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Case Report

Examining Abnormal Non-stenotic Renal Arteries in Children With Hypertension

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ABSTRACT

Secondary hypertension is more common in children than adults, and renal disease is the most common cause. Several studies have shown a relationship between abnormalities in renal arterial vascularity and the onset of hypertension. We reported a case of hypertension in a 10-year-old girl with elevated plasma renin and normal aldosterone levels. Antihypertensive therapy was necessary to achieve blood pressure control, and the final diagnosis of hypertension was obtained from Computed Tomography (CT) angiography demonstrating unusual renal vascular abnormalities.

Keywords: Vascular malformations, Renin, Hypertension, Renovascular, Child

Introduction

Pediatric hypertension is defined as systolic and or diastolic blood pressure values greater than the 95th percentile for sex, age, and height. Most childhood hypertension is secondary to an underlying disorder, whereas essential hypertension is rarely found in children younger than 10 years and is a diagnosis of exclusion [1]. Renal-Vascular Hypertension (RVH) is responsible for 5%-25% of hypertension in children [2] and occurs when low blood flow to the kidneys activates the renin-angiotensin mechanism [3]. Renal artery stenosis, alone or in combination with middle aorta syndrome, is a crucial vascular cause of hypertension in childhood [4]. Furthermore, the relationship between the onset of RVH and the presence of renal artery abnormalities has been described since 1951 [5-9].

Case Presentation

We report a 10-year-old girl referred to our Emergency Department with palpitations and left-sided chest pain that was not relieved by anti-inflammatory drugs.

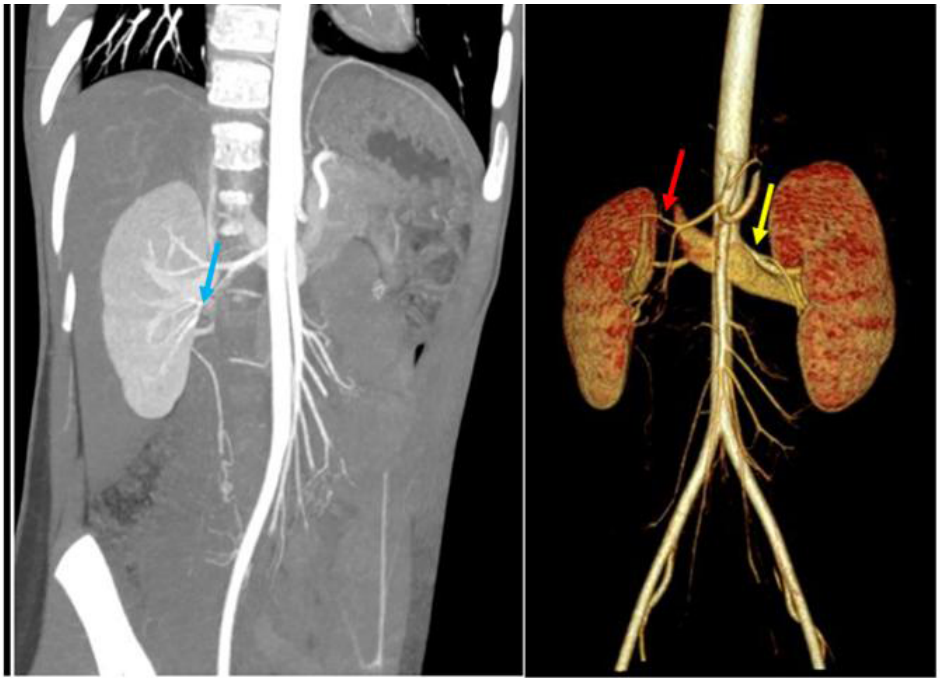

Figure 1. Computerized Tomography (CT) angiography of the renal arteries

1) Early branching (at about 1.5 cm from the emergence) of the left renal artery (yellow arrow); 2) Presence of a right upper polar artery (about 1 cm from the emergence) (red arrow), division of the branch directed to the lower middle third of the right kidney into multiple branches at the hilar level (blue arrow). No stenotic features were Highlighted.

In repeated measurements, the patient's blood pressure was 160/115 mm Hg (above the 95th percentile for age, sex, and height), and the heart rate was 132 bpm. Her body mass index was 16.2 kg/m^2 (between the 25th and 50th percentile for her age). She and her parents had a personal medical history that did not indicate cardiovascular risk factors, while the paternal grandfather and maternal grandmother had been diagnosed with hypertension in adulthood.

The diagnosis of hypertension and tachycardia was confirmed by 24-h blood pressure and Electrocardiogram (ECG) monitoring. The echocardiography show abnormalities secondary to systemic hypertension (concentric parietal hypertrophy of the left ventricle, mass index 80 g/m^2) with preserved left ventricular function. Examining fundus oculi and chest X-ray showed no anomalies. She started a low-sodium diet and antihypertensive drug treatment.

The patient underwent a workup for secondary hypertension. Laboratory evaluation included complete blood count, a basic metabolic panel, thyroid function tests, urinary protein/creatinine ratio, creatinine clearance, plasma cortisol, 17-OH-progesterone, 24-hour urine collection of vanillylmandelic acid, catecholamines and metanephrines which showed no abnormalities. The plasma aldosterone level was normal, with renin greater than 500 µIU/mL (reference range: 2.4-29 and 3.3-41 µIU/mL in supine and standing positions, respectively). A renal Doppler ultrasound was performed, and no signs of stenosis were observed. Magnetic resonance imaging findings were negative for masses. Computed tomography angiography did not show renal artery stenosis. However, it showed the presence of multiple abnormalities: early branching of both main arterial branches, a right superior polar artery, and division of the branch directed to the lower middle third of the right kidney into several branches at the hilar level (Figure 1).

Discussion

Variations in renal artery anatomy, in terms of origin, number, branching, and spatial distribution, are so numerous that classical anatomy is present in only 41%-86% of people [10-12]. These anatomical variations could be explained by errors occurring during the embryogenesis of renal vessels [13]. Various types of renal arteries, their locations, entry port to the kidney, and segmentation have been extensively studied [14-16]. They are described as supernumerary, aberrant, anomalous, or incidental renal arteries, as well as polar arteries (superior and inferior) arising from the aorta

J Ped Nephrol
Journal of Pediatric Nephrology

[12]. Since Marshall's report, there have been numerous reports in the literature that renal artery anomalies increase the risk of RVH by activating the renin-angiotensin-aldosterone system due to reduced renal perfusion caused by changes in renal artery size.

Our case report suggests that early branching of the main arterial trunk causes the kidney to be perfused via vessels of a smaller caliber. According to the law of continuity, since the sum of the cross-sectional areas of these vessels is less than the cross-sectional area of the lumen of the main trunk, the volume of blood transported to the kidney per unit time is low. A local reduction in blood flow in the kidney can stimulate macula densa and juxtaglomerular cells to increase renin synthesis and release, inducing a hypertensive state comparable to renal artery stenosis [17].

Conclusion

Pediatric patients with persistently elevated blood pressure should be investigated for renal vascular abnormalities. The contribution of imaging is crucial in diagnosing a patient with suspected RVH, looking not only for renal artery stenosis but also for other vascular changes known in the literature.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest

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