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Severe Bilateral Emphysematous Pyelonephritis: A Case Report

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Abstract | **Case Report**

Background: Emphysematous pyelonephritis (EPN) is a rare, severe necrotizing infection of the renal parenchyma and surrounding tissues characterized by gas production by uropathogenic bacteria, most commonly *Escherichia coli*. It is associated with high morbidity and mortality, particularly in patients with uncontrolled diabetes mellitus. Bilateral involvement is extremely rare and carries a particularly poor prognosis if not managed promptly and appropriately. EPN often requires early identification with imaging such as computed tomography (CT), which remains the gold standard for diagnosis. CT-based classification systems have been used to stratify severity and guide management. Early aggressive therapy combining antibiotics with drainage or surgical intervention improves outcomes. ***Case Presentation:*** We present the case of a 24-year-old patient with chronic kidney disease who presented with acute onset of bilateral flank pain, fever, and systemic signs of infection. Laboratory investigations revealed leukocytosis and acute kidney injury. CT scan demonstrated extensive gas formation in both kidneys consistent with bilateral emphysematous pyelonephritis. ***Conclusion:*** Bilateral EPN is an uncommon but life-threatening condition. Early diagnosis based on imaging, rapid initiation of appropriate antimicrobial therapy, and timely intervention, such as drainage or nephrectomy when indicated, are critical to improving survival and preserving renal function. This case highlights the importance of integrating clinical, radiological, and microbiological data for optimal management of bilateral EPN.

Keywords: Emphysematous pyelonephritis, Bilateral EPN, Chronic kidney disease, Computed tomography, Gas-forming infection, Escherichia coli.

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INTRODUCTION

Emphysematous pyelonephritis (EPN) is a rare, life-threatening necrotizing infection characterized by gas accumulation within the renal parenchyma and surrounding tissues [1-3]. It predominantly affects patients with diabetes mellitus, while urinary tract obstruction is another recognized predisposing factor [1,2]. The clinical presentation is often nonspecific and may include fever, flank pain, nausea, vomiting, and signs of sepsis [2]. Bilateral involvement is an uncommon presentation associated with particular diagnostic and therapeutic challenges because both kidneys are affected [6].

Early diagnosis is essential to guide treatment and improve outcomes. Computed tomography (CT) is the preferred imaging modality for confirming the diagnosis, assessing disease extent, and identifying complications. The Huang and Tseng classification, based on CT findings, is widely used to stratify disease severity and inform management decisions [1,2]. Treatment has evolved from an approach centered on emergency nephrectomy toward conservative management combining intravenous antibiotics, supportive care, and percutaneous drainage when indicated. Nephrectomy remains an option for patients who fail to respond to conservative treatment [2]. Despite advances in diagnosis and management, EPN remains a potentially fatal infection requiring prompt recognition and individualized multidisciplinary care.

CASE PRESENTATION

A 24-year-old man with a history of chronic kidney disease of undetermined etiology, on chronic hemodialysis, presented to the emergency department with a one-week history of fever and severe deterioration in his general condition. He reported intense, colicky bilateral flank pain associated with nausea and vomiting. Reduced oral intake and signs of dehydration were also noted. There was no prior history of urinary tract infection or renal surgery.

On physical examination, the patient appeared acutely ill, dehydrated, and in moderate distress. He was

febrile with a temperature of 38 °C, tachycardic at 120 bpm, and tachypneic with a respiratory rate of 25 breaths/min. His Glasgow Coma Scale score was 15/15. Abdominal examination revealed generalized tenderness, with pronounced bilateral costovertebral angle tenderness. No peripheral edema or skin lesions were observed.

Laboratory investigations revealed:

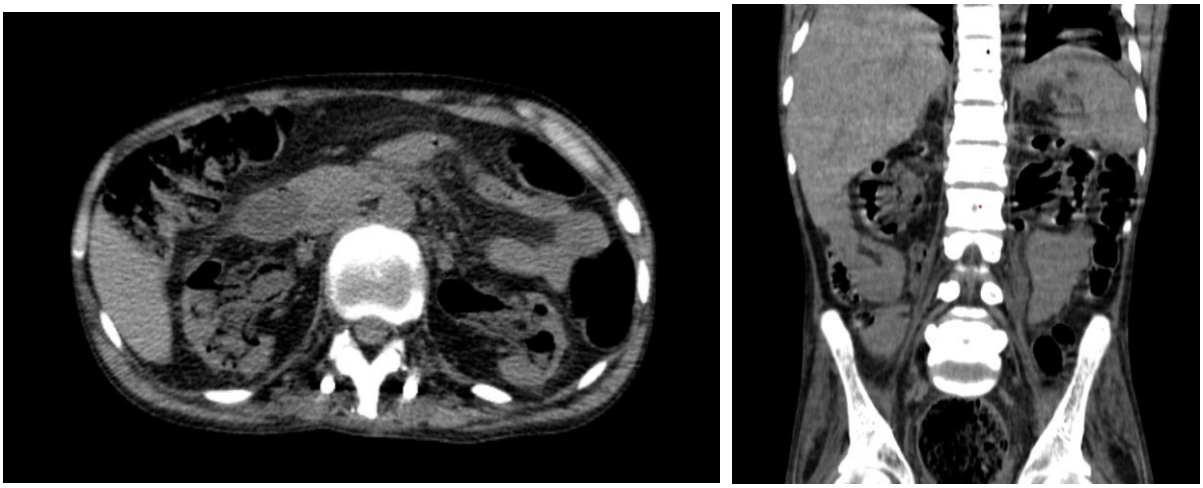
- White blood cell count: markedly elevated.
- C-reactive protein (CRP): significantly elevated.
- Serum creatinine and urea: consistent with chronic kidney disease on hemodialysis.
- Urinalysis showed pyuria and bacteriuria. Blood and urine cultures were pending at the time of initial management.

Radiological Findings (Figure 1):

CT scan of the abdomen and pelvis demonstrated bilaterally reduced kidney size with lobulated contours, intraparenchymal gas (air bubbles) in both kidneys, and a right renal calculus.

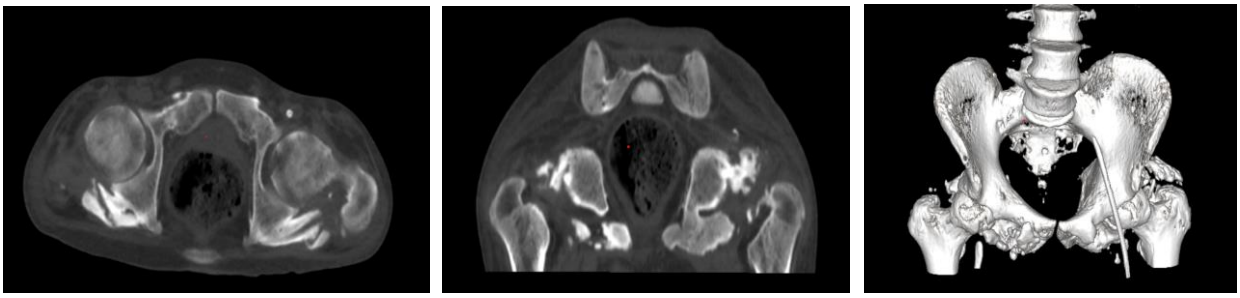
These findings confirmed the diagnosis of bilateral emphysematous pyelonephritis. No additional urinary tract obstruction was observed.

Management included broad-spectrum intravenous antibiotics, aggressive fluid resuscitation, and supportive care. Percutaneous drainage was considered due to the extent of gas and the patient's clinical condition. Over one week, his general condition did not improve markedly, inflammatory markers decreased, and residual renal function was preserved.



A B

Figure 1: Axial and coronal CT images showing a reduced-size kidney with lobulated, dysmorphic contours and multiple intraparenchymal and pelvicalyceal gas locules, consistent with emphysematous pyelonephritis.



A B C

Figure 2: Axial and coronal bone-window CT images (a, b) and three-dimensional volume-rendered CT reconstruction (c) of the pelvis showing extensive bilateral osseous abnormalities involving the hip joints, with marked irregularity of the articular surfaces, disruption of the normal osseous architecture, and multiple periarticular bone fragments. In the appropriate clinical and biochemical context, these findings may be suggestive of renal osteodystrophy

DISCUSSION

Emphysematous pyelonephritis (EPN) is a rare, life-threatening necrotizing infection characterized by gas accumulation within the renal parenchyma and, in more advanced cases, the surrounding tissues. It is most frequently associated with diabetes mellitus, although urinary tract obstruction and other predisposing conditions may also contribute to its development. *Escherichia coli* and *Klebsiella pneumoniae* are among the most commonly isolated causative organisms [1,3].

Computed tomography (CT) is the imaging modality of choice for diagnosing EPN, assessing its extent, and identifying associated complications. The classification proposed by Huang and Tseng remains widely used in clinical practice. It distinguishes four categories according to the distribution of gas [1,2]:

Class 1: gas confined to the collecting system.
Class 2: gas within the renal parenchyma without extrarenal extension.
Class 3a: extension into the perinephric space.
Class 3b: extension into the pararenal space.
Class 4: bilateral EPN or involvement of a solitary kidney.

In our patient, the bilateral distribution of intraparenchymal gas supports classification as class 4 EPN. However, the extent of extrarenal involvement and the presence of associated collections should be assessed separately on CT, as these findings may influence management and prognosis.

Bilateral EPN is an uncommon presentation that raises particular concerns because both kidneys are affected, potentially compromising residual renal function. In their meta-analysis, Falagas *et al.,* identified bilateral involvement as a factor associated with increased mortality (odds ratio [OR], 5.36; 95% confidence interval [CI], 1.41–20.33) [4]. These results should be interpreted cautiously because the analysis included only seven cohorts comprising 175 patients. More recent systematic reviews have reported lower overall mortality and a shift toward conservative and minimally invasive treatment strategies, although severe disease remains associated with substantial risk [5]. Accordingly, a fixed mortality estimate should not be applied to every patient with bilateral EPN, as the outcome also depends on the presence of sepsis, shock, thrombocytopenia, renal dysfunction, and other indicators of disease severity.

The clinical presentation of EPN is often nonspecific. Fever, flank pain, and nausea or vomiting are frequently reported, but their absence does not exclude the diagnosis [2,3]. In our patient, the combination of fever, flank pain, and gastrointestinal symptoms was consistent with the reported clinical presentation. The history of chronic kidney disease requiring dialysis is an important clinical consideration, particularly when evaluating residual renal function, treatment tolerance, and the consequences of further renal injury. Early CT assessment is therefore essential when EPN is suspected, especially in patients presenting with severe urinary tract infection and relevant predisposing conditions.

The management of EPN has evolved from a predominantly surgical approach toward initial treatment with intravenous broad-spectrum antibiotics, appropriate supportive care, and urinary decompression or percutaneous drainage when indicated [2,3,5]. Treatment should be individualized according to hemodynamic stability, microbiological findings, the presence of obstruction or drainable collections, the extent of infection, and the patient's underlying renal function. Minimally invasive drainage may help control the infection while avoiding immediate nephrectomy. Nephrectomy remains a potential rescue procedure when conservative and minimally invasive measures fail to control the infection or when the patient's condition deteriorates despite adequate treatment [2,5].

In bilateral disease, preservation of functioning renal tissue is particularly important, and nephrectomy may have major implications for renal replacement requirements. Nevertheless, the need for definitive source control must not be delayed when conservative treatment is unsuccessful. Management should therefore involve close clinical and biochemical monitoring, microbiological reassessment, and multidisciplinary coordination among urologists, radiologists, nephrologists, and intensive care specialists when necessary.

Our case illustrates the importance of recognizing bilateral EPN and defining its extent using CT. The clinical course and outcome should be interpreted in light of the patient's baseline renal function, severity of infection, treatment strategy, and documented response. In particular, the timing of antibiotic administration, the use of drainage procedures, and the evolution of inflammatory and renal parameters should be reported whenever these data are available, as they help explain the therapeutic decisions and clinical outcome.

In summary, bilateral EPN is a severe presentation requiring prompt diagnosis and individualized multidisciplinary management. CT remains central to diagnosis and anatomical classification, while early antimicrobial treatment, adequate source control when indicated, and careful monitoring are essential components of management. Although conservative and minimally invasive strategies have reduced the need for immediate nephrectomy in many patients, treatment decisions must remain guided by clinical severity, infection control, and the preservation of residual renal function.

CONCLUSION

Bilateral emphysematous pyelonephritis is a rare and potentially life-threatening infection requiring prompt diagnosis and early, individualized treatment. Computed tomography plays a pivotal role in confirming the diagnosis, assessing disease extent, and guiding therapeutic decisions. Early administration of appropriate antibiotics, adequate source control when indicated, and multidisciplinary management are essential to optimize outcomes while preserving residual renal function. This case highlights the importance of

early recognition and tailored management of this severe condition.

Abbreviations:

- **CT:** Computed tomography
- **EPN:** Emphysematous pyelonephritis

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Conflict of Interest: The authors declare no conflict of interest.

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