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Abstract

Emphysematous pyelonephritis (EPN) is a rare, severe infection of renal parenchyma presenting commonly with fever and flank pain and presence of gas in the renal and/or perirenal space. EPN can be life threatening if not diagnosed and treated promptly. Air shadows in the renal or peri-renal region on imaging studies of the abdomen are diagnostic features of EPN. However, computed tomography (CT) scan of the abdomen is better than ultrasound for diagnostic classification, prognosis, and treatment options. We treated a young female with uncontrolled type II diabetes mellitus who had severe abdominal and back pain with fever. The CT scan confirmed the diagnosis of EPN. The conservative treatment itself was effective in complete resolution of the disease even though patient had severe type of EPN.

Keywords: computed tomography, diabetes, emphysematous pyelonephritis, fever, ultrasound

Introduction

Diabetics are prone to urinary tract infections and the severity depends on the status of immunity. Emphysematous pyelonephritis (EPN) is a severe, potentially fatal, necrotising pyelonephritis with a variable clinical picture ranging from mild abdominal pain to septic shock. EPN is caused by organisms such as *Escherichia coli* (66%) and *Klebsiella pneumoniae* (26%). Mixed organisms are observed in 10% (1). Two distinct clinical entities; emphysematous pyelitis and emphysematous pyelonephritis have important prognostic and therapeutic implications.

Wan et al. (2) described two types. Type I includes patients showing parenchymal destruction with streaky or mottled gas but with no fluid collection having a mortality rate of 69%. Type II patients showed air in renal, in the collecting system or perirenal space fluid collections and mortality rate was 18%. Another classification has 4 classes (3–5); class 1: Gas confined to the collecting system, class 2: Gas confined to the renal parenchyma alone, class 3A: Perinephric extension of gas or abscess, Class 3B: Extension of gas beyond the Gerota fascia, class 4: Bilateral EPN or EPN in a solitary kidney. Emphysematous pyelitis (EP) is characterised by air in collecting system but not in parenchyma, diabetes is the co-morbid condition in 50% cases.

Overall EP has less grave prognosis. EPN has overall 60–75% mortality under antibiotic treatment and 21–29% after antibiotic treatment

and nephrectomy.

Case Report

A 35-year-old female was hospitalised for high fever with chills and rigors and abdominal pain suggestive of urinary infection for the last one week. The pain was in the right upper abdomen and right upper back. Pain was aggravated by deep breathing and relieved on lying on the left lateral position. Patient was under treatment for type II diabetes and was taking met for min 500 mg twice a day (BD) supplemented by insulin 46 IU subcutaneously every day; though not regularly. Patient was treated for cystitis one month ago and had tubectomy 10 years ago.

On examination the following was recorded: pulse 100/min, blood pressure (BP) 110/70 mm of Hg, temperature 102 °F, respiration 24/min and patient appeared in distress. There was marked tenderness in right lumbar and hypochondriac area. Rest of the examination was normal. Investigations revealed haemoglobin of 9.8 g/dL, total white cell count $7.6 \times 10^9/L$; platelet count $50 \times 10^9/L$; red blood cells (RBC) were microcytic hypochromic, erythrocyte, sedimentation rate was 28 mm in 1 h, RBC indices were Mean Corpuscular Volume MCV 77.9 fL, Mean Corpuscular Haemoglobin (MCH) of 24.2 pgl, Mean Corpuscular Haemoglobin Concentration (MCHC) of 31.0 g/dL, urine analysis revealed ketones of 15 mg/dL, albumin 3+, glucose 3+ and 2 to 3 pus cells/HP. Blood urea was 83 mg/

dL and creatinine was 2.0 mg/dL. The HbA1C was 9%; random blood glucose was 456 mg/dL. Arterial blood gas analysis showed mild metabolic acidosis. Total serum bilirubin was 0.6 mg/dL (direct 0.3 mg/dL). Hepatic transaminases were normal. Serum proteins were 6.3 g/dL with an albumin of 2.9 g/dl. Serum sodium, potassium, calcium, phosphorous, uric acid estimations were normal. Human immunodeficiency virus (HIV) and Hepatitis B surface antigen (HBsAg) tests were negative. Blood culture grew staphylococcus aureus sensitive to ceftriaxone and levofloxacin; but urine culture did not grow any organisms. Electrocardiogram and chest X-ray were normal. Ultrasonography of abdomen revealed bulky right kidney with increased right renal cortical echogenicity with perirenal fat and small collection of free fluid in right pleural space. Left kidney and rest of the abdomen and pelvis revealed no abnormality. Computed tomography (CT) scan of abdomen showed enlarged right kidney with perirenal fat stranding and a small air pocket in the right kidney anteriorly (Figure 1). Some air was present in renal parenchyma (Figure 2).

Emphysematous pyelonephritis with minimal pleural reaction in the right posterior costophrenic recess with few minimally enlarged retroperitoneal lymph nodes was the impression. Diagnosis of (Type I) EPN was made based on clinical, laboratory and CT findings.

Diabetic ketoacidosis was treated to normalise the hyperglycemia, dehydration, and electrolytes abnormalities and renal impairment. Antimicrobial drugs ceftriaxone-sulbactam (1.5 g) and metronidazole 500 mg were administered 8 hourly intravenously. Tramadol 50 mg was used intramuscularly for relief of pain. After one week post-parenteral antibiotics, the patient was treated with levofloxacin 500 mg daily for the next two weeks. Patient recovered within three weeks of treatment.

Discussion

The first case of gas-forming renal infection was reported in 1898 by Kelly and MacCallum (3). Since then, approximately 200 cases of EPN have been reported (6). Although most information has been from case reports, a few large series have also been reported (7-9) Emphysematous pyelonephritis has been defined as a necrotising infection of the renal parenchyma and its surrounding areas that results in the presence of gas in the renal parenchyma, collecting system or perinephric tissue (4). More than 90% of cases

occur in diabetics with poor glycemic control. Other predisposing factors include urinary tract obstruction, polycystic kidneys, end-stage renal disease, and immuno suppression (4,10). The pathogenesis of EPN remains unclear; however, four factors have been implicated, including gas-forming bacteria, high tissue glucose level, impaired tissue perfusion and a defective immune response due to impaired vascular supply. Intra-renal thrombi and renal infarctions have been claimed to be predisposing factors in non-diabetic patients (4,10).

The most common is *Escherichia coli*. Our

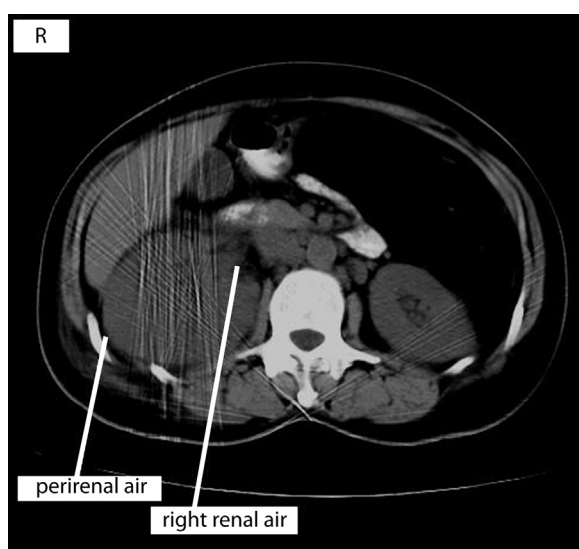


Figure 1: Abdominal computed tomography showing enlarged right kidney with perinephric air.

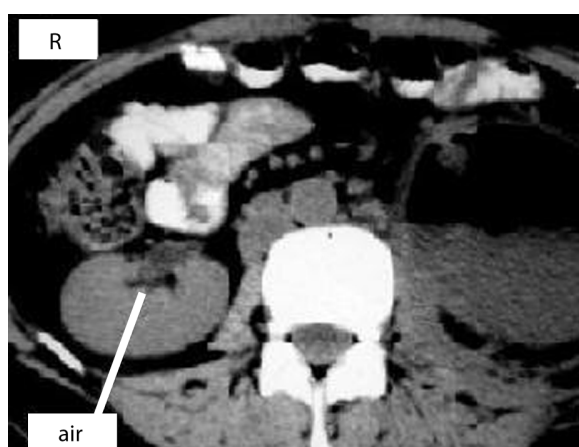


Figure 2: Abdominal computed tomography showing air in renal parenchyma on right side.

patient grew Methicilin-resistant *Staphylococcus aureus* (MRSA) from blood culture, which appeared to be skin contaminant. There are scant reports of MRSA urinary infections in elderly who are physically challenged. The epidemiological data suggest that mean patient age was 55 years and women outnumbered men. The left kidney was affected more frequently than the right one (4). The clinical manifestations of EPN appear to be similar to upper urinary tract infections. Our patient had some of the uncommon features of EPN such as younger age, infection of right kidney, absence of leukocytosis and pyuria (4). Risk factors indicating poor prognosis include thrombocytopenia, acute renal failure, disturbance of consciousness and shock (4,11).

There are some controversial opinions on the treatment. The meta-analysis of these studies suggested that conservative treatment alone is a risk factor for adverse outcome (12).

CT-guided percutaneous drainage or open drainage, along with antibiotic treatment, may be a reasonable alternative to nephrectomy. However, surgical intervention should not be delayed in patients with extensive disease or in those who do not substantially improve after appropriate medical treatment and drainage. Conservative treatment is indicated in the following situations (1): Patients with compromised renal function, early cases associated with gas in the collecting system alone, and patient is in otherwise stable condition, class 1 and class 2 EPN. Class 3 and class 4 EPN: In the presence of fewer than two risk factors.

Nephrectomy is indicated in most patients with no improvement on antibiotics. It is a choice in case there is no access to percutaneous drainage or internal stenting. Gas in the renal parenchyma or "dry-type" EPN and bilateral EPN, patients in class 3 and class 4 EPN having more than two risk factors are also indications for nephrectomy. Our patient appeared to have class I type EPN or 3A on CT grading and responded well to antibiotics obviating the surgical options.

Conclusions

Emphysematous pyelonephritis is not uncommon. It should be suspected in every diabetic patient with urosepsis. CT is the definitive modality for diagnosing EPN. Early diagnosis and effective conservative treatment obviate the need for nephrectomy and decrease mortality. EPN is now being more readily diagnosed, at an early stage, making conservative management of EPN a safe, effective, and feasible option (13,14).

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Conflict of Interest

None.

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