CASE REPORTS

RENAL DOPPLER ULTRASOUND – A LATE DIAGNOSIS OF AORTIC COARCTATION

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Abstract

Aortic coarctation is characterized by a segmental narrowing of the aortic lumen, usually diagnosed and treated in the neonatal period or early childhood, but can remain undiagnosed until adulthood. It manifests as a broad spectrum of signs and symptoms, ranging from mild to severe, of which arterial hypertension is one of the most common. In this article, the authors describe the clinical case of a 9-year-old child under investigation in the Pediatric Department for secondary causes of arterial hypertension. A renal Doppler ultrasound study revealed the presence of bilateral parvus et tardus waveform morphology in renal and intrarenal arteries and the proximal abdominal aorta. These findings were suspicious for diagnosing aortic coarctation, which thoracic CTangio confirmed.

Keywords: *Aortic Coarctation, Hypertension, Ultrasonography, Doppler, Congenital Heart Defects.*

INTRODUCTION

Aortic coarctation comprehends about 8 to 10% of congenital cardiopathies and is a condition that is present in 0,4% of children at birth and 7% among children that present cardiac diseases.[1,2] Aortic coarctation is characterized by a segmental luminal narrowing of the aortic artery, more frequently the thoracic aorta after the origin of the left subclavian artery, around the insertion of arterial duct.[3]

In most cases, the diagnosis of aortic coarctation is established in the neonatal period, even though this condition is rarely diagnosed in late childhood or even in adulthood. The early diagnosis and treatment of aortic coarctation prevents complications of this disease, such as arterial hypertension and heart failure.

CLINICAL CASE

A 9 years-old female was under investigation in the Pediatric Department for persistent high blood pressure (HBP) to search for secondary causes of arterial hypertension.

At clinical examination, the patient presented a blood pressure of 135/80mmHg (P>99/95-99) measured in the superior limbs, with broad and synchronous peripherical pulses and without clinical abnormalities at cardiac auscultation or other relevant personal or familiar backgrounds.

The blood analysis had no relevant abnormalities and an Ambulatory Blood Pressure Monitoring revealed 24-hour Average Blood Pressure of 130/79mmHg, Daytime Blood Pressure of 133/80mmHg, and Nighttime Blood Pressure of 117/74mmHg.

A Renal Doppler ultrasound of the renal arteries was performed and revealed a parvus-tardus waveform with diminished Resistance Index (RI) and diminished systolic peak velocity at the evaluation of the intra-renal arteries and main renal arteries bilaterally. (Figure 1, figure 2) In evaluating the accessible part of the abdominal aortic artery above the renal arteries, the wave morphology was similar to the one observed in the renal arteries, which raised suspicion of an

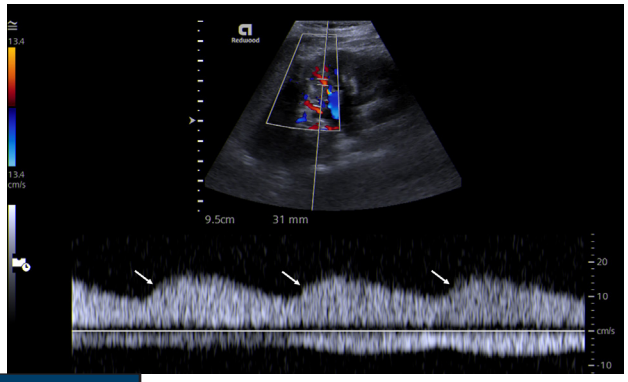

Figure 1 *Renal Doppler Ultrasound of the intra-renal arteries with prolonged acceleration time and diminished systolic peak (arrow).*

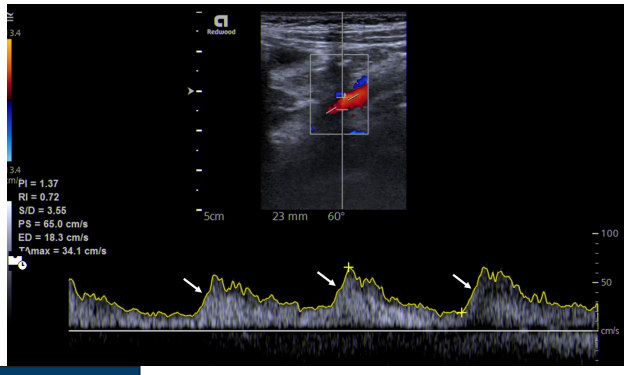

Figure 3 *Spectral Doppler Ultrasound of the abdominal aorta proximal to the origin of the renal arteries, with prolonged acceleration time and diminished peak systolic velocity (arrow), similar to the renal and intra-renal arteries.*

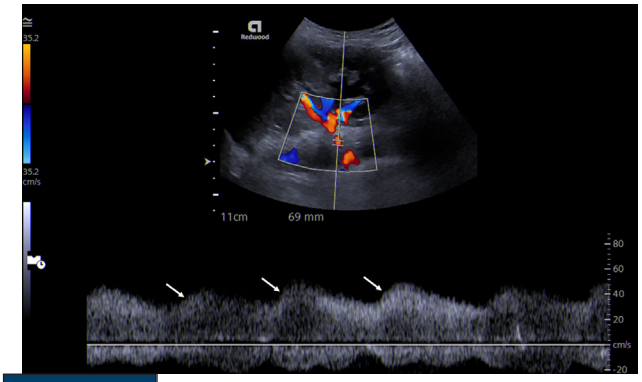

Figure 2 *Doppler Ultrasound of the renal artery (median third) with parvus-tardus wave morphology (arrow).*

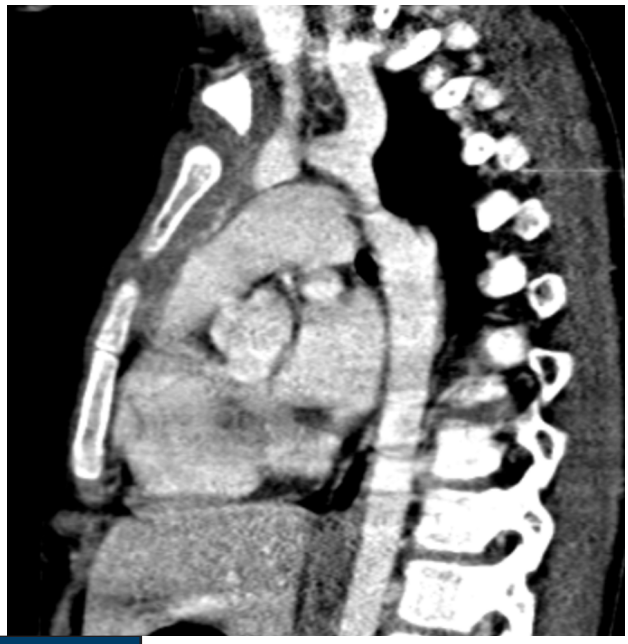

Figure 4 *Thoracic CTangio, sagittal reconstruction – luminal narrowing of the descending thoracic aorta, distally to the emergency of the left subclavian artery – aortic coarctation.*

obstruction of the thoracic aorta, such as aortic coarctation. (Figure 3) Thoracic Angio-CT later confirmed this hypothesis and the patient was submitted to surgical correction of the coarctation. (Figure 4)

DISCUSSION

Aortic coarctation is one of the most common congenital heart disease, present in around 0,4% of children at birth and 7% among children with other cardiac diseases. It is characterized by a segmental luminal narrowing of the aortic artery, in most cases after the origin of the arterial brachiocephalic trunk, and especially after the subclavian artery.[4,5]

The clinical presentation of this condition is variable according to the children's age it presents, the extension of the stenosis, and the presence of other cardiac malformations.[4] In the neonatal period, the signs and symptoms are more severe and suggestive of congestive heart disease, which can lead to heart failure and death in 5% to 10% of the cases. In children diagnosed later in life, the symptoms are less severe and generally related to HBP and leg claudication.[2]

Around two-thirds of children with aortic coarctation present with HBP; aortic coarctation is a rare secondary cause (<1%) of HBP.[4]

The clinical suspicion of aortic coarctation rises in the presence of HBP in a child or adolescent, different pulse amplitude and blood pressure between arms and legs.

Renal Doppler Ultrasound is one step in investigating HBP's secondary causes to exclude renovascular origin. In spectral Doppler evaluation of the normal renal artery, the wave morphology is characterized by a rapid upstroke and smooth velocity decline with persistent flow through the cardiac cycle, with IR between 0,55 and 0,75. In the Doppler evaluation distally to a stenotic area, the arterial

waveform is dampened due to a drop in perfusion pressure, with delayed systolic upstroke and diminished systolic peak, which originates a classic parvus-tardus waveform - the hallmark of a post-stenotic area. Tardus means slow and late and parvus means small and little. The reduction of systolic peak velocity results from the attenuation and deceleration of the driving systolic flow after the stenotic area (parvus). This deceleration of blood flow velocity increases the time to reach the systolic peak (tardus).[5, 6, 7]

The presence of these findings in only one of the renal arteries is suggestive of renal artery stenosis; nonetheless, when both renal arteries present these changes, although very uncommon, are suspicious of the proximal aortic artery stenosis, which should also be evaluated in this imaging study.

The acceleration slope, deceleration slope, decreasing of peak systolic velocity, and prolonged acceleration time are the main findings in renal and proximal aortic arteries in patients with aortic coarctation.[8] The primary differential diagnosis in the presence of these findings in the pediatric age is aortic valve stenosis.[6]

The definitive diagnosis of aortic coarctation should be made with an echocardiogram or thoracic CTangio. The treatment can be surgical, with resection of the affected area, but in selected cases a balloon angioplasty or placement of an endovascular stent can also be performed.[6,9]

The average life expectancy of these children is lower than that general population even after treatment, with increased risk of aneurism formation, re-coarctation, and persistence or recurrence of HBP, complications which are more familiar with the late diagnosis of this disease.[4]

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