A 40-year-old female patient with diabetes mellitus presented with high fever and left flank pain, not responding to antibiotics. Urinalysis showed marked pyuria. Emphysematous pyelonephritis was diagnosed on initial x-ray & ultrasound. CT scan confirmation of an abnormal gas shadow in left renal parenchyma led to nephrectomy to which the patient responded promptly.

Imaging Findings:

A diabetic patient presented with fever, dysuria, reduced urine output and left flank pain since 5 days, not responding to treatment. There was no history of obstructive lower urinary tract symptoms, hematuria, discharge, trauma or instrumentation. She appeared sick and pyrexic (38.3 °C) with dry mucous membranes and acidic breathing. The abdomen was soft with sluggish bowel sounds and tenderness in the left flank. WBC count was raised with high blood urea 131.4 mg/dL and serum creatinine (Cr) 3.8mg/dL. Her random blood sugar was 542mg/dl. ABG analysis showed metabolic acidosis. Urinalysis showed glycosuria, ketonuria, and gross pyuria, with 15-20 RBCs per HPF, few epithelial cells and leukocyte casts. Blood and urine culture were sterile up to 48 hours. The abdominal X-ray revealed a suspicious lucency in the left renal region [Fig.1]. On ultrasound left kidney appeared enlarged with multiple echogenicities seen within the parenchyma casting dirty distal acoustic (ring down artifacts) suggestive of air within the renal parenchyma [Fig.2]. Computerized tomography (CT) of the kidneys confirmed an enlarged left kidney showing multiple low-density areas with air and fluid collection [Fig.3] suggesting EPN. A diagnosis of diabetic ketoacidosis with urosepsis with left emphysematous pyelonephritis was made. Despite aggressive management with fluids, insulin, inotropic agents and i.v. antibiotics her condition worsened progressively. Therefore, on 3rd day left nephrectomy was done. Following the operation, her condition started improving promptly. She was discharged after 4 weeks and was in good health with a normal urine examination & serum Cr (0.8 mg/dL) at 6 months follow-up.

Discussion:

The first case of “Emphysematous Pyelonephritis” was reported by Kelly and MacCullum [1] in 1898. Approximately 90% cases are associated with diabetes mellitus [2]. Other Risk factors include urinary tract obstruction by calculi, neoplasm or stricture [3]. The left kidney is involved more frequently [4]. Women more commonly affected because of their increased susceptibility to urinary tract infection due to associated diabetic cystopathy and vaginitis. The pathogenesis involves renal damage by toxic oxygen radicals produced due to: 1) High levels of tissue glucose 2) Proliferation of glucose fermenting gas-producing microorganisms, 3) Decreased tissue perfusion 4) Impaired host immunity. Most patients present with fever and chills, flank or abdominal pain or costovertebral angle knocking pain, shock, lethargy and confusion and nausea and vomiting. The demonstration of gas in the renal structures is pathognomonic of EPN. The ipsilateral psoas shadow may be obscured and obstructing stones identified at
abdominal radiography [5]. Intravenous urography will demonstrate a persistent nephrogram on the affected side secondary to delayed excretion of contrast material. Sonographic features consist of multiple high amplitude echoes within the renal parenchyma, renal sinus and perirenal space associated with dirty distal shadowing. The infiltration of the perirenal environment and the excretory cavities by gas forms a shield against ultrasonic waves and leads to non-visualization of kidney (vanishing kidney sign). Computerized tomography is the procedure of choice which is both highly sensitive and specific method for demonstrating intrarenal air and for characterizing the location and extent of that air (intracalyceal, intraparenchymal, perinephric, or pararenal). A CT classification of emphysematous pyelonephritis proposed by Wan et al [6] has prognostic significance. Type I EPN, the classical form, characterized by renal parenchymal destruction and diffuse gas throughout the parenchyma in a streaked or mottled pattern with little or no fluid, has a grave prognosis. Type II EPN defined either as the presence of renal or perirenal fluid in association with a bubbly or loculated gas pattern, or gas in the collecting system with acute bacterial nephritis or renal or perirenal fluid-containing abscesses has a better prognosis than type I EPN. CT also helps in differentiating EPN from Emphysematous pyelitis, in which the gas is limited to only the collecting system of the affected kidney. A crescentic collection of gas within the Gerota fascia indicates extension into perirenal fat and a more advanced stage of renal necrosis [7]. Percutaneous CT-guided drainage of EPN is a safe, quick and life-saving alternative to surgery and palliative treatment of choice particularly with minimal functional impairment and localized disease (discrete abscess or focal pyelonephritis) or in cases of single kidney or in an inoperable high-risk patient [8]. A reciprocal relationship in the renal uptake of Ga-67 citrate and a cortical agent (Tc-99m dimethylsuccinate) on nuclear scintigraphy indicates the response of therapy and the degree of improvement of renal cortical function [9]. A high index of suspicion coupled with radiologic exploration is essential for an early detection of this otherwise camouflaging condition with grave prognosis.

Differential Diagnosis List: Diabetic ketoacidosis with urosepsis with left emphysematous pyelonephritis

Final Diagnosis: Diabetic ketoacidosis with urosepsis with left emphysematous pyelonephritis

References:

Kelly HA, MacCallum WG. Pneumaturia. JAMA 31:375, 1898.
Figure 1

Description: Fig.1 – Plain abdominal X-ray of KUB region showing evidence of semilunar lucency in the left renal area suggestive of suspicious gas in the left kidney. Origin:
Description: Fig.2 – Ultrasound scan of Lt Kidney (Transverse scan) shows multiple hyperechogenic foci with dirty ring down shadowing suggestive of air within renal parenchyma. Origin:

Description: Fig.3 – Plain CT scan of abdomen shows multiple lucencies in the left kidney with evidence of necrosis, confirming the diagnosis of left sided emphysematous pyelonephritis. Origin: