors significantly associated with pediatric patients with the syndrome were multiorgan failure (84.2% vs 50%, $P = 0.006$), temporal lobe involvement (63.3% vs 39%, $P = 0.04$), restricted diffusion (42.1% vs 18%, $P = 0.02$), and less likelihood of cerebellar involvement (21.1% vs 57%, $P = 0.004$). On bivariate logistic regression analysis, all these factors remained significantly associated with pediatric PRES; multiorgan failure (odds ratio: 5.80, 95% confidence interval: 1.45 to 29.41, $P = 0.03$), temporal lobe involvement (odds ratio: 5.08, 95% confidence interval: 1.17 to 22.17, $P = 0.03$), restricted diffusion (odds ratio: 2.48, 95% confidence interval: 1.61 to 10.10, $P = 0.02$), and less likely to have cerebellar involvement (odds ratio: 0.08, 95% confidence interval: 0.002 to 0.39, $P = 0.002$). **CONCLUSIONS:** Factors unique to PRES in children compared with adults include a greater propensity with multi-organ failure, involvement of the temporal lobe, and restricted diffusion on imaging.

Keywords: Posterior reversible encephalopathy syndrome, Hypertensive encephalopathy, PRES, pediatric, imaging

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Introduction

Posterior reversible encephalopathy syndrome (PRES) is a well-recognized acute neurological syndrome characterized by a combination of clinical and neuroimaging findings. The spectrum of neurological features observed in patients with PRES includes headache, impaired level of consciousness, seizures, visual disturbances, nausea, vomiting, and focal neurological deficits.[1,2] Neuroimaging characteristics of PRES include bilateral, cortical or subcortical vasogenic edema most commonly involving the parietal and occipital regions followed by frontal and cerebellar regions.[3,4]

Predisposing conditions associated with PRES include severe hypertension, renal failure, pre-eclampsia, eclampsia, autoimmune disorders, and cytotoxic agents.[4] The pathophysiology of PRES is debated. Proposed hypotheses include vasoconstriction from hypertension with autoregulatory compensation leading to ischemia and cerebral edema, severe hypertension exceeding the autoregulatory limit,

TABLE 1.
Comparison of Pediatric and Adult Posterior Reversible Encephalopathy Syndrome Patients

Variables	Pediatric Patients; n = 19; n (%)	Adult Patients; n = 100; n (%)	P Value
Gender (males)	9 (47.4)	27 (27)	0.08
Race (Caucasian)	13 (68.4)	72 (72)	0.75
Past seizure (SZ) history	0 (0)	7 (7)	0.23
Clinical features			
Headache	9 (47.4)	39 (39)	0.49
Nausea, vomiting	10 (52.6)	34 (34)	0.12
Encephalopathy	13 (68.4)	82 (82)	0.18
Vision change	1 (5.3)	24 (24)	0.07
Cranial nerve involvement	1 (5.3)	25 (25)	0.06
Weakness	2 (10.5)	14 (14)	0.68
Seizures	17 (89.5)	70 (70)	0.08
Hospital characteristics			
GCS at insult (mean ± SD)	14.05 ± 2.61	12.39 ± 3.64	0.06
LOH stay (mean ± SD)	28.95 ± 33.15	18.52 ± 29.78	0.17
LO ICU stay (mean ± SD)	9.79 ± 24.02	4.99 ± 10.16	0.15
Intubation	5 (26.3)	32 (32)	0.62
Multiorgan failure	16 (84.2)	50 (50)	0.006
Precipitating cause			
Hypertension	15 (78.9)	83 (83)	0.67
Eclampsia	2 (10.5)	10 (10)	0.95
Renal failure	8 (42.1)	48 (48)	0.64
Malignancy	7 (36.8)	34 (34)	0.81
Chemotherapy	8 (42.1)	32 (32)	0.39
Autoimmune condition	1 (5.3)	17 (17)	0.19
Admission laboratories			
Hemoglobin gm/dl (mean ± SD)	11.05 ± 2.35	11.44 ± 2.19	0.48
Hematocrit % (mean ± SD)	32.67 ± 6.78	34.42 ± 6.36	0.28
White cell count K/µL (mean ± SD)	11.39 ± 7.46	10.71 ± 6.59	0.69
Platelet count K/µL (mean ± SD)	185.11 ± 153.72	197.70 ± 139.78	0.72
Blood urea nitrogen mg/dl (mean ± SD)	21.47 ± 20.57	24.00 ± 19.41	0.61
Creatinine mg/dl (mean ± SD)	2.09 ± 3.13	2.47 ± 3.00	0.62
Blood glucose mg/dl (mean ± SD)	115.89 ± 63.23	130.78 ± 52.59	0.28
Sodium mmol/L (mean ± SD)	137.11 ± 6.05	137.18 ± 5.02	0.96
Calcium mg/dL (mean ± SD)	8.30 ± 1.99	8.66 ± 1.02	0.24
Magnesium mg/dL (mean ± SD)	2.19 ± 0.71	2.10 ± 0.66	0.59

Abbreviations:
FLAIR = Fluid-attenuated inversion recovery
GCS = Glasgow coma score
LOH = Length of hospitalization
LO ICU = Length of Intensive care unit
SD = Standard deviation

TABLE 2.
Imaging Features of Posterior Reversible Encephalopathy Syndrome in Pediatric and Adult Patients

Imaging Features	Pediatric Patients; n = 19; n (%)	Adult Patients; n = 100; n (%)	P Value
Parietal	19 (100)	93 (93)	0.23
Occipital	17 (89.5)	93 (93)	0.60
Frontal	16 (84.2)	89 (89)	0.55
Temporal	12 (63.2)	39 (39)	0.04
Cerebellar	4 (21.1)	57 (57)	0.004
Thalamus	2 (10.5)	32 (32)	0.06
Midbrain	0 (0)	8 (8)	0.20
Pons	2 (10.5)	28 (28)	0.11
Medulla	0	5 (5)	0.32
Lentiform nucleus or caudate	1 (5.3)	16 (16)	0.22
Putamen	2 (10.5)	15 (15)	0.61
Corpus callosum	4 (21.1)	20 (20)	0.91
Number of lobes involved			
Typical	2 (10.5)	4 (4)	0.27
Atypical	17 (89.5)	96 (96)	0.24
Cortical	18 (94.7)	84 (84)	0.22
Restricted diffusion	8 (42.1)	18 (18)	0.02
Contrast enhancement	3 (15.8)	8 (8)	0.28
Hemorrhage	2 (10.5)	26 (26)	0.14
Grade of posterior reversible encephalopathy syndrome			
Mild	12 (63.2)	57 (57)	0.62
Moderate	7 (36.8)	36 (36)	0.95
Severe	0 (0)	7 (7)	0.23

vessel pruning, decreased cerebral blood flow indicative of endothelial dysfunction of the arterioles has been observed in various groups.[8,9]

Numerous studies have attempted to identify various clinical and radiological features unique to pediatric patients with PRES.[7,10,11] Features commonly observed in childhood PRES include altered consciousness, visual disturbance, seizures, status epilepticus, epilepsy, frontal

TABLE 3.
Outcome of Pediatric Posterior Reversible Encephalopathy Syndrome

Clinical	Pediatric Patients; n = 19; n (%)	Adult Patients; n = 100; n (%)	P Value
mRS (modified Rankin Score; mean ± SD)	1.11 ± 1.66	1.93 ± 1.96	0.09
GOS (Glasgow coma score; mean ± SD)	4.63 ± 1.01	4.15 ± 1.18	0.10
Follow-up imaging done	13 (68.4)	41 (41)	0.03
Resolution on follow-up imaging			
Complete	4 (21.1)	19 (19)	0.83
Incomplete	8 (42.1)	12 (12)	0.001
Progression	0	4 (4)	0.38
Relapse	0	5 (5)	0.32

Abbreviation:
SD = Standard deviation

leading to hyperperfusion, cerebral edema, and endothelial dysfunction.[2,5-7] Similar to reversible cerebral vasoconstriction syndrome, vasculopathy, diffuse vasoconstriction, and