

A Rare Case of Emphysematous Pyelonephritis

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Abstract

Background: This case illustrates the potential for class 3A emphysematous pyelonephritis with the presence of nephrolithiasis to be initially treated solely by relieving the hindered urinary outflow and with systemic antibiotics if diagnosed early with appropriate imaging studies.

Case Presentation: 64-year-old Caucasian female with history of diabetes mellitus type 2, hyperlipidemia, hypertension, coronary artery disease and diastolic congestive heart failure presented to the emergency department with respiratory distress of 2 days duration. Her chief complaint was associated with anuria for two days, abdominal pain, generalized weakness, and loss of appetite. The patient was admitted to the medical intensive care unit (MICU) for hypotension, severe mixed respiratory and metabolic acidosis, and uremia. She was intubated for pending respiratory failure and underwent emergency hemodialysis for acute renal failure. She received hemodynamic support and was also started on systemic antibiotics. A computerized tomography (CT) scan of the abdomen/pelvis revealed class 3A emphysematous pyelonephritis (EPN) of the left kidney and an 8 mm non-obstructing calculus in the left proximal ureter. Subsequently a left ureteral stent was placed to relieve the obstruction. In addition, blood cultures revealed bacteremia with *Klebsiella pneumoniae*. Although she had thrombocytopenia, acute renal failure and shock, the intra-renal emphysema improved with the stent and she was eventually weaned off of vasopressors, extubated and showed marked clinical improvement.

Conclusion: Rare cases of class 3A EPN precipitated by any degree of urinary tract obstruction may be treated initially with relief of outflow hindrance and aggressive supportive care if an early diagnosis can be made with appropriate imaging studies.

Keywords: Emphysematous pyelonephritis; Conservative treatment; Percutaneous catheter drainage; Nephrectomy

Abbreviations EPN: Emphysematous Pyelonephritis; CT: Computerized Tomography-scan; PCD: Percutaneous Catheter Drainage; MICU: Medical Intensive Care Unit; US: Ultrasound

Introduction

Emphysematous pyelonephritis is an acute gas forming suppurative infection of the urinary tract including the renal parenchyma, collecting system, perinephric and pararenal spaces [1,2]. Multiple case series have shown a mortality rate of up to 30% in the most severe forms of this rare and life threatening infection. Urinary tract obstruction is a predisposing factor along with diabetes mellitus and female gender. The majority of EPN patients (79% to 90%) are diabetics with poor glycemic control and females are 5 times to 6 times more likely to be affected than males. Kidneys are infected bilaterally in less than 10% of cases [1-4]. *Escherichia coli* or *Klebsiella pneumoniae* are common organisms cultured from urine and infected tissue. Both organisms might be present occasionally. Other organisms include *Acinetobacter*, *Proteus*, *Streptococcus*, and *Pseudomonas* spp., *Bacteroides fragilis*, *Clostridium septicum*, *Candida* and *Aspergillus* [5-10].

Immunocompromised individuals with elevated glucose concentrations in the renal tissue and decreased perfusion of tissue are more vulnerable to the disease [11,12]. Hyperglycemic environments in hypoperfused tissues are favorable for catabolism in bacteria via mixed acid fermentation resulting in excess production of H₂. In addition, obstruction of the urinary tract impedes the renal circulation even further and prevents the gas from being removed. Common signs and symptoms at presentation include fever, abdominal pain, nausea, and vomiting, depressed level of consciousness, shock, costovertebral angle tenderness, pyuria and acute renal failure. Less common presentations include dysuria, dyspnea, and crepitus [6,13,14]. Thrombocytopenia is seen in 46% of the patients [13].

EPN requires a radiological diagnosis with computer tomography-scan (CT) being the most definitive modality. Abdominal X-ray is another useful modality as it can detect mottled gas in the renal and perirenal space in about 33% of the cases but overlying intestinal gas and body habitus limit its utility. Ultrasound (US) is beneficial in that it can detect an associated urinary tract obstruction but posterior structures tend to be obscured. CT scan of the abdomen is the preferred diagnostic tool as it can define the extent and quantification of the gas, and any destruction of the renal parenchyma [2,15,16].

EPN has two classification systems. Type 1 versus type 2 classification is based on the appearance of gas and the presence of

fluid collections on CT scan. EPN type 1 has evidence of mottled or streaky appearance of gas in the destructed tissue with a lack of fluid collection. The presence of gas in type 2 EPN appears bubbly or loculated with fluid collections in the renal or extra renal spaces or gas in ureter or pelvicalyceal system [3]. The Huang and Tseng [13] classification differentiates the disease based on the extent to which the gas is spread through the collecting system, renal parenchyma, perinephric and pararenal space. Class 3a and 3b may also have an abscess.

Historically, percutaneous catheter drainage (PCD) of gas and purulent material and emergent nephrectomy have been advocated as first line treatments for emphysematous pyelonephritis, especially for class 3A to class 4 disease [5,6,17-19]. However, 13.5% mortality was associated with treatment including medical management and percutaneous catheter drainage while 25% mortality was seen in patients treated with medical management and emergent nephrectomy in a systematic review of 10 retrospective studies [20]. In more recent reports, even severe EPN with poor prognostic factors like acute renal failure, thrombocytopenia, and septic shock have been shown to be successfully treated with conservation management. For example, Laway [21] reported a case of a 70-year-old woman with newly diagnosed diabetes mellitus who was aggressively treated with optimal systemic antibiotics and hemodynamic support leading to marked recovery [22,23].

Case Presentation

The patient was a 64-year-old Caucasian female with a medical history of diabetes mellitus type 2, hyperlipidemia, hypertension, coronary artery disease and diastolic congestive heart failure who presented to the emergency department with respiratory distress, diffuse abdominal pain, generalized weakness and anuria for two days. Her symptoms were associated with loss of appetite and nausea. Upon arrival she was hypotensive with a blood pressure of 60/40 mmHg and her breathing was labored. In addition, she had dry mucous membranes and 2+ bilateral lower extremity pitting edema. Initial blood tests were consistent with severe sepsis likely secondary to a urinary tract infection and acute kidney injury due to a post-renal cause. She was also found to be thrombocytopenic with approximately 100 K/mm^3 platelets and hyperglycemic with elevated blood glucose of 225 mg/dL. The patient eventually became hypoxic, her hypotension worsened, and she was found to be in metabolic acidosis along with uremia. She was intubated, hemodynamically supported with vasopressors and stress dose steroids, and systemic antibiotics were started. Urgent hemodialysis was also started due to anuria and persistent hyperkalemia despite medical treatment. Elevated blood glucose sugars were controlled on insulin drip.

Consequently, the presence of persistent diffuse abdominal pain warranted for further imaging with a CT scan of the abdomen/pelvis which showed evidence of an 8 mm calculus at the left proximal ureter with left-sided EPN. As shown in Figure 1, extra parenchymal gas was found within the perirenal and pararenal spaces on the left secondary to extension of air from a possible calyceal rupture. There was associated small abdominal and pelvic ascites. Although percutaneous catheter drainage and emergent nephrectomy were immediately considered given the extent of disease, the patient was found to be too hemodynamically unstable and at a high risk for bleeding during surgery. Instead, a left ureteral stent was placed for relief of the urinary tract obstruction (Figure 1).

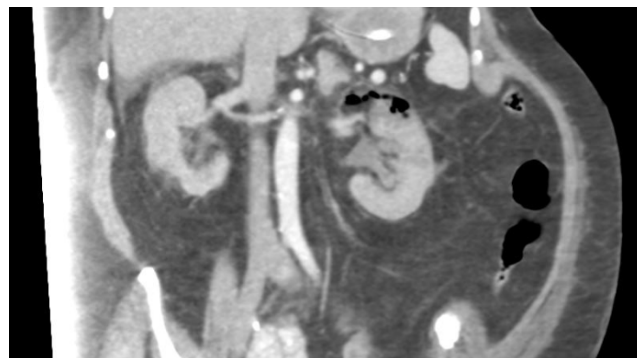


Figure 1: Computerized tomographic scan of the abdomen and pelvis with contrast. A 8 mm calculus at the left proximal ureter with extra parenchymal gas within the perirenal and pararenal spaces on the left suggestive of left-sided emphysematous pyelonephritis.

After 24 h to 48 h, blood cultures revealed bacteremia with gram negative rods. Empiric broad-spectrum antibiotics were ciprofloxacin and meropenem once the bacterium was identified to be *Klebsiella pneumoniae*.

As the patient was slowly recovering with supportive care and antibiotics, serial CT scans of the abdomen and pelvis showed a dilated left kidney with an interval decrease in parenchymal and perirenal emphysema. Although the perinephric and periureteral inflammation showed improvement, the persistent enlargement of the left kidney with an echogenic 2 cm focus was suspicious for the presences of an abscess. A retroperitoneal US confirmed a renal abscess measuring 7 cm \times 4.3 cm \times 4 cm. With consideration of the extent of the disease, PCD and emergent nephrectomy were again considered (Figure 2).

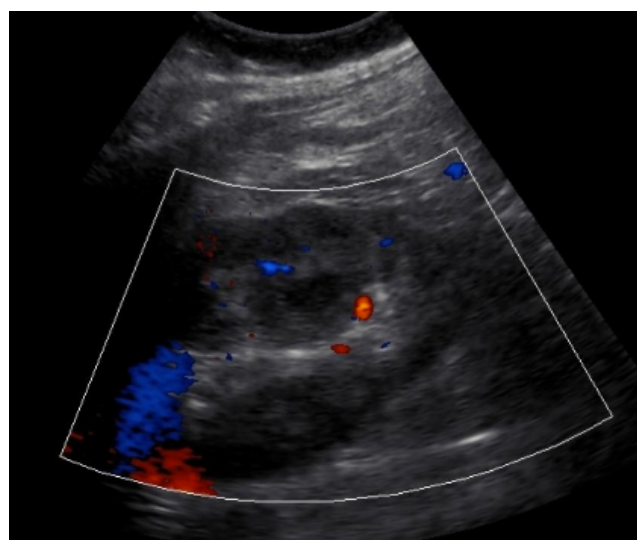


Figure 2: Ultrasound of the left retroperitoneum showing a 2 cm echogenic focus in the left kidney, calculi versus gas.

Consensus decision resulting from discussion between intensive care, urology, and interventional radiology departments was to continue supportive care in light of the patient's rapidly improving clinical status following stenting. Two weeks after being admitted, the patient stabilized and was transferred to medicine, followed by acute rehabilitation for deconditioning. Upon discharge the patient was scheduled for ureteroscopic lithotripsy and maintained on nitrofurantoin for prophylaxis.

Discussion and Conclusion

Our case emphasizes that optimal supportive care provided by relieving obstruction in the urinary tract, controlling hyperglycemia, fighting the bacteria with most effective antibiotics, and providing hemodynamic support can be a favorable treatment regimen for severe emphysematous pyelonephritis regardless of poor prognostic factors. In contrast to recommendations, PCD was not performed due to concern for insignificant amount of purulent material and localized gas to be aspirated and emergent nephrectomy was not warranted in light of a smaller right kidney. Thus, a day by day intervention was formulated for this patient to give her a chance for recovery without having to place her on long-term dialysis. This case depicts a 64-year-old female who was treated for class 3A emphysematous pyelonephritis with conservative management and showed drastic clinical improvement. Sharma et al. [24] presented 14 cases of EPN out of which 4 patients belonged to class IIIA presentation. Their study showed that conservative management with increasingly potent systemic antibiotics and dynamic critical care may be a more beneficial approach initially while reserving acute invasive modalities for those who do not recover with minimally invasive interventions. This case, along with previously reported cases [25], further strengthen and support the proposition that EPN can be favorably managed with conservative measures based on clinical progress without requiring invasive interventions such as percutaneous drainage and/or nephrectomy.

Author's Contributions

DL, NR, HL were responsible for patient care and wrote the manuscript. EB, PL, and MK provided patient care and were corresponding authors. AA provided patient care and guidance through chart review and manuscript work. All authors read and approved the final manuscript.

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