Infection

Emphysematous Pyelonephritis

Definition

Emphysematous pyelonephritis (EP) refers to a necrotizing parenchymal and perirenal condition that often affects diabetics and other immunocompromised patients. It is associated with poorly functioning kidneys and kidneys which are obstructed. Although the pathophysiology of EP is poorly understood, it is suspected to be caused by organisms that ferment glucose to carbon dioxide. The infection is often life threatening, with mortality rates reported near 40%\(^1\) and is most commonly associated with *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterobacter cloacae*.

Clinical Presentation

The clinical presentation of EP is not distinct from that of other upper urinary tract infections. Fever, flank pain, and pyuria are common, though, because EP can illicit an intense inflammatory response, an elevated white count, tachycardia, low systolic blood pressures, and other hemodynamic parameters consistent with sepsis.

Diagnosis

The diagnosis is often made radiographically. The single best radiographic test is the abdominal computed tomography (CT) scan, but, although less reliably, plain abdominal radiographs or ultrasonography can also make the diagnosis\(^2\). Regardless of imaging modality, the characteristic signs of EP are the presence of gas in the renal and perinephric tissues with tissue destruction (Figure 36.1). At times the gas may extend into the renal pelvis and ureter (Figure 36.2).

A radiographic classification has been made regarding the CT appearance of air in patients with EP. Type I EP is characterized by parenchymal destruction with either absence of fluid collection or presence of streaky or mottled gas, whereas type II EP is characterized as either renal or perirenal fluid collections with bubbly or loculated gas or gas in the collecting system.

Management

Once it is clear clinically that the patient has an infection from a urinary tract source, appropriate broad-spectrum antibiotics should be started, urinary tract obstruction should be assessed and relieved, and prompt control of blood glucose should begin. If EP is diagnosed and fails to respond promptly to nonsurgical management, the appropriate treatment is most commonly surgical removal (radical nephrectomy), although for select cases the less aggressive approach of percutaneous nephrostomy tube placement and antibiotics has been successful\(^3\).
Prognosis

In a recent study by Wan et al., predictors of survival in their cohort of patients with EP included platelet count, serum creatinine level, and the radiologic type of EP. Patients with a platelet count of less than 60,000, a serum creatinine level above 1.4, and radiologic type I EP were significantly more likely to die.4,5

Renal and Perirenal Abscess

Definition

Renal abscesses are divided into two types. One type is the renal cortical abscess, which is believed to originate from hematogenous spread of bacteria, most commonly *Staphylococcus aureus* and usually from infected skin, bone, or an endovascular prosthesis.6 Predisposing factors for cortical abscesses are intravenous drug use and diabetes.

The second type of renal abscess is the corticomedullary abscess, which is believed to be caused by an ascending infection from the bladder. The organisms that cause these abscesses are the typical bacteria that cause lower urinary tract infections, such as *E. coli, K. pneumonia, and Proteus*. In either case, the renal abscess from the offending organism causes pyelonephritis. If the local immune response cannot adequately control the bacteria, parenchymal destruction and liquefaction result, leading to microabscess formation, which can coalesce to form either solitary or multiple larger renal abscesses. These abscesses can break through the capsule of the

![Figure 36.1. Emphysematous pyelonephritis. (A) Radiograph shows crescent-shaped (arrowheads) and loculated (arrows) gas in the right renal area. (B) Computed tomography image obtained after administration of contrast material shows a low-attenuation area (arrowheads) in the right kidney caused by acute pyelonephritis as well as a subcapsular abscess with fluid and bubbly and loculated gas. The patient survived after percutaneous drainage was performed. (A and B reprinted with permission from Wan et al.5)](image1)

![Figure 36.2. Emphysematous pyelonephritis. Gas in the left renal and perirenal tissues. The renal pelvis and ureter are also distended with gas. (Reprinted with permission of Elsevier from Grainger & Allison’s Diagnostic Radiology: A Textbook of Medical Imaging, 4th ed. New York: Churchill Livingstone, 2001.)(image2)