Austin Journal of Nephrology and Hypertension

Open Access

Austin Publishing Group

Rapid Communication

A Critical Review of Posterior Reversible Encephalopathy Syndrome Cases in a Peritoneal Dialysis Population: Case Series and Review of Literature

Oliveira J*, Freitas J, Sala I, Santos S, Carvalho MJ, Rodrigues A and Cabrita A

Department of Nephrology, Centro Hospitalar e Universitário do Porto, Porto, Portugal

***Corresponding author:** Oliveira J, Department of Nephrology, Centro Hospitalar e Universitário do Porto, Largo do Prof. Abel Salazar, 4099-001 Porto, Portugal

Received: December 27, 2021; **Accepted:** January 21, 2022; **Published:** January 28, 2022

Abstract

Introduction: Posterior reversible encephalopathy syndrome (PRES) represents a neurological disorder with varied clinical presentation and typical imaging findings. End-stage-renal-disease patients have a combination of risk-factors for PRES: hypertension, volume-overload, erythropoietin stimulating agents, immunosuppressants, hyponatremia, uremia.

Methods: We explored the presentation and outcome of PRES in a chronic peritoneal-dialysis (PD) population over a 2-year period. We also reviewed the literature on PRES in PD.

Result: 3 patients had PRES over a 2-year period. They were young, had uncontrolled hypertension and most presented shortly after PD-induction. Fluid/salt non-compliance, faster decline of urine-output after graft-failure, maintenance immunosuppression/ESA was possible triggers.

Conclusion: PRES is a serious complication associated with a higher risk for dialytic modality transition since subclinical hypervolemia is a prevalent and probable risk factor. The complication is hardly predictable, with inconsistent correlation of clinical presentation, blood-pressure and weight-gain profiles after PD-induction.

Keywords: Peritoneal dialysis; PRES; Hypervolemia; Hypertension

Introduction

Posterior reversible encephalopathy syndrome (PRES) represents a neurological disorder with varied clinical presentation and typical imaging findings. Numerous triggering-factors are prevalent among end-stage renal disease (ESRD) population: arterial hypertension, volume-overload, uremia, transplantation, autoimmune and hematological diseases, (pre)eclampsia, infection, electrolyte disturbances, medication [immunosuppressants, chemotherapy, erythropoietin stimulating agents (ESA)] [1-5]. Clinical manifestations depend on the involved region(s) of the brain [1]. Fugate et al. [6], proposed a diagnostic algorithm: at least one acute neurological symptom (seizure, altered mental-state, headache, visual disturbance); at least one risk-factor (severe hypertension, renal failure, immunosuppressants or chemotherapy, eclampsia, autoimmune disorder); brain imaging with bilateral vasogenic edema, cytotoxic edema with patterns of PRES or normal brain imaging; and no other alternative diagnosis. It is thought that a rapid rise in blood-pressure (BP) eventually overcomes the auto-regulatory capabilities of the cerebral vasculature causing vascular leakage, vasogenic edema and blood-brain barrier (BBB) dysfunction. The areas supplied by the posterior circulation at exceptional risk due to the lack of sympathetic tone of the basilar artery vasculature [7]. Thirty percent do not exhibit the elevated BP necessary to exceed the autoregulatory control of the cerebral vasculature and a process of endothelial dysfunction is thought to be the primary culprit [8]. With timely and proper treatment, PRES is generally a reversible condition with good long-term prognosis. The most important steps in the acute clinical management are confirmation of diagnosis with prompt cerebral MRI, removal of the underlying cause, careful BP lowering [1,9].

Methods

We present a detailed description of the PRES cases (n=3) in PD patients that happened at our institution over a two-year period. We are based on a tertiary health-care facility with a prevalent PD program with 80-90 patients on regular program. Literature review was PUBMED based linking the following keywords: peritoneal dialysis, posterior reversible encephalopathy syndrome.

Results

Table 1 details patient and episode characteristics. Patient A is a 21-year-old female, with past medical history of chronic kidney disease (CKD) secondary to genetic focal and segmental glomerular sclerosis (podocin mutation) on renal replacement therapy since 2018, with a previous PRES-episode (before dialysis induction). She presented (2019) to the emergency department (ER) with vomit and severe headache. BP was 198/144 mmHg. MRI was compatible with PRES. She transitioned from continuous ambulatory peritoneal dialysis (CAPD) to APD and presented a gradual favourable response to volume management. Patient B is a 25-year-old male, past medical history of CKD secondary to congenital anomaly of kidney and urinary tract (CAKUT), on PD for 7 years with volume management difficulty in the last year due to water-saline noncompliance, ultrafiltration failure and anuria. He presented (2020) to the ER with

Citation: Oliveira J, Freitas J, Sala I, Santos S, Carvalho MJ, Rodrigues A, et al. A Critical Review of Posterior Reversible Encephalopathy Syndrome Cases in a Peritoneal Dialysis Population: Case Series and Review of Literature. Austin J Nephrol Hypertens. 2022; 9(1): 1102.

Table 1: Clinical summary of PRES in PD patients.

Characteristics	Patient		
	A	B	C
Gender	Female	Male	
Age	15-30		45-60
CKD Etiology	FSGS	CAKUT	
Dialysis induction (date)	2019	2014	2020
Previous renal transplant	No		Yes
Previous PRES episode	Yes	No	
Time since PD induction (mo)	4	72	2
Uncontrolled hypertension (previous 3 mo)	Yes		
Potencialy risk associated medication	ESA	ESA	ESA, tacrolimus
KRF (L)	< 1	0	2
Seizure at presentation	No	Yes	
Headache	Yes		No
Suspected trigger	Hypervolemia		Unknown
Dialysis otimization	Transition CAPD to APD	Transition to hemodialysis	
Weight variation at 3 months since PD induction *1	5.2	NA	1.1
Weight variation (from admission to discharge) %	-15.9	-9.3	NA*2

*1(Infused peritoneal-dialysis solution volume excluded).
*2 (prolonged admission, significant muscle wasting).
Legend: CAKUT: Congenital Abnormalities Of Kidney And Urinary Tract; CKD: Chronic Kidney Disease; ESA: Erythropoietin Stimulating Agents; FSGS: Focal and Segmental Glomerular Sclerosis; KRF: Kidney Residual Function in Liters; PD: Peritoneal Dialysis; PRES Posterior Reversible Encephalopathy Syndrome.

Table 2: Major topics and recommendations.

Pres In The PD Population	
Presentation	Varied clinical presentation. Hypertension not mandatory.
Risk factors	Younger age, post-PD induction period, previous uncontrolled hypertension, water/ saline restriction non-compliance, previous PRES-episode, loss of KRF, medication use (ESA, immunosuppressants).
Diagnostic criteria	≥ 1 acute neurological symptom; ≥ 1 risk factor; Abnormal brain imaging is not mandatory; No other alternative diagnosis.
Preventive measures	Frequent assessment particularly in the post-dialysis induction period; Dietary education; Avoidance of potential nephrotoxic factors (contrast, NSAIDs, aminoglycosides); Balance between RKF preservation and fluid overload (alert for loss of residual renal function), anti-hypertensive optimization.
Recommended treatment	ICU (hypertensive emergency), gradual BP-lowering, dialysis optimization (transition to hemodialysis should be considered because it allows precise ultrafiltration-rates, but is not mandatory), stop PRES-enabling medication, consider maintenance anti-convulsive therapy.
Prognosis	Generally favorable.

Legend: BP: blood-Pressure; ICU: Intensive Care Unit; KRF: Kidney Residual Function in Liters; NSAID: Non-Steroidal Anti-Inflammatory Agents; PRES: Posterior Reversible Encephalopathy Syndrome.

generalized-seizure. BP was 191/110 mmHg. He was transitioned to hemodialysis with a favourable outcome. BP is currently controlled on no antihypertensive medication. Patient C is a 51-year-old male, with past medical history of CKD secondary to CAKUT, and a second renal transplant in 1999. He initiated PD (2020) due to gradual chronic rejection and ultimate failure. Two months after dialysis induction he presents to the ER with generalized-seizure and BP of 220/120 mmHg. Neurologic examination revealed pupillary asymmetry. MRI was compatible with PRES. He was transitioned to HD. A gradual functional and neurologic improvement was also observed.

Discussion and Literature Review

Moreiras-Plaza M, et al. (2018) [10] reviewed the literature on PRES in PD and found less than twenty reported-cases. The majority were male aged between 20 and 50 years. The length-of-time on PD prior to the episode was almost one-year (from three-weeks to three-years). Practically all cases presented with seizures as an initial symptom. Volume-overload, poor dialysis, and ESA stand-out as enabling or aggravating factors. Three patients had recurring episodes. Increased dose of administered dialysis and ultrafiltration, and transition to haemodialysis (HD) were reported strategies adopted as part of treatment. Most recovered without sequelae. Since this review only three other case-reports were published: 1) 44-year-old male on automated peritonealdialysis (APD) with a PRES-episode also attributed to under-dialysis [11]; 2) recurrent PRES in a 17-year-old boy [12]; 3) 24-month-old girl whose PRES trigger was assumed to be hypotension and a 6-year-old girl with episode attributed to BP fluctuation due to fluid shifts in intermittent PD [13].

Giving the limited number of published cases and significant heterogeneity, relevant conclusions on epidemiology,

pathophysiology, risk factors and proper management cannot be determined. Two of three of our cases happened shortly after PD-induction. Uncontrolled hypertension was present at the last ambulatory consult in all. The suspected trigger was hypervolemia in 2 out of 3 patients with favourable response to body weight reduction during hospital stay.

Weight-gain following dialysis induction is a common phenomenon mainly due to increased appetite and body-mass. However, this anabolic gain may hide an increase in body-water that can lead to increased risk for PRES as well as other vascular complications. A conservative approach on volume-control is usually adopted at the beginning of dialysis due to the benefits of preserving kidney residual function (KRF). Also, post-transplant, immunosuppressants are usually maintained for this same purpose. Multifrequency-bioimpedance, employed for serial volume-assessment, lacks accuracy on the post-dialysis induction period but can potentially help reach euvolemia, leading potentially lowering PRES risk [14-15]. All patients were submitted to dialysis prescription optimization (either transition to hemodialysis or transfer from PD scheme).

Conclusion

PRES in PD patients was a rare event, hardly predictable and with inconsistent correlation between clinical presentation, BP profile and weight tendency. Sub-clinical hypervolemia in the post PD-induction period, uncontrolled hypertension, lower adherence to fluid and salt restriction, maintenance immunosuppression posttransplant failure and ESA were possible triggers. Nevertheless, presentation and triggers differ between published case-reports and between patients in our case-series. We essay to apply preventive measures: 1) Anticipate the risk in elective patients (younger, lower therapy adhesion, PD after graft failure, previous PRES episode); 2) Closely balance RKF and the risk for uncontrolled hypertension and subclinical hypervolemia; 3) Keep in mind the serious menace of both neurologic impact and PD-drop-out.

References

1. Lamy C, Oppenheim C, Mas JL. Posterior reversible encephalopathy syndrome. Handb Clin Neurol. 2014; 121: 1687-1701.
2. Bartynski WS, Zeigler Z, Spearman MP, Lin L, Shadduck RK, Lister J. Etiology of cortical and white matter lesions in cyclosporin-A and FK-506 neurotoxicity. AJNR Am J Neuroradiol. 2001; 22: 1901-1914.
3. Delanty N, Vaughan C, Frucht S, Stubgen P. Erythropoietin-associated hypertensive posterior leukoencephalopathy. Neurology. 1997; 49: 686-689.
4. Chiang WF, Chen PT, Chen YL, Chen MH. Atypical posterior reversible encephalopathy syndrome in a noncompliant hemodialysis patient: Case report and literature review. Hemodial Int. 2019; 23: E100-E103.
5. Jourde-Chiche N, Dou L, Cerini C, Dignat-George F, Brunet P. Vascular incompetence in dialysis patients--protein-bound uremic toxins and endothelial dysfunction. Semin Dial. 2011; 24: 327-337.
6. Fugate JE, Rabinstein AA. Posterior reversible encephalopathy syndrome: clinical and radiological manifestations, pathophysiology, and outstanding questions. Lancet Neurol. 2015; 14: 914-925. Epub 2015. Erratum in: Lancet Neurol. 2015; 14: 874.
7. Bartynski WS. Posterior reversible encephalopathy syndrome, part 2: controversies surrounding pathophysiology of vasogenic edema. AJNR Am J Neuroradiol. 2008; 29: 1043-1049.
8. Marra A, Vargas M, Striano P, Del Guercio L, Buonanno P, Servillo G. Posterior reversible encephalopathy syndrome: the endothelial hypotheses. Med Hypotheses. 2014; 82: 619-622.
9. Roth C, Ferbert A. Posterior reversible encephalopathy syndrome: long-term follow-up. J Neurol Neurosurg Psychiatry. 2010; 81: 773-777.
10. Moreiras-Plaza M, Fernández-Fleming F, Azkárate-Ramírez N, Nájera-de la Garza W, Martín-Baez I, Hernansanz-Pérez M. Peritoneal dialysis: A factor of risk or protection for posterior reversible encephalopathy syndrome? Review of the literature. Nefrologia (Engl Ed). 2018; 38: 136-140.
11. Kaneko S, Hirai K, Minato S, Yanai K, Mutsuyoshi Y, Ishii H, et al. A case of posterior reversible encephalopathy syndrome in a patient undergoing automated peritoneal dialysis. CEN Case Rep. 2019; 8: 178-182.
12. Keller T, Wille DA, Laube GF. Pathophysiological aspects of posterior reversible encephalopathy syndrome in two peritoneal-dialyzed children. Clin Case Rep. 2020; 9: 260-265.
13. Shieh A, Darro N. Recurrent Posterior Reversible Encephalopathy Syndrome in an Adolescent Boy with End-Stage Renal Disease. Case Rep Pediatr. 2021; 2021: 6675454.
14. Wang AY, Dong J, Xu X, Davies S. Volume management as a key dimension of a high-quality PD prescription. Perit Dial Int. 2020; 40: 282-292.
15. Gungor O, Kircelli F, Kitis O, Asci G, Toz H, Ok E. Can strict volume control be the key for treatment and prevention of posterior reversible encephalopathy syndrome in hemodialysis patients? Hemodial Int. 2013; 17: 107-110.