

Clinical Image

Emphysematous Pyelonephritis in A Young Female presenting as Abdominal Pain & Swelling

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Abstract:

Background: Emphysematous pyelonephritis (EP) is a severe necrotic infection of the kidney by gas forming organisms, characterized by the presence of gas within the renal parenchyma. The risk factors for developing emphysematous pyelonephritis (EP) include uncontrolled diabetes mellitus, obstruction of the urinary tract, and immunosuppression. The most frequent organism identified on culture is *Escherichia Coli*.

Case Report: We report a case of a patient who was admitted with the symptoms of abdominal pain and swelling with fever for 2 weeks. Imaging revealed gas in the renal parenchyma establishing the diagnosis. The patient was treated initially with antibiotics & percutaneous drainage but as the condition deteriorated, surgical removal of the affected kidney was necessary.

Conclusion: Emphysematous pyelonephritis is a medical emergency, and a high degree of suspicion is needed once pyelonephritis is not responding properly to antibiotics alone. An early diagnosis and prompt initiation of treatment is a must to reduce mortality.

Keywords: Emphysematous Pyelonephritis, Kidney.

Introduction:

Emphysematous pyelonephritis is a severe necrotizing infection of the kidney and its surroundings. The first case was described in 1898 by Kelly and MacCullum¹. It is different from “emphysematous pyelitis” which represents the existence of gas only within the collecting system and which is caused usually by iatrogenic interventions, reflux of gas from the urinary bladder or fistulas other than infection.²

Most of the patients suffering from emphysematous pyelonephritis have diabetes mellitus, about 90% reported according to different series; obstructive uropathy is the other contributing factor. It is mostly unilateral but in 10% is bilateral. Patients are usually critically ill, with a high mortality rate ranging from 69% to 18% depending on various³.

Computed tomography (CT) of whole abdomen remains the optimal diagnostic radiological investigation. *Escherichia coli*

is the most common causative pathogen isolated on urine or pus culture. Nearly 70% of all the reported cases are caused by *E. coli*⁴. Aggressive treatment with broad spectrum antibiotics is recommended. Early interference with nephrectomy was almost a mandatory approach. This trend has changed in recent studies because of advances in interventional radiology and advent of stronger antibiotics.

Case history:

A 40-year-old female was admitted with the complaints of fever, abdominal pain and swelling of abdomen for 2 weeks. Physical examination revealed a sick ill looking patient with high grade fever (103° F) with an asymmetrically swollen abdomen with tenderness over the swelling, which occupied almost whole of the left side of the abdomen. Investigations on admission reported uncontrolled blood sugar (19 mmol/L). Urine for ketone bodies was negative. Complete blood count showed neutrophilic leukocytosis and thrombocytopenia. Chest X-ray showed minimal left sided pleural effusion. Urine routine and microscopy showed excess WBC. Xray KUB revealed gas shadows over left kidney region. Ultrasound report showed a normal right kidney with a non-visualized left kidney because of excess gas shadows.

She was started empirically on ceftazidime injection after sending blood and urine for CS which later revealed growth of resistant *E coli* (ESBL positive), placed on intravenous fluids and insulin infusion pump. Blood and urine for culture & sensitivity were sent. After 72 hours blood and urine cultures reported growth of resistant *E coli* (ESBL positive). Antibiotics were changed to meropenem injection according to the C/S report. CT scan of whole abdomen with contrast was done. It reported mild left pleural effusion with hugely enlarged left kidney with multiple areas of air density with

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perinephric fat stranding consistent with left-sided emphysematous nephritis. The right kidney had normal findings (Figures 1 and 2). She was diagnosed as acute emphysematous pyelonephritis with sepsis.

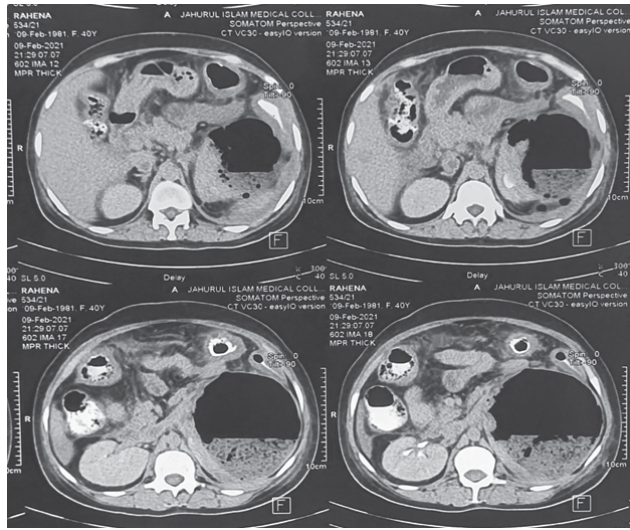


Figure 1: CT scan of abdomen with contrast showing hugely enlarged left kidney with multiple areas of air density with perinephric fat stranding consistent with left-sided emphysematous nephritis. (Axial plane).

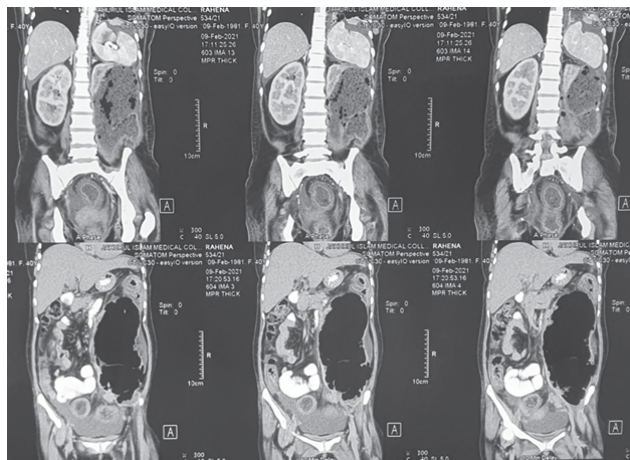


Figure 2: CT scan of abdomen with contrast showing hugely enlarged left kidney with multiple areas of air density with perinephric fat stranding consistent with left-sided emphysematous nephritis. (Coronal plane).

An urology consultation was done. Initially a percutaneous drainage with iv antibiotic trial was done. But the condition of the patient did not improve. And during the course of treatment, she developed AKI. After initial management of AKI, the patient was prepared for left nephrectomy. Histopathology of the surgical specimen was consistent with pyelonephritis. After the surgery the condition of the patient improved gradually and ultimately she was discharged home in stable condition.

Discussion:

Emphysematous pyelonephritis is a severe necrotizing infection of the kidney and its surroundings. The causative pathogen of EP is usually *E. Coli* (70%), *Proteus mirabilis*, *Klebsiella pneumoniae*, *Streptococcus Group D*, *Staphylococcus coagulase (-)* and more rarely anaerobes like *Clostridium septicum*, *Candida albicans*, *Cryptococcus neoformans* and *Pneumocystis jirovecii*⁵.

It is a uniformly fatal illness if left untreated. Patients who are treated medically have a higher mortality rate than those treated surgically, 70% vs. 30%. Most cases are associated with uncontrolled diabetes mellitus, around 90% in different series, obstructive uropathy is the other predisposing factor^{1,3}. EPN pathophysiology in diabetics include uncontrolled hyperglycemia, presence of glucose-fermenting bacteria, impaired vascular supply with poor kidney perfusion, and impaired immunity^{1,6}.

Clinical manifestations are similar to patients presenting as acute pyelonephritis but usually not responding to medical treatment⁵. Confirmation of the diagnosis is by radiologic study. Plain X-ray abdomen can be more specific than sonography in detecting air in the renal collecting system, but both have series limitations because of superimposition of gas from the bowel or retroperitoneum. Ultrasound shows an enlarged kidney with hyperechoic reflections inside the renal parenchyma with posterior dirty acoustic shadow⁵.

CT abdomen is a more specific and sensitive tool and has been recommended as the most useful diagnostic modality. CT designates better the amount of gas, the destruction of renal parenchyma, the presence of fluid collections and fluid-gas levels as well as the underlying cause of urinary tract obstruction. After the injection of contrast medium (after excluding AKI), asymmetry in the enhancement of the two kidneys can be seen and delay of the excretion of the contrast medium. During the nephrographic phase, focal necrosis or abscess may be seen.

Radionuclide imaging is the most specific and sensitive modality for assessing differential function when nephrectomy is decided^{1,7,8}. The differential diagnosis of EP includes renal abscess, iatrogenic presence of gas, posttraumatic infarction and hollow organ perforation^{2,9,10}. Several patterns have been described as CT findings including streaky, streaky and mottled, and streaky and bubbly. Gas can extend into perinephric area, renal vein or inferior vena cava⁸.

Two distinct types of EPN have been described. Type 1 is characterized by renal parenchymal necrosis with absence of fluid content or presence of a streaky/mottled gas pattern. It has a fulminant course and mortality rate of 18%. Type 2 is characterized by presence of renal or perirenal fluid accompanied by bubbly gas pattern or gas in the collecting system^{1,7,11}.

Huang et al. adopted a modified staging system, based on CT findings, as four classes correlated with severity⁸. EP is classified according to Huang and Tseng into 5 categories¹². In type 1 gas is confined in the pyelocaliceal system only. In type

2 gas is found in the renal parenchyma. In type 3A gas extends into the perinephric space and in type 3B into the pararenal space. Finally, in type 4 EP affects a solitary kidney or the infection is bilateral.

In a meta-analysis of seven cohort studies, including 175 patients, risk factors for mortality were analyzed. The overall mortality rate was 25 % (range from 11% - 42%). Risk factors associated with higher mortality were as follows: conservative treatment, bilateral EPN, type one EPN, thrombocytopenia, and systolic blood pressure less than 90 mmHg, serum creatinine greater than 230 umol/L (2.5mg/dL) and disturbed consciousness. There was no association with diabetes mellitus¹¹. These risk factors should be taken into consideration when deciding on treatment approach. An early suspicion of EPN should be raised when a poor response to antibiotic therapy is noted in a patient with diabetes thought to have uncomplicated pyelonephritis. Early imaging studies should be performed, and surgery pursued early in patients who are at high risk of mortality.

The combination of antibiotics and percutaneous drainage is considered to be the best choice as it shows the lowest mortality rate¹³. Percutaneous drainage of the kidney may be done with pigtail catheters with a diameter of at least 14 Fr under the guidance of CT or US. The catheter can be removed when CT shows a remission of the inflammation. In more extreme cases, nephrectomy may be needed.

Conclusions:

EPN is a medical emergency. If left untreated mortality is very high. High index of clinical suspicion is a must for the diagnosis of EPN, mostly in patients who are not responding to conventional antibiotics. Early diagnosis and prompt treatment can reduce mortality.

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