



## Trifid and tetrafid renal sinus: a rare anatomical variation present in a pediatric patient

Trodelni i četvorodelni bubrežni sinus: retka anatomska varijacija prisutna kod pedijatrijskog pacijenta

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### Abstract

**Introduction.** The anatomical variations of the renal sinus appear as hyperechoic areas on ultrasonography, which may be misinterpreted as true hyperechoic masses like renal angiomyolipomas. **Case report.** A 10-year-old girl was referred to a tertiary children's hospital due to suspected bilateral renal angiomyolipomas. Upon admission, laboratory test results were within normal reference ranges. Ultrasonographic examination revealed that both kidneys had a normal position and size. On the sagittal ultrasound scan of the right kidney, three columnar masses extending across the sinus were observed, creating the appearance of three hyperechoic zones, indicating a trifid renal sinus. On the sagittal ultrasound scan of the left kidney, multiple columnar masses extending across the sinus were observed, creating the appearance of four hyperechoic zones, identified as a tetrafid renal sinus. The findings were interpreted as a rare benign anatomical variation with no signs of pathology, and additional radiological imaging was not required. **Conclusion.** Accurate identification of these variations is crucial to prevent patients from undergoing unnecessary biopsies and additional imaging.

**Keywords:**  
anatomic variation; diagnosis; kidney; pediatrics; ultrasonography.

### Apstrakt

**Uvod.** Anatomske varijacije bubrežnog sinusa se na ultrazvuku pojavljuju kao hiperehogena područja koja se mogu pogrešno protumačiti kao prave hiperehogene mase, poput bubrežnih angiomiolipoma. **Prikaz bolesnika.** Desetogodišnja devojčica upućena je u dečiju bolnicu tercijarnog nivoa zbog sumnje na bilateralne angiomiolipome bubrega. Prilikom prijema, rezultati laboratorijskih analiza bili su u granicama normalnih vrednosti. Ultrazvučnim pregledom utvrđeno je da su oba bubrega imala normalan položaj i veličinu. Na sagitalnom ultrazvučnom snimku desnog bubrega uočene su tri cilindrične mase koje se pružaju kroz sinus i daju izgled tri hiperehogene zone što ukazuje na trodelni bubrežni sinus. Na sagitalnom snimku levog bubrega prikazano je prisustvo višestrukih cilindričnih masa koje se pružaju kroz sinus i stvaraju izgled četiri hiperehogene zone identifikovane kao četvorodelni bubrežni sinus. Nalaz je protumačen kao retka benigna anatomska varijacija bez patoloških promena, te dodatna radiološka snimanja nisu bila potrebna. **Zaključak.** Precizna identifikacija ovih varijacija je važna kako bi se sprečilo da bolesnici budu podvrgnuti nepotrebnoj biopsiji i dodatnom snimanju.

**Ključne reči:**  
anatomija, varijacije; dijagnoza; bubreg; pedijatrija; ultrasonografija.

### Introduction

The renal sinus is a fatty area on the inner side of the kidney. It encompasses adipose tissue, fibrous material, the collection system, renal blood vessels, and lymphatic structures<sup>1, 2</sup>. The renal sinus appears as an echogenic oval zone on ultrasound imaging<sup>1-3</sup>. The most common variations of the renal sinus include a bifid renal sinus, a

parenchymal junctional defect, a parenchymal interjunctional line, and a hypertrophied column of Bertin.

A junctional parenchymal defect appears as a triangular echogenic cortical irregularity in the upper pole of the kidney. A parenchymal interjunctional line appears as an echogenic line crossing the kidney from the antero-superior outline to the renal sinus. The presence of a hypertrophied column of Bertin is attributed to the indentation

of renal cortical tissue in the renal sinus. In a bifid renal sinus, an intrasinus columnar mass crosses the sinus, creating the appearance of two separate hyperechoic zones<sup>4-6</sup>. Familiarity with these variations is important for distinguishing them from renal hyperechoic lesions, such as angiomyolipomas, lipomas, lymphomas, extramedullary hematopoiesis, and hematomas<sup>7-11</sup>. These insights are crucial to prevent unnecessary additional imaging, biopsies, and follow-up procedures.

We present the first case report of a rare right trifid and a left tetrafid renal sinus variation in a pediatric patient.

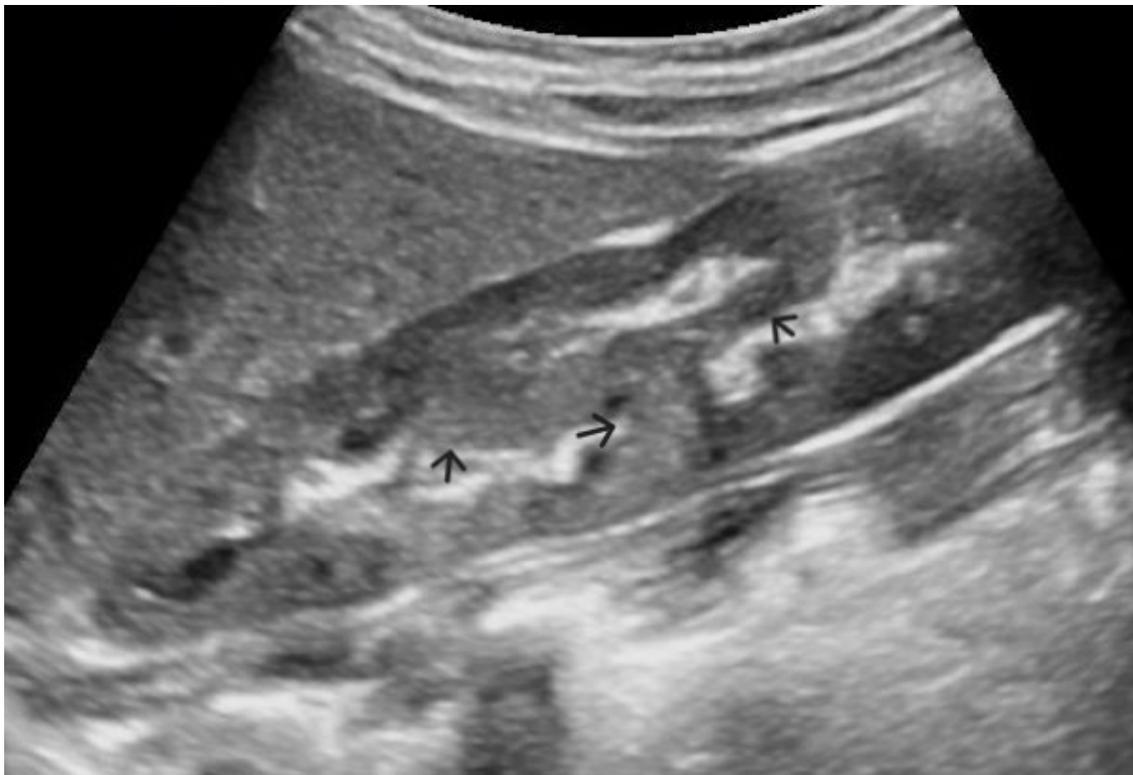
### Case report

A 10-year-old girl was referred to our tertiary children's hospital because of the suspicion of bilateral renal angiomyolipomas identified through ultrasound evaluation at the regional hospital. Her past medical history was otherwise unremarkable. On admission, the results of the laboratory examination (complete blood cell count, kidney function tests, urine analysis) appeared to be within normal limits. The abdominal real-time ultrasound examination was performed using a Mindray R9 ultrasound machine (Shenzhen Mindray Bio-Medical Electronics Co., Ltd., Shenzhen, China) equipped with a convex 6-1 MHz probe and color Doppler imaging. A comprehensive evaluation of the kidneys was performed using longitudinal, transverse, and oblique imaging approaches. Both kidneys

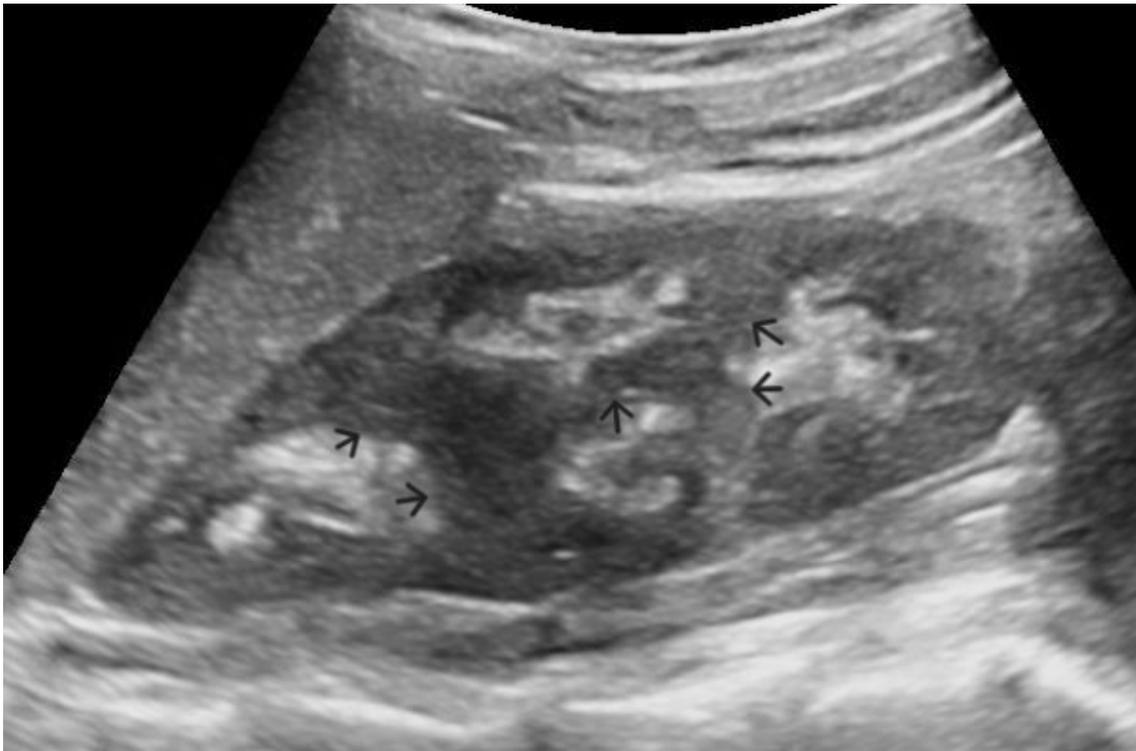
were placed in their normal anatomical positions, with the right kidney measuring  $11.2 \times 2.8 \times 2.5$  cm and the left kidney measuring  $10.5 \times 3.8 \times 2.7$  cm.

On sagittal and oblique scans, the right kidney was presented by three intrasinus columnar masses crossing the sinus and giving an appearance of three hyperechoic zones indicating a trifid renal sinus (Figure 1). The examination of the left kidney revealed multiple columnar masses crossing the sinus, producing the appearance of four hyperechoic structures, identified as a tetrafid renal sinus (Figure 2). Ultrasound image analysis showed that the columnar masses were surrounded by echogenic renal sinus fat, which partially traversed the sinus rather than completely dividing it. The thickness of the intrasinus columnar masses ranged from 3.7 mm to 12 mm (mean value 7.9 mm) in the right kidney and from 4.5 mm to 9.3 mm in the left kidney (mean value 6.9 mm). No evidence of renal calculi, solid-cystic masses, or hydronephrosis was found in the analysis.

A radiological diagnosis identified an incidental finding of a right trifid and left tetrafid renal sinus, highlighting a unique radiological anatomical variation. Since the variant was well characterized by ultrasonography and there were no clinical or laboratory findings suggestive of pathology, further imaging with magnetic resonance or computed tomography urography was considered unnecessary. This case highlights the diagnostic value of ultrasound in characterizing benign renal sinus variants, avoiding additional cost and radiation exposure.



**Fig. 1 – Ultrasound image of the right kidney (sagittal scan) shows three columnar masses (arrows) crossing the sinus and giving an appearance of a trifid renal sinus.**



**Fig. 2 – Ultrasound image of the left kidney (sagittal scan) shows multiple columnar masses (arrows) crossing the sinus and giving an appearance of a tetrafid renal sinus.**

### Discussion

The ultrasonographic assessment of our patient indicated the presence of a right trifid renal sinus, resulting in the appearance of three hyperechoic areas, and a left tetrafid renal sinus, characterized by the formation of four hyperechoic areas.

The study conducted by Dalla Palma et al.<sup>12</sup> examined the prevalence of renal sinus anomalies in a cohort of 50 children (0–9 years) and 200 adults (20–89 years). In the pediatric group, a parenchymal junctional defect was identified in 16 (32%) right kidneys and 8 (16%) left kidneys, a parenchymal interjunctional line in 26 (52%) right and 11 (22%) left kidneys, and a bifid renal sinus in 17 (34%) right and 8 (16%) left kidneys. A bifid renal sinus was observed bilaterally in 3 (6%) children, whereas no trifid or tetrafid renal sinus was detected in this group. In the adult group (n = 200), a parenchymal junctional defect was detected in 29 (14.5%) right kidneys and 16 (8%) left kidneys, a parenchymal interjunctional line in 38 (19%) right and 17 (8.5%) left kidneys, and a bifid renal sinus in 118 (59%) right and 68 (34%) left kidneys. Bilateral bifid renal sinuses were observed in 63 (31.5%) adults. In addition, a trifid renal sinus was identified in 16 (8%) right and 6 (3%) left kidneys, and a tetrafid renal sinus in 14 (7%) right and 8 (4%) left kidneys among the

adult population. These findings demonstrate that the visualization of intrasinus cortical columns increases with age and is more frequent on the right side in both populations.

Dalla Palma et al.<sup>12</sup> reported that the thickness of the intrasinus columnar masses varied between 4 and 12 mm with an average of 8.6 mm on the right side, and between 4 and 18 mm with an average of 10 mm on the left side. In our patient, the thickness of the intrasinus columnar masses varied from 3.7 mm to 12 mm, with an average of 7.9 mm in the right kidney, and from 4.5 mm to 9.3 mm, with an average of 6.9 mm in the left kidney.

Similar to our findings, Kumar et al.<sup>4</sup> reported a rare case of a trifid renal pelvis in an adult with a solitary kidney, emphasizing the clinical importance of recognizing such anatomical variants to avoid unnecessary invasive investigations.

### Conclusion

We reported the first case of a rare anatomical variation of the renal sinus presented as a right trifid and a left tetrafid renal sinus in a pediatric patient. Awareness of the differences in kidney anatomy is important to avoid unnecessary additional imaging and biopsy examinations.

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