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Pyonephrosis complicated with spontaneous intraperitoneal rupture and diffuse peritonitis: Case report and literature review

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Key words
pyonephrosis – abscess – peritonitis – rupture

Abstract. Pyonephrosis is a serious condition that can lead to kidney dysfunction, loss of the organ, and even fatal end due to its complications. The underlying etiologic factors include lithiasis, recurrent urinary infections, ureter stricture, ureteropelvic junction obstruction, malignancy, and retroperitoneal fibrosis. One of the rare possible complications of pyonephrosis is a retroperitoneal rupture with spontaneous communication to the abdomen causing secondary peritonitis. We present such a case which is the first video-documented report of the peritoneal rupture site within the abdominal cavity.

Introduction

Pyonephrosis is an entity characterized by accumulation of purulent exudate found in an obstructed collecting system, leading to renal parenchymal destruction and its dysfunction. The nonspecific symptomatology mainly presents with bilateral or unilateral flank pain, chills, and recurrent urinary infections, and the delay of prompt diagnosis and treatment can lead to overwhelming sepsis and may require nephrectomy. Urolithiasis is reported to be the main etiologic factor [1]. Positive bacteriological urine findings are present in the majority of cases (65.2%), with detection of *Escherichia coli* infection in 30.4%. The reported mortality rate is 8.7% [2]. As a result of delayed diagnosis, a rupture of the pyonephrotic kidney may lead to retroperitoneal abscess formation and in extremely rare cases may rupture spontaneously into the abdominal cavity and cause generalized peritonitis. In such patients, clinical finding of acute abdomen is the predominant one and requires an emergency exploratory laparotomy [2, 3]. We present a case of right-sided pyonephrosis complicated with retroperitoneal abscess with spontaneous rupture in the abdominal cavity.

Case report

A 70-year-old female patient was admitted to our hospital with clinical and radiological findings of small intestine obstruction. Eight years before, the patient was treated for endometrial adenocarcinoma (hysterectomy with bilateral salpingo-oophorectomy plus adjuvant radiotherapy). Prior to this surgery, double J stents were placed into the ureters. During stent removal, pus was noted in the urinary bladder, and cefixime was prescribed. In the following years, the pa-

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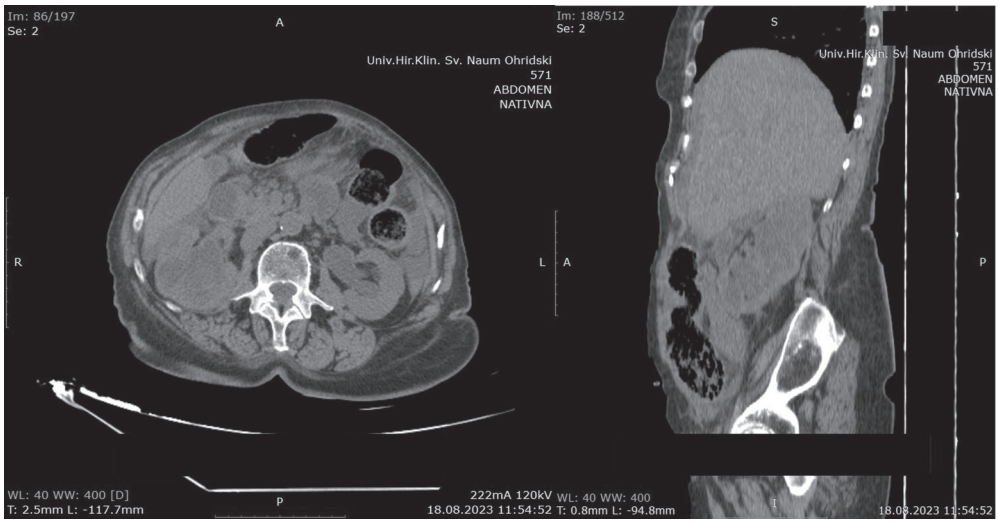

Figure 1. Abdominal computerized tomography scan (axial and sagittal view) showing moderate hydronephrosis.

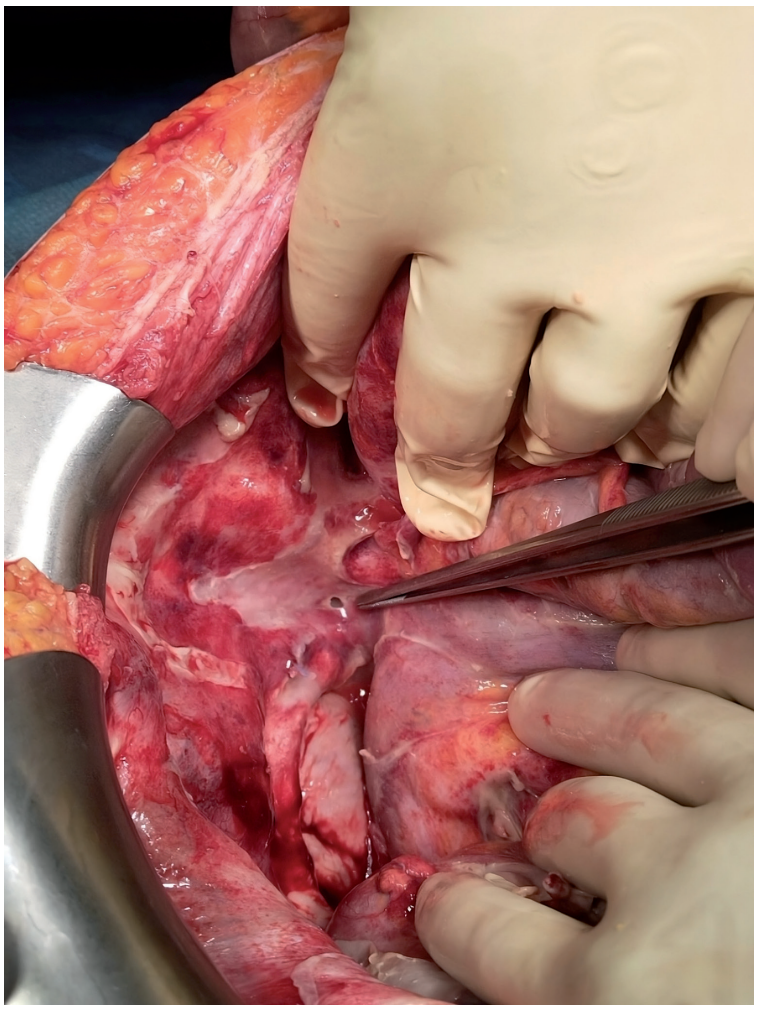

Figure 2. Intraoperative finding of spontaneous rupture in the right iliac fossa (instrument pointing on the opening).

tient was occasionally treated for recurrent urinary infections with confirmed *Escherichia coli* from urine culture. In April 2022, the patient was admitted to our hospital and operated on due to the existence of pelvic abscess. The cause for abscess formation was not identified. A computerized tomography (CT) scan performed at that time revealed grade 2 – 3 right kidney hydronephrosis and dilated right ureter to the pelvis (post-radiation fibrosis). After the uneventful postoperative period, the patient was referred to a nephrologist, when diagnosis of chronic kidney failure stage 2 (serum urea 13 mmol/L and serum creatinine 210 µmol/L) was confirmed.

Following the present admission, complete blood and serum analysis and abdominal CT scan were ordered. Positive laboratory findings were hemoglobin level of 76 g/L, erythrocytes count of 2.9×10^{12}/L, platelets count of 490×10^{9}/L, serum urea of 16.4 mmol/L, serum creatinine of 293.7 µmol/L, serum potassium of 5.93 mmol/L, and C-reactive protein of 272.8 mg/L. CT scan revealed bilateral hydronephrosis with moderate dilation of both ureters up to the pelvis without obvious cause of obstruction (Figure 1). A significant amount of abdominal fluid was noted. In the next 2 days, the patient's condition gradually worsened, in terms of high-grade fever (38.5 °C), tachypnea, and tachycardia. Interleukin-6 of 54.55 pg/mL and procalcitonin of 28.85 ng/mL confirmed presence of septicemia. Therefore, exploratory laparotomy was indi-

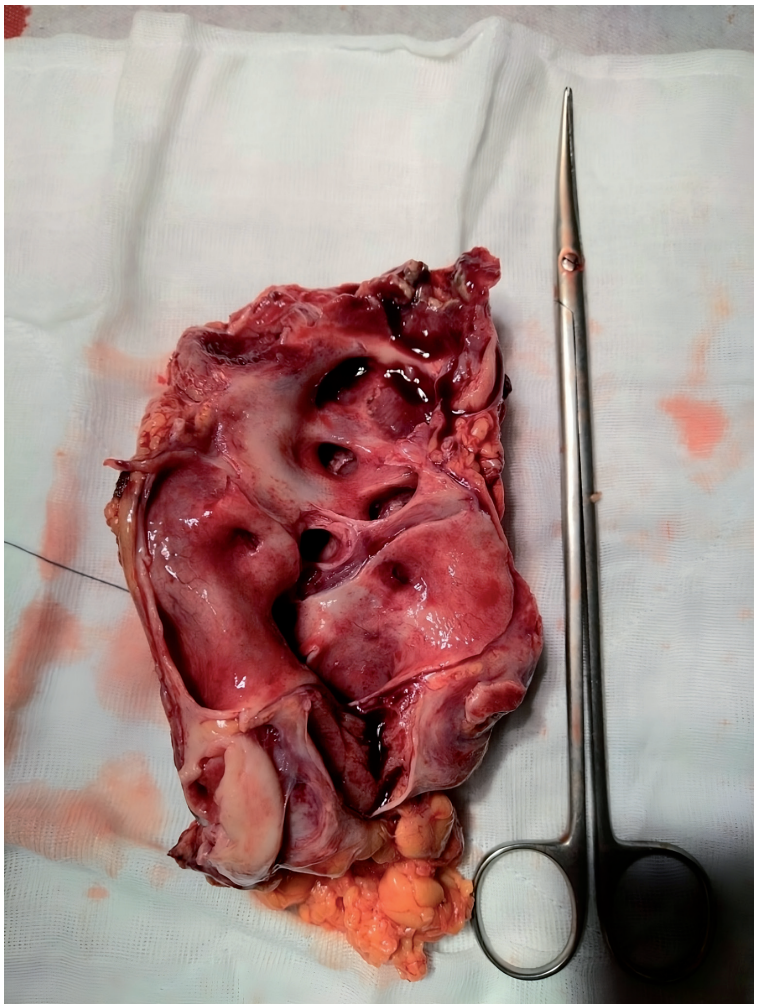

Figure 3. Operative specimen (right kidney).

cated. Gross purulent exudate with diffuse peritonitis was found. In addition, a sample was taken for microbiological examination. A spontaneous opening with a diameter of 3 mm in the right iliac fossa was seen, with purulent discharge from the defect (Figure 2). When applying manual pressure over the right kidney, additional purulent discharge was noted, thus directly proving spontaneous peritoneal rupture of pyonephrosis complicated with retroperitoneal abscess presence (Supplemental Video). A right nephrectomy was performed (Figure 3), followed by abdominal cavity lavage with saline and drainage.

In the postoperative period, the patient's condition was deteriorating, and was held on mechanical ventilation. During that time, high inflammatory markers, fever, and metabolic acidosis were present. Intravenous antibiotics (meropenem) were administrated preoperatively, intraoperatively, and continued during the postoperative period. Blood samples for hemoculture were sent for microbiological examination. Negative hemoculture was obtained. *Escherichia coli* was isolated from the abdominal pus. The patient was treated in the intensive care unit and deceased on postoperative day 21.

Discussion

Pyonephrosis is defined as parenchymal destruction of the kidney by a gross suppurative process in an obstructed collecting system causing loss of kidney function and progressive deterioration of the whole organism due to sepsis and peritonitis as in this case. Pyonephrosis is a life-threatening condition if diagnosis and intervention are delayed. Based on recent results of thorough research and our previous clinical experience, peritoneal fistulization due to pyonephrosis is a rare event that inevitably leads to generalized peritonitis, further masking the diagnosis of the pyonephrosis (Table 1). This report is the first video-documented case of peritoneal rupture accompanied by purulent discharge from the retroperitoneal space.

The root of the problem is linked with the presence of obstruction mainly caused by urolithiasis, followed by bacterial infection. The most commonly reported sites of obstruction are the renal pelvis, distal ureter, calyces, and proximal ureter. Other less common etiological factors include ureteric stricture, ureteropelvic junction syndrome, malignancy, retroperitoneal fibrosis, extrinsic ureteral compression, pregnancy, and posterior urethral valve [1, 10, 12].

Cytobacteriological urine sample examinations report the isolation of *Escherichia coli*, *Klebsiella sp.*, *Proteus mirabilis*, *Enterococcus faecalis*, and *Staphylococcus saprophyticus* [2]. Pyonephrosis can occur at any age. However, the collection of estimated study reports shows an average age of 49. Data on gender predominance are so far contradictory [2, 13].

This condition can manifest as a febrile syndrome, loin pain, and palpable mass due to kidney enlargement, shock, jaundice, anuria, and cardiac decompensation [13]. Laboratory results show leukocytosis, elevated serum creatinine value, pyuria, and microhematuria in some cases [1].

Table 1. Review of the literature for known cases of spontaneous intraperitoneal rupture of retroperitoneal abscess with described peritonitis caused by pyonephrosis.

Author / year	Patient age (years) / gender	Pyonephrosis cause	Rupture dimension	Treatment	Patient outcome
Reece [4] / 1962 (2 cases)	51 / female 38 / male	Tuberculous pyonephrosis (in both cases)	Not measured	Nephrectomy + streptomycin and p-aminosalicylic acid (in both)	Uneventful recovery (in both cases)
Tiwari [5] / 1966	33 / female	Nephrolithiasis	1 cm diameter	Retroperitoneal drainage + delayed nephrectomy	Uneventful recovery
Balas et al. [6] / 1971	41 / male	Nephrolithiasis	1 × 1 cm	Nephrectomy	Uneventful recovery
Rahman [7] / 1975	55 / male	Unknown	Not reported	Nephrectomy	Uneventful recovery
Michel and Pagliano [8] / 1993	30 / male	Unknown	Not reported	Drainage of abscess	Uneventful recovery
M'Bida et al. [9] / 2005	36 / female	Pyeloureteral junction syndrome	Not measured	Nephrectomy	Not reported
Quaresima et al. [10] / 2011	68 / male	Nephrolithiasis + renal carcinosarcoma	Not measured	Nephrectomy + multi-agent chemotherapy and radiation therapy	Uneventful recovery
Shifti and Bekele [3] / 2018	28 / male	Suspected ureteropelvic junction obstruction	1.5 cm diameter	Nephrectomy	Uneventful recovery
Jalbani et al. [11] / 2019	50 / female	Unknown	Not measured	Laparotomy + lavage + double J stent	Uneventful recovery
Elmoudane et al. [12] / 2022	22 / male	Suspected ureteropelvic junction obstruction	Not reported	Nephrostomy + delayed nephrectomy	Uneventful recovery
This report	70 / female	Post-radiation ureteral stenosis	0.4 mm diameter	Laparotomy + lavage + nephrectomy	Deceased

Expected complications include rupture of pyonephrosis, peritoneal fistulization, peritonitis, and sepsis, as in this case [3].

Diagnosis establishment requires high suspicion. Starting from baseline investigations such as blood work-up and urinalysis, ultrasound plays an important role with a high discriminatory ability between two entities (hydronephrosis and pyonephrosis), with a sensitivity of 90% and a specificity of 97%. However, a CT scan has the most trustworthy accuracy in the diagnosis of pyonephrosis and its complications.

Pyonephrosis requires an emergent therapeutic intervention, including both invasive and non-invasive treatment combined with systemic broad-spectrum antibiotics. Percutaneous nephrostomy is a safe diagnostic and therapeutic modality, allowing drainage of the pus, diagnosis, and providing material for bacterial isolation at the same time [1, 3, 11, 12]. Percutaneous nephrostomy is shown to be a lifesaving procedure in patients with functional kidney with success rates of 96 – 99%. However, nephrectomy is described in the literature as the treatment of choice, with a better overall outcome and shorter hospital stay in comparison to percutaneous nephrostomy. Before deciding on a nephrectomy, a maximal attempt to salvage a functional kidney should be made. Other treatments where the etiology is nephrolithiasis include nephrolithotomy, pyelolithotomy, and ureterolithotomy [12, 13]. In this case, the decision for nephrectomy was made intraoperatively due to the preoperative diagnostic uncertainty.

Although rare, secondary diffuse peritonitis due to fistulization into the peritoneal cavity should be suspected in gradually deteriorating patients with pre-diagnosed pyonephrosis.

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Conflict of interest

None to declare.

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