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Emphysematous Pyelonephritis Associated with Bosniak IV Renal Cyst: An Infectious and Oncological Collision

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Abstract | **Case Report**

Background: Emphysematous pyelonephritis (EPN) is a rare, life-threatening necrotizing infection of the renal parenchyma characterized by gas production, predominantly affecting patients with uncontrolled diabetes. Concurrently, Bosniak IV renal cysts are complex cystic masses with solid enhancing components that carry a high suspicion of malignancy (cystic renal cell carcinoma). The simultaneous occurrence of these two distinct pathologies in the same kidney is an extremely rare clinical entity. ***Case Presentation:*** We present the case of a 68-year-old diabetic male admitted for febrile lumbar pain and subocclusive syndrome. Computed tomography (CT) revealed right-sided EPN (gas, hydroaeric levels, pneumocalices) coexisting with a Bosniak IV cyst in the upper pole. This association created an initial therapeutic dilemma: standard percutaneous drainage of the collection was contraindicated due to the risk of tumor seeding along the needle tract. A sequential approach was adopted, initiating with broad-spectrum intravenous antibiotics (Piperacillin-Tazobactam) and internal urinary diversion via a JJ stent. Although renal function improved (creatinine decreasing from 47.9 mg/L to 19 mg/L), follow-up ultrasound revealed persistent perirenal collections infiltrating the psoas. Consequently, a targeted percutaneous nephrostomy was performed, carefully avoiding the cystic lesion. ***Conclusion:*** This exceptional association creates a "therapeutic collision" between an infectious emergency requiring drainage and oncological caution requiring surgical integrity. A sequential, individualized approach guided by dynamic imaging and multidisciplinary discussion proved successful in controlling the infection while preserving oncological options.

Keywords: Emphysematous pyelonephritis; Bosniak IV renal cyst; Therapeutic dilemma; Percutaneous drainage; Multidisciplinary management; Diabetes mellitus.

INTRODUCTION

Emphysematous pyelonephritis (EPN) is defined as a severe, necrotizing infection of the renal parenchyma and perirenal tissues, characterized by the presence of gas within the renal system [1]. Although rare, it is a formidable clinical entity associated with significant morbidity and mortality rates if not recognized promptly. The condition shows a strong predilection for patients with diabetes mellitus, who account for approximately 90% of reported cases [2]. The pathophysiology typically involves gas-forming uropathogens, most commonly *Escherichia coli* and *Klebsiella pneumoniae*, fermenting glucose into carbon dioxide and hydrogen in a hyperglycemic environment.

Diagnosis relies heavily on Computed Tomography (CT), which is considered the gold standard for assessing the extent of gas and classifying the severity of the disease, often utilizing the Huang-Tseng classification system [11]. Standard management protocols have evolved from immediate nephrectomy to more conservative strategies combining aggressive antibiotic therapy with percutaneous catheter drainage (PCD) [1, 3].

However, the management of EPN becomes significantly more complex when associated with concomitant renal pathology, such as a complex renal cyst. The Bosniak classification system, updated in 2019, stratifies cystic renal masses based on malignancy risk. A Bosniak IV cyst is characterized by solid, enhancing components and carries a malignancy risk ranging from 85% to 100%, necessitating surgical resection [5, 19]. The coexistence of EPN and a Bosniak IV cyst is exceptionally rare and presents a unique "therapeutic

collision." The standard intervention for severe EPN — percutaneous drainage—may be contraindicated or technically hazardous due to the risk of disseminating malignant cells from the Bosniak IV lesion along the drainage tract. This case report describes the management of a 68-year-old patient presenting with this rare association. We aim to illustrate the diagnostic and therapeutic challenges imposed by this duality and discuss the rationale behind a sequential, image-guided multidisciplinary approach.

Case Presentation

Patient History

A 68-year-old male presented to the emergency department. His medical history was significant for Type 2 diabetes mellitus, insulin-dependent for 10 years, and hypertension treated with Medzar for 15 years. His surgical history included a cholecystectomy 10 years prior and an umbilical hernia repair 4 years ago.

Clinical Presentation

The patient initially reported symptoms of a subocclusive syndrome persisting for two days, characterized by cessation of bowel movements and vomiting, alongside febrile lumbar pain, dysuria, and an episode of spontaneous, non-clotting macroscopic hematuria. On physical examination, the patient was conscious (Glasgow Coma Scale 15/15) and hemodynamically stable. He was apyretic at admission (37.2°C) with stable blood pressure. Abdominal examination revealed distinct right lumbar tenderness. Diuresis was preserved.

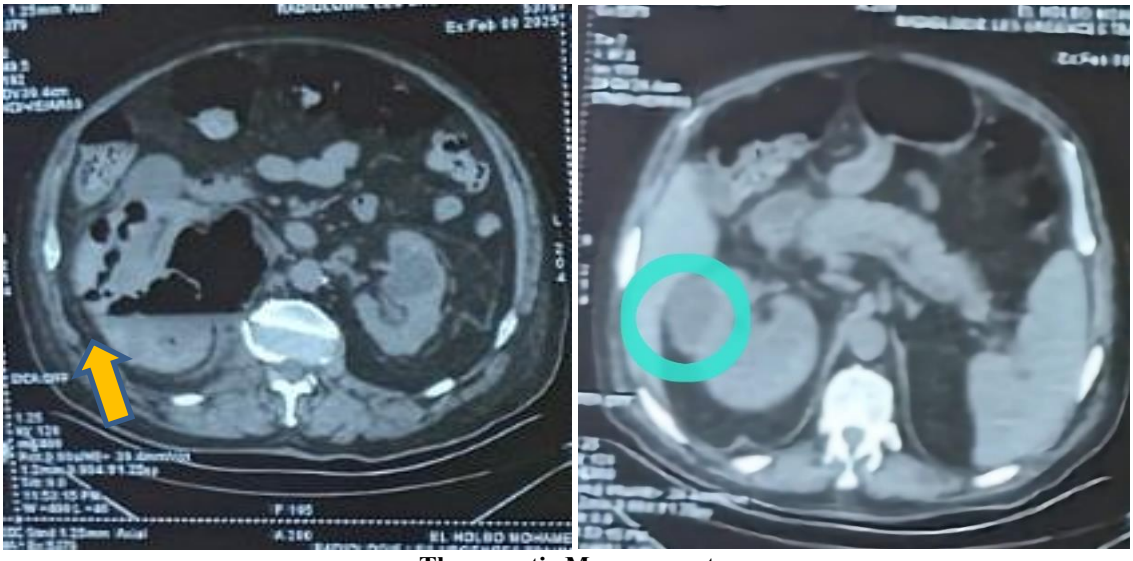
Laboratory Findings

Initial biological assessment revealed acute renal insufficiency with a serum creatinine level of 47.9 mg/L (423 µmol/L) and a marked inflammatory syndrome. Glycemic control was poor, consistent with his history of diabetes.

Imaging Results

An abdominopelvic CT scan with contrast injection was performed, serving as the cornerstone for diagnosis. Findings included:

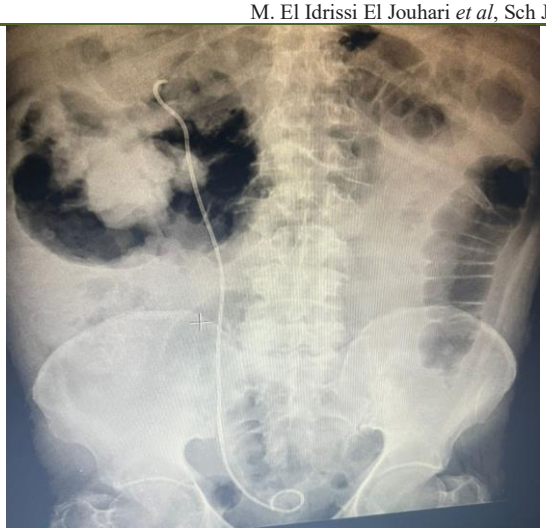
- **Right Kidney:** Significantly enlarged (15 cm long axis) with lobulated contours. The parenchyma showed poor cortico-medullary differentiation. Multiple confluent collections were identified, the largest measuring 5.5 × 3.4 cm and extending 15.4 cm into the perirenal space, infiltrating the ipsilateral psoas muscle.
- **Gas Formation:** The presence of hydroaeric levels and pneumocalices confirmed the diagnosis of emphysematous pyelonephritis.
- **Associated Lesions:** Three cortical formations were identified. Crucially, an exophytic formation in the upper pole presented with a solid component enhancing after contrast injection, classified as Bosniak IV. Two other mid-renal formations were simple cysts (Bosniak I).
- **Staging:** According to the Huang-Tseng classification, the findings were consistent with Class II EPN (renal parenchymal gas with perirenal fluid).



Therapeutic Management

Phase 1: Conservative Sequential Approach

Immediate percutaneous drainage of the perirenal collections was initially deferred due to the proximity of the Bosniak IV cyst and the theoretical risk of tumor seeding. A conservative but aggressive strategy was adopted. The patient was started on broad-spectrum intravenous antibiotics (Piperacillin-Tazobactam 4g every 8 hours). To ensure urinary drainage without traversing the parenchyma, a right JJ ureteral stent was placed endoscopically. The procedure successfully drained urine containing air bubbles, confirming communication with the emphysematous focus.



JJ Stent

Initial Evolution (Week 1)

Under this regimen, the patient showed significant clinical improvement with resolution of fever, reduction in pain, and recovery of appetite. Biologically, renal function recovered substantially, with serum creatinine dropping from 47.9 mg/L to 19 mg/L. Inflammatory markers also trended downwards.

Phase 2: Imaging Reassessment and Interventional Drainage

Despite clinical improvement, a control ultrasound performed on Day 10 showed persistence of the perirenal collections. The right kidney remained heterogeneous. Two distinct collections were noted: an anterior collection (~60x40 mm) and a posterior collection (~70x40 mm) extending into the psoas muscle. The persistence of these collections despite internal drainage and antibiotics necessitated escalation of therapy. A decision was made to proceed with percutaneous nephrostomy. The procedure was planned meticulously to target the infectious collection while strictly avoiding the trajectory of the Bosniak IV lesion. The drainage was successful, evacuating purulent material and gas.

Current Status

The infection is currently controlled. The patient is scheduled for renal scintigraphy to assess the differential function of the right kidney. This functional assessment will guide the definitive surgical plan: partial nephrectomy (if the kidney is functional and the tumor is resectable) versus total nephrectomy (if the kidney is non-functional).

DISCUSSION

1. Epidemiology and Diagnostic Considerations

Emphysematous pyelonephritis remains a critical condition with a mortality rate that historically reached 40-50%, though modern management has improved outcomes [1, 2]. Our patient fits the classic demographic profile: an elderly male with long-standing diabetes. The diagnosis was straightforward regarding the infection, thanks to the pathognomonic gas findings on CT [13]. However, the incidental discovery of a Bosniak IV cyst complicated the picture. With a malignancy probability of 85-100% for Bosniak IV lesions [5, 7], the radiologic evaluation had to simultaneously stage a life-threatening infection and a likely renal cell carcinoma.

2. The Therapeutic Dilemma: Infection vs. Oncology

The core challenge in this case lies in the conflicting requirements of the two pathologies.

Standard EPN Care:

Current guidelines and systematic reviews advocate for percutaneous drainage (PCD) combined with antibiotics for Class II and III EPN,

reserving nephrectomy for non-responders or extensive organ destruction [3, 4, 15]. PCD has been shown to significantly reduce mortality compared to medical management alone [10].

Oncological Safety:

Conversely, intervening percutaneously in a kidney with a localized cystic tumor raises concerns about needle tract seeding. While the risk of seeding for renal cell carcinoma is generally considered low, it is a recognized complication [20, 22]. Furthermore, puncturing a cystic tumor can rupture the cyst, potentially disseminating malignant cells into the retroperitoneum.

3. Justification of the Sequential Approach

Our team adopted a sequential approach to navigate this dilemma.

Step 1 (Internal Drainage): The placement of a JJ stent provided urinary decompression without breaching the renal capsule or the tumor. This, combined with Piperacillin-Tazobactam [17], stabilized the patient

and improved renal function, buying time for further assessment.

Step 2 (Targeted External Drainage): When imaging confirmed that the perirenal collections were not resolving, the risk of uncontrolled sepsis outweighed the theoretical oncological risk. The nephrostomy was performed, but with "oncological mindfulness"—selecting a puncture site remote from the Bosniak IV lesion. This aligns with literature suggesting that while conservative management can work [9, 26], undrained collections often require intervention [28].

4. Comparative Analysis

Table 1 summarizes the therapeutic options considered. Upfront nephrectomy was discarded to avoid operating on a septic, unstable patient and to attempt renal preservation. Antibiotics alone were insufficient given the collection size. The chosen hybrid strategy mirrors the necessity for individualized care in complex urological cases, where guidelines for single pathologies (EPN guidelines [16] vs. RCC guidelines [19]) conflict.

Table 1: Therapeutic Options Comparison

Option	Advantages	Disadvantages	Indication
Antibiotics alone	Non-invasive	Insufficient for large collections; high failure rate in EPN	Mild EPN (Class I)
JJ Stent	Internal drainage; avoids renal puncture	Limited efficacy for perirenal/psoas collections	Obstructive pyelonephritis
Percutaneous Drainage	Effective source control; minimally invasive	Risk of tumor seeding in Bosniak IV context	EPN Classes II-III
Upfront Nephrectomy	Definitive treatment; removes tumor and infection	High morbidity in septic patients; loss of renal unit	Fulminant EPN; Non-functional kidney
Sequential Approach (Current Case)	Balances sepsis control with oncological safety	Prolonged treatment duration	Complex associations

CONCLUSION

The coexistence of emphysematous pyelonephritis and a Bosniak IV renal cyst represent a rare "collision" of infectious urgency and oncological prudence. This case demonstrates that standard algorithms for EPN must be adapted when malignancy is suspected. An initial conservative approach with internal drainage and antibiotics is a safe first step, but persistent collections necessitate percutaneous drainage. In such scenarios, drainage must be image-guided and targeted specifically to avoid the tumor trajectory. The definitive management (partial vs. total nephrectomy) depends on the functional recovery of the renal unit after infection control.

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