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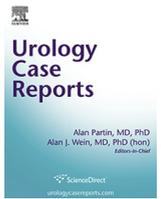
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Inflammation and Infection

Emphysematous Pyelonephritis with Renal Artery Pseudoaneurysm



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ABSTRACT

Emphysematous pyelonephritis is an acute infection of the renal parenchyma and perinephric tissues caused by gas-forming microorganisms, resulting in the radiographic presence of gas in the kidney, collecting system, and surrounding spaces. Here we present a case of severe emphysematous pyelonephritis in the setting of *Klebsiella* urosepsis. Surgical exploration of the flank revealed infectious disintegration of the renal parenchyma into a large phlegmon. The post-operative course was complicated by renal artery pseudoaneurysm and cutaneous fistulization of a perinephric fluid collection. Despite the high rate of mortality associated with this condition, the patient survived and has remained clinically well.

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Introduction

Emphysematous pyelonephritis is an acute infection of the renal parenchyma and perinephric tissues caused by gas-forming microorganisms, resulting in the radiographic presence of gas in the kidney, collecting system, and surrounding spaces. Unlike emphysematous pyelitis, a benign condition in which gas from the renal parenchyma is confined to the collecting system and which responds well to medical management alone, emphysematous pyelonephritis is a rarer and more serious illness, with high rates of morbidity and mortality.¹ Once the gas spreads from the collecting system to the perinephric space and beyond, case fatality rates rise dramatically. Thus, the suspicion of gas in the setting of infection warrants urgent evaluation and potential intervention.

Case presentation

A 64-year-old gentleman developed urosepsis one week after presenting with a 4 mm left distal ureteral calculus that had been managed expectantly. He required vasopressors and had multiple laboratory abnormalities, including blood urea nitrogen concentration of 145 mg/dL and serum creatinine concentration of 5.6 mg/dL. Computed tomography (CT) of the abdomen and pelvis revealed

extensive air in the left renal bed and retroperitoneum with extension into the peri-aortic and pararenal spaces, bladder wall, and mesenteric planes (Fig. 1, panels A and B), consistent with severe emphysematous pyelonephritis.

The patient underwent emergent surgical exploration of the left flank for anticipated nephrectomy, but no discrete kidney was seen, as the entire renal parenchyma had formed a large phlegmon. Debridement and washout were performed, multiple surgical drains were placed, and the patient stabilized. Blood and urine cultures demonstrated *Klebsiella pneumoniae*, which was treated with culture-specific antibiotics.

On post-operative day 8, he developed acute hemodynamic instability, with a precipitous fall in serum hemoglobin to 5.5 g/dL, associated with multiple episodes of melena. CT showed a large perinephric and retroperitoneal hematoma (Fig. 1, panel C) secondary to a left renal artery branch pseudoaneurysm. He underwent successful angioembolization of the main renal artery, but the melena and acute anemia persisted, requiring multiple transfusions. An upper endoscopy was performed and revealed a cratered duodenal ulcer with active hemorrhage that was subsequently cauterized. The patient's hemoglobin level stabilized, and he was discharged on post-operative day 18.

Follow-up imaging at three and six months demonstrated a left renal fluid collection that was decreasing in size (Fig. 1, panel D). Given the potential morbidity of re-exploration, and taking into account the patient's preferences, he was initially maintained on observation. He subsequently developed fistulization of the abscess to his flank with continuous drainage of turbid fluid, but without

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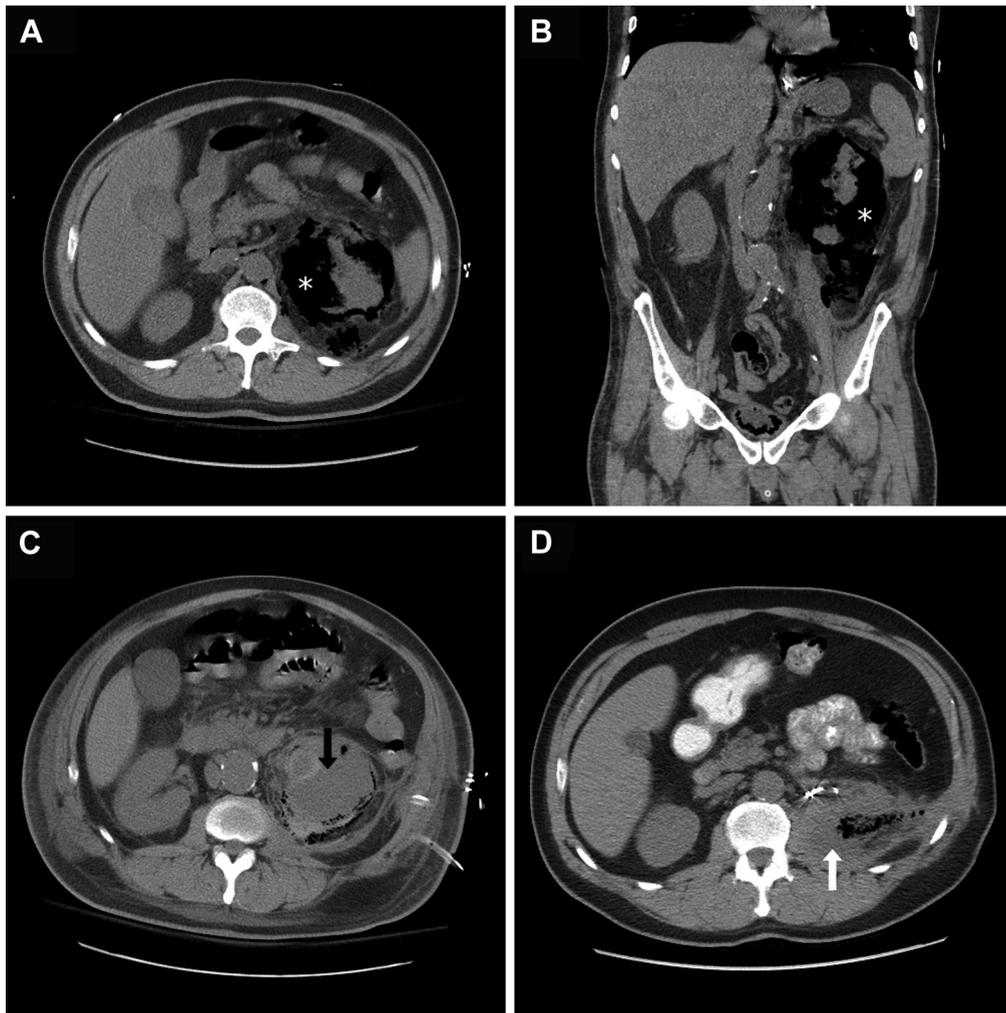


Figure 1. Computed tomography of the abdomen and pelvis. (A) Transverse and (B) coronal images showing free air in the left renal bed (asterisk), retroperitoneum, pararenal and peri-aortic spaces, bladder wall, and mesenteric planes. (C) Large hematoma in the left perinephric space (black arrow). (D) Follow-up imaging at six months, showing replacement of the renal parenchyma by a stable fluid collection (white arrow).

systemic signs or symptoms of infection. Elective surgical re-exploration of the flank was performed nine months after initial presentation and revealed replacement of the perinephric space and pararenal fat by an encapsulated collection. This was incised and drained, and the fistula subsequently resolved.

Discussion

Proposed classification schemes for emphysematous pyelonephritis have centered on radiographic findings of gas extension. The system used widely in the contemporary literature was developed by Huang and Tseng based on their case series of 48 patients.² Class I involves gas in the collecting system only; class II involves parenchymal gas only; class III involves the extension of gas into the perinephric (IIIa) or pararenal (IIIb) spaces; and class IV occurs in patients with a solitary kidney or who present with bilateral disease. In our patient with class IIIb emphysematous pyelonephritis, mortality rates of up to 50% have been reported even after early nephrectomy,³ making this patient's clinical recovery with minimal sequelae more remarkable.

The choice between surgical and non-operative management of emphysematous pyelonephritis remains a subject of ongoing investigation. Early studies showed a survival benefit in patients who underwent early nephrectomy, leading to popularity of a

surgical algorithm. More recent literature, however, has suggested lower mortality rates with non-operative management,⁴ in particular with the availability of percutaneous drainage that can spare viable parenchyma and evacuate gas and fluid in areas with necrotic tissue.⁵ A subset of patients who are initially treated with percutaneous drainage may not improve or may go on to lose unilateral renal function entirely; in these cases, nephrectomy is indicated. This is consistent with data suggesting that critically-ill patients (i.e., those who present with class III infection) are likely to benefit from immediate nephrectomy, instead of delaying surgery for more conservative interventions.¹

This was the strategy we chose in the present case. Interestingly, the renal parenchyma was not distinguishable on exploration. Given the patient's clinical instability, we performed an incision and drainage with drain placement, which was ultimately effective at stabilizing the patient. It is possible that not performing immediate total nephrectomy led to the development of the renal artery pseudoaneurysm. However, nephrectomy was not feasible at the time of initial exploration secondary to active hemodynamic instability and obliteration of tissue planes. Pseudoaneurysm may also have been caused by parenchymal infection attenuating the renal vasculature. Although the direct cause is unclear, the pseudoaneurysm was effectively managed via angioembolization.

Fistulization of a perirenal collection to the flank was a sequela of our surgical strategy, though this was straightforwardly managed with delayed exploration and drainage. Any remnant kidney was not identifiable at the time of re-exploration in the setting of a lack of recognizable landmarks in the flank. We have not performed post-operative functional renal imaging as this would not have changed our management. Notably, however, the patient's serum creatinine has been stable since normalizing following his acute illness.

Conclusion

Emphysematous pyelonephritis is a life-threatening illness, the clinical and radiographic hallmarks of which must be recognized in order to expedite management and optimize outcomes. In severe cases like the one presented here, early surgical intervention is generally recommended to halt the progress of infection and minimize long-term morbidity. Nephrectomy may or may not be

required, though removal of nonviable tissue should be performed when possible.

Conflict of interest

The authors have no conflicts to disclose.

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