Urol Radiol 9:149–151 (1987)

Urologic Radiology

The Nubbin Sign on Computed Tomography and Sonography

Deborah Blair, Christopher Rigsby, and Arthur T. Rosenfield
Department of Diagnostic Radiology, Yale University School of Medicine, New Haven, Connecticut, USA

Abstract. The loss of parenchyma in the lower pole of a kidney with a duplicated collecting system may mimic a mass on urography ("the nubbin sign"). Computed tomographic findings of this entity are diagnostic. The diagnosis may be difficult to make using sonography alone.

Key words: Kidney, CT — Kidney, US — Duplicated kidney — Reflux nephropathy.

On excretory urography (EU), the "nubbin sign" is characterized by a diminutive lower pole in a kidney with a duplicated collecting system [1]. Due to reflux into the lower pole, this marked parenchymal loss may mimic a renal mass, infarct, or neoplasm and may be a curable cause of hypertension. The nature of the abnormality makes diagnosis difficult on EU, especially when a pyelogram is not seen due to inadequate function of the lower pole. We report our experience in identification of the nubbin sign on computed tomography (CT) and ultrasonography (US), as these may be the first imaging studies in patients with multiple medical problems. We suggest that CT-urography is the optimal diagnostic approach when results of EU are suspicious but not diagnostic of the lesion.

Address reprint requests to: Arthur T. Rosenfield, M.D., Department of Diagnostic Radiology, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06510, USA

Case Report

A 19-year-old woman was admitted to Yale–New Haven Hospital for the evaluation of recent recurrent urinary tract infections. At age 4, the patient underwent EU and voiding cystourethrogram (VCUG) for repeated urinary tract infections. At that time, a duplicated right renal collecting system was identified with reflux to the right lower pole, and the left kidney was found to be atrophic. She underwent ureteral implantation of the right lower pole ureter and had no recurrent infections. She was followed up with repeated VCUG examinations, which demonstrated no reflux. At age 19, she again developed recurrent urinary tract infections requiring multiple hospitalizations. VCUG showed no reflux. US and CT studies were performed to evaluate the kidney as well as exclude the presence of an intra-abdominal abscess, as the patient developed persistent fevers despite antibiotic therapy.

Sonography demonstrated focal parenchymal loss in the lower pole of the right kidney, associated with increased echogenicity in the same area (Fig. 1). There was no evidence of urinary tract dilatation, and a single renal sinus was demonstrated. The right ureters were not identified.

CT was diagnostic in recognizing two right ureters, a finding characteristic of a duplicated renal collecting system. Parenchymal loss in the lower pole as seen on US was a remnant of parenchyma from the lower pole duplication (Fig. 2). In addition, there was hypertrophy of the upper pole parenchyma (Fig. 3). Since an EU, which was performed at age 4, had revealed normal parenchyma in the right lower pole, this process was not secondary to congenital hypoplasia but rather a sequela of reflux nephropathy.

Subsequently, selective ureteral catheterization localized the infection to the lower pole of the right kidney. The patient underwent resection of the right lower pole nubbin and has had no further infections.

Discussion

While duplication of the urinary tract is common (the incidence varies from 0.3 to 6% in different series) [2], the associated loss of renal parenchyma

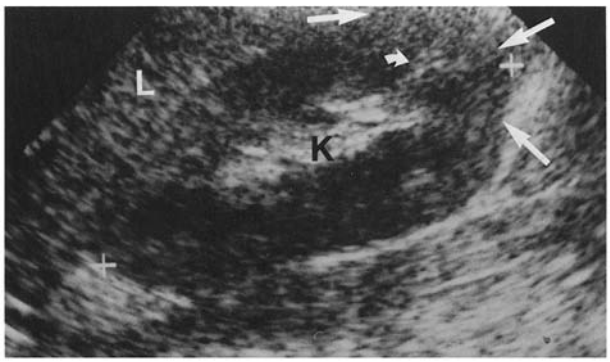

Fig. 1. Longitudinal sonogram of the right kidney. The cursors define the sagittal dimension of the right kidney. Focal parenchymal loss inferiorly represents the nubbin of lower pole parenchyma. Straight arrows outline the lower pole moiety, which has increased high level echoes; the curved arrow highlights the renal sinus of the lower pole. L, liver; K, kidney.

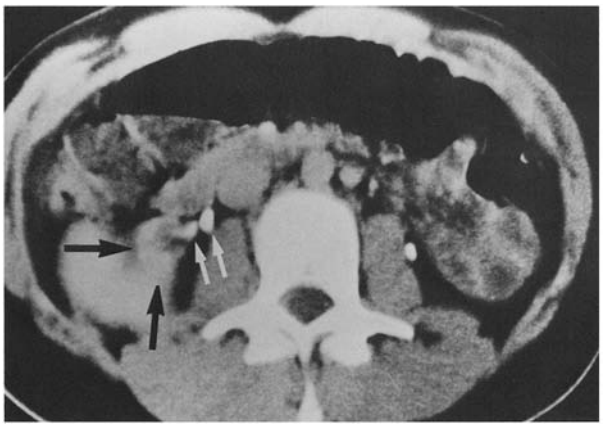

Fig. 2. CT of the lower pole of the right kidney. Large arrows outline the residual parenchyma of the lower pole. Two ureters are clearly identified (small arrows). The lateral ureter, from the nubbin of lower pole parenchyma, contains opaque contrast medium.

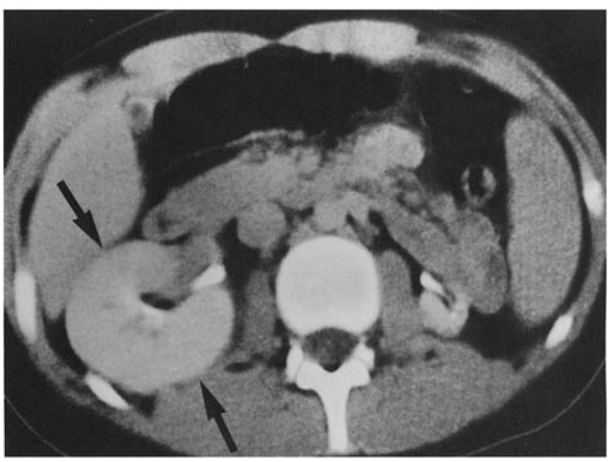

Fig. 3. CT image of the midpole of the right kidney. The upper pole parenchyma has hypertrophied (straight arrows). A single ureter filled with contrast is identified at this level posterior to the unopacified renal vein. The left kidney has been atrophic since childhood.

in the lower pole is rarely so severe that it causes confusion on imaging studies. The presence of a nubbin on either US, as demonstrated by our case, or on EU [1] can cause significant confusion, particularly when the lower pole does not excrete opaque contrast medium.

Ultrasound is an excellent modality to identify an obstructed duplicated system; it may demonstrate a dilated lower pole collecting system when reflux is present if the scan is performed at the time that the patient is refluxing. A different situation exists in a duplicated collecting system without obstruction to the upper pole or active reflux into the lower pole. While an initial report suggested that a single central echo complex in the renal sinus excluded duplication [3], our experience has shown that it exists in the majority of duplication anomalies, and that the majority of patients with two renal sinuses have a single bifid system [4]. The central echo complex of a renal sinus is generated from the fat and fibrous tissue in the sinus, which is independent of the number of collecting systems. The echogenic urothelium of a nondistended system merges with the surrounding renal sinus fat and fibrous tissue. In 40% of patients, two echogenic renal sinuses occur due to the absence of embryologic fusion of the upper and lower pole renunculi from which the kidney is formed in utero [5]. In our patient a single renal sinus was demonstrated in the kidney with a duplicated collecting system. However, there was increased focal echogenicity and marked focal parenchymal loss in the lower pole. This finding, typical of scarring such as in chronic atrophic pyelonephritis (reflux nephropathy) [6], may be the only US abnormality in duplication with a residual nubbin.

In the original article on the nubbin sign by Curtis and Pollack [1], VCUG was suggested to identify reflux in the lower pole when this entity was suspected but could not be verified on EU. However, in their series, two of the eight patients failed to have reflux at the time of the cystogram. This is not surprising since vesicoureteral reflux is frequently intermittent. Similarly, vesicoureteral reflux was not demonstrated in our patient on several VCUG examinations. In this case, CT clearly identified the diminutive lower pole and two normal-size ureters. When contrast material is present in the ureter, reflux should be excluded on CT by evaluation of the

distal ureter for distention and the presence of contrast material. Even without visible excretion of contrast material two ureters can usually be identified on CT. In addition, when the ureter is collapsed and difficult to visualize, a CT scan obtained at the exact level of the junction between the upper and lower pole of a duplicated renal collecting system may demonstrate a "faceless" kidney [7] lacking in vascular or collecting system structures and indicative of a duplicated system. Thus, CT is diagnostic in this situation, excluding all the other entities in the differential diagnosis.

As an initial approach to diagnose recurrent urinary tract infections in a young patient, EU is the recommended procedure. When a nonfunctioning nubbin is suspected on EU, CT performed immediately after will confirm the diagnosis without reinjection of intravenous contrast medium [8]. In cases of poor renal function or contrast allergy, CT performed without intravenous contrast medium will still be diagnostic as two ureters will almost always be identified from the kidney, one associated with a nubbin of lower pole parenchyma. Observation of a duplicated central collecting system, with a faceless kidney [8] between the two collecting systems, confirms the diagnosis of a nubbin even when the distal ureter cannot be followed distally due to collapse, nonfunction of the lower pole moiety, or lack of retroperitoneal fat to separate it from surrounding soft tissue structures. Often CT is performed as an initial procedure in patients with multiple medical problems and, in these situations, a definitive diagnosis can be made by CT alone.

References

1. Curtis JA, Pollack HM: Renal duplication with a diminutive lower pole: the nubbin sign. *Radiology 131:*327–331, 1979
2. Privett JTJ, Jeans WD, Roylance J: The incidence and importance of renal duplication. *Clin Radiol 27:*521–530, 1976
3. Schaffer RM, Shih YH, Becker JA: Sonographic identification of collecting system duplications. *J Clin Ultrasound 11:*309–312, 1983
4. Horgan JG, Rosenfield NS, Weiss RM, Rosenfield AT: Is renal ultrasound a reliable indicator of a nonobstructed duplication anomaly? *Pediatr Radiol 14:*388–391, 1984
5. Carter AR, Horgan JG, Jennings TA, Rosenfield AT: The junctional parenchyma defect: a sonographic variant of renal anatomy. *Radiology 154:*499–502, 1985
6. Kay CJ, Rosenfield AT, Taylor KJW, Rosenberg MA: Ultrasound characteristics of chronic atrophic pyelonephritis. *AJR 132:*47–49, 1979
7. Hulnick DH, Bosniak MA: "Faceless kidney": CT sign of renal duplicity. *J Comput Assist Tomogr 10:*771–772, 1986
8. Zaontz MR, Pahira JJ, Wolfman M, Gargurevich AJ, Zeman RK: Acute focal bacterial nephritis: a systematic approach to diagnosis and treatment. *J. Urol 133:*752-757, 1985