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Case Report

Recurrent urinary tract infections in an adult with a duplicated renal collecting system

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ABSTRACT

Because of advancements in fetal imaging, anatomic variants of the genitourinary tract are most often discovered in the antenatal period. As such, general internists are less likely to encounter adult patients with previously undiagnosed anatomic abnormalities of the renal collecting system, such as duplicated kidneys. These abnormalities put patients at risk for urinary obstruction and recurrent infections of the urinary tract. We report the case of a 40-year-old diabetic patient with a previously undiagnosed duplex kidney who had recurrent episodes of diabetic ketoacidosis triggered by urinary tract infections. She was ultimately found to have abscess formation in the duplicated renal moiety. We reviewed the epidemiology, diagnosis, and management of duplex kidneys. We also reviewed the indications for renal imaging in adult patients with similar clinical presentations.

Introduction

The most common anatomic variant of renal anatomy is duplication of the kidney's collecting system, wherein an additional renal moiety is situated adjacent (usually superior) to the kidney with an independent ureteral origin. Estimated prevalence of duplex kidneys ranges between 0.3% and 6% of the population with a female preponderance [1–4]. One consequence of a redundant renal collecting system is ureteric orifice malpositioning, such that the ureter of the inferior pole implants with a shorter tunnel into the bladder, thereby predisposing to vesicoureteral reflux. On the other hand, the positioning of the ureter of the superior pole of the kidney makes it more prone to ureteroceles and obstruction at the ureterovesicular junction. Childhood detection of such renal anomalies has dramatically increased because of more innovative fetal imaging; however, a significant number of undiagnosed adults still exist [1,5,6]. Such adult patients are at increased risk of recurrent episodes of urinary tract infections (UTIs) and pyelonephritis.

Case report

A 41-year-old female patient with a medical history of type I diabetes mellitus and hypothyroidism presented with 4 days of nausea, vomiting, and decreased oral intake. She also

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complained of malodorous urine with left-sided flank pain but did not have dysuria. At home, she noted that her random blood sugars surpassed 300 despite strict adherence to a carbohydrate-controlled diet and insulin regime. The night before presentation, the patient also experienced fever and chills. The patient also shared a history of frequent UTIs as a child and young adult, including a similar episode approximately 6 weeks before this presentation, for which she was seen at an outside hospital.

On presentation, the patient's vital signs were initially within normal limits, and her examination was remarkable for a fatigued appearance, dry mucous membranes, tachycardia, dry and warm skin, and left flank and costovertebral angle tenderness. Laboratory work-up was significant for a marked leukocytosis, acute kidney injury, and an anion gap metabolic acidosis with positive serum ketones. Urinalysis showed pyuria and bacteriuria. The patient was diagnosed with diabetic ketoacidosis with pyelonephritis as a presumed source of infection. She was managed with crystalloid fluid resuscitation, an insulin infusion, and she was initiated on empiric ceftriaxone. Initially, the patient clinically improved with ceftriaxone targeting *Escherichia coli*, the organism isolated from an admission urine culture. However, on hospital day 3, she again began to experience high-grade fevers and rigors despite appropriate therapy. This raised the suspicion for complicated pyelonephritis with abscess formation.

Given her young age, history of recurrent UTIs, and persistent fevers, she underwent a retroperitoneal ultrasound, which showed an approximately 6 × 6-cm heteroechogenic mass on the superior pole of her left kidney with variable Doppler flow (Fig. 1). This finding was determined to be quite concerning as either a severely damaged and infected portion of the kidney versus malignancy. To further characterize this mass, she underwent computerized tomography and magnetic resonance imaging of the abdomen, which showed a 6.1 × 6.7 × 5.5-cm heterogeneous-enhancing soft-tissue mass that was consistent with a duplicated collecting system on the superior pole of her left kidney, although it was initially mistaken for representing a mass suspicious for cystic renal cell carcinoma (Figs. 2 and 3). Ultimately, magnetic resonance imaging characterized abscess formation within the duplicated kidney.

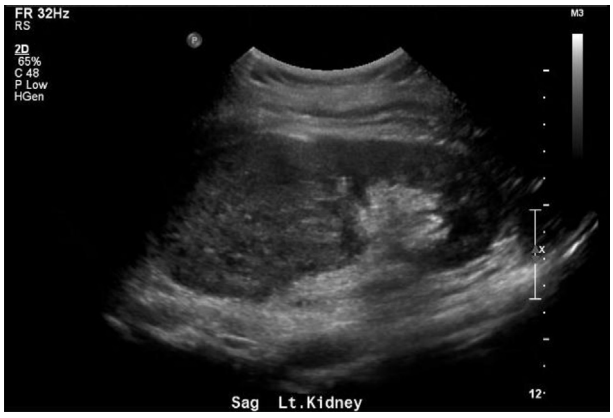

Fig. 1 – Sagittal ultrasound of left kidney demonstrating echogenic superior pole density.

She subsequently underwent interventional radiology-guided percutaneous drain placement that initially yielded over 20 cc of purulent material with culture positivity for *E. coli*. She was then continued on oral cefpodoxime to complete her 28-day course (based on microbiologic sensitivities) and continued to improve clinically with arrangements made outpatient follow-up with urology and interventional radiology. Ultimately, serial ultrasound follow-up imaging and fluoroscopic drainage of the duplicated system occurred over the following 2 months by interventional radiology, and the patient recovered without complication.

Discussion

Diagnosis of a duplicated kidney is the best made radiographically by identification of dual collecting systems. The redundant renal moiety can often be atrophied and may thus have variable size and appearance on diagnostic imaging, often being confused for renal cysts [7]. Traditionally, ultrasound and voiding cystourethrograms have been used to visualize the complete urinary tract and to show evidence of reflux [8]. More conventionally, contrast-enhanced computerized tomography scan can demonstrate the redundant ureter and evidence of associated hydronephrosis.

The two most important clinical consequences of a duplex kidney are vesicoureteral reflex and ureterovesicular junction obstruction. Previous reports on this condition in children detail the many possible anatomic variations of a duplicated collecting system, differing mostly in where the redundant ureter inserts [9]. Clinical presentations associated with duplicated kidneys include flank pain, hematuria, and UTIs [1]. Patients who are symptomatic most often present during childhood, with adult cases more often being discovered incidentally on abdominal imaging [6]. Thus, our case was unusual since one would expect the abnormality in such a symptomatic patient have come to clinical attention earlier in life.

When the diagnosis of duplex kidneys is made in children, radioisotope studies can be conducted to quantify differential renal function in the normal kidney and redundant renal moiety [8]. Surgical extraction is not without risk as over half of pediatric patients will have at least a slight decrease in renal function, and approximately 8% of patients will have more dramatic decrease in renal function [3]. Although there have not been similar studies conducted in adults with duplicated systems, we postulate as a parallel a higher proportion of this subset may suffer from a significant decrease in renal function. As in our case, patients with acutely infected duplex kidneys should receive antibiotic therapy, along with abscess drainage when indicated, before definitive management of the duplicated collecting system.

Of all adult patients with UTIs, the proportion with hitherto undiagnosed anatomic renal abnormalities is suspected to be quite low. Similarly, pyelonephritis is a clinical diagnosis and does not ordinarily require imaging, especially in patients who respond to therapy [10]. Expert clinical opinion states that even in patients with recurrent UTIs, routine urologic imaging has a low diagnostic yield [11]. The decision to pursue