Community acquired quinolone-resistant *Escherichia coli* pyelonephritis complicated with multiple renal abscesses: a case report

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Abstract

Acute pyelonephritis is a potentially organ-damaging and life-threatening infection. A 37-year old woman was admitted to Intensive Care Unit in septic shock and multi-organ failure due to acute pyelonephritis with systemic bacterial dissemination caused by a quinolone-resistant *Escherichia coli*. The patient, a previously healthy woman, reported recurrent episodes of urinary tract infection in the previous 3 years, which were treated with quinolones. Treatment course with broad-spectrum antimicrobial agents reversed her septic shock and multi-organ failure. However, pyelonephritis progressed to intrarenal and perirenal abscesses formation. The patient fully recovered after surgical removal of the infected kidney. Hippokratia 2012, 16, 4: 381-383

Key words: acute pyelonephritis, septic shock, quinolone-resistant *Escherichia coli*, renal abscesses, nephrectomy

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Introduction

Pyelonephritis is the most severe form of urinary tract infection (UTI) with women being more likely to be affected than men. The pathogen involved in most cases (>80% of community-acquired UTIs and approximately 50% of UTIs in hospital patients) is *Escherichia coli*\(^1\). We hereby report a case of acute pyelonephritis, in a previously healthy woman, caused by an *E. coli* isolate which, despite appropriate antimicrobial therapy, led to systemic bacterial dissemination and destruction of her left kidney. This infection was associated with prolonged sepsis that resolved after the performance of nephrectomy.

Case-report

A 37-year-old Greek Caucasian woman was admitted to the hospital with clinical symptoms of pyelonephritis. The patient reported recurrent episodes of UTIs in the previous 3 years, which were treated with norfloxacin. Six weeks prior to hospital admission, the patient suffered an initial episode of *E. coli* cystitis which was treated with norfloxacin and cefuroxime for 10 days. The day prior to hospitalization, she suffered lower back pain, for which she was prescribed a non-steroidal anti-inflammatory drug (NSAID). After the sudden onset of fever, dysuria and aggravated pain, the patient was admitted to the Urology Department of a municipal hospital. Clinical symptoms, presence of pyuria, as well as fever (38.4° C), led to the diagnosis of acute pyelonephritis and treatment with ciprofloxacin and netromycin began. An ultrasound examination revealed a normal-sized right kidney and a moderate dilatation of the left pyelocalyceal system, without apparent calculi. Within the next 8 hours, her hemodynamic and respiratory state deteriorated rapidly and the patient required mechanical ventilation due to acute hypoxemic respiratory failure, as well as vasoactive agents. A pigtail was inserted in her left ureter and a few hours later she was transferred to Intensive Care Unit (ICU).

Upon ICU admission, the physical examination revealed fever (38.8° C). Her blood pressure was 110/50 mmHg (with the use of norepinephrine up to 25μg/min), pulse rate was 140/min and she had normal urine output. Her chest radiograph revealed diffuse pulmonary infiltrates and the patient ventilated in a lung-protective manner with 70% fraction of oxygen. Complete differential cell counts revealed the following values: white blood cells (WBC) 33610/mm\(^3\) (94% neutrophils), haemoglobin 12.6gr/dl and platelets 91000/mm\(^3\). Other abnormal laboratory results included: serum creatinine 2.6 mg/dl, total bilirubinaemia 2.3 mg/dl (predominantly conjugated), clotting abnormalities (PT= 19.5 sec, INR=1.73, aPTT= 70 sec), C-reactive protein 349 mg/L and procalcitonin 10 ng/ml.

She began treatment with ciprofloxacin, meropenem and netromycin without resolution of fever. Steroid supplementation was also initiated in order to deal with the septic shock. An *E. coli* isolate (verocytotoxins VT1 and
VT2 negative, Shiga toxin 1 and Shiga toxin 2 negative, O4 negative) was cultured from both urine and blood samples, which revealed resistance to ampicillin, quinolones and trimethoprim/sulfamethoxazole (TMP/SMX) and treatment with ciprofloxacin was discontinued.

A CT scan revealed an enlarged left kidney with heterogeneous contrast enhancement and many ill-defined hypovascular areas mainly at the periphery of the cortex measuring 1-4cm in diameter. There was also thickening of the Gerottas’ fascia. On the 5th day of hospitalization, the patient’s septic shock and ARDS had been successfully reversed, WBC number was decreased (to 13190/mm³), number of the platelets was increased (222000/mm³) and patient’s renal function improved (serum creatinine 1.1 mg/dl). Due to the high fever persistence (up to 39-39.4°C daily) metronidazole and vancomycin were added. However, ten days after her ICU admission, the patient became again hemodynamically unstable, her WBC count was raised (18180/mm³) and a new CT scan (Figure 1a,b,c) revealed deterioration. There was no resolution of the ill-defined hypovascular areas that appeared with lower density values indicative of abscess formation. A new small perirenal and anterior pararenal collection on the left were also evident. The patient referred urgently to the operation room, where a left nephrectomy was performed. Three days after the operation her hemodynamic state was improved, the leukocytosis resolved (11410/mm³) and the patient became afebrile. She was extubated and transferred to the Urology Department. The patient was discharged from our hospital in good clinical condition with a stable renal function after a total of 25 days.

Gross pathological examination revealed an enlarged kidney (14×8×7.5 cm in dimensions and 455 gr in weight plus the perinephric fat) with distorted renal parenchyma and four cystic lesions (2-6 cm in diameter) filled with yellowish and brownish purulent fluid. Histological examination revealed extensive acute and chronic pyelonephritis with multiple necrotic areas and abscesses formation, as well as focal lesions of xanthogranulomatous inflammation (Figure 2). Extension of the inflammation to the perirenal fat was also identified.

**Discussion**

Compared to sepsis from other sources, the prognosis of urosepsis is generally considered to be more favorable. In our young patient, pyelonephritis rapidly progressed...
despite prompt antibiotic treatment, causing life-threatening septic shock and multi-organ failure. Repeated episodes of UTI had previously necessitated several antibiotic treatment cycles, which certainly contributed to this overwhelming E. coli urosepsis described here. The initial empirical treatment was not adequately effective, since the pathogen turned out to be resistant to quinolones. Fluoroquinolones are recommended for the empiric treatment of UTIs in communities in which uropathogen resistance to TMP/SMX is ≥ 10% to 20%9. Susceptibility data from 10049 E. coli isolates derived from community-acquired urinary tract infections in Greece indicated a high incidence (34.7%) of TMP/SMX resistance, thus justifying the empirical treatment with quinolones in the minority of cases where urine culture is not available1. Several factors have been identified as independent risk factors for acquisition of quinolone resistant E. coli UTIs: urinary tract abnormalities, patient 65 years or older, recent hospitalization, urinary catheterization, recurrent UTI and prior exposure to quinolones2-4.

Our patient’s prior episodes of UTI, although uncomplicated, had already damaged her kidney, based on the histological lesions of chronic pyelonephritis and xanthogranulomatous inflammation. The present episode of acute pyelonephritis, despite prompt antibiotic treatment, progressed to intrarenal and perirenal abscesses formation. Although development of renal abscesses may be result of an ascending infection by E. coli already isolated within the urinary tract, in our case we could not rule out hematogenous spread of bacteria. Based on the CT findings, the lesions were located in the renal cortex. Abscess formation is more commonly seen in the renal cortex as compared with the medulla, as the former has richer blood supply, richer lymphatics and lower interstitial pressure8. Although a high correlation exists between organisms grown in urine culture and those linked to the abscess, fluid culture from an abscess can reveal different microorganisms, thus justifying a broad-spectrum treatment course6. Management of renal abscesses includes medical and interventional treatment. Dalla Palma et al recommended avoidance of aggressive interventional or surgical treatment of renal and perinephric abscesses of 5cm in diameter or less, which can have complete remission after antibiotic treatment7. Lee et al also reported that medium- and small-sized renal abscess were treated successfully with intravenous antibiotics alone8. More recently, Coelho reported that renal abscesses can be managed by medical treatment only, reserving interventional treatment for large collections or patients with clinical impairment9. Perinephric and mixed abscesses, however, were successfully managed by interventional treatment. Our patient, despite receiving a 14-day course with broad-spectrum antimicrobial agents, she finally exhibited clinical and imaging deterioration thus making nephrectomy unavoidable.

In conclusion, our patient suffered from life-threatening E. coli urosepsis that progressed to intrarenal and perirenal abscesses despite antibiotic therapy. The strain was quinolone-resistant as a consequence of our patient’s recurrent UTI and prior exposure to quinolones. Sepsis was eventually arrested by surgically removing the infected kidney. Early diagnosis is an important factor in the outcome of renal and perirenal abscesses. With the advent of effective antibiotics along with percutaneous techniques, the open surgical approach is now reserved for more severe, refractory cases.

Conflict of interest
All authors report no conflict of interest relevant to this article

References