





# A rare presentation of bilateral emphysematous pyelonephritis with concurrent lung abscess: A case report

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## ABSTRACT

Bilateral emphysematous pyelonephritis (EPN) is a rare complication in uncontrolled diabetes mellitus patients and linked to a high patient mortality rate [1]. We present a case of a 62-year-old female patient with bilateral EPN who also developed a concurrent lung abscess. She came with high-grade fever, lethargy, and left flank pain. She had left lumbar tenderness and right-sided chest crepitations. Upon hospitalization, the patient developed septic shock. However, severity of her clinical presentation does not correlate with chest X-ray of right sided pneumonic changes and cavitation of the lungs on admission. Abdominopelvic computed tomography (CT) imaging revealed extensive left EPN (Huang-Tseng CT classification: class 4), early right EPN (Huang-Tseng CT classification: class 2), and right middle lobe lung abscess, which was treated with intravenous antibiotics, drainage, and optimal glycaemic management. This was followed by the resolution of sepsis and improvement in clinical status.

**Keywords:** abdominal pain, kidney, emphysematous pyelonephritis, lung abscess, diabetes mellitus

## INTRODUCTION

Emphysematous pyelonephritis (EPN) is an uncommon, potentially fatal illness that can lead to deterioration in renal function and septic shock [1]. Only 10% of bilateral EPN cases have been recorded in English-language literature, making it an even rare phenomenon linked to a high patient fatality rate [2]. The infection is characterized by the fermentation of microbes that produce gas in the intra- and peri-renal tissues [1]. The two main risk factors for this rare infection is obstructive uropathy and uncontrolled diabetes mellitus [1]. Lung abscess, on the other hand, is a localized collection of pus within the lung tissue, often caused by bacterial infection. While it is a well-recognized pulmonary condition, its concurrent occurrence with bilateral EPN is exceedingly rare and presents a complex clinical scenario that requires prompt and appropriate intervention. This case illustrates the life-threatening condition of bilateral EPN with concurrent right lung abscess in uncontrolled diabetic patients and the significance of primary care providers detecting EPN early to prevent our patient's death. To our knowledge, no previous case describing bilateral EPN complicated by right lung abscess has been published.

## CASE PRESENTATION

A 62-year-old woman with a 10-year history of poorly controlled type 2 DM presented with a one-week history of fever, lethargy, and discomfort at the left flank.

The fever was intermittent, high-grade, and associated with cough, runny nose, and anorexia. It was partially alleviated by paracetamol. She had completed a one-week course of oral Amoxicillin-clavulanic acid within the first week of illness. However, the fever did not resolve. Her daughter brought the patient to the hospital for a further check-up as the symptoms did not show any resolution, and she was admitted.

The patient was mildly dehydrated, lethargic, and in pain on admission. Her temperature was 38.0 °C, pulse rate 110/minute, and blood pressure 140/67 mmHg. On abdominal examination, there was tenderness over the left lumbar region. Chest X-ray revealed pneumonic changes with cavitation of the lungs bilaterally. She was admitted to the general ward and treated for pneumonia with a differential diagnosis of pulmonary tuberculosis.

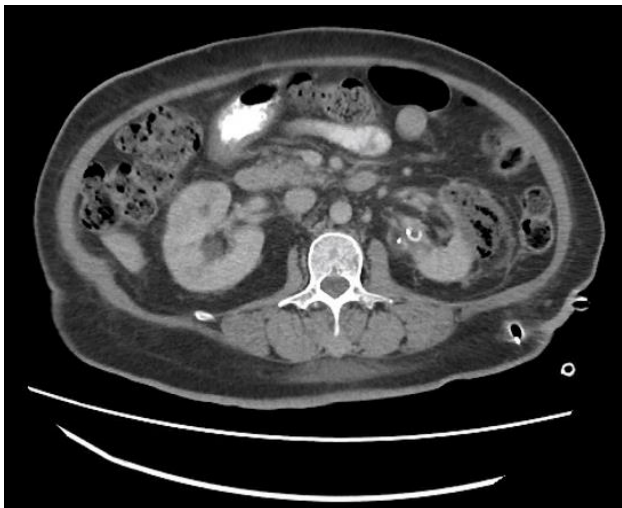
She was treated with IV piperacillin/tazobactam 2.25 g QID in the ward. However, despite the medications and supportive treatment, she still had an intermittent high-grade fever ranging from 37.5-40.0 °C with persistent pain at the left lumbar region. An abdominal X-ray was ordered and showed the left kidney with a surrounding rim of air, which suggested the diagnosis of EPN (**Figure 1**). Contrast-enhanced computed tomography of the abdomen and pelvis, which reported extensive left EPN (Huang-Tseng computed tomography (CT) classification: class 4), early right EPN (Huang-Tseng CT classification: class 2) and right middle lobe lung abscess, confirmed the diagnosis of EPN (**Figure 2** and **Figure 3**). Thus, she was referred to general surgery. The patient was diagnosed as septicemic shock with urosepsis secondary to left EPN and early right EPN and right middle lobe lung abscess.



**Figure 1.** Plain abdominal X-ray (reprinted with permission of the patient)



**Figure 3.** Coronal view contrast enhanced CT of abdomen & pelvis (reprinted with permission of the patient)



**Figure 2.** Axial view contrast enhanced computed tomography of abdomen & pelvis (reprinted with permission of the patient)

Laboratory investigations revealed leucocytosis (16,500/ml) and thrombocytopenia (46,000/ml), hyperglycaemia (16.2 mmol/l), and impaired renal function (serum creatinine 320 µmol/l) (**Table 1**). Urine microscopy revealed abundant pus and yeast cells. Blood and urine cultures were carried out.

The patient was initially planned for a nephrectomy. However, she developed a coagulopathy and her kidney function deteriorated. She was transfused with four units of fresh frozen plasma and underwent dialysis to optimize her for the operation. Since her condition was not improving, the surgical team decided for open drainage procedure of the left kidney under general anaesthesia.

Intraoperatively, there was oedematous subcutaneous tissue at the left lumbar area. Upon incision over the left kidney, a mixture of pus and blood with an air bubble emerged from the surgical site.

**Table 1.** Blood examination result during admission

Full blood count		
Parameter	Result	Reference range
Hb	105.0 g/dl	120.0-150.0
MCV	72.3 fL	83.0-101.0
MCH	24.2 pg	27.0-32.0
Platelet	46.0×10 <sup>9</sup> /L	150.0-410.0
WBC	16.5×10 <sup>9</sup> /L	4.0-10.0
Neutrophils	79.1%	40.0-80.0
Lymphocyte	10.8%	20.0-40.0
Full blood picture	-Hypochromic microcytic anaemia for investigation -White cell changes to consider due to the infection -Thrombocytopenia for investigation	
Glycaemic parameter		
HbA1c	14%	<6.5
RBS	16.2 mmol/l	<11.1
Renal function test		
Urea	5.3 mmol/l	2.8-7.2
Sodium	119.0 mmol/l	133.0-145.0
Potassium	3.9 mmol/l	3.5-5.1
Chloride	87.0 mmol/l	96.0-108.0
Creatinine	320.0 µmol/l	45.0-84.0

Postoperatively, the patient was admitted to intensive care unit for two days before being transferred to the general ward.

Following the surgery, her septic parameters returned to normal. Pus culture reported growth of *E.coli*. Left kidney tissue was sent for a histopathology examination. She completed four week's course of antibiotics, IV piperacillin/tazobactam for three weeks, which later was changed to IV cefuroxime for one week. She was eventually discharged from the hospital and continued to take oral antibiotics for seven weeks. Her latest renal function prior to discharge was urea 3.4 mmol/L and creatinine 138 µmol/L. On follow-up, the patient remained healthy and was seen a week later in endocrine clinic; her HbA1c was 14, highlighting her poor glycaemic control in the past.

## DISCUSSION

EPN is an acute complication that can be deadly in patients with diabetes [1, 2]. It is an infection of the kidneys mainly brought on by gram-negative rods, capable of digesting glucose in an anaerobic setting [3]. The pathogenesis of EPN involves four factors: high tissue glucose, gas-forming bacteria, a deficient immune system, and decreased tissue perfusion. It has been proposed that elevated glucose tissue levels and reduced tissue perfusion create ideal conditions for the metabolism and proliferation of facultative anaerobes [4]. Diabetic microangiopathy may exacerbate tissue damage by delaying the removal of catabolic end products from necrotic tissue, which causes gas to build up in tissues [4].

The two main risk factors for emphysematous UTIs are DM and urinary tract obstruction [3]. They affect females more frequently compared to males [1, 3]. Patients often present with symptoms indicative of severe acute pyelonephritis or a fever of unknown origin [5]. A prompt radiographic assessment is the best method for clinically diagnosing EPN [1, 6]. Plain abdominal films can also identify air associated with EPN, with reported sensitivity levels ranging from 50% to 85% [1, 7]. Currently, a CT scan is the radiographic technique of choice for diagnosing EPN and determining severity of the condition [1].

Our case demonstrates the significance of a prompt imaging examination in the search for another source of sepsis, particularly when the current working diagnosis does not respond to the broad-spectrum empirical antibiotic.

The clinico-radiological classification and the treatment of the condition determine the prognosis for EPN. Based on CT scan results, Huang and Tseng described the clinical radiological classification, treatment, and prognosis of EPN. They categorized 48 EPN cases into four classes. In class 1, gas is accumulated in the collecting system only (mortality rate 0%). In class 2, gas is confined in the renal parenchyma without extension to the extrarenal space, with a mortality rate of 10%. In class 3A, there was an extension of gas or an abscess to the perinephric space with a mortality rate of 29% and to pararenal space in 3B with mortality rate of 19%. Finally, in type 4 EPN, a single kidney is affected, or the infection is bilateral (mortality rate 50%) [1].

As a result, the clinico-radiological classification of the condition is used as the basis for managing EPN. Nephrectomy was the optimal treatment for EPN of classes 3 and 4 with a fulminant course. In contrast, classes 1, 2, 3, and 4 EPNs with benign manifestations are eligible for non-operative treatment [1]. Thrombocytopenia, abrupt renal failure, disturbance of consciousness, and shock were listed as two or more poor prognostic markers that characterize the fulminant course of EPN [1, 8].

Medical treatment has emerged as a successful alternative to nephrectomy due to improved imaging techniques and newer antibiotics [6]. It was reported that there were cases of bilateral EPN with a fulminant course that were successfully treated medically [9].

Our case presented a class 4 EPN, and two risk factors linked with high mortality: thrombocytopenia and acute renal impairment. Thus, a nephrectomy was planned. Patients with two or more risk factors had an extremely high treatment failure rate, necessitating immediate nephrectomy. Shokeir evaluated his 15-year experience with 20 EPN patients in Egypt

[10]. He emphasized the need to do a nephrectomy on a medically stable patient [10].

The presence of a concurrent lung abscess adds further complexity to the case, where the bilateral pulmonary findings obscured the underlying cause of her rapidly deteriorating and unresponsive condition.

Medical therapy is the first step in treating bilateral EPN and lung abscess to optimize the patient's condition before nephrectomy. This therapy includes broad-spectrum antibiotics to cover the suspected causing pathogens, typically gram-negative bacteria like *Escherichia coli* or *Klebsiella pneumoniae*. The antibiotic was changed to a culture-specific regime after the culture result was obtained. In addition, it is essential to take supportive measures such as administering intravenous fluids, correcting electrolyte imbalances, optimizing glycaemic control and closely monitoring the patient's vital signs. However, there was not much evidence to imply a clinical improvement following administering parenteral antibiotics. The patient further deteriorated, and an open drainage was performed to relieve the urinary tract obstruction. Her general condition significantly improved the following day after the open drainage procedure. Thus, a nephrectomy was avoided.

In this case, the successful treatment of bilateral EPN with a concurrent lung abscess suggests that the infection was controlled effectively, likely due to appropriate antibiotic therapy, open drainage procedure, improved blood glucose control, and close monitoring.

A case of left EPN that failed percutaneous drainage was reported to be effectively treated with open drainage surgery and antibiotic therapy [11]. The infection of the patient was treated without the need for a nephrectomy. The case proposed that achieving adequate drainage could lead to improved kidney function, even when renal function has been lost and nephrectomy is necessary [11].

Recent research supports preservation of kidneys; it was found a low mortality rate of 8% when using CT-guided percutaneous drainage in conjunction with antibiotics and supportive care [12]. If conservative therapy is used, antibiotic therapy should be continued for at least four weeks [13].

## CONCLUSIONS

In conclusion, EPN is an uncommon but potentially fatal consequence of acute pyelonephritis experienced by diabetes patients. For medical professionals in primary care who encounter diabetic patients with high grade fever and flank pain, acute pyelonephritis should be suspected following the exclusion of common infectious pathologies. An abdominal X-ray should be performed to rule out EPN in selected cases, followed by abdominal ultrasound, which has higher sensitivity in detecting EPN. Early referral to a related specialty is necessary to ensure an accurate diagnosis and to initiate proper medical care and surgical intervention, which are essential for the effective management of EPN.

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