



Hypertension of the child in the posterior reversible encephalopathy syndrome in Algerian child

SADDOK Houcine, BAKRI Sid Ahmed, BOUMENDIL Dalila, BATOUCHE Djilali, BATOUCHE Djamilia-Djahida

Service d'anesthésie réanimation pédiatrique et néonatale EHU 1er novembre Oran

Laboratoire de recherche LERMER université d'Oran

Hôpital Kremlin Bicêtre

Email: khedidjabatouche@yahoo.fr

Summary: The hypertension of PRES in pediatric intensive care unit is not frequently encountered. It may be secondary to acute or chronic renal injury, PRES can also be seen following an immunosuppressive treatment for one or following tumor lysis syndrome after chemotherapy.

Material-methods: retrospective study of 05 files of children admitted between May 2017- october 2019

Aim: clinical, etiological, radiological characteristics of this HE, as well as the therapeutic modalities.

Parameters studied: clinical signs on admission, stages of hypertension, renal function,

hydroelectrolytic assessment during the first 24 hours, as well as brain imaging (CT and MRI)

Results: 06 children with an average age of 10.78 ± 3.76 years old, (13 months- 12 years old)

presented a clinical and radiological picture of PRES: 03 children following chronic renal failure, 1 after taking ciclosporin for syndrome nephrotic, 02 children of the oncohematological entity presented clinical forms of convulsive hypertensive crises: following a tumor lysis syndrome after chemotherapy for Burkitt tumor and following the antimetabolic treatment methotrexate in intrathecal in 01 patients and IV cyclophosphamide in another patient

All these patients were admitted for altered state of consciousness with hypertension, convulsions with oligoanuric renal failure. Cerebral CT objectified a cerebral edema with zone hypodenses without effect of mass and the cerebral MRI within 48 hours in the patients showed Zones of hypersignal in T2 and FLAIR at the level of the white substance.

Conclusion: the clinical entity of hypertensive encephalopathy of PRES is a neuroradiological entity that should be known, because it is easily resolved under treatment.

Key words: children, posterior reversible encephalopathy syndrome, neurological symptoms, renal failure , Toxicity chemotherapy.

INTRODUCTION

Posterior reversible encephalopathy syndrome (PRES) is a clinicoradiological entity that was well described by Hinchey et al. [1]. The hypertension of the PRES is rare in pediatric intensive unit care. A first case of reversible cortical blindness secondary to an arterial hypertension (HTA) with posterior hypodensities with the cerebral TDM had been described by Monterio et al. [2].

PRES is characterized by variable associations of seizure activity, consciousness impairment, headaches, visual abnormalities, nausea/vomiting, and focal neurological signs. The cerebral imagery highlights neuroradiologic signs characteristic of a vasogenic oedema within the white substance and predominating in the parieto-occipital posterior cerebral areas [3, 4].

The causes are various and probably multifactorial. This syndrome was described in adult hypertensive encephalopathy, the renal insufficiency, eclampsia, during immunosuppressors treatments like the cyclosporin, or cisplatin or at the time of tumoral lysis syndrome (TLS) to the waning of chemotherapy.

This study aimed to study the clinical characteristics and the etiology of the PRES as well as its association with hypertension in Algerian children.

Methods and patients:

A retrospective study conducted from May 2017 to October 2019, of all the admitted children for neurological disorders with arterial hypertension in pediatric intensive care unit, where all the children presenting neuro- clinical and radiological signs of the posterior encephalopathy reversible syndrome were included.

The inclusion criteria were: severe hypertension defined as SBP >130mm Hg; DBP of 90mmHg [5] and focal neurological signs. We have also searched for other clinical parameters such as: kidney function during the first 24H, cerebral imaging during the first 24H by cerebral magnetic resonance imaging or cerebral tomography compared to control imaging. The children were recruited in the service of pediatric of all the city of Oran

Results:

Six patients with 10.78 ± 3.76 years old , (13 month s- 12 years old) with a sex ratio of 3/2, have presented a clinical-radiologic tableau complicated to PRES. The possible etiology of the HTN associated to the PRES is represented in the (Table 1.)

The possible causes of SEPR hypertension are cumulated in the following table 1

N=	Causes initiales	Suspicion de l'étiologie
03	Kidney injury	hypertensive encephalopathy
2	oncological nosology	toxicity
	acute lymphocytic leukemia	ciclophosphamide
	burkitt tumor	methotrexate
		tumor lysis syndrome
1	Nephrotic syndrome	cyclosporine

1. Hypertensive encephalopathy of the acute kidney failure:

Three children's of a mean age of 5.4 years old admitted for Focal Neurological signs associated with Arterial hypertension. The clinical tableau at the admission was:

A severe hypertension, one patient had non reactive coma stage 2, one children were in post-critical coma and 2 children with headaches and blurred vision. The biologic parameters were: Hyponatraemia (129 ± 1.05 meq/), Hypocalcaemia (82 ± 1.4 mg/l), Glomerular Filtration Rate calculated at the admission ($35-20$ ml/min/m²).

A cerebral tomography has revealed in all the patients, a hypodensity with no contrast, symmetry with a posterior predominance. A cerebral magnetic resonance imaging realized in 2 patients during the first 24H, has shown in the most cases : T1 Hyposignal zones, T2 Hypersignal and FLAIR sequence in the white matter, posterior Sub-cortical, and on parietal. All the patients were treated with calcium antagonist (Nicardipine) 0.5-1µl/min, starter dose, waiting for the dialysis in one patient.

The convulsive crisis was treated with (benzodiazepine: (valium à 0.5 mg/kg in intrarectal) a status epilepticus has occurred to 2 patients, they received hypnovel associated with a mechanic ventilation during 24 hours. The first Dialysis session with no ultrafiltration was handled in 01 patient. The cerebral tomography realized at the admission showed: Hypodensities the most commonly without a contrast, oftenly symmetric, predominantly in the posterior region (**Figure 1**) and the realized cerebral magnetic resonance imaging showed Hypersigns T2 bilaterals, parieto-occipital in the majority of the patients (**Figure 2**).

The evolution is positive: a cerebral magnetic resonance imaging was possible after two weeks of hospitalization, has showed a normalization of the radiologic imaging in 2 patients. There was a disappearance of the cerebral oedema at the control cerebral tomography.

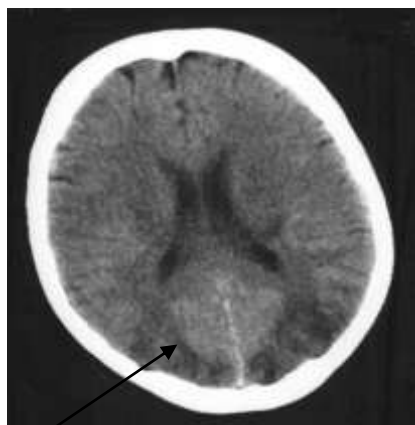


Fig.1 : Hypodensities the most commonly without a contrast, oftenly symmetric, predominantly in the posterior region

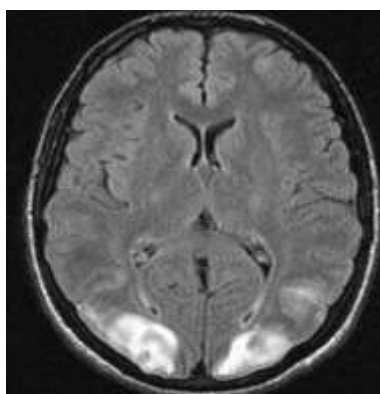


Fig 2: cerebral magnetic resonance imaging showed Hypersigns T2 bilaterals, parieto-occipital in the majority of the patients.

2-Arterial hypertension of the PRES induced by chemotherapy:

01 patient according to the pediatric oncology service for abdominal lymphomas of Burkitt and 01 patient for acute lymphoid leukaemia were treated initially by alkalization of urine and administration of allopurinol and furosemide

A secondary acute kidney failure appeared with the 1st cure of chemotherapy among one patient with tumor lysis syndrome (TLS) and at the 2nd cure of the other therapy with cyclophosphamide into intravenous, and méthotrexate in intrathecal. During the cure, a moderate arterial hypertension has appeared in 1 patients and a severe one in another patient. A cerebral scanner has showed in the majority of the patients hypodense zones sub cortical and magnetic resonance imaging revealed a hypertense signals in T2 and in the white matter in the most of patients. All the patients were treated with calcium antagonist (Nicardipine) 0.5-1µ/min

Evolution:

At the control magnetic resonance imaging, a positive regression is noticed, after 02 weeks of evolution in these patients. However, one death was noticed in the patients treated for the acute lymphoid leukaemia. medium after one month after the acute episode, by visceral failure secondary to the septic choc.

3. Arterial hypertension of the PRES in the nephrotic syndrome :

The child is admitted in the Pediatric Intensive care with acute hypertensive crisis with acute kidney failure, with focused convulsions, blurred vision and a severe systolo-diastolique hypertension, this child was treated with ciclosporine for 5 weeks.

A kidney Echodoppler has shown a disppareance of a vascular thrombosis. The cerebral tomography has showed a diffused cerebral edema, an MRI revealed hypersignal in T2, and FLAIR sequence in the parietal region with a normal coefficient of diffusion

In a context of acute renal failure, (urea=1,5g/l, créatinemia = 35mg/l), a risiduel ciclosporinemia dosed at 450ng/ml (thérapeutic goal was to 200ng/ml). In paediatric intensive care, the child was treated with valium in intra rectal at 0,5mg/kg, calcium antagonist, and with daily dialysis for 02 days.

Discussion:

The typical features of PRES consist of consciousness impairment, seizure activity, headaches, visual abnormalities, a state of lethargy, and focal neurological signs. Nausea/vomiting are present in 75 % of the cases. The tendon reflexes are sharp [6], an arterial hypertension with a diastolic blood pressure higher than 120 mmHg is usually observed [7]. The PRES is one of the complications of the hypertensive encephalopathy or the malignant HTN which represents approximately 20 % of the allowed hypertensive crises to the emergencies [8].

Few pediatric cases of PRES are found, in a study of 25 children, Pavlakis and al. [9] found 44% of the neuro-radiologic manifestations. Kwon et al. [10], found in another study of 12 children, headaches and visual abnormalities in 42%. In our study, all the children had a systolo-diastolo Hypertension. The arterial hypertension is considered as the most frequent sign of the PRES with disorders of the kidney function [1], or in acute glomerulonephritis [11] and in 59% in the study of Onder AM et al.[12].

In the literature several factors are associated with the PRES: the immunosuppressors treatment, the tumoral lysis syndrome, chemotherapy, acute or chronic renal failure [1-16]. Hypertensive encephalopathy found in our 03 children in their acute kidney failure, is the main cause of this PRES, secondary to the constitution of a vasogenic oedema, revealed in the patients with undertreated hypertension.

The cytotoxic chemotherapy may have a direct cytotoxic effect by the lysis of the blood brain barrier. The drugs may induce hypertension, the Intrathécal Chemotherapy and can cause the vasospasm cerebral and a cerebral vascular auto regulation dysfunction [16- 18]

The tumor lysis syndrome can be considered as a contributive element to the pathogenesis of the PRES, in our children treated for the the Burkitt's Lymphoma. The metabolic outcomes (hyperkaliemia, hypocalcemia..), associated to the onset of the hypertensive acute kidney failure, were predisposing factors.

Our patients treated with the méthotrexate associating cytarabine, cyclophosphamide, dexamethasone, developed anuria with hypertension, acute kidney failure, followed with neurologic abnormalities.

The methotrexate and the cyclophosphamide were associated to the development of neurologic abnormalities with their direct cytotoxic effect toward the blood brain barrier [19, 20].

The cyclosporin is an immunosuppressor agent with a well known neurologic secondary effect [21]. A higher concentration of it predisposes the patient to neurotoxic. The hypertension can be linked to an overdose of cyclosporin, associated to a kidney failure.

The PRES can be detected with a cerebral tomography showing hypodensities, but the MRI is considered as a referenced exam [22]. The cerebral MRI revealed hypertenses lesions in T2 sequences and FLAIR ones, and lesions iso or hypotenses in sequence T1 with a normal diffusion coefficient in the 2/3 of our patients or more, where we found a vasogenic oedema with reversible lesions of the white matter during the control imaging

Conclusion:

The posterior reversible encephalopathy syndrome is neuro-radiologic with multifactorial causes. The diagnosis has to be made in front of each acute encephalopathy and the MRI in FLAIR and diffusion sequence removes all cerebral vascular accident.

The evolution of the SEPR is usually favorable under adapted treatment, with disappearance of the neurological signs and regression of the neuro radiological anomalies, generally in less than 15 days. The treatment is essentially based on antihypertensive and anticonvulsant treatments, the stopping of the favoring treatments and the management of an eventual outbreak of the underlying systemic disease.

A better and accurate medical treatment can prevent irreversible lesions.

The authors declare no conflict of interest.

REFERENCES

- 1 - Hinchey J, Chaves C, Appignani B, et al (1996) A reversible posterior leukoencephalopathy syndrome. *N Engl J Med* 334: 494–500
- 2- Monteiro ML, Hoyt WF, Imes RK. Puerperal cerebral blindness. Transient bilateral occipital involvement from presumed cerebral venous thrombosis. *Arch Neurol* 1984; 41:1300-1.
- 3- Bartynski WS (2008) Posterior reversible encephalopathy syndrome, part 1: fundamental imaging and clinical features. *AJNR Am J Neuroradiol* 29: 1036–1042
- 4-Bartynski WS (2008) Posterior reversible encephalopathy syndrome, part 2: controversies surrounding pathophysiology of vasogenic edema. *AJNR Am J Neuroradiol* 29: 1043–1049
- 5- The heart –org :task force on blood pressure control in children *J.Pediatr* 1987 ;79 :1-25
- 6- Servillo G et al. Posterior-reversible encephalopathy syndrome in intensive care medicine. *Intensive Care Med* 2007; 33: 230-6.
- 7- Schwartz RB. Hyperperfusion encephalopathies: hypertensive encephalopathy and related conditions. *Neurologist* 2002;8:22-34
- 8- Zampaglione B, Pascale C, Hypertensive urgencies and emergencies. Prevalence and clinical presentation. *Hypertension* 1996; 27:144-7
- 9- Pavlakis SG, Frank Y. Hypertensive encephalopathy, reversible occipitoparietal encephalopathy, or reversible posterior leukoencephalopathy: Three names for an old syndrome. *J Child Neurol* 1999; 14:277-81.
- 10- Kwon S, Clinical spectrum of reversible posterioleukoencephalopathy syndrome. *Pediatr Neurol* 2001;24:361-64
- 11-Gupta S, Goyal , K V , Tallkdar B Reversible Posterior Leucoencephalopathy Syndrome in Post Streptococcal Glomerulonephritis
- 12-Onder AM et al Posterior reversible encephalopathy syndrome in the pediatric renal population. *Pediatr Nephrol* 2007;22:1921-9
- 13- Prasad N, Gulati S, Gupta RK, Kumar R, Sharma K, Sharma RK (2003) Is reversible posterior leukoencephalopathy with severe hypertension completely reversible in all patients? *Pediatr Nephrol* 18:1161–1166
- 14- Henderson JN, Noetzel MJ, McKinstry RC, White DA, Armstrong M, DeBaun MR (2003) Reversible posterior leukoencephalopathy syndrome and silent cerebral infarcts are associated with severe acute chest syndrome in children with sickle cell disease. *Blood* 101:415–419
- 15-Ozkan A, Hakyemez B, Ozkalemkas F, Ali R, Ozkocaman V, Ozelik T, Taskapilioglu O, Altundal Y, Tunali A. Tumor lysis syndrome as a contributory factor to the development of reversible posterior leukoencephalopathy. *Neuroradiology* 2006;48:887-92.
- 16- Saito B, Nakamaki T, Nakashima H, Usui T, Hattori N, Kawakami K, Tomoyasu S. Reversible posterior leukoencephalopathy syndrome after repeat intermediate dose cytarabine chemotherapy in a patient with acute myeloid leukemia. *Am J Hematol* 2007;82:304-6.
- 17-Edwards MJ, Walker R, Vinnicombe S, Barlow C, MacCallum P, Foran JM. Reversible posterior leukoencephalopathy syndrome following CHOP chemotherapy for diffuse large B-cell lymphoma. *Ann Oncol* 2001;12:1327-9
- 18- Garg R K. Posterior leukoencephalopathy syndrome. *Postgrad Med J* 2001;77:24-8.

19- Gupta A, Sameer B , Swaroop C, simultaneous occurrence of posterior reversible leukoencephalopathy syndrome in two cases of childhood acute lymphoblastic leukemia induction chemotherapy *Pediatr hematolOncol* 2008 ; 25 : 351-8

20-Suminoe A, Matsuzaki A, Kira R, Fukunaga N, Nishio T, Hoshina T, Hara T. Reversible posterior leukoencephalopathy syndrome in children with cancers. *J Pediatr Hematol Oncol* 2003;25:236-9.

21-Gijtenberk JM, Van den Bent et al Cyclosporin neurotoxicity a review. *J Neurol* 1999.246 :339-46

22- Casey SO, (2000) Posterior reversible encephalopathy syndrome: utility of fluid-attenuated inversion recovery MR imaging in the detection of cortical and subcortical lesions. *AJNR* 21:1199–1206

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