Pediatric Arterial Hypertension - The Importance of Regular Assessment

Ana Maria Marques Moura de Almeida Figueiredo[1,2], Ana Carolina Gonçalves Cordinhã[2], Carmen do Carmo Carapau Ferreira[2], Clara Maria da Silva Gomes Ferreira[2]

1 Servicio Pediátrico, Centro Hospitalar Médio Tejo, Torres Novas, Portugal (Morada: R. Xanana Gusmão 45, 2350-754 Torres Novas)
2 Unidade de Nefrología Pediátrica, Hospital Pediátrico de Coimbra, Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal (Morada: Avenida, R. Dr. Afonso Romão, 3000-602 Coimbra)

RESUMEN

La prevalencia de la hipertensión arterial en pediatría ha aumentado en las últimas décadas y a menudo pasa desapercibida. La hipertensión puede clasificarse como primaria o secundaria. Las enfermedades renales son la causa más común de hipertensión secundaria. La hipertensión renovascular es el resultado de la activación del sistema renina-angiotensina-aldosterona, que reduce el flujo sanguíneo a una parte o a la totalidad de uno o ambos riñones, por lo que depende en gran parte de la presencia o ausencia de un riñón contralateral funcional. Presentamos el caso de un niño con hipertensión diagnosticada durante un chequeo de rutina, que posteriormente se confirmó como hipertensión renovascular en un niño con un solo riñón funcional. La dificultad para controlar la presión arterial alta en estas situaciones puede llevar a daño en órganos objetivos. A pesar de que las técnicas de diagnóstico e intervención son seguras, no siempre son completamente efectivas, y a menudo pueden dar lugar a complicaciones, como en el caso presentado, con la pérdida del único riñón y la necesidad de trasplante renal. Al presentar este caso, buscamos concienciar sobre la importancia de evaluar regularmente la presión arterial y realizar en la práctica clínica un seguimiento cuidadoso de estos niños a largo plazo.

Palabras clave:

Hipertensión arterial, hipertensión arterial secundaria, hipertensión renovascular, niño, riñón único funcional.

ABSTRACT

The prevalence of arterial hypertension in paediatrics has increased in recent decades and is often overlooked. Hypertension can be classified as primary or secondary, with renal diseases the most common cause of secondary hypertension. Renovascular hypertension results from the activation of the renin-angiotensin-aldosterone system, with a reduction of reducing blood flow to part or the entirety of one or both kidneys, making it highly dependent on the presence or absence of a functioning contralateral kidney. We present the case of a child with hypertension diagnosed during a routine check-up, which was later confirmed as renovascular hypertension in a child with a single functioning kidney. The difficulty of controlling high blood pressure in these situations can lead to target organ damage. Despite diagnostic and intervention techniques being safe, they are not always entirely effective and can often result in complications, as in the presented case, with the loss of the single kidney and the need for kidney transplantation. By presenting this case, we aim to raise awareness of the importance of regular blood pressure assessment and long-term careful follow-up of these children in clinical practice.

Keywords:

Arterial hypertension, secondary arterial hypertension, renovascular hypertension, children, single functioning kidney.

Abbreviations and Acronyms:

BP: Blood pressure
DUS: Doppler ultrasound
ECG: Electrocardiogram
HTN: Hypertension
PICU: Pediatric Intensive Care Unit
RVH:Renovascular hypertension

Corresponding author:
Email: anammouraf@gmail.com
Received: 27/11/2023. Accepted: 23/2/2024

INTRODUCTION

The prevalence of hypertension (HTN) in childhood has increased in recent decades1, is a cause for concern and a significant public health problem[2]. Hypertension affects between 1-5% of the paediatric population[2–4]. It is defined by the presence of systolic or diastolic blood pressure (BP) values equal to or greater than P95 for age, sex, and height, in at least three measurements on different occasions[1–3,5].

At paediatric ages, HTN can be classified as primary or secondary4. Primary HTN is more common in older children and adolescents and is a diagnosis by exclusion. It is associated with a positive family history of HTN, excess weight, or obesity[3,4]. Secondary HTN is more frequent in prepubescent children[3,4], especially those under the age of 15 (98%)[4], with renal diseases being the most common cause (68%), and renovascular disease present in approximately 10% of cases[4].

Renovascular hypertension (RVH) results from the activation of the renin-angiotensin-aldosterone system[3,5], which reduces blood flow to part or the entirety of one or both kidneys[5], making it highly dependent on the presence or absence of a functioning contralateral kidney[3].

We present a brief description of a patient followed in the Paediatric Nephrology Unit for RVH with a single functioning kidney.

CLINICAL CASE

A previously healthy boy with no relevant family history was referred to a paediatric consultation after detection of a high blood pressure value above P99, at the age of 8, during a routine evaluation. During the visit, the patient was asymptomatic, and the BP value was 135/79 mmHg (above P99/ above P95). Analytical evaluation, electrocardiogram (ECG), renal and vesical ultrasound, and echocardiogram were performed. This evaluation revealed no analytical abnormalities, with a normal urine sample, normal ECG, a renal and vesical ultrasound showing the right kidney without changes and the left kidney with a 4.5 cm formation composed of cystic structures, the largest of which was 24 mm, and an echocardiogram indicating mild pulmonary valve insufficiency and very mild mitral valve insufficiency. The patient was admitted for monitoring, further investigation and treatment. A combination of several antihypertensive medications (nifedipine, captopril, and propranolol) resulted in partial response, with values remaining above P99. On the 8th day of hospitalisation, a renal Doppler ultrasound (DUS) was performed, revealing stenosis of the right renal artery with increased velocity and turbulence, a multicystic left kidney with a circulation and a *parvus tardus* type pulse. At that time, the result showed a high plasma renin level (13.5 ng/mL/h).

After that, he was transferred to a level III hospital for further investigation. Blood tests and a renal DUS were repeated on the 2nd day of hospitalisation. From this evaluation, the notable results were a haemoglobin level of 13.4 g/dL, serum creatinine of 39 umol/L, urea 5.4 mmol/L, normal electrolyte levels, aldosterone at 8.2 ng/dL (normal) and renin at 21.4 UI/mL (normal). The renal DUS showed the right renal artery with a decrease in calibre in its proximal third over an extent of 10 mm, and haemodynamically significant stenosis (>80%) and a dysplastic left kidney, approximately 5 cm in diameter, that was multicystic with no identifiable parenchyma. The patient underwent renal angiography with angioplasty of the stenosed segment of the right renal artery, recovering four-fifths of its calibre. After the procedure, he still had stage II hypertension and experienced vomiting, leading to the addition of amlodipine. Despite optimised treatment, he continued to have malignant HTN (SBP 135-222 mmHg and DBP 77-135 mmHg), which prompted his transfer to the Paediatric Intensive Care Unit (PICU).

In the PICU, the patient remained asymptomatic and there was a gradual addition of maximum-dose antihypertensive therapy (atenolol, hydrochlorothiazide/spironolactone, isradipine, and minoxidil), leading to an improvement in BP control. However, BP values continued above P95. Consequently, renal DUS was repeated, which still showed a reduction in the calibre of the right renal artery, although this was worse compared to the previous study. An echocardiogram revealed evidence of target organ damage. The patient underwent another angioplasty of the right renal artery with stent placement and started dual antiplatelet therapy with aspirin and clopidogrel. The BP profile progressively improved, allowing for a reduction in antihypertensive therapy. As a result, the patient was transferred to the Paediatric ward, where he showed good clinical progress and normalisation of BP values under minoxidil and atenolol therapy.

He continued to be monitored in the Nephrology Unit, maintaining BP control (below P95) with dual antihypertensive therapy and a low-sodium diet. Serial renal DUS were performed post-stent placement, which showed no worsening of the arterial stenosis.

One year after the procedure, the single functioning right kidney developed renal artery thrombosis in the context of a gastroenteritis, necessitating nephrectomy. This left the patient with end-stage renal disease, requiring dialysis, and five months later, he underwent a kidney transplant.

Currently, seven years later, the patient has developed obesity. Until one year ago, his BP was well-controlled, but since then he has required amlodipine therapy. He has a functioning kidney graft, and renal graft stenosis was excluded.

DISCUSSION

In young children, HTN is less common than among adults, and almost always associated with recognisable secondary causes[1]. In up to 25% of cases, RVH is one of the reported secondary causes[5,6], and despite being severe

is a potentially treatable condition in paediatric age[3,5]. The fact that BP is often not routinely assessed in daily clinical practice and that HTN is asymptomatic in most children[3,6] often leads to diagnostic delays, reducing the chances of treatment[6]. However, despite not having a specific clinical presentation, this patient experienced a hypertensive crisis, highlighting the potential severity of the condition. Renovascular hypertension results in elevated BP caused by renal hypoperfusion, often associated with renal artery stenosis and subsequent activation of the renin-angiotensin-aldosterone system[6]. Like the described case, the most common sign of RVH with moderate renal artery stenosis is stage II HTN resistant or refractory to treatment[6].

In patients with suspected RVH, the diagnosis of renal artery stenosis requires a thorough blood analysis and imaging study[3]. While renal DUS, CT angiography, or MR angiography can aid in diagnosis[3,6], angiography remains the gold standard for investigation, allowing for simultaneous intervention[3,5,6].

Therapeutic options include medical therapy (general and pharmacological measures), which should be maintained during patient evaluation, and revascularisation methods[3]. As in our case, children with renovascular disease often require more than one medication for adequate BP control[3,6], and endovascular therapy is indicated when control is inadequate and associated with significant complications[5]. Some children require more than one intervention and 60% of patients need a repeat stent placement procedure[3].

Despite the high success rates of these interventions, some degree of hypertension may persist, and there is also a risk of complications related to the procedure, as occurred in the reported case. This results in the need for careful, long-term follow-up of these children.

Elevated BP in childhood and the risk of developing metabolic syndrome are closely related. Therefore, controlling comorbidities such as obesity is crucial for HTN management and the improvement of these patients' prognosis.

This case reinforces the need to monitor BP during routine consultations and its aetiological investigation.

Funding

This study has not received specific grants from public sector agencies, commercial sector, or non-profit organisations.

Conflicts of interests

Nothing to disclose.

References

1. Díaz Anadón LR, González López C, Ordóñez Álvarez FA, Santos Rodríguez F. Infantile Arterial Hypertension: A Diagnostic Challenge in Paediatrics. An Pediatr. 2021;94(2):117.e1-117.e8.
2. Lurbe E, Agabiti-Rosei E, Cruickshank JK, Dominiczak A, Erdine S, Hirth A, *et al.* 2016 European Society of Hypertension Guidelines for the Management of High Blood Pressure in Children and Adolescents. J Hypertens. 2016;34(1):1887–920.
3. Gomes C, Cordinhã C, Carmo C, Gomes C, Correia AJ. Hipertensão Renovascular: Casuística de uma Consulta de Nefrologia Pediátrica. Acta Pediátrica Port. 2018;49(1):43–7.
4. Mattoo TK. Epidemiology, Risk Factors, and Etiology of Hypertension in Children and Adolescents. UpToDate. 2021. p. 1–36.
5. Patel PA, Cahill AM. Renovascular Hypertension in Children. CVIR Endovasc. 2001;4(10).
6. de Oliveira Campos JL, Bitencourt L, Pedrosa AL, Silva DF, Lin FJJ, de Oliveira Dias LT, *et al.* Renovascular Hypertension in Pediatric Patients: Update on Diagnosis and Management. Pediatr Nephrol. 2020;36(12):3853–68.