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Synchronous Renal and Isthmic Abscesses in a Horseshoe Kidney in a Young Adult: Added Value of Multiphase CT and Delayed Images

RCM. Manzika Dzoussi[1*], N. Ait Said[1], N. Bakri[1], Y. Bouktib[1], A. Elhajjami[1], B. Boutakioute[1], NCI. El Ganouni[1]

[1]Department of Radiology, Ar-Razi Hospital, Mohammed VI University Hospital Center, Marrakech, Morocco

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***Corresponding author:** R.C.M. Manzika Dzoussi
Department of Radiology, Ar-Razi Hospital, Mohammed VI University Hospital Centre, Marrakech, Morocco

Abstract **Case Report**

***Introduction*:** Horseshoe kidney (HSK) is the most common renal fusion anomaly. Its malrotation and impaired urinary drainage predispose to infection, yet abscess formation within the isthmus is exceptionally reported. ***Case Presentation*:** An 18-year-old man with recurrent urinary tract infections presented with a 20-day history of right flank pain and fever (39 °C), leukocytosis (18,000/mm³), C-reactive protein of 88 mg/L and Escherichia coli on urine culture; ultrasound suggested a right renal abscess. Multiphase CT urography showed a horseshoe kidney fused at the lower poles by an enhancing parenchymal isthmus. The right moiety (14 × 7.2 cm) contained a 9 × 5.8 cm septated corticomedullary collection with an irregular rim-enhancing wall, displacing the renal pelvis with minimal pelvicalyceal dilatation and mild perirenal fat stranding. A second 33.5 × 23 mm collection with identical features lay in the right side of the isthmus, best seen on delayed images. The left moiety was atrophic (6 × 2.8 cm) without obstruction. ***Discussion*:** Multiphase CT defines the fusion anatomy, separates abscess from acute pyelonephritis and cystic mimics, and maps the isthmus, its vessels and the collecting system. Delayed images were decisive for detecting the small isthmic focus, which was inconspicuous on the portal venous phase. Measuring each collection separately gives clinicians the basis for choosing between antibiotics alone and image-guided drainage. ***Conclusion*:** When a renal abscess is found in a horseshoe kidney, the isthmus should be examined systematically on every phase, and particularly on delayed images, because a second focus changes the treatment plan.

Keywords: Horseshoe Kidney; Renal Abscess; Isthmus; Computed Tomography; Renal Fusion Anomaly; Case Report.

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INTRODUCTION

Horseshoe kidney (HSK) is the most common renal fusion anomaly, with a prevalence of roughly 1 in 400 to 600 individuals. It combines three anatomical features: ectopia, malrotation and variant vascular supply [1]. The two moieties are joined, usually at their lower poles, by an isthmus that is most often functioning parenchyma and less often a fibrous band; its ascent is arrested beneath the inferior mesenteric artery [1, 2].

This anatomy has clinical consequences. The renal pelves face anteriorly and the ureters cross over the isthmus, which favours urinary stasis, ureteropelvic junction obstruction, stones and infection [1-3]. Kidney stones are found in about 36% of adults with HSK [3]. Infection in a fused kidney can progress along the usual spectrum from acute pyelonephritis to focal bacterial nephritis and abscess [4, 5].

Renal abscess in HSK has been reported only as isolated cases, after calyceal diverticulum infection, shock-wave lithotripsy or with unusual organisms [6–8]. Involvement of the isthmus itself is rarely described. We report synchronous abscesses of the right moiety and of the isthmus in a young adult. We highlight the multiphase CT findings, the differential diagnosis and how the fused anatomy shapes management.

CASE PRESENTATION

Clinical History

An 18-year-old non-diabetic man with a history of recurrent urinary tract infections presented to the emergency department with right flank pain of 20 days' duration and fever of 39 °C. Laboratory tests showed leukocytosis at 18,000/mm³ with neutrophil predominance, C-reactive protein at 88 mg/L and normal renal function (serum creatinine 9 mg/L). Urinalysis showed leukocyturia, and urine culture grew *Escherichia*

coli. Blood cultures were not performed. Abdominal ultrasound suggested a right renal abscess, and CT urography was requested for characterisation.

Imaging Findings

CT urography was performed on a multidetector scanner with 2.5 mm sections before and after intravenous contrast, including arterial, portal venous and two delayed excretory phases, with multiplanar reformations.

The kidneys were fused at their lower poles by a parenchymal isthmus crossing anterior to the lumbar spine, which enhanced in the same way as the renal parenchyma, consistent with a horseshoe kidney (Fig. 1).

The right moiety was enlarged (14 × 7.2 cm) with lobulated contours. Its mid and lower thirds contained a large, roughly round, well-defined corticomedullary collection measuring 9 × 5.8 cm. The collection was spontaneously hypodense, had a thick irregular wall with peripheral enhancement after contrast, and contained a few thin septa (Fig. 2). It displaced the right renal pelvis, which was draped over its upper margin on excretory images, and caused minimal pelvicalyceal dilatation (Fig. 3). Mild stranding of the adjacent perirenal fat was present.

A second collection with the same features, measuring 33.5 × 23 mm, lay within the isthmus, lateralised to the right. It was subtle on the portal venous phase and best delineated on delayed images, where it stood out against the enhanced isthmic parenchyma (Figs. 1 and 4a).

The left moiety was small (6 × 2.8 cm; Fig. 1) with lobulated, scalloped contours suggesting scarring, without pelvicalyceal dilatation or obstruction. The adrenal glands and bladder were normal. There was no peritoneal effusion. There was no gas within the collections and no urinary calculus on the unenhanced series.

The imaging diagnosis was right renal and isthmic abscesses in a horseshoe kidney, with an atrophic left moiety.

Clinical Course

At the time of writing, no follow-up imaging had been performed. Details of antibiotic therapy and of any drainage procedure were not available in the records.

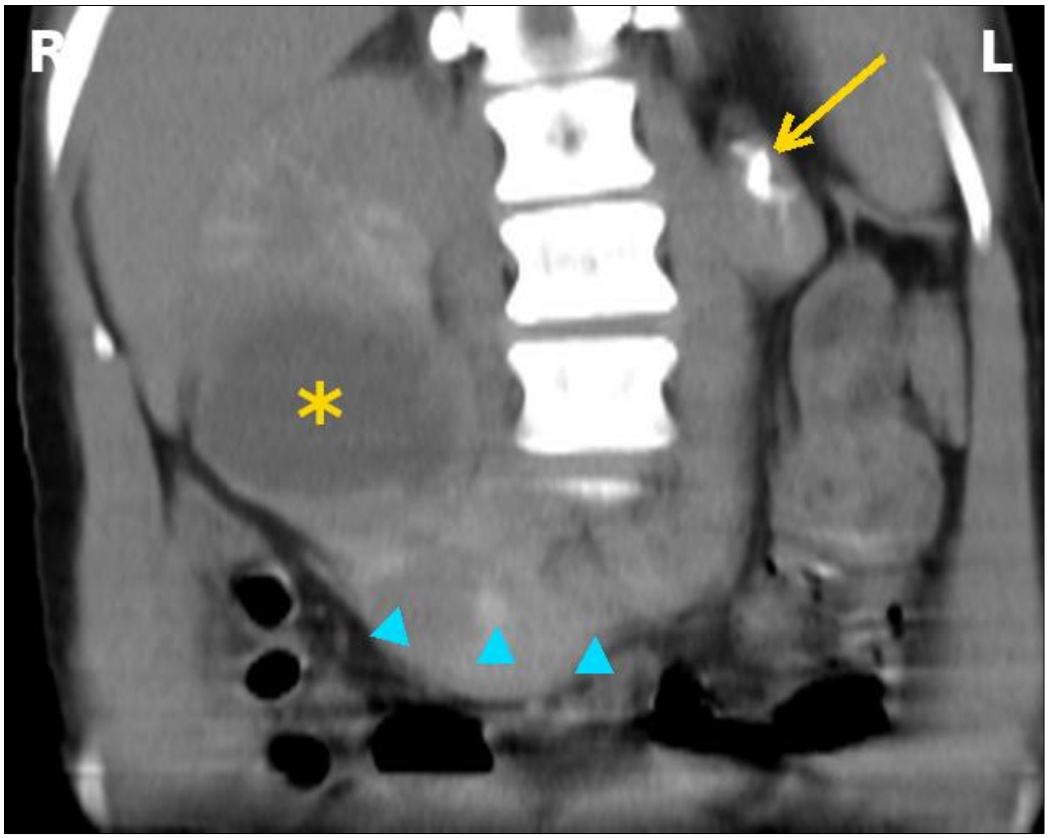


Figure 1: Oblique coronal thick-slab reformation (10 mm average) of the delayed phase, angled along the long axis of the fused kidney, showing the whole horseshoe. The enlarged right moiety contains the large abscess (asterisk); the enhancing parenchymal isthmus (arrowheads) crosses the midline in front of the lower lumbar spine and contains the smaller hypodense isthmic collection on its right side; it joins the small, atrophic left moiety, whose collecting system shows hyperdense excreted contrast (arrow). R, right; L, left.

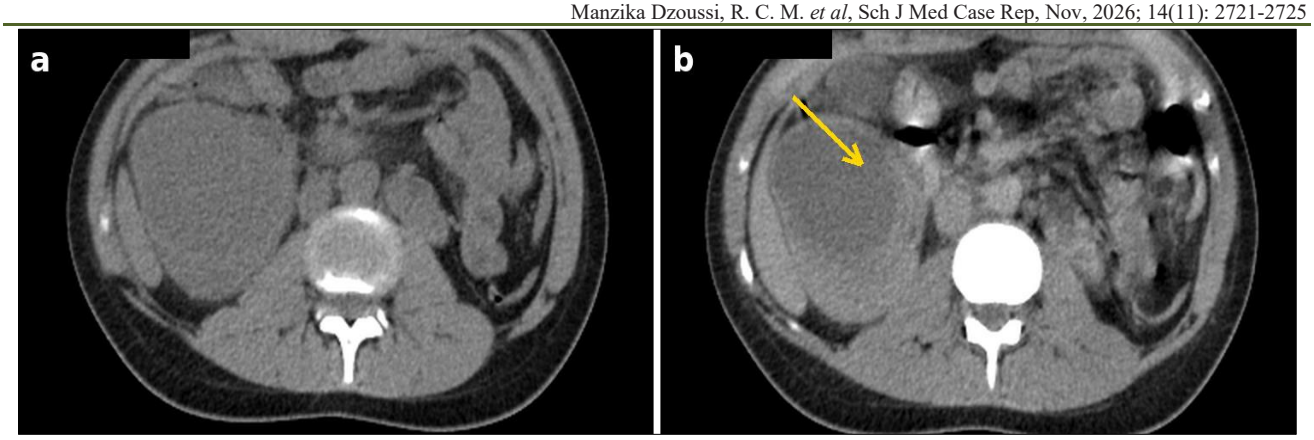


Figure 2: Axial CT at the level of the right moiety. (a) Unenhanced image: large, well-defined, homogeneously hypodense collection of the right moiety. (b) Portal venous phase: the collection (9 × 5.8 cm) has an irregular peripherally enhancing wall (arrow) and does not enhance centrally.

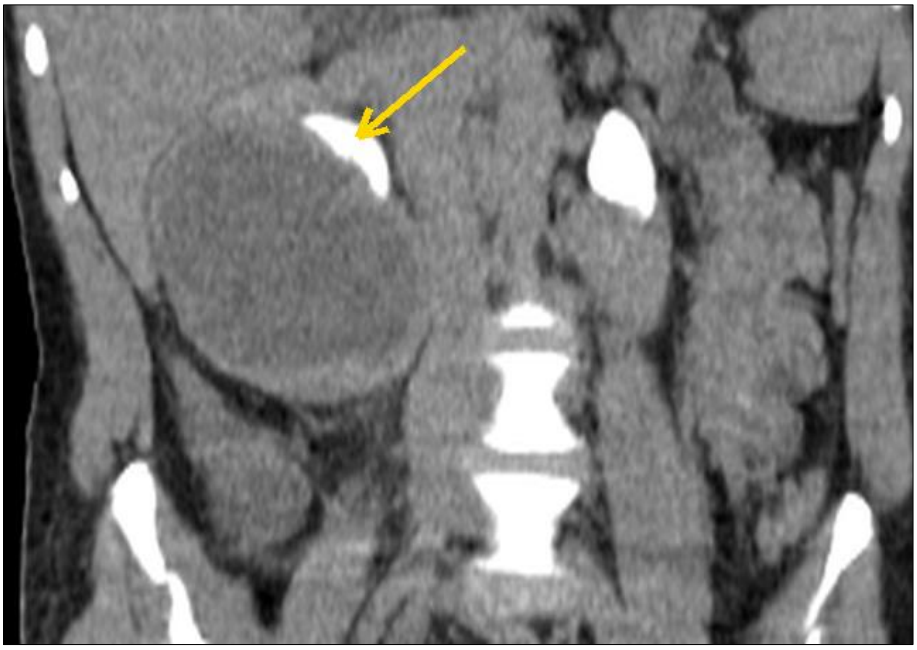


Figure 3: Coronal reformation of the delayed excretory phase: the hyperdense, contrast-filled right renal pelvis (arrow) is displaced and draped over the upper margin of the abscess, with minimal pelvicalyceal dilatation.

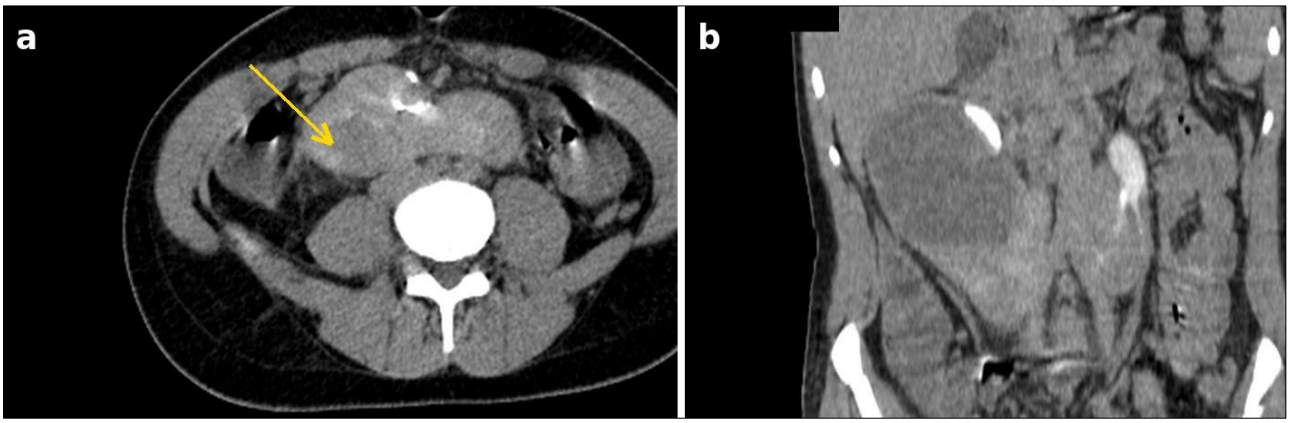


Figure 4: (a) Axial delayed-phase image at the level of the isthmus: second hypodense collection (33.5 × 23 mm, arrow) in the right part of the enhancing isthmus, anterior to the lumbar spine; it is best delineated on this phase, against the enhanced surrounding parenchyma. (b) Coronal reformation of the delayed phase: horseshoe kidney with the large right moiety collection and the isthmus joining the lower poles; excreted contrast opacifies both collecting systems.

DISCUSSION

Why Horseshoe Kidneys Become Infected

The embryological arrest of the fused kidney below the inferior mesenteric artery leaves the pelves anterior, the ureters inserting high and crossing the isthmus, and the collecting system prone to stasis [1, 2]. Stasis favours stones, which affect about one-third of adults with HSK and are themselves a nidus for infection [3]. Rodríguez Alonso *et al.,* attributed the predisposition of HSK to severe infection to the pelvic ectasia that accompanies malrotation [5]. Our patient had no diabetes, the most common predisposing condition in adult series [13], but had recurrent urinary tract infections. The isolation of Escherichia coli, the leading uropathogen, supports an ascending route. The minimal pelvicalyceal dilatation was more likely a consequence of mass effect than a cause, but chronic stasis and possible reflux remain plausible substrates. The atrophic, scarred left moiety raises the question of prior infection or reflux nephropathy and justifies a dedicated work-up.

The Isthmus as a Site of Infection

Published abscesses in HSK involve a moiety, a calyceal diverticulum or the perinephric space [6–8]. A focus within the isthmus is rarely documented. A parenchymal isthmus has its own blood supply, frequently from the aorta below the isthmus or from the iliac arteries, and can host the same pathology as the rest of the kidney [1-9]. Isthmic involvement matters for three reasons. It is easily overlooked when attention is drawn to a large moiety abscess; in our case it was subtle on the portal phase and conspicuous only on delayed images. It lies against the aorta, inferior vena cava and bowel, which limits percutaneous access. And it may persist as a source of relapse if only the dominant collection is treated.

CT Diagnosis and Differential

Contrast-enhanced CT is the reference examination for complicated upper urinary tract infection. It separates focal pyelonephritis, which appears as poorly marginated wedge-shaped hypoenhancement, from abscess, which appears as a fluid-attenuation collection with an enhancing wall [4-10]. Multiphase acquisition adds value in HSK. Arterial images map the often multiple and aberrant renal arteries [9]. Excretory images show the relationship of the collection to the collecting system, as did the draped right pelvis in our case. Delayed (nephrographic to excretory) images also increase the contrast between enhanced parenchyma and a non-enhancing collection, which revealed the small isthmic focus here. Coronal reformations best display the fusion and the isthmus.

The main differential diagnoses of a septated, rim-enhancing renal mass in a young adult are an infected cyst or calyceal diverticulum, a cystic renal neoplasm, and, in endemic regions such as Morocco, a hydatid cyst. A hydatid cyst may show daughter cysts, a detached membrane or wall calcification. Xanthogranulomatous pyelonephritis usually associates a staghorn calculus and dilated calyces with an enlarged, poorly functioning kidney [4]. Here, the febrile subacute course, inflammatory syndrome, Escherichia coli urinary infection, perirenal stranding and thick enhancing wall favoured abscess.

What the Report Must Give the Clinician

Imaging findings drive management, although no universally accepted size threshold exists [11]. In the classic series of Siegel *et al.,* abscesses under 3 cm resolved with antibiotics alone, those of 3 to 5 cm resolved with percutaneous drainage in 92% of cases, and larger abscesses often needed repeated drainage [12]. Lee *et al*., treated most abscesses of 5 cm or less medically [13], and recent cohorts add inflammatory markers and the abscess-to-kidney ratio to size [11-14].

The report should therefore measure each collection separately. Here, the 9 cm moiety abscess fell in the drainage range, whereas the 3.4 cm isthmic focus lay at the threshold where antibiotics may suffice. Missing the isthmic focus would have left an untreated source of persistent sepsis or relapse. If drainage is considered, the route must be planned on CT: the moieties are low and anterior, the isthmus overlies the aorta and inferior vena cava, and aberrant arteries may cross the path [1-9]. The report should also describe the collecting system, the contralateral moiety and any calculus, since these determine the need for further urological work-up.

Limitations

This report describes a single case. Blood cultures were not obtained, treatment details were not available, and no follow-up imaging had been performed at the time of writing, so the response of each collection to treatment cannot be reported. The report therefore focuses on the diagnostic contribution of CT.

CONCLUSION

Renal abscess can involve the isthmus of a horseshoe kidney and may coexist with a larger abscess of one moiety. Multiphase CT with coronal reformations and delayed images establishes the fused anatomy, characterises each collection and maps vessels and the collecting system before drainage. Each collection should be measured and managed on its own merits, and follow-up imaging should include the isthmus.

Learning Points

- In any renal abscess on a horseshoe kidney, review the isthmus systematically: a second focus is easy to miss beside a dominant collection.
- Coronal reformations and delayed images are the most useful views: they show fusion, the

isthmus, small isthmic collections and displacement of the collecting system.

- Size remains the main driver of treatment (antibiotics under 3 cm, drainage above 5 cm), adjusted for clinical status and biomarkers.
- Plan any percutaneous route on CT, because the isthmus overlies the great vessels and aberrant renal arteries are common.
- An atrophic contralateral moiety warrants work-up for prior infection or reflux.

DECLARATIONS

Patient Consent: Written informed consent for publication of this case and the accompanying images was obtained from the patient. All images have been anonymised. [Confirm that consent was obtained.]

Ethics: Ethical approval is not required for a single anonymised case report at our institution. [Confirm local policy.]

Conflicts of Interest: The authors declare no conflicts of interest.

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