

## **Selected Topics: Emergency Radiology**

### **ULTRASONOGRAPHY OF FLANK PAIN IN THE EMERGENCY DEPARTMENT: RENAL CELL CARCINOMA AS A DIAGNOSTIC CONCERN**

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□ **Abstract**—Acute flank pain is a common emergency department presenting symptom, and bedside ultrasound is being used increasingly in its evaluation. Emergency renal ultrasonography concentrates on the focused presence or absence of hydronephrosis as is often seen in patients with acute flank pain secondary to renal colic. We present three cases in which other abnormal sonographic signs not commonly taught prompted further investigation, revealing renal cell carcinoma. Baseline knowledge of sonographic characteristics of tumors will benefit the occasional emergency patient who has unsuspected renal carcinoma. © 2000 Elsevier Science Inc.

□ **Keywords**—ultrasound; flank pain; renal cell carcinoma; hydronephrosis; renal ultrasonography

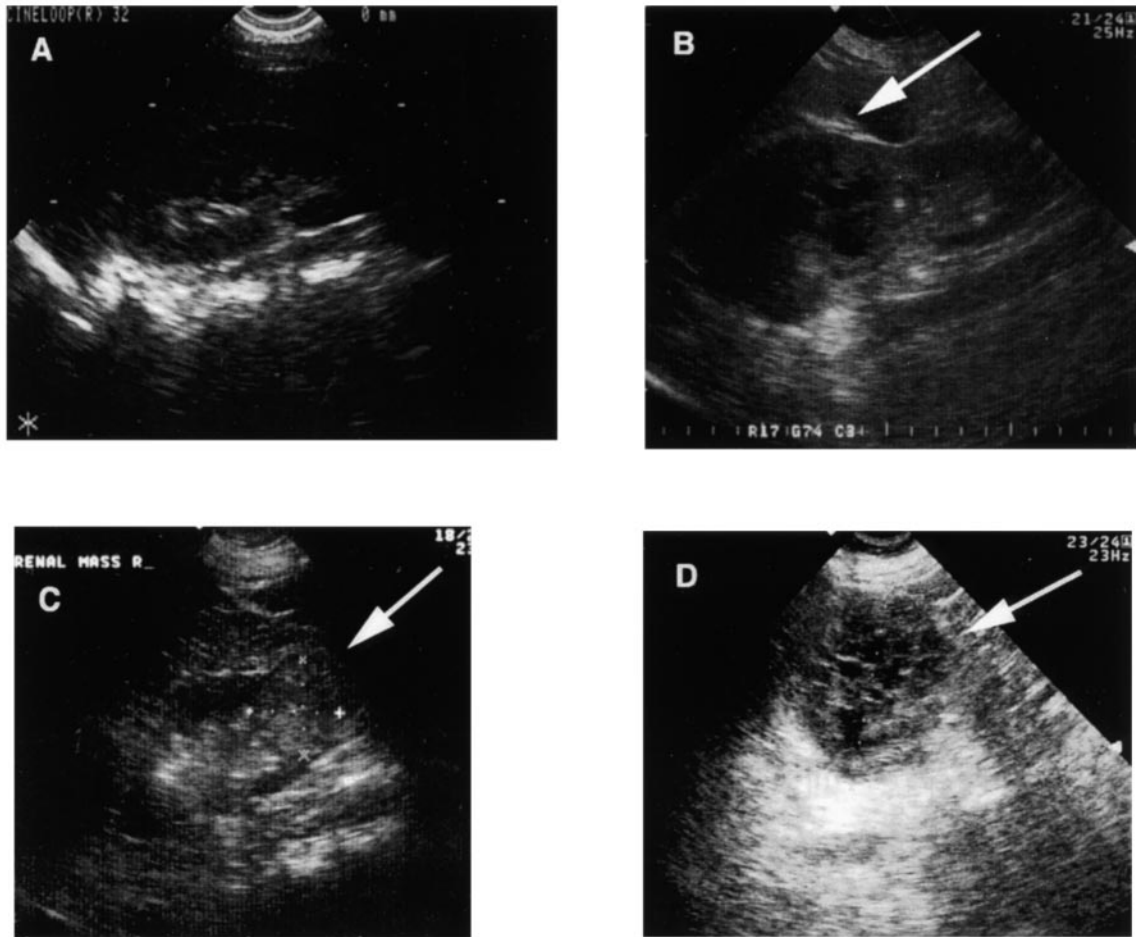
#### **INTRODUCTION**

Acute flank pain is a common emergency department (ED) complaint, and ED bedside ultrasound has an established role in its evaluation (1–3). Typically, in this scenario, ultrasound is used for the detection of hydronephrosis, cholelithiasis, or abdominal aortic aneurysm. In addition, patients with ectopic pregnancy and traumatic conditions may present with acute flank pain, and ultrasound can be a valuable adjunct to diagnosis. We describe three patients evaluated for acute flank pain in whom the emergency physician identified an abnormal renal sonographic appearance, prompting a definitive

imaging modality. These ultrasound findings are not commonly taught within emergency ultrasound curricula (4). In the presented cases, renal cell carcinoma was the cause of the identified renal mass.

#### *Case 1*

A 50-year-old man with a history of hypertension and chronic low back pain was referred to the ED to “rule out pyelonephritis.” He had a 9-month history of low back pain that had worsened in his right back over the previous 3 weeks. On examination, he was alert and in the left decubitus position. Blood pressure was 164/110 torr with a heart rate of 112 beats/min, respirations of 24 breaths/min, and oral temperature of 36.5°C (97.8°F). The patient had right costovertebral angle tenderness and mild diffuse abdominal tenderness without peritoneal signs. Neurologic examination revealed weakness of the right calf and a decreased ankle reflex on that side. Laboratory evaluation was remarkable for a leukocytosis of 17.2 and a urinalysis with 5–10 red cells per high power field but no pyuria or bacteruria. An emergency ultrasound was performed to search for hydronephrosis, and a mass next to the kidney was found (Figure 1B). An abdominal computed tomography (CT) scan revealed an 8×8-cm mass on the kidney, which later was found to be Robson stage 4 renal cell carcinoma with metastasis to the right



**Figure 1.** A) Normal renal ultrasound; B) Case 1: renal ultrasound demonstrating a large mass at the upper pole of the kidney (arrow). The mass contains intratumoral cystic areas while the inferior pole has a normal-appearing architecture; C) Case 2: a well-circumscribed isoechoic lesion is seen at the inferior pole of the kidney (arrow); D) Case 3: a large complex mass is seen replacing the entire normal renal architecture (arrow).

sacroiliac joint. The patient underwent a nephrectomy and was started on radiotherapy.

### CASE 2

A 56-year-old male presented with bilateral flank pain, right greater than left, and mild abdominal pain. He also reported hematuria for the past week. Blood pressure was 148/93 torr, heart rate 88 beats/min, respirations 20 breaths/min, and temperature 37°C (98.6°F). On examination, he had mild costovertebral angle tenderness with mild lower abdominal tenderness without rebound. Urinalysis revealed gross hematuria; the rest of the laboratory testing was normal. Bedside ultrasound looking for hydronephrosis was completed; a 5 × 5-cm mass was noted on the lower pole of the right kidney (Figure 1C). This was confirmed by CT scan, and the patient under-

went nephrectomy for Robson stage 1 renal cell carcinoma.

### CASE 3

A 70-year-old female with a history of hypertension presented to the ED with acute flank pain and hematuria for 1 day. She reported having three similar episodes in the past 2 months. Blood pressure was 156/94 torr, heart rate 106 beats/min, respirations 22 breaths/min, and temperature 37.5°C (99.6°F). Physical examination was normal. Urinalysis revealed 25–50 red cells and 10–25 white cells per high power field and moderate bacteriuria. A bedside emergency ultrasound was performed looking for hydronephrosis from a possible infected renal stone. During this examination, a complex renal mass was noted on the right kidney (Figure 1D). This was

found to be Robson stage 1 renal cell carcinoma; the patient had a right nephrectomy.

## DISCUSSION

Emergency ultrasonography concentrates on primary indications and the focused findings directly related to that pathology. In most cases, the identified organs will be normal (Figure 1A) or exhibit findings normally taught to emergency physicians performing sonography. In the case of renal ultrasonography, the focused emergency goal is the detection of hydronephrosis (2,3). On an occasional basis, which has not been quantified, emergency ultrasonography will reveal abnormal pathology that is considered optional in standard emergency ultrasound curricula (4). The three cases reported here demonstrate one such diagnosis in which ultrasonography of the flank can detect abnormal pathology not usually taught or emphasized to emergency physicians.

Renal cell carcinoma is the most common kidney tumor, forming 85% of all renal tumors and increasing in incidence. It represents 3% of adult malignancies, with an expected 29,900 new cases in 1998 (5,6). It is a malignancy of adults in their 40s to 60s living in urban areas, but cases also occur in childhood (7). Men are more commonly affected than women, and a familial form has been reported. In addition, renal cell carcinoma is associated with von Hippel-Lindau disease and acquired cystic kidney disease (8). Renal cell carcinoma arises from the proximal convoluted tubule. A definite etiology has not been identified, though the tumor is more common in smokers (5).

Though not common, the classic triad presentation consists of flank pain, hematuria, and a palpable mass, and often indicates advanced disease (8). In addition, weight loss, fatigue, and fever are common. Hypertension is occasionally seen because of excess levels of renin. Laboratory evaluation can reveal anemia or polycythemia, hypercalcemia, or nonmetastatic hepatic dysfunction (5).

Ultrasound detection of renal tumors has been used extensively and has helped the early detection of this cancer (9–12). It is estimated that two-thirds of all locally confined renal tumors are found serendipitously. Tumors detected in this fashion have a lower grade and stage. Since surgical resection is the mainstay of therapy, earlier detection leads to an overall better survival (9,10,13–15). Renal tumors are classified as cystic, solid, or complex by sonography. Cystic lesions usually have a smooth well-defined border, sharp interface with local tissue, an anechoic interior, and excellent through-sound transmission. Solid lesions often have a nongeometric shape with irregular borders, poor interface definition

with local tissue, low-level internal echoes, and poor through-sound transmission. Complex tumors have characteristics of both cystic and solid lesions.

Renal carcinoma is found in both kidneys with equal frequency and has no predilection for a region of the kidney. Tumors are more often detected in the right kidney using ultrasound because of the acoustic window of the liver and because of the frequency of hepatobiliary ultrasound examinations (16). In our cases, all tumors were found in the right kidney. Most renal tumors are solid and isoechoic in quality, but they may be hyperechoic or hypoechoic (17). The tumor may be discrete in nature or may be diffuse within the kidney, with either form causing deformation of the characteristic kidney shape. The tumor wall is often indistinct and poorly defined (17). In addition, intratumoral cystic structures may be noted on sonography, and tumor calcification is seen in a small number of cases (18). Figures 1B & 1D demonstrate intratumoral cystic areas. The unaffected kidney always should be scanned to note subtle differences of sonographic appearance. All sonograms showing any abnormality as described above need definitive imaging. CT scan is the imaging modality of choice for detection and staging of this disease and can accurately differentiate cystic and solid structures while detecting local and distant spread of the disease. Magnetic resonance imaging is being used increasingly and is particularly useful in patients with contrast dye allergy, renal failure, or pregnancy (19).

The sophistication of emergency department bedside ultrasonography has increased steadily over the last 10 years (20). Knowledge of important alternate diagnoses will play a small but significant role in emergency ultrasonography. We do not advocate that emergency physicians screen or attempt to primarily diagnosis renal tumors, and ED use of renal ultrasound should be confined to patients suspected of having acute renal colic. Despite these efforts, there will be presentations of renal tumors that will mimic renal colic. We hope that knowledge of ultrasound features of renal tumors will help the occasional patient who otherwise may not have been correctly diagnosed.

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