

Double J stenting in severe emphysematous pyelonephritis with multisystem involvement: A conservative approach case report

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ABSTRACT

We report the case of an 88-year-old female with poorly controlled type 2 diabetes mellitus, hypertension, and chronic kidney disease (CKD), who presented with right lumbar pain and dyspnea. She was diagnosed with acute kidney injury on CKD due to right-sided emphysematous pyelonephritis (EPN) complicated by renal abscess, moderate pleural effusion, and basal lung atelectasis. Urine culture indicated the growth of *Pseudomonas aeruginosa*, a rare but virulent pathogen in EPN. Management included double J stenting, pleural tapping, and targeted intravenous antibiotics, leading to favorable recovery without nephrectomy. Imaging classified her condition as EPN Class 3A, supporting conservative management. Despite multiple poor prognostic indicators, early intervention with organ-preserving strategies proved successful. This case highlights the evolving role of minimally invasive treatments in elderly, high-risk patients with multisystem involvement, underscoring the importance of individualized, multidisciplinary approaches for optimizing outcomes in severe EPN.

Key words: Atelectasis, Emphysematous pyelonephritis, *Pseudomonas aeruginosa*, Renal abscess

Emphysematous pyelonephritis (EPN) is a rare, life-threatening necrotizing infection of the renal parenchyma and perirenal tissues, characterized by gas formation, predominantly affecting individuals with uncontrolled diabetes mellitus and underlying renal impairment [1]. The most common causative bacterial pathogens are *Escherichia coli* (68%) and *Klebsiella pneumoniae* (29%) [2]. In rare cases, facultative anaerobes like *Pseudomonas aeruginosa*, as seen in our patient, may be responsible; a more virulent and resistant pathogen may be implicated, especially in immunocompromised hosts. The clinical course can be rapidly progressive, often complicated by acute kidney injury (AKI), septic shock, and multiorgan involvement, including pleural effusions and pulmonary complications such as basal atelectasis [3]. Chronic kidney disease (CKD) further exacerbates the morbidity associated with EPN due to impaired immune response and reduced renal reserve [4]. Prompt diagnosis and individualized management, often combining image-guided drainage, double J (DJ) stent placement for urinary decompression, and targeted antimicrobial therapy, are essential to improve outcomes [5].

This case is presented to emphasize the unusual incidence of *P. aeruginosa*-induced EPN with

multisystem involvement (renal and pulmonary) in an elderly diabetic with CKD, effectively controlled with conservative treatments, a rarity in the current literature.

CASE REPORT

An 88-year-old female was admitted to the urology department with chief complaints of right lumbar abdominal pain, which was rated as 6/10, described as dull and painful, persistent, and made worse by movement or heavy breathing. The condition was restricted to the right lumbar area and had been present for 3 days before admission. The pain was also associated with dyspnea accompanied by a dry cough for the past 3 days. She had a recent history of right-sided EPN and had undergone right DJ stenting 1 month before admission. Her medical history was significant for type 2 diabetes mellitus (T2DM) diagnosed 1 year ago and hypertension for the past 2 years. She was on tablet cilnidipine 10 mg daily and regular insulin according to a sliding scale regimen.

At the time of admission, the patient was diagnosed with AKI on CKD, with an *in situ* right DJ stent for previously diagnosed EPN, complicated by a right renal abscess, moderate right-sided pleural effusion, and associated basal lung atelectasis.

On systemic examination, the abdomen was soft, with tenderness localized to the right lumbar region.

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Bowel sounds and epigastric tenderness were within normal limits. Vital signs were stable: Blood pressure 130/80 mmHg, respiratory rate 16 breaths/min, pulse rate 101 beats/min, and SpO₂ of 96% on room air.

Laboratory investigations revealed severe anemia (hemoglobin 7.1 g/dL) and markedly elevated inflammatory markers, including C-reactive protein at 120.82 mg/L. Renal function tests showed elevated urea (89 mmol/L) and serum creatinine (3.5 mg/dL), indicative of impaired renal function. Liver enzyme derangements (alkaline phosphatase 386 U/L, gamma-glutamyl transferase 210 U/L) suggested possible biliary obstruction, while hypoalbuminemia (2.5 g/dL) was consistent with protein loss secondary to nephropathy.

Ultrasound of the abdomen and pelvis demonstrated findings suggestive of right-sided EPN with abscess formation, left kidney grade II parenchymal changes, mild ascites, and a moderate right pleural effusion with adjacent basal lung atelectasis.

Urine culture grew *P. aeruginosa*, highlighting the severity and virulence of the infection. Management involved both procedural and pharmacological interventions. In view of respiratory distress, pleural tapping was performed, whereas therapeutic management such as piperacillin–tazobactam (2.25 g), furosemide (40 mg), and regular insulin per sliding scale. At the time of discharge, the patient was prescribed ciprofloxacin (250 mg).

Upon follow-up 2 weeks after being discharged, the patient reported better respiratory and gastrointestinal symptoms, a normal appetite, and the ability to return to regular activities. The serum creatinine level increased to 2.2 mg/dL.

DISCUSSION

This case highlights the successful conservative management of Class 3A EPN in a patient with underlying AKI on CKD, diabetes, hypertension, and systemic complications including pleural effusion and basal atelectasis. The patient's diabetes mellitus and hypertension were central to disease progression. Poor glycemic control fosters the growth of gas-forming pathogens and impairs immune defenses, while vascular damage from hypertension compromises renal perfusion [3,4,6]. Interestingly, *P. aeruginosa* – a rare causative organism in EPN was isolated. Its gas production through glucose and lactate fermentation exemplifies the danger posed by atypical pathogens in immunocompromised patients. The most frequently implicated pathogen is *E. coli*, followed by *K. pneumoniae* and other Gram-negative bacteria [2]. In rare cases, facultative anaerobes like *P. aeruginosa*, as seen in our patient, may be responsible. The pathogenesis of EPN is multifactorial, involving gas-forming organisms, elevated glucose concentrations in tissues, impaired perfusion, and immune dysfunction [3,4].

In our patient, isolation of *P. aeruginosa* through urine culture enabled prompt, targeted antimicrobial therapy with piperacillin-tazobactam. Given the pathogen's inherent resistance potential and the patient's background of CKD and T2DM, culture-guided therapy was essential in optimizing treatment efficacy, minimizing renal toxicity, and avoiding surgical intervention. *P. aeruginosa* possesses complex resistance mechanisms, including β -lactamase production and efflux pumps, which necessitate sensitivity-directed antibiotic use to prevent therapeutic failure and resistance development [7]. This underscores the importance of early microbiological identification and antibiotic sensitivity testing in the management of EPN, especially in high-risk and immunocompromised patients [8].

Radiological Classification and Prognosis

Radiological grading is critical in guiding management. Huang and Tseng's computed tomography-based classification (2000) is the most widely used system [3]: Class 1: Gas confined to the collecting system; Class 2: Gas localized within the renal parenchyma; Class 3A: Extension of gas/abscess into the perinephric space; Class 3B: Extension beyond Gerota's fascia into the pararenal space; and Class 4: Bilateral EPN or EPN in a solitary kidney. Our patient's imaging findings perinephric abscess (~40 cc), air foci, and mild perinephric fat stranding were consistent with Class 3A, indicating intermediate severity with potential for successful conservative management.

Wan *et al.*'s classification (1996) provides a prognostic perspective based on gas distribution: Type 1: Renal necrosis with streaky or mottled gas and no fluid collection (69% mortality) and Type 2: Bubbly or loculated gas with associated fluid collection (18% mortality) [9]. Our patient's features aligned more closely with Type 2, again supporting non-surgical intervention.

According to Huang and Tseng, key prognostic risk factors for poor outcomes in EPN include thrombocytopenia, AKI, altered mental status, and shock [3]. In this case, AKI on CKD was present, with serum creatinine ranging from 3.5 to 3.84 mg/dL.

Pulmonary involvement, including pleural effusion and basal atelectasis, further complicated this presentation. These manifestations are likely due to reactive pleuritis resulting from diaphragmatic irritation caused by adjacent renal inflammation, as well as fluid overload associated with renal impairment [10]. Such thoracic findings can mimic primary pulmonary conditions like pneumonia or heart failure, potentially delaying diagnosis of the renal source [11]. In our patient, pleural tapping was performed both diagnostically and therapeutically, revealing non-malignant, lymphocyte-predominant fluid, and contributing to symptomatic relief. This underscores the importance of considering

extrapulmonary causes in patients presenting with respiratory symptoms and systemic infection.

Management of EPN has evolved significantly over recent decades. Once treated aggressively with early nephrectomy, the current trends favor conservative, kidney-preserving approaches. As highlighted in the previous case report by Das and Pal [12], medical stabilization combined with minimally invasive techniques like DJ stenting or percutaneous nephrostomy can yield excellent outcomes, even in high-risk cohorts [12]. In their study, DJ stenting alone achieved success in nearly half of the cases, avoiding the need for surgery. Our patient's recovery was achieved through timely antibiotics, DJ stenting, and pleural tapping, which demonstrates the potential of conservative management in elderly, comorbid individuals.

This case contrasts starkly with the fatal outcome reported by McDermid *et al.*, where delayed intervention led to multiorgan failure [13]. It reaffirms the value of early diagnosis, interdisciplinary care, and individualized, minimally invasive strategies in reducing EPN mortality. In this case, a stepwise, multidisciplinary approach was adopted, beginning with hemodynamic stabilization, targeted intravenous antibiotics (piperacillin-tazobactam), and glycemic control. Early urological decompression through DJ stenting helped relieve obstruction, while pleural tapping addressed respiratory compromise. The patient's culture-guided therapy for *P. aeruginosa* avoided nephrectomy. Emerging antibiotics like ceftolozane-tazobactam or cefetecol may be considered in resistant cases, while adjunctive measures such as albumin correction and nutritional support can aid recovery. This case reinforces that conservative, individualized treatment, including drainage, supportive care, and timely antibiotics, can lead to full recovery even in elderly, high-risk patients.

The previous prospective study by Rafiq *et al.* [14] assessed 20 cases of EPN in T2DM patients, revealing *E. coli* as the predominant pathogen (80%), with no *Pseudomonas* reported. In contrast, our case involved *P. aeruginosa*, a less common, more virulent pathogen often linked to severe infections and multidrug resistance. Hypertension (95%) and AKI (75%) were prevalent in Rafiq's study, mirroring our patients' comorbidities [12]. Unlike Rafiq's nephrectomy-requiring patients with obstruction and azotemia, our patient improved with DJ stenting and conservative care, despite Class 3A/Type 2 severity. In contrast to the prior case report by Nishikawara *et al.* [15], a 75-year-old man with poorly controlled T2DM and CKD developed Class 3B EPN complicated by septic shock and disseminated intravascular coagulation, requiring ureteral stenting, percutaneous drainage, and hemodiafiltration. In comparison, our patient, a diabetic woman with CKD and thoracic complications (pleural effusion and basal atelectasis), presented directly with Class 3A EPN and AKI, and was managed conservatively without intensive care or dialysis. Notably, both patients were on SGLT2

inhibitors (ipragliflozin and dapagliflozin, respectively), raising potential concerns about increased susceptibility to severe urinary tract infections such as EPN. While Nishikawara *et al.* emphasized re-evaluation with CT within 72 h of unresolved pyelonephritis [15], our case demonstrates that even high-risk patients with systemic involvement can recover fully with timely and targeted conservative treatment.

CONCLUSION

This case illustrates the successful conservative management of Class 3A EPN due to *P. aeruginosa* in a patient with diabetes, CKD, and systemic complications, including pleural effusion. Limitations include the single-patient scope, lack of long-term follow-up, and incomplete laboratory data, which may affect generalizability. Nonetheless, the case underscores the value of early imaging, culture-guided therapy, and minimally invasive interventions such as DJ stenting in high-risk patients. Compared to more invasive approaches reported in similar severe cases, this outcome reinforces the evolving role of individualized, multidisciplinary conservative management even in complex EPN presentations.

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