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Title: Fatal pyonephrosis without a pre-existing urinary tract obstruction with autopsy findings

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Case Presentation

A 73-year-old, male patient with type 2 diabetes mellitus presented with a six-day history of fever and fatigue. He was critically ill, and his vital signs were respiratory rate 36 breaths per minute, heart rate 130 beats per minute, blood pressure 108/78 mmHg, and temperature 38.8°C (101.8°F). Physical examination revealed tenderness in the left costovertebral angle. The other physical examination findings were unremarkable. Laboratory tests showed elevated inflammatory markers with C-reactive protein 44.17 (normal < 0.14) mg/dL, procalcitonin 171.25 (normal < 0.04) pg/mL, and creatinine 1.65 mg/dL (normal: 0.65-1.07). His glycated hemoglobin (A1C) was 9.8%. Contrast-enhanced computed tomography (CT) on admission showed mild left hydronephrosis (**Figure A**) without any apparent cause of ureteral obstruction. Two sets of blood culture and urine culture on admission grew *Proteus mirabilis*, which was susceptible to common antimicrobials. Left pyelonephritis was diagnosed, and he received two weeks of intravenous ampicillin, but his sepsis persisted and was complicated by candidemia and candiduria. Antifungal agents were given for the invasive candidiasis, but repeated contrast-enhanced CT on hospital Day 27 showed progressive enlargement of the upper left ureter and renal pelvis (**Figure B, arrows**) with thickening of the renal pelvic wall. At the time of the second abdominal CT, his serum

creatinine was 1.81 mg/dL. A nephrectomy was not possible owing to his general condition. He died from septic shock with severe acute kidney injury on hospital day 31. An autopsy revealed purulent material filling the upper left ureter and renal pelvis (**Figure C, arrows**). No cause of the ureteral obstruction, such as urolithiasis, malignancies or other obstructive processes, was observed. Pyonephrosis was subsequently diagnosed based on the autopsy findings.

Pyonephrosis is a rare form of urinary tract infection (UTI) characterized by the presence of pus in a dilated renal collecting system¹ and usually develops in patients with an upper urinary tract obstruction secondary to various causes (e.g., urolithiasis in most cases, tumors, and anatomical anomalies).² The mainstay of treatment consists of appropriate antimicrobials and prompt drainage of the pus by percutaneous nephrostomy, nephrectomy or ureteral stenting.³

Timely diagnosis of pyonephrosis is challenging. There is a continuum from infected hydronephrosis to pyonephrosis, and the latter can only be definitively diagnosed by renal urine aspiration.⁴ Furthermore, owing to the lack of radiological findings of urinary tract obstruction, a timely decision to perform preemptive surgery in this case was difficult to make. We hypothesized that the high viscosity of the purulent urine and the ureteral narrowing caused by the ureteral wall edema resulted in impaired urine excretion leading to pyonephrosis. The patient's poorly controlled diabetes mellitus might have further predisposed him to pyonephrosis development.

The present case demonstrates that pyonephrosis may develop, albeit rarely, without a pre-existing urinary tract obstruction and can be fatal. Repeated imaging tests should be performed to identify the source of the infection if urosepsis continues despite appropriate antimicrobial therapy. Moreover, clinicians should consider the possibility of pyonephrosis as a rare complication of a UTI if dilation of the ureter and renal pelvis progress despite appropriate antimicrobial administration. In a such cases, urological intervention, including a percutaneous nephrostomy or nephrectomy, should be considered for diagnostic and therapeutic purposes.

(523 words)

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